CITY OF NEW BRAUNFELS, TEXAS
PLANNING COMMISSION MEETING

CITY HALL - COUNCIL CHAMBERS
ZOOM

TUESDAY, JUNE 1, 2021 at 6:00 PM

To participate via zoom use the link: https://us02web.zoom.us/j/81588462801 or call (833) 926-2300 with 81588462801. Instructions for participation, use link https://www.nbtexas.org/2722/Planning-Commission-Online-Meeting-Guide.

AGENDA

1. **CALL TO ORDER**

2. **ROLL CALL**

3. **APPROVAL OF MINUTES**

   A) Approval of the May 4th, 2021 Regular Meeting Minutes pg. 2

4. **CITIZENS' COMMUNICATIONS**

This time is for citizens to address the Planning Commission on any issues or items NOT on the agenda. It is a violation of the Texas Open Meetings Act for the Commission to address, discuss or take action on any items not on the agenda. In addition to this venue, citizens may also email any comments to planning@nbtexas.org. Emailed comments will be distributed to the Planning Commission.

5. **CONSENT AGENDA**

All items listed below are considered to be routine and non-controversial by the Planning Commission and will be approved by one motion. There will be no separate discussion of these items unless a Planning Commissioner or citizen so requests, in which case the item will be removed from the consent agenda and considered as part of the normal order of business.

   A) FP21-0133 Approval of the final plat for Deer Crest Subdivision, Unit 4 pg. 9
   Applicant: HMT Engineering & Surveying (Bill Ball, P.E.)
   Owner: KB Home Lone Star, Inc. (David Brodbeck)

   B) FP21-0157 Approval of the final plat for Veramendi - Word Pkwy Phase 2. pg. 15
   Applicant: Pape-Dawson Engineers (Todd Blackmon, P.E.)
   Owner: ASA Properties (Garrett Mechler)

   C) FP21-0168 Approval of the final plat for The Silos Subdivision, Unit 5 with conditions. pg. 21
   Applicant: HMT Engineering & Surveying

Owner: Milestone Conrads Development, Ltd.

D) FP21-0169 Approval of the final plat for The Silos Subdivision, Unit 4 with conditions. pg. 27
Applicant: HMT Engineering & Surveying
Owner: Milestone Conrads Development, Ltd.

E) FP21-0170 Approval of the final plat for Elliott Electric New Braunfels with conditions. pg. 33
Applicant: HMT Engineering & Surveying
Owner: Elliott Electric Supply

F) FP21-0173 Approval of the final plat for New Braunfels Sports Complex pg. 39
Applicant: HMT Engineering & Surveying (Chris Van Heerde, P.E.)
Owner: City of New Braunfels

6. INDIVIDUAL ITEMS FOR CONSIDERATION

A) Presentation of the Mayfair Development, Design and Control Document (DDCD). pg. 47
Applicant: Thad Rutherford, SouthStar Communities
Presenter**:** Jeff Jewell, Director

B) Public hearing and recommendation to City Council regarding proposed City of New Braunfels drainage policy changes. pg. 51
Presenter: Melissa Reynolds, First Assistant City Engineer

C) **PZ21-0150** Public hearing and recommendation to City Council regarding a proposed rezoning of approximately 60.1 acres out of the J. Thompson Survey, A-608 and William H. Pate Survey, A-259 located east of the intersection of FM 1044 and Michelson Lane, from "APD" Agricultural/Pre-Development District to "ZH-A" Zero Lot Line Home District. pg. 195
Applicant: Chris Van Heerde, P.E., HMT Engineering & Surveying
Owner: Sandra Wunderlich

D) **PZ21-0155** Public hearing and recommendation to City Council regarding the proposed rezoning of Block 1 Lot 15 and a portion of Lot 14, Guada Coma Subdivision, addressed at 46 Guada Coma Drive, from "R-1A-6.6" Single-family District to "R-2A" Single-family and Two-family District. pg. 217
Applicant: City of New Braunfels
Owner: Gordon & Nancy Schroeder

E) **SUP21-123** Public hearing and recommendation to City Council regarding a proposed rezoning to apply a Special Use Permit to allow a truck stop in the "M-1A AH" Light Industrial, Airport Hazard Overlay District, addressed at 4001, 4023 and 4165 IH 35 North. pg. 231

Applicant/Owner: Love's Travel Stops and Country Stores, Inc. (Brad Peck)

F) **SUP21-126** Public hearing and recommendation to City Council regarding a proposed rezoning to apply a Type 2 Special Use Permit to adopt a site plan and establish development standards for an RV Resort on approximately 29 acres consisting of Lot 1D-R Walnut Heights Subdivision and approximately 25 acres out of the J. M. Veramendi A-2 Survey, located in the 700 block of N. Walnut Avenue. pg. 787
Applicant: James Ingalls, INK Civil
Owner: Gary Henry

G) **SUP21-156** Public hearing and recommendation to City Council regarding a proposed rezoning to apply a Special Use Permit to allow short term rental of a single-family dwelling in the "C-3" Commercial District, addressed at 218 South Peach Avenue. pg. 803
Applicant/Owner: Senaido Rodriguez, Jr.

H) **PZ-20-001** Discuss and consider a recommendation to City Council regarding the proposed abandonment of a 0.366-acre portion of Tolle Street Right-of-Way, located between South Gilbert Avenue and the terminus of Tolle Street. pg. 819
Applicant/Owner: IAKOBO Four LP (Monique Weston)

I) **MP21-0174**, **WVR21-177** and **WVR21-178** Discuss and consider approval of the master plan for Creekside Terrace Subdivision with waivers to Sections 118-44(b) and 118-46(d) of the Subdivision Platting Ordinance to allow block length to exceed 1,200 feet and to not require projection of streets into adjacent unplatted property. pg. 837
Applicant: Pape-Dawson Engineers (Matt Geistweidt, P.E.)
Owner: Charles Grimm

J) **WVR21-153** Discuss and consider a waiver request from Section 118-44(b) to allow block length to exceed 1,200 feet in the proposed Goodwin Tract Subdivision. pg. 849
Applicant: Ink Civil (James Ingalls, P.E.)
Owner: EB Industries (Richard Byrd)

K) **WVR21-161** Discuss and consider a waiver request from Section 118-51(f)(3)(b) to not require the floodway be designated a drainage easement on the replat of Misty Acres, Unit 2, Block 3, Lot 6. pg. 855
Applicant: HMT Engineering & Surveying (Chris Van Heerde, P.E.)
Owner: Darrell & Maureen Jonas

L) **WVR21-162** Discuss and consider a waiver from Section 118-49(a) of the Subdivision Platting Ordinance to allow an alternative pedestrian access plan adjacent to existing Zipp Road for the Highland Ridge

Subdivision. pg. 861
Applicant: HMT Engineering & Surveying (Chris Van Heerde, P.E.)
Owner: NB Corridor Investments, LLC (Fred Heimer)

M) **ORD21-129** Public Hearing and recommendation to City Council of an ordinance to revise sections 144 -1.3, Definitions, to define efficiency/studio apartments, and to 144-5.1-3 Schedule of Required Spaces to identify parking standards for efficiency/studio apartments. pg. 871
Presenter**:** Jean Drew, Senior Planner

7. STAFF REPORT

Legislative Update

8. ADJOURNMENT

CERTIFICATION

I hereby certify the above Notice of Meeting was posted on the bulletin board at the New Braunfels City Hall.

_____
Board Liaison

NOTE: Persons with disabilities who plan to attend this meeting and who may need auxiliary aids or services such as interpreters for persons who are deaf or hearing impaired, readers, or large print, are requested to contact the City Secretary's Office at 221-4010 at least two (2) work days prior to the meeting so that appropriate arrangements can be made.

City of New Braunfels

Planning Commission Agenda Item Report

550 Landa Street
New Braunfels, TX

6/1/2021

Agenda Item No. A)

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Planning Commission
Regular Meeting Minutes
May 4, 2021

Members Present
Chair Lee Edwards
Vice Chair Stanley Laskowski
Ron Reaves
Thomas Meyer
Chad Nolte
Creighton Tubb
Jerry Sonier
John Mathis

Staff Present
Christopher J. Looney, Planning Director
Frank Onion, Assistant City Attorney
Melissa Reynolds, First Assistant City Engineer
Holly Mullins, Senior Planner
Matt Greene, Planner
Matthew Simmont, Planner
Sam Hunter, Planning Technician
Maddison O'Kelley, Assistant Planner

Members Absent
Shaun Gibson

1. The above meeting was called to order by Chair Edwards at 6:00 p.m.

2. ROLL CALL
Roll was called, and a quorum was declared.

3. APPROVAL OF MINUTES
Motion by Vice Chair Laskowski, seconded by Commissioner Sonier, to approve the regular meeting minutes of April 6, 2021 with revisions. Motion carried (6-0-0).

4. CITIZENS COMMUNICATION
William Rodgers, 16 La Mesa, asked for clarification on zoning.

Discussion followed.

Glen Young, 2749 Ridgeforest Dr, asked for clarification on Citizen Communication.

Discussion followed.

5. CONSENT AGENDA
A) FP21-0132 Approval of the final plat for Simon Street Subdivision.
Applicant/Owner: Moeller & Associates (James Ingalls, P.E.)
B) FP21-0133 Approval of the final plat for Deer Crest Subdivision, Unit 3.
Applicant/Owner: HMT Engineering & Surveying (Bill Ball, P.E.)
C) FP21-0138 Approval of the final plat for Mission Hill Park.
Applicant/Owner: Pape-Dawson Engineers (Todd Blackmon, P.E.)

Motion by Vice Chair Laskowski, seconded by Commissioner Sonier, to approve the consent agenda with staff recommendations. Motion carried (8-0-0).

6. ITEMS FOR CONSIDERATION
Chair Edwards requested to move items 6B through 6G to be considered ahead of item 6A with no objections from the Commission.

B) SUP20-267 Public hearing and recommendation to City Council regarding a proposed rezoning to apply a Special Use Permit to allow a variety of residential and non-residential development on

approximately 49.5 acres out of the A-103, Sarah Dewitt Survey, addressed at 514 & 720 W. Zipp Road, from "R-1A-6.6" Single Family District to allow uses allowed in the following zoning districts: "MU-B" High Intensity Mixed Use, "R-1A-4" Single-Family Small Lot Residential, "ZH-A" Zero Lot Line Home and "R-2A" Single and Two-Family Residential. *Applicant: Thor Thornhill, HMT Engineering & Surveying; Owner: Gregory Family Revocable Trust, Rosemarie L Gregory; Case Manager: Matthew Simmont.*

Mr. Simmont presented and recommended approval.

Chair Edwards asked if there were any questions for staff.

Discussion followed on additional information provided prior to the meeting.

Chair Edwards asked if the applicant would like to speak.

Caren Williams-Murch, 144 Sage Meadows, provided clarification on the project to address concerns from surrounding residents and the city.

Discussion followed on two story structures, the type of housing allowed, and the proposed Walnut alignment.

Chair Edwards opened the public hearing and asked if anyone wished to speak.

Chris Canton, 2713 Ridge Path Dr, stated opposition to the request citing transportation, land use.

William Rodgers, 16 La Mesa Dr, stated opposition to the request in line with prior comments.

Jyoti Canton, 2713 Ridge Path Dr, stated opposition to the request in line with prior comments.

Lauren Stevenson, 2709 Ridge Path Dr, stated they are not opposed to the request so long as the residential buffer is maintained and cited concerns with the development.

Kristen York, 2757 Ridgeforest Dr, asked about a pre-existing easement along the rear of the residential development.

Glen Young, 2749 Ridgeforest, stated opposition to the request citing surrounding neighborhood context and in line with prior comments.

Robert & Kelly Yanez, 2761 Ridgeforest Dr, stated opposition in line with prior comments.

Chair Edwards closed the public hearing.

Discussion followed on the difference between a Planned Development District and SUP and further clarification on lot dimensions and easements.

Chair Edwards asked if there were any further questions or a motion.

Motion by Vice Chair Laskowski, seconded by Commissioner Meyer, to recommend approval to City Council of the proposed rezoning to apply a Special Use Permit to allow a variety of residential and non-residential development on approximately 49.5 acres out of the A-103, Sarah Dewitt Survey, addressed at 514 & 720 W. Zipp Road, from "R-1A-6.6" Single Family District to allow uses allowed in the following zoning districts: "MU-B" High Intensity Mixed Use, "R-1A-4" Single-Family Small Lot Residential, "ZH-A" Zero Lot Line Home and "R-2A" Single and Two-Family Residential with conditions to extend the 125-foot wide R-1A-4, ZH-A, and R-2A residential to the North East corner of 2705 Ridge Path Dr, and include a detention pond adjacent to the Ridgemont Subdivision and W Klein Rd, and to not allow windows or balconies on

second story residences facing the Ridgemont subdivision. Motion carried (7-0-1) with Commissioner Tubb in opposition.

C) SUP21-115 Public hearing and recommendation to City Council regarding a proposed rezoning to apply a Special Use Permit to allow residential use in the M-2 Heavy Industrial District and short term rental of a single-family residence on approximately 0.15 acres out of the AM Esnaurizar A-1 Survey No. 1, addressed at 747 Oasis Street. *Applicant: Kathleen Lund; Owner: Holly Gardener; Case Manager: Holly Mullins.*

Mrs. Mullins presented and recommended approval with conditions as listed in the staff report.

Chair Edwards asked if there were any questions for staff.

Discussion followed on off-street parking.

Chair Edwards asked if the applicant would like to speak.

Kathleen Lund, 747 Oasis St, provided intent behind the request.

Discussion followed on the proposed driveway.

Chair Edwards opened the public hearing and asked if anyone wished to speak.

William Rodgers, 16 La Mesa, asked if the property would be made ADA compliant with remodeling.

Discussion followed.

Chair Edwards closed the public hearing.

Chair Edwards asked if there were any further questions or a motion.

Motion by Commissioner Vice Chair Laskowski, seconded by Commissioner Sonier, to recommend approval to City Council of the proposed rezoning to apply a Special Use Permit to allow residential use in the M-2 Heavy Industrial District and short term rental of a single-family residence on approximately 0.15 acres out of the AM Esnaurizar A-1 Survey No. 1, addressed at 747 Oasis Street with staff conditions. Motion carried (8-0-0).

D) SUP21-122 Public hearing and recommendation to City Council regarding a proposed rezoning to apply a Special Use Permit to allow short term rental of a single-family dwelling in the "C-3" Commercial District, addressed at 306 E. Faust Street. *Applicant/Owner: Jeffrey A Coultas; Case Manager: Matt Greene.*

Mr. Greene presented and recommended approval with conditions as listed in the staff report.

Chair Edwards asked if there were any questions for staff.

Discussion followed for clarification of the request.

Chair Edwards asked if the applicant would like to speak.

Jeff Coultas, 306 E Faust, provided intent and context behind the request.

Chair Edwards opened the public hearing and asked if anyone wished to speak.

Douglas Miller, 1735 Canyon Way, stated he is the property owner of number 16 and cited support for the request.

William Rodgers, 16 La Mesa, asked for clarification of the request and asked about ADA compliance.

Discussion followed on ADA standards.

Darrel Panozzo, 219 E Faust, stated he is in favor of the request in line with prior comments.

Chair Edwards closed the public hearing.

Chair Edwards asked if there were any further questions or a motion.

Motion by Commissioner Reaves, seconded by Commissioner Meyer, to recommend approval to City Council of the proposed rezoning to apply a Special Use Permit to allow short term rental of a single-family dwelling in the "C-3" Commercial District, addressed at 306 E. Faust Street. Motion carried (8-0-0).

E) CS21-0128 Public hearing and recommendation to City Council regarding a request for acceptance of approximately 110 acres out of the WJ Ragsdale A-268 Survey and the AM Esnaurizar A-20 Survey, into the City of New Braunfels extraterritorial jurisdiction (ETJ), located near the intersection of FM 758 and SH 123 North. *Applicant: Dennis Wilkerson; Case Manager: Holly Mullins.*

Mrs. Mullins presented.

Chair Edwards asked if there were any questions for staff.

Chair Edwards asked if the applicant would like to speak.

No one spoke.

Chair Edwards opened the public hearing and asked if anyone wished to speak.

No one spoke.

Chair Edwards closed the public hearing.

Chair Edwards asked if there were any further questions or a motion.

Motion by Commissioner Reaves, seconded by Commissioner Meyer, to recommend approval to City Council of the proposed request for acceptance of approximately 110 acres out of the WJ Ragsdale A-268 Survey and the AM Esnaurizar A-20 Survey, into the City of New Braunfels extraterritorial jurisdiction (ETJ), located near the intersection of FM 758 and SH 123 North. Motion carried (8-0-0).

F) CS21-0139 Discuss and consider a recommendation to City Council regarding a variance request to allow a proposed business, addressed at 494 North Seguin Avenue, to provide alcohol sales (wine and beer, on premises consumption) within 300 feet of a church. *Applicant: Rashmi Bhat; Case Manager: Maddison O'Kelley, Assistant Planner.*

Ms. O'Kelley presented the request.

Chair Edwards asked if there were any questions for staff.

Discussion followed on the public notice.

Chair Edwards asked if the applicant would like to speak.

Rashmi Bhat, 224 Limestone Creek, stated they were available to answer any questions.

Discussion followed on if the church was contacted by the applicant.

Chair Edwards opened the public hearing and asked if anyone wished to comment.

William Rodgers, 16 La Mesa Dr, asked for clarification of the request.

Discussion followed for clarification.

Chair Edwards asked if there were any further questions or a motion.

Motion by Commissioner Sonier, seconded by Commissioner Mathis, to recommend approval to City Council of the proposed variance request to allow a proposed business, addressed at 494 North Seguin Avenue, to provide alcohol sales (wine and beer, on premises consumption) within 300 feet of a church. Motion carried (8-0-0).

G) Proposed ordinance revision to sections 144 -1.3, Definitions, to define efficiency/studio apartments, and to 144-5.1-3 Schedule of required spaces to identify parking standards for efficiency/studio apartments. *Case Manager: Jean Drew.*

Mrs. Drew presented the request.

Chair Edwards asked if there were any questions for staff.

Discussion followed on clarification of parking requirements and if a public hearing was needed.

Commissioner Reaves left the meeting at 8:19 pm.

Motion by Vice Chair Laskowski, seconded by Commissioner Tubb, to table Item 6A and discuss Item 7A. Motion passed (7-0-0).

A) Presentation and discussion regarding proposed City of New Braunfels drainage policy changes. *Melissa Reynolds, First Assistant City Engineer.*

Mrs. Reynolds presented.

Chair Edwards asked if there were any questions for staff.

Discussion followed on the proposed changes.

7. STAFF REPORT

A) Discuss and consider shifting to in-person/virtual hybrid Commission meetings.

Discussion followed on how the hybrid meetings would be conducted, if each commissioner was comfortable with going back to in-person meetings, and protocol on masks.

Motion by Commissioner Sonier, seconded by Commissioner Mathis, to shift back to in-person meetings at the next regular meeting. Motion passed (6-1-0) with Commissioner Meyer abstained.

Motion by Vice Chair Laskowski, seconded by Commissioner Sonier, to shift back to in-person/virtual hybrid meetings at the next regular meeting then shifting to only in-person for the months following. Motion passed (6-1-0) with Commissioner Meyer abstained.

Motion by Vice Chair Laskowski, seconded by Commissioner Sonier, to remove item 6A from the table. Motion passed (7-0-0).

8 ADJOURNMENT

There being no further business, Chair Edwards adjourned the meeting at 9:20 pm.

_____ _____

Chair **Date**

City of New Braunfels

Planning Commission Agenda Item Report

550 Landa Street
New Braunfels, TX

6/1/2021

Agenda Item No. A)

PRESENTER:
Applicant: HMT Engineering & Surveying (Bill Ball, P.E.)
Owner: KB Home Lone Star, Inc. (David Brodbeck)
SUBJECT:
FP21-0133 Approval of the final plat for Deer Crest Subdivision, Unit 4

DEPARTMENT: Planning and Development Services

COUNCIL DISTRICTS IMPACTED: N/A (Outside City Limits)

BACKGROUND INFORMATION:

Applicant: HMT Engineering & Surveying (Bill Ball, P.E.)
290 S. Castell Ave., Suite 100
New Braunfels, TX 78130
(830) 625-8555 billb@hmtnb.com

Owner: KB Home Lone Star, Inc. (David Brodbeck)
4800 Fredericksburg Rd.
San Antonio, TX 782329
(210) 301-2868 dbbrobeck@kbhome.com

Staff Contact: Matt Greene
(830) 221-4053 mgreene@nbtexas.org

Description: Platting 15.51 acres into 87 single-family residential lots and 2 drainage lots

ISSUE:
The subject property is located on the west side of State Highway 46 South in Guadalupe County across from the Avery Park Subdivision, consists of 15.51 acres and is proposed for the development of 87 single-family residential lots and 2 drainage lots.

Drainage:
The Public Works Department reviewed preliminary drainage with the Letter of Certification process as required by Section 118-51e of the Subdivision Platting Ordinance and in accordance with Chapter 143 Municipal Drainage Utility Systems and the Drainage and Erosion Control and Design Manual.

No portion of this subdivision is located within the 100-year floodplain.

Utilities:

Electric and wastewater services will be provided by New Braunfels Utilities (NBU) and water service will be provided by Springs Hill Water Supply. Utility Easements have been designated on the plat as requested by the utility entities.

Transportation:
Regional Transportation Plan
This final plat is in compliance with the City's Regional Transportation Plan as there are no existing or proposed thoroughfares within or adjacent to the subject property.

Hike and Bike
This final plat is in compliance with the City's Hike and Bike Trails Plan as it does not indicate any proposed trails within or adjacent to the subdivision.

Sidewalks:
Four-foot wide public sidewalks will be construct per City standards adjacent to the curb. The developer will construct sidewalks adjacent to Drainage Lots 605, Block 9 and 610, Block 13 at the time of subdivision construction and the builder/owner of each residential lot will construct sidewalks at the time of building construction.

Roadway Impact Fees:
This final plat is located outside the city limits and the Roadway Impact Fee Study Area and Roadway Impact Fees do not apply.

Parkland Dedication and Development:
This subdivision is subject to the 2006 Parkland Dedication and Development Ordinance. An HOA park was dedicated in Unit 1 of the subdivision and the developer intends to comply with the parkland development requirements. Park Development Fees will be paid prior to final plat recordation if the park improvements have not been installed and approved prior to recordation.

FISCAL IMPACT:
N/A

RECOMMENDATION:
To meet the requirements of the Subdivision Platting Ordinance and other adopted codes, the applicant's proposed final plat must comply with the conditions noted below. Staff recommends approval of the applicant's proposed final plat with the following Conditions of Approval:

1. Park Development Fees must be paid prior to plat recordation or an approval letter from the Parks and Recreation Department must be submitted stating park improvements are in compliance with the Prk Land Dedication and Development Ordinance. *(NBCO 118-65)*

2. Add a plat note stating: "This subdivision is within the Conical Zone of the Airport Hazard Zoning District and is subject to Airport Hazard Zoning District standards and regulations." *(NBCO 118-24(15))*

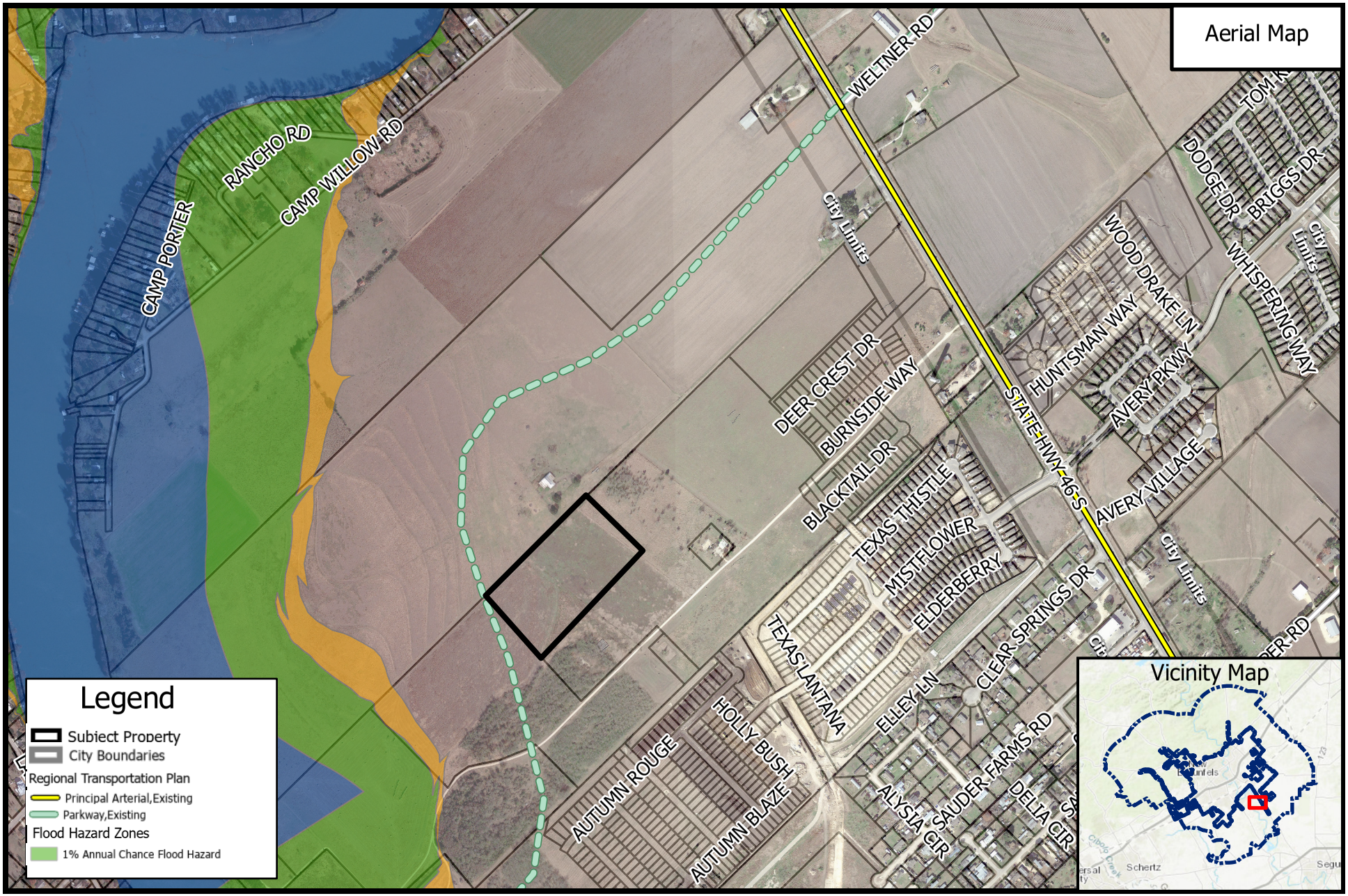
3. The temporary turnaround at the terminus of Bow Crossing must be recorded and a copy of the recorded easement document provided to the City prior to recordation of the plat. *(NBCO 118-46(j))*

4. Revise “Comal County” to “Guadalupe County” in plat note #7. *(NBCO 118-29(i))*

5. Update the recorded plat document information for Deer Crest, Unit 2 on Sheet 2. *(NBCO 118-24(4))*

Approval Compliance:
To obtain approval of the final plat the applicant must submit to the City a written response that satisfies each condition of approval prior to expiration of the final plat (Section 118-32(k)). In accordance with Chapter 212, Texas Local Government Code, the City will determine the final plat approved if the response adequately addresses each Condition of approval.

Attachments:
Aerial Map
Final Plat



FP21-0172

Deer Crest Unit 4 - Final Plat

0 480 960 Feet

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Path:
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Source: City of New Braunfels Planning Date: 5/18/2021

DISCLAIMER: This map and information contained in it were developed exclusively for use by the City of New Braunfels. Any use or reliance on this map by anyone else is at that party's risk and without liability to the City of New Braunfels, its officials or employees for any discrepancies, errors, or variances which may exist.

FINAL PLAT ESTABLISHING

DEER CREST, UNIT 4

BEING 15.51 ACRES OF LAND SITUATED IN THE A.M. ESNAURIZAR SURVEY, ABSTRACT NO. 20, GUADALUPE COUNTY, TEXAS, AND BEING A PORTION OF A CALLED 64.60 ACRE TRACT, TRACT 1, RECORDED IN DOCUMENT NO. 201999000688, OFFICIAL PUBLIC RECORDS, GUADALUPE COUNTY, TEXAS.

PLAT NOTES:

1. ALL LOTS WITHIN THE SUBDIVISION WILL BE PROVIDED WATER SERVICES BY SPRINGS HILL WATER SUPPLY CORPORATION (SHWSC). SEWER AND ELECTRIC SERVICES WILL BE PROVIDED BY NEW BRAUNFELS UTILITIES (NBU). TELEPHONE AND CABLE SERVICES FOR THE SUBDIVISION WILL BE PROVIDED BY AT&T COMMUNICATIONS AND/OR SPECTRUM.
2. ALL BEARINGS AND COORDINATES SHOWN HEREON ARE BASED UPON THE TEXAS COORDINATE SYSTEM, SOUTH CENTRAL ZONE (4204), NORTH AMERICAN DATUM 1983, GRID. DISTANCES SHOWN HEREON ARE BASED UPON SURFACE MEASUREMENTS. TO CONVERT SURFACE DISTANCES TO GRID, APPLY A COMBINED SCALE FACTOR OF 1.00015.
3. MONUMENTS WERE FOUND OR SET AT EACH CORNER OF THE SURVEY BOUNDARY OF THE SUBDIVISION. MONUMENTS AND LOT MARKERS WILL BE SET WITH 1/2" IRON PINS WITH PLASTIC CAP STAMPED "HMT" IMMEDIATELY AFTER COMPLETION OF UTILITY INSTALLATION AND STREET CONSTRUCTION UNLESS NOTED OTHERWISE.
4. THIS SUBDIVISION IS NOT WITHIN THE EDWARDS AQUIFER RECHARGE ZONE.
5. THIS SUBDIVISION IS WITHIN THE EXTRATERRITORIAL JURISDICTION LIMITS OF THE CITY LIMITS OF THE CITY OF NEW BRAUNFELS, TEXAS.
6. THIS SUBDIVISION IS WITHIN THE COMAL INDEPENDENT SCHOOL DISTRICT.
7. NO PORTION OF THE SUBDIVISION IS LOCATED WITHIN AN INDICATED SPECIAL FLOOD HAZARD ZONE ACCORDING TO THE ADOPTED FLOOD MAPS OF THE CITY OF NEW BRAUNFELS, AS DEFINED BY THE COMAL COUNTY, TEXAS, FLOOD INSURANCE RATE MAP NUMBER 48187C0120F, EFFECTIVE DATE NOVEMBER 2, 2007 AS PREPARED BY THE FEDERAL EMERGENCY MANAGEMENT AGENCY.
8. NO STRUCTURES, WALLS OR OTHER OBSTRUCTIONS OF ANY KIND SHALL BE PLACED WITHIN THE LIMITS OF THE DRAINAGE EASEMENTS SHOWN ON THIS PLAT. NO LANDSCAPING, FENCES, OR OTHER TYPE OF MODIFICATIONS WHICH ALTER THE CROSS SECTIONS OF THE DRAINAGE EASEMENTS OR DECREASE THE HYDRAULIC CAPACITY OF THE EASEMENT, AS APPROVED, SHALL BE ALLOWED WITHOUT THE APPROVAL OF THE CITY ENGINEER. THE CITY OF NEW BRAUNFELS SHALL HAVE THE RIGHT OF INGRESS AND EGRESS OVER GRANTOR'S ADJACENT PROPERTY TO REMOVE ANY OBSTRUCTIONS PLACED WITHIN THE LIMITS OF SAID DRAINAGE EASEMENTS AND TO MAKE ANY MODIFICATIONS OR IMPROVEMENTS WITHIN SAID DRAINAGE EASEMENTS.
9. FUTURE DEVELOPMENT IS SUBJECT TO CHAPTER 114 (STREETS, SIDEWALKS AND OTHER PUBLIC SPACES) OF THE NEW BRAUNFELS CODE OF ORDINANCES.
10. FOUR (4) FOOT WIDE SIDEWALKS WILL BE CONSTRUCTED PER CITY STANDARDS ADJACENT TO THE CURB BY THE DEVELOPER AT THE TIME OF SUBDIVISION STREET CONSTRUCTION ALONG:
    A. WAKE ST – LOT 605, BLOCK 9 AND LOT 610, BLOCK 13.
    B. DEER CREST DR – LOT 610, BLOCK 13.
11. FOUR (4) FOOT WIDE SIDEWALKS WILL BE CONSTRUCTED PER CITY STANDARDS ADJACENT TO THE CURB BY THE HOME BUILDER AT THE TIME OF BUILDING CONSTRUCTION ALONG:
    A. HARVEST FIELDS, WAKE ST, BOW CROSSING, AND DEER CREST DR.
12. THE ELEVATION OF THE LOWEST FLOOR OF A STRUCTURE SHALL BE AT LEAST 10 INCHES ABOVE THE FINISHED GRADE OF THE SURROUNDING GROUND, WHICH SHALL BE SLOPED IN A FASHION SO AS TO DIRECT STORMWATER AWAY FROM THE STRUCTURE. PROPERTIES ADJACENT TO STORMWATER CONVEYANCE STRUCTURES MUST HAVE A FLOOR SLAB ELEVATION OR BOTTOM OF FLOOR JOISTS A MINIMUM OF ONE FOOT ABOVE THE 100-YEAR WATER FLOW ELEVATION IN THE STRUCTURE. DRIVEWAYS SERVING HOUSES ON THE DOWNHILL SIDE OF THE STREET SHALL HAVE A PROPERLY SIZED CROSS SWALE PREVENTING RUNOFF FROM ENTERING THE GARAGE AND SHALL PREVENT WATER FROM LEAVING THE STREET.
13. THIS SUBDIVISION IS SUBJECT TO THE 2006 CITY OF NEW BRAUNFELS PARK LAND DEDICATION AND DEVELOPMENT ORDINANCE. THIS PLAT IS APPROVED FOR ONE DWELLING UNIT(S) PER BUILDABLE LOT WITH A MAXIMUM OF 87 BUILDABLE LOTS. AT SUCH TIME THAT ADDITIONAL DWELLING UNITS ARE CONSTRUCTED, THE OWNER OF THE LOT(S) SHALL NOTIFY THE CITY AND COMPLY WITH THE ORDINANCE FOR EACH DWELLING UNIT.
14. THIS UNIT CONTAINS 87 BUILDABLE RESIDENTIAL LOTS.
15. LOT 605, BLOCK 9 (DRAINAGE) AND LOT 610, BLOCK 13 (DRAINAGE) SHALL BE OWNED AND MAINTAINED BY THE DEER CREST HOME OWNERS ASSOCIATION, ITS SUCCESSORS AND/OR ASSIGNS.
16. ALL DRAINAGE EASEMENTS WITHIN THE LOTS WILL BE OWNED AND MAINTAINED BY PROPERTY OWNER.

NEW BRAUNFELS UTILITIES NOTES:

1. MAINTENANCE OF DEDICATED UTILITY EASEMENTS IS THE RESPONSIBILITY OF THE PROPERTY OWNER. ANY USE OF AN EASEMENT, OR ANY PORTION OF IT, INCLUDING LANDSCAPING OR DRAINAGE FEATURES, IS SUBJECT TO AND SHALL NOT CONFLICT WITH THE TERMS AND CONDITIONS IN THE EASEMENT, MUST NOT ENDANGER OR INTERFERE WITH THE RIGHTS GRANTED BY THE EASEMENT TO NEW BRAUNFELS UTILITIES, ITS SUCCESSORS AND ASSIGNS, AND SHALL BE SUBJECT TO APPLICABLE PERMIT REQUIREMENTS OF THE CITY OF NEW BRAUNFELS OR ANY OTHER GOVERNING BODY. THE PROPERTY OWNER MUST OBTAIN, IN ADVANCE, WRITTEN AGREEMENT WITH THE UTILITIES TO UTILIZE THE EASEMENT, OR ANY PART OF IT.
2. UTILITIES WILL POSSESS A 5' WIDE SERVICE EASEMENT TO THE DWELLING ALONG THE SERVICE LINE TO THE SERVICE ENTRANCE. THIS EASEMENT WILL VARY DEPENDING UPON LOCATION OF DWELLING AND SERVICE.
3. UTILITIES SHALL HAVE ACCESS TO THE METER LOCATIONS FROM THE FRONT YARD AND METER LOCATIONS SHALL NOT BE LOCATED WITHIN A FENCED AREA.
4. EACH LOT MUST HAVE ITS OWN WATER AND SEWER SERVICE AT THE OWNER'S/DEVELOPER'S EXPENSE.
5. DO NOT COMBINE ANY NEW UTILITY EASEMENTS (U.E.) WITH DRAINAGE EASEMENTS (D.E.) OR MAKE CHANGES IN GRADE WITHIN THE UTILITY EASEMENTS (U.E.) WITHOUT WRITTEN APPROVAL FROM NEW BRAUNFELS UTILITIES.

KNOW ALL MEN BY THESE PRESENTS:

I, THE UNDERSIGNED DOROTHY J. TAYLOR, A REGISTERED PROFESSIONAL LAND SURVEYOR IN THE STATE OF TEXAS, HEREBY CERTIFY THAT THIS PLAT IS TRUE AND CORRECTLY MADE UNDER MY SUPERVISION AND IN COMPLIANCE WITH CITY AND STATE SURVEY REGULATIONS AND LAWS AND MADE ON THE GROUND AND THAT THE CORNER MONUMENTS WERE PROPERLY PLACED UNDER MY SUPERVISION.

PRELIMINARY, THIS DOCUMENT SHALL NOT BE RECORDED FOR ANY PURPOSE.

DOROTHY J. TAYLOR
REGISTERED PROFESSIONAL LAND SURVEYOR NO. 6295
290 S. CASTELL AVE., SUITE 100, NEW BRAUNFELS, TEXAS 78130

PLAT PREPARED MAY 3, 2021

HMT ENGINEERING & SURVEYING
290 S. CASTELL AVE., STE. 100
NEW BRAUNFELS, TX 78130
TBPE FIRM F-10961
TBPLS FIRM 10153600

SPRINGS HILL WATER SUPPLY CORPORATION (SHWSC):

1. EXISTING WATER INFRASTRUCTURE IN THE VICINITY OF THE TRACT IS AVAILABLE TO SERVE THE PROPOSED DEVELOPMENT. IF THE DEVELOPMENT EXCEEDS THE CAPACITY OF THE EXISTING WATER INFRASTRUCTURE, THEN IT WILL BE THE DEVELOPER'S RESPONSIBILITY TO MAKE THE NECESSARY WATER AND WASTEWATER IMPROVEMENTS TO THE EXISTING INFRASTRUCTURE TO PROVIDE SUFFICIENT CAPACITY. EXTENT OF THE NECESSARY WATER IMPROVEMENTS WILL BE OUTLINED IN A MEMORANDUM OF UNDERSTANDING OR NON-STANDARD SERVICE AGREEMENT PRIOR TO THE APPROVAL OF ANY FINAL PLAT.
2. SHWSC SHALL HAVE ACCESS TO METER LOCATIONS FROM THE FRONT YARD WITH THE LOCATION NOT BEING WITHIN A FENCED AREA.
3. ANY EASEMENT DESIGNATED AS A SHWSC UTILITY EASEMENT SHALL REMAIN OPEN FOR ACCESS AT ALL TIMES AND SHALL NOT BE WITHIN A FENCED AREA.
4. ALL SHWSC EASEMENTS ARE FOR CONSTRUCTION, MAINTENANCE (INCLUDING BUT NOT LIMITED TO REMOVAL OF TREES AND OTHER OBSTRUCTIONS), READING OF METERS, AND REPAIR OF ANY SHWSC FACILITY LOCATED WITHIN SAID EASEMENT.

_____ _____
AUTHORIZED AGENT — DATE
SPRINGS HILL WATER SUPPLY CORPORATION

STATE OF TEXAS
COUNTY OF GUADALUPE

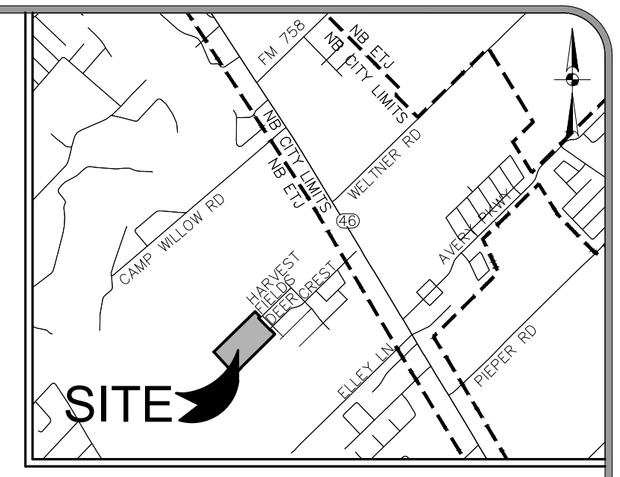
I (WE) THE UNDERSIGNED OWNER(S) OF THE LAND SHOWN ON THIS PLAT, AND DESIGNATED HEREIN AS THE DEER CREST, UNIT 4 A SUBDIVISION TO THE CITY OF NEW BRAUNFELS, COUNTY OF GUADALUPE, TEXAS, AND WHOSE NAME IS SUBSCRIBED HERETO, DO HEREBY SUBDIVIDE SUCH PROPERTY AND DEDICATE TO THE USE OF THE PUBLIC ALL STREETS, ALLEYS, PARKS, DRAINS, EASEMENTS, AND PUBLIC PLACES THEREON SHOWN FOR THE PURPOSES AND CONSIDERATION THEREIN EXPRESSED.

_____
KB HOME LONE STAR, INC.
BY: JOE C. HERNANDEZ, AUTHORIZED AGENT
4800 FREDERICKSBERG ROAD
SAN ANTONIO, TX 78229

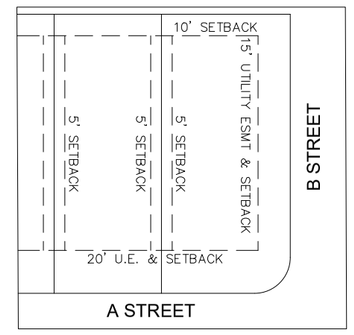
STATE OF TEXAS
COUNTY OF _____

THIS INSTRUMENT WAS ACKNOWLEDGED BEFORE ME ON THIS
_____ DAY OF _____, 20___,
BY _____

_____
NOTARY PUBLIC, STATE OF TEXAS
MY COMMISSION EXPIRES: _____



LOCATION MAP
NOT TO SCALE



TYPICAL BUILDING SETBACK LINE AND UTILITY EASEMENT DIAGRAM
NOT-TO-SCALE

APPROVED THIS THE _____ DAY OF _____, 20___,
BY THE PLANNING COMMISSION OF THE CITY OF NEW BRAUNFELS, TEXAS.

_____ _____
CHAIRMAN — DATE

APPROVED FOR ACCEPTANCE

_____ _____
DATE — PLANNING DIRECTOR

_____ _____
DATE — CITY ENGINEER

_____ _____
DATE — NEW BRAUNFELS UTILITIES

STATE OF TEXAS
COUNTY OF GUADALUPE

_____
COUNTY CLERK, GUADALUPE COUNTY, TEXAS

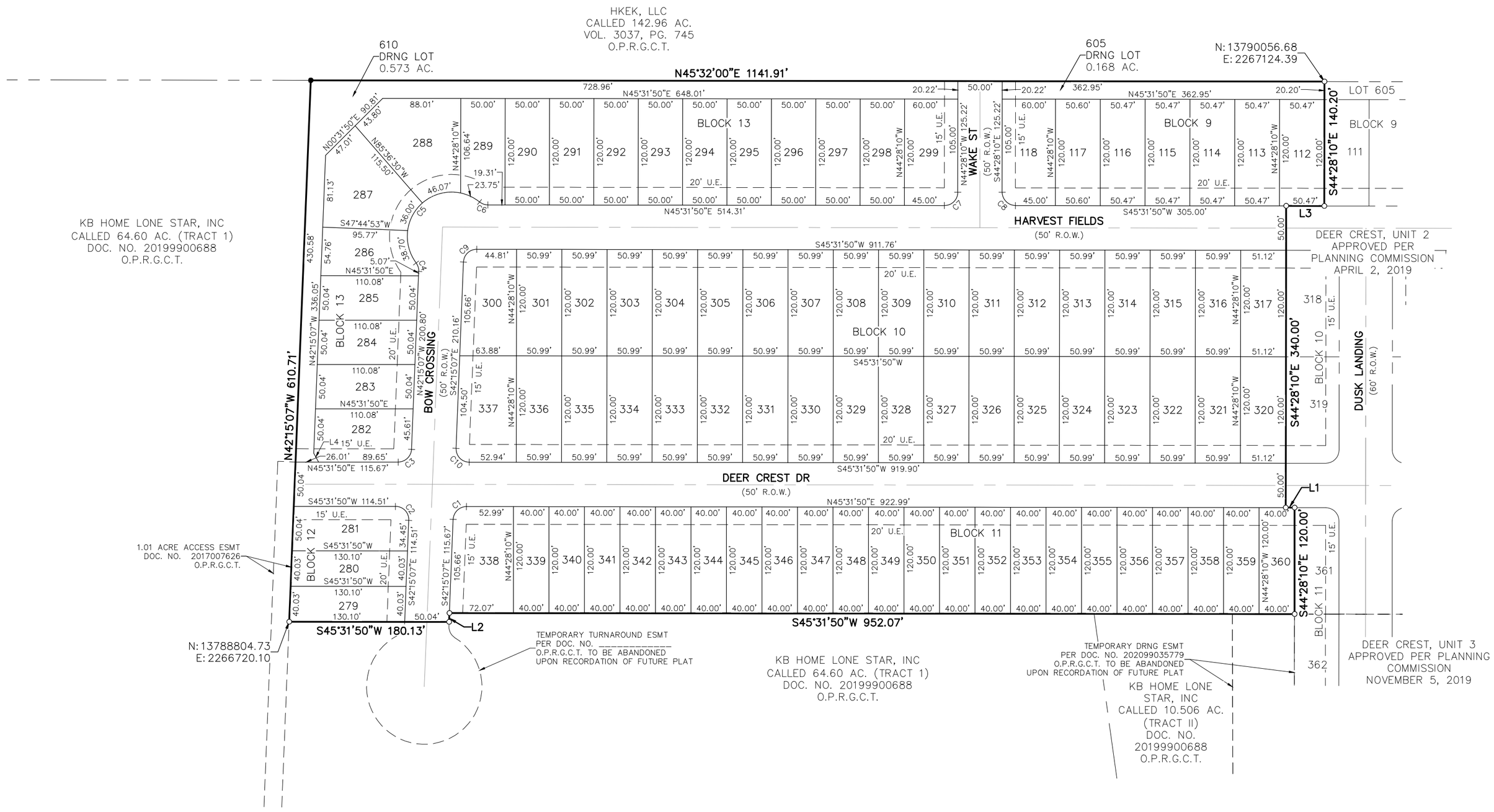
_____
DEPUTY

Drawing Name: T:\011 - KB Homes\011.026 - Deer Crest Unit 4\Deer Crest Unit 4 Plat.dwg User: kellyk Apr 26, 2021 - 9:48am

FINAL PLAT ESTABLISHING

DEER CREST, UNIT 4

BEING 15.51 ACRES OF LAND SITUATED IN THE A.M. ESNAURIZAR SURVEY, ABSTRACT NO. 20, GUADALUPE COUNTY, TEXAS, AND BEING A PORTION OF A CALLED 64.60 ACRE TRACT, TRACT 1, RECORDED IN DOCUMENT NO. 201999000688 OFFICIAL PUBLIC RECORDS, GUADALUPE COUNTY, TEXAS.



LEGEND:

- ● = FND 1/2" IRON PIN W/ PLASTIC CAP STAMPED "HMT" (UNLESS NOTED OTHERWISE)
- ○ = SET 1/2" IRON PIN W/ PLASTIC CAP STAMPED "HMT"
- U.E. = UTILITY EASEMENT
- DRNG = DRAINAGE
- ESMT = EASEMENT
- R.O.W. = RIGHT-OF-WAY
- M.P.R.G.C.T. = MAP AND PLAT RECORDS, GUADALUPE COUNTY, TEXAS
- O.P.R.G.C.T. = OFFICIAL PUBLIC RECORDS, GUADALUPE COUNTY, TEXAS

CURVE TABLE						
CURVE	LENGTH	RADIUS	DELTA	TANGENT	CHORD LENGTH	CHORD BEARING
C1	22.98'	15.00'	087°46'57"	14.43'	20.80'	S01°38'21"W
C2	24.14'	15.00'	092°13'03"	15.59'	21.62'	N88°21'39"W
C3	22.98'	15.00'	087°46'57"	14.43'	20.80'	N01°38'21"E
C4	10.07'	14.95'	038°35'04"	5.23'	9.88'	N61°58'59"W
C5	144.52'	50.00'	165°36'19"	395.94'	99.21'	N01°35'55"E
C6	10.18'	15.00'	038°52'15"	5.29'	9.98'	N64°57'57"E
C7	23.56'	15.00'	090°00'00"	15.00'	21.21'	N00°31'50"E
C8	23.56'	15.00'	090°00'00"	15.00'	21.21'	S89°28'10"E
C9	22.98'	15.00'	087°46'57"	14.43'	20.80'	S01°38'21"W
C10	24.14'	15.00'	092°13'03"	15.59'	21.62'	S88°21'39"E

LINE TABLE		
LINE #	LENGTH	DIRECTION
L1	10.00'	N45°31'50"E
L2	10.01'	S42°15'07"E
L3	42.95'	S45°31'50"W
L4	11.46'	N73°47'37"W

PLAT PREPARED MAY 3, 2021

HMT ENGINEERING & SURVEYING
290 S. CASTELL AVE., STE. 100
NEW BRAUNFELS, TX 78130
TBPE FIRM F-10961
TBPLS FIRM 10153600

Drawing Name: T:\011 - KB Homes\011.026 - Deer Crest Unit 4\Deer Crest Unit 4 Plat.dwg User: kellyk Apr 28, 2021 - 10:30am

City of New Braunfels

Planning Commission Agenda Item Report

550 Landa Street
New Braunfels, TX

6/1/2021

Agenda Item No. B)

PRESENTER:
Applicant: Pape-Dawson Engineers (Todd Blackmon, P.E.)
Owner: ASA Properties (Garrett Mechler)
SUBJECT:
FP21-0157 Approval of the final plat for Veramendi - Word Pkwy Phase 2.
DEPARTMENT: Planning and Development Services
COUNCIL DISTRICTS IMPACTED: Outside City Limits

BACKGROUND INFORMATION:

Applicant: Pape-Dawson Engineers, Inc. (Todd Blackmon, P.E.)
1672 Independence Drive, Suite 102
New Braunfels, TX 78132
(830) 632-5633 tblackmon@pape-dawson.com

Owner: Veramendi PE - Brisbane, LLC
ASA Properties (Garrett Mechler)
387 W. Mill Street
New Braunfels, TX 78130
(830) 643-1338 garrett.mechler@asaproperties.us.com

Staff Contact: Matthew Simmont
(830) 221-4058 msimmont@nbtexas.org

Description: Platting 2.454 acres into a public right-of-way

ISSUE:
The subject property is located north of Loop 337 within Sector 2 of the Veramendi Development and will allow for an extension (approximately 500 feet) of Word Parkway to be constructed.

Drainage:
The Public Works Department reviewed preliminary drainage with the Letter of Certification process as required by Section 118-51e of the Subdivision Platting Ordinance and in accordance with Chapter 143 Municipal Drainage Utility Systems and the Drainage and Erosion Control and Design Manual. Final drainage is under review with the submitted construction plans.

No portion of this subdivision is located within the 100-year floodplain.

Utilities:
Electric, water and wastewater services will be provided by New Braunfels Utilities (NBU). Utility Easements have been designated on the plat as requested by the utility entities. Utilities are being extended with this plat.

Transportation:
Street Layout
The street and pedestrian network within the proposed Veramendi - Word Pkwy, Phase 2 Final Plat is in compliance with the Master Framework Pan, Sector Plan 2 and the Plat Design Code. Adequate right-of-way will be dedicated and streets will be constructed as required by the DDCD.

Sidewalks and Accessways
Six-foot wide sidewalk is required on the south side of the right-of-way and will be built at the time of subdivision construction. A ten-foot wide accessway is required on the north side of the right-of-way and will be built at the time of building permit with adjacent development.

Transportation Improvement Fees:
Transportation Improvement Fees are hereby assessed with approval of the final plat. Transportation Improvement Fees are collected at time of building permit as indicated in the Development Agreement fee schedule for the intended use.

Parkland Dedication and Development:
The proposed final plat does not include a park since right-of-way and street development is not subject to the neighborhood park requirements.

Tree Protection:
A tree survey has been submitted that indicates high value trees located within the plat that will be mitigated. A tree preservation and mitigation summary is also continuously updated with the progression of the project. Plat notes address tree protection measures that are required.

FISCAL IMPACT:
N/A
RECOMMENDATION:
To meet the requirements of the Subdivision Platting Ordinance and other adopted codes, the applicant's proposed final plat must comply with the conditions noted below. Staff recommends approval of the applicant's proposed final plat with the following Conditions of Approval:

1. Add the document numbers for all contiguous easements and subdivisions *(NBCO 118-29(b))*.

Approval Compliance:
To obtain approval of the final plat the applicant must submit to the City a written response that satisfies each condition of approval prior to expiration of the final plat (Section 118-32(k)). In accordance with Chapter 212, Texas Local Government Code, the City will determine the final plat approved if the response adequately addresses each Condition of Approval.

Attachments:
Aerial Map
Final Plat

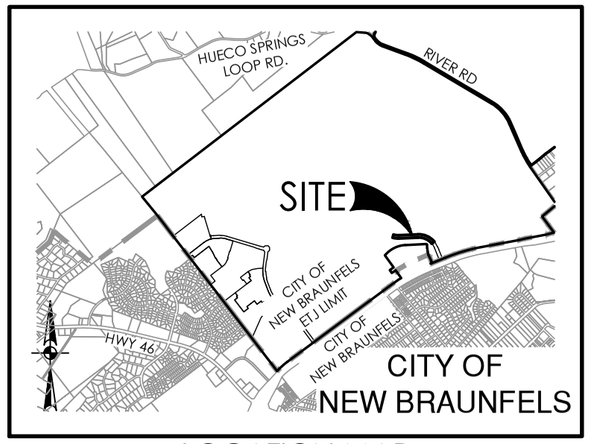
FP21-0157
Veramendi Word Pkwy Phase 2

0 100 200 Feet

1:2,500

Document Path:
\\file-04\Users$\Planning\MOKelley\Documents\ArcGIS\Projects\Base Map\My Base Map\My Base Map.aprx

Source: City of New Braunfels GIS
Date: 5/19/2021



LOCATION MAP

MAPSCO MAP GRID: 123X1
NOT-TO-SCALE

CERTIFICATE OF APPROVAL

APPROVED THIS THE _____ DAY OF _____, 20 ____, BY THE PLANNING COMMISSION OF THE CITY OF NEW BRAUNFELS, TEXAS.

_____
PLANNING COMMISSION CHAIRPERSON

APPROVED FOR ACCEPTANCE

_____ _____
DATE DIRECTOR OF PLANNING

_____ _____
DATE CITY ENGINEER

_____ _____
DATE NEW BRAUNFELS UTILITIES

SURVEYOR'S NOTES:

1. MONUMENTS WERE FOUND OR SET AT EACH CORNER OF THE SURVEY BOUNDARY OF THE SUBDIVISION AS NOTED. MONUMENTS AND LOT MARKERS WILL BE SET WITH ½" IRON ROD WITH CAP MARKED "PAPE-DAWSON" OR MAG NAIL WITH DISK MARKED "PAPE-DAWSON" AFTER COMPLETION OF UTILITY INSTALLATION AND STREET CONSTRUCTION UNLESS NOTED OTHERWISE.
2. COORDINATES SHOWN ARE BASED ON THE NORTH AMERICAN DATUM OF 1983 NAD83 (NA2011) FROM THE TEXAS COORDINATE SYSTEM ESTABLISHED FOR THE SOUTH CENTRAL ZONE DISPLAYED IN GRID VALUES DERIVED FROM THE NGS COOPERATIVE CORS NETWORK.
3. DIMENSIONS SHOWN ARE SURFACE (SCALE FACTOR = 0.9998600196)
4. BEARINGS ARE BASED ON THE NORTH AMERICAN DATUM OF 1983 NAD83 (NA2011) EPOCH 2010.00, FROM THE TEXAS COORDINATE SYSTEM ESTABLISHED FOR THE SOUTH CENTRAL ZONE.

KNOW ALL MEN BY THESE PRESENTS

I, THE UNDERSIGNED DAVID A. CASANOVA, A REGISTERED PROFESSIONAL LAND SURVEYOR IN THE STATE OF TEXAS, HEREBY CERTIFY THAT THIS PLAT IS TRUE AND CORRECTLY MADE UNDER MY SUPERVISION AND IN COMPLIANCE WITH CITY AND STATE SURVEY REGULATIONS AND LAWS AND MADE ON THE GROUND AND THAT THE CORNER MONUMENTS WERE PROPERLY PLACED UNDER MY SUPERVISION.

PRELIMINARY, THIS DOCUMENT SHALL NOT BE RECORDED FOR ANY PURPOSE AND SHALL NOT BE USED OR VIEWED OR RELIED UPON AS A FINAL SURVEY DOCUMENT.

DAVID A. CASANOVA
REGISTERED PROFESSIONAL LAND SURVEYOR #4251
PAPE-DAWSON ENGINEERS, INC.
2000 NW LOOP 410
SAN ANTONIO, TEXAS 78213

NBU NOTES:

1. MAINTENANCE OF DEDICATED UTILITY EASEMENTS IS THE RESPONSIBILITY OF THE PROPERTY OWNER. ANY USE OF AN EASEMENT, OR ANY PORTION OF IT, INCLUDING LANDSCAPING OF DRAINAGE FEATURES, IS SUBJECT TO AND SHALL NOT CONFLICT WITH THE TERMS AND CONDITIONS IN THE EASEMENT, MUST NOT ENDANGER OR INTERFERE WITH THE RIGHTS GRANTED BY THE EASEMENT TO NEW BRAUNFELS UTILITIES, ITS SUCCESSORS AND ASSIGNS, AND SHALL BE SUBJECT TO APPLICABLE PERMIT REQUIREMENTS OF THE CITY OF NEW BRAUNFELS OR ANY OTHER GOVERNING BODY. THE PROPERTY OWNER MUST OBTAIN, IN ADVANCE, WRITTEN AGREEMENT WITH THE UTILITIES TO UTILIZE THE EASEMENT, OR ANY PART OF IT.
2. UTILITIES WILL POSSESS A 5' WIDE SERVICE EASEMENT TO THE BUILDING STRUCTURE ALONG THE SERVICE LINE TO THE SERVICE ENTRANCE. THIS EASEMENT WILL VARY DEPENDING UPON LOCATION OF DWELLING AND SERVICE.
3. UTILITIES SHALL HAVE ACCESS TO THE METER LOCATIONS FROM THE FRONT YARD AND METER LOCATIONS SHALL NOT BE LOCATED WITHIN A FENCED AREA.
4. EACH LOT MUST HAVE ITS OWN WATER AND SEWER SERVICE AT THE OWNER/DEVELOPERS EXPENSE.
5. DO NOT COMBINE ANY NEW UTILITY EASEMENTS (UE) WITH DRAINAGE EASEMENTS (DE) OR MAKE CHANGES IN GRADE WITHIN THE UTILITY EASEMENTS (UE) WITHOUT WRITTEN APPROVAL FROM NEW BRAUNFELS UTILITIES.
6. NBU IS NOT RESPONSIBLE FOR LANDSCAPING OR IRRIGATION IN UE/LE.

FLOOD ZONE NOTE:

NO PORTION OF ANY LOT ON THIS PLAT IS WITHIN AN INDICATED SPECIAL FLOOD HAZARD ZONE ACCORDING TO THE FEMA FIRM MAP NO. 48091C0435F EFFECTIVE DATE 9/2/2009.

UTILITY PROVIDER NOTE:

THE PROPERTY WILL BE SERVED BY THE FOLLOWING:
NEW BRAUNFELS UTILITIES (WATER, SEWER, ELECTRIC)
AT&T (TELECOMMUNICATIONS)
SPECTRUM

DRAINAGE EASEMENT NOTES:

1. DRAINAGE EASEMENTS SHALL "REMAIN FREE OF ALL OBSTRUCTIONS."
2. MAINTENANCE OF DRAINAGE EASEMENT SHOWN OUTSIDE OF LOT LINES SHALL BE THE SOLE RESPONSIBILITY OF THE VERAMENDI DEVELOPMENT COMPANY.
3. NO STRUCTURES, WALLS OR OTHER OBSTRUCTIONS OF ANY KIND SHALL BE PLACED WITHIN THE LIMITS OF DRAINAGE EASEMENTS SHOWN ON THIS PLAT. NO LANDSCAPING, FENCES, OR OTHER TYPE OF MODIFICATIONS WHICH ALTER THE CROSS SECTIONS OF THE DRAINAGE EASEMENTS OR DECREASES THE HYDRAULIC CAPACITY OF THE EASEMENT, AS APPROVED, SHALL BE ALLOWED WITHOUT THE APPROVAL OF THE CITY ENGINEER. THE CITY OF NEW BRAUNFELS AND COMAL COUNTY SHALL HAVE THE RIGHT OF INGRESS AND EGRESS OVER GRANTORS ADJACENT PROPERTY TO REMOVE ANY OBSTRUCTIONS PLACED WITHIN THE LIMITS OF SAID DRAINAGE EASEMENTS AND TO MAKE ANY MODIFICATIONS OR IMPROVEMENTS WITHIN SAID DRAINAGE EASEMENTS.

SIDEWALK NOTES:

1. SIDEWALK TO THE NORTH OF THE RIGHT-OF-WAY SHALL BE CONSTRUCTED AT THE TIME OF BUILDING PERMIT WITH ADJACENT DEVELOPMENTS. SIDEWALK TO THE SOUTH OF THE RIGHT-OF-WAY SHALL BE CONSTRUCTED AT TIME OF THE WORD PKWY ROAD CONSTRUCTION. THE SIDEWALK ON THE SOUTH SIDE OF THE RIGHT-OF-WAY SHALL BE 6' WIDE AND THE SIDEWALK ON THE NORTH SIDE OF THE RIGHT-OF-WAY SHALL BE 10' WIDE. THE SIDEWALKS MAY MEANDER WITHIN BOTH THE STREET RIGHT-OF-WAY AND/OR FUTURE ADJACENT PEDESTRIAN EASEMENTS.

SUBDIVISION PLAT OF VERAMENDI - WORD PKWY PHASE 2

BEING A TOTAL OF 2.454 ACRES OF LAND OUT OF AN 81.86 ACRE TRACT RECORDED IN DOC. NO. 201706024862 OF THE OFFICIAL PUBLIC RECORDS OF COMAL COUNTY, TEXAS, OUT OF THE JUAN MARTIN DE VERAMENDI SURVEY NO. 2, ABSTRACT 3, COMAL COUNTY, TEXAS.

PLAT NOTES:

1. THIS PLAT IS SUBJECT TO THE REQUIREMENTS AND REGULATIONS OF THE VERAMENDI DEVELOPMENT COMPANY DEVELOPMENT AGREEMENT, RECORDED AS DOCUMENT NO. 201506029547 AND AS AMENDED.
2. THIS PLAT IS LOCATED WITHIN THE NEIGHBORHOOD (MIXED DENSITY) RESIDENTIAL PLANNING AREA.
3. STANDARDS FOR PLANT MATERIALS SHALL CONFORM TO THE STANDARDS OF THE LATEST EDITION OF THE *AMERICAN NATIONAL STANDARD A300 PLANTING AND TRANSPLANTING NURSERY STOCK* PUBLISHED BY THE AMERICAN ASSOCIATION OF NURSERYMEN.
4. TREE REPLACEMENT SHALL OCCUR WITHIN 12 MONTHS OF REMOVAL OF THE HIGH VALUE TREE UNLESS DEFERRED TO AN ADJACENT UNIT, WHERE A REPLACEMENT TREE DOES NOT SURVIVE FOR A PERIOD OF AT LEAST 24 MONTHS, THE ORIGINAL APPLICANT OR CURRENT LANDOWNER SHALL REPLACE THE TREE, PREFERABLY DURING OCTOBER - FEBRUARY, UNTIL THE TREE SURVIVES A 12-MONTH PERIOD.
5. SHOULD ANY TREE DESIGNATED FOR RETENTION IN AN APPROVED TREE PROTECTION PLAN DIE PRIOR TO, OR WITHIN 12 MONTHS OF THE COMPLETION OF CONSTRUCTION WORKS, THE APPLICANT SHALL REPLACE THE DEAD TREE WITH A REPLACEMENT TREE/S EQUAL TO THE TOTAL CALIPER INCHES OF THE DEAD TREE. NO GRADING, TRENCHING OR EQUIPMENT SHALL BE CONDUCTED IN THE AREA IDENTIFIED IN THE ROOT PROTECTION ZONE, ALL WORK TO BE PERFORMED BY HAND OR UNDER THE SUPERVISION OF A CERTIFIED ARBORIST.
6. DURING CONSTRUCTION, THE CLEANING OF EQUIPMENT OR MATERIALS AND/OR THE DISPOSAL OF ANY WASTE MATERIAL, INCLUDING, BUT NOT LIMITED TO PAINT, OIL, SOLVENTS, ASPHALT, CONCRETE, MORTAR, ETC., UNDER THE CANOPY OR DRIP LINE OF ANY HIGH VALUE TREE SHALL BE PROHIBITED. NO GRADING, TRENCHING OR EQUIPMENT SHALL BE CONDUCTED OR USED IN THE AREA IDENTIFIED IN THE ROOT PROTECTION ZONE. ALL WORK SHALL BE PERFORMED BY HAND OR UNDER THE SUPERVISION OF A CERTIFIED ARBORIST. NO ATTACHMENTS OR WIRES OF ANY KIND, OTHER THAN THOSE OF A PROTECTIVE NATURE, SHALL BE ATTACHED TO ANY HIGH VALUE TREE.
7. ROADS, FACILITIES, STRUCTURES AND IMPROVEMENTS SUCH AS SIDEWALKS, PATHS, TRAILS, TRAILHEADS, PARK IDENTIFICATION AND WAY FINDING SIGNAGE, SEATING, PICNIC TABLES, DRINKING FOUNTAINS, PET DRINKING FOUNTAINS, TRASH RECEPTACLES, PET WASTE RECEPTACLES, SHADE STRUCTURES, OUTLOOKS, RETAINING WALL, PUBLIC UTILITIES, STORMWATER MANAGEMENT FACILITIES, WATER QUALITY MEASURES AND SIGNAGE ARE PERMITTED WITHIN THE GREEN RIBBON. ALL OTHER DEVELOPMENT SHALL BE PROHIBITED WITHIN THE GREEN RIBBON.
8. LOTS TO BE HELD IN COMMON PROPERTY BY A HOMEOWNERS' OR PROPERTY OWNERS' ASSOCIATION SHALL BE SHOWN ON THE PLAT AS A SEPARATE LOT.
9. NO BUILDING SHALL BE SITED WITHIN THE EXTENT OF A SENSITIVE FEATURE AND ASSOCIATED BUFFER. FOR ANY LOT WHICH CONTAINS A HIGH VALUE TREE, AND A BUILDING ENVELOPE WAS NOT APPROVED AS PART OF A FINAL PLAT, THE LOCATION OF A BUILDING ENVELOPE SHALL BE APPROVED BY THE PLANNING DIRECTOR PRIOR TO A BUILDING PERMIT BEING ISSUED.
10. FUTURE DEVELOPMENT IS SUBJECT TO CHAPTER 114 (STREETS, SIDEWALKS AND OTHER PUBLIC SPACES) OF THE NEW BRAUNFELS CODE OF ORDINANCES.
11. IMPERVIOUS COVER THE MAXIMUM CUMULATIVE IMPERVIOUS COVER PERCENTAGE FOR THE PROPERTY AS A WHOLE AND FOR EACH SECTOR PLAN SHALL NOT EXCEED SIXTY-FIVE PERCENT (65%).
12. AMENDMENTS TO THE PARK PROGRAMMING SCHEDULE, INCLUDING BUT NOT LIMITED TO THE PROVISION OF ADDITIONAL IMPROVEMENTS OR SUBSTITUTING IMPROVEMENTS, SHALL BE ADMINISTRATIVELY APPROVED BY THE PARKS DIRECTOR.
13. THIS PLAT WILL COMPLY WITH LOCATION AND AMENITY STANDARDS FOR TRAILS AS SHOWN IN THE SECTOR PLAN.
14. TOTAL NUMBER OF LOTS = 0.

SCHOOL DISTRICT NOTE:

REFERENCED PROPERTY LIES WITHIN THE NEW BRAUNFELS INDEPENDENT SCHOOL DISTRICT.

PAPE-DAWSON ENGINEERS
NEW BRAUNFELS I SAN ANTONIO I AUSTIN I HOUSTON I FORT WORTH I DALLAS
2000 NW LOOP 410 I SAN ANTONIO, TX 78213 I 210.375.9000
TEXAS ENGINEERING FIRM #470 I TEXAS SURVEYING FIRM #10028800

DATE OF PREPARATION: April 2, 2021

STATE OF TEXAS
COUNTY OF COMAL

I (WE), THE UNDERSIGNED OWNER(S) OF THE LAND SHOWN ON THIS PLAT, AND DESIGNATED HEREIN AS THE VERAMENDI - WORD PKWY PHASE 2 SUBDIVISION TO THE CITY OF NEW BRAUNFELS, COUNTY OF COMAL, TEXAS, AND WHOSE NAME IS SUBSCRIBED HERETO, DO HEREBY SUBDIVIDE SUCH PROPERTY AND DEDICATE TO THE USE OF THE PUBLIC ALL STREETS, ALLEYS, PARKS, DRAINS, EASEMENTS, AND PUBLIC PLACES THEREON SHOWN FOR THE PURPOSES AND CONSIDERATION THEREIN EXPRESSED.

_____
OWNER/DEVELOPER: PETER JAMES DATE
VERAMENDI PE - DARWIN, LLC
387 W. MILL STREET, SUITE 200
NEW BRAUNFELS, TEXAS 78130

STATE OF TEXAS
COUNTY OF COMAL

BEFORE ME, THE UNDERSIGNED AUTHORITY ON THIS DAY PERSONALLY APPEARED _____ KNOWN TO ME TO BE THE PERSON WHOSE NAME IS SUBSCRIBED TO THE FOREGOING INSTRUMENT, AND ACKNOWLEDGED TO ME THAT HE EXECUTED THE SAME FOR THE PURPOSES AND CONSIDERATIONS THEREIN EXPRESSED AND IN THE CAPACITY THEREIN STATED. GIVEN UNDER MY HAND AND SEAL OF OFFICE THIS _____ DAY OF _____, A.D. 20____.

_____
NOTARY PUBLIC, STATE OF TEXAS

MY COMMISSION EXPIRES: _____

STATE OF TEXAS
COUNTY OF COMAL

I (WE), THE UNDERSIGNED OWNER(S) OF THE LAND SHOWN ON THIS PLAT, AND DESIGNATED HEREIN AS THE VERAMENDI - WORD PKWY PHASE 2 SUBDIVISION TO THE CITY OF NEW BRAUNFELS, COUNTY OF COMAL, TEXAS, AND WHOSE NAME IS SUBSCRIBED HERETO, DO HEREBY SUBDIVIDE SUCH PROPERTY AND DEDICATE TO THE USE OF THE PUBLIC ALL STREETS, ALLEYS, PARKS, DRAINS, EASEMENTS, AND PUBLIC PLACES THEREON SHOWN FOR THE PURPOSES AND CONSIDERATION THEREIN EXPRESSED.

_____
OWNER/DEVELOPER: DATE

COMAL COUNTY WCID 1A
14755 PRESTON ROAD, SUITE 600
DALLAS, TEXAS 75254

STATE OF TEXAS
COUNTY OF COMAL

THIS INSTRUMENT WAS ACKNOWLEDGED BEFORE ME ON THIS _____ DAY OF _____, 20_____, BY _____.

_____
NOTARY PUBLIC
STATE OF TEXAS

MY COMMISSION EXPIRES: _____

STATE OF TEXAS

COUNTY OF COMAL

I, _____, DO HEREBY CERTIFY THAT THE FOREGOING INSTRUMENT WAS FILED FOR RECORD IN THE MAP AND PLAT RECORDS, DOC #_____ OF COMAL COUNTY ON THE _____ DAY OF _____, 20_____, AT _____ M.

WITNESS MY HAND OFFICIAL SEAL, THIS THE _____ DAY OF _____, 20_____.

COUNTY CLERK, COMAL COUNTY, TEXAS

BY: _____, DEPUTY

SHEET 1 OF 2

VERAMENDI - WORD PKWY PHASE 2

Civil Job No. 7620-83; Survey Job No. 9305-15

Date: Apr 2, 2021 - 11:58 AM - User ID: CASANOVA
File: P:\VERAMENDI\Design\Civil\Plat\PLAT-7620-83.dwg

SUBDIVISION PLAT
OF
VERAMENDI - WORD PKWY
PHASE 2

BEING A TOTAL OF 2.454 ACRES OF LAND OUT OF AN 81.86 ACRE TRACT RECORDED IN DOC. NO. 201706024862 OF THE OFFICIAL PUBLIC RECORDS OF COMAL COUNTY, TEXAS, OUT OF THE JUAN MARTIN DE VERAMENDI SURVEY NO. 2, ABSTRACT 3, COMAL COUNTY, TEXAS.

SCALE: 1"= 100'

0' 100' 200' 300'

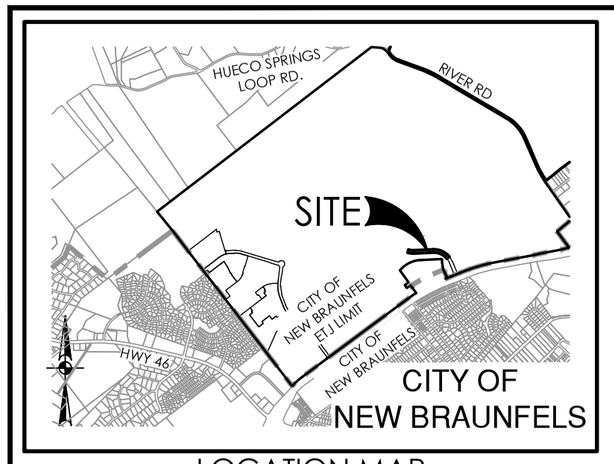
PAPE-DAWSON ENGINEERS

NEW BRAUNFELS I SAN ANTONIO I AUSTIN I HOUSTON I FORT WORTH I DALLAS

2000 NW LOOP 410 I SAN ANTONIO, TX 78213 I 210.375.9000

TEXAS ENGINEERING FIRM #470 I TEXAS SURVEYING FIRM #10028800

DATE OF PREPARATION: April 2, 2021



LOCATION MAP

MAPSCO MAP GRID: 123X1
NOT-TO-SCALE

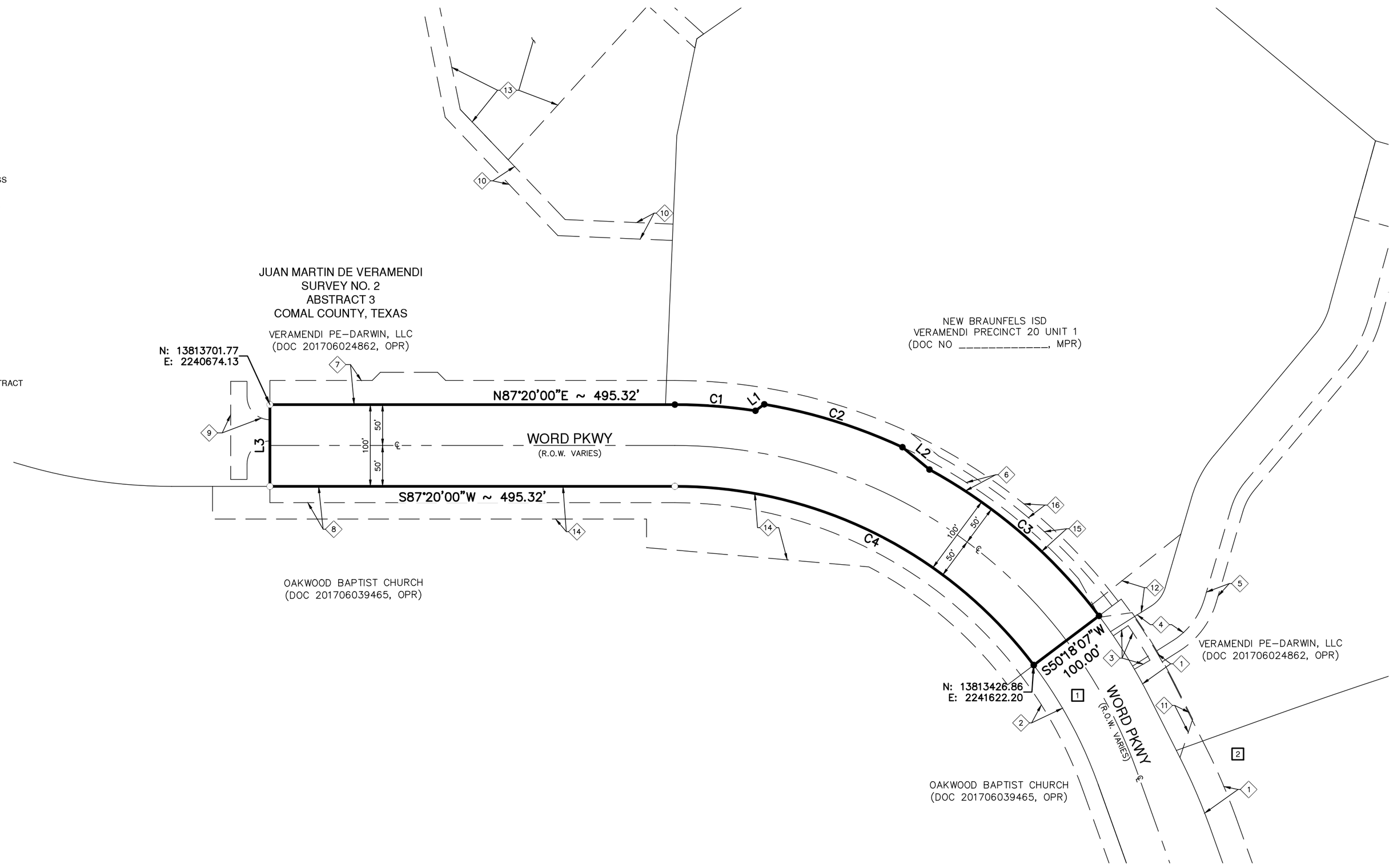
LEGEND

AC	ACRE(S)	VOL	VOLUME
CCPR	COMAL COUNTY DEED AND PUBLIC RECORDS	PG	PAGE(S)
		ROW	RIGHT-OF-WAY
DOC	DOCUMENT NUMBER	(SURVEYOR) ●	FOUND 1/2" IRON ROD (UNLESS NOTED OTHERWISE)
ESMT	EASEMENT	○	SET 1/2" IRON ROD (PD)
ETJ	EXTRATERRITORIAL JURISDICTION	○	SET 1/2" IRON ROD (PD)-ROW
INT	INTERSECTION	(TYPE I, II OR III) ☒	FOUND TxDOT MONUMENTATION
MPRCCT	MAP AND PLAT RECORDS OF COMAL COUNTY, TEXAS	☒	FOUND MONUMENTATION
OPR	OFFICIAL PUBLIC RECORDS (OFFICIAL PUBLIC RECORDS OF REAL PROPERTY) OF COMAL COUNTY, TEXAS		

CITY OF NEW BRAUNFELS LIMITS
ORIGINAL SURVEY/COUNTY LINE
CENTERLINE

1. 0.152 AC. VARIABLE WIDTH UTILITY EASEMENT (DOC. NO. 201906045807, OPR)
2. 02.80 AC. 20' UTILITY EASEMENT (DOC.NO. 201906045802, OPR)
3. 0.025 AC. 22' ACCESS EASEMENT (DOC. NO. 201906045805, OPR)
4. 50' (0.717 AC) SHARED ACCESS EASEMENT (DOC. NO. 202106002453, OPR)
5. 15' ELECTRICAL EASEMENT (DOC. NO. _____)
6. VARIABLE WIDTH PEDESTRIAN EASEMENT (DOC. NO. 202106002452, OPR)
7. VARIABLE WIDTH UTILITY EASEMENT (DOC. NO. _____)
8. 20' UTILITY EASEMENT (DOC. NO. _____)
9. VARIABLE WIDTH TURN AROUND EASEMENT - TO EXPIRE UPON PLATTING OF FUTURE RIGHT OF WAY (DOC. NO. _____)
10. 20' SANITARY SEWER EASEMENT (DOC. NO. 202106002452, OPR)
11. VARIABLE WIDTH PEDESTRIAN EASEMENT (DOC. NO. _____)
12. VARIABLE WIDTH SIGNAGE, MONUMENTATION AND LANDSCAPE EASEMENT (0.110 ACRES) (DOC. NO. _____)
13. VARIABLE WIDTH DRAINAGE EASEMENT (DOC. NO. 201706024862, OPR)
14. VARIABLE WIDTH DRAINAGE EASEMENT (DOC. NO. _____)
15. VARIABLE WIDTH UTILITY EASEMENT (DOC. NO. _____, MPR)
16. VARIABLE WIDTH UTILITY EASEMENT (DOC. NO. _____, OPR)

1. VERAMENDI WORD PKWY PHASE 1 (DOC. NO. 202006030614, MPR)
2. WORD BORCHERS RANCH REAL ESTATE LIMITED PARTNERSHIP REMAINING PORTION 2086 ACRES TRACT (DOC. NO. 201006024825, OPR)



LINE TABLE		
LINE #	BEARING	LENGTH
L1	N51°03'36"E	13.34'
L2	N53°04'52"W	42.90'
L3	N2°40'00"W	100.00'

CURVE TABLE					
CURVE #	RADIUS	DELTA	CHORD BEARING	CHORD	LENGTH
C1	650.00'	8°43'36"	S88°18'12"E	98.90'	99.00'
C2	659.50'	15°25'15"	S75°24'37"E	176.96'	177.50'
C3	650.00'	24°20'25"	N51°52'06"W	274.06'	276.13'
C4	550.00'	52°58'07"	N66°10'57"W	490.55'	508.46'

VERAMENDI - WORD PKWY PHASE 2

Civil Job No. 7620-83; Survey Job No. 9305-15

Date: Apr 2, 2021, 11:56 AM - User ID: CARDSER
File: P:\7620\00\01\Design\Civil\VP2-7620831.dwg

City of New Braunfels

Planning Commission Agenda Item Report

550 Landa Street
New Braunfels, TX

6/1/2021

Agenda Item No. C)

PRESENTER:
Applicant: HMT Engineering & Surveying
Owner: Milestone Conrads Development, Ltd.

SUBJECT:
FP21-0168 Approval of the final plat for The Silos Subdivision, Unit 5 with conditions.

DEPARTMENT: Planning and Development Services

COUNCIL DISTRICTS IMPACTED: Council District 2

BACKGROUND INFORMATION:
Case #: FP21-0168

Owner: Chesley Swann, Vice President
Milestone Conrads Development, LTD
P.O. Box 6862
San Antonio, Texas 78209
cis@me.com

Engineer: Chris Van Heerde, P.E.
HMT Engineering & Surveying
290 S. Castell Avenue
New Braunfels, TX 78130
(830) 625-8555
plats@hmtnb.com

Case Manager: Holly Mullins
(830) 221-4054
hmullins@nbtexas.org

Description: 1 commercial lot on 7.4 acres

The subject property is located at the intersection of W. Klein Road and Pahmeyer Road, within the City limits. A master plan for The Silos Subdivision was approved in 2015 and the residential portion of the development is substantially complete.

ISSUE:
Unit 5 proposes one commercial lot on 7.4 acres. The current zoning is C-1A Neighborhood Business District.

Drainage:
The Public Works Department reviewed preliminary drainage with the Letter of Certification process as required by Section 118-51e of the Platting Ordinance and in accordance with the requirements of Chapter 143 Municipal Drainage Utility Systems, and the Drainage and Erosion Control and Design Manual. Final project drainage will be reviewed with the building permit.

No portion of this property is located within the 1% annual chance flood zone.

Utilities:
Electric service will be provided by Guadalupe Valley Electric Cooperative (GVEC). Water will be provided by Green Valley Special Utility District (GVSUD) and Guadalupe-Blanco River Authority (GBRA) is the wastewater provider.

Transportation Plan:
The plat is in compliance with the City's Regional Transportation Plan. Klein Road is designated as a Minor Arterial. The City acquired adequate right-of-way with the Klein Road street improvement project and no additional dedication is required. Pahmeyer Road is designated as a Minor Collector (60 feet in width) and adequate right-of-way exists.

The City of New Braunfels will assume responsibility for two mitigation measures recommended in the project Traffic Impact Analysis (TIA): an all-way stop at Klein Road/Pahmeyer Road and all-way stop at Klein Road/Walnut Avenue.

Hike and Bike:
The plat is in compliance with the City's Hike and Bike Trail Plan. A shared-use path was constructed by the City along Klein Road with recent street improvements.

Sidewalks:
A sidewalk/shared use path was constructed along Klein Road with recent street improvements. Six-foot wide sidewalks will be constructed along Pahmeyer Road by the developer at time of building construction.

Roadway Impact Fees:
This subdivision is in Roadway Impact Fee Study Area 5. Impact Fees are hereby assessed with approval of the final plat. Fees will be calculated and payable at the time of building permit based on land use at the then current rate.

Parkland Dedication and Development:
Nonresidential development is exempt from parkland dedication and development fees.

FISCAL IMPACT:
N/A

RECOMMENDATION:
To meet the requirements of the City's Subdivision Platting Ordinance and other adopted codes, the plat must

comply with the conditions notes below. Staff recommends approval of the proposed plat subject to the following Conditions of Approval:

1. Title the plat as a Final Plat. (NBCO 118-27)
2. Show all proposed and existing sidewalks on the utility/street plan. (NBCO 118-25)
3. Update Note 10 to reflect that sidewalks along Klein Road are existing. (NBCO 118-49)
4. Remove signature line for GBRA at the bottom of their notes. (NBCO 118-30)
5. Provide a corner clip at the northwest and northeast corners of the subdivision where the two-utility easement meet at a right angle. (NBCO 118-48)
6. Revise the outer boundary to qualify as an accurate boundary. (NBCO 118-29)
7. Note: A digital plat must be submitted when recording (NBCO 118-21), formatted as:
   - NAD 1983 State Plane Texas South Central FIPS 4204 (US Survey feet).
   - Grid scale.
   - All x-referenced files must not be in blocks.
   - Dwg format 2018 version or earlier.

Approval Compliance:

To obtain approval of the plat, the applicant must submit to the City a revised plat and a written response that satisfies each condition of approval prior to expiration of the plat (Sec. 118-32(b)). In accordance with Chapter 212, Texas Local Government Code, the City will determine the plat approved if responses adequately address each Condition of Approval.

Attachments:

1. Aerial Map
2. Final Plat

ATTACHMENT 1

City of New Braunfels

FP21-0168
The Silos Unit 5
Final Plat

MINOR PLAT ESTABLISHING

THE SILOS, UNIT 5

BEING A 7.402 ACRE TRACT OF LAND SITUATED IN THE SARAH DE WITT NO. 48 SURVEY, ABSTRACT NO. 103, GUADALUPE COUNTY, TEXAS, BEING A PORTION OF A CALLED 49.483 ACRE TRACT RECORDED IN VOLUME 4194, PAGE 453, OFFICIAL PUBLIC RECORDS AND A PORTION OF A CALLED 29.990 ACRE TRACT RECORDED IN VOLUME 4194, PAGE 448, OFFICAL PUBLIC RECORDS, ALL IN GUADALUPE COUNTY, TEXAS.

PLAT NOTES:

1. ALL LOTS WITHIN THE SUBDIVISION WILL BE PROVIDED WATER SERVICE BY GREEN VALLEY SPECIAL UTILITY DISTRICT (GVSUD). SEWER SERVICE WILL BE PROVIDED BY GUADALUPE-BLANCO RIVER AUTHORITY (GBRA). ELECTRIC SERVICE WILL BE PROVIDED BY GUADALUPE VALLEY ELECTRIC COOPERATIVE (GVEC). TELEPHONE AND CABLE SERVICES FOR THE SUBDIVISION WILL BE PROVIDED BY AT&T COMMUNICATIONS AND/OR SPECTRUM.
2. ALL BEARINGS AND COORDINATES SHOWN HEREON ARE BASED UPON THE TEXAS COORDINATE SYSTEM, SOUTH CENTRAL ZONE (4204), NORTH AMERICAN DATUM 1983, GRID. DISTANCES SHOWN HEREON ARE BASED UPON SURFACE MEASUREMENTS. TO CONVERT SURFACE DISTANCES TO GRID, APPLY A COMBINED SCALE FACTOR OF 1.00015.
3. MONUMENTS WERE FOUND OR SET AT EACH CORNER OF THE SURVEY BOUNDARY OF THE SUBDIVISION. MONUMENTS AND LOT MARKERS WILL BE SET WITH 1/2" IRON PINS WITH PLASTIC CAP STAMPED "HMT" IMMEDIATELY AFTER COMPLETION OF UTILITY INSTALLATION AND STREET CONSTRUCTION UNLESS NOTED OTHERWISE.
4. THIS SUBDIVISION IS NOT WITHIN THE EDWARDS AQUIFER RECHARGE ZONE.
5. THIS SUBDIVISION IS WITHIN THE CITY LIMITS OF NEW BRAUNFELS, TEXAS.
6. THIS SUBDIVISION IS WITHIN THE NEW BRAUNFELS INDEPENDENT SCHOOL DISTRICT.
7. NO PORTION OF THE SUBDIVISION IS LOCATED WITHIN ANY SPECIAL FLOOD HAZARD AREA (100 YR. FLOOD), AS DEFINED BY THE GUADALUPE COUNTY, TEXAS, FLOOD INSURANCE RATE MAP NUMBER 48187C0115F, EFFECTIVE DATE NOVEMBER 2, 2007 AS PREPARED BY THE FEDERAL EMERGENCY MANAGEMENT AGENCY.
8. NO STRUCTURES, WALLS OR OTHER OBSTRUCTIONS OF ANY KIND SHALL BE PLACED WITHIN THE LIMITS OF THE DRAINAGE EASEMENTS SHOWN ON THIS PLAT. NO LANDSCAPING, FENCES, OR OTHER TYPE OF MODIFICATIONS WHICH ALTER THE CROSS SECTIONS OF THE DRAINAGE EASEMENTS OR DECREASE THE HYDRAULIC CAPACITY OF THE EASEMENT, AS APPROVED, SHALL BE ALLOWED WITHOUT THE APPROVAL OF THE CITY ENGINEER. THE CITY OF NEW BRAUNFELS SHALL HAVE THE RIGHT OF INGRESS AND EGRESS OVER GRANTOR'S ADJACENT PROPERTY TO REMOVE ANY OBSTRUCTIONS PLACED WITHIN THE LIMITS OF SAID DRAINAGE EASEMENTS AND TO MAKE ANY MODIFICATIONS OR IMPROVEMENTS WITHIN SAID DRAINAGE EASEMENTS.
9. FUTURE DEVELOPMENT IS SUBJECT TO CHAPTER 114 (STREETS, SIDEWALKS AND OTHER PUBLIC SPACES) OF THE NEW BRAUNFELS CODE OF ORDINANCES.
10. SIX (6) FOOT WIDE SIDEWALKS WILL BE CONSTRUCTED PER CITY STANDARDS ADJACENT TO THE CURB BY THE DEVELOPER AT THE TIME OF BUILDING CONSTRUCTION ALONG:
    A. PAHMEYER RD – LOT 1, BLOCK 1.
    B. W KLEIN RD – LOT 1, BLOCK 1.
11. THE ELEVATION OF THE LOWEST FLOOR OF A STRUCTURE SHALL BE AT LEAST 10 INCHES ABOVE THE FINISHED GRADE OF THE SURROUNDING GROUND, WHICH SHALL BE SLOPED IN A FASHION SO AS TO DIRECT STORMWATER AWAY FROM THE STRUCTURE. PROPERTIES ADJACENT TO STORMWATER CONVEYANCE STRUCTURES MUST HAVE A FLOOR SLAB ELEVATION OR BOTTOM OF FLOOR JOISTS A MINIMUM OF ONE FOOT ABOVE THE 100-YEAR WATER FLOW ELEVATION IN THE STRUCTURE. DRIVEWAYS SERVING HOUSES ON THE DOWNHILL SIDE OF THE STREET SHALL HAVE A PROPERLY SIZED CROSS SWALE PREVENTING RUNOFF FROM ENTERING THE GARAGE AND SHALL PREVENT WATER FROM LEAVING THE STREET.
12. NON-RESIDENTIAL USE SUBDIVISIONS ARE NOT SUBJECT TO THE PARK LAND DEDICATION AND DEVELOPMENT REQUIREMENTS. HOWEVER, AT SUCH TIME ANY DWELLING UNITS ARE CONSTRUCTED, THE OWNER OF THE LOT SHALL CONTACT THE CITY AND COMPLY WITH THE ORDINANCE FOR EACH DWELLING UNIT.

GBRA NOTES:

1. PROVIDE DEDICATED EASEMENTS IN THE NAME OF GBRA. EASEMENTS SHALL NOT OVERLAP OR BE WITHIN RESIDENTIAL LOTS.
2. WHERE OUTSIDE OF PUBLIC RIGHT-OF-WAY, PROVIDE DEDICATED EASEMENTS WITH A MINIMUM WIDTH EQUAL TO PIPE OUTSIDE DIAMETER, ROUNDED UP TO THE NEAREST FOOT, PLUS 10 FEET MINIMUM ON EACH SIDE. FOR EASEMENTS WITH MULTIPLE PIPES, PROVIDE 10 FEET MINIMUM HORIZONTAL CLEARANCE BETWEEN PIPES. PROVIDE ADDITIONAL WIDTH FOR EASEMENTS THAT ARE NOT LOCATED ADJACENT TO PUBLIC RIGHT-OF-WAY.
3. THE GUADALUPE-BLANCO RIVER AUTHORITY (GBRA) IS HEREBY DEDICATED THE EASEMENT AND RIGHTS-OF-WAY IN THE AREAS DESIGNATED ON THIS PLAN FOR WASTEWATER FACILITIES FOR THE PURPOSE OF INSTALLING, CONSTRUCTING, RECONSTRUCTING, OPERATING, MAINTAINING, INSPECTING, REPAIRING, REMOVING, AND RELOCATING BURIED AND/OR EXPOSED WASTEWATER FACILITIES AND APPURTENANCES.
4. TOGETHER WITH THE RIGHT OF INGRESS AND EGRESS, GBRA SHALL HAVE THE RIGHT TO REMOVE SAID LANDS OF ALL TREES OR PARTS THEREOF, OR ANY OTHER OBSTRUCTIONS WHICH MAY ENDANGER, OR INTERFERE WITH MAINTENANCE OF THE FACILITIES AND APPURTENANCES.
5. OTHER UTILITIES, STRUCTURES, GRADING, DRAINAGE, DETENTION/RETENTION PONDS, LANDSCAPING, TREES, ROADS, PARKING LOTS, FENCES, WALLS, CONSTRUCTION OF ANY TYPE, OR ANY OTHER IMPROVEMENTS OR OBSTRUCTIONS, ARE NOT ALLOWED WITHIN GBRA EASEMENTS.
6. DESIGNS FOR ANY PROPOSED ALTERATIONS OR CROSSINGS OF GBRA EASEMENTS MUST BE APPROVED IN WRITING BY GBRA AND THE INSTALLATION OF SUCH MUST BE INSPECTED AND APPROVED BY GBRA.
7. MAINTENANCE OF EASEMENTS IS THE RESPONSIBILITY OF THE PROPERTY OWNER.
8. THE PROPERTY OWNER MUST INSTALL 16-FOOT GATES IN ANY FENCES THAT CROSS GBRA UTILITIES; GATES MUST BE CENTERED ACROSS GBRA UTILITIES.
9. CUSTOMER WASTEWATER SERVICES SHALL NOT BE INSTALLED WITHIN FENCED AREAS.

THIS SUBDIVISION PLAT HAS BEEN SUBMITTED TO AND APPROVED FOR EASEMENTS. UPON REQUEST OF THE CUSTOMER AND PAYMENT OF THE REQUIRED FEES, GBRA WILL PROVIDE DOMESTIC SEWER SERVICE TO EACH LOT IN THIS SUBDIVISION, BY AGREEMENT WITH THE DEVELOPER.

_____ _____.
GUADALUPE-BLANCO RIVER AUTHORITY DATE

KNOW ALL MEN BY THESE PRESENTS:

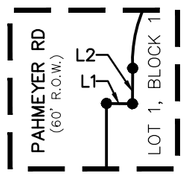
I, THE UNDERSIGNED DOROTHY J. TAYLOR, A REGISTERED PROFESSIONAL LAND SURVEYOR IN THE STATE OF TEXAS, HEREBY CERTIFY THAT THIS PLAT IS TRUE AND CORRECTLY MADE UNDER MY SUPERVISION AND IN COMPLIANCE WITH CITY AND STATE SURVEY REGULATIONS AND LAWS AND MADE ON THE GROUND AND THAT THE CORNER MONUMENTS WERE PROPERLY PLACED UNDER MY SUPERVISION.

PRELIMINARY, THIS DOCUMENT SHALL NOT BE RECORDED FOR ANY PURPOSE.

DOROTHY J. TAYLOR
REGISTERED PROFESSIONAL LAND SURVEYOR NO. 6295
290 S. CASTELL AVE., SUITE 100, NEW BRAUNFELS, TEXAS 78130

PLAT PREPARED APRIL 12, 2021

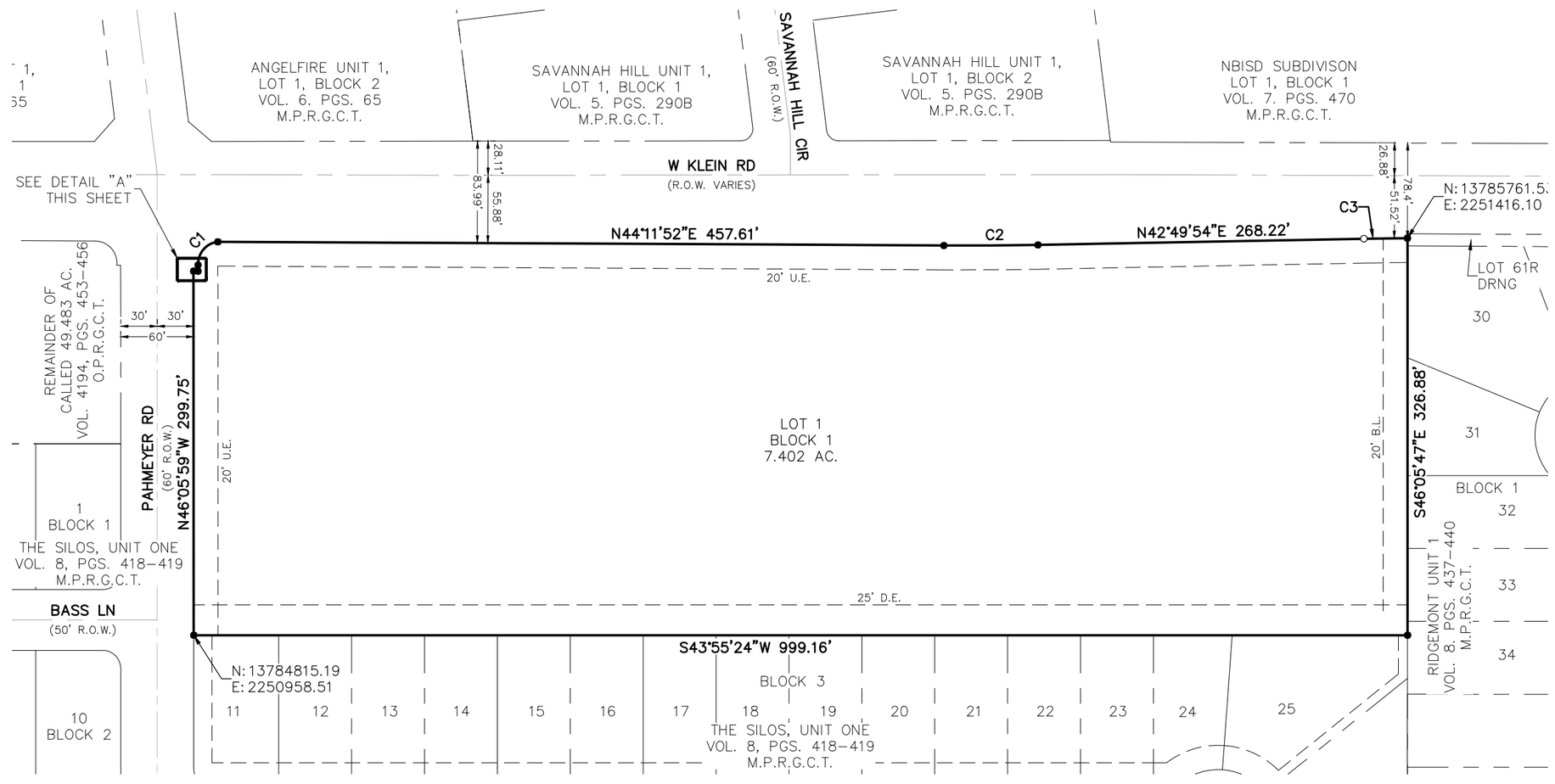
HMT ENGINEERING & SURVEYING
290 S. CASTELL AVE., STE. 100
NEW BRAUNFELS, TX 78130
TBPE FIRM F-10961
TBPLS FIRM 10153600

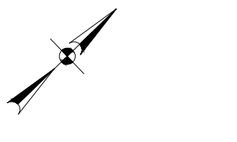


DETAIL "A"
SCALE: 1"=20'

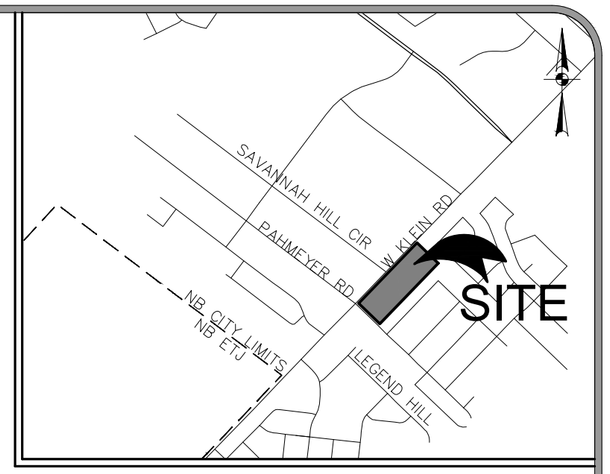
LINE TABLE		
LINE #	LENGTH	DIRECTION
L1	3.62'	N44°33'06"E
L2	4.95'	N45°32'43"W

CURVE TABLE						
CURVE	LENGTH	RADIUS	DELTA	TANGENT	CHORD LENGTH	CHORD BEARING
C1	27.78'	18.31'	086°56'27"	17.36'	25.19'	N05°47'39"W
C2	77.49'	3049.00'	001°27'22"	38.75'	77.49'	N43°33'19"E
C3	35.99'	2951.00'	000°41'56"	18.00'	35.99'	N43°10'52"E





LEGEND:
- ● = FND 1/2" IRON PIN W/ PLASTIC CAP STAMPED "HMT" (UNLESS NOTED OTHERWISE)
- ○ = SET 1/2" IRON PIN W/ PLASTIC CAP STAMPED "HMT"
- U.E. = UTILITY EASEMENT
- DRNG = DRAINAGE
- R.O.W. = RIGHT-OF-WAY
- M.P.R.G.C.T. = MAP AND PLAT RECORDS, GUADALUPE COUNTY, TEXAS
- O.P.R.G.C.T. = OFFICIAL PUBLIC RECORDS, GUADALUPE COUNTY, TEXAS



LOCATION MAP
NOT TO SCALE

GVSUD NOTES:

EASEMENT CERTIFICATE
THE OWNER OF THE LAND SHOWN ON THIS PLAT AND WHOSE NAME IS SUBSCRIBED HERETO, IN PERSON OR THROUGH A DULY AUTHORIZED AGENT, DEDICATES TO GREEN VALLEY SPECIAL UTILITY DISTRICT OF MARION, TEXAS, ITS SUCCESSORS AND ASSIGNS, A PERPETUAL EASEMENT WIT THE RIGHT TO ERECT, CONSTRUCT, INSTALL AND LAY OVER AND ACROSS THOSE AREAS MARKED AS "WATERLINE EASEMENT" AND IN ALL STREETS AND BYWAYS, SUCH PIPELINES, SERVICE LINES, WATER METERS, AND OTHER WATER SYSTEM APPURTENANCES AS IT REQUIRES, TOGETHER WIT THE RIGHT OF INGRESS AND EGRESS, THE RIGHT TO REMOVE FROM SAID LAND ALL TREES, SHRUBS, GRASSES, PAVEMENTS, FENCES, STRUCTURES, IMPROVEMENTS OR OTHER OBSTRUCTIONS WHICH MAY INTERFERE WITH THE FACILITY OR THE ACCESS THERETO. IT IS AGREED AND UNDERSTOOD THAT NO BUILDING, CONCRETE SLAB OR WALLS WILL BE PLACED WITHIN SAID EASEMENT AREAS. NO OTHER UTILITY LINES MAY BE LOCATED WITHIN 36" PARALLEL TO WATER LINES.

ANY MONETARY LOSS TO GREEN VALLEY SUD RESULTING FROM MODIFICATIONS REQUIRED OF UTILITY EQUIPMENT LOCTED WITHIN SAID EASEMENTS DUE TO GRADE CHANGE OR GROUND ELEVATION ALTERATION SHALL BE CHARGED TO THE PERSON OR PERSONS DEEMED RESPONSIBLE FOR SAID GRADE CHANGES OR GROUND ELEVATION ALTERATIONS. UPON ENTERING IN AND UPON SAID EASEMENT, THE DISTRICT WILL ENDEAVOR TO RESTORE THE LAND SURFACE TO A USEABLE CONDITION BUT IS NOT OBLIGATED TO RESTORE IT TO A PRE-EXISTING CONDITION.

THE EASEMENT CONVEYED HEREIN WAS OBTAINED OR IMPROVED THROUGH FEDERAL FINANCIAL ASSISTANCE. THIS EASEMENT IS SUBJECT TO THE PROVISION OF TITLE VI OF THE CIVIL RIGHTS ACT OF 1964, AND THE REGULATION ISSUED PURSUANT THERETO FOR SO LONG AS THE EASEMENT CONTINUES TO BE USED FOR THE SAME OR SIMILAR PURPOSE FOR WHICH FINANCIAL ASSISTANCE WAS EXTENDED OR FOR AS LONG AS THE GRANTEE OWNS IT, WHICHEVER IS LONGER.

GVEC NOTES:

1. GVEC WILL POSSESS A 5-FOOT WIDE EASEMENT TO THE SERVICE METER LOCATION. EASEMENT TO FOLLOW SERVICE LINE AND WILL VARY DEPENDING ON LOCATION OF BUILDING OR STRUCTURE.
2. GVEC SHALL HAVE ACCESS TO METER LOCATIONS FROM THE FRONT YARD WITH THE LOCATION NOT BEING WITHIN A FENCED AREA.
3. ANY EASEMENT DESIGNATED AS A GVEC 20'x20' UTILITY EASEMENT SHALL REMAIN OPEN FOR ACCESS AT ALL TIMES AND SHALL NOT BE WITHIN A FENCED AREA.
4. ALL UTILITY EASEMENTS ARE FOR THE CONSTRUCTION, MAINTENANCE (INCLUDING BUT NOT LIMITED TO REMOVAL OF TREES AND OTHER OBSTRUCTIONS), READING OF METERS, AND REPAIR OF ALL OVERHEAD AND UNDERGROUND UTILITIES.

APPROVED THIS THE _____ DAY OF _____, 20___, BY THE PLANNING COMMISSION OF THE CITY OF NEW BRAUNFELS, TEXAS.

_____.
CHAIRMAN

APPROVED FOR ACCEPTANCE

_____ _____
DATE PLANNING DIRECTOR

_____ _____
DATE CITY ENGINEER

STATE OF TEXAS
COUNTY OF GUADALUPE

I (WE) THE UNDERSIGNED OWNER(S) OF THE LAND SHOWN ON THIS PLAT, AND DESIGNATED HEREIN AS THE SILOS, UNIT 5 A SUBDIVISION TO THE CITY OF NEW BRAUNFELS, COUNTY OF GUADALUPE, TEXAS, AND WHOSE NAME IS SUBSCRIBED HERETO, DO HEREBY SUBDIVIDE SUCH PROPERTY AND DEDICATE TO THE USE OF THE PUBLIC ALL STREETS, ALLEYS, PARKS, DRAINS, EASEMENTS, AND PUBLIC PLACES THEREON SHOWN FOR THE PURPOSES AND CONSIDERATION THEREIN EXPRESSED.

_____
MILSTONE CONRADS DEVELOPMENT, LTD
BY: CHESLEY SWANN III, VICE PRESIDENT
P.O. BOX 6862
SAN ANTONIO, TX 78209

STATE OF TEXAS
COUNTY OF COMAL

THIS INSTRUMENT WAS ACKNOWLEDGED BEFORE ME ON THIS _____ DAY OF _____, 20___,
BY _____

_____
NOTARY PUBLIC, STATE OF TEXAS
MY COMMISSION EXPIRES: _____

STATE OF TEXAS
COUNTY OF GUADALUPE

_____
COUNTY CLERK, GUADALUPE COUNTY, TEXAS

_____
DEPUTY

Drawing Name: T:\056 - Milestone Properties\056.020 - The Silos 4 & 5\Unit 5\The Silos Unit 5 Plat.dwg User: kellyk Apr 12, 2021 - 8:22am

City of New Braunfels

Planning Commission Agenda Item Report

550 Landa Street
New Braunfels, TX

6/1/2021

Agenda Item No. D)

PRESENTER:
Applicant: HMT Engineering & Surveying
Owner: Milestone Conrads Development, Ltd.

SUBJECT:
FP21-0169 Approval of the final plat for The Silos Subdivision, Unit 4 with conditions.

DEPARTMENT: Planning and Development Services

COUNCIL DISTRICTS IMPACTED: Council District 2

BACKGROUND INFORMATION:
Case #: FP21-0169

Owner: Chesley Swann, Vice President
Milestone Conrads Development, LTD
P.O. Box 6862
San Antonio, Texas 78209
cis@me.com

Engineer: Chris Van Heerde, P.E.
HMT Engineering & Surveying
290 S. Castell Avenue
New Braunfels, TX 78130
(830) 625-8555
plats@hmtnb.com

Case Manager: Holly Mullins
(830) 221-4054
hmullins@nbtexas.org

Description: 1 commercial lot on 1.27 acres

The subject property is located at the intersection of W. Klein Road and Pahmeyer Road, within the City limits. A master plan for The Silos Subdivision was approved in 2015 and the residential portion of the development is substantially complete.

ISSUE:
Unit 4 proposes one commercial lot on 1.27 acres. The current zoning is C-1A Neighborhood Business District.

Drainage:
The Public Works Department reviewed preliminary drainage with the Letter of Certification process as required by Section 118-51e of the Platting Ordinance and in accordance with the requirements of Chapter 143 Municipal Drainage Utility Systems, and the Drainage and Erosion Control and Design Manual. Final project drainage will be reviewed with the building permit.

No portion of this property is located within the 1% annual chance flood zone.

Utilities:
Electric service will be provided by Guadalupe Valley Electric Cooperative (GVEC). Water will be provided by Green Valley Special Utility District (GVSUD) and Guadalupe-Blanco River Authority (GBRA) is the wastewater provider.

Transportation Plan:
The plat is in compliance with the City's Regional Transportation Plan. Klein Road is designated as a Minor Arterial up to 120 feet in width. The City acquired adequate right-of-way with the Klein Road street improvement project and no additional dedication is required. Pahmeyer Road is designated as a Minor Collector (60 feet in width) and adequate right-of-way exists.

Hike and Bike:
The plat is in compliance with the City's Hike and Bike Trail Plan. A shared-use path was constructed by the City along Klein Road with recent street improvements.

Sidewalks:
A sidewalk was constructed along Klein Road with the recent street improvement project. Six-foot wide sidewalks will be constructed along Pahmeyer Road by the developer at time of building construction.

Roadway Impact Fees:
This subdivision is in Roadway Impact Fee Study Area 5. Impact Fees are hereby assessed with approval of the final plat. Fees will be calculated and payable at the time of building permit based on land use at the then current rate.

Parkland Dedication and Development:
Nonresidential development is exempt from parkland dedication and development fees.

FISCAL IMPACT:
N/A
RECOMMENDATION:
To meet the requirements of the City's Subdivision Platting Ordinance and other adopted codes, the plat must comply with the conditions notes below. Staff recommends approval of the proposed plat subject to the following Conditions of Approval:
1. Title the plat as a Final Plat. (NBCO 118-27)
2. Show all proposed and existing sidewalks on the utility/street plan. (NBCO 118-25)
3. Update Note 10 to reflect that sidewalks along Klein Road are existing. (NBCO 118-49)
4. Remove signature line for GBRA at the bottom of their notes. (NBCO 118-30)
5. Provide a corner clip at the northwest and northeast corners of the subdivision where the two-utility

easement meet at a right angle. (NBCO 118-48)

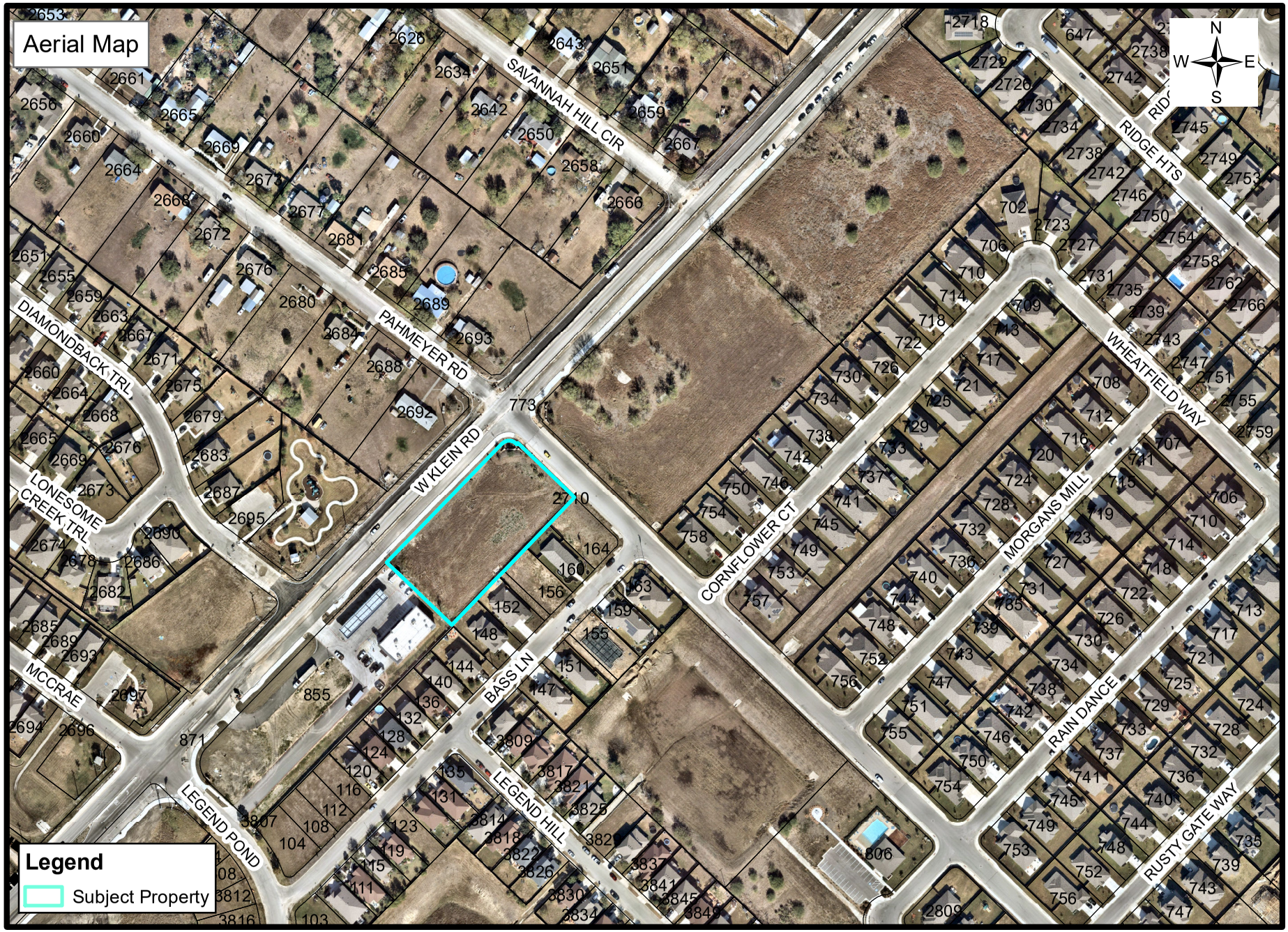
6. Note: A digital plat must be submitted when recording (NBCO 118-21), formatted as:
    - NAD 1983 State Plane Texas South Central FIPS 4204 (US Survey feet).
    - Grid scale.
    - All x-referenced files must not be in blocks.
    - Dwg format 2018 version or earlier.

Approval Compliance:

To obtain approval of the plat, the applicant must submit to the City a revised plat and written response that satisfies each condition of approval prior to expiration of the plat (Sec. 118-32(b)). In accordance with Chapter 212, Texas Local Government Code, the City will determine the plat approved if the response adequately addresses each Condition of Approval.

Attachments:

1. Aerial Map
2. Final Plat



ATTACHMENT 1

City of New Braunfels

FP21-0169
The Silos Unit 4
Final Plat

MINOR PLAT ESTABLISHING

THE SILOS, UNIT 4

BEING A 1.27 ACRE TRACT OF LAND SITUATED IN THE SARAH DEWITT SURVEY NO. 48, ABSTRACT NO. 103, GUADALUPE COUNTY, TEXAS. BEING A PORTION OUT OF A CALLED 49.483 ACRE TRACT RECORDED IN VOLUME 4194, PAGE 453, OFFICIAL PUBLIC RECORDS, GUADALUPE COUNTY, TEXAS.

PLAT NOTES:

1. ALL LOTS WITHIN THE SUBDIVISION WILL BE PROVIDED WATER SERVICE BY GREEN VALLEY SPECIAL UTILITY DISTRICT (GVSUD). SEWER SERVICE WILL BE PROVIDED BY GUADALUPE–BLANCO RIVER AUTHORITY (GBRA). ELECTRIC SERVICE WILL BE PROVIDED BY GUADALUPE VALLEY ELECTRIC COOPERATIVE (GVEC). TELEPHONE AND CABLE SERVICES FOR THE SUBDIVISION WILL BE PROVIDED BY AT&T COMMUNICATIONS AND/OR SPECTRUM.
2. ALL BEARINGS AND COORDINATES SHOWN HEREON ARE BASED UPON THE TEXAS COORDINATE SYSTEM, SOUTH CENTRAL ZONE (4204), NORTH AMERICAN DATUM 1983, GRID. DISTANCES SHOWN HEREON ARE BASED UPON SURFACE MEASUREMENTS. TO CONVERT SURFACE DISTANCES TO GRID, APPLY A COMBINED SCALE FACTOR OF 1.00015.
3. MONUMENTS WERE FOUND OR SET AT EACH CORNER OF THE SURVEY BOUNDARY OF THE SUBDIVISION. MONUMENTS AND LOT MARKERS WILL BE SET WITH 1/2" IRON PINS WITH PLASTIC CAP STAMPED "HMT" IMMEDIATELY AFTER COMPLETION OF UTILITY INSTALLATION AND STREET CONSTRUCTION UNLESS NOTED OTHERWISE.
4. THIS SUBDIVISION IS NOT WITHIN THE EDWARDS AQUIFER RECHARGE ZONE.
5. THIS SUBDIVISION IS WITHIN THE CITY LIMITS OF NEW BRAUNFELS, TEXAS.
6. THIS SUBDIVISION IS WITHIN THE NEW BRAUNFELS INDEPENDENT SCHOOL DISTRICT.
7. NO PORTION OF THE SUBDIVISION IS LOCATED WITHIN ANY SPECIAL FLOOD HAZARD AREA (100 YR. FLOOD), AS DEFINED BY THE GUADALUPE COUNTY, TEXAS, FLOOD INSURANCE RATE MAP NUMBER 48187C0115F, EFFECTIVE DATE NOVEMBER 2, 2007 AS PREPARED BY THE FEDERAL EMERGENCY MANAGEMENT AGENCY.
8. NO STRUCTURES, WALLS OR OTHER OBSTRUCTIONS OF ANY KIND SHALL BE PLACED WITHIN THE LIMITS OF THE DRAINAGE EASEMENTS SHOWN ON THIS PLAT. NO LANDSCAPING, FENCES, OR OTHER TYPE OF MODIFICATIONS WHICH ALTER THE CROSS SECTIONS OF THE DRAINAGE EASEMENTS OR DECREASE THE HYDRAULIC CAPACITY OF THE EASEMENT, AS APPROVED, SHALL BE ALLOWED WITHOUT THE APPROVAL OF THE CITY ENGINEER. THE CITY OF NEW BRAUNFELS SHALL HAVE THE RIGHT OF INGRESS AND EGRESS OVER GRANTOR'S ADJACENT PROPERTY TO REMOVE ANY OBSTRUCTIONS PLACED WITHIN THE LIMITS OF SAID DRAINAGE EASEMENTS AND TO MAKE ANY MODIFICATIONS OR IMPROVEMENTS WITHIN SAID DRAINAGE EASEMENTS.
9. FUTURE DEVELOPMENT IS SUBJECT TO CHAPTER 114 (STREETS, SIDEWALKS AND OTHER PUBLIC SPACES) OF THE NEW BRAUNFELS CODE OF ORDINANCES.
10. SIX (6) FOOT WIDE SIDEWALKS WILL BE CONSTRUCTED PER CITY STANDARDS ADJACENT TO THE CURB BY THE DEVELOPER AT THE TIME OF BUILDING CONSTRUCTION ALONG:
    A. PAHMEYER RD – LOT 1, BLOCK 1.
    B. W KLEIN RD – LOT 1, BLOCK 1.
11. THE ELEVATION OF THE LOWEST FLOOR OF A STRUCTURE SHALL BE AT LEAST 10 INCHES ABOVE THE FINISHED GRADE OF THE SURROUNDING GROUND, WHICH SHALL BE SLOPED IN A FASHION SO AS TO DIRECT STORMWATER AWAY FROM THE STRUCTURE. PROPERTIES ADJACENT TO STORMWATER CONVEYANCE STRUCTURES MUST HAVE A FLOOR SLAB ELEVATION OR BOTTOM OF FLOOR JOISTS A MINIMUM OF ONE FOOT ABOVE THE 100–YEAR WATER FLOW ELEVATION IN THE STRUCTURE. DRIVEWAYS SERVING HOUSES ON THE DOWNHILL SIDE OF THE STREET SHALL HAVE A PROPERLY SIZED CROSS SWALE PREVENTING RUNOFF FROM ENTERING THE GARAGE AND SHALL PREVENT WATER FROM LEAVING THE STREET.
12. NON–RESIDENTIAL USE SUBDIVISIONS ARE NOT SUBJECT TO THE PARK LAND DEDICATION AND DEVELOPMENT REQUIREMENTS. HOWEVER, AT SUCH TIME ANY DWELLING UNITS ARE CONSTRUCTED, THE OWNER OF THE LOT SHALL CONTACT THE CITY AND COMPLY WITH THE ORDINANCE FOR EACH DWELLING UNIT.

GBRA NOTES:

1. PROVIDE DEDICATED EASEMENTS IN THE NAME OF GBRA. EASEMENTS SHALL NOT OVERLAP OR BE WITHIN RESIDENTIAL LOTS.
2. WHERE OUTSIDE OF PUBLIC RIGHT–OF–WAY, PROVIDE DEDICATED EASEMENTS WITH A MINIMUM WIDTH EQUAL TO PIPE OUTSIDE DIAMETER, ROUNDED UP TO THE NEAREST FOOT, PLUS 10 FEET MINIMUM ON EACH SIDE. FOR EASEMENTS WITH MULTIPLE PIPES, PROVIDE 10 FEET MINIMUM HORIZONTAL CLEARANCE BETWEEN PIPES. PROVIDE ADDITIONAL WIDTH FOR EASEMENTS THAT ARE NOT LOCATED ADJACENT TO PUBLIC RIGHT–OF–WAY.
3. THE GUADALUPE–BLANCO RIVER AUTHORITY (GBRA) IS HEREBY DEDICATED THE EASEMENT AND RIGHTS–OF–WAY IN THE AREAS DESIGNATED ON THIS PLAN FOR WASTEWATER FACILITIES FOR THE PURPOSE OF INSTALLING, CONSTRUCTING, RECONSTRUCTING, OPERATING, MAINTAINING, INSPECTING, REPAIRING, REMOVING, AND RELOCATING BURIED AND/OR EXPOSED WASTEWATER FACILITIES AND APPURTENANCES.
4. TOGETHER WITH THE RIGHT OF INGRESS AND EGRESS, GBRA SHALL HAVE THE RIGHT TO REMOVE SAID LANDS OF ALL TREES OR PARTS THEREOF, OR ANY OTHER OBSTRUCTIONS WHICH MAY ENDANGER, OR INTERFERE WITH MAINTENANCE OF THE FACILITIES AND APPURTENANCES.
5. OTHER UTILITIES, STRUCTURES, GRADING, DRAINAGE, DETENTION/RETENTION PONDS, LANDSCAPING, TREES, ROADS, PARKING LOTS, FENCES, WALLS, CONSTRUCTION OF ANY TYPE, OR ANY OTHER IMPROVEMENTS OR OBSTRUCTIONS, ARE NOT ALLOWED WITHIN GBRA EASEMENTS.
6. DESIGNS FOR ANY PROPOSED ALTERATIONS OR CROSSINGS OF GBRA EASEMENTS MUST BE APPROVED IN WRITING BY GBRA AND THE INSTALLATION OF SUCH MUST BE INSPECTED AND APPROVED BY GBRA.
7. MAINTENANCE OF EASEMENTS IS THE RESPONSIBILITY OF THE PROPERTY OWNER.
8. THE PROPERTY OWNER MUST INSTALL 16–FOOT GATES IN ANY FENCES THAT CROSS GBRA UTILITIES; GATES MUST BE CENTERED ACROSS GBRA UTILITIES.
9. CUSTOMER WASTEWATER SERVICES SHALL NOT BE INSTALLED WITHIN FENCED AREAS.

THIS SUBDIVISION PLAT HAS BEEN SUBMITTED TO AND APPROVED FOR EASEMENTS. UPON REQUEST OF THE CUSTOMER AND PAYMENT OF THE REQUIRED FEES, GBRA WILL PROVIDE DOMESTIC SEWER SERVICE TO EACH LOT IN THIS SUBDIVISION, BY AGREEMENT WITH THE DEVELOPER.

_____ _____.
GUADALUPE–BLANCO RIVER AUTHORITY DATE

KNOW ALL MEN BY THESE PRESENTS:

I, THE UNDERSIGNED DOROTHY J. TAYLOR, A REGISTERED PROFESSIONAL LAND SURVEYOR IN THE STATE OF TEXAS, HEREBY CERTIFY THAT THIS PLAT IS TRUE AND CORRECTLY MADE UNDER MY SUPERVISION AND IN COMPLIANCE WITH CITY AND STATE SURVEY REGULATIONS AND LAWS AND MADE ON THE GROUND AND THAT THE CORNER MONUMENTS WERE PROPERLY PLACED UNDER MY SUPERVISION.

PRELIMINARY, THIS DOCUMENT SHALL NOT BE RECORDED FOR ANY PURPOSE.

DOROTHY J. TAYLOR
REGISTERED PROFESSIONAL LAND SURVEYOR NO. 6295
290 S. CASTELL AVE., SUITE 100, NEW BRAUNFELS, TEXAS 78130

PLAT PREPARED APRIL 12, 2021

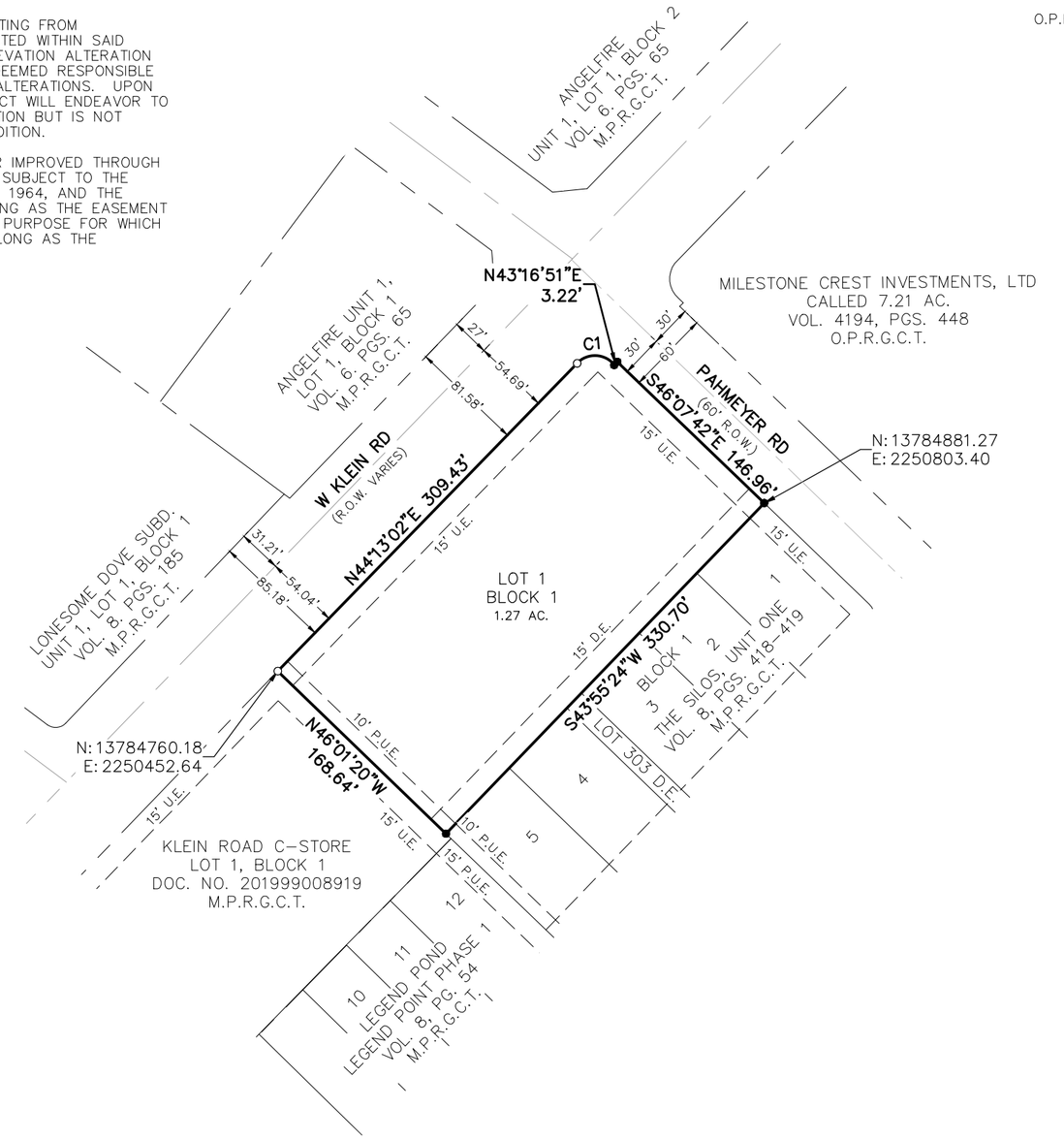
HMT ENGINEERING & SURVEYING
290 S. CASTELL AVE., STE. 100
NEW BRAUNFELS, TX 78130
TBPE FIRM F-10961
TBPLS FIRM 10153600

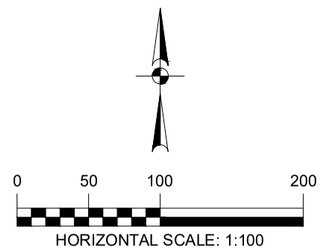
GVSUD NOTES:

EASEMENT CERTIFICATE
THE OWNER OF THE LAND SHOWN ON THIS PLAT AND WHOSE NAME IS SUBSCRIBED HERETO, IN PERSON OR THROUGH A DULY AUTHORIZED AGENT, DEDICATES TO GREEN VALLEY SPECIAL UTILITY DISTRICT OF MARION, TEXAS, ITS SUCCESSORS AND ASSIGNS, A PERPETUAL EASEMENT WIT THE RIGHT TO ERECT, CONSTRUCT, INSTALL AND LAY OVER AND ACROSS THOSE AREAS MARKED AS "WATERLINE EASEMENT" AND IN ALL STREETS AND BYWAYS, SUCH PIPELINES, SERVICE LINES, WATER METERS, AND OTHER WATER SYSTEM APPURTENANCES AS IT REQUIRES, TOGETHER WIT THE RIGHT OF INGRESS AND EGRESS, THE RIGHT TO REMOVE FROM SAID LAND ALL TREES, SHRUBS, GRASSES, PAVEMENTS, FENCES, STRUCTURES, IMPROVEMENTS OR OTHER OBSTRUCTIONS WHICH MAY INTERFERE WITH THE FACILITY OR THE ACCESS THERETO. IT IS AGREED AND UNDERSTOOD THAT NO BUILDING, CONCRETE SLAB OR WALLS WILL BE PLACED WITHIN SAID EASEMENT AREAS. NO OTHER UTILITY LINES MAY BE LOCATED WITHIN 36" PARALLEL TO WATER LINES.

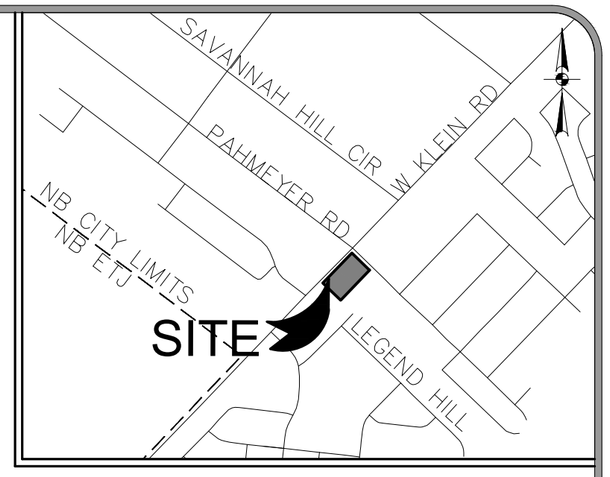
ANY MONETARY LOSS TO GREEN VALLEY SUD RESULTING FROM MODIFICATIONS REQUIRED OF UTILITY EQUIPMENT LOCTED WITHIN SAID EASEMENTS DUE TO GRADE CHANGE OR GROUND ELEVATION ALTERATION SHALL BE CHARGED TO THE PERSON OR PERSONS DEEMED RESPONSIBLE FOR SAID GRADE CHANGES OR GROUND ELEVATION ALTERATIONS. UPON ENTERING IN AND UPON SAID EASEMENT, THE DISTRICT WILL ENDEAVOR TO RESTORE THE LAND SURFACE TO A USEABLE CONDITION BUT IS NOT OBLIGATED TO RESTORE IT TO A PRE–EXISTING CONDITION.

THE EASEMENT CONVEYED HEREIN WAS OBTAINED OR IMPROVED THROUGH FEDERAL FINANCIAL ASSISTANCE. THIS EASEMENT IS SUBJECT TO THE PROVISION OF TITLE VI OF THE CIVIL RIGHTS ACT OF 1964, AND THE REGULATION ISSUED PURSUANT THERETO FOR SO LONG AS THE EASEMENT CONTINUES TO BE USED FOR THE SAME OR SIMILAR PURPOSE FOR WHICH FINANCIAL ASSISTANCE WAS EXTENDED OR FOR AS LONG AS THE GRANTEE OWNS IT, WHICHEVER IS LONGER.





LEGEND:
- ● = FND 1/2" IRON PIN W/ PLASTIC CAP STAMPED "HMT" (UNLESS NOTED OTHERWISE)
- ○ = SET 1/2" IRON PIN W/ PLASTIC CAP STAMPED "HMT"
- U.E. = UTILITY EASEMENT
- R.O.W. = RIGHT–OF–WAY
- M.P.R.G.C.T. = MAP AND PLAT RECORDS, GUADALUPE COUNTY, TEXAS
- O.P.R.G.C.T. = OFFICIAL PUBLIC RECORDS, GUADALUPE COUNTY, TEXAS



LOCATION MAP
NOT TO SCALE

CURVE TABLE						
CURVE	LENGTH	RADIUS	DELTA	TANGENT	CHORD LENGTH	CHORD BEARING
C1	30.29'	18.01'	096°21'45"	20.13'	26.84'	S87°30'41"E

GVEC NOTES:

1. GVEC WILL POSSESS A 5–FOOT WIDE EASEMENT TO THE SERVICE METER LOCATION. EASEMENT TO FOLLOW SERVICE LINE AND WILL VARY DEPENDING ON LOCATION OF BUILDING OR STRUCTURE.
2. GVEC SHALL HAVE ACCESS TO METER LOCATIONS FROM THE FRONT YARD WITH THE LOCATION NOT BEING WITHIN A FENCED AREA.
3. ANY EASEMENT DESIGNATED AS A GVEC 20'x20' UTILITY EASEMENT SHALL REMAIN OPEN FOR ACCESS AT ALL TIMES AND SHALL NOT BE WITHIN A FENCED AREA.
4. ALL UTILITY EASEMENTS ARE FOR THE CONSTRUCTION, MAINTENANCE (INCLUDING BUT NOT LIMITED TO REMOVAL OF TREES AND OTHER OBSTRUCTIONS), READING OF METERS, AND REPAIR OF ALL OVERHEAD AND UNDERGROUND UTILITIES.

APPROVED THIS THE _____ DAY OF _____, 20___, BY THE PLANNING COMMISSION OF THE CITY OF NEW BRAUNFELS, TEXAS.

_____.
CHAIRMAN

APPROVED FOR ACCEPTANCE

_____ _____.
DATE PLANNING DIRECTOR

_____ _____.
DATE CITY ENGINEER

STATE OF TEXAS
COUNTY OF GUADALUPE

I (WE) THE UNDERSIGNED OWNER(S) OF THE LAND SHOWN ON THIS PLAT, AND DESIGNATED HEREIN AS THE SILOS, UNIT 4 A SUBDIVISION TO THE CITY OF NEW BRAUNFELS, COUNTY OF GUADALUPE, TEXAS, AND WHOSE NAME IS SUBSCRIBED HERETO, DO HEREBY SUBDIVIDE SUCH PROPERTY AND DEDICATE TO THE USE OF THE PUBLIC ALL STREETS, ALLEYS, PARKS, DRAINS, EASEMENTS, AND PUBLIC PLACES THEREON SHOWN FOR THE PURPOSES AND CONSIDERATION THEREIN EXPRESSED.

_____
MILESTONE CONRADS DEVELOPMENT, LTD
BY: CHESLEY SWANN III, VICE PRESIDENT
P.O. BOX 6862
SAN ANTONIO, TX 78209

STATE OF TEXAS
COUNTY OF COMAL

THIS INSTRUMENT WAS ACKNOWLEDGED BEFORE ME ON THIS _____ DAY OF _____, 20___,
BY _____

_____
NOTARY PUBLIC, STATE OF TEXAS
MY COMMISSION EXPIRES: _____

STATE OF TEXAS
COUNTY OF GUADALUPE

_____
COUNTY CLERK, GUADALUPE COUNTY, TEXAS

_____
DEPUTY

Drawing Name: T:\056 – Milestone Properties\056.020 – The Silos 4 & 5\Unit 4\The Silos Unit 4 Plat.dwg User: kellyk Apr 12, 2021 – 8:20am

City of New Braunfels

Planning Commission Agenda Item Report

550 Landa Street
New Braunfels, TX

6/1/2021

Agenda Item No. E)

PRESENTER:
Applicant: HMT Engineering & Surveying
Owner: Elliott Electric Supply

SUBJECT:
FP21-0170 Approval of the final plat for Elliott Electric New Braunfels with conditions.

DEPARTMENT: Planning and Development Services

COUNCIL DISTRICTS IMPACTED: Council District 2

BACKGROUND INFORMATION:
Case #: FP21-0170

Owner: Elliott Electric Supply
Josh Thomas, Construction Manager
4851 LBJ Freeway, 10th Floor
Dallas, TX 75244
(936) 715-4024 joshthomas@elliottelectric.com

Engineer: Eric Ply, P.E.
HMT Engineering & Surveying
290 S. Castell Avenue
New Braunfels, TX 78130
(830) 625-8555 plats@hmtnb.com

Case Manager: Holly Mullins
(830) 221-4054 hmullins@nbtexas.org

Description: 1 commercial lot on 4.26 acres

The subject property is located on Highway 46 South at the entrance to Deer Crest Subdivision. This commercial tract was included in the Deer Crest Master Plan and the majority of the lot is within the city limits.

ISSUE:

Drainage:
The Public Works Department reviewed preliminary drainage with the Letter of Certification process as required by Section 118-51e of the Platting Ordinance and in accordance with the requirements of Chapter 143 Municipal Drainage Utility Systems, and the Drainage and Erosion Control and Design Manual. Final project

drainage will be reviewed with the building permit.

No portion of this property is located within the 1% annual chance flood zone.

Utilities:
Water service will be provided by Springs Hill Water Supply Corporation. Electric and wastewater will be provided by New Braunfels Utilities (NBU).

Transportation Plan:
The plat is in compliance with the City's Regional Transportation Plan. State Highway 46 is designated as a Principal Arterial with appropriate right-of-way width determined to be 120 feet. No additional dedication is required; however, TxDOT has requested a right-of-way reservation of 15 feet along Highway 46.

Sidewalks:
Six-foot wide sidewalks will be constructed along Highway 46 and Deer Crest Drive by the developer at the time of development.

Hike and Bike:
The City's Hike and Bike Trails Plan indicates an off-street shared use path along Highway 46. It was determined with the Deer Crest master plan that the developer would not be required to construct the 10-foot wide path because the City was not prepared to maintain it at the time. Therefore, the developer will install only the standard 6-foot wide sidewalk.

Roadway Impact Fees:
This subdivision is in Roadway Impact Fee Study Area 6. Impact Fees are hereby assessed with approval of the final plat. Fees will be calculated and payable at the time of building permit based on land use at the then current rate.

Parkland Dedication and Development:
Nonresidential development is exempt from parkland dedication and development fees.

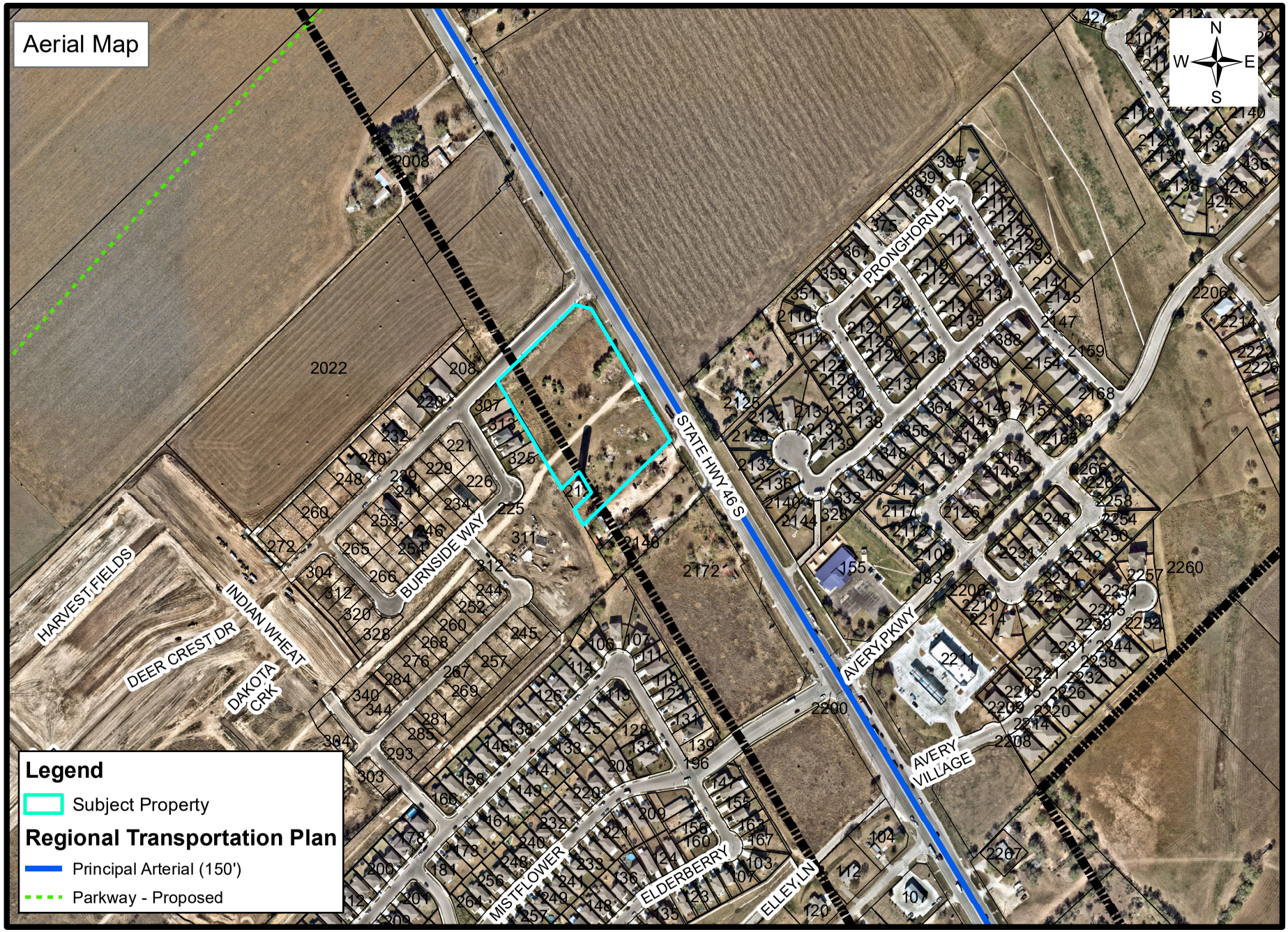
FISCAL IMPACT:
N/A
RECOMMENDATION:
To meet the requirements of the City's Subdivision Platting Ordinance and other adopted codes, the final plat must comply with the conditions notes below. Staff recommends approval of the proposed plat subject to the following Conditions of Approval:

1. Label the city limits/ETJ line on the location map. (NBCO 118-29)
2. Add the TxDOT right-of-way reservation to the plat. (NBCO 118-21)
3. Correct street name label to State Highway 46 S. (NBCO 118-46)
4. Note: A digital plat must be submitted when recording (NBCO 118-21), formatted as:
   - NAD 1983 State Plane Texas South Central FIPS 4204 (US Survey feet).
   - Grid scale.
   - All x-referenced files must not be in blocks.
   - Dwg format 2018 version or earlier.

Approval Compliance:

To obtain approval of the plat, the applicant must submit to the City a revised plat and a written response that satisfies each condition of approval prior to expiration of the plat (Sec. 118-32(b)). In accordance with Chapter 212, Texas Local Government Code, the City will determine the plat approved if the response adequately addresses each Condition of Approval.

Attachments:
1. Aerial Map
2. Final Plat



ATTACHMENT 1

City of New Braunfels

FP21-503
Elliott Electric New Braunfels
Final Plat

FINAL PLAT ESTABLISHING

ELLIOT ELECTRIC NEW BRAUNFELS

BEING A 4.261 ACRE TRACT OF LAND SITUATED IN THE A.M. ESNAURIZAR SURVEY, ABSTRACT NO. 20, GUADALUPE COUNTY, TEXAS. BEING THE REMAINDER OF A CALLED 9.636 ACRE TRACT RECORDED IN VOLUME 2050, PAGE 598, GUADALUPE COUNTY, TEXAS.

PLAT NOTES:

1. ALL LOTS WITHIN THE SUBDIVISION WILL BE PROVIDED WATER SERVICE BY SPRINGS HILL WATER SUPPLY CORPORATION. SEWER AND ELECTRIC SERVICES WILL BE PROVIDED BY NEW BRAUNFELS UTILITIES. TELEPHONE AND CABLE SERVICES FOR THE SUBDIVISION WILL BE PROVIDED BY AT&T AND/OR SPECTRUM.
2. ALL BEARINGS AND COORDINATES SHOWN HEREON ARE BASED UPON THE TEXAS COORDINATE SYSTEM, SOUTH CENTRAL ZONE (4204), NORTH AMERICAN DATUM 1983, GRID. DISTANCES SHOWN HEREON ARE BASED UPON SURFACE MEASUREMENTS. TO CONVERT SURFACE DISTANCES TO GRID, APPLY A COMBINED SCALE FACTOR OF 1.00015.
3. MONUMENTS WERE FOUND OR SET AT EACH CORNER OF THE SURVEY BOUNDARY OF THE SUBDIVISION. MONUMENTS AND LOT MARKERS WILL BE SET WITH 1/2" IRON PINS WITH PLASTIC CAP STAMPED "HMT" IMMEDIATELY AFTER COMPLETION OF UTILITY INSTALLATION AND STREET CONSTRUCTION UNLESS NOTED OTHERWISE.
4. THIS SUBDIVISION IS NOT WITHIN THE EDWARDS AQUIFER RECHARGE ZONE.
5. A PORTION OF THIS SUBDIVISION IS WITHIN THE CITY LIMITS OF NEW BRAUNFELS AND A PORTION IS WITHIN THE EXTRATERRITORIAL JURISDICTION OF THE CITY LIMITS OF NEW BRAUNFELS.
6. THIS SUBDIVISION IS WITHIN THE COMAL INDEPENDENT SCHOOL DISTRICT.
7. NO PORTION OF THE SUBDIVISION IS LOCATED WITHIN ANY SPECIAL FLOOD HAZARD AREA (100 YR. FLOOD), AS DEFINED BY THE GUADALUPE COUNTY, TEXAS, FLOOD INSURANCE RATE MAP NUMBER 48187C1120F, EFFECTIVE DATE SEPTEMBER 2, 2007 AS PREPARED BY THE FEDERAL EMERGENCY MANAGEMENT AGENCY.
8. NO STRUCTURES, WALLS OR OTHER OBSTRUCTIONS OF ANY KIND SHALL BE PLACED WITHIN THE LIMITS OF THE DRAINAGE EASEMENTS SHOWN ON THIS PLAT. NO LANDSCAPING, FENCES, OR OTHER TYPE OF MODIFICATIONS WHICH ALTER THE CROSS SECTIONS OF THE DRAINAGE EASEMENTS OR DECREASE THE HYDRAULIC CAPACITY OF THE EASEMENT, AS APPROVED, SHALL BE ALLOWED WITHOUT THE APPROVAL OF THE CITY ENGINEER. THE CITY OF NEW BRAUNFELS SHALL HAVE THE RIGHT OF INGRESS AND EGRESS OVER GRANTOR'S ADJACENT PROPERTY TO REMOVE ANY OBSTRUCTIONS PLACED WITHIN THE LIMITS OF SAID DRAINAGE EASEMENTS AND TO MAKE ANY MODIFICATIONS OR IMPROVEMENTS WITHIN SAID DRAINAGE EASEMENTS.
9. FUTURE DEVELOPMENT IS SUBJECT TO CHAPTER 114 (STREETS, SIDEWALKS AND OTHER PUBLIC SPACES) OF THE NEW BRAUNFELS CODE OF ORDINANCES.
10. SIX (6) FOOT WIDE SIDEWALKS WILL BE CONSTRUCTED PER CITY STANDARDS ALONGSIDE AND ADJACENT TO THE RIGHT-OF-WAY LINE BY THE DEVELOPER AT THE TIME OF DEVELOPMENT ALONG:
    A. STATE HIGHWAY 46.
11. SIX (6) FOOT WIDE SIDEWALKS WILL BE CONSTRUCTED PER CITY STANDARDS ALONGSIDE AND ADJACENT TO THE CURB BY THE DEVELOPER AT THE TIME OF DEVELOPMENT ALONG:
    A. DEER CREST DRIVE.
12. THE ELEVATION OF THE LOWEST FLOOR OF A STRUCTURE SHALL BE AT LEAST 10 INCHES ABOVE THE FINISHED GRADE OF THE SURROUNDING GROUND, WHICH SHALL BE SLOPED IN A FASHION SO AS TO DIRECT STORMWATER AWAY FROM THE STRUCTURE. PROPERTIES ADJACENT TO STORMWATER CONVEYANCE STRUCTURES MUST HAVE A FLOOR SLAB ELEVATION OR BOTTOM OF FLOOR JOISTS A MINIMUM OF ONE FOOT ABOVE THE 100-YEAR WATER FLOW ELEVATION IN THE STRUCTURE. DRIVEWAYS SERVING HOUSES ON THE DOWNHILL SIDE OF THE STREET SHALL HAVE A PROPERLY SIZED CROSS SWALE PREVENTING RUNOFF FROM ENTERING THE GARAGE AND SHALL PREVENT WATER FROM LEAVING THE STREET.
13. NON-RESIDENTIAL SUBDIVISIONS ARE NOT SUBJECT TO PARK LAND DEDICATION AND DEVELOPMENT REQUIREMENTS. HOWEVER, AT SUCH TIME THAT DWELLING UNITS ARE CONSTRUCTED, THE OWNER OF THE LOT SHALL CONTACT THE CITY AND COMPLY WITH THE ORDINANCE FOR EACH NEW DWELLING UNIT.
14. THIS SUBDIVISION IS SUBJECT TO THE AIRPORT HAZARD ZONING DISTRICT STANDARDS AND REGULATIONS. THIS PROPERTY IS LOCATED IN THE CONICAL ZONE FOR HEIGHT RESTRICTIONS.
15. ALL DRAINAGE EASEMENTS DESIGNATED WITHIN THE LOTS WILL BE OWNED AND MAINTAINED BY THE PROPERTY OWNER.

NEW BRAUNFELS UTILITIES NOTES:

1. MAINTENANCE OF DEDICATED UTILITY EASEMENTS IS THE RESPONSIBILITY OF THE PROPERTY OWNER. ANY USE OF AN EASEMENT, OR ANY PORTION OF IT, INCLUDING LANDSCAPING OR DRAINAGE FEATURES, IS SUBJECT TO AND SHALL NOT CONFLICT WITH THE TERMS AND CONDITIONS IN THE EASEMENT, MUST NOT ENDANGER OR INTERFERE WITH THE RIGHTS GRANTED BY THE EASEMENT TO NEW BRAUNFELS UTILITIES, ITS SUCCESSORS AND ASSIGNS, AND SHALL BE SUBJECT TO APPLICABLE PERMIT REQUIREMENTS OF THE CITY OF NEW BRAUNFELS OR ANY OTHER GOVERNING BODY. THE PROPERTY OWNER MUST OBTAIN, IN ADVANCE, WRITTEN AGREEMENT WITH THE UTILITIES TO UTILIZE THE EASEMENT, OR ANY PART OF IT.
2. UTILITIES WILL POSSESS A 5' WIDE SERVICE EASEMENT TO THE DWELLING ALONG THE SERVICE LINE TO THE SERVICE ENTRANCE. THIS EASEMENT WILL VARY DEPENDING UPON LOCATION OF DWELLING AND SERVICE.
3. UTILITIES SHALL HAVE ACCESS TO THE METER LOCATIONS FROM THE FRONT YARD AND METER LOCATIONS SHALL NOT BE LOCATED WITHIN A FENCED AREA.
4. EACH LOT MUST HAVE ITS OWN WATER AND SEWER SERVICE AT THE OWNER'S/DEVELOPER'S EXPENSE.
5. DO NOT COMBINE ANY NEW UTILITY EASEMENTS (U.E.) WITH DRAINAGE EASEMENTS (D.E.) OR MAKE CHANGES IN GRADE WITHIN THE UTILITY EASEMENTS (U.E.) WITHOUT WRITTEN APPROVAL FROM NEW BRAUNFELS UTILITIES.
6. NBU IS NOT RESPONSIBLE FOR DAMAGES TO PROPERTY IMPROVEMENTS (I.E. LANDSCAPING, TREES, PAVEMENT, SIGNS, DRAINAGE STRUCTURES, PRIVATE UTILITIES, ETC.) THAT ARE PLACED IN ANY TYPE OF UTILITY EASEMENT. TO ENSURE NO CONFLICTS EXIST WITH UTILITY INFRASTRUCTURE IN THE EASEMENT, ALL SUCH IMPROVEMENTS PLACED IN ANY TYPE OF UTILITY EASEMENT MUST BE REVIEWED AND APPROVED THROUGH THE NBU EASEMENT ENCROACHMENT PROCESS. NBU DEVELOPMENT SERVICES FACILITATES THE EASEMENT ENCROACHMENT APPLICATION PROCESS.

KNOW ALL MEN BY THESE PRESENTS:

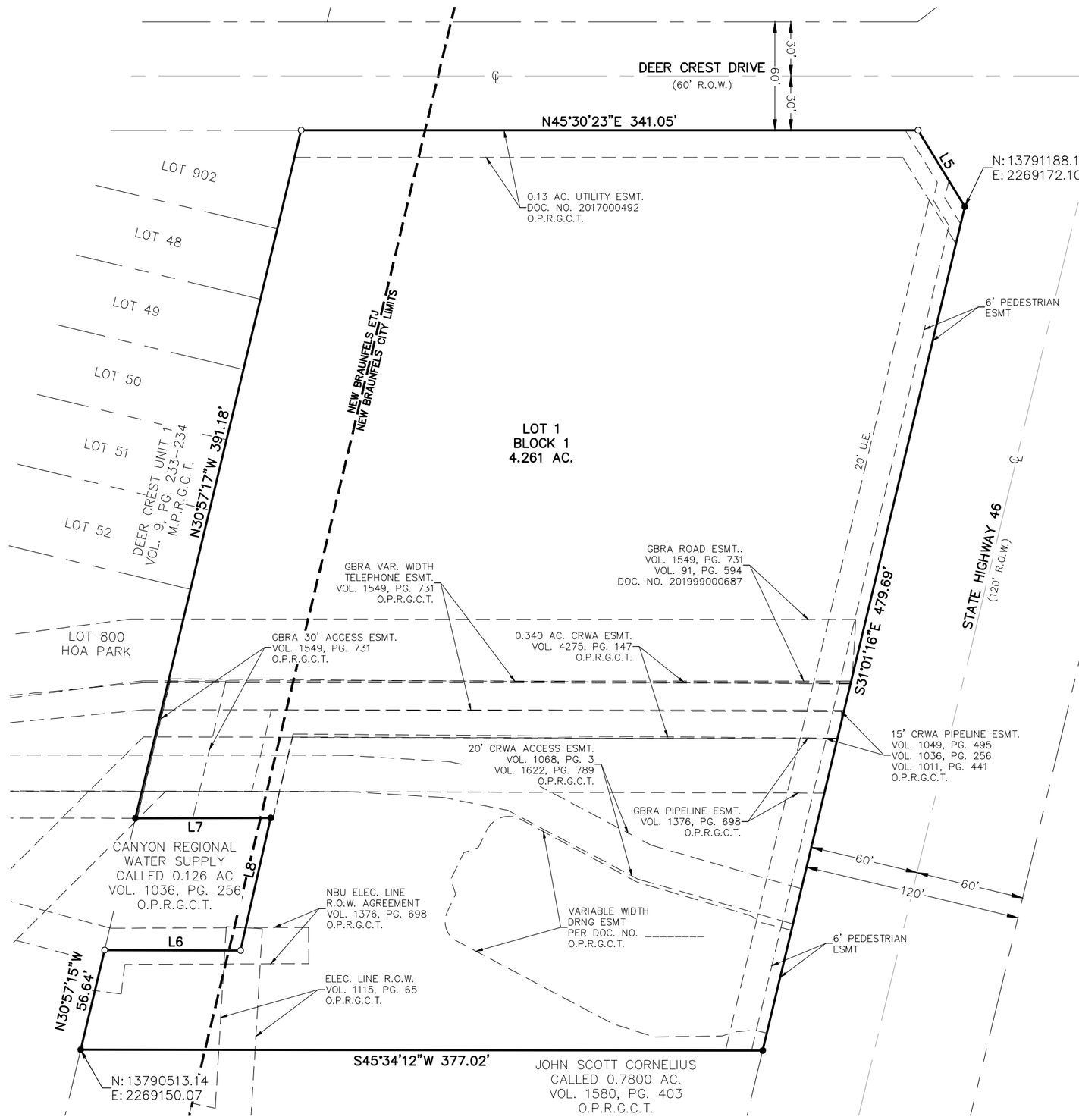
I, THE UNDERSIGNED DOROTHY J. TAYLOR, A REGISTERED PROFESSIONAL LAND SURVEYOR IN THE STATE OF TEXAS, HEREBY CERTIFY THAT THIS PLAT IS TRUE AND CORRECTLY MADE UNDER MY SUPERVISION AND IN COMPLIANCE WITH CITY AND STATE SURVEY REGULATIONS AND LAWS AND MADE ON THE GROUND AND THAT THE CORNER MONUMENTS WERE PROPERLY PLACED UNDER MY SUPERVISION.

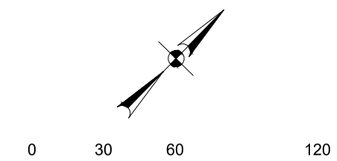
PRELIMINARY, THIS DOCUMENT SHALL NOT BE RECORDED FOR ANY PURPOSE.

DOROTHY J. TAYLOR
REGISTERED PROFESSIONAL LAND SURVEYOR NO. 6295
290 S. CASTELL AVE., SUITE 100, NEW BRAUNFELS, TEXAS 78130

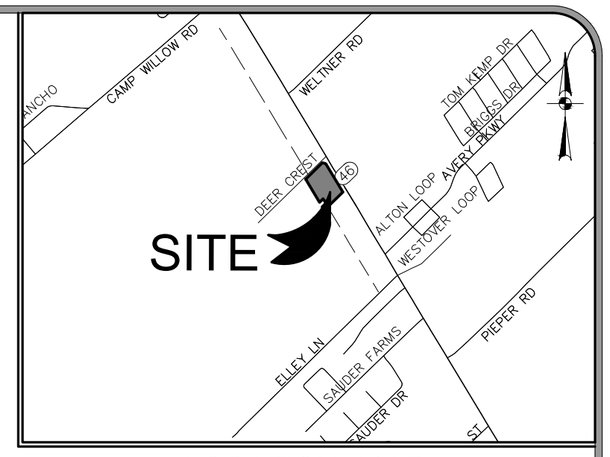
PLAT PREPARED FEBRUARY 12, 2021

HMT ENGINEERING & SURVEYING
290 S. CASTELL AVE., STE. 100
NEW BRAUNFELS, TX 78130
TBPE FIRM F-10961
TBPLS FIRM 10153600





LINE TABLE		
LINE #	LENGTH	DIRECTION
L5	49.50'	S76°02'05"E
L6	75.01'	N45°41'48"E
L7	74.80'	S45°24'10"W
L8	75.17'	N31°34'56"W



LOCATION MAP
NOT TO SCALE

LEGEND:
- ● = FND 1/2" IRON PIN W/ PLASTIC CAP STAMPED "HMT" (UNLESS NOTED OTHERWISE)
- ○ = SET 1/2" IRON PIN W/ PLASTIC CAP STAMPED "HMT"
- ℄ = EXISTING STREET CENTER LINE
- U.E. = UTILITY EASEMENT
- R.O.W. = RIGHT-OF-WAY
- M.P.R.G.C.T. = MAP AND PLAT RECORDS, GUADALUPE COUNTY, TEXAS
- O.P.R.G.C.T. = OFFICIAL PUBLIC RECORDS, GUADALUPE COUNTY, TEXAS

TXDOT NOTES:

1. FOR RESIDENTIAL DEVELOPMENT DIRECTLY ADJACENT TO STATE RIGHT-OF-WAY, THE DEVELOPER SHALL BE RESPONSIBLE FOR ADEQUATE SETBACK AND/OR SOUND ABATEMENT MEASURES FOR FUTURE NOISE MITIGATION.
2. OWNER/DEVELOPER IS RESPONSIBLE FOR PREVENTING ANY ADVERSE IMPACT TO THE EXISTING DRAINAGE SYSTEM WITHIN THE HIGHWAY RIGHT-OF-WAY. FOR PROJECTS IN THE EDWARDS AQUIFER RECHARGE OR CONTRIBUTING ZONES, OUTFALLS FOR WATER QUALITY AND/OR DETENTION PONDS TREATING IMPERVIOUS COVER RELATED TO THE DEVELOPMENT, WILL NOT ENCROACH BY STRUCTURE OR GRADING INTO STATE R.O.W. PLACEMENT OF PERMANENT STRUCTURAL BEST MANAGEMENT PRACTICE DEVICES OR VEGETATIVE FILTER STRIPS WITHIN STATE R.O.W. WILL NOT BE ALLOWED.
3. MAXIMUM ACCESS POINTS TO STATE HIGHWAY FROM THIS PROPERTY WILL BE REGULATED AS DIRECTED BY TXDOT'S "ACCESS MANAGEMENT MANUAL". THIS PROPERTY IS ELIGIBLE FOR ZERO (0) ACCESS POINT, BASED ON AN OVERALL PLATTED HIGHWAY FRONTAGE OF APPROXIMATELY 525.0 FEET. WHERE TOPOGRAPHY OR OTHER EXISTING CONDITIONS MAKE IT INAPPROPRIATE OR NOT FEASIBLE TO CONFORM TO THE CONNECTION SPACING INTERVALS, THE LOCATION OF REASONABLE ACCESS WILL BE DETERMINED WITH CONSIDERATION GIVEN TO TOPOGRAPHY, ESTABLISHED PROPERTY OWNERSHIPS, UNIQUE PHYSICAL LIMITATIONS, AND/OR PHYSICAL DESIGN CONSTRAINTS. THE SELECTED LOCATION SHOULD SERVE AS MANY PROPERTIES AND INTERESTS AS POSSIBLE TO REDUCE THE NEED FOR ADDITIONAL DIRECT ACCESS TO THE HIGHWAY. IN SELECTING LOCATIONS FOR FULL MOVEMENT INTERSECTIONS, PREFERENCE WILL BE GIVEN TO PUBLIC ROADWAYS THAT ARE ON LOCAL THOROUGHFARE PLANS.
4. IF SIDEWALKS ARE REQUIRED BY APPROPRIATE CITY ORDINANCE, A SIDEWALK PERMIT MUST BE APPROVED BY TXDOT, PRIOR TO CONSTRUCTION WITHIN STATE RIGHT-OF-WAY. LOCATIONS OF SIDEWALKS WITHIN STATE RIGHT-OF-WAY SHALL BE AS DIRECTED BY TXDOT.
5. ANY TRAFFIC CONTROL MEASURES (LEFT-TURN LANE, RIGHT-TURN LANE, SIGNAL, ETC.) FOR ANY ACCESS FRONTING A STATE MAINTAINED ROADWAY SHALL BE THE RESPONSIBILITY OF THE DEVELOPER/OWNER.

APPROVED THIS THE _____ DAY OF _____, 20___, BY THE PLANNING COMMISSION OF THE CITY OF NEW BRAUNFELS, TEXAS.

_____, CHAIRMAN

APPROVED FOR ACCEPTANCE

_____ DATE _____ PLANNING DIRECTOR

_____ DATE _____ CITY ENGINEER

_____ DATE _____ NEW BRAUNFELS UTILITIES

STATE OF TEXAS
COUNTY OF GUADALUPE

I (WE) THE UNDERSIGNED OWNER(S) OF THE LAND SHOWN ON THIS PLAT, AND DESIGNATED HEREIN AS ELLIOT ELECTRIC NEW BRAUNFELS A SUBDIVISION TO THE CITY OF NEW BRAUNFELS, COUNTY OF GUADALUPE, TEXAS, AND WHOSE NAME IS SUBSCRIBED HERETO, DO HEREBY SUBDIVIDE SUCH PROPERTY AND DEDICATE TO THE USE OF THE PUBLIC ALL STREETS, ALLEYS, PARKS, DRAINS, EASEMENTS, AND PUBLIC PLACES THEREON SHOWN FOR THE PURPOSES AND CONSIDERATION THEREIN EXPRESSED.

_____
ELLIOT ELECTRIC SUPPLY
BY: JOSH THOMAS – CONSTRUCTION MANAGER
4851 LBJ FREEWAY, 10TH FLOOR
DALLAS, TEXAS 75244

STATE OF TEXAS
COUNTY OF _____.

THIS INSTRUMENT WAS ACKNOWLEDGED BEFORE ME ON THIS _____ DAY OF _____, 20___,
BY _____

_____
NOTARY PUBLIC, STATE OF TEXAS
MY COMMISSION EXPIRES: _____

SPRINGS HILL WATER SUPPLY CORPORATION (SHWSC):

1. EXISTING WATER INFRASTRUCTURE IN THE VICINITY OF THE TRACT IS AVAILABLE TO SERVE THE PROPOSED DEVELOPMENT. IF THE DEVELOPMENT EXCEEDS THE CAPACITY OF THE EXISTING WATER INFRASTRUCTURE, THEN IT WILL BE THE DEVELOPER'S RESPONSIBILITY TO MAKE THE NECESSARY WATER AND WASTEWATER IMPROVEMENTS TO THE EXISTING INFRASTRUCTURE TO PROVIDE SUFFICIENT CAPACITY. EXTENT OF THE NECESSARY WATER IMPROVEMENTS WILL BE OUTLINED IN A MEMORANDUM OF UNDERSTANDING OR NON-STANDARD SERVICE AGREEMENT PRIOR TO THE APPROVAL OF ANY FINAL PLAT.
2. SHWSC SHALL HAVE ACCESS TO METER LOCATIONS FROM THE FRONT YARD WITH THE LOCATION NOT BEING WITHIN A FENCED AREA.
3. ANY EASEMENT DESIGNATED AS A SHWSC UTILITY EASEMENT SHALL REMAIN OPEN FOR ACCESS AT ALL TIMES AND SHALL NOT BE WITHIN A FENCED AREA.
4. ALL SHWSC EASEMENTS ARE FOR CONSTRUCTION, MAINTENANCE (INCLUDING BUT NOT LIMITED TO REMOVAL OF TREES AND OTHER OBSTRUCTIONS), READING OF METERS, AND REPAIR OF ANY SHWSC FACILITY LOCATED WITHIN SAID EASEMENT.
5. WATER LINE IS TO BE CONSTRUCTED IN ACCORDANCE WITH SPRINGS HILL WATER SUPPLY CORPORATION STANDARD DRAWINGS AND SPECIFICATIONS.
6. WATER MAIN SHALL HAVE A MINIMUM OF 30 INCHES OF COVER, OTHERWISE CONCRETE ENCASEMENT WILL BE REQUIRED.
7. CONTRACTOR WILL KEEP THE AREA ON TOP OF AND AROUND TE WATER METER BOX FREE OF ALL OBJECTS AND DEBRIS.
8. NO METER BOXES TO BE SET IN DRIVEWAYS. ANY METER BOX SET IN A DRIVEWAY WILL BE RELOCATED AT THE CONTRACTOR'S AND/OR DEVELOPER'S EXPENSE.
9. NO VALVE, HYDRANTS, ETC. SHALL BE CONSTRUCTED WITHIN CURBS, SIDEWALKS, DRIVEWAYS, OR ROADWAYS. SHWSC WILL NOT BE RESPONSIBLE FOR ANY DAMAGES TO CONCRETE OR PAVED AREAS IF DEVELOPER DOES NOT COMPLY.

THIS SUBDIVISION PLAT OF ELLIOT ELECTRIC SUBMITTED TO AND APPROVED BY SPRINGS HILL WATER SUPPLY CORPORATION.

_____. _____.
AGENT FOR SPRINGS HILL WATER SUPPLY CORPORATION DATE

STATE OF TEXAS
COUNTY OF GUADALUPE

_____
COUNTY CLERK, GUADALUPE COUNTY, TEXAS

_____
DEPUTY

SHEET 1 OF 1

Drawing Name: T:\380 - Elliot Electric Supply\001 - Elliot Electric New Braunfels\Plat\Elliot Electric New Braunfels Plat.dwg User: kellyk Apr 30, 2021 - 9:35am

City of New Braunfels

Planning Commission Agenda Item Report

550 Landa Street
New Braunfels, TX

6/1/2021

Agenda Item No. F)

PRESENTER:
Applicant: HMT Engineering & Surveying (Chris Van Heerde, P.E.)
Owner: City of New Braunfels

SUBJECT:
FP21-0173 Approval of the final plat for New Braunfels Sports Complex

DEPARTMENT: Planning and Development Services

COUNCIL DISTRICTS IMPACTED: Council District 2

BACKGROUND INFORMATION:

Applicant: HMT Engineering & Surveying (Chris Van Heerde, P.E.)
290 S. Castel Avenue, Suite 100
New Braunfels, TX 78130
(830) 625-8555 plats@hmtnb.com

Owner: City of New Braunfels
550 Landa Street
New Braunfels, TX 78130

Staff Contact: Matt Greene
(830) 221-4053 mgreene@nbtexas.org

Description: Platting 150.99 acres into 2 commercial lots and 1 park lot

ISSUE:
The subject property is located on the southeast corner of the intersection of FM 1044 and W. Klein Road. The property is proposed to be platted into 2 commercial lots and 1 park lot for the New Braunfels Sports Complex.

Drainage:
The Public Works Department reviewed preliminary drainage with the Letter of Certification process as required by Section 118-51e of the Subdivision Platting Ordinance and in accordance with Chapter 143 Municipal Drainage Utility Systems and the Drainage and Erosion Control and Design Manual.

A portion of the property is located within the 100-year floodplain.

Utilities:

Water service will be provided by Green Valley Special Utility District (GVSUD), wastewater service by Guadalupe-Blanco River Authority (GBRA) and electric services by Guadalupe Valley Electric Cooperative (CVEC). Utility easements have been designated on the plat s requested by the utility entities.

Transportation:

Regional Transportation Plan

This final plat is in compliance with the City's Regional Transportation Plan. FM 1044 is designated as a 200-foot wide Parkway adjacent to the subdivision. FM 1044 has a current right-of-way width of 80 feet and an additional 60 feet of right-of-way adjacent to FM 1044 will be dedicated with this plat. West Klein Road is designated as a 120-foot wide Minor Arterial and a right-of-way width determination of 94 feet approved by the City Council in 2014. The existing right-of-way width of W. Klein Road varies between 48 and 52 feet. Dedication of approximately 42 to 46 feet of right-of-way width adjacent to W. Klein Road will be dedicated with this plat. The southeast boundary of the subdivision encompasses a portion of the future extension of W. Zipp Road, a 60-foot wide Collector. A right-of-way dedication of 30 feet for the future extension of W. Zipp Road will occur with this plat.

Hike and Bike

There is an existing 10-foot wide hike and bike trail adjacent to the property along W. Klein Road. No additional hike and bike construction is required with this subdivision.

Sidewalks

There is an existing 10-foot wide hike and bike trail adjacent to the property along W. Klein Road. No additional sidewalk construction along W. Klein Road will be required with this plat. Along FM 1044, 6-foot wide sidewalks will be required to be constructed by the owner of each lot at the time of development.

Roadway Impact Fees:

Roadway Impact Fees for Service Area 5 are hereby assessed with the approval of the final plat. Roadway Impact Fees will be collected at the time of building permit as indicated in the then current fee schedule.

Parkland Dedication and Development:

This plat is proposed for non-residential development and does not require parkland dedication or development. Should the property be developed with residential units, the owners of the property will be required to comply with the ordinance for each dwelling unit.

FISCAL IMPACT:

The City will collect Roadway Impact Fees at the time of building permit for 2 commercial lots.

RECOMMENDATION:

To meet the requirements of the Subdivision Platting Ordinance and other adopted codes, the applicant's proposed final plat must comply with the conditions noted below. Staff recommends approval of the applicant's proposed final plat with the following Conditions of Approval:

1. Revise plat note #7 to indicate a portion of the property is located within a Special Flood Hazard Area Zone A and add "according to the adopted flood maps of the City of New Braunfels" after "(100-yr. flood)". *(NBCO 118-(30)(j))*
2. Revise plat note #12 to state: "This subdivision is subject to the City of New Braunfels 2018 Park Land

Dedication and Development Ordinance. At such time that residential dwelling units are constructed within the subdivision, the owners shall contact the City of New Braunfels and comply with the ordinance for each dwelling unit." *(NBCO 118-24(15)*

3. Revise plat note #10 to indicate there is an existing 10-foot wide hike and bike trail adjacent to W. Klein Road and 6-foot wide sidewalks will be constructed adjacent to FM 1044 and the W. Zipp Road right-of-way dedication by the owner/builder at the time of development. *(NBCO 118-30(h)*
4. Revise the plat scale so it is no less than 1" = 100'. *(NBCO 118-29(a))*
5. Provide a drainage easement for the 36" storm sewer line that drains into Pond A1 as shown on the preliminary street and utility exhibit. *(NBCO 118-51(e)(2)a.)*
6. Conduct a study of where the base flood elevation will be, assuming a fully developed watershed, and show a drainage easement on the plat, and the elevation of the flood plain at intervals of every 500 lineal feet. *(NBCO 118-51(f)(3)d.1.)*
7. Conduct a study, using HEC or similar modeling that is approved by the City Engineer, to insure the proposed development would not increase the elevation of the one percent annual chance base flood. *(NBCO 118-51(f)(3)d.2.)*
8. On Sheet 1 of the plat, revise "Sheet 1 of 2" to read "Sheet 1 of 4". *(NBC) 118-24(15)*

Approval Compliance:
Pursuant to state law, if the Planning Commission approves with conditions, to obtain approval of the final plat, the applicant must submit to the City a written response that satisfies each condition of approval prior to expiration of the final plat (Section 118-32(b)). In accordance with Chapter 212, Texas Local Government Code, the City will determine the final plat approved if the response adequately addresses each Condition of Approval.

Attachments:
Aerial Map
Final Plat

FP21-0173

New Braunfels Sports Complex - Final Plat

0 750 1,500 Feet

N

Path:
\\file-04\Users$\Planning\mgreene\Desktop\FP21-0173 Aerial Map.aprx

Source: City of New Braunfels Planning
Date: 5/18/2021

DISCLAIMER: This map and information contained in it were developed exclusively for use by the City of New Braunfels. Any use or reliance on this map by anyone else is at that party's risk and without liability to the City of New Braunfels, its officials or employees for any discrepancies, errors, or variances which may exist.

FINAL PLAT ESTABLISHING
NEW BRAUNFELS SPORTS COMPLEX

BEING A 150.99 ACRE TRACT SITUATED IN THE SARAH DEWITT SURVEY, ABSTRACT NO. 103, GUADALUPE COUNTY, TEXAS. BEING ALL OF A CALLED 125.99 ACRE TRACT RECORDED IN DOCUMENT NO. 201899005552 AND A CALLED 25.00 ACRE TRACT RECORDED IN DOCUMENT NO. 201899005553, OFFICIAL PUBLIC RECORDS, GUADALUPE COUNTY, TEXAS.

PLAT NOTES:

1. ALL LOTS WITHIN THE SUBDIVISION WILL BE PROVIDED WATER SERVICES BY GREEN VALLEY SPECIAL UTILITY DISTRICT (GVSUD). SEWER SERVICES WILL BE PROVIDED BY GUADALUPE-BLANCO RIVER AUTHORITY (GBRA). ELECTRIC SERVICES WILL BE PROVIDED BY GUADALUPE VALLEY ELECTRIC COOPERATIVE (GVEC). TELEPHONE AND CABLE SERVICES FOR THE SUBDIVISION WILL BE PROVIDED BY AT&T COMMUNICATIONS AND/OR SPECTRUM.
2. ALL BEARINGS AND COORDINATES SHOWN HEREON ARE BASED UPON THE TEXAS COORDINATE SYSTEM, SOUTH CENTRAL ZONE (4204), NORTH AMERICAN DATUM 1983, GRID. DISTANCES SHOWN HEREON ARE BASED UPON SURFACE MEASUREMENTS. TO CONVERT SURFACE DISTANCES TO GRID, APPLY A COMBINED SCALE FACTOR OF 1.00015.
3. MONUMENTS WERE FOUND OR SET AT EACH CORNER OF THE SURVEY BOUNDARY OF THE SUBDIVISION. MONUMENTS AND LOT MARKERS WILL BE SET WITH 1/2" IRON PINS WITH PLASTIC CAP STAMPED "HMT" IMMEDIATELY AFTER COMPLETION OF UTILITY INSTALLATION AND STREET CONSTRUCTION UNLESS NOTED OTHERWISE.
4. THIS SUBDIVISION IS NOT WITHIN THE EDWARDS AQUIFER RECHARGE ZONE.
5. THIS SUBDIVISION IS WITHIN THE CITY LIMITS OF NEW BRAUNFELS, TEXAS.
6. THIS SUBDIVISION IS WITHIN THE MARION INDEPENDENT SCHOOL DISTRICT.
7. A PORTION OF THE SUBDIVISION IS LOCATED WITHIN A SPECIAL FLOOD HAZARD AREA (100 YR. FLOOD), AS DEFINED BY THE GUADALUPE COUNTY, TEXAS, FLOOD INSURANCE RATE MAP NUMBER 48187C0115F, EFFECTIVE DATE NOVEMBER 2, 2007 AND FLOOD INSURANCE MAP NUMBER 48187C0095F, EFFECTIVE DATE NOVEMBER 2, 2007 AS PREPARED BY THE FEDERAL EMERGENCY MANAGEMENT AGENCY.
8. NO STRUCTURES, WALLS OR OTHER OBSTRUCTIONS OF ANY KIND SHALL BE PLACED WITHIN THE LIMITS OF THE DRAINAGE EASEMENTS SHOWN ON THIS PLAT. NO LANDSCAPING, FENCES, OR OTHER TYPE OF MODIFICATIONS WHICH ALTER THE CROSS SECTIONS OF THE DRAINAGE EASEMENTS OR DECREASE THE HYDRAULIC CAPACITY OF THE EASEMENT, AS APPROVED, SHALL BE ALLOWED WITHOUT THE APPROVAL OF THE CITY ENGINEER. THE CITY OF NEW BRAUNFELS SHALL HAVE THE RIGHT OF INGRESS AND EGRESS OVER GRANTOR'S ADJACENT PROPERTY TO REMOVE ANY OBSTRUCTIONS PLACED WITHIN THE LIMITS OF SAID DRAINAGE EASEMENTS AND TO MAKE ANY MODIFICATIONS OR IMPROVEMENTS WITHIN SAID DRAINAGE EASEMENTS.
9. FUTURE DEVELOPMENT IS SUBJECT TO CHAPTER 114 (STREETS, SIDEWALKS AND OTHER PUBLIC SPACES) OF THE NEW BRAUNFELS CODE OF ORDINANCES.
10. SIX (6) FOOT WIDE SIDEWALKS WILL BE CONSTRUCTED PER CITY STANDARDS ADJACENT TO THE PROPERTY LINE BY THE DEVELOPER AT THE TIME OF STREET CONSTRUCTION ALONG:
    A. FM 1044, KLEIN RD
    B. THE FUTURE EXTENSION OF ZIPP RD
11. THE ELEVATION OF THE LOWEST FLOOR OF A STRUCTURE SHALL BE AT LEAST 10 INCHES ABOVE THE FINISHED GRADE OF THE SURROUNDING GROUND, WHICH SHALL BE SLOPED IN A FASHION SO AS TO DIRECT STORMWATER AWAY FROM THE STRUCTURE. PROPERTIES ADJACENT TO STORMWATER CONVEYANCE STRUCTURES MUST HAVE A FLOOR SLAB ELEVATION OR BOTTOM OF FLOOR JOISTS A MINIMUM OF ONE FOOT ABOVE THE 100-YEAR WATER FLOW ELEVATION IN THE STRUCTURE. DRIVEWAYS SERVING HOUSES ON THE DOWNHILL SIDE OF THE STREET SHALL HAVE A PROPERLY SIZED CROSS SWALE PREVENTING RUNOFF FROM ENTERING THE GARAGE AND SHALL PREVENT WATER FROM LEAVING THE STREET.
12. NON-RESIDENTIAL USE SUBDIVISIONS ARE NOT SUBJECT TO THE PARK LAND DEDICATION AND DEVELOPMENT REQUIREMENTS. HOWEVER, AT SUCH TIME ANY DWELLING UNITS ARE CONSTRUCTED, THE OWNER OF THE LOT SHALL CONTACT THE CITY AND COMPLY WITH THE ORDINANCE FOR EACH DWELLING UNIT.
13. ALL DRAINAGE EASEMENTS WITHIN THE LOTS WILL BE OWNED AND MAINTAINED BY PROPERTY OWNER.
14. PERMANENT WATER QUALITY CONTROLS ARE REQUIRED FOR THIS SUBDIVISION PLAT IN ACCORDANCE WITH THE CITY OF NEW BRAUNFELS DRAINAGE AND EROSION CONTROL DESIGN MANUAL.

GBRA NOTES:

1. PROVIDE DEDICATED EASEMENTS IN THE NAME OF GBRA. EASEMENTS SHALL NOT OVERLAP OR BE WITHIN RESIDENTIAL LOTS.
2. WHERE OUTSIDE OF PUBLIC RIGHT-OF-WAY, PROVIDE DEDICATED EASEMENTS WITH A MINIMUM WIDTH EQUAL TO PIPE OUTSIDE DIAMETER, ROUNDED UP TO THE NEAREST FOOT, PLUS 10 FEET MINIMUM ON EACH SIDE. FOR EASEMENTS WITH MULTIPLE PIPES, PROVIDE 10 FEET MINIMUM HORIZONTAL CLEARANCE BETWEEN PIPES. PROVIDE ADDITIONAL WIDTH FOR EASEMENTS THAT ARE NOT LOCATED ADJACENT TO PUBLIC RIGHT-OF-WAY.
3. THE GUADALUPE-BLANCO RIVER AUTHORITY (GBRA) IS HEREBY DEDICATED THE EASEMENT AND RIGHTS-OF-WAY IN THE AREAS DESIGNATED ON THIS PLAN FOR WASTEWATER FACILITIES FOR THE PURPOSE OF INSTALLING, CONSTRUCTING, RECONSTRUCTING, OPERATING, MAINTAINING, INSPECTING, REPAIRING, REMOVING, AND RELOCATING BURIED AND/OR EXPOSED WASTEWATER FACILITIES AND APPURTENANCES.
4. TOGETHER WITH THE RIGHT OF INGRESS AND EGRESS, GBRA SHALL HAVE THE RIGHT TO REMOVE SAID LANDS OF ALL TREES OR PARTS THEREOF, OR ANY OTHER OBSTRUCTIONS WHICH MAY ENDANGER, OR INTERFERE WITH MAINTENANCE OF THE FACILITIES AND APPURTENANCES.
5. OTHER UTILITIES, STRUCTURES, GRADING, DRAINAGE, DETENTION/RETENTION PONDS, LANDSCAPING, TREES, ROADS, PARKING LOTS, FENCES, WALLS, CONSTRUCTION OF ANY TYPE, OR ANY OTHER IMPROVEMENTS OR OBSTRUCTIONS, ARE NOT ALLOWED WITHIN GBRA EASEMENTS.
6. DESIGNS FOR ANY PROPOSED ALTERATIONS OR CROSSINGS OF GBRA EASEMENTS MUST BE APPROVED IN WRITING BY GBRA AND THE INSTALLATION OF SUCH MUST BE INSPECTED AND APPROVED BY GBRA.
7. MAINTENANCE OF EASEMENTS IS THE RESPONSIBILITY OF THE PROPERTY OWNER.
8. THE PROPERTY OWNER MUST INSTALL 16-FOOT GATES IN ANY FENCES THAT CROSS GBRA UTILITIES; GATES MUST BE CENTERED ACROSS GBRA UTILITIES.
9. CUSTOMER WASTEWATER SERVICES SHALL NOT BE INSTALLED WITHIN FENCED AREAS.

KNOW ALL MEN BY THESE PRESENTS:

I, THE UNDERSIGNED DOROTHY J. TAYLOR, A REGISTERED PROFESSIONAL LAND SURVEYOR IN THE STATE OF TEXAS, HEREBY CERTIFY THAT THIS PLAT IS TRUE AND CORRECTLY MADE UNDER MY SUPERVISION AND IN COMPLIANCE WITH CITY AND STATE SURVEY REGULATIONS AND LAWS AND MADE ON THE GROUND AND THAT THE CORNER MONUMENTS WERE PROPERLY PLACED UNDER MY SUPERVISION.

PRELIMINARY, THIS DOCUMENT SHALL NOT BE RECORDED FOR ANY PURPOSE.

_____
DOROTHY J. TAYLOR
REGISTERED PROFESSIONAL LAND SURVEYOR NO. 6295
290 S. CASTELL AVE., SUITE 100, NEW BRAUNFELS, TEXAS 78130

PLAT PREPARED MAY 3, 2021

HMT ENGINEERING & SURVEYING
290 S. CASTELL AVE., STE. 100
NEW BRAUNFELS, TX 78130
TBPE FIRM F-10961
TBPLS FIRM 10153600

GVSUD NOTES:

EASEMENT CERTIFICATE
THE OWNER OF THE LAND SHOWN ON THIS PLAT AND WHOSE NAME IS SUBSCRIBED HERETO, IN PERSON OR THROUGH A DULLY AUTHORIZED AGENT, DEDICATES TO GREEN VALLEY SPECIAL UTILITY DISTRICT OF MARION, TEXAS, ITS SUCCESSORS AND ASSIGNS, A PERPETUAL EASEMENT WIT THE RIGHT TO ERECT, CONSTRUCT, INSTALL AND LAY OVER AND ACROSS THOSE AREAS MARKED AS "WATERLINE EASEMENT" AND IN ALL STREETS AND BYWAYS, SUCH PIPELINES, SERVICE LINES, WATER METERS, AND OTHER WATER SYSTEM APPURTENANCES AS IT REQUIRES, TOGETHER WIT THE RIGHT OF INGRESS AND EGRESS, THE RIGHT TO REMOVE FROM SAID LAND ALL TREES, SHRUBS, GRASSES, PAVEMENTS, FENCES, STRUCTURES, IMPROVEMENTS OR OTHER OBSTRUCTIONS WHICH MAY INTERFERE WITH THE FACILITY OR THE ACCESS THERETO. IT IS AGREED AND UNDERSTOOD THAT NO BUILDING, CONCRETE SLAB OR WALLS WILL BE PLACED WITHIN SAID EASEMENT AREAS. NO OTHER UTILITY LINES MAY BE LOCATED WITHIN 36" PARALLEL TO WATER LINES.

ANY MONETARY LOSS TO GREEN VALLEY SUD RESULTING FROM MODIFICATIONS REQUIRED OF UTILITY EQUIPMENT LOCTED WITHIN SAID EASEMENTS DUE TO GRADE CHANGE OR GROUND ELEVATION ALTERATION SHALL BE CHARGED TO THE PERSON OR PERSONS DEEMED RESPONSIBLE FOR SAID GRADE CHANGES OR GROUND ELEVATION ALTERATIONS. UPON ENTERING IN AND UPON SAID EASEMENT, THE DISTRICT WILL ENDEAVOR TO RESTORE THE LAND SURFACE TO A USEABLE CONDITION BUT IS NOT OBLIGATED TO RESTORE IT TO A PRE-EXISTING CONDITION.

THE EASEMENT CONVEYED HEREIN WAS OBTAINED OR IMPROVED THROUGH FEDERAL FINANCIAL ASSISTANCE. THIS EASEMENT IS SUBJECT TO THE PROVISION OF TITLE VI OF THE CIVIL RIGHTS ACT OF 1964, AND THE REGULATION ISSUED PURSUANT THERETO FOR SO LONG AS THE EASEMENT CONTINUES TO BE USED FOR THE SAME OR SIMILAR PURPOSE FOR WHICH FINANCIAL ASSISTANCE WAS EXTENDED OR FOR AS LONG AS THE GRANTEE OWNS IT, WHICHEVER IS LONGER.

TXDOT NOTES:

1. FOR RESIDENTIAL DEVELOPMENT DIRECTLY ADJACENT TO STATE RIGHT-OF-WAY, THE DEVELOPER SHALL BE RESPONSIBLE FOR ADEQUATE SETBACK AND/OR SOUND ABATEMENT MEASURES FOR FUTURE NOISE MITIGATION.
2. OWNER/DEVELOPER IS RESPONSIBLE FOR PREVENTING ANY ADVERSE IMPACT TO THE EXISTING DRAINAGE SYSTEM WITHIN THE HIGHWAY RIGHT-OF-WAY. FOR PROJECTS IN THE EDWARDS AQUIFER RECHARGE OR CONTRIBUTING ZONES, OUTFALLS FOR WATER QUALITY AND/OR DETENTION PONDS TREATING IMPERVIOUS COVER RELATED TO THE DEVELOPMENT, WILL NOT ENCROACH BY STRUCTURE OR GRADING INTO STATE R.O.W. PLACEMENT OF PERMANENT STRUCTURAL BEST MANAGEMENT PRACTICE DEVICES OR VEGETATIVE FILTER STRIPS WITHIN STATE R.O.W. WILL NOT BE ALLOWED.
3. MAXIMUM ACCESS POINTS TO STATE HIGHWAY FROM THIS PROPERTY WILL BE REGULATED AS DIRECTED BY TXDOT'S "ACCESS MANAGEMENT MANUAL". THIS PROPERTY IS ELIGIBLE FOR ONE (1) POINT OF ACCESS TO FM 1044, BEING RIGHT-IN/RIGHT-OUT ONLY, BASED ON AN APPROXIMATE OVERALL FRONTAGE OF 1,434.37 FEET. WHERE TOPOGRAPHY OR OTHER EXISTING CONDITIONS MAKE IT INAPPROPRIATE OR NOT FEASIBLE TO CONFORM TO THE CONNECTION SPACING INTERVALS, THE LOCATION OF REASONABLE ACCESS WILL BE DETERMINED WITH CONSIDERATION GIVEN TO TOPOGRAPHY, ESTABLISHED PROPERTY OWNERSHIPS, UNIQUE PHYSICAL LIMITATIONS, AND/OR PHYSICAL DESIGN CONSTRAINTS. THE SELECTED LOCATION SHOULD SERVE AS MANY PROPERTIES AND INTERESTS AS POSSIBLE TO REDUCE THE NEED FOR ADDITIONAL DIRECT ACCESS TO THE HIGHWAY. IN SELECTING LOCATIONS FOR FULL MOVEMENT INTERSECTIONS, PREFERENCE WILL BE GIVEN TO PUBLIC ROADWAYS THAT ARE ON LOCAL THOROUGHFARE PLANS.
4. IF SIDEWALKS ARE REQUIRED BY APPROPRIATE CITY ORDINANCE, A SIDEWALK PERMIT MUST BE APPROVED BY TXDOT, PRIOR TO CONSTRUCTION WITHIN STATE RIGHT-OF-WAY. LOCATIONS OF SIDEWALKS WITHIN STATE RIGHT-OF-WAY SHALL BE AS DIRECTED BY TXDOT.
5. ANY TRAFFIC CONTROL MEASURES (LEFT-TURN LANE, RIGHT-TURN LANE, SIGNAL, ETC.) FOR ANY ACCESS FRONTING A STATE MAINTAINED ROADWAY SHALL BE THE RESPONSIBILITY OF THE DEVELOPER/OWNER.

STATE OF TEXAS
COUNTY OF GUADALUPE

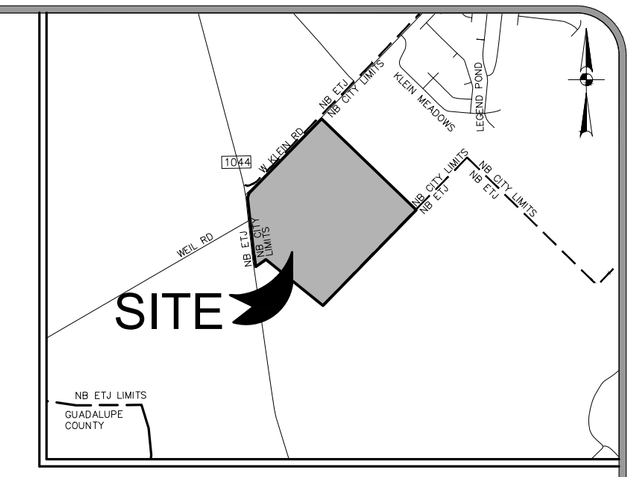
I (WE) THE UNDERSIGNED OWNER(S) OF THE LAND SHOWN ON THIS PLAT, AND DESIGNATED HEREIN AS THE NEW BRAUNFELS SPORTS COMPLEX A SUBDIVISION TO THE CITY OF NEW BRAUNFELS, COUNTY OF COMAL, TEXAS, AND WHOSE NAME IS SUBSCRIBED HERETO, DO HEREBY SUBDIVIDE SUCH PROPERTY AND DEDICATE TO THE USE OF THE PUBLIC ALL STREETS, ALLEYS, PARKS, DRAINS, EASEMENTS, AND PUBLIC PLACES THEREON SHOWN FOR THE PURPOSES AND CONSIDERATION THEREIN EXPRESSED.

_____
CITY OF NEW BRAUNFELS
BY: ROBERT CAMARENO – AUTHORIZED AGENT
550 LANDA ST
NEW BRAUNFELS, TEXAS 78130

STATE OF TEXAS
COUNTY OF COMAL

THIS INSTRUMENT WAS ACKNOWLEDGED BEFORE ME ON THIS
_____ DAY OF _____, 20___,
BY _____

_____
NOTARY PUBLIC, STATE OF TEXAS
MY COMMISSION EXPIRES: _____



LOCATION MAP
NOT TO SCALE

GVEC NOTES:

1. EACH LOT IS SUBJECT TO A FLOATING 10' WIDE BY 30' LONG ELECTRIC GUY WIRE EASEMENT TO BE LOCATED BY GVEC.
2. ALL UTILITY EASEMENTS ARE FOR THE CONSTRUCTION, MAINTENANCE (INCLUDING BUT NOT LIMITED TO REMOVAL OF TREES AND OTHER OBSTRUCTIONS), READING OF METERS, AND REPAIR OF ALL OVERHEAD AND UNDERGROUND UTILITIES.
3. GVEC WILL POSSESS A 5' WIDE EASEMENT TO THE SERVICE METER LOCATION. EASEMENT TO FOLLOW SERVICE LINE AND WILL VARY DEPENDING ON LOCATION OF BUILDING OR STRUCTURE.
4. GVEC SHALL HAVE ACCESS TO METER LOCATIONS FROM THE FRONT YARD WITH THE LOCATION NOT BEING WITHIN A FENCED AREA.

APPROVED THIS THE _____ DAY OF _____, 20___,
BY THE PLANNING COMMISSION OF THE CITY OF NEW BRAUNFELS, TEXAS.

_____.
CHAIRMAN

APPROVED FOR ACCEPTANCE

_____ _____.
DATE PLANNING DIRECTOR

_____ _____.
DATE CITY ENGINEER

_____ _____.
DATE NEW BRAUNFELS UTILITIES

STATE OF TEXAS
COUNTY OF GUADALUPE

_____
COUNTY CLERK, GUADALUPE COUNTY, TEXAS

_____.
DEPUTY

Drawing Name: T:\040- City of New Braunfels\040.031 - New Braunfels Sports Complex\Plat\NB Sports Complex Plat.dwg User: kellyk Apr 28, 2021 - 2:15pm

FINAL PLAT ESTABLISHING

NEW BRAUNFELS SPORTS COMPLEX

BEING A 150.99 ACRE TRACT SITUATED IN THE SARAH DEWITT SURVEY, ABSTRACT NO. 103, GUADALUPE COUNTY, TEXAS. BEING ALL OF A CALLED 125.99 ACRE TRACT RECORDED IN DOCUMENT NO. 201899005552 AND A CALLED 25.00 ACRE TRACT RECORDED IN DOCUMENT NO. 201899005553, OFFICIAL PUBLIC RECORDS, GUADALUPE COUNTY, TEXAS.

HORIZONTAL SCALE: 1:200

LEGEND:
- ● = FND 1/2" IRON PIN W/ PLASTIC CAP STAMPED "HMT" (UNLESS NOTED OTHERWISE)
- ○ = SET 1/2" IRON PIN W/ PLASTIC CAP STAMPED "HMT"
- □ = FOUND TXDOT MONUMENT
- U.E. = UTILITY EASEMENT
- DRNG = DRAINAGE
- R.O.W. = RIGHT-OF-WAY
- M.P.R.G.C.T. = MAP AND PLAT RECORDS, GUADALUPE COUNTY, TEXAS
- O.P.R.G.C.T. = OFFICIAL PUBLIC RECORDS, GUADALUPE COUNTY, TEXAS

CITY OF NEW BRAUNFELS
CALLED 0.201 AC.
DOC. NO. 201999005012
O.P.R.G.C.T.

WALTER A. GRIER, JR.
CALLED 0.453 AC.
VOL. 4023, PG. 385
O.P.R.G.C.T.

ZACHARY NEAL GRIER
CALLED 1.08 AC.
VOL. 3179, PG. 770
O.P.R.G.C.T.

ZACHARY NEAL GRIER
CALLED 2.878 AC.
VOL. 3179, PG. 770
O.P.R.G.C.T.

TINA GRIER
CALLED 0.827 AC.
DOC. NO. 2017019054
O.P.R.G.C.T.

VARIABLE WIDTH R.O.W.
HEREBY DEDICATED
1.84 AC.

KIM N. GRIER & DEBRA F. GRIER
CALLED 30.6624 AC.
DOC. NO. 2015021970
O.P.R.G.C.T.

SJM BENN PROPERTIES, LLC
CALLED 0.887 AC.
DOC. NO. 2017023172
O.P.R.G.C.T.

W KLEIN RD
(R.O.W. VARIES)
N44°16'19"E 2009.79'

NEW BRAUNFELS ETJ
NEW BRAUNFELS CITY LIMITS
FOUND PK NAIL

N: 13781106.67
E: 2246881.94

VARIABLE WIDTH R.O.W.
HEREBY DEDICATED
1.90 AC.

PAUL F & ALICE L HOFFMANN
REVOCABLE LIVING TRUST
CALLED 46.0 AC.
VOL. 1383, PG 41
O.R.G.C.T.

FRED HEIMER TRUSTEE
CALLED 1.16 AC.
DOC. NO. 201999000667
O.P.R.G.C.T.

FM 1044
(80' R.O.W.)

N06°24'03"W 1122.56'

20' U.E.

VARIABLE WIDTH PEDESTRIAN ESMT (SEE DETAIL "A" SHEET 3 OF 4)

N44°14'48"E 337.32'

N44°11'20"E 436.38'

N44°11'20"E 527.33'

LOT 2
(3.45 AC.)
BLOCK 1

20' GBRA SANITARY SEWER ESMT

VARIABLE WIDTH DRNG ESMT

N44°10'41"E 645.83'

S44°10'41"W 444.09'

SEE DETAIL "B" SHEET 3 OF 4

VARIABLE WIDTH DRNG ESMT

LOT 3
(13.52 AC.)
BLOCK 1

FRED HEIMER TRUSTEE
CALLED 114.114 AC.
DOC. NO. 201999000667
O.P.R.G.C.T.

N62°59'54"E 455.27'

S62°59'54"W 471.90'

S83°01'12"W 312.02'

SEE DETAIL "C" SHEET 3 OF 4

N83°01'22"E 444.41'

S83°01'22"W 431.51'

N46°03'27"W 759.92'

20' GBRA SANITARY SEWER ESMT

20' GVSUD WATER ESMT

VARIABLE WIDTH ACCESS & P.U.E.

S55°31'40"W 242.99'

VARIABLE WIDTH DRNG ESMT

FOUND FENCE CORNER

S31°50'38"W 510.40'

N31°50'38"E 514.27'

SEE DETAIL "F" SHEET 3 OF 4

LOT 1
(128.50 AC.)
BLOCK 1

S06°38'48"E 881.97'

N06°57'47"W 901.96'

NBISD LEGEND POND
LOT 1
VOL. 8, PG. 6
M.P.R.G.C.T.

N46°03'27"W 987.88'

1627.74'

S46°03'27"E 2541.32'

SEE DETAIL "D" SHEET 3 OF 4

LOCATION OF 100-YR FLOODPLAIN-ZONE A

VARIABLE WIDTH DRNG ESMT

LOCATION OF 100-YR FLOODPLAIN-ZONE A

MARY JO ZIPP
CALLED 90.012 AC.
VOL. 4255, PG. 680
O.P.R.G.C.T.

N51°10'02"W 1418.53'

1358.39'

NEW BRAUNFELS CITY LIMITS
NEW BRAUNFELS ETJ

S83°01'08"W 1032.66'

N83°01'08"E 1060.92'

N83°01'08"E 1454.87'

S83°01'08"W 1465.91'

20' GBRA SANITARY SEWER ESMT

SEE DETAIL "E" SHEET 3 OF 4

VARIABLE WIDTH DRNG ESMT

15' U.E.

N44°16'48"E 714.78'

N44°16'48"E 362.37'

15.07'

30.14'

30.00'

S44°16'48"W 2581.36'

NEW BRAUNFELS CITY LIMITS
NEW BRAUNFELS ETJ

FOUND 60D NAIL IN 8" POST

N: 13777495.07
E: 2246909.56

MARY JO ZIPP
CALLED 29.00 AC.
VOL. 4255, PG. 680
O.P.R.G.C.T.

30' R.O.W. FOR FUTURE ZIPP RD HEREBY DEDICATED 1.78 AC.

NANCY KAY GRIER
CALLED 54.75 AC.
VOL. 966, PG. 244
O.P.R.G.C.T.

PLAT PREPARED MAY 3, 2021

HMT ENGINEERING & SURVEYING
290 S. CASTELL AVE., STE. 100
NEW BRAUNFELS, TX 78130
TBPE FIRM F-10961
TBPLS FIRM 10153600

Drawing Name: T:\040- City of New Braunfels\040.031 - New Braunfels Sports Complex\Plat\NB Sports Complex Plat.dwg User: kellyk Apr 28, 2021 - 2:15pm

FINAL PLAT ESTABLISHING

NEW BRAUNFELS SPORTS COMPLEX

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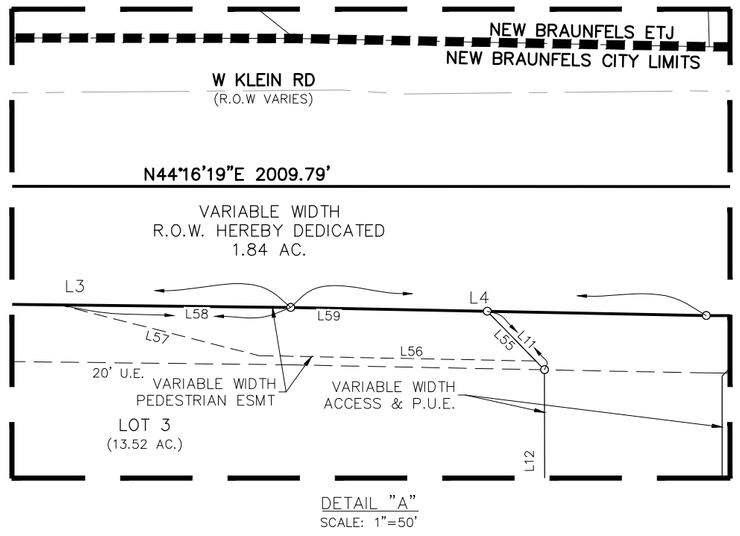
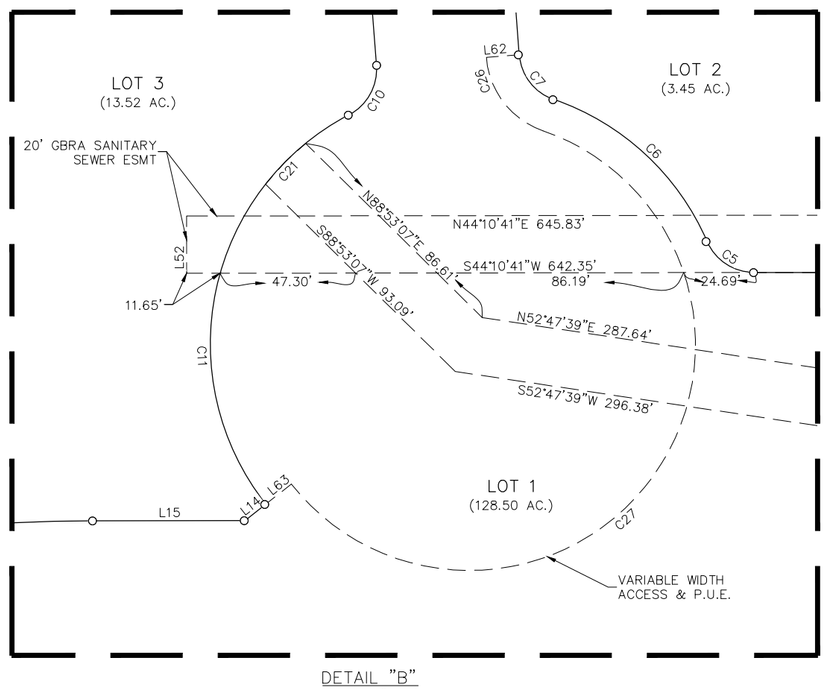
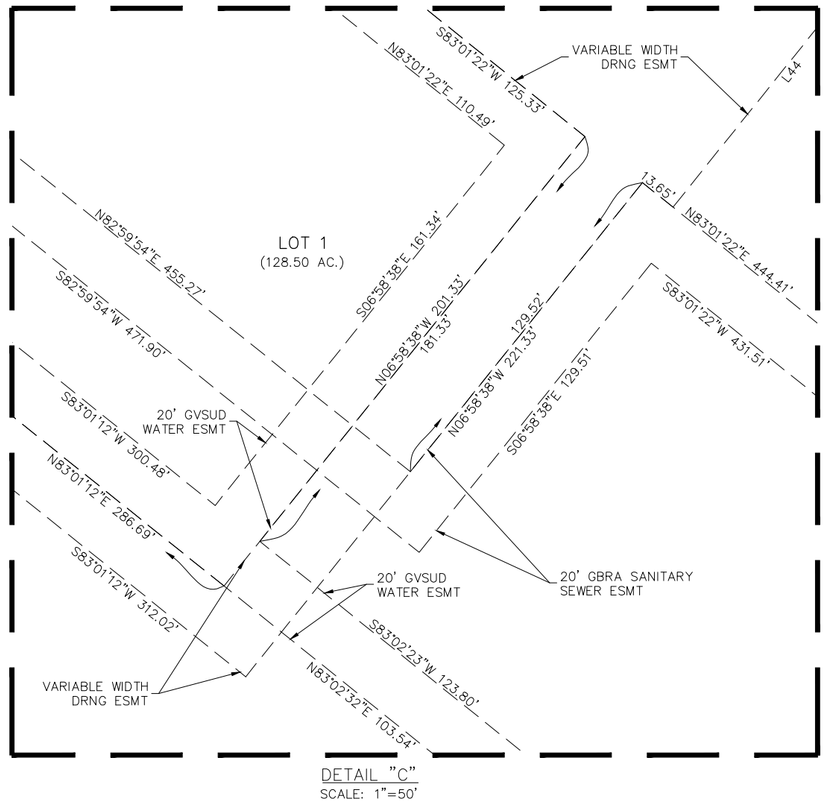


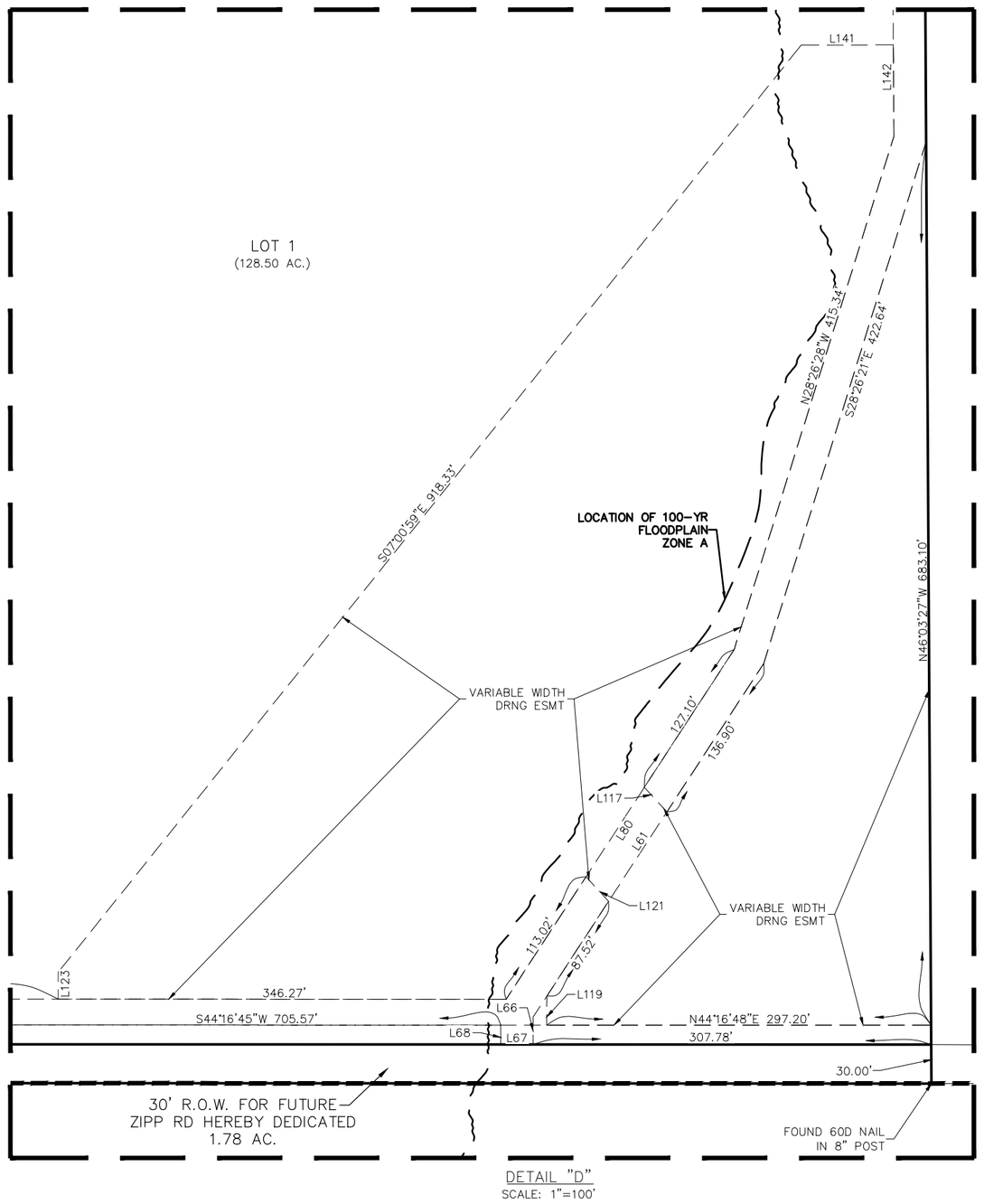
DETAIL "A"
SCALE: 1"=50'



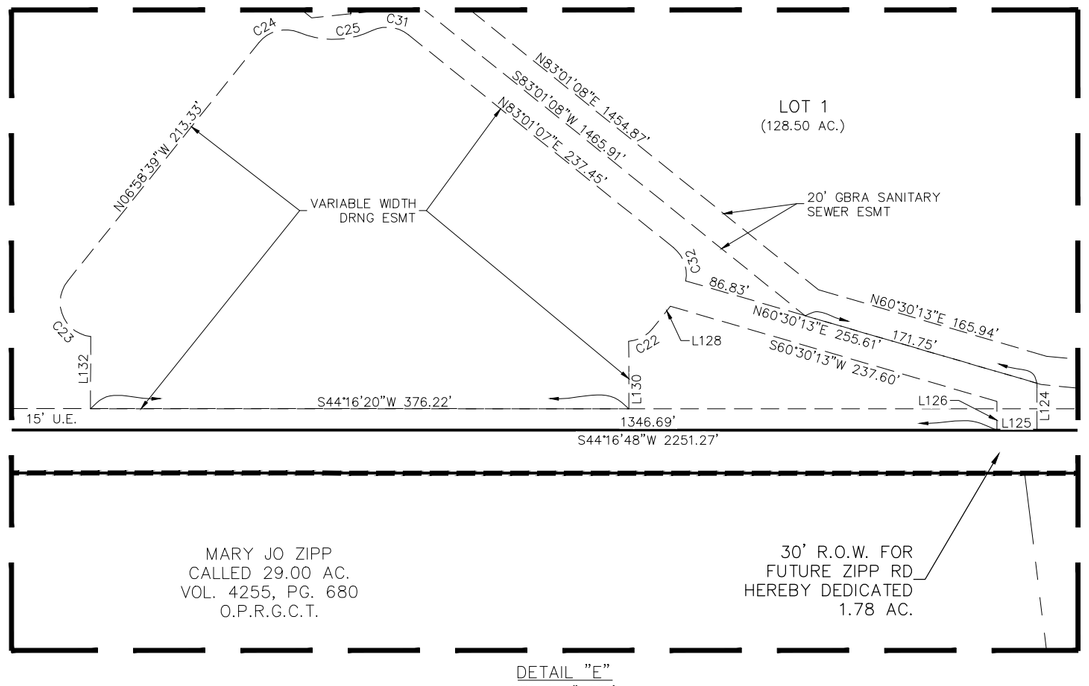
DETAIL "B"
SCALE: 1"=50'



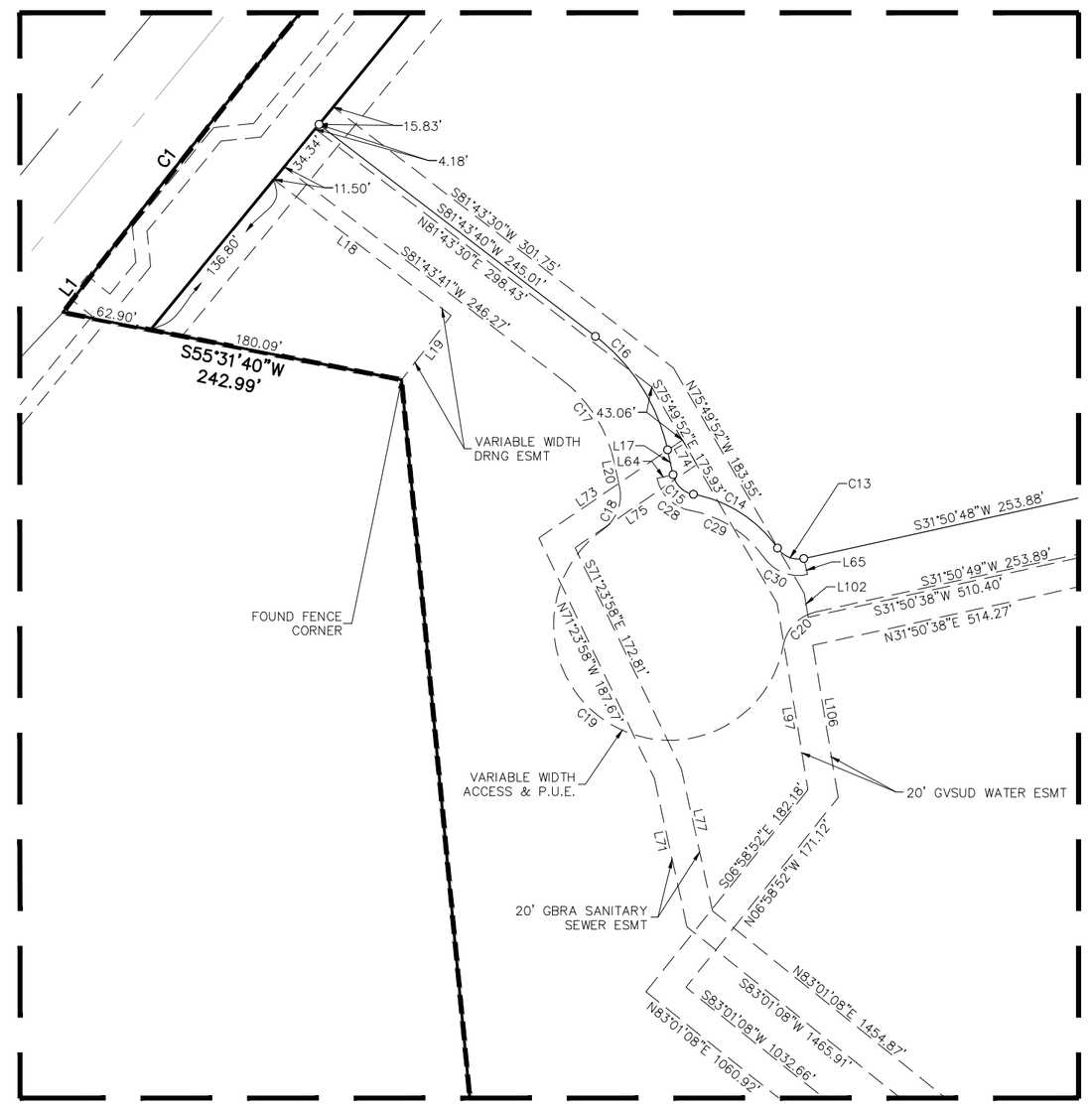
DETAIL "C"
SCALE: 1"=50'



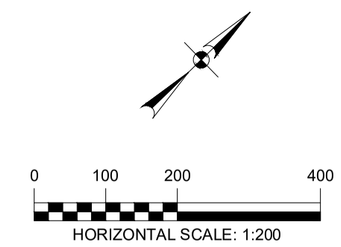
DETAIL "D"
SCALE: 1"=100'



DETAIL "E"
SCALE: 1"=100'



DETAIL "F"
SCALE: 1"=100'



LEGEND:

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- ○ = SET 1/2" IRON PIN W/ PLASTIC CAP STAMPED "HMT"
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- M.P.R.G.C.T. = MAP AND PLAT RECORDS, GUADALUPE COUNTY, TEXAS
- O.P.R.G.C.T. = OFFICIAL PUBLIC RECORDS, GUADALUPE COUNTY, TEXAS

PLAT PREPARED MAY 3, 2021

HMT ENGINEERING & SURVEYING
290 S. CASTELL AVE., STE. 100
NEW BRAUNFELS, TX 78130
TBPE FIRM F-10961
TBPLS FIRM 10153600

Drawing Name: T:\040- City of New Braunfels\040.031 - New Braunfels Sports Complex\Plat\NB Sports Complex Plat.dwg User: kellyk Apr 28, 2021 - 2:15pm

FINAL PLAT ESTABLISHING

NEW BRAUNFELS SPORTS COMPLEX

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CURVE TABLE						
CURVE	LENGTH	RADIUS	DELTA	TANGENT	CHORD LENGTH	CHORD BEARING
C1	174.71'	5694.74'	001°45'28"	87.36'	174.71'	N07°29'24"W
C2	10.00'	2905.10'	000°11'50"	5.00'	10.00'	N06°29'58"W
C3	107.17'	2965.10'	002°04'15"	53.59'	107.16'	N07°26'10"W
C4	134.68'	668.91'	011°32'09"	67.57'	134.45'	N61°56'12"E
C5	20.94'	18.00'	066°39'33"	11.84'	19.78'	S77°30'27"W
C6	75.11'	90.50'	047°33'00"	39.87'	72.97'	S87°03'44"W
C7	20.95'	18.00'	066°40'25"	11.84'	19.78'	N83°22'34"W
C8	6.94'	8.00'	049°41'38"	3.70'	6.72'	N25°11'33"W
C9	25.39'	32.00'	045°28'17"	13.41'	24.73'	N23°04'52"W
C10	20.93'	18.00'	066°38'04"	11.83'	19.77'	S16°43'20"E
C11	158.72'	90.50'	100°29'19"	108.79'	139.15'	S33°38'58"E
C12	1007.18'	564.00'	102°19'03"	700.44'	878.58'	S06°58'23"E
C13	21.11'	18.00'	067°12'36"	11.96'	19.92'	S65°27'06"W
C14	72.07'	93.00'	044°23'54"	37.95'	70.28'	S76°51'27"W
C15	21.11'	18.00'	067°12'35"	11.96'	19.92'	S88°15'48"W
C16	96.68'	138.00'	040°08'25"	50.42'	94.72'	N78°12'07"W
C17	69.70'	99.49'	040°08'25"	36.35'	68.28'	N78°12'07"W
C18	34.60'	29.50'	067°12'28"	19.60'	32.65'	N24°31'41"W
C19	319.21'	81.49'	224°26'15"	199.50'	150.88'	S76°51'27"W
C20	34.60'	29.50'	067°12'24"	19.60'	32.65'	S01°45'26"E

CURVE TABLE						
CURVE	LENGTH	RADIUS	DELTA	TANGENT	CHORD LENGTH	CHORD BEARING
C21	20.04'	90.50'	012°41'11"	10.06'	20.00'	S01°12'49"E
C22	19.42'	24.00'	046°21'23"	10.27'	18.89'	S16°11'37"W
C23	51.26'	24.00'	122°22'44"	43.63'	42.05'	N68°10'01"W
C24	30.95'	24.00'	073°53'30"	18.05'	28.85'	N29°58'06"E
C25	52.70'	62.49'	048°18'52"	28.03'	51.15'	N42°45'25"E
C26	34.32'	29.50'	066°40'21"	19.40'	32.42'	S83°22'32"E
C27	293.40'	78.99'	212°49'07"	268.22'	151.54'	N10°18'09"W
C28	34.60'	29.50'	067°12'35"	19.60'	32.65'	N88°15'48"E
C29	63.15'	81.50'	044°23'54"	33.26'	61.59'	S76°51'27"W
C30	34.60'	29.50'	067°12'36"	19.60'	32.65'	N65°27'06"E
C31	26.98'	24.00'	064°25'07"	15.12'	25.58'	N50°48'33"E
C32	26.00'	24.00'	062°04'38"	14.44'	24.75'	S65°56'34"E

LINE TABLE		
LINE #	LENGTH	DIRECTION
L1	37.44'	N08°12'15"W
L2	89.66'	N18°57'41"E
L3	132.98'	N44°55'28"E
L4	145.22'	N45°22'55"E
L5	130.51'	N44°18'10"E
L6	169.41'	N44°22'18"E
L7	39.44'	S45°56'26"E
L8	79.62'	N50°02'22"W
L9	73.09'	N45°49'01"W
L10	29.78'	N00°49'01"W
L11	28.57'	S89°46'57"W
L12	105.36'	S45°49'01"E
L13	82.48'	S50°02'22"E
L14	9.13'	S06°06'24"W
L15	53.04'	S44°11'09"W
L16	106.43'	S58°07'55"E
L17	17.94'	N58°07'55"W
L18	157.23'	S81°43'41"W
L19	57.07'	N08°17'18"W
L20	17.96'	N58°07'55"W

LINE TABLE		
LINE #	LENGTH	DIRECTION
L21	38.49'	S58°09'11"E
L23	287.64'	N52°47'39"E
L24	167.81'	N40°04'34"E
L25	21.41'	N49°54'18"W
L26	45.37'	N45°49'30"W
L27	20.00'	N44°10'41"E
L28	44.66'	S45°49'30"E
L29	22.92'	S49°54'18"E
L30	112.51'	N54°25'40"E
L31	159.98'	N80°28'19"E
L35	168.73'	N68°04'03"W
L36	209.97'	N45°34'03"W
L37	80.09'	N43°45'16"E
L38	83.61'	S85°57'26"E
L39	38.14'	N55°45'45"E
L40	52.32'	S46°03'27"E
L41	37.74'	S04°34'16"E
L42	97.79'	S46°06'13"E
L43	18.54'	S83°01'21"W
L44	147.85'	S06°58'38"E

LINE TABLE		
LINE #	LENGTH	DIRECTION
L47	154.91'	S80°28'19"W
L48	114.39'	S54°25'40"W
L49	178.78'	S40°04'35"W
L50	296.38'	S52°47'39"W
L52	20.00'	N45°49'30"W
L53	109.02'	N63°57'05"E
L55	24.29'	S89°46'57"W
L56	96.80'	N45°22'55"E
L57	71.91'	N58°31'31"E
L58	80.80'	S44°55'28"W
L59	68.68'	S45°22'55"W
L60	1122.56'	N06°24'03"W
L61	326.16'	S12°37'11"E
L62	11.50'	S39°57'38"W
L63	11.50'	S06°06'24"W
L64	11.50'	N31°52'05"E
L65	11.50'	N58°09'12"W
L66	21.30'	S45°43'26"E
L67	25.00'	S44°16'48"W
L68	15.01'	N45°43'26"W

LINE TABLE		
LINE #	LENGTH	DIRECTION
L69	169.10'	S50°03'52"W
L71	106.85'	N58°08'05"W
L73	122.32'	N09°56'08"E
L74	20.05'	S75°50'06"E
L75	103.66'	S09°56'06"W
L77	102.12'	S58°08'05"E
L79	166.27'	N50°03'52"E
L80	322.63'	N12°37'11"W
L81	65.80'	S43°56'46"W
L82	58.70'	N43°56'46"E
L84	102.18'	S63°57'05"W
L85	42.39'	S45°56'26"E
L86	250.53'	S34°41'26"E
L87	30.34'	S63°57'05"W
L88	233.72'	S45°34'03"E
L89	20.00'	S43°45'05"W
L90	229.98'	N45°34'03"W
L91	168.73'	N68°04'03"W
L95	41.27'	N38°08'59"E
L97	132.85'	S55°09'22"E

LINE TABLE		
LINE #	LENGTH	DIRECTION
L102	16.86'	N55°09'22"W
L103	178.96'	S15°47'31"W
L104	20.00'	N74°12'29"W
L105	181.78'	N15°47'31"E
L106	108.56'	N55°09'22"W
L108	24.70'	S38°08'59"W
L110	33.81'	N80°28'19"E
L111	21.50'	S06°58'48"E
L112	300.48'	S83°01'12"W
L115	177.86'	S68°04'03"E
L117	25.78'	N88°25'30"W
L119	22.41'	S45°40'27"E
L121	25.79'	S88°25'30"E
L123	20.89'	S45°43'26"E
L124	32.87'	S45°43'26"E
L125	27.93'	S44°16'47"W
L126	20.17'	N45°43'26"W
L128	19.97'	S06°59'04"E
L130	47.15'	S45°56'24"E
L132	50.37'	N45°34'19"W

LINE TABLE		
LINE #	LENGTH	DIRECTION
L141	71.19'	S44°09'26"W
L142	70.82'	N46°03'27"W

PLAT PREPARED MAY 3, 2021

HMT ENGINEERING & SURVEYING
290 S. CASTELL AVE., STE. 100
NEW BRAUNFELS, TX 78130
TBPE FIRM F-10961
TBPLS FIRM 10153600

Drawing Name: T:\040- City of New Braunfels\040.031 - New Braunfels Sports Complex\Plat\NB Sports Complex Plat.dwg User: kellyk Apr 28, 2021 - 2:16pm

City of New Braunfels

Planning Commission Agenda Item Report

550 Landa Street
New Braunfels, TX

6/1/2021

Agenda Item No. A)

SUBJECT:
Presentation of the Mayfair Development, Design and Control Document (DDCD).

DEPARTMENT: Economic and Community Development

Applicant: Thad Rutherford, SouthStar Communities
Presenter**:** Jeff Jewell, Director

COUNCIL DISTRICTS IMPACTED: This property is located adjacent to District 4, outside the city limits in the ETJ.

BACKGROUND INFORMATION:
In 2019, the Texas General Land Office (GLO) solicited proposals for the sale and development of approximately 2,400 acres owned by the state agency. This property is located just north of the city limits of New Braunfels along both the east and west sides of IH 35, within the city's extra territorial jurisdiction (ETJ). In 2020, Southstar Communities, a New Braunfels based developer, began discussions with the City. They sought to negotiate an agreement outlining roles and responsibilities of both the City and the development project. This agreement defines what regulations will govern the development, and how the City will review the project and grant approvals to new developments within the property boundaries. This development agreement covers just under 1,900 acres of the original 2,400, and proposes a mix of residential, commercial and public uses.

Given that the project is within the ETJ, the City's ability to regulate development is limited. Development located within the City's ETJ would not typically have zoning, landscaping requirements, building permit reviews or building safety inspections, and only development regulations associated with platting property would apply. While there are some requirements for projects to meet county fire code, residential projects are not required to obtain building permits to certify adequate construction, provide drainage mitigation, park land, or a host of other reviews developments in the city currently receive. However, the creation of a special district authorized by the City Council provides for an opportunity to exercise governance and impose regulatory requirements on the project not allowed otherwise.

SouthStar Communities proposes to create a Water Improvement District (WID). The enabling legislation requires the WID to enter a development agreement with New Braunfels prior to its creation. The legislation provides the WID with the authority to impose an assessment to pay for drainage, roads, water and sewer utilities, parks and other items appropriate by law. The assessment's purpose is to provide a reimbursement process to developers for the construction of a variety of public facilities. The Development Agreement authorizes the City to exercise some level of governance over the project on a long-term basis. As a regulatory and legal document, the Development Agreement provides for specific project requirements and processes, to include:

- document definitions;
- entitlement and permitting processes;
- land uses residential unit limits (6,000);
- conditions for when the project must be reviewed by City Council or Planning Commission;
- traffic and roadway impacts and reviews;
- park commitments and delivery schedules;
- bond issuance limits and procedures;
- annexation;
- deed restrictions; and
- utility commitments.

The proposed developed will include the following:

- NBU utility service
- 300 acres of public parkland and open space
- Over 13 miles of trails
- Sites for up to four new Comal ISD schools
- 160-acre Employment Center along IH 35
- Up to 6,000 residential units
- Diversity score to encourage a variety of housing types
- Connectivity score
- 17 miles of shared paths and 3 miles of separate bike lanes
- East-west IH 35 Underpass
- Improved and New roadways
- Vegetative stream buffers

ISSUE:

During the time of negotiation of the development agreement and the DDCD, staff and the city's consultants

worked with elected officials to identify high level goals for the project. Similar to the Veramendi agreement, the overriding guidance was to identify and create development standards that either met or exceeded those required for development within the city of New Braunfels. A specific guiding principal was that the DDCD include standards that implement Envision New Braunfels, the community's Comprehensive Plan. Staff believes most of the issues have been satisfactorily achieved, although at the time of printing there were several unresolved issues.

FISCAL IMPACT:
A 2021 economic impact assessment for the project estimates that near buildout in year 15, the project will have approximately $1.8B in new value and have approximately 1,500 jobs. A Strategic Partnership Agreement is an exhibit to the proposed Development Agreement and the project intends to share half of sales tax revenue of approximately $2M annually. The project is responsible for its infrastructure impacts.

RESOURCE LINKS:
<http://www.nbtexas.org/3166/Project-Mayfair>

City of New Braunfels

Planning Commission Agenda Item Report

550 Landa Street
New Braunfels, TX

6/1/2021

Agenda Item No. B)

Presenter/Contact
Presenter: Melissa Reynolds, First Assistant City Engineer
(830) 221-4020 - mreynolds@nbtexas.org

SUBJECT:
Public hearing and recommendation to City Council regarding proposed City of New Braunfels drainage policy changes.

BACKGROUND / RATIONALE:
City staff is proposing amendments to the Drainage and Erosion Control Design Manual and the Code of Ordinances, Chapter 58 - Floods. The proposed amendments are based on recommendations from the Drainage Area Master Plan (DAMP) development and the Community Rating System (CRS) Improvement Report. These items were previously presented in fall of 2020 and have been posted on the Engineering webpage for comment since late 2020. Staff has received minor comments and questions primarily regarding one element, to which more detail is presented below.

The DAMP, initiated in 2019, is currently finalizing Phase 1 which includes updates to regulations to align with State standards. These updates are important for Phase 2 - remapping of floodplains based on new hydrology. Phase 1 also provided recommendations for improvements to the floodplain ordinance to improve CRS rating enhancements. This DAMP is intended to function as a comprehensive and holistic watershed program that is sustainable.

The CRS is the National Flood Insurance Program's (NFIP) voluntary incentive program that recognizes and encourages community floodplain management activities that exceed the minimum NFIP requirements. The CRS Improvement Report was intended to investigate the City's potential to achieve improved CRS rating, creating better benefits for residents.

Drainage and Erosion Control Design Manual
The following amendments are proposed to the Drainage and Erosion Control Design Manual:

Chapter 2 - Drainage Policy and Criteria are proposed and include a new section, Floodplain Development Requirements. This section will include floodplain development requirements, establishing floodplain regulation to the 1% annual chance ultimate development (AC UD) flood, establishing requirements for compensatory excavation in the floodplain to offset lost floodplain volume in the 1% AC UD.

Section 2.9 is proposed to be revised to incorporate stream buffers (previously termed erosion hazard setbacks) regulated by contributing drainage areas. Feedback received to date has produced the need for more staff efforts to create a GIS map supporting this implementation and clarifying intent. Due to the additional efforts, we are proposing delaying this element to a later date at which time we will take this item, stand-alone, through the approval process.

Chapter 3 - Design Rainfall was revised ahead of the full policy changes and updates the City's Design Rainfall to align with the new NOAA Atlas 14, Volume 11 Texas. Note that this change went into effect January 2021 and is simply included to illustrate the holistic changes.

Chapter 4 - Determination of Design Discharge are proposed in order to update references to design rainfall criteria. Additionally, proposed changes include adding mitigation for the 50-year design storm to the already required 2, 10, 25, and 100-year storms.

Chapter 7 - Storm Drain Systems include updates proposed to incorporate changes based on stakeholder input clarifying hydraulic grade line (HGL) criteria and cover over pipe requirements.

Chapter 10 - Detention and Retention Facilities include updates for clarification for maximum water depths and incorporating the 50-year storm frequency to the design criteria for mitigation ponds.

Other updates include updates to Appendixes for Definitions of Terms, incorporating new terminology and removing the Stream Bank Erosion Hazard Setback Exhibit.

Code of Ordinances, Chapter 58 - Floods
The following amendments are proposed to the City of New Braunfels Code of Ordinances, Chapter 58, Floods:

Sec. 58-27 - Definitions is proposed to be revised to include new terms and clarification for existing terms.

Sec. 58-28.2 - General Provisions for establishment of the one percent annual chance ultimate development with Atlas 14 as the regulatory floodplain, which is critical to ensure accurate analysis prior to actual map revisions are adopted.

Sec. 58-29 - Administration include designating the floodplain administrator as the City Engineer, updates to reference the current Fee Schedule, and updating the variance procedures to remove the Construction Board of Appeals and insert City Council.

Sec. 58-30 - Provisions for flood hazard reduction is proposed to be amended to include a language not permitting recreational vehicles in the floodway. Further updates include a new section, 58-30.5 Floodplain to include the detailed requirements for development in the floodplain and reference to new hydrology requirements. Additionally, clarifications and reference updates were provided for Sec. 58-30.7 - "No-rise/no-impact certification" in order to clarify the modelling needs for review analysis.

Review Process
This item was initially presented to the Watershed Advisory Committee, Planning Commission, and City Council for information and initial feedback in fall of 2020. The changes have been posted online for stakeholder and public input since December 2020. Engineering hosted 2 virtual stakeholder presentations on April 1, 2021 along with an engineering workshop on April 8, 2021.

The feedback received and proposed text was discussed at a follow-up meeting for the Watershed Advisory Committee on April 22, 2021 receiving approval.

ADDRESSES A NEED/ISSUE IN A CITY PLAN OR COUNCIL PRIORITY:
Envision New Braunfels:

ACTION 4.28 [PROGRAM] Acquire and set aside as much land as possible along the Comal and Guadalupe Rivers and their tributaries within the floodplain for greenspace and/or additional river access.
ACTION 5.2 [POLICY] Discourage development in Edwards Aquifer Recharge and contributing zones, stream zones, flood-prone areas, steep slopes, or other ecologically constrained areas. Where development in these areas must occur, require that it be environmentally sound using tools such as but not limited to low impact development (LID).
ACTION 5.6 [POLICY] Implement measures to achieve and maintain a high National Flood Insurance Program CRS rating to ensure the safety of all residents and to reduce property owner flood insurance rates.
ACTION 5.15 [POLICY] Ensure that developers adequately address drainage in their projects and developments.

Municipal Separate Storm Sewer System (MS4) Stormwater Management Program: Minimum Control Measure 4: Post-Construction stormwater management in new development and re-development. Encouraging low impact development designs and establishing riparian zones and vegetative areas.

Stormwater Management Strategy Report (2013):
Open Space Conservation - Set aside lands and preserve open space that have high infiltration rates which would contribute to reduced peak flow levels and increased infiltration.
Floodway Hazard Mitigation - to Further limit or restrict new construction in the 100-year floodplain and floodway beyond existing ordinance.
Stream Bank Setback - Establish setbacks from streams for new development.

FISCAL IMPACT:
N/A

COMMITTEE RECOMMENDATION:
This item will be presented for discussion and recommendation to City Council at the next Planning Commission meeting.

STAFF RECOMMENDATION:
Staff recommends approval of these updates to the Drainage and Erosion Control Design Manual and the proposed amendments to the Code of Ordinances Chapter 58 - Floods.

City of New Braunfels
Drainage and Erosion Control Design Manual

2016

Manual Updates:

2017-1, 2018-1, 2021-1

Notice of Manual Updates 2017-1

Manual: City of New Braunfels Drainage and Erosion Control Design Manual (2016)

From: Engineering Division | Public Works Department

City Council Approval: August 28, 2017

Effective Date: September 1, 2017

Purpose: To provide clarification and implement best practices.

Content: The following updates were made to the City of New Braunfels Drainage and Erosion Control Design Manual (2016):

Chapter 2 – Drainage Policy and Criteria

- Section 2.1.4 – Specify requirements for Preliminary Drainage Report.
- Section 2.1.5 – Specify requirements for Master Drainage Plan Report.
- Section 2.5 – Specify that the elevation of the lowest floor shall be elevated to 10 inches above finished grade of the surrounding ground (in previous DCM).
- Section 2.5 – Specify that the elevation of the lowest floor shall be elevated to 12 inches above adjacent stormwater conveyance structures (clarification).
- Section 2.5 – Require and specify grading plan required at plat and building permit.
- Section 2.5 – Specify that residential lots shall be graded to avoid water flowing over curb and driveway, and out of right-of-way.
- Section 2.7 – Specify that if development activity changes runoff characteristics that creates point discharge or any increase in discharge rates or velocities, the flow shall outfall into right-of-way or drainage easement that has capacity and an impact analysis is required to verify capacity and no adverse impact.
- Section 2.7 – Specify engineered retaining walls greater than three feet shall be designed to prevent freefall of stormwater.
- Section 2.11 – Specify pumped drainage facilities design, maintenance and operations requirements.
- Section 2.11 – Require feasibility analysis of pumped detention prior to permit application.

Supersedes: The revised manual supersedes prior versions of the City of New Braunfels Drainage and Erosion Control Design Manual (2016)

Notice of Manual Updates 2018-1

Manual: City of New Braunfels Drainage and Erosion Control Design Manual (2016)

From: Engineering Division | Public Works Department

City Council Approval: January 22, 2018

Effective Date: February 5, 2018

Purpose: To provide amend and clarify channel and maintenance access requirements.

Content: The following updates were made to the City of New Braunfels Drainage and Erosion Control Design Manual (2016):

Chapter 2 – Drainage Policy and Criteria

- Section 2.3 – Clarify and revise channel definition, design frequency and freeboard.
- Section 2.10.2 – Clarify easement and maintenance access criteria.

Chapter 8 – Open Channels

- Section 8.1 – Clarify easement and maintenance access criteria and specify pilot channel and channel fencing requirements.

Appendix B – Definition of Terms

- Redefine channel and define ditch and swale.

Supersedes: The revised manual supersedes prior versions of the City of New Braunfels Drainage and Erosion Control Design Manual (2016)

Notice of Manual Updates 2021-1

Manual: City of New Braunfels Drainage and Erosion Control Design Manual (2016)

From: Engineering Division | Public Works Department

City Council Approval: July XX, 2021

Effective Date: Month 1, 2021

Purpose: To provide hydrology updates aligning with new statewide NOAA Atlas 14 adoption. To implement floodplain criteria improvements providing better designs in flood prone areas allowing for higher standards of protection for the citizens of New Braunfels.

Content: The following updates were made to the City of New Braunfels Drainage and Erosion Control Design Manual (2016):

Chapter 2 – Drainage Policy and Criteria
- Section 2.3 – Specify Floodplain Development Requirements.
- Section 2.3.1 – Establish floodplain regulation to the 1% annual chance ultimate development flood
- Section 2.3.2 – Establish requirements for compensatory excavation in the floodplain.

Chapter 3 – Design Rainfall
- Section 3.1 – Update hydrology data to align with NOAA Atlas 14 point precipitation frequencies.

Chapter 4 – Determination of Design Discharge
- Section 4.1 – Update various references for NOAA Atlas 14 point precipitation frequencies.
- Section 4.3 – Update various references for NOAA Atlas 14 point precipitation frequencies.

Chapter 7 – Storm Drain Systems
- Section 7.1 – Updated hydraulic grade line (HGL) criteria and pipe cover requirements

Chapter 10 – Detention and Retention Facilities
- Section 10.1 – Clarification to the maximum water depths criteria.
- Section 10.2 – Update design mitigation to include the 2, 10, 25, 50, and 100-year
- Section 10.3 – Update the outlet structure design requirements to reference 2, 10, 25, 50, and 100-year

Appendix B – Definition of Terms
- Add new definitions

Appendix C – Stream Bank Erosion Hazard Setbacks Exhibit
- Removed.

Supersedes: The revised manual supersedes prior versions of the City of New Braunfels Drainage and Erosion Control Design Manual (2016)

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Appendix A: References
Appendix B: Definition of Terms

1 Introduction

1.1 Purpose and Scope

The purpose of the Drainage and Erosion Control Design Manual is to establish standard principles and practices for the design and construction of storm drainage, flood protection, erosion control, and water quality facilities within the City of New Braunfels, Texas and its extraterritorial jurisdiction (ETJ).

The design factors, formulas, graphs, and procedures described in this manual are intended to serve as guidelines for the design of drainage improvements and projects involving the volume, rate of flow, method of collection, storage, conveyance, treatment, and disposal of stormwater and erosion protection from stormwater flows. Responsibility for actual design remains with the design engineer. Any variations from the methodology or requirements in this manual must have expressed written approval of the City Engineer and Engineering Division, as permitted by Ordinance.

This manual and the City of New Braunfels Code of Ordinances contain requirements for the design of storm drainage, flood protection, water quality, and erosion control facilities. Where there is any conflict between this manual and the current code, the code shall take precedence. The design engineer is responsible for complying with the latest version of this manual and code adopted by the City.

Should conflicts occur between policy and criteria in this manual versus other regulatory authorities with jurisdiction in the same area, such as Texas Commission on Environmental Quality (TCEQ) or Texas Department of Transportation (TxDOT), then the more stringent requirement will apply and the designer will need to show how both requirements have been met.

1.2 Applicability

Criteria in this manual shall apply to all drainage improvements and projects that may have an impact on drainage, both publicly and privately funded, within the City of New Braunfels, Texas and within its ETJ. Criteria in this manual shall apply to any capital improvement or development project, plat, master plan, or building permit except as otherwise noted in the manual.

1.3 Computer Programs

The use of computer programs for calculating and modeling storm data and drainage facilities is accepted as standard practice. There are a variety of computer programs available and the design engineer maintains responsibility of selecting the appropriate approach and/or computer program unless otherwise specified in this manual. Computer programs are not a replacement for sound engineering judgment and the user must understand how the program performs the calculations and what assumptions are made.

1.4 References and Definition of Terms

At certain points in the text, the reader will encounter numbers enclosed in brackets, for example [1]. These numbers correspond to the references listed in **Appendix A**. Figures and tables reproduced from

other sources have the source listed beneath each figure or table. Common terms used in this manual are provided in **Appendix B**.

1.5 Acknowledgements

This manual is the result of the dedication and energy of the Drainage Advisory Committee members for the 2000 edition. For the 2015 update, acknowledgements go to City staff, Watershed Advisory Committee, Design Workshop, Lockwood Andrews & Newnam, Inc., and input from a wide variety of stakeholders.

Updates incorporated in 2021, acknowledgements go to City Staff, Pape Dawson Engineers, and the Watershed Advisory Committee.

2 Drainage Policy and Criteria

2.1 Drainage and Water Quality Design Requirements

All drainage improvements and projects shall be designed and constructed in accordance with the current regulations, standards and specifications adopted by the City of New Braunfels. Any capital improvement or development project within the City of New Braunfels jurisdiction is required to comply with the requirements outlined in this manual. When necessary, properly sized easements shall be granted across all contiguous property owned by the property owner.

A drainage report is required to be submitted by the property owner or its agent according to the requirements of this manual. The Engineering Division prior to issuance of a permit must approve the report. The type of development and report shall be based on the location and additional impervious cover of the development as shown in Table 2-1.

Table 2-1: Development Categories

Category	Criteria
Type 1 Development	Less than one acre of land; and < 1,000 SF additional impervious cover
Type 2 Development	Less than one acre of land; and 1,000 – 4,999 SF additional impervious cover; or Agricultural development (not including feedlots)
Type 3 Development	≥ 5,000 SF additional impervious cover; or Development within FEMA designated Special Flood Hazard Area

If any onsite and offsite stormwater structure related to the development is known to be at or above design capacity, the development will be considered a Type 3 Development.

Drainage report requirements are outlined below. An electronic media copy of the report is required in addition to a paper copy at time of city acceptance of infrastructure improvements.

2.1.1 Type 1 Drainage Report

A Type 1 Development is any development or redevelopment that disturbs less than one acre of land and creates less than 1,000 square foot of additional impervious cover. The Type 1 Drainage Report shall be prepared by the property owner or its agent, and consist of the following:

A. Applicant contact information (e.g. name, address, phone number, and email address)
B. Site location map
C. Detailed site drawing or sketch showing any existing features or infrastructure and proposed disturbance
D. Temporary erosion control plan

2.1.2 Type 2 Drainage Report

A Type 2 Development is any development or redevelopment that disturbs less than one acre of land, and creates more than 1,000 but less than 5,000 square foot of additional impervious cover. Type 2 Developments also include any agricultural development not including feedlots. The Type 2 Drainage Report shall be prepared by the property owner or its agent, and consist of the following:

A. Applicant contact information (e.g. name, address, phone number, and email address)
B. Site location map
C. Detailed site drawing or sketch of the affected area scaled to 1" = 50' (or less) on minimum 11" x 17" paper showing the following:
    1. Existing drainage ways and easements
    2. Runoff flow directions
    3. Floodplain boundaries
    4. Proposed grading and development
    5. Proposed drainage and erosion control facilities
    6. A copy of the survey plat showing the lot layout, streets, and utility and drainage easements
D. Temporary erosion control plan
E. If any on-site and off-site stormwater structure related to this development is known to be at or above design capacity, the development will be considered a Type 3 Development

2.1.3 Type 3 Drainage and Water Quality Report

A Type 3 Development is any development or redevelopment greater than or equal to 5,000 square feet of additional impervious cover, not Type 1 or Type 2, or any development within a Federal Emergency Management Agency (FEMA) designated Special Flood Hazard Area. A Type 3 Drainage and Water Quality Report shall be prepared by a professional engineer licensed in the State of Texas, experienced in civil engineering, and having a thorough knowledge of the hydraulic analysis and design. The report shall be signed and sealed, per Texas Board of Professional Engineers, by the person responsible for the report. The Type 3 Drainage and Water Quality Report shall consist of the following:

A. Applicant contact information (e.g. name, address, phone number, and email address)
B. Site location map
C. A copy of the final plat showing the lot layout, streets, and utility and drainage easements
D. Construction drawings adhering to all applicable codes and regulations including details and specifications
E. Drainage and Water Quality Report as outlined in **Section 2.2** – Type 3 Drainage and Water Quality Report Criteria
F. Temporary and permanent erosion control plan as outlined in **Section 12** – Site Erosion Control
G. Approval letters from other agencies with jurisdiction or permit requirements for the site location

2.1.4 Preliminary Drainage Report

A Preliminary Drainage Report of the storm drainage system is required with a preliminary plat. The report shall include the following:

A. Preliminary Drainage Site Plan including: plat boundary; existing and proposed drainage infrastructure, right-of-way and easements in and adjacent to the plat; proposed stormwater connections and point(s) of development discharge; and proposed changes to floodplain and floodway boundaries. Drainage infrastructure includes inlets, channels, storm sewer, detention, retention and water quality facilities.
B. Conformance with the Master Drainage Plan Report (if applicable) specified in **Section 2.1.5**. The report may require updating for development plat submittals and changes in the drainage design.

2.1.5 Master Drainage Plan Report

A Master Drainage Plan Report shall be provided with a subdivision master plan and planned development. The report shall include the following:

A. Existing Drainage Site Plan including: development boundary; existing and proposed drainage infrastructure, right-of-way and easements in and adjacent to the development; and floodplain and floodway boundaries. Drainage infrastructure includes inlets, channels, storm sewer, detention, retention and water quality facilities.
B. Existing Watershed Map including: development boundary; existing drainage area and all sub areas; 2-foot contours; and existing runoff flow directions.
C. Preliminary Drainage Site Plan including: development boundary; proposed drainage infrastructure, right-of-way and easements in and adjacent to the development; proposed stormwater connections and point(s) of development discharge; and proposed changes to floodplain and floodway boundaries.
D. Master Drainage Plan Summary including how drainage and water quality resulting from the proposed development will be managed and how proposed drainage infrastructure will impact adjacent property owners.

2.2 Type 3 Drainage and Water Quality Report Criteria

The planning and design of drainage systems should ensure that problems are not transferred from one location to another. Grading and other construction activities may not change the terrain in such a way to cause damage to public or private property from drainage or flood problems, increased runoff, or increased erosion or sediment movement.

Existing drainage between developed lots will remain the responsibility of the affected property owners. Commercial developments are required to drain surface runoff from an individual lot to a public right-of-way or to a drainage system contained in an easement. Residential lot-to-lot drainage of sheet flows should be avoided, and residential developments are encouraged to direct surface runoff to a public right-of-way or to a drainage system contained in an easement.

The Engineering Division shall not approve any drainage report pertaining to proposed construction, platting or other development where the proposed activity or change in the land would result in post-development discharge from the site exceeding discharge under pre-developed conditions (for new development) or existing conditions (for re-development). Downstream capacity shall not be exceeded as a result of development. Exemptions from this provision are as follows:

A. Additional drainage improvements are not required if drainage improvements have been provided for the fully developed condition, which includes the proposed development.
B. Prior written approval of a Stormwater Connection Fee from the City Engineer.

No proposed development shall be constructed which impedes or constricts runoff from an upstream watershed based on fully developed conditions. Therefore drainage computations shall be provided to verify no adverse impact upstream or downstream.

2.3 Floodplain Development Requirements

The purpose of floodplain management is to focus on safety of the citizens, minimize flood loses, avoid flooding of buildings, preserve floodplain areas and ultimately improve quality of life for the residents of City of New Braunfels. With this being the primary focus, the City has adopted higher standards than currently illustrated in FEMA's general guidance (FEMA Policy Standards for Flood Risk Analysis and Mapping).

1% Annual Chance (AC) floodplain, also known as the 100-year floodplain is the area subject to 1% or greater chance of flooding in any given year, as described in FEMA guidelines. These zones are typically represented as Zone A, AE, AH or AO on FEMA Flood Insurance Rate Maps (FIRM Panels) and are classified as High-Risk flood zones. Based on FEMA guidelines, the Shaded-X area can be delineated either using the 0.2% AC storm or 1% AC storm based on Ultimate Development (UD) Conditions, also known as Future Conditions (FC). The City permits floodplain reclamation if supported by a signed and sealed study which demonstrates no adverse impacts to any property and demonstrates a no-rise in the 1% AC UD water surface elevation outside of the requestor's property limits.

2.3.1 Regulating to the 1% Annual Chance Ultimate Development Flood

The City of New Braunfels has adopted the 1% AC UD floodplain mapped using Atlas 14 rainfall data published in this document, as the regulatory floodplain. Such floodplain is delineated based on flows developed by assuming the entire watershed is fully developed. The City's GIS portal provides information regarding future zoning projections, which can be used to estimate fully developed conditions. The City requires all new and re-studied FEMA floodplains to delineate the 1% AC UD floodplain to be depicted and platted or otherwise secured as a drainage easement.

Once the Flood Insurance Rate Maps (FIRM) for City of New Braunfels are updated with the revised rainfall data, the 1% AC UD floodplains will be designated as Shaded-X areas for all FEMA floodplain establishments or revisions. Until the FEMA FIRM are updated with the revised rainfall data, the City's regulatory criteria will require all storm water management facilities or a combination of facilities, stream crossings, new-development or re-development in the floodplain to be designed for Ultimate Development Conditions. The City requires demonstration of the elevation of fill placed in the 1% AC UD

floodplain for construction of habitable structures to be greater than the 1% AC UD water surface elevation. This includes but is not restricted to back of lot elevations, finished floor elevations, drainage facilities, etc.

The City requires all drainage easements and crossings in the floodplains to be based on the 1% AC UD conditions. For drainage areas greater than 150 acres, which propose or require grading adjacent to the stream, for unmapped streams and within the floodplain for mapped streams; the City requires a rainfall-runoff model (such as HEC-HMS or similar) to support engineering calculations used to develop the 1% AC flows.

The City will issue a floodplain development permit upon receiving and reviewing a signed report from an engineer, licensed to practice in the State of Texas. The report shall consist of all supporting information, data and calculations and may be accompanied with exhibits to support their 1% AC UD flows and floodplain delineation.

The City allows floodplain reclamation if accompanied with a signed and sealed study which demonstrates no adverse impacts to any property outside of the requester and demonstrates a no adverse impact to the 1% AC UD water surface elevation outside of the requestor's property limits.

For streams which have a drainage area greater than 150 acres and currently not-mapped by FEMA, the City requires the requestor to submit a flood study report which is signed and sealed by a Professional Engineer registered in the State of Texas, which establishes a 1% AC UD floodplain along, within or adjacent to the project site and plat the floodplain delineation as a drainage easement.

2.3.2 Compensatory – Excavation

The City's goal is conservation of floodplain areas, avoid potential impacts on structures adjacent to the currently mapped floodplains and ensure no net-loss of floodplain volume to preserve the area of conveyance. As such, the City will require Compensatory-Cut, also known as Compensatory-Excavation to offset/mitigate lost floodplain volume due to fill placed in the 1% Annual Chance (AC) Ultimate Development (UD) floodplain. The City permits excavation in the floodplain to mitigate the increases to 1% AC UD water surface elevations, in additional to excavation compensation along the same flooding source and must be within the general vicinity of the fill being placed. All submittals must include a signed drawing by a licensed Professional Engineer clearly marking the areas of Cut and Fill in the floodplain and should also include a table showing both volumes, indicating total Cut volume higher than total Fill volume placed in the 1% AC UD floodplain established for the site.

If excavation is performed in the floodplain, the City requires a signed and sealed report/memo from a Professional Engineer registered to practice in the State of Texas to demonstrate excavation is performed outside of the Waters of the United States (WOUS) also known as Jurisdictional Waters, including an exhibit clearly showing the Jurisdictional Delineation. If WOUS are impacted by the project, the City will require evidence of coordination and approval from the US Army Corps of Engineers.

2.4 Freeboard

Freeboard is the vertical distance between the design water surface and the elevation of the drainage facility, such as the top of channel or detention pond. Freeboard is intended to provide a factor of safety and prevent the fluctuation of the water surface from overflowing the drainage facility. Freeboard requirements are shown in Table 2-2. Freeboard is not required where parking areas are designed to serve as detention facilities; however, site design should consider safety and drainage overflow location.

Table 2-2: Freeboard Requirements

Drainage Facility	Design Frequency	Minimum Freeboard
Street right-of-way	100-year	None
Creek improvements	100-year	1.0 ft
Channels with drainage area > 128 acres	100-year	1.0 ft
Channels with drainage area ≤ 128 acres		
• 100-year design depth < 5 ft	100-year	25-year + 0.5 ft
• 100-year design depth 5-10 ft	100-year	25-year + 10% design depth
• 100-year design depth > 10 ft	100-year	25-year + 1.0 ft
Detention ponds and reservoirs	100-year	1.0 ft
Bridges and culverts	25-year	See note *2*
Floodways and floodplains	100-year	2.0 ft (See note *3*)

[1] Channels with drainage area ≤ 128 acres shall be designed to contain the 100-year storm event or 25-year storm event plus freeboard, whichever is greater.

[2] Bridges and culverts shall be designed to withstand the 100-year event, but the water level may reach roadway level at the 25-year design level if no public safety issues are involved.

[3] Floodways and floodplains shall have a minimum of 2-feet freeboard or the minimum freeboard established in the most recently adopted Floodplain Ordinance.

2.5 Drainage Easements and Rights-of-way

All private drainage and water quality facilities must have an associated drainage easement, restrictive covenant, or similar recorded instrument that clearly identifies ownership and the party responsible for maintenance. Drainage easements and rights-of-way shall be dedicated to the City as required in the Code of Ordinances.

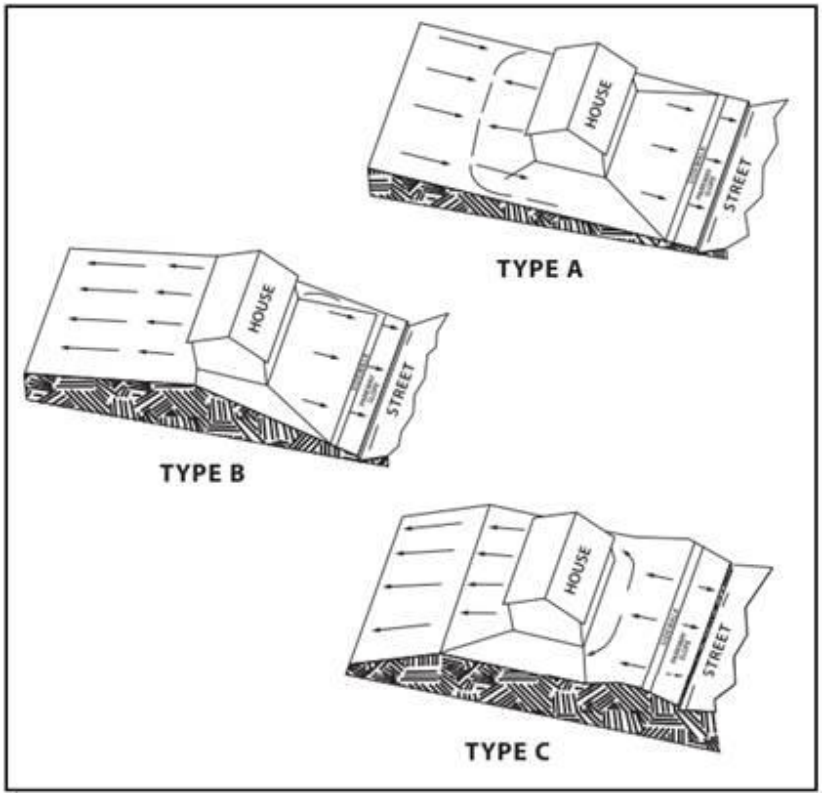
2.6 Finished Floor Elevations

The elevation of the lowest floor shall be elevated 10 inches above the finished grade of the surrounding ground as prescribed in the building regulations and Code of Ordinances. Finished grades shall be sloped to direct stormwater away from the structure. Developments adjacent to stormwater conveyance structures must be elevated 12 inches above the 100-year water flow elevation (in the conveyance structure) to the same elevation that a development adjacent to a 100-year floodplain would be required to meet. Driveways serving houses on the downhill side of the street shall have properly sized swales before entering the garage.

A grading plan shall be prepared and submitted to the City at final plat and building permit, which indicates typical lot grading for all lots in the subdivision using typical Federal Housing Administration

(FHA) lot grading types (A, B and C). See Figure 2-1. No more than two (2) residential lots may drain onto another lot unless a drainage easement is dedicated and free of obstructions to contain the runoff. An alternate grading plan may be submitted for large lot or commercial subdivisions.

Figure 2-1: Typical Federal Housing Administration Lot Grading



Where residential lots are located on the downhill side of a T-intersection, cul-de-sac, or elbow, the street intersection shall be graded so to avoid water flowing over the curb and driveway, and out of the right-of-way. Detailed calculations shall be required at permit to show that the discharges are contained within the right-of-way.

2.7 Stormwater Mitigation

It is the intent of this manual, in concert with applicable ordinances, to provide all development under its jurisdiction the option of providing mitigation or demonstrating that no mitigation is in the best interest of the watershed and paying a share of the cost to participate with a stormwater connection fee.

Mitigation through detention, retention, or some other technique must be designed, constructed, and maintained to reduce the post-development discharge rates to below that of pre-development/existing rates for the two (2), ten (10), twenty-five (25), and one-hundred (100) year design storms. Participation in neighborhood or regional mitigation is an acceptable option.

Demonstration that no mitigation is in the best interest of the watershed shall be accomplished by showing no adverse impact due to any increased runoff from the proposed development for the design

storms. Approval of a Stormwater Connection Fee is required in compliance with Chapter 143 of the Code of Ordinances. The property owner, or his/her designee, shall meet with the Engineering Division to discuss mitigation and/or Stormwater Connection Fee options prior to commencing the project.

For stormwater mitigation, the following two development conditions shall be analyzed with each adverse impact analysis:

A. Existing Conditions. This refers to current development conditions in the watershed and on site. This shall be used as the baseline for determining the impact of the development of the site, or the watershed, to other properties or drainage systems.
B. Proposed Conditions. This refers to existing conditions with the proposed development added. This shall be used to determine if the increased runoff from the proposed development results in an adverse impact to other properties or drainage systems.

2.8 Drainage Facility Design

Drainage design in the urban environment should also consider appearance as an integral part of the design and structures should generally blend with the natural surroundings as much as possible to maintain the aesthetics of the natural area.

The City requires preservation of the natural floodplains. The protection of existing trees and vegetation should be maximized during development of drainage plans. Whenever possible, the replacement of the trees destroyed by drainage and flood protection procedures is encouraged.

Computations to support all drainage designs shall be submitted to the Engineering Division for review in an easy to follow format. On-site pre-development stormwater runoff computations shall be based upon conditions representing the existing land conditions with respect to soil type, percentage cover, and cover type as indicated by current aerial imagery and supporting documentation. Design of structures shall use fully developed sub-basin conditions for the prescribed design storms based on the sub-basin zoning. If zoning does not exist, then the engineer shall assume the ultimate development based on the most recently adopted Future Land Use Plan.

If a development activity changes stormwater runoff characteristics in a manner that creates a point or points of concentrated flow, where previously there was sheet flow or lesser intensity flow pattern, or any increase in discharge rates or velocities for the 2, 10, 25 and 100-year frequency storms, the flow shall outfall into right-of-way or drainage easement that has the capacity for the discharge. An impact analysis is required to verify the capacity and/or required size of the downstream facility clearly demonstrating no adverse impact.

In development of engineered retaining walls greater than three feet, drainage facilities shall be designed in such a manner as to prevent the freefall of stormwater from natural drainage patterns and sheet flow conditions.

The design requirements and criteria are specified in following chapters. Modeling and calculations shall be included in drainage report submittals to ensure the specified criteria are met for all drainage

infrastructure improvements. Infrastructure that is within TxDOT right-of-way and requires dual permitting from both the City and TxDOT shall be designed in compliance with the more conservative requirements.

2.9 Stream Bank Erosion Hazard Setback

Erosion hazard setback zone determination is necessary for the banks of streams in which the natural channel is to be preserved. The purpose of the setbacks is to reduce the amount of structural damage and stream degradation caused by the erosion of the bank. With the application of stream bank erosion hazard setbacks, an easement is dedicated to the City such that no structure can be located, constructed, or maintained in the area encompassing the erosion hazard setback.

The City allows for stream bank stabilization as an alternative to dedicating the erosion hazard setback zone. Stream bank erosion hazard setbacks may extend beyond the limits of the regulatory floodplain and are shown in Table 2-3.

Table 2-3: Stream Bank Erosion Hazard Setbacks

Contributing Drainage Area (square miles)	Setback Distance from Stream Centerline (feet)
0-1	0
1-5	50
5 or more	100

A map delineating the contributing drainage area sizes along each stream in the City's jurisdiction is included for reference in **Appendix C**. For the purpose of this manual, any watercourse that was included in the rivers and stream data set published in the United States Geological Survey (USGS) National Hydrography Dataset (NHD) in 2013 was considered a stream.

2.10 Water Quality Controls

Temporary water quality best management practices (BMPs) shall be required when any disturbance could result in appreciable erosion that could result in measurable accumulation of sedimentation in dedicated streets, alleys, any waterway or other private properties during construction activities. Site erosion control requirements are provided in **Section 12**.

Development and redevelopment located over the Edwards Aquifer regulatory zones shall comply with the latest TCEQ published rules and technical design guidance for the Edwards Aquifer. Permanent water quality BMPs for development outside of the Edwards Aquifer regulated zones shall be designed to provide adequate treatment of the water quality volume in the City's jurisdiction as defined in **Section 13**.

2.11 Maintenance of Drainage Facilities

The property owner or designee will maintain the hydraulic integrity of drainage systems not dedicated to the City. The City will maintain the hydraulic integrity of drainage systems dedicated to and accepted

by the City. Maintenance of the floodplain, drainage easements, and water quality features shall be explicitly stated in a recorded instrument.

2.11.1 Maintenance Schedule

A maintenance schedule supported by engineering or scientific published documents shall be submitted to the Engineering Division prior to approval of construction plans for public and private facilities. The City has the right to conduct periodic inspections of privately owned and maintained drainage and water quality improvements to ensure that the maintenance schedule is being implemented.

2.11.2 Maintenance Access

Access shall be provided for all channels to allow equipment access for maintenance. Access shall have a width of at least 12 feet and a cross slope no greater than two percent. Maintenance ramps used for access shall have a vertical grade no steeper than 6:1. An unobstructed access easement connecting the channel drainage easement with a roadway parallel to or near the easement shall be provided at a minimum spacing of one access easement at a minimum of 1,000 feet intervals. Access shall be provided within dedicated right-of-way or within the drainage easement dedicated for the channel. The bottom of the channel cannot be considered as maintenance access.

2.12 Pumped Drainage Facilities

The City of New Braunfels discourages the use of Pumped Drainage Facilities. A Pumped Drainage Facility is defined as any drainage system not wholly utilizing gravity outflow. Facility designs considered under this section's guidelines must first demonstrate that a gravity system is not feasible from both an engineering and economic standpoint. A feasibility analysis is required to be submitted prior to permit application. The applicant must have expressed written approval from the City Engineer and Engineering Division with permit application.

Pumped Drainage Facilities will only be acceptable in commercial applications and must meet all other drainage requirements outlined in this manual. All approved Pumped Drainage Facilities must be privately owned and maintained. The owner assumes responsibility for any damage to property as a result of a system's normal operation or failure.

2.12.1 Design Requirements

If approved by the Engineering Division, Pumped Drainage Facilities design submittals should include the following items:

A. Pump discharge shall be used for a maximum of 50% of the total required basin capacity, not including freeboard. The remaining volume must discharge by gravity.
B. A minimum of two (2) pumps will be provided, each of which is sized to pump the designed flow rate.
C. Provide an emergency power source for the drainage facility pumps.
D. Design should include but not be limited to controls, pumps, cycling and anti-vandalism measures.
E. Facility discharge must be into an existing right-of-way or drainage easement that has the capacity for the increase discharge.

F. Provide an armored gravity emergency outflow structure designed to allow the outflow of the 100-year design storm, assuming the pond is full and the discharge is 100% clogged. At minimum, the emergency overflow shall engage when ponding exceeds the 100-year water surface elevation plus freeboard.

2.12.2 Maintenance and Operations

A maintenance and operations plan shall be submitted to the Engineering Division prior to approval of construction plans for all facilities. The City has the right to conduct periodic inspections of privately owned and maintained drainage improvements to ensure that the maintenance schedule is being implemented.

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3 Design Rainfall

3.1 Rainfall Intensity Duration Frequency

The City evaluated precipitation based on NOAA Atlas 14, Volume 11 Texas statewide precipitation study. This study updated precipitation frequency estimates for Texas and replaces previous precipitation estimate studies. The revised rainfall data will be the standard for Design for the City of New Braunfels.

Runoff shall be calculated in accordance with Section 4 using the updated precipitation values as shown in Tables 3-1 and 3-2. The 100-year (1% AC) 24-hour rainfall depth for City of New Braunfels is 13.1 inches. The data published by NOAA Atlas 14 varies linearly across the City. The values shown below are taken from the highest rainfall data within the City limits.

Table 3-1: New Braunfels Atlas 14 Area Depth-Duration Value

Year	Depth-Duration-Frequency (inches)									
	5-Min	15-Min	1-Hr	2-Hr	3-Hr	6-Hr	12-Hr	24-Hr	2-day	3-day
2	0.528	1.06	1.96	2.4	2.67	3.13	3.59	4.08	4.66	5.05
5	0.664	1.33	2.45	3.08	3.47	4.14	4.79	5.48	6.27	6.78
10	0.781	1.66	2.88	3.71	4.23	5.13	5.97	6.86	7.82	8.43
25	0.946	1.88	3.5	4.63	5.39	6.66	7.82	8.99	10.2	10.9
50	1.08	2.14	3.97	5.4	6.39	8.03	9.46	10.9	12.3	13.1
100	1.22	2.41	4.49	6.26	7.54	9.62	11.4	13.1	14.7	15.6
500	1.57	3.09	5.95	8.74	10.8	14.2	17.1	19.8	22	23.1

Table 3-2 shows rainfall intensities by storm event. The intensities were calculated based off the depth duration table for each frequency storm. Durations range from 5 minutes up to 1 day for recurrence intervals from the 2-year to 500-year storm events, which will be the standard design for New Braunfels.

The City requires all flood study submittals to be performed using rainfall data presented in the document. If a FEMA submittal is required for the purpose of a map revision or amendment such as a Conditional Letter of Map Revision (CLOMR) or Letter of Map Revision (LOMR) or a Letter of Map Amendment (LOMA), FEMA will require the hydrologic and hydraulic models to be updated based on the information used for the Current Effective Flood Insurance Study (FIS). In which case, the City requires two separate submittals. One, which uses FEMA data and will be submitted for FEMA map revisions and incorporation upon City Floodplain Administrator's (FPA) approval; another which uses the guidelines published in this manual and will be submitted for review and approval by the City Engineer or his/her designee.

Regardless of a FEMA submittal, the City will require a signed and sealed memo or report, summarizing the hydrologic and hydraulic analysis as illustrated in this manual, for all improvements adjacent to a mapped or un-mapped stream with a contributing drainage area greater than 200 acres.

Table 3-2: New Braunfels Rainfall Intensities by Storm Event

Rainfall Intensity (inches/hour) by Storm Frequency							
Time (minutes)	**2**	**5**	**10**	**25**	**50**	**100**	**500**
5	6.34	7.97	9.37	11.35	12.96	14.64	18.84
6	5.98	7.53	8.88	10.78	12.29	13.88	17.72
7	5.70	7.18	8.47	10.30	11.73	13.24	16.83
8	5.45	6.88	8.11	9.87	11.24	12.68	16.08
9	5.24	6.61	7.79	9.48	10.79	12.17	15.42
10	5.05	6.36	7.50	9.12	10.38	11.70	14.82
11	4.87	6.13	7.23	8.78	9.99	11.26	14.27
12	4.70	5.92	6.97	8.45	9.61	10.83	13.76
13	4.54	5.71	6.72	8.13	9.25	10.42	13.27
14	4.39	5.51	6.47	7.82	8.90	10.03	12.81
15	4.24	5.32	6.24	7.52	8.56	9.64	12.36
16	4.10	5.14	6.03	7.26	8.25	9.29	11.93
17	3.97	4.98	5.83	7.02	7.98	8.98	11.54
18	3.86	4.83	5.66	6.81	7.74	8.71	11.19
19	3.75	4.69	5.50	6.62	7.51	8.46	10.88
20	3.65	4.57	5.36	6.45	7.31	8.23	10.59
21	3.57	4.46	5.23	6.29	7.12	8.01	10.33
22	3.48	4.35	5.10	6.14	6.95	7.82	10.09
23	3.41	4.26	4.99	6.00	6.79	7.64	9.86
24	3.34	4.17	4.88	5.87	6.64	7.47	9.65
25	3.27	4.08	4.78	5.75	6.50	7.32	9.46
26	3.20	4.00	4.69	5.64	6.37	7.17	9.27
27	3.14	3.93	4.60	5.53	6.25	7.03	9.10
28	3.09	3.85	4.52	5.43	6.13	6.90	8.94
29	3.03	3.79	4.44	5.33	6.02	6.78	8.79
30	2.98	3.72	4.36	5.24	5.92	6.66	8.64
31	2.93	3.66	4.29	5.15	5.82	6.55	8.50
32	2.88	3.60	4.22	5.07	5.73	6.44	8.37
33	2.84	3.54	4.15	4.99	5.63	6.34	8.24
34	2.79	3.49	4.09	4.91	5.55	6.24	8.12
35	2.75	3.43	4.02	4.84	5.46	6.15	8.00
36	2.71	3.38	3.96	4.77	5.38	6.06	7.89
37	2.67	3.33	3.90	4.70	5.30	5.97	7.78
38	2.63	3.28	3.85	4.63	5.23	5.89	7.68
39	2.59	3.24	3.79	4.57	5.16	5.80	7.58
40	2.55	3.19	3.74	4.50	5.09	5.73	7.48
41	2.52	3.14	3.69	4.44	5.02	5.65	7.38
42	2.48	3.10	3.64	4.38	4.95	5.58	7.29
43	2.45	3.06	3.59	4.32	4.88	5.50	7.20
44	2.42	3.02	3.54	4.27	4.82	5.43	7.12
45	2.38	2.98	3.49	4.21	4.76	5.36	7.03
46	2.35	2.94	3.45	4.16	4.70	5.30	6.95
47	2.32	2.90	3.40	4.11	4.64	5.23	6.87
48	2.29	2.86	3.36	4.06	4.58	5.17	6.79
49	2.26	2.82	3.31	4.00	4.53	5.11	6.71
50	2.23	2.79	3.27	3.95	4.47	5.04	6.64
51	2.20	2.75	3.23	3.91	4.42	4.98	6.56
52	2.17	2.72	3.19	3.86	4.36	4.93	6.49
53	2.14	2.68	3.15	3.81	4.31	4.87	6.42
54	2.11	2.65	3.11	3.76	4.26	4.81	6.35
55	2.08	2.61	3.07	3.72	4.21	4.76	6.28
56	2.06	2.58	3.03	3.67	4.16	4.70	6.21
57	2.03	2.55	2.99	3.63	4.11	4.65	6.14
58	2.00	2.51	2.95	3.59	4.06	4.59	6.08
59	1.98	2.48	2.92	3.54	4.02	4.54	6.01
60	1.95	2.45	2.88	3.50	3.97	4.49	5.95
120	1.20	1.54	1.86	2.32	2.70	3.13	4.37
180	0.89	1.16	1.41	1.80	2.13	2.51	3.60
240	0.71	0.93	1.14	1.47	1.75	2.08	3.02
360	0.52	0.69	0.85	1.11	1.34	1.60	2.37
720	0.30	0.40	0.50	0.65	0.79	0.95	1.43
1440	0.17	0.23	0.29	0.37	0.45	0.55	0.83

4 Determination of Design Discharge

4.1 General Requirements

The selection of the appropriate method for calculating runoff depends upon the size of the drainage area, time of concentration, and detention mitigation. Flows are to be analyzed for both existing, proposed, and ultimate development conditions at all locations where runoff leaves a proposed project for the 2, 10, 25, 50, and 100- year frequencies. Design discharges are to be calculated by either Rational Method or Unit Hydrograph using Atlas 14 rainfall from Section 3.

4.2 The Rational Method

Rational Method equation is based on the following assumptions:

- Rainfall intensity is constant over the time it takes to drain the watershed (time of concentration)
- The runoff coefficient remains constant during the time of concentration
- The watershed area does not change
- The minimum time of concentration is not less than 10 minutes and does not exceed 3-hours

The Rational Method may be used to generate peak flows for drainage basins less than 150 acres that do not require detention or timing considerations. For drainage areas in excess of 150 acres, reclaiming floodplains, creating lakes or building other types of drainage-related facilities on major drainage courses where the use of the Rational Method does not provide reliable results, a unit hydrograph method shall be used. The discharge computed by the Rational Method is the peak discharge for a given frequency on the watershed in question, and is given by the following relationship (Equation 4-2):

Equation 4-1

$$Q = CIA$$

Where:
Q = peak design for a given frequency on the watershed at the desired design point (cfs)
C = dimensionless weighted runoff coefficient, representing ground cover conditions and/or land use within the watershed area. (See Table 4-1)
I = average rainfall intensity in inches per hour at a rainfall duration equal to the time of concentration, associated with the desired design frequency. (See Table 3-12) (in/hr)
A = the drainage area in acres contributing runoff to the desired design point (acres).

4.2.1 Runoff Coefficient

Suggested coefficients with respect to specific surface types are given in Table 4-1. “C” values for developed conditions should be based on composite values. The Engineering Division must approve assumptions for fully developed conditions where maximum allowable impervious cover is not defined by city ordinance. The runoff coefficients include an antecedent precipitation factor to reflect the additional runoff that results from saturated ground conditions with less frequent recurrence intervals.

Table 4-1: Runoff Coefficients

RATIONAL METHOD RUNOFF COEFFICIENTS FOR COMPOSITE ANALYSIS Runoff Coefficient (C)							
Character of Surface	Return Period						
	2 Years	5 Years	10 Years	25 Years	50 Years	100 Years	500 Years
DEVELOPED							
Asphaltic	0.73	0.77	0.81	0.86	0.90	0.95	1.00
Concrete	0.75	0.80	0.83	0.88	0.92	0.97	1.00
Grass Areas (Lawns, Parks, etc.)							
Poor Condition*							
Flat, 0-2%	0.32	0.34	0.37	0.40	0.44	0.47	0.58
Average, 2-7%	0.37	0.40	0.43	0.46	0.49	0.53	0.61
Steep, over 7%	0.40	0.43	0.45	0.49	0.52	0.55	0.62
Fair Condition**							
Flat, 0-2%	0.25	0.28	0.30	0.34	0.37	0.41	0.53
Average, 2-7%	0.33	0.36	0.38	0.42	0.45	0.49	0.58
Steep, over 7%	0.37	0.40	0.42	0.46	0.49	0.53	0.60
Good Condition***							
Flat, 0-2%	0.21	0.23	0.25	0.29	0.32	0.36	0.49
Average, 2-7%	0.29	0.32	0.35	0.39	0.42	0.46	0.56
Steep, over 7%	0.34	0.37	0.40	0.44	0.47	0.51	0.58
UNDEVELOPED							
Cultivated							
Flat, 0-2%	0.31	0.34	0.36	0.40	0.43	0.47	0.57
Average, 2-7%	0.35	0.38	0.41	0.44	0.48	0.51	0.60
Steep, over 7%	0.39	0.42	0.44	0.48	0.51	0.54	0.61
Pasture/Range							
Flat, 0-2%	0.25	0.28	0.30	0.34	0.37	0.41	0.53
Average, 2-7%	0.33	0.36	0.38	0.42	0.45	0.49	0.58
Steep, over 7%	0.37	0.40	0.42	0.46	0.49	0.53	0.60
Forest/Woodlands							
Flat, 0-7%	0.22	0.25	0.28	0.31	0.35	0.39	0.48
Average, 2-7%	0.31	0.34	0.36	0.40	0.43	0.47	0.56
Steep, over 7%	0.35	0.39	0.41	0.45	0.48	0.52	0.58
Composite "C" value for developed conditions (C_{DEV}) is : $C_{DEV} = IC_1 + (1-I)C_2$							
Where: I = Impervious cover, percent C_1 = "C" value for impervious cover C_2 = "C" value for pervious area (grass, lawns, parks, etc.)							
* Grass cover less than 50 percent of the area. ** Grass cover on 50 to 75 percent of the area. *** Grass cover larger than 75 percent of the area.							
Source: *City of Austin Drainage Criteria Manual* [2]							

The drainage area under investigation may consist of several different drainage surfaces or zoning classifications. In such cases, an average coefficient weighted in accordance with the respective areas shall be used, as outlined in Equation 4-2.

Equation 4-2

$$C_w = \left(\frac{A_1C_1 + A_2C_2 + \cdots A_nC_n}{A_1 + A_2 + A_3 + \cdots A_n}\right)$$

4.2.2 Time of Concentration

The time of concentration (T_c) is the amount of time required for surface runoff to travel from the most hydraulically remote point within the drainage basin to the drainage point under consideration. The most hydraulically remote drainage point refers to the route requiring the longest drainage travel time and not necessarily the greatest linear distance. Furthermore, the most hydraulically remote point must be taken from a location that best represents the majority of the contributing area.

The Natural Resources Conservation Service (NRCS) method in *Technical Release 55: Urban Hydrology for Small Watersheds (TR-55)* [3] is the preferred method for estimating time of concentration, unless the design engineer can justify why an alternative method is more suitable for the watershed under analysis. Other methodologies can be used but must be approved by the Engineering Division.

The procedure for estimating time of concentration, as described in TR-55, is outlined below. The overall time of concentration is calculated as the sum of the sheet, shallow concentrated and channel flow travel times as shown in Equation 4-3. Note that there may be multiple shallow concentrated and channel segments depending on the nature of the flow path.

Equation 4-3

$$T_C = T_{t(sheet)} + T_{t(shallow\ concentration)} + T_{t(channel)}$$

Sheet Flow

Sheet flow is shallow flow over land surfaces, which usually occurs in the headwaters of streams. The engineer should realize that sheet flow occurs for only very short distances, especially in urbanized conditions. Sheet flow for both natural (undeveloped) and developed conditions should be limited to a maximum of 100 feet. Sheet flow for developed conditions should be based on the actual pavement or grass conditions for areas that are already developed and should be representative of the anticipated land use within the headwater area in the case of currently undeveloped areas. In a typical residential subdivision, sheet flow may be the distance from one end of the lot to the other or from the house to the edge of the lot. In some heavily urbanized drainage areas, sheet flow may not exist in the headwater area. The NRCS method employs Equation 4-4, which is a modified form kinematic wave equation, for the calculation of the sheet flow travel time.

Equation 4-4

$$T_t = \frac{0.007(nL)^{0.8}}{(P_2^{0.5})(s^{0.4})} \times 60$$

Where:
T_t = Sheet flow travel time (min)
L = Length of the reach (ft)
n = Manning's n (see Table 4-2)
P_2 = 2-year, 24-hour rainfall (in) (see Table 3-2)
s = Slope of the ground (ft/ft).

Table 4-2: Manning's "n" for overland flow

Manning's "n"[1]	Surface Description
0.015	Concrete (rough or smoothed finish)
0.016	Asphalt
0.05	Fallow (no residue)
	Cultivated Soils:
0.06	Residue Cover ≤ 20%
0.17	Residue cover > 20%
	Grass:
0.15	Short-grass prairie
0.24	Dense grasses[2]
0.41	Bermuda Grass
0.13	Range (natural)
	Woods[3]:
0.04	Light underbrush
0.8	Dense underbrush
[1] The Manning's n values are a composite of information compiled by Engman (1986).	
[2] Includes species such as weeping lovegrass, bluegrass, buffalo grass, blue grama grass, and native grass mixtures.	
[3] When selecting n, consider cover to a height of about 0.1 ft. This is the only part of the plant cover that will obstruct sheet flow.	
Source: *City of Austin Drainage Criteria Manual* [2] and *TR-55* [3]	

Shallow Concentrated Flow

After a maximum of approximately 100 feet, sheet flow usually becomes shallow concentrated flow collecting in swales, small rills, and gullies. Shallow concentrated flow is assumed not to have a well-defined channel and has flow depths of 0.1 to 0.5 feet. The travel time for shallow concentrated flows can be computed by Equation 4-5 and Equation 4-6. These two equations are based on the solution of Manning's Equation with different assumptions for n (Manning's Roughness Coefficient) and r (hydraulic radius, ft). For unpaved areas, n is 0.05 and r is 0.4; for paved areas, n is 0.025 and r is 0.2.

Equation 4-5 : Unpaved

$$T_t = \frac{L}{(60)(16.1345)(s^{0.5})}$$

Equation 4-6: Paved

$$T_t = \frac{L}{(60)(20.3282)(s^{0.5})}$$

Where:
T_t = Travel time for shallow concentrated flows (min)
L = Length of the reach (ft)
s = Slope of the ground (ft/ft).

4.2.3 Channel or Storm Drain Flow

The velocity in an open channel or a storm drain not flowing full can be determined by using Manning's Equation. Channel velocities can also be determined by using backwater profiles. For open channel flow, average flow velocity is usually determined by assuming a bank-full condition. Note that the channel flow component of the time of concentration may need to be divided into multiple segments in order to represent significant changes in channel characteristics. The details of using Manning's Equation and selecting Manning's "n" values for channels can be obtained from **Section 8**.

For the storm drain flow under pressure conditions (hydraulic grade line is higher than the lowest crown of a storm drain) the following equation should be applied:

Equation 4-7

$$V = \frac{Q}{A}$$

Where:
V = Average velocity (ft/s)
Q = Design discharge (cfs)
A = Cross-sectional area (ft^2).

Total travel time through a channel and/or storm drain can be calculated by Equation 4-8.

Equation 4-8

$$T_t = \sum \left(\frac{L_i}{60 V_i} \right)$$

Where:
L_i = The i-th channel segment length (ft)
V_i = The average flow velocity within the i-th channel segment (ft/s)
T_t = Total flow travel time through the channel (min).

4.3 SCS/NRCS Unit Hydrograph

The preferred unit hydrograph in general is the Soil Conservation Service (SCS)/Natural Resource Conservation Service (NRCS) Dimensionless Unit Hydrograph. The runoff curve number(s) used in calculating the pre-development/existing condition, the post-development condition, and the ultimate development condition shall be documented. Post-development conditions, condition of the given site and drainage area after the anticipated development has taken place, shall be based on the project. A fully developed watershed and the proposed project shall be assumed for the ultimate development condition based on future zoning projections. NRCS curve numbers are to be selected from Table 4-3. Curve numbers in Table 4-4 shall be used when performing an analysis of fully developed conditions. Average antecedent moisture conditions II (AMC II) shall be assumed.

Table 4-3: NRCS Runoff Curve Numbers for Urban Areas and Agricultural Lands

Cover Description	Average % Impervious Area[1]	Curve Numbers for Hydrologic Soil Group			
Cover Type and Hydrologic Condition		**A**	**B**	**C**	**D**
Fully developed urban areas (vegetation established)					
Open space (lawns, parks, golf courses, cemeteries, etc.):					
Poor condition (grass cover 50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right of way)		98	98	98	98
Streets and roads:					
Paved; curbs and storm drains (excluding right of way)		98	98	98	98
Paved; open ditches (including right of way)		83	89	92	93
Gravel (including right of way)		76	85	89	91
Dirt (including right of way)		72	82	87	89
Developing urban areas					
Newly graded areas (pervious areas only, no vegetation)		77	86	91	94
Agricultural lands					
Grassland, or range-continuous forage for grazing[2]	Poor Fair Good	68 49 39	79 69 61	86 79 74	89 84 80
Meadow-continuous grass, protected from grazing and generally mowed for hay		30	58	71	78
Brush—brush-weed-grass mixture with brush the major element[3]	Poor Fair Good	48 35 30	67 56 48	77 70 65	83 77 73
Woods—grass combination (orchard or tree farm).[4]	Poor Fair Good	57 43 32	73 65 58	82 76 72	86 82 79
Woods[5]	Poor Fair Good	45 36 30	66 60 55	77 73 70	83 79 77
Farmsteads—buildings, lanes, driveways and surrounding lots		59	74	82	86

[1] Poor: less than 50 percent ground cover or heavily grazed with no mulch.
Fair: 50 to 75 percent ground cover and not heavily grazed.
Good: greater than 75 percent ground cover and lightly or only occasionally grazed.
[2] Poor: less than 50 percent ground cover.
Fair: 50 to 75 percent ground cover.
Good: greater than 75 percent ground cover.
[3] Curve numbers shown were computed for areas with 50 percent woods and 50 percent grass (pasture) cover. Other combinations of conditions may be computed from the curve numbers for woods and pasture.
[4] Poor: Forest litter, small trees and brush are destroyed by heavy grazing or regular burning.
Fair: Woods are grazed but not burned, and some forest litter covers the soil.
Good: Woods are protected from grazing, and litter and brush adequately cover the soil.

Source: *TR-55* [3]

Table 4-4: Curve Numbers for Fully Developed Conditions

Zone	Curve Numbers for Hydrologic Soil Group			
	A	B	C	D
R-1/R-1A Single family	61	75	83	87
R-2/R-2A Single and two family	77	85	90	92
R-3/R-3L Multi family high density	77	89	92	94
R-3/R-3H Multi family low density	77	85	90	92
B-1/B-1A Convent & mobile homes	61	75	83	87
TH/TH-A Townhouse	77	89	92	92
ZH/ZH-A Zero lot line homes	68	79	87	90
C-1/C1A Neighborhood business	83	89	92	93
C-2/C-1B General Business	77	86	93	94
C-3 Commercial	89	92	94	95
C-4/C-4A Resort Commercial/PUD (must use composite values)	-	-	-	-
M-1/M1A Light industry	68	79	87	90
M-2/M-2A Heavy industry	89	92	94	95
Source: *TR-55* [3]				

Curve numbers can be reduced by either using a climatic adjustment as described in the *Texas Department of Transportation (TxDOT) Hydraulic Design Manual (HDM)* [4] or calibrating to historical storms. If curve numbers are calibrated from historical storms, the Engineer must provide documented data for rainfall, stream flow data, or detention pond stage storage data used to determine the historical curve numbers.

Time of concentration shall be computed using the same techniques as for the Rational Method. The lag time, defined as the time between the center of mass of excess rainfall to the runoff peak, is typically used in the Hydrologic Modeling System (HEC-HMS) implementation of the SCS methodology. The lag time can be estimated with Equation 4-9.

Equation 4-9

$$T_{lag} = 0.6T_c$$

The SCS/NRCS Unit Hydrograph shall be analyzed using 24-hour rainfall depths provided in Table 3-2. The 24-hour rainfall depths are to be distributed temporally with the NRCS Type III rainfall distribution.

4.4 Hydrologic Computer Programs

The preferred hydrologic model for the City is HEC-HMS. The use of other computer modeling software is discussed in **Section 1.3**. When using any model, use the procedures outlined in the respective user's manual. Data generated with the model and the results of the program shall be summarized on the drainage plans.

5 Street Flow

5.1 General Requirements

A. All roadways and/or paved alleys must contain the 100-year flow within the right-of-way. Runoff shall not enter private property from a street except in recorded drainage easements or rights-of-way, or in historic watercourses where easements or rights-of-way have not yet been obtained.

B. 100-year design storm depth of water shall not exceed 10 inches at any point within the street right-of-way and the product of maximum depth (feet) times average cross-section velocity (feet per second) at any point shall not exceed 6.0.

C. Rundowns, roadway slope, shall be designed to convey and contain drainage carried by the roadway to ensure the 100-year event is contained within the right-of-way. If a storm drain system is present, rundowns shall be designed for the difference between the storm drain capacity and the 100-year runoff, with a 25-year minimum design assuming all of the flow bypasses the storm drain system.

D. Driveways should be constructed to allow the 25-year design storm runoff to pass under the driveway in a culvert (18 inches minimum or equivalent) or over the driveway on a concrete apron. Concrete aprons or box culverts are preferred in areas of heavy sediment transport.

E. The side slope of a ditch or swale on the side adjacent to City roads shall be no steeper than 4:1. Roadways under TxDOT jurisdiction shall be designed in accordance with TxDOT requirements (6:1).

F. Water Spread Limits for Roadways is as indicated in Table 5-1. No lowering of the standard height of street crown shall be allowed for the purposes of obtaining additional hydraulic capacity. Where additional hydraulic capacity is required, the proposed street gradient must be increased or curb inlets and storm sewers installed to remove a portion of the flow.

Table 5-1: Water Spread Limits for Roadways

Street Classification	10-Yr Permissible Water Spread
Arterial Streets and Parkways	One 11-foot traffic lane must remain open in each direction.
Collector Streets	Clear width of 11 feet must remain open.
< Collector Streets	Water flow must not exceed the top of either curb.

5.2 Positive Overflow

The approved drainage system shall provide for positive overflow at all low points. The term “positive overflow” means that, when the inlets do not function properly or when the design capacity of the conduit or roadway ditch is exceeded, the excess flow can be conveyed overland along an open course. Normally, this would mean along a street or alley, but it can be constructed on private property within the dedication of a drainage easement.

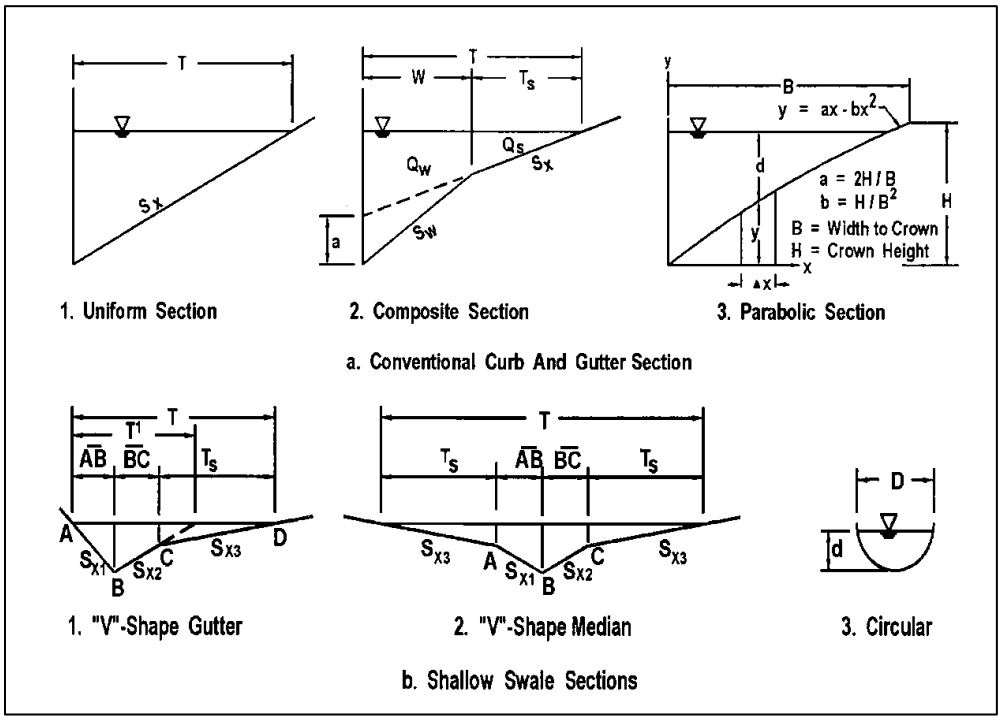
5.3 Street Flow Calculations

Evaluation of street flow is based upon open channel hydraulics theory, with the Manning’s Equation modified to allow direct solution, based on the street cross section. Refer to *Hydraulic Engineering*

Circular 22: Urban Drainage Design Manual (HEC 22) [5]. All proposed projects must meet the ponding criteria defined in this manual.

The following information was summarized from *HEC 22* for street flow calculations. The distance of the spread, T, is measured perpendicular to the curb face to the extent of the water on the roadway and is shown in Figure 5-1.

Figure 5-1: Typical Gutter Sections



Source: *HEC 22* [5]

Capacity Relationship

Gutter flow calculations are necessary to establish the spread of water on the shoulder, parking lane, or pavement section. A modification of the Manning's Equation can be used for computing flow in triangular channels. The modification is necessary because the hydraulic radius in the equation does not adequately describe the gutter cross section, particularly where the top width of the water surface may be more than 40 times the depth at the curb. To compute gutter flow, the Manning's Equation is integrated for an increment of width across the section [6]. The resulting equation is:

Equation 5-1

$$Q = \left(\frac{K_u}{n}\right) {S_x}^{1.67} {S_L}^{0.5} T^{2.67}$$

Or in terms of *T*:

Equation 5-2

$$T = \left[\frac{Qn}{K_u S_x^{1.67} S_L^{0.5}}\right] T^{0.375}$$

Where:

K_u = 0.56 in English units
n = Manning's coefficient (Table 5-2)
Q = Flow rate (cfs)
T = Width of flow (spread) (ft)
S_x = Cross slope (ft/ft)
S_L = Longitudinal slope (ft/ft).

Equation 5-1 neglects the resistance of the curb face since this resistance is negligible.

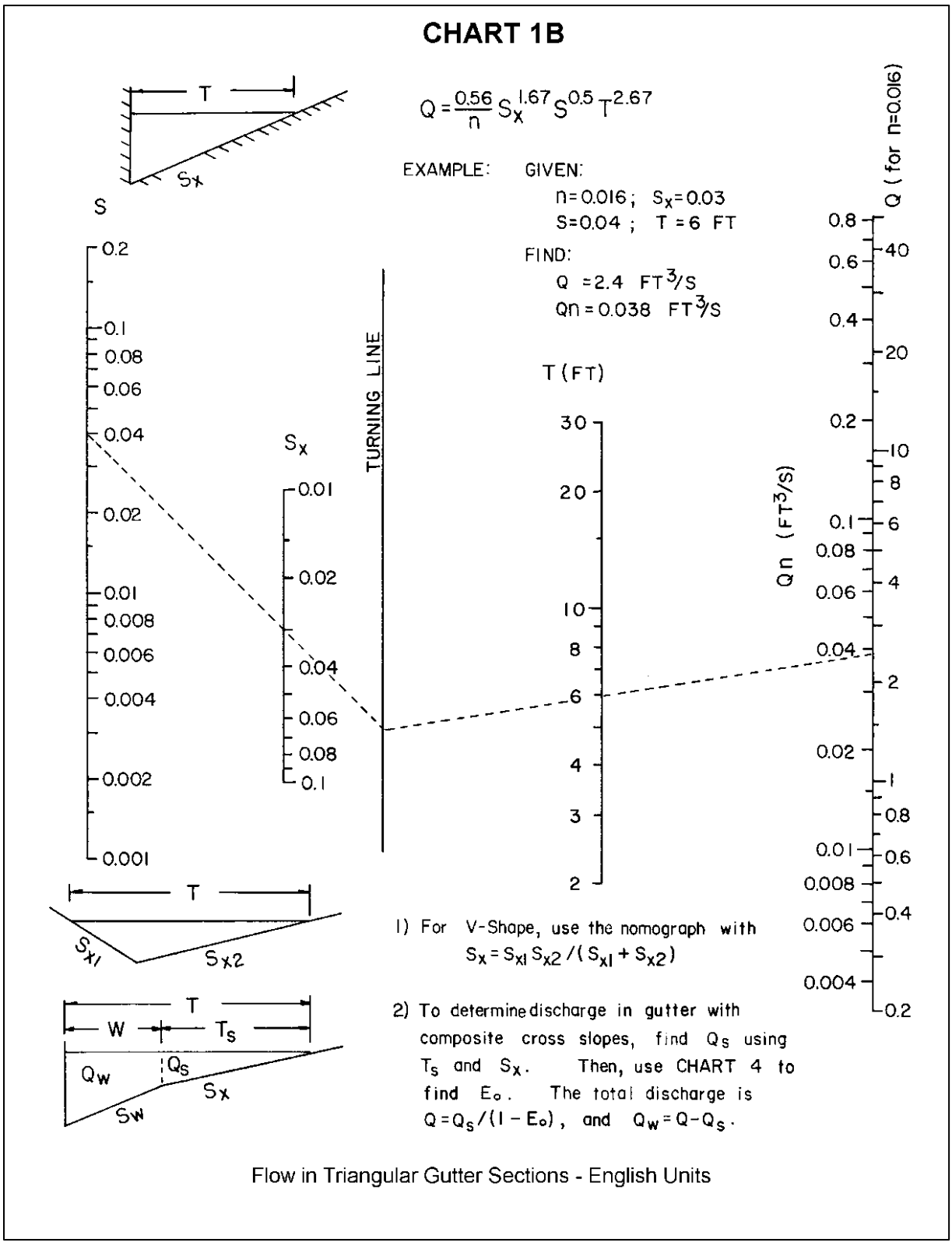
Spread on the pavement and flow depth at the curb are often used as criteria for spacing pavement drainage inlets. Figure 5-2 is a nomograph for solving Equation 5-1 and should be used as reference only, Figure 5-2 is not intended to replace equation 5-1. The chart can be used for either criterion with the relationship:

Equation 5-3

$$d = TS_x$$

Where:
d = Depth of flow (ft)
T = Width of flow (ft)
S_x = Cross slope (ft/ft).

Figure 5-2: Chart 1B – Flow in Triangular Gutter Sections



Source: *HEC 22* [5]

Table 5-2: Manning's n for Street and Pavement Gutters

Type of Gutter or Pavement	Manning's n
Concrete gutter, troweled finish	0.012
Asphalt Pavement: Smooth texture Rough texture	 0.013 0.016
Concrete gutter-asphalt pavement: Smooth Rough	 0.013 0.015
Concrete pavement: Float finish Broom finish	 0.014 0.016
For gutters with small slope, where sediment may accumulate, increase above values of "n" by…….	0.002
Source: *Design Charts for Open-Channel Flow (HDS 3)* [7]	

5.3.1 Shallow Swale Sections

Where curbs are not needed for traffic control, a small swale section of circular or V-shape may be used to convey runoff from the pavement. As an example, the control of pavement runoff on fills may be needed to protect the embankment from erosion. Small swale sections may have sufficient capacity to convey the flow to a location suitable for interception.

In lieu of using an irregular open channel cross-section to compute flow in small swale, Figure 5-2 can be used to compute the flow in a shallow V-shaped section. When using Chart 1B for V-shaped channels, the cross slope, S_x is determined by the following equation:

Equation 5-4

$$S_x = \frac{(S_{x1}S_{x2})}{(S_{x1} + S_{x2})}$$

5.4 Alley Flow Limitations

Alley capacities shall be checked at all alley turns and “T” intersections to determine if curbing is needed or grades should be flattened. Curbing shall be required for at least 10 feet on either side of an inlet in an alley and on the other side of the alley so that the top of the inlet is even with the high edge of the alley pavement. Alleys adjacent to drainage channel shall be required to have curbs for the full length of the channel.

5.5 Alley Flow Calculations

Flow in alleys is also based upon open channel hydraulic theory, with the Manning equation modified to allow direct solution, with regard to the alley cross section.

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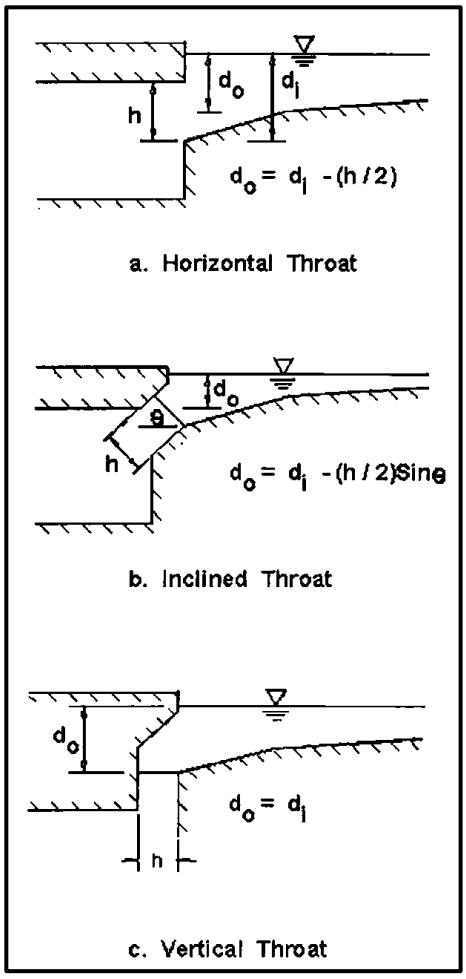
6 Inlet Design

6.1 General Requirements

Inlets shall be located as necessary to remove the flow based on the 25-year storm and accommodate ponding widths in streets as defined in Table 5-1. The hydraulic efficiency of storm drain inlets varies with the amount of gutter flow, street grade, street crown and the geometry of the inlet opening. The following are design considerations, which must be given attention during inlet design:

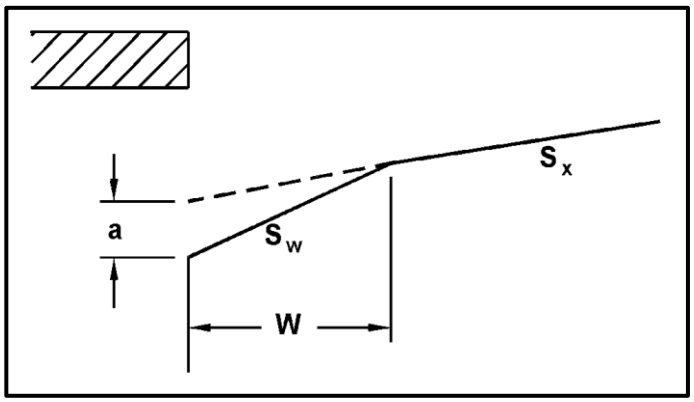
1. Inlets must be located where the allowable street flow capacities are exceeded, at low points (sumps or sags) and upstream of transition between normal and super-elevated street sections. Inlets should be located to intercept stormwater prior to traversing intersections.
2. In super-elevated sections of divided arterial streets, inlets placed against the center medians shall have no gutter depression. Interior gutter flow (flow along the median) shall be intercepted at the point of super-elevation transition, to prevent pavement cross flow.
3. At bridges with curbed approaches, gutter flow shall be intercepted prior to flowing onto the bridge, to prevent ice from developing during cold weather.
4. The maximum approved inlet throat opening is seven inches. Openings larger than seven inches require approval by the Engineering Division and, if approved, must contain a bar or other form of restraint. For curb opening inlets the throat opening is shown as “h” in Figure 6-1.
5. The design and location of all inlets must take into consideration pedestrian and bicycle traffic. Combination curb inlets (with opening in curb and grate opening in gutter) may be used only where space behind the curb prohibits the use of other inlet types.
6. Where recessed inlets are required, they shall not decrease the width of the sidewalk or interfere with utilities. Recessed inlets must also be depressed. The depression is measured from the theoretical gutter flow line, shown as “a” in Figure 6-2, and shall be one inch minimum.
7. Non-recessed, depressed inlets shall have a maximum allowable inlet depression of five inches.
8. The use of slotted drains is not allowed except in instances where there is no alternative, in which case approval must be obtained from the City Engineer. If slotted drains are used, the inlet capacity shall be the lesser of the calculated capacity from this manual or the manufacturer’s design guidelines and cleanouts shall be provided.

Figure 6-1: Curb Opening Inlet Examples



Source: *HEC 22* [5]

Figure 6-2: Depressed Curb Opening Inlet



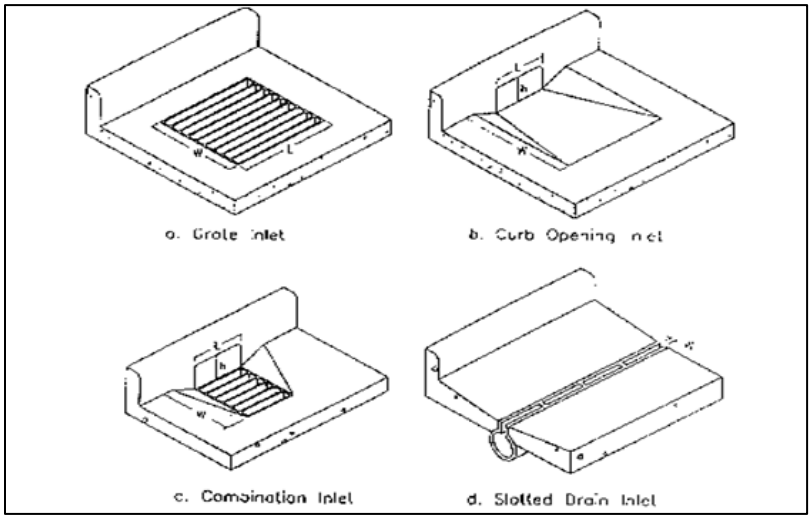
Source: *HEC 22* [5]

6.2 Inlet Types and Descriptions

Stormwater inlets are used to remove surface runoff and convey it to a storm drainage system. For the purposes of this manual, inlets are divided into four classes listed below and shown in Figure 6-3.

1. Grate Inlets
2. Curb Opening Inlets
3. Combination Inlet
4. Slotted Drain Inlets

Figure 6-3: Inlet Types



Source: *TxDOT HDM* [4]

6.2.1 Grate Inlets

Although grate inlets may be designed to operate satisfactorily in a range of conditions, they may become clogged by floating debris during storm events. In addition, they can produce a hazard to wheel chair and bicycle traffic and must be designed to be safe for both. For these reasons, they may be used only at locations where space restriction prohibit the use of other types of inlets and shall be designed to be twice as large as the theoretical required area to compensate for clogging.

6.2.2 Curb Opening Inlets

Curb opening inlets are the most effective type of inlet on slopes flatter than 3%, in sag locations, and with flows which typically carry large amounts of debris. Similar to grate inlets, curb opening inlets also tend to lose capacity as street grades increase, but to a lesser degree than grate inlets.

6.2.3 Combination Inlets

A combination inlet consists of both the grate inlet and the curb opening inlet. This configuration provides many of the advantages of both inlet types. The combination inlet also reduces the chance of clogging by debris with flow into the curb portion of the inlet. If a curb opening is extended on the upstream side of the combination inlet it will act as a “Sweeper”, and remove debris before it reaches the grate portion of the inlet.

6.2.4 Slotted Drain Inlets

Although slotted drain inlets can be used to intercept sheet flow, or flow in wide sections, they are not recommended for use in the City of New Braunfels since they are very susceptible to clogging from debris. Slot inlets may only be used with the permission of the City Engineer.

6.3 Inlet Capacity Calculations

The inlet capacity calculations provided below are summarized from *TxDOT HDM*. For additional information refer to the source document.

6.3.1 Combination Inlets

For a combination curb opening and grate inlet, assume that the capacity of the combination inlet comprises the sum of the capacity of the grate and the upstream curb opening length. Ignore the capacity of the curb opening that is combined with the grate opening. Refer to *HEC 22* for additional procedures and examples for computing the interception capacity of combination inlets.

6.3.2 Curb Opening Inlets On-Grade

The design of on-grade curb opening inlets involves determination of length required for total flow interception, subjective decision about actual length to be provided, and determination of any resulting carryover rate. For each on-grade inlet, determine early whether or not carryover is to be a valid design consideration. In some cases due to a logical location of the inlet, no carryover may be allowed. In other cases, while carryover is acceptable, there may not be a convenient location to accommodate the bypass flow. Use the following procedure to design curb inlets on-grade:

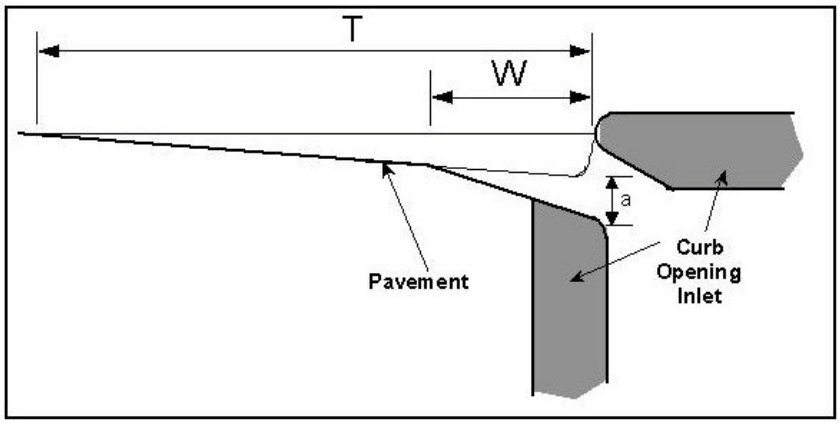
1. Compute depth of flow and ponded width (T) in the gutter section at the inlet.
2. Determine the ratio of the width of flow in the depressed section (W) to the width of total gutter flow (T) using Equation 6-1. Figure 6-4 shows the gutter cross section at an inlet.

Equation 6-1

$$E_0 = \frac{K_w}{K_w + K_0}$$

Where:
E_0 = ratio of depression flow to total flow
K_w = conveyance of the depressed gutter section (cfs)
K_0 = conveyance of the gutter section beyond the depression (cfs).

Figure 6-4: Gutter Cross-Section Diagram



Source: *TxDOT HDM* [4]

3. Use Equation 6-2 to calculate conveyance, K_w and K_0.

Equation 6-2

$$K = \frac{zA^{5/3}}{nP^{2/3}}$$

Where:
K = conveyance of cross section (cfs)
z = 1.486 for English measurements
A = area of cross section (ft^2)
n = Manning's roughness coefficient
P = wetted perimeter (ft).

4. Use Equation 6-3 to calculate the area of cross section in the depressed gutter section.

Equation 6-3

$$A_w = WS_x\left(T - \frac{W}{2}\right) + \frac{1}{2}aW$$

Where:
A_W = area of depressed gutter section (ft^2)
W = depression width for an on-grade curb inlet (ft)
S_X = cross slope (ft/ft)
T = calculated ponded width (ft)
a = curb opening depression depth (ft).

5. Use Equation 6-4 to calculate the wetted perimeter in the depressed gutter section.

Equation 6-4

$$P_W = \sqrt{[(WS_x + a)^2 + W^2]}$$

Where:
P_W = wetted perimeter of depressed gutter section (ft)
W = depression width for an on-grade curb inlet (ft)
S_X = cross slope (ft/ft)
a = curb opening depression depth (ft).

6. Use
7. Equation 6-5 to calculate the area of cross section of the gutter section beyond the depression.

Equation 6-5

$$A_0 = \frac{S_x}{2}(T - W)^2$$

Where:
A_0 = area of gutter/road section beyond the depression width (ft^2)
S_x = cross slope (ft/ft)
W = depression width for an on-grade curb inlet (ft)
T = calculated ponded width (ft).

8. Use Equation 6-6 to calculate the wetted perimeter of the gutter section beyond depression.

Equation 6-6

$$P_0 = T - W$$

Where:
P_0 =wetted perimeter of the depressed gutter section (ft)
T = calculated ponded width (ft)
W = depression width for an on-grade curb inlet (ft).

9. Use Equation 6-7 to determine the equivalent cross slope (S_e) for a depressed curb opening inlet.

Equation 6-7

$$S_e = S_x + \frac{a}{W} E_0$$

Where:
S_e = equivalent cross slope (ft/ft)
S_x = cross slope of the road (ft/ft)
a = gutter depression depth (ft)
W = gutter depression width (ft)
E_0 = ratio of depression flow to total flow.

10. Use Equation 6-8 to calculate the length of curb inlet required for total interception.

Equation 6-8

$$L_r = zQ^{0.42}S^{0.3}\left(\frac{1}{nS_e}\right)^{0.6}$$

Where:
L_r = length of curb inlet required (ft)
z = 0.6 for English measurement
Q = flow rate in gutter (cfs)
S = longitudinal slope (ft/ft)
n = Manning's roughness coefficient
S_e = equivalent cross slope (ft/ft).

If no carryover is allowed, the inlet length is assigned a nominal dimension of at least L_r. Use a nominal length available in standards for curb opening inlets. Do not use the exact value of L_r if doing so requires special details, special drawings and structural design, and costly and unfamiliar construction. If carryover is considered, round the curb opening inlet length down to the next available (nominal) standard curb opening length and compute the carryover flow.

6.3.2.1 Determine Carryover Flow

In carryover computations, efficiency of flow interception varies with the ratio of actual length of curb opening inlet supplied (L_a) to length L_r and with the depression to depth of flow ratio. Use Equation 6-9 for determining carryover flow.

Equation 6-9

$$Q_{co} = Q\left(1 - \frac{L_a}{L_r}\right)^{1.8}$$

Where:
Q_{co}= carryover discharge (cfs)
Q = total discharge (cfs)
La = design length of the curb opening inlet (ft)
L_r = length of curb opening inlet required to intercept the total flow (ft).

Carryover rates usually should not exceed about 0.5 cfs or about 30% of the original discharge. Greater rates can be troublesome and cause a significant departure from the principles of the Rational Method application. In all cases, you must accommodate any carryover rate at some other specified point in the storm drain system.

6.3.2.2 Calculate Intercepted Flow

Calculate the intercepted flow as the original discharge in the approach curb and gutter minus the amount of carryover flow.

6.3.3 Curb Inlets in Sag Configuration

The capacity of a curb inlet in a sag depends on the water depth at the curb opening and the height of the curb opening. The inlet operates as a weir to depths equal to the curb opening height and as an orifice at depths greater than 1.4 times the opening height. At depths between 1.0 and 1.4 times the opening height, flow is in a transition stage and the capacity should be based on the lesser of the computed weir and orifice capacity. Generally, this ratio should be less than 1.4 such that the inlet operates as a weir.

If the depth of flow in the gutter (d) is less than or equal to 1.4 times the inlet opening height (h), (d≤1.4H), determine the length of inlet required considering weir control. Otherwise, skip this step. Calculate the capacity of the inlet when operating under weir conditions with Equation 6-10.

Equation 6-10

$$L = \frac{Q}{C_w d^{1.5}} - 1.8W$$

Where:
Q = total flow reaching inlet (cfs)
C_w= weir coefficient ($ft\frac{0.5}{s}$)

Suggested value = 2.3 $ft.\frac{0.5}{s}$ for depressed inlets.

Suggested value = 3.0 $ft.\frac{0.5}{s}$ without depression.

d = head at inlet opening (ft), computed with Equation 10-1.
L = length of curb inlet opening (ft)
W = gutter depression width (perpendicular to curb)

If L > 12 ft, then W = 0 and C_w = 3.0 $ft.\frac{0.5}{s}$

If the depth of flow in the gutter is greater than the inlet opening height (d > h), determine the length of inlet required considering orifice control. The equation for interception capacity of a curb opening operating as an orifice follows:

Equation 6-11

$$Q = C_o h L \sqrt{2 g d_o}$$

Where:
Q = total flow reaching inlet (cfs)
*C*o = orifice coefficient = 0.67 *h* = depth of opening (ft) (this depth will vary slightly with the inlet detail used)
L = length of curb opening inlet (ft)
g = acceleration due to gravity = 32.2 ft/s^2
d_o = effective head at the centroid of the orifice (ft).

For curb inlets with an inclined throat such as Type C inlet, the effective head, d_0, is at the centroid of the orifice.

This changes Equation 6-11 to:

Equation 6-12

$$Q = C_o h L \sqrt{2 g (y + a - \frac{h}{2} sin\theta)}$$

Where:
Q = total flow reaching inlet (cfs)
C_o = orifice coefficient = 0.67
h = depth of opening (ft) (this depth will vary slightly with the inlet detail used)
L = Length of curb opening inlet (ft)
g = acceleration due to gravity = 32.2 ft/s^2
y = depth of water in the curb and gutter cross section (ft)
a = gutter depression depth (ft).

Rearranging Equation 6-12 allows a direct solution for required length.

Equation 6-13

$$L = \frac{Q}{C_o h \sqrt{2 g (y + a - \frac{h}{2} \sin\theta)}}$$

If both steps 1 and 2 were performed (i.e., h < d < 1.4h), choose the larger of the two computed lengths as being the required length. Select a standard inlet length that is greater than the required length.

6.3.4 Slotted Drain Inlet Design

Use the following procedure for on-grade slotted drain inlets:

1. Determine the length of slotted drain inlet required for interception of all of the water in the curb and gutter calculated by Equation 6-14.

Equation 6-14

$$L_r = \frac{zQ_a^{0.442}S^E S_x^{-0.849}}{n^{0.384}}$$

Where:
*L*r = length of slotted drain inlet required for total interception of flow (ft)
z = 0.706 for English measurement
Q_a = total discharge (cfs)
S = gutter longitudinal slope (ft/ft)
E = function of S and S_X as determined by Equation
S_X = transverse slope (ft/ft)
n = Manning's roughness coefficient.

Equation 6-14 is limited to the following ranges of variables: total discharge ≤ 5.5 cfs longitudinal gutter slope ≤ 0.09 ft/ft roughness coefficient (n) in the curb and gutter: 0.011 ≤ n ≤ 0.017.

Equation 6-15

$$E = 0.207 - 19.084S^2 + 2.613S - 0.0001S_x^{-2} + 0.007S_x^{-1} - 0.049SS_x^{-1}$$

The longitudinal slope exponent (E) is determined with Equation 6-14: Because the equations are empirical, extrapolation is not recommended.

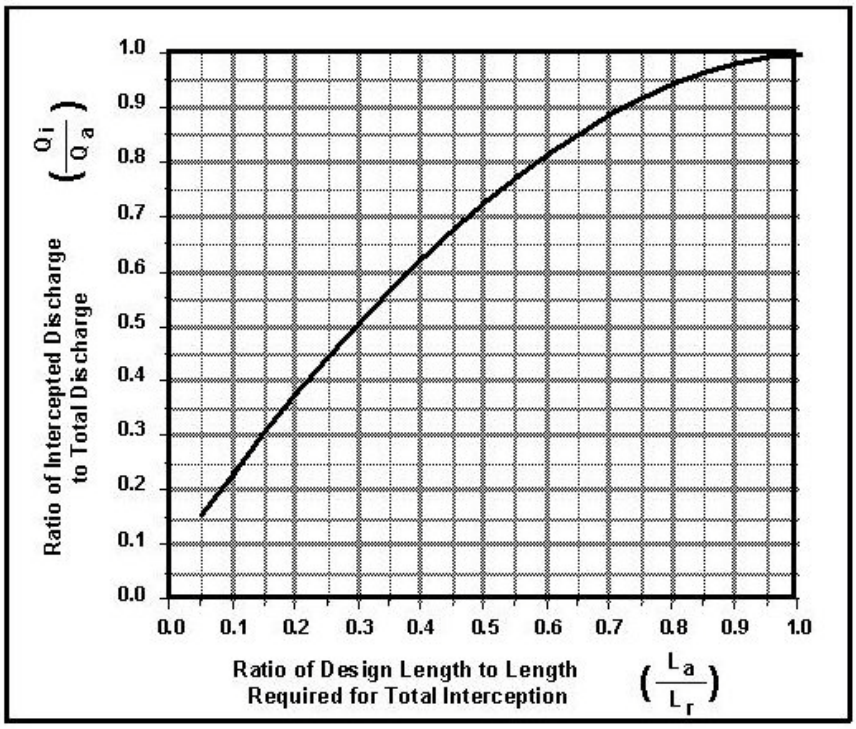
2. Select the desired design slotted drain length (L_a) based on standard inlet sizes. If $L_a < L_r$ the interception capacity may be estimated using Figure 6-5, multiplying the resulting discharge ratios by the total discharge. Alternatively, the carryover for a slotted drain inlet length may be directly computed using Equation 6-16.

Equation 6-16

$$Q_{co} = 0.918\,Q\left(1 - \frac{L_a}{L_r}\right)^{1.769}$$

Where:
Q_{co} = carryover discharge (cfs)
Q = total discharge (cfs)
L_a = design length of slotted drain inlet (ft)
L_r = length of slotted drain inlet required to intercept the total flow (ft).

Figure 6-5: Slotted Drain Inlet Interception Rate



Source: *TxDOT HDM* [4]

As a rule of thumb, you can optimize slotted drain inlets' economy by providing actual lengths (L_a) to required lengths (L_r) in an approximate ratio of about 0.65. This implies a usual design with carryover for on-grade slotted drain inlets.

6.3.5 Grate Inlets On-Grade

The capacity of a grate inlet on-grade depends on its geometry and cross slope, longitudinal slope, total gutter flow, depth of flow, and pavement roughness. The depth of water next to the curb is the major factor affecting the interception capacity of grate inlets. At low velocities, all of the water flowing in the section of gutter occupied by the grate, called frontal flow, is intercepted by grate inlets, and a small portion of the flow along the length of the grate, termed side flow, is intercepted. On steep slopes, only a portion of the frontal flow will be intercepted if the velocity is high or the grate is short and splash-over occurs. For grates less than 2 feet long, intercepted flow is small. Agencies and manufacturers of grates have investigated inlet interception capacity. For inlet efficiency data for various sizes and shapes of grates, refer to *Hydraulic Engineering Circular 12: Drainage of Highway Pavements (HEC 12)* [8].

Grate inlets shall be designed to be twice as large as the theoretical required area.

6.3.5.1 Bicycle Safety

A parallel bar grate is the most efficient type of gutter inlet; however, when crossbars are added for bicycle safety, the efficiency is reduced. Where bicycle traffic is a design consideration, the curved vane grate and the tilt bar grate are recommended for both their hydraulic capacity and bicycle safety

features. In certain locations where leaves may create constant maintenance problems, the parallel bar grate may be used more efficiently if bicycle traffic is prohibited.

6.3.5.2 Design Procedure

Use the following procedure for grate inlets on-grade:

1. Compute the ponded width of flow (T).
2. Choose a grate type and size.
3. Find the ratio of frontal flow to total gutter flow (E_o) for a straight cross-slope using Equation 6-1. No depression is applied to a grate on-grade inlet.
4. Find the ratio of frontal flow intercepted to total frontal flow, R_f, using Equation 6-17, Equation 6-18, and Equation 6-19.

Equation 6-17

$$R_f = 1 - 0.3(v - v_o) \ , if \ v > v_o$$

Equation 6-18

$$R_f = 1.0 \ , if \ v > v_o$$

Where:

R_f = ratio of frontal flow intercepted to total frontal
v = approach velocity of flow in gutter (ft/s)
v_o = minimum velocity that will cause splash over grate (ft/s).

For triangular sections, calculate the approach velocity of flow in gutter (v) using Equation 6-19.

Equation 6-19

$$v = \frac{2Q}{Ty} = \frac{2Q}{T^2 S_x}$$

Otherwise, compute the section area of flow (A) and calculate the velocity using Equation 6-20.

Equation 6-20

$$v = \frac{Q}{A}$$

Calculate the minimum velocity (v_o) that will cause splash over the grate using the appropriate equation in Table 6-1.

Where:
v_o = splash-over velocity (ft/s)
L = length of grate (ft).

Table 6-1: Splash-Over Velocity Calculation Equations

Grate Configuration	Typical Bar Spacing (in.)	Splash-over Velocity Equation
Parallel Bars	2	$v_o = 2.218 + 4.031L - 0.649L^2 + 0.056L^3$
Parallel Bars	1.2	$v_o = 1.762 + 3.117L - 0.451L^2 + 0.033L^3$
Transverse Curved Vane	4.5	$v_o = 1.381 + 2.78L - 0.300L^2 + 0.020L^3$
Transverse 45° Tilted Vane	4	$v_o = 0.988 + 2.625L - 0.359L^2 + 0.029L^3$
Parallel bars w/ transverse rods	2 parallel / 4 trans	$v_o = 0.735 + 2.437L - 0.265L^2 + 0.018L^3$
Transverse 30° Tilted Vane	4	$v_o = 0.505 + 2.344L - 0.200L^2 + 0.014L^3$
Reticuline	n/a	$v_o = 0.030 + 2.278L - 0.179L^2 + 0.010L^3$

Source: *TxDOT HDM* [4]

5. Find the ratio of side flow intercepted to total side flow, R_s.

Equation 6-21

$$R_s = \left[1 + \frac{zv^{1.8}}{S_x L^{2.3}}\right]^{-1}$$

Where:
R_S = ratio of side flow intercepted to total flow
z = 0.15 for English measurement
S_x = transverse slope
v = approach velocity of flow in gutter (ft/s)
L = length of grate (ft).

6. Determine the efficiency of grate, E_f. Use Equation 6-22.

Equation 6-22

$$E_f = \left[R_f E_o + R_s(1 - E_o)\right]$$

7. Calculate the interception capacity of the grate, Q_i. Use Equation 6-23. If the interception capacity is greater than the design discharge, skip step 8.

Equation 6-23

$$Q_i = E_f Q = Q[R_f E_o + R_s(1 - E_o)]$$

8. Determine the carryover, CO. Use Equation 6-24.

Equation 6-24

$$CO = Q - Q_i$$

9. Depending on the carryover, select a larger or smaller inlet as needed. If the carryover is excessive, select a larger configuration of inlet and return to step 3. If the interception capacity far exceeds the design discharge, consider using a smaller inlet and return to step 3.

6.3.6 Design Procedure for Grate Inlets in Sag Configurations

A grate inlet in sag configuration operates in weir flow at low ponding depths. A transition to orifice flow begins as the ponded depth increases. Use the following procedure for calculating the inlet capacity:

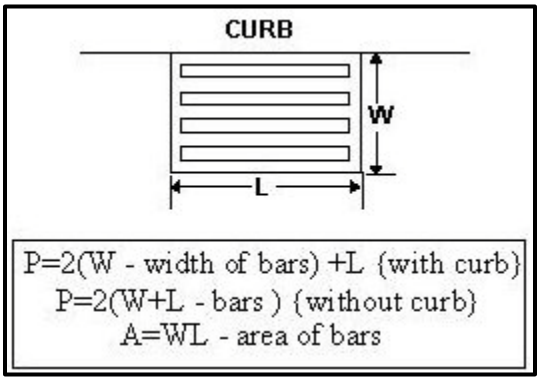
1. Choose a grate of standard dimensions to use as a basis for calculations.
2. Determine an allowable head (h) for the inlet location. This should be the lower of the curb height and the depth associated with the allowable ponded width. No gutter depression is applied at grate inlets.
3. Determine the capacity of a grate inlet operating as a weir. Under weir conditions, the grate perimeter controls the capacity. Figure 6-6 shows the perimeter length for a grate inlet located next to and away from a curb. The capacity of a grate inlet operating as a weir is determined using Equation 6-25.

Equation 6-25

$$Q_w = C_w P^{1.5}$$

Where:
Q_w = weir capacity of grate (cfs)
C_w = weir coefficient = 3 for English measurement
P = perimeter of the grate (ft) as shown in Figure 6-6: A multiplier of 0.5 is required to be applied to the measured perimeter as a safety factor.
h = allowable head on grate (ft).

Figure 6-6: Perimeter Length for Grate Inlet in Sag Configuration



Source: *TxDOT HDM* [4]

4. Determine the capacity of a grate inlet operating under orifice flow. Under orifice conditions, the grate area controls the capacity. The capacity of a grate inlet operating under orifice flow is computed with Equation 6-26.

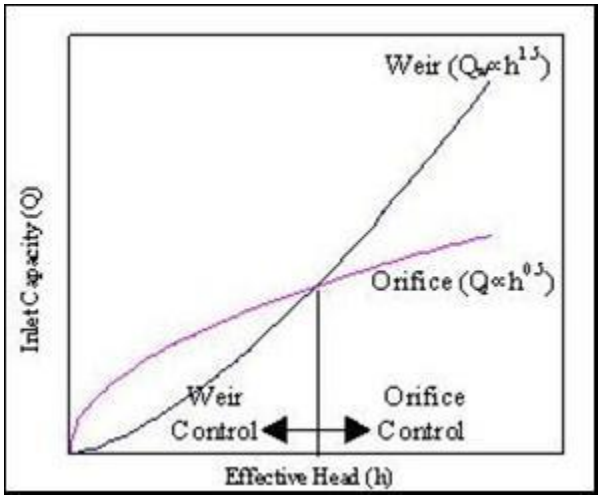
Equation 6-26

$$Q_o = C_o A \sqrt{2 g h}$$

Where:
Q_o = orifice capacity of grate (cfs)
C_o = orifice flow coefficient = 0.67
A = clear opening area (ft²) of the grate (the total area available for flow). A multiplier of 0.5 is required to be applied to the measured area as a safety factor
g = acceleration due to gravity = 32.2 ft/s²
h = allowable head on grate (ft).

5. Compare the calculated capacities from steps 3 and 4 and choose the lower value as the design capacity. The design capacity of a grated inlet in a sag is based on the minimum flow calculated from weir and orifice conditions. Figure 6-7 demonstrates the relationship between weir and orifice flow. If Q_o is greater than Q_w (to the left of the intersection in Figure 6-7), then the designer would use the capacity calculated with the weir equation. If, however, Q_o is less than Q_w (to the right of the intersection), then the capacity as determined with the orifice equation would be used.

Figure 6-7: Relationship between Head and Capacity for Weir and Orifice Flow



Source: *TxDOT HDM* [4]

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7 Storm Drain Systems

7.1 General Requirements

A. Storm drain systems shall be designed for the 25-year design storm with the design hydraulic grade line (HGL) of the system located, at minimum, below the gutter flow line and shall not cause surcharging. Storm drain energy grade lines (EGL) shall remain below top of curb elevation.

B. Storm drain pipe shall be reinforced concrete pipe (AASHTO M170 Class III). Corrugated metal pipe or plastic pipe shall not be permitted for storm drain systems in the public right-of-way.

C. Concrete pipe collars or manufactured transition pieces must be used at all pipe size changes on trunk lines. For all pipe junctions other than manholes and junction boxes, manufactured wye connections should be used, and the angle of intersection shall not be greater than 45 degrees. This includes discharges into box culverts and channels. Laterals shall be connected to trunk lines using manholes or manufactured wye connections. Inlet laterals will connect only one inlet to the trunk line. Vertical curves in the conduit will not be permitted, and horizontal curves must meet manufacturer's requirements for offsetting of the joints.

D. The maximum manhole and junction box spacing for storm drain systems are shown in Table 7-1. Manholes or junction boxes shall also be place at: pick up points having three or more laterals; trunk line size changes for pipes with diameter differences greater than 24 inches; vertical alignment changes; and, future collection points. The requirement for manholes may be waived if the pipe size allows direct access into the pipe by maintenance personnel and equipment.

E. The crown of circular pipe should be at minimum 6 inches below design pavement section and should be based on the type of pipe used, the expected loads and the supporting strength of the pipe. Box sections should normally have a minimum of one foot of cover; however, box sections may be designed for direct traffic in special situations with approval.

F. Grates for drop inlets should be designed to facilitate removal for maintenance, but minimize vandalism. Design shall consider traffic loading, bicycle and pedestrian safety, and a means to secure grate.

G. The minimum lateral and trunk line pipe shall be 24 inches.

H. At no time shall bypass flow exceed the water spread limits for roadways as defined by Table 5-1. Inlets shall be located to prevent water convergence and/or excessive flows through intersections.

I. For arterial or collector streets with super-elevated sections, no more than 3 cubic feet per second of the 25-year flow will be allowed to cross flow from the higher elevation to the lower elevation.

J. All storm sewer conduits to be dedicated to the City of New Braunfels, and outside of the right-of-way, shall be located in drainage easements dedicated to the City of New Braunfels at the time of final platting of the property. Storm sewer easements shall be at least 15 feet wide. Wider easements may be required to accommodate larger storm drain systems.

Table 7-1: Maximum Spacing of Manholes and Junction Boxes

Pipe Diameter (in)	Max. Spacing (ft)
24	400
27-39	800
42-60	1,000
Larger than 60	1,200

7.2 Design Criteria

A. Storm drain systems shall be designed for the 25-year design storm and evaluated for the 100-year design storm. Systems shall be designed with Manning's Equation and step backwater methodology outlined in the *TxDOT HDM* and summarized in this section. The minimum coefficient of roughness for concrete storm drain pipe is 0.013.

B. The minimum velocity in a conduit shall be 2.5 feet per second for the 25-year design storm. This minimum velocity is required to minimize or prevent the accumulation of sediment in the system. Such sediment accumulation can severely reduce to ability of the system to convey the design flow.

C. Maximum velocities in conduits are important because of the possibility of excessive erosion of the storm drainpipe material. Table 7-2 lists the maximum velocities allowed. Maximum flow velocities at the downstream end of pipe systems shall be consistent with the maximum allowable velocities for the receiving channel (refer to **Section 8**). Erosion protection is required for outfalls into natural channels.

D. The maximum discharge velocities in the pipe shall not exceed the design velocity of the receiving channel or conduit at the outfall. The maximum outfall velocity of a conduit in partial flow shall be computed for partial depth and shall not exceed the maximum permissible velocity of the receiving channel unless controlled by an appropriate energy dissipater.

E. When establishing the hydraulic gradient of a storm sewer, entrance and exit losses, expansion losses, manhole and bend losses, junction losses, and minor head losses at points of turbulence shall be calculated and included in the computation of the hydraulic gradient.

F. The flow lines of storm sewer conduits that discharge into open channels shall be higher than or equal to the flow line of the channel. Storm sewer outfall pipes shall not be at sump with the receiving channel.

G. Pipe diameters shall increase downstream. Pipe size and slope shall be designed so that the velocity of flow will increase progressively down the system or at least will not appreciably decrease at inlets, bends or other changes in geometry or configuration to prevent sedimentation.

H. At points of change in storm drain size, pipe crowns (soffits) shall be set at the same elevation.

Table 7-2: Maximum Velocity in Storm Drains

Storm Drain Type	Maximum Velocity
Inlet Laterals (shorter than 30 feet)	No Limit
Inlet Laterals (longer than 30 feet)	15 feet per second
Trunk Lines	15 feet per second

7.3 Calculation of the Hydraulic Grade Line

The 25-year and 100-year frequency hydraulic grade line (HGL) shall be computed and plotted for all storm drain systems. The 25-year frequency hydraulic grade line shall be calculated throughout the system and shall be at least two feet below the theoretical gutter line at the entrance to the inlet. The determination of friction losses and minor losses are required for these calculations.

7.3.1 Tailwater Conditions

A. The designer must determine the tailwater conditions at the downstream end of the proposed storm drain system when calculating the hydraulic performance of the system. When proposed storm drains are to discharge into existing watercourses, the tailwater elevation used in hydraulic calculations of the proposed storm drain system will be determined by the design engineer. The tailwater elevation shall be the greater of the water surface of the receiving stream and the minimum outlet water surface, y_m, both in feet above mean sea level (ft msl). The minimum water surface, y_m, is derived from the following equations:

Equation 7-1

$$y_m = \frac{(D_0 + y_c)}{2} + FL$$

Where:
y_m = minimum water surface elevation of the pipe (ft msl)
D_0 = pipe outlet diameter (ft)
y_c = critical depth of the channel for a given flow and geometric conditions (ft)
FL = flow line of the pipe, lateral, trunk, or channel (ft msl).

The critical depth, y_c, is determined by the following equation for Froude Number, which is set equal to 1.0 and solved for depth:

Equation 7-2

$$1.0 = \frac{\left({}^{Q}/_{A}\right)}{(gD)^{0.5}}$$

Where:
Q = flow in the inlet pipe (cfs)
A = cross-sectional area of the flow (ft^2)
D = diameter of the inlet pipe (ft)
g = acceleration due to gravity = 32.2 ft/sec^2

B. Storm drain outfalls to a river or stream creates the need to consider the joint or coincidental probability of two hydrologic events occurring at the same time to adequately determine the elevation of the tailwater in the receiving stream. The relative independence of the discharge from the storm drainage system can be qualitatively evaluated by a comparison of the drainage area of the receiving stream to the area of the storm drainage system. For example, if the storm drainage system has a drainage area much smaller than that of the receiving stream, the peak discharge from the storm drainage system may be out of phase with the peak discharge from the receiving watershed. In this case, it would be necessary to establish an appropriate design tailwater elevation for a storm drainage system based on the expected coincident storm frequency on the outfall channel. The area ratio shown in Figure 7-3 is the ratio of the main stream (receiving area) to the tributary (storm system drainage area).
C. The designer must also perform a “Normal Depth” outfall analysis to determine the maximum outlet velocities of the facility. This analysis includes solving the downstream boundary condition using Manning’s Equation for Normal Depth.

Table 7-3: Frequencies for Coincidental Occurrences

Area Ratio	2-Year design		5-Year Design	
	Main Stream	Tributary	Main Stream	Tributary
10,000:1	1	2	1	5
	2	1	5	1
1,000:1	1	2	2	5
	2	1	5	2
100:1	2	2	2	5
	2	2	5	5
10:1	2	2	5	5
	2	2	5	5
1:1	2	2	5	5
	2	2	5	5
Area Ratio	**10-year design**		**25-year design**	
	Main Stream	**Tributary**	**Main Stream**	**Tributary**
10,000:1	1	10	2	25
	10	1	25	2
1,000:1	2	10	5	25
	10	2	25	5
100:1	5	10	10	25
	10	5	25	10
10:1	10	10	10	25
	10	10	25	10
1:1	10	10	25	25
	10	10	25	25
Area Ratio	**50-year design**		**100-year design**	
	Main Stream	**Tributary**	**Main Stream**	**Tributary**
10,000:1	2	50	2	100
	50	2	100	2
1,000:1	5	50	10	100
	50	5	100	10
100:1	10	50	25	100
	50	10	100	25
10:1	25	50	50	100
	50	25	100	50
1:1	50	50	100	100
	50	50	100	100
Source: *TxDOT HDM* [4]				

7.3.2 Friction Losses

Friction losses or major losses shall be computed using Manning's Equation. The friction loss (h_f) for a segment of conduit is defined by the product of the friction slope at full flow and the length of the conduit. Per the *TxDOT HDM*, the simplified form of the equation is shown in Equation 7-3.

Equation 7-3

$$h_f = \frac{Q^2 n^2}{z^2 A^2 R^{4/3}} L$$

Where:
Q = discharge (cfs)
n = Manning's roughness coefficient
z = 1.486 for use with English measurements only
A = cross-sectional area of flow (ft^2)
R = hydraulic radius (ft)
L = length of pipe (ft).

7.3.3 Minor Energy Losses

Minor energy losses in storm drains are attributed from junctions, bends, manholes or inlets, and expansions and contractions. Minor energy losses are required to be evaluated when designing a storm drain system. The following equations and methods shall be used when designing a storm drain system and are base on design information in the *TxDOT HDM*.

7.3.3.1 Junction Loss Equation

A pipe junction is the connection of a lateral pipe to a larger trunk pipe without the use of an access hole. The minor loss equation for a pipe junction is in the form of the momentum equation. In Equation 7-4, the subscripts "i", "o", and "1" indicate the inlet, outlet and lateral, respectively.

Equation 7-4

$$h_j = \frac{Q_o v_o - Q_i v_i - Q_1 v_1 cos\theta}{0.5 g (A_o + A_i)}$$

Where:

h_j = junction head loss (ft)
Q = flow (cfs)
v = velocity (fps)
A = cross-sectional area (ft^2)
θ = angle in degrees of lateral with respect to centerline of outlet pipe
g = gravitational acceleration = 32.2 ft/s^2.

The above equation applies only if $v_0 > v_i$ and assumes that $Q_o = Q_i + Q_1$.

7.3.3.2 Exit Loss Equation

The exit loss, h_0, is a function of the change in velocity at the outlet of the pipe as shown in Equation 7-5.

Equation 7-5

$$h_o = C_o \frac{v^2 - v_d^2}{2g}$$

Where:
h_o = exit loss (ft)
v = average outlet velocity (fps)
v_d = channel velocity downstream of the outlet (fps)
C_O = exit loss coefficient (0.5 typical).

The above assumes that the channel velocity is lower than the outlet velocity. Note that, for partial flow where the pipe outfalls into a channel with water moving in the same direction, the exit loss may be reduced to virtually zero.

7.3.3.3 Inlet and Access Hole Energy Loss Equations

HEC 22 presents the method to compute energy losses for inlets and access holes.

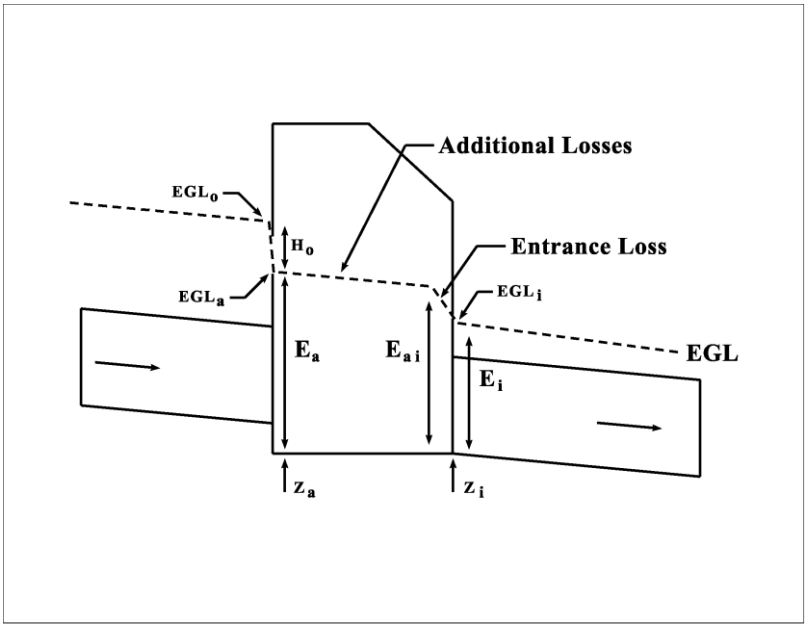
As a starting point, the outflow pipe energy head (E_i) is the difference between the energy gradeline in the outflow pipe (EGL_i) and the outflow pipe flowline (Z_i), as determined in Equation 7-6 and shown on Figure 7-1.

Equation 7-6

$$E_i = EGL_i - Z_i$$

Where:
E_i = Outflow pipe energy head (ft)
EGL_i = Outflow pipe energy gradeline (ft)
Z_i = Outflow pipe flowline elevation (ft).

Figure 7-1: Access Hole Energy Level Definitions



Source: *TxDOT HDM* [4]

Initial Access Hole Energy Level

The initial estimate of energy level (E_{ai}) is taken as the maximum of the three values, E_{aio}, E_{ais}, and E_{aiu}, as determined in Equation 7-7.

Equation 7-7

$$E_{ai} = max(E_{aio}, E_{ais,} E_{aiu})$$

Where:
E_{aio} = estimated access hole energy level for outlet control (full and partial flow)
E_{ais} = estimated access hole energy level for inlet control (submerged)
E_{aiu} = estimated access hole energy level for inlet control (unsubmerged).

E_{aio} – Estimated Energy Level for Outlet Control

In the outlet control condition, flow out of the access hole is limited by the downstream storm drain system. The outflow pipe would be in subcritical flow and could be either flowing full or partially full. Whether the outflow pipe is flowing full or partially full affects the value of E_{aio}. This can be determined by describing and rearranging the outflow pipe energy head E_i. E_i can be described as the sum of the potential head, pressure head, and velocity head, as shown in Equation 7-8.

Equation 7-8

$$E_i = y + \left({}^{P}/_{\gamma}\right) + \frac{V^2}{2g}$$

Where:
y = Outflow pipe depth (potential head) (ft)
(P/γ) = Outflow pipe pressure head (ft)
$V^2/2g$ = Outflow pipe velocity head (ft).

Rearranging Equation 7-8 to isolate the potential head and pressure head gives Equation 7-9.

Equation 7-9

$$y + \left({}^{P}/_{\gamma}\right) = E_i - \frac{V^2}{2g}$$

If $y + (P/\gamma)$ is less than the diameter of the outflow pipe, then the pipe is in partial flow and the estimated initial structure energy level (E_{aio}) is equal to zero ($E_{aio} = 0$).

If $y + (P/\gamma)$ is greater than the diameter of the outflow pipe, then the pipe is in full flow, and the estimated initial structure energy level (E_{aio}) is calculated using Equation 7-10:

Equation 7-10

$$E_{aio} = E_i + H_i$$

Where:
E_i = Outflow pipe energy head (ft)
H_i = entrance loss assuming outlet control, using Equation 7-11.

Equation 7-11

$$H_i = 0.2\frac{V^2}{2g}$$

Where:
$V^2/2g$ = Outflow pipe velocity head (ft).

E_{ais} – Estimated Energy Level for Inlet Control: Submerged

The submerged inlet control energy level (E_{ais}) checks the orifice condition and is estimated using Equation 7-12:

Equation 7-12

$$E_{ais} = D_o(DI)^2$$

Where:
D_o = Diameter of outflow pipe (ft)
DI = Discharge Intensity parameter, calculated by Equation 7-13:

Equation 7-13

$$DI = \frac{Q}{[A(gD_o)^{0.5}]}$$

Where:
DI = discharge Intensity parameter
Q = flow in outfall pipe (cfs)
A = area of outflow pipe (ft^2)
D_o = diameter of outflow pipe (ft).

E_{aiu} – Estimated Energy Level for Inlet Control: Unsubmerged

The unsubmerged inlet control energy level (E_{aiu}) checks the weir condition and is estimated using Equation 7-14:

Equation 7-14

$$E_{aiu} = 1.6D_o(DI)^{0.67}$$

Adjustments for Benching, Angled Flow, and Plunging Flow

The revised access hole energy level (E_a) is determined by adding three loss factors for: (1) benching configurations; (2) flows entering the structure at an angle; and (3) plunging flows. Flows entering a structure from an inlet can be treated as plunging flows and determined by Equation 7-15.

Equation 7-15

$$E_a = E_{ai} + H_a$$

Where:
E_a = the revised access hole energy level
E_{ai} = the initial estimate of access hole energy level, calculated using Equation 7-7
H_a = additional energy loss due to benching, angled inflow and plunging inflow, calculated using Equation 7-16.

If E_a is calculated to be less than the outflow pipe energy head (E_i), then E_a should be set equal to E_i.

Equation 7-16

$$H_a = (C_B + C_\theta + C_p)(E_{ai} - E_i)$$

Where:

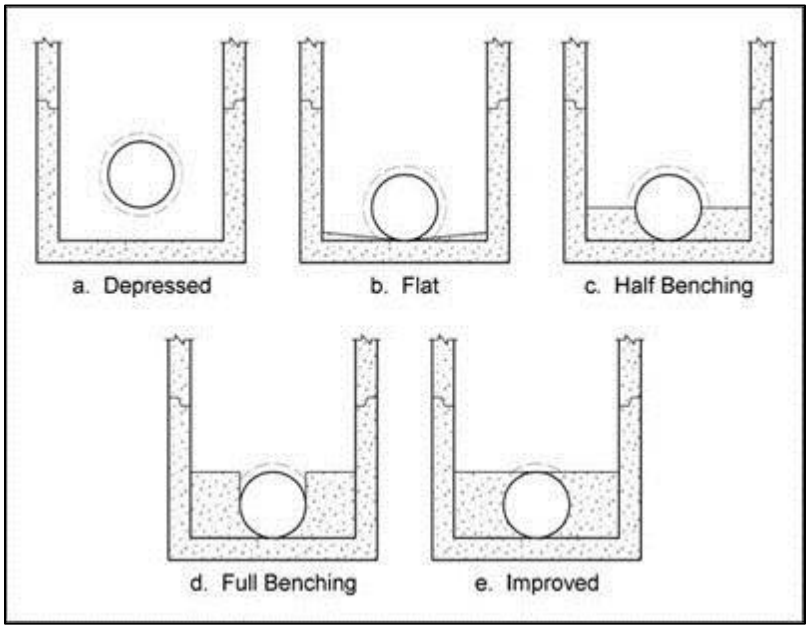
C_B = Coefficient for benching (floor configuration)
C_θ = Coefficient for angled flows
C_P = Coefficient for plunging flows.

Note that the value of H_a should always be positive. If not, H_a should be set to zero.

Additional Energy Loss: Benching

Benching serves to direct flow through the access hole, which reduces energy losses. Figure 7-2 illustrates some typical bench configurations.

Figure 7-2: Access hole benching methods



Source: *TxDOT HDM* [4]

The energy loss coefficient for benching, (C_B), is obtained from Table 7-4. A negative value indicates water depth will be decreased rather than increased.

Table 7-4: Values for the Coefficient, CB

Floor Configuration	C_B
Flat (level)	-0.05
Depressed	0.0
Unknown	-0.05

Source: *TxDOT HDM* [4]

Additional Energy Loss: Angled Inflow

The angles of all inflow pipes into the access hole are combined into a single weighted angle (θ_w) using Equation 7-17:

Equation 7-17

$$\theta_W = \Sigma\left(\left(Q_J\theta_J\right)\left(\Sigma Q_J\right)\right)$$

Where:
Q_J = Contributing flow from inflow pipe (cfs)
θ_J = Angle measured from the outlet pipe (degrees)(plunging flow is 180 degrees).

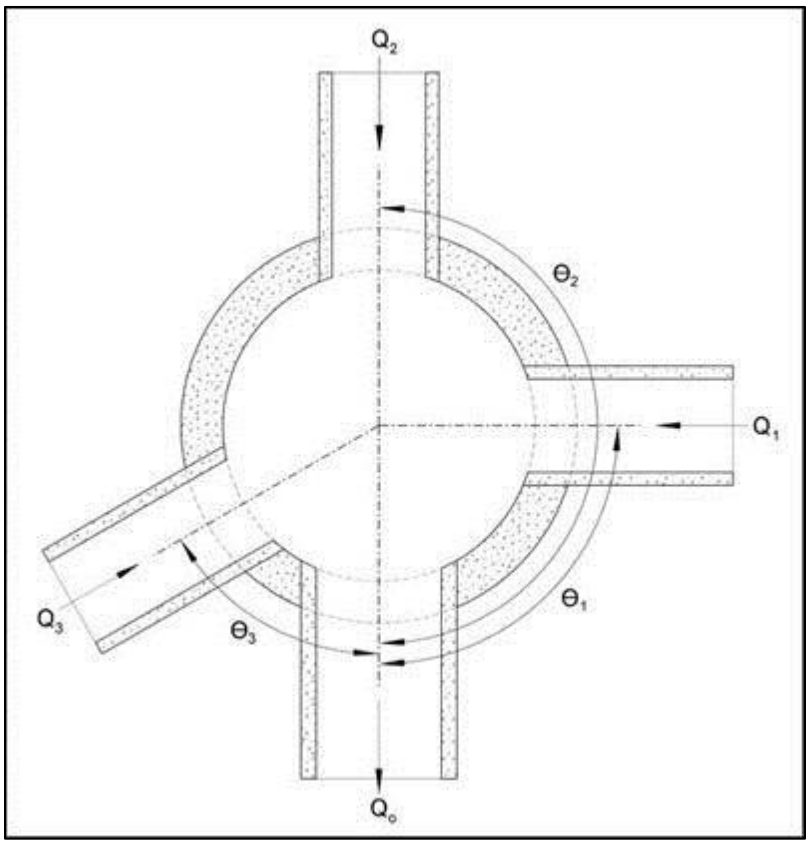
Figure 7-3 illustrates the orientation of the pipe inflow angle measurement. The angle for each inflow pipe is referenced to the outlet pipe, so that the angle is not greater than 180 degrees. A straight pipe angle is 180 degrees. If all flows are plunging, θ_w is set to 180 degrees; the angled inflow coefficient approaches zero as θ_w approaches 180 degrees and the relative inflow approaches zero. The angled inflow coefficient (C_θ) is calculated by Equation 7-18:

Equation 7-18

$$C_\theta = 4.5\frac{\left(\sum Q_J\right)}{Q_o}\cos\left(\frac{\theta_W}{2}\right)$$

Where:
Q_o = Flow in outflow pipe (cfs).

Figure 7-3: Access hole angled inflow definition



Source: *TxDOT HDM* [4]

Additional Energy Loss: Plunging Inflow

Plunging inflow is defined as inflow from an inlet or a pipe where the pipe flowline is above the estimated access hole water depth (approximated by E_{ai}).

The relative plunge height (h_k) for each inflow pipe is calculated using Equation 7-19

Equation 7-19

$$h_k = \frac{(Z_k - E_{ai})}{D_o}$$

Where:
Z_k = the difference between the inflow pipe flowline elevation and the access hole flowline elevation. If $Z_k > 10D_o$ it should be set to $10D_o$.

The relative plunge height for each inflow pipe is calculated separately and then combined into a single plunging flow coefficient (C_P):

Equation 7-20

$$C_p = \frac{\sum(Q_k H_k)}{Q_o}$$

As the proportion of plunging flows approaches zero, C_P also approaches zero.

Access Hole Energy Gradeline

Knowing the access hole energy level (E_a) and assuming that the access hole flowline (Z_a) is the same elevation as the outflow pipe flowline (Z_i) allows determination of the access hole energy gradeline (EGL_a):

Equation 7-21

$$EGL_a = E_a + Z_a$$

As described earlier, the potentially highly turbulent nature of flow within the access hole makes determination of water depth problematic. Research has shown that determining velocity head within the access hole is very difficult, even in controlled laboratory conditions. However, a reasonable assumption is to use the EGL_a as a comparison elevation to check for potential surcharging of the system.

Inflow Pipe Exit Losses

The final step is to calculate the energy gradeline into each inflow pipe, whether plunging or non-plunging.

Non-Plunging Inflow Pipe

Non-plunging inflow pipes are those pipes with a hydraulic connection to the water in the access hole. Inflow pipes operating under this condition are identified when the revised access hole energy gradeline (E_a) is greater than the inflow pipe flowline elevation (Z_o). In this case, the inflow pipe energy head (EGL_o) is equal to:

Equation 7-22

$$EGL_o = EGL_a + H_o$$

Where:
$H_o = 0.4(V^2/2g)$ = Inflow pipe exit loss.

Exit loss is calculated in the traditional manner using the inflow pipe velocity head since a condition of supercritical flow is not a concern on the inflow pipe.

Plunging Inflow Pipe

For plunging inflow pipes, the inflow pipe energy gradeline (EGL_o) is logically independent of access hole water depth and losses.

Continuing Computations Upstream

For either the nonplunging or plunging flows, the resulting energy gradeline is used to continue computations upstream to the next access hole. The procedure of estimating entrance losses, additional losses, and exit losses is repeated at each access hole.

7.3.4 Energy Gradeline Procedure

1. Determine the EGL_i and HGL_i downstream of the access hole. The EGL and HGL will most likely need to be followed all the way from the outfall. If the system is being connected to an existing storm drain, the EGL and HGL will be that of the existing storm drain.
2. Verify flow conditions at the outflow pipe.
    a. If HGL_i is greater or equal to the soffit of the outflow pipe, the pipe is in full flow.
    b. If HGL_i is less than the soffit of the outflow pipe but greater than critical depth, the pipe is not in full flow but downstream conditions still control.
    c. If HGL_i is less than the soffit of the outflow pipe but greater than critical depth and less than or equal to normal depth, the pipe is in subcritical partial flow. EGL_i becomes the flowline elevation plus normal depth plus the velocity head.
    d. If HGL_i is less than critical depth, the pipe is in super-critical partial flow conditions. Pipe losses in a supercritical pipe section are not carried upstream.
3. Estimate E_i (outflow pipe energy head) by subtracting Z_i (pipe flowline elevation) from the EGL_i using Equation 7-6. Calculate $y + P/\gamma$ using Equation 7-9. Compute DI using Equation 7-13.
4. Calculate E_{ai} as maximum of E_{aio}, E_{ais}, and E_{aiu} as below:
    a. If $(y + P/\gamma) > D$, then the pipe is in full flow and $E_{aio} = E_i + H_i$ (Equation 7-10). If $(y + P/\gamma) < D$, then the pipe is in partial flow and $E_{aio} = 0$.
    b. $E_{ais} = D_o(DI)^2$ (Equation 7-12)
    c. $E_{aiu} = 1.6\ D_o(DI)^{0.67}$ (Equation 7-14)

    If $E_{ai} < E_i$, the head loss through the access hole will be zero, and $E_{ai} = E_i$. Go to Step 10.

5. Determine the benching coefficient (C_B) using Table 7-4. The values are the same whether the bench is submerged or unsubmerged.
6. Determine the energy loss coefficient for angle flow (C_θ) by determining θ_W for every pipe into the access hole.
    a. Is $E_i <$ inflow pipe flowline? If so, then the flow is plunging and θ_W for that pipe is 180 degrees.
    b. If the pipe angle is straight, then θ_W for that pipe is 180 degrees.
    c. Otherwise, θ_W is the angle of the inflow pipe relevant to the outflow pipe. Maximum angle is 180 degrees (straight).

Use Equation 7-17 and Equation 7-18 to calculate θ_W and C_θ.

7. Determine the plunging flow coefficient (C_P) for every pipe into the access hole using Equation 7-20. The relative plunge height (h_k) is calculated using Equation 7-19. Z_k is the difference between the access hole flowline elevation and the inflow pipe flowline elevation. If $Z_k > 10D_o$, Z_k should be set to $10D_o$.
8. If the initial estimate of the access hole energy level is greater than the outflow pipe energy head ($E_{ai} > E_i$), then $E_a = E_i$. If $E_{ai} < E_i$, then $H_a = (E_{ai} - E_i)(C_B + C_\theta + C_P)$. If $H_a < 0$, set $H_a = 0$.
9. Calculate the revised access hole energy level (E_a) Equation 7-15. If $E_a < E_i$, set $E_a = E_i$.
10. Compute EGL_a by adding E_a to the outflow pipe flowline elevation. Assume HGL_a at the access hole structure is equal to EGL_a.
11. Compare EGL_a with the critical elevation (ground surface, top of grate, gutter elevation, or other limits). If EGL_a exceeds the critical elevation, modifications must be made to the design.

7.4 Hydraulic Grade Line Computation Sheet

The design engineer shall provide a HGL computation sheet that depicts all forms or energy loss for each junction and pipe connection and identifies the upstream and downstream HGL and EGL elevations. These computations shall be provided for the design storm and 100-year assessment.

8 Open Channels

8.1 General Requirements

The general classifications for open channels are: (1) Natural channels, which include all watercourses that have been carved by nature through erosion; and (2) Engineered channels, which are constructed or existing channels that have been significantly altered by human effort.

A. The City of New Braunfels encourages the preservation of natural channels and drainage patterns. Developed drainage flows must enter and depart from a developed area in the same manner and location as under pre-development conditions. Any concentration of previous over-land flow is required to leave the developed site into a receivable body such as a drainage easement or city right-of-way in a manner so as to not impact downstream properties and/or facilities.
B. Easements or drainage rights-of-way shall be provided for all open channels such that the 100-year runoff and maintenance access are contained within drainage easements and/or right-of-way. Drainage easements shall be designated on plats for recording. For properties with existing structural development on previously platted lots, additional drainage easements shall be dedicated by separate recorded instrument or an amended plat. Easements and FEMA floodways shall not be encroached upon with fill materials or structures, which would reduce the channel's ability to carry the 100-year flood.
    a. Easement width shall be at least the width of the water surface from the 100-year design storm runoff under post-development conditions plus maintenance access. Maintenance access shall extend 2 feet from one side of the channel and 12 feet on the other side of the channel. If a channel is located parallel and adjoining a roadway, maintenance access shall extend 2 feet from both sides of the channel.
    b. Additional easement width should be provided to allow for channel meandering near bends of channels
C. Engineered channels shall be designed to meet the applicable design, freeboard and easement requirements. Freeboard along the outside of channel bends shall include the increased water surface due to superelevation.
D. Fencing and/or warning signs should be required to prevent public access where flowing water would pose a safety hazard. Fencing shall be designed in such a way as to not pose a drainage obstruction.
E. Shear stress shall be computed for all open channels and adequate protection provided in accordance with *Hydraulic Engineering Circular 15: Design of Roadway Channels with Flexible Linings (HEC 15)* [9]. Channels shall be designed to be stable and to not create safety hazards. Side slopes of vegetative lined channels should be 3:1 or flatter (4:1 or flatter along roadways) in channels with depths greater than 2 feet. Recommended maximum water velocities for earthen channels are given in Table 8-1. Erosion control or energy dissipation devices should be used to control velocities such that channel degradation does not occur. Bank stabilization measures shall not reduce channel capacity and shall follow sound engineering practices

Table 8-1: Maximum Velocity in Open Channels

Channel Lining Material[1]	Channel Slope (%)	Maximum Velocity (fps)
Earthen Channels	0 – 5	6
	5 – 10	5
	> 10	4
Rock (native subgrades)		10
Gabion Lined		12
Reinforced concrete lining		20
Rock Riprap (placed rock)		12
Prefabricated lining products		Use 90% of manufacturer's recommended velocity limits

[1] *Uniform, in well-maintained condition.*

F. Should diversion of a natural drainage way be required, sufficient work shall be done upstream and/or downstream to provide all affected properties at least the same level of flood protection and erosion control that existed prior to the diversion. The time length of a diversion channel must be at least as long as the segment of natural channel being replaced so that velocity is not increased.

G. Fencing shall be required adjacent to the channel where channel vertical wall heights exceed 30 inches and where channel side slopes exceed 2:1 and the depth is greater than 30 inches. Fencing shall be a minimum of 42 inches high, provide for maintenance access and not hinder sight distance for traffic. Fence type and location shall be determined by the design engineer.

H. Concrete pilot channels shall be provided for channels with longitudinal slopes less than 0.5 percent or bottom widths greater than 30 feet. The minimum bottom width of the pilot channel shall be 4 feet and the minimum earthen slope draining toward the pilot channel shall be 1 percent.

8.2 Design Criteria

A. The depth and velocity of flow are necessary for the design and analysis of channel linings and structures. The depth and velocity at which a given discharge flows in a channel of known geometry, roughness, and slope can be determined through hydraulic analysis. The following two methods are commonly used in the hydraulic analysis of open channels:

1. Slope Conveyance Method
2. Standard Step Backwater Method

The Slope Conveyance and Standard Step Backwater Methods have been summarized from the *TxDOT HDM*.

B. Channels should have sufficient gradient, depending upon the type of soil or channel lining material, to provide velocities that will be self-cleaning (greater than 2 feet per second for the 2-year storm event) but not cause erosion due to excessive shear stress.

C. Appropriate energy dissipating structures may be used to control erosion due to high velocities at pipe system outfalls and steep grades and shall be designed in accordance with accepted design

practices such as outlined by the Soil Conservation Service, the Corps of Engineers, the Bureau of Land Reclamation, or TxDOT.

8.3 Channel Capacity

Per *HEC 22*, the most commonly used equation for solving steady, uniform flow problems is the Manning's Equation (Equation 8-1). The depth of flow in steady, uniform flow is called the normal depth.

Equation 8-1

$$v = \frac{z}{n} R^{2/3} S^{1/2}$$

Where:

v = velocity (cfs)
z = 1.486 for English measurement units
n = Manning's roughness coefficient (a coefficient for quantifying the roughness characteristics of the channel)
R = hydraulic radius (ft) = A/WP
WP = wetted perimeter of flow (the length of the channel boundary in direct contact with the water) (ft) and A = area of conveyance (ft^2)
S = slope of the energy gradeline (ft/ft) (For uniform, steady flow, S = channel slope, ft/ft).

Combine Manning's Equation with the continuity equation to determine the channel uniform flow capacity as shown in Equation 8-2.

Equation 8-2

$$Q = \frac{z}{n} A R^{2/3} S^{1/2}$$

Where:
Q = discharge (cfs)
z = 1.486 for English measurement units
A = cross-sectional area of flow (ft^2).

For convenience, Manning's Equation in this manual assumes the form of Equation 8-2. Since Manning's Equation does not allow a direct solution to water depth (given discharge, longitudinal slope, roughness characteristics, and channel dimensions), an indirect solution to channel flow is necessary.

8.4 Roughness Coefficients

All hydraulic conveyance formulas quantify roughness subjectively with a coefficient. In Manning's Equation, the roughness coefficients, or n-values, for Texas streams and channels range from 0.200 to 0.012; values outside of this range are probably not realistic. Determination of a proper n-value is the

most difficult and critical of the engineering judgments required when using the Manning’s Equation. The recommended Manning's roughness coefficients ("N" values) for use in open channel hydraulic calculations are listed in Table 8-2.

Table 8-2: Manning's Roughness Coefficients

Natural Channels	Min	Normal	Max
Minor Streams (top width at flood stage <30 meters)			
Streams on plain:			
♦ Clean, straight, full stage, no rifts or deep pools	0.025	0.030	0.033
♦ Same as above, but more stones and weeds	0.030	0.035	0.040
♦ Clean, winding, some pools and shoals	0.033	0.040	0.045
♦ Same as above, but some stones and weeds	0.035	0.045	0.050
♦ Same as above, but lower stages, more ineffective slopes and sections	0.040	0.048	0.055
♦ Clean, winding, some pools and shoals, some weeds and many stones	0.045	0.050	0.060
♦ Sluggish reaches, weedy, deep pools	0.050	0.070	0.080
♦ Very weedy reaches, deep pools, or floodways with heavy stand of timber and underbrush	0.075	0.100	0.150
Mountain streams, no vegetation in channel, banks usually steep, trees and brush along banks submerged at high stages:			
♦ Bottom: gravel, cobbles, and few boulders	0.030	0.040	0.050
♦ Bottom: cobbles with large boulders	0.040	0.050	0.070
Flood Plains			
Pasture, no brush:			
♦ Short grass	0.025	0.030	0.035
♦ High grass	0.030	0.035	0.050
Cultivated areas:			
♦ No crop	0.020	0.030	0.040
♦ Mature row crops	0.025	0.035	0.045
♦ Mature field crops	0.030	0.040	0.050
Brush:			
♦ Scattered brush, heavy weeds	0.035	0.050	0.070
♦ Light brush and trees, in winter	0.035	0.050	0.060
♦ Light brush and trees, in summer	0.040	0.060	0.080
♦ Medium to dense brush, in winter	0.045	0.070	0.110
♦ Medium to dense brush, in summer	0.070	0.100	0.160
Trees:			
♦ Dense willows, summer, straight	0.110	0.150	0.200
♦ Cleared land with tree stumps, no sprouts	0.030	0.040	0.050
♦ Same as above, but with heavy growth of sprouts	0.050	0.060	0.080
♦ Heavy stand of timber, a few down trees, little undergrowth, flood stage below branches	0.080	0.100	0.120
♦ Same as above, but flood stage reaching branches	0.100	0.120	0.160
Major Streams (top width at flood stage >30 meters)			
♦ Regular section with no boulders or brush	0.025	--	0.060
♦ Irregular and rough section	0.035	--	0.100
Lined Channels			
♦ Concrete-lined	0.012	--	0.018
♦ Concrete rubble	0.017	--	0.030
Unlined Channels			
♦ Earth, straight and uniform	0.017	--	0.025
♦ Winding and sluggish	0.022	--	0.030
♦ Rocky beds, weeds on bank	0.025	--	0.040
♦ Earth bottom, rubble sides	0.028	--	0.035
♦ Rock cuts	0.025	--	0.045
Source: *TxDOT HDM* [4]			

In some instances, such as a trapezoidal section under a bridge, the n-value may vary drastically within a section, but the section should not be sub-divided. If the n-value varies as such, use a weighted n-value (n_w). This procedure is defined by Equation 8-3 as follows:

Equation 8-3

$$n_w = \frac{\sum(n\,WP)}{\sum WP}$$

Where:
WP = subsection wetted perimeter
n = subsection n-value.

8.5 Subdividing Cross-Sections

Because any estimating method involves the calculation of a series of hydraulic characteristics of the cross section, arbitrary water-surface elevations are applied to the cross section. The computation of flow or conveyance for each water-surface application requires a hydraulic radius. The hydraulic radius is intended as an average depth of a conveyance. A hydraulic radius and subsequent conveyance is calculated under each arbitrary water surface elevation. If there is significant irregularity in the depth across the section, the hydraulic radius may not accurately represent the flow conditions. Divide the cross section into sufficient subsections so that realistic hydraulic radii are derived.

Subdivide cross sections primarily at major breaks in geometry. Additionally, major changes in roughness may call for additional subdivisions. Subdivisions for major breaks in geometry or for major changes in roughness should maintain these approximate basic shapes so that the distribution of flow or conveyance is nearly uniform in a subsection.

Documentation must be submitted by the design engineer describing the methodology used to subdivide cross sections for review and approval by the City Engineer.

8.6 Slope Conveyance Method

The Slope Conveyance Method requires more judgment and assumptions than the Standard Step Method. In many situations, however, use of the Slope Conveyance Method is justified, as in the following conditions:

- Standard roadway ditches
- Culverts
- Storm drain outfalls

The procedure involves an iterative development of calculated discharges associated with assumed water surface elevations in a typical section. The series of assumed water surface elevations and associated discharges comprise the stage-discharge relationship. When stream gauge information exists, a measured relationship (usually termed a “rating curve”) may be available.

A channel cross section and associated roughness and slope data considered typical of the stream reach are required for this analysis. A typical section is one that represents the average characteristics of the stream near the point of interest. This cross section should be located downstream of and as close as reasonably possible to the proposed drainage facility discharge site. The closer to the proposed site a typical cross section is taken, the less error in the final water surface elevation

A typical cross section should be used for the analysis. If a cross section does not exist, then a "control" cross section (also downstream) should be used. The depth of flow in a control cross section is controlled by a constriction of the channel, a damming effect across the channel, or possibly an area with extreme roughness coefficients. The cross section should be normal to the direction of stream flow under flood conditions.

After identifying the cross section, apply Manning's roughness coefficients (n-values). Divide the cross section with vertical boundaries at significant changes in cross-section shape or at changes in vegetation cover and roughness components. Determine the average bed slope near the site.

8.6.1 Slope Conveyance Procedure

The calculation of the stage-discharge relationship should proceed as described in this section.

1. Select a trial starting depth and apply it to a plot of the cross section.
2. Compute the area and wetted perimeter weighted n-value for each submerged subsection.
3. Compute the subsection discharges with Manning's Equation. Use the subsection values for roughness, area, wetted perimeter, and slope. The sum of all of the incremental discharges represents the total discharge for each assumed water surface elevation. NOTE: Compute the average velocity for the section by substituting the total section area and total discharge into the continuity equation (Equation 8-4).
4. Tabulate or plot the water surface elevation and resulting discharge (stage versus discharge).
5. Repeat the above steps with a new channel depth, or add a depth increment to the trial depth. The choice of elevation increment is somewhat subjective. However, if the increments are less than about 0.25 feet, considerable calculation is required. On the other hand, if the increments are greater than 1.5 feet, the resulting stage-discharge relationship may not be detailed enough for use in design.
6. Determine the depth for a given discharge by interpolation of the stage versus discharge table or plot.

Equation 8-4

$$V = \frac{Q}{A}$$

8.7 Standard Step Backwater Method

Calculations of water surface profiles can be accomplished by using the Standard Step Method. Water surface profiles for the design frequency floods shall be computed for all channels and shown on all final drawings.

The Corps of Engineers HEC-RAS Water Surface Profile Programs may also be used to perform standard step backwater calculations, and if used, a summary table shall be submitted to the City. In addition, the design engineer shall provide documentation that justifies the flow regime (subcritical, supercritical, or mixed) used in the analysis. Losses due to changes in velocity, drops, bridge openings, and other obstructions shall be considered in the backwater computations, as described in the HEC-RAS User's Manuals.

Use the Standard Step Method for analysis in the following instances:

- Results from the Slope-Conveyance Method may not be accurate enough
- The drainage facility's level of importance deserves a more sophisticated channel analysis
- The channel is highly irregular with numerous or significant variations of geometry, roughness characteristics, or stream confluences
- A controlling structure affects backwater.

This procedure applies to most open channel flow, including streams having an irregular channel with the cross section consisting of a main channel and separate overbank areas with individual n-values. Use this method either for supercritical flow or for subcritical flow.

8.7.1 Standard Step Data Requirements

At least four cross sections are required to complete this procedure. The number and frequency of cross sections required is a direct function of the irregularity of the stream reach. The cross sections should represent the reach between them. A system of measurement or stationing between cross sections is also required. Evaluate roughness characteristics (n-values) and associated sub-section boundaries for all of the cross sections.

The selection of cross sections used in this method is critical. As the irregularities of a stream vary along a natural stream reach, accommodate the influence of the varying cross-sectional geometry. Incorporate transitional cross sections into the series of cross sections making up the stream reach.

8.7.2 Standard Step Procedure

The Standard Step Method uses the Energy Balance Equation, Equation 8-5, which allows the water surface elevation at the upstream section (noted as subscript 2) to be found from a known water surface elevation at the downstream section (noted as subscript 1). The following procedure assumes that cross sections, stationing, discharges, and n-values have already been established. Generally, for Texas, the assumption of subcritical flow will be appropriate to start the process. Subsequent calculations will check this assumption.

Equation 8-5

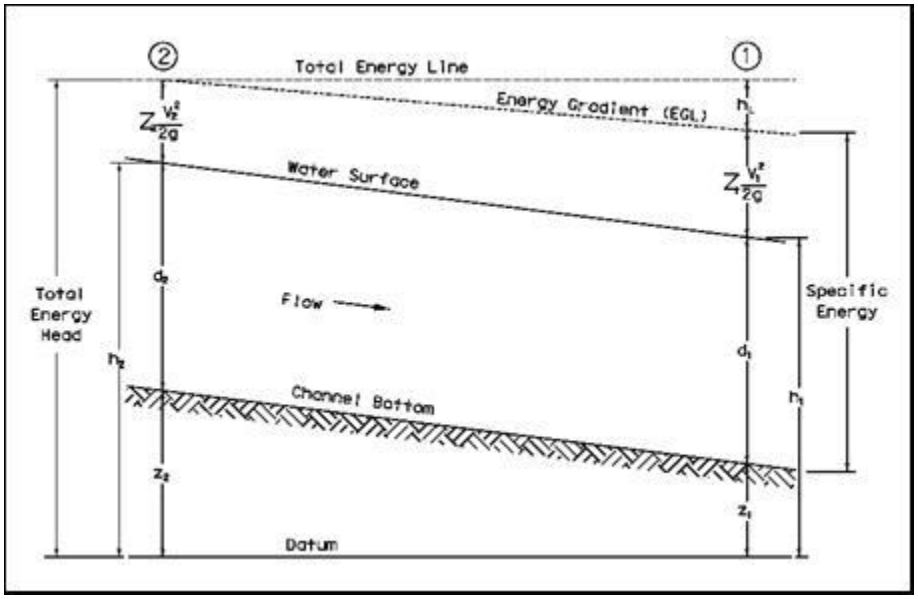
$$z_2 + d_2 + \alpha_2\left(\frac{v_2^2}{2g}\right) = z_1 + d_1 + \alpha_1\left(\frac{v_1^2}{2g}\right) + h_f + other\ losses$$

Where:
z = elevation of the streambed (ft)
d = depth of flow (ft)
α = kinetic energy coefficient
v = average velocity of flow (fps)
h_f = friction head loss from upstream to downstream (ft)
g = acceleration due to gravity = 32.2 ft/ s^2.

1. Select the discharge to be used. Determine a starting water surface elevation. For subcritical flow, begin at the most downstream cross section. Use one of the following methods to establish a starting water surface elevation for the selected discharge: a measured elevation, the Slope-Conveyance Method to determine the stage for an appropriate discharge, or an existing (verified) rating curve.
2. Referring to Figure 8-1 and Equation 8-5, consider the downstream water surface to be section 1 and calculate the following variables:

   z_1 = flowline elevation at section 1
   y_1 = tailwater minus flowline elevation
   α= kinetic energy coefficient (For simple cases or where conveyance does not vary significantly, it may be possible to ignore this coefficient).

Figure 8-1: EGL for Water Surface Profile



Source: *TxDOT HDM* [4]

3. From cross section 1, calculate the area, A_1. Then use Equation 8-6 to calculate the velocity, v_1, for the velocity head at A_1. The next station upstream is usually section 2. Assume a depth y_2 at section 2, and use y_2 to calculate z_2 and A_2. Calculate, also, the velocity head at A_2.

Equation 8-6

$$Q = A_1 v_1 = A_2 v_2$$

Q = discharge (cfs)
A = flow cross-sectional area (ft^2)
v = mean cross-sectional velocity (fps, perpendicular to the flow area).

The superscripts 1 and 2 refer to successive cross sections along the flow path.

4. Calculate the friction slope between the two sections using Equation 8-7and Equation 8-8:

Equation 8-7

$$s_f = \left(\frac{Q}{K_{ave}}\right)^2$$

Where:

$$K_{ave} = \frac{K_1 + K_2}{2} = 0.5\left(\frac{ZA_1R_1^{\frac{2}{3}}}{n_1} + \frac{ZA_2R_2^{\frac{2}{3}}}{n_2}\right)$$

5. Calculate the friction head losses (h_f) between the two sections using:

Equation 8-8

$$h_f = S_{ave}L$$

Where:

L = Distance between the two sections (ft).

6. Calculate the kinetic energy correction coefficients (α_1 and α_2) using Equation 8-9.

Equation 8-9

$$\alpha = \frac{\sum(Q_i v_i^2)}{Q v^2} = \frac{\sum[K_i(K_i/A_i)^2]}{K_t(K_t/A_t)^2}$$

Where:

v_i = average velocity in subsection (fps) (see Continuity Equation section)

Q_i = discharge in same subsection (cfs) (see Continuity Equation section)
Q = total discharge in channel (cfs)
v = average velocity in river at section or Q/A (ft/s)

K_i = conveyance in subsection (cfs) (see Conveyance section)

A_i = flow area of same subsection (ft^2)

K_t = total conveyance for cross-section (cfs)

A_t = total flow area of cross-section (ft^2).

7. Where appropriate, calculate expansion losses (h_e) using Equation 8-10 and contraction losses (h_c) using Equation 8-11 (Other losses, such as bend losses, are often disregarded as an unnecessary refinement.)

Equation 8-10

$$h_e = K_e \frac{\Delta V^2}{2g}$$

Where:
K_e = 0.1 for a gentle contraction
K_e = 0.5 for a sudden contraction

Equation 8-11

$$h_c = K_c \frac{\Delta V^2}{2g}$$

Where:

K_c = 0.1 for a gentle contraction

K_c = 0.5 for a sudden contraction

8. Check the energy equation for balance using Equation 8-12 and Equation 8-13.

Equation 8-12

$$L = z_2 + y_2 + \alpha_1 \frac{v_2^2}{2g}$$

Equation 8-13

$$R = z_1 + y_1 + \alpha_1 \frac{v_1^2}{2g} + h_f + h_e + h_c$$

The following considerations apply:

- if L=R within a reasonable tolerance, then the assumed depth at Section 1 is okay. This will be the calculated water surface depth at Section 1; proceed to step (9)
- if L≠R, go back to step (3) using a different assumed depth.

9. Determine the critical depth (d_c) at the cross section and find the uniform depth (d_u) by iteration. If, when running a supercritical profile, the results indicate that critical depth is greater than uniform depth, then it is possible the profile at that cross section is supercritical. For sub-critical flow, the process is similar but the calculations must begin at the upstream section and proceed downstream.
10. Assign the calculated depth from step (8) as the downstream elevation (Section 1) and the next section upstream as Section 2, and repeat steps (2) through (10).
11. Repeat these steps until all of the sections along the reach have been addressed.

8.8 Supercritical Flow

The Froude Number provides a relationship between flow velocity and the hydraulic depth of flow, and gravitational action, and shall be calculated for all channel improvements designs. Subcritical flow conditions occur when the Froude Number is less than 1.0 and supercritical flow conditions exist in lined channels when the Froude Number exceeds 1.0.

If a channel's normal depth is supercritical, its alternate depth is a deeper subcritical depth. Obstructions that may enter a stream during a storm event may cause supercritical flows to experience a hydraulic jump and become subcritical flows. When it is calculated that supercritical conditions could occur for the design storm, the depth of the channel must be at least the alternate depth plus the required freeboard. Adequate protection of the channel must be provided to protect against supercritical flow.

Subcritical flow conditions are recommended for all channel designs, as supercritical flow tends to have high velocities and high potential for channel erosion. Supercritical flow conditions will not be allowed in channels with a vegetative lining. Subcritical flow conditions may be achieved by using energy dissipators in areas where the existing topography will not allow subcritical flow conditions to occur

naturally. In all cases, the channel improvements shall be designed to avoid the unstable transitional flow conditions that occur when the Froude Number is between 0.9 and 1.1.

8.9 Flow in Bends

Adequate freeboard must be provided for a channel, ditch and swales as shown in Table 2-2. Flow around a bend in an open channel induces centrifugal forces because of the change in flow direction. This results in a superelevation of the water surface at the outside of bends and can cause the flow to splash over the side of the channel if adequate freeboard is not provided. This superelevation can be estimated by equation using Equation 8-14 from HEC-15.

Equation 8-14

$$\Delta H = \frac{V^2 T}{g R_c}$$

Where:

ΔH = Difference in water surface elevation between the inner and outer banks of the channel in the bend, (ft)
V = Average velocity (fps)
T = Surface width of the channel (ft)
Rc = Radius to the centerline of the channel (ft)
g = Gravitational acceleration = 32.2 ft/s^2.

Equation 8-14 is valid for subcritical flow conditions. The elevation of the water surface at the outer channel bank will be Δd/2 higher than the centerline water surface elevation (the average water surface elevation immediately before the bend) and the elevation of the water surface at the inner channel bank will be Δd/2 lower than the centerline water surface elevation.

Flow around a channel bend also imposes higher shear stress on the channel bottom and banks and may impact channel stability. Refer to *HEC 15* for further guidance if shear stress around a channel bend is anticipated to cause channel erosion.

8.10 Shear Stress

Shear stress shall be computed for all open channels and adequate protection shall be provided based on the tractive force method described in *HEC 15* and the permissible shear stresses reported in the *TxDOT HDM*.

A. The hydrodynamic force of water flowing in a channel is known as the tractive force. The basis for stable channel design with flexible lining materials is that flow-induced tractive force should not exceed the permissible or critical shear stress of the lining materials. In a uniform flow, the tractive force is equal to the effective component of the drag force acting on the body of water, parallel to the channel bottom [10]. The mean boundary shear stress applied to the wetted perimeter is computed with Equation 8-15.

Equation 8-15

$$\tau = \gamma RS$$

Where:
τ_o = mean boundary shear stress (lb/ft^2)
γ = unit weight of water (62.4 lb/ft^3)
R = hydraulic radius (ft)
S_o = average bottom slope (equal to energy slope for uniform flow) (ft/ft).

B. The maximum shear stress on a channel bottom, τ_d, and on the channel side, τ_s, in a straight channel depends on the channel shape. To simplify the design process, the maximum channel bottom shear stress is computed with Equation 8-16.

Equation 8-16

$$\tau = \gamma dS$$

Where:
τ_d = shear stress in channel at maximum depth (lb/ft^2)

d = maximum depth of flow in the channel for the design discharge (ft).

C. Determine channel lining or protection needed. Calculate uniform flow depth (y_m in ft or m) at design discharge using the Slope Conveyance Method. Compute maximum shear stress at normal depth using Equation 8-16. Select a lining and determine the permissible shear stress (in lbs/ft^2 or N/m^2) using Table 8-3 and Table 8-4. If $\tau_d < \tau_p$, then the lining is acceptable.

Table 8-3: Retardation Class for Lining Materials

Retardance Class	Cover	Condition
A	Weeping Lovegrass	Excellent stand, tall (average 30 in. or 760 mm)
	Yellow Bluestem Ischaemum	Excellent stand, tall (average 36 in. or 915 mm)
B	Kudzu	Very dense growth, uncut
	Bermuda grass	Good stand, tall (average 12 in. or 305 mm)
	Native grass mixture little bluestem, bluestem, blue gamma, other short and long stem medwest grasses	Good stand, unmowed
	Weeping Lovegrass	Good Stand, tall (average 24 in. or 610 mm)
	Lespedeza sericea	Good stand, not woody, tall (average 19 in. or 480 mm)
	Alfalfa	Good stand, uncut (average 11 in or 280 mm)
	Weeping lovegrass	Good stand, unmowed (average 13 in. or 330 mm)
	Kudzu	Dense growth, uncut
	Blue gamma	Good stand, uncut (average 13 in. or 330 mm)
C	Crabgrass	Fair stand, uncut (10-to-48 in. or 55-to-1220 mm)
	Bermuda grass	Good stand, mowed (average 6 in. or 150 mm)
	Common lespedeza	Good stand, uncut (average 11 in. or 280 mm)
	Grass-legume mixture: summer (orchard grass redtop, Italian ryegrass, and common lespedeza)	Good stand, uncut (6-8 in. or 150-200 mm)
	Centipedegrass	Very dense cover (average 6 in. or 150 mm)
	Kentucky bluegrass	Good stand, headed (6-12 in. or 150-305 mm)
D	Bermuda grass	Good stand, cut to 2.5 in. or 65 mm
	Common lespedeza	Excellent stand, uncut (average 4.5 in. or 115 mm)
	Buffalo grass	Good stand, uncut (3-6 in. or 75-150 mm)
	Grass-legume mixture: fall, spring (orchard grass Italian ryegrass, and common lespedeza	Good Stand, uncut (4-5 in. or 100-125 mm)
	Lespedeza sericea	After cutting to 2 in. or 50 mm (very good before cutting)
E	Bermuda grass	Good stand, cut to 1.5 in. or 40 mm
	Bermuda grass	Burned stubble
Source: *TxDOT HDM* [4]		

Table 8-4: Permissible Shear Stresses for Various Linings

Protective Cover	(lb./sq.ft.)	tp (N/m2)
Retardance Class A Vegetation (See the "Retardation Class for Lining Materials" table above)	3.7	177
Retardance Class B Vegetation (See the "Retardation Class for Lining Materials" table above)	2.1	101
Retardance Class C Vegetation (See the "Retardation Class for Lining Materials" table above)	1	48
Retardance Class D Vegetation (See the "Retardation Class for Lining Materials" table above)	0.6	29
Retardance Class E Vegetation (See the "Retardation Class for Lining Materials" table above)	0.35	17
Woven Paper	0.15	7
Jute Net	0.45	22
Single Fiberglass	0.6	29
Double Fiberglass	0.85	41
Straw W/Net	1.45	69
Curled Wood Mat	1.55	74
Synthetic Mat	2	96
Gravel, D50 = 1 in. or 25 mm	0.4	19
Gravel, D50 = 2 in. or 50 mm	0.8	38
Rock, D50 = 6 in. or 150 mm	2.5	120
Rock, D50 = 12 in. or 300 mm 6-in. or 50-mm Gabions	5 35	239 1675
4-in. or 100-mm Geoweb	10	479
Soil Cement (8% cement)	>45	>2154
Dycel w/out Grass	>7	>335
Petraflex w/out Grass	>32	>1532
Armorflex w/out Grass	20-Dec	574-957
Erikamat w/3-in or 75-mm Asphalt	13-16	622-766
Erikamat w/1-in. or 25 mm Asphalt	<5	<239
Armorflex Class 30 with longitudinal and lateral cables, no grass	>34	>1628
Dycel 100, longitudinal cables, cells filled with mortar	<12	<574
Concrete construction blocks, granular filter underlayer	>20	>957
Wedge-shaped blocks with drainage slot	>25	>1197
Source: *TxDOT HDM* [4]		

8.11 Drop Structures

The function of a drop structure is to reduce flow velocities by dissipating some of the kinetic energy of the flow at the drop structure, and also providing flatter channel slopes upstream and downstream of the drop structure. Sloping channel drops and vertical channel drops are two commonly used drop structure types.

An apron shall be designed and constructed immediately upstream and downstream of a drop structure to protect against turbulence and prevent scour. Unless an alternative is approved by the City Engineer, the upstream apron shall extend at least ten feet upstream from the point where flow becomes supercritical, and the downstream apron shall be extended downstream from the anticipated location of

the hydraulic jump by the minimum distance listed in Table 8-5. Each end shall include a concrete toe that extends a minimum of twenty-four inches into the ground.

Table 8-5: Minimum Lengths of Downstream Aprons beyond Hydraulic Jumps

Discharge Rate per Unit Width of Apron (cfs/ft)	Minimum Distance to extend Downstream Apron beyond the Hydraulic Jump (ft)
0-14	10
15	15
20	20
25	23
30	25

All drop structures shall be constructed of reinforced concrete, and the bottom and walls (if any) shall have a minimum thickness of six inches. To facilitate maintenance, drop structures should be located near bridges or culverts if possible.

8.11.1 Vertical Drop Structures

The drop length and the hydraulic jump length of the drop structure should be calculated to determine the length of the downstream apron required to prevent erosion [8] [11]. In order to utilize a vertical drop structure vehicular access must be provided to both the upstream and downstream ends of the structures.

8.11.2 Sloping Drop Structures

The location of the hydraulic jump should be determined based on the upstream and downstream flow depths and channel slopes [8] [11]. When utilizing a sloping drop structure, a minimum slope of 6:1 shall be used to allow vehicular access from one end across the structure. If the slope of the drop structure is less than 6:1, vehicular access must be provided to both the upstream and downstream ends of the structures.

8.12 Energy Dissipators

Although hydraulic jumps can be used as energy dissipators, impact dissipators are recommended for their predictability, efficiency, and economy. The Baffled Apron is used to dissipate the energy in the flow at a drop. It requires no initial tailwater to be effective, although scour is reduced with tailwater. The chute of the Baffle Apron is constructed on a 2:1 or flatter slope extending below the channel bottom. Refer to *Hydraulic Engineering Circular 14: Energy Dissipators (HEC 14)* [12] for methods to design energy dissipators.

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9 Bridges and Culverts

9.1 General Requirements

A bridge is defined as a structure, including supports, erected over a depression or an obstruction (e.g., water, highway or railway) having a roadway for carrying traffic or other moving loads, and having an opening measured along the center of the roadway of more than 20 feet between faces of abutments, spring lines of arches, or extreme ends of openings for multiple box culverts. Culverts convey surface water through a roadway embankment or away from the roadway right-of-way or into a channel along the right-of-way.

A. Bridges and culverts shall be designed to withstand the 100-year design storm.
B. Bridges and culverts on arterial streets and parkways shall meet the following requirements:
    1. 50-year design storm runoff with headwater one foot below the top of the culvert structure.
    2. 100-year water surface shall not encroach through half of roadway lanes.
    3. Minimum culvert size of a 24-inch circular pipe or equivalent for alternate shapes.
C. Bridges and culverts on all other streets shall meet the following requirements:
    1. 25-year design storm runoff with headwater one foot below the top embankment.
    2. 25-year water surface shall leave at least one lane open.
    3. 50-year design storm runoff no more than 6 inches over top of roadway.
    4. Allowance shall be made for conveyance of the 100-year runoff across the road and into the downstream channel without damage to the road or adjacent property.
    5. Minimum culvert size of an 18-inch circular pipe or equivalent for alternate shapes.
D. Temporary crossings shall be designed to safely pass the 2-year design storm runoff.
E. The backwater created by a culvert or bridge during the 100-year design storm runoff shall not cause damage to public or private property.
F. Culvert outlets shall be designed to minimize damage caused by erosion.
G. Culverts and bridges shall be aligned with natural drainage ways in grade and direction whenever practical. Culverts shall have a minimum design storm velocity of 2.5 feet per second for the 2-year storm to reduce sediment accumulation.
H. Larger culvert sizes, bridges, box culverts, and/or smooth-walled pipes are recommended for crossings where heavy debris or sediment accumulations are anticipated. Trash racks may be required.
I. All headwalls shall be constructed of reinforced concrete.
J. Plastic pipe is prohibited for use as a culvert pipe material in the public right-of-way.
K. Corrugated metal pipe will not be allowed in the public right-of-way except beneath driveways.

9.2 Bridge Design Criteria

Design criteria for all bridges shall be on a case-by-case basis as determined by the City Engineer.

9.3 Culvert Design Criteria

A. Headwalls and necessary erosion protection shall be provided at all culverts and shall comply with TxDOT standard details. All culverts and bridges are to be analyzed at both the design flow and 100-year check flow.

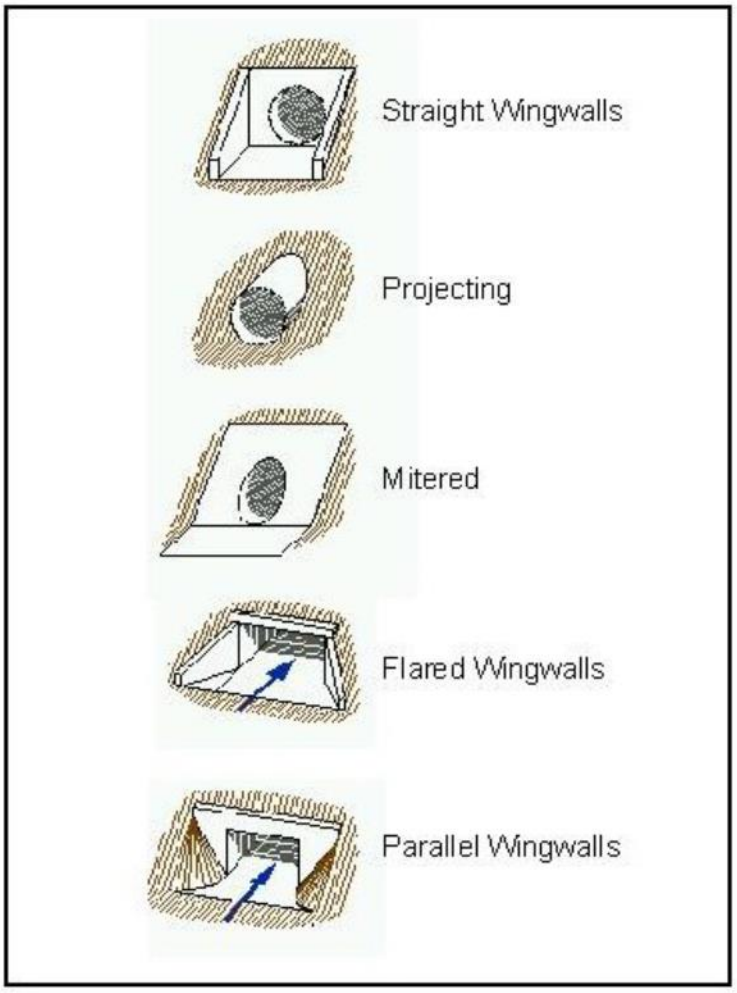
B. Alignment, location and grade of proposed culverts must be consistent with planned development of the drainage system for that watershed. In the event the particular watershed or waterway is not covered by a planned storm drainage system, the designer should proceed with the design from the nearest downstream control (i.e. bridge, culvert dam, etc.) and design the proposed drainage system improvements anticipating future system expansion due to fully developed watershed conditions.

C. Wingwalls, if used, may be either straight parallel, flared, or tapered. Approach and discharge aprons shall be provided for all culvert headwall designs. Precast headwalls and end walls may be used if all other criteria are satisfied.

9.4 Culvert End Treatments

Figure 9-1 shows sketches of various end treatment types. The TxDOT Bridge Division maintains standard details of culvert end treatments. Safety End Treatment (SET) of a culvert provides a method of mitigating a less safe condition with-out interfering with the hydraulic function of the culvert. SETs such as those used with driveway and other small diameter culverts may be more hydraulically efficient by providing both tapered wingwalls and a beveled edge instead of using a mitered section. SETs for larger culverts that are not protected by a railing or guard fence use pipe runners arranged either horizontally or vertically.

Figure 9-1: Typical Culvert End Treatments



Source: *TxDOT HDM* [4]

The pipes of pipe runner SETs have been proven to be within the tolerance of the entrance loss equations. Therefore, the entrance should be evaluated solely for its shape and the effect of the pipes should be ignored.

9.5 Culvert Hydraulics

The hydraulic design of culverts shall be based upon design guidelines set forth by TxDOT, the U.S. Department of Transportation, or other suitable material as approved by the City Engineer. Computer programs such as FHWA's "HY-8" may be used, provided that the design engineer provides output tables showing models results and input data.

Values of entrance loss coefficients (C_e) are shown in Table 9-1 based on culvert shape and entrance condition.

Table 9-1: Entrance Loss Coefficients

Concrete Pipe	Ce
Projecting from fill, socket end (groove end)	0.2
Projecting from fill, square cut end	0.5
Headwall or headwall and wingwalls:	-
• Socket end of pipe (groove end)	0.2
• Square-edge	0.5
• Rounded (radius 1/12 D)	0.2
Mitered to conform to fill slope	0.7
End section conforming to fill slope	0.5
Beveled edges, 33.7º or 45º bevels	0.2
Side- or slope-tapered inlet	0.2
Corrugated Metal Pipe or Pipe Arch	-
Projecting from fill (no headwall)	0.9
Headwall or headwall and wingwalls square-edge	0.5
Mitered to conform to fill slope, paved or unpaved slope	0.7
End section conforming to fill slope	0.5
Beveled edges, 33.7º or 45º bevels	0.2
Side- or slope-tapered inlet	0.2
Reinforced Concrete Box	-
Headwall parallel to embankment (no wingwalls):	-
• Square-edged on 3 edges	0.5
• Rounded on 3 edges to radius of 1/12 barrel dimension, or beveled edges on 3 sides	0.2
Wingwalls at 30º to 75º to barrel:	-
• Square-edged at crown	0.4
• Crown edge rounded to radius of 1/12 barrel dimension, or beveled top edge	0.2
Wingwall at 10º to 25º to barrel: square-edged at crown	0.5
Wingwalls parallel (extension of sides): square-edged at crown	0.7
Side- or slope-tapered inlet	0.2
Source: *TxDOT HDM* [4]	

There are two categories of flow through culverts: inlet control and outlet control.

1. **Inlet Control.** The flow is controlled by the cross-sectional area of the culvert, inlet configuration, and headwater depth. Slope, roughness and length of culvert are of no importance. Nomographs are available for inlet control estimations as proved in Hydraulic Design of Highway Culverts [13].
2. **Outlet control.** The flow is controlled by the cross-section area of the culvert, inlet configuration, and headwater depth and, slope, roughness and length of culvert. Culverts will be outlet controlled if the culvert slope is relatively flat, the tailwater sufficiently deep or the culvert is quite long. It is also possible, where the water enters the culvert under inlet control, but the culvert slope or tailwater conditions cause a hydraulic jump near the outlet. This situation should be avoided because damage can occur to the culvert pipe. Unstable conditions are most likely when the culvert is placed at a near-critical slope.

The design engineer shall calculate both outlet and inlet control conditions and use the more conservative of the two as the design condition.

9.6 Debris Fins

For conditions where more than one box culvert is required, the upstream face of the structure may incorporate debris deflector fins to prevent debris buildup. For multiple-pipe, or single box in critical situations, installations of debris fins may be used but are not required unless the Engineering Division requires upon review of the design situation. The engineer of record should analyze the situation for the applicability of debris fins.

The debris fin is an extension of the interior walls of a multiple-box culvert. The wall thickness shall be designed to satisfy structural requirements and reduce impact and turbulence to the flow.

A debris fin is constructed to the height of the culvert with a fin length of one and one-half times the height of the box culvert. Since the debris fins are subject to the same erosive forces as bridge piers, care must be taken in the design of the footing. A reinforced toewall at the upstream end of the debris fin and the apron is required. The reinforced toewall shall include a toe that extends a minimum of twenty-four inches into the ground.

9.7 Culvert Outlet Protection

High discharge velocities from culverts can cause eddies or other turbulence which could damage unprotected downstream channel banks and roadway embankments. To prevent damage from scour and erosion in these conditions, culvert outlet protection is needed. The outlet protection should extend downstream to a point where non-erosive channel velocities or shear stress are established in accordance with **Section 8.10** of this manual. The outlet protection should be placed sufficiently high on the adjacent banks to extend 1’ above the design WSEL. All outlet protection shall be designed with an appropriate toe depth. All toes shall be no less than twenty-four inches.

9.8 Energy Dissipation

Design of riprap stone protection shall be done in accordance to *HEC 22*. Design of concrete baffles and stilling basins shall be done in accordance with *HEC 14*.

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10 Detention and Retention Facilities

10.1 General Requirements

Detention is the storage of runoff for a controlled release during or immediately following a design storm. Retention is an artificial pond with used for flood protection, water quality or aesthetic improvement.

A. The method(s) of retention or detention shall be appropriate to the type of development, topography, and amount of control needed. Examples of methods include, but are not limited to, the following:
   1. Basins or swales – single or multiple
   2. Check dams in gullies to slow runoff and trap sediment
   3. Leach fields, infiltration chambers, dry wells, rain barrels, French drains
   4. Granular fill under permeable paving blocks
   5. Contour terracing, improved vegetation cover
B. Parking areas may be used as detention facilities provided that maximum depths of ponding do not exceed eight inches, and ponding is in the areas most remotely situated from structures.
C. Stormwater infiltration systems are not permitted for mitigation in any development where there is a potential for pollutants to adversely affect ground water quality (e.g. Edwards Aquifer Recharge Zone).
D. No detention or retention basin shall retain standing water longer than 36 hours unless it is designed and constructed to be a permanent pond with appropriate health, safety and water quality measures. Permanent ponds must comply with all applicable water rights requirements for such a body of water.
E. Detention basins to be excavated shall provide positive drainage through the pond. A concrete pilot channel shall be provided to convey runoff from entry points of concentrated flow into the pond to the outlet structure of the pond during low flow conditions. The minimum longitudinal slope of the concrete pilot channel shall be 0.25% and the minimum slope to the pilot channel shall be 0.5%. Erosion protection must be provided adjacent to the pilot channel to prevent undermining of the pilot channel due to scour.
F. Facilities shall be located such that the edge of the 100-year water surface is at least 10 feet from the pavement edge of any public road. Finished floors of adjacent structures should be a minimum of 1 foot above the 100-year water surface in the facility. Facilities should preferably be located such that the invert of the outlet structure is above the 100-year flood level in the receiving body; but in all cases facilities shall be designed to function properly during conditions where the outlet is submerged by the tailwater of the receiving stream.
G. Drainage easements are required for retention/detention facilities. Easement boundaries shall contain the berms, inlet and outlet structures, access ramps, permanent erosion control facilities, the 100-year water surface and any additional area needed for access and maintenance.
H. Ponding below natural grade (depressed storage) is allowed.

I. Detention facilities shall be designed with one or more outlet structures to allow safe passage of the 100-year post-development design storm runoff. If an overflow weir is not incorporated into the design of the outlet structure, then an emergency overflow weir or spillway shall be provided with sufficient capacity to pass at least the 25-year design storm runoff, assuming the pond is full and the discharge pipe in the outfall structure is 100% clogged. At minimum, the emergency overflow weir should engage when ponding exceeds the 100-year water surface elevation.

J. Weirs, spillways and outlets shall be protected from erosion with riprap, grouted riprap, or other method of erosion control to adequately protect the structure and downstream channel. Outflows shall be conveyed within proposed property limits to an appropriate receiving drainage facility in a manner such that roadways, private property, buildings, etc. are not damaged.

K. Best management practices shall be used in the event a detention facility empties into another storage facility downstream. The timing of the hydrograph from the detention facility shall be checked against the timing of the receiving storage facility to prevent any increase in the flow rate from the downstream facility.

L. Side slopes of earthen embankments shall be designed for stability and safety, with the following minimum requirements for facilities with unrestricted access: side slopes of earthen banks shall be 3:1 or flatter; a benched configuration is required for facilities with ponding depths over 6 feet. Bench widths shall be at least 4 feet, spaced at least every 3 feet vertically. The above slope criteria may be waived if security barriers are provided. Barriers may consist of chain-link, masonry, wood, vegetation or other materials, but must not restrict the hydraulic capacity of drainage facilities. Minimum barrier height is 48”. Vegetative barriers must be of a width equal to or greater than the greatest interior embankment height/depth, with density sufficient to restrict access. All constructed stormwater structures of earthen material shall be re-vegetated to mature growth.

M. Maximum water depths over 6 feet shall not be allowed. In cases where design limitations require excess depths, due hardship shall be presented for consideration to the Engineering Division, consideration for exception approval will require additional safety measures of the design. Additional safety measures can include but shall not be limited to:

    a. Fencing,
    b. Benching,
    c. And/or other forms of access restriction.

N. Any detention facility that is classified as a dam by the State of Texas shall conform to the more stringent of rules listed in this manual or the dam safety rules adopted by the State of Texas.

O. Earthen embankments of a height greater than 3 feet used to impound a required detention volume must have a minimum top-width of 4 feet, shall contain a non-permeable core, and shall be based on a geotechnical investigation for the site. Compaction of all earthen drainage structures shall be to 90% standard proctor.

P. A maintenance ramp shall be provided for vehicular access in detention basin design for periodic de-silting and debris removal. The slope of the ramp shall not exceed 6:1 and the minimum width shall be 12 feet.

Q. Basins with permanent storage must include dewatering facilities to provide for maintenance.

R. The design of detention facilities shall include provisions for collecting and removing sediment deposited after collecting and releasing stormwater.

S. Detention ponds and reservoirs shall provide at least 1-foot of freeboard for the 100-year storm event measured from top of berm to the 100-year water surface elevation of the pond.

10.2 Design Criteria

A. Stormwater detention basins are used to temporarily impound (detain) excess stormwater, thereby reducing peak discharge rates.
B. All detention ponds are to be designed to prevent an increase in flow to the existing 2, 10, 25, 50, and 100-year peak runoff leaving a proposed site.
C. Detention ponds will be sized using the NRCS synthetic hydrograph as outlined in **Section 4** of this manual.

10.3 Outlet Structure Design

A. Multi-level outlet structures may be necessary to reduce the 2, 10, 25, 50, and 100-year developed design storm runoff to pre-development levels. See publication *Stormwater Detention Outlet Control Structures* [14] for further outlet design and construction guidance not presented below.
B. Documentation on retention or detention structures should include design hydrographs, calculation of stage-storage-discharge tables, drawings of the basin, spillway, weir and outlet size and location, and erosion control measures.
C. Development of a composite stage-discharge curve requires consideration of the discharge rating relationships for each component of the outlet structure. The following sections are design relationships for typical outlet controls summarized from *HEC 22*.

10.3.1 Orifices

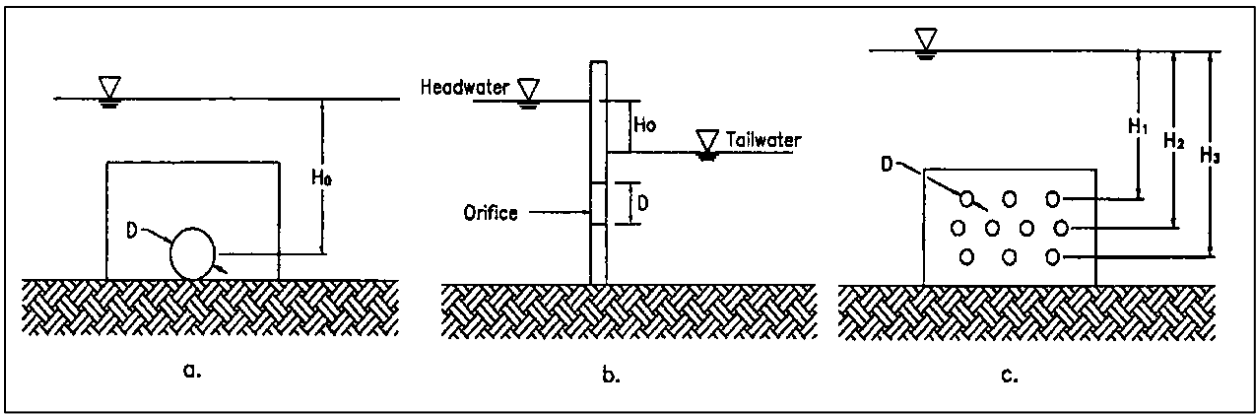
For a single orifice as illustrated in Figure 10-1 (a), orifice flow can be determined using Equation 10-1.

Equation 10-1

$$Q = C_o A_o (2gH_o)^{0.5}$$

Where:
Q = Orifice flow rate (cfs)
C_o = Discharge coefficient 0.40 – 0.60
A_o = Area of orifice (ft^2)
H_o = Effective head on the orifice measured from the centroid of the opening (ft)
g = Gravitational acceleration = 32.2 ft/s^2.

Figure 10-1: Definition Sketch for Orifice Flow



Source: *HEC 22* [5]

If the orifice discharges as a free outfall, then the effective head is measured from the centerline of the orifice to the upstream water surface elevation. If the orifice discharge is submerged, then the effective head is the difference in elevation of the upstream and downstream water surfaces. This latter condition of a submerged discharge is shown in Figure 10-1(b).

For square-edged, uniform orifice entrance conditions, a discharge coefficient of 0.6 should be used. For ragged edged orifices, such as those resulting from the use of an acetylene torch to cut orifice openings in corrugated pipe, a value of 0.4 should be used.

For circular orifices with C_o set equal to 0.6, the following equation results:

Equation 10-2

$$Q = K_{or} D^2 H_o^{0.50}$$

Where:

K_{or} = 3.78 (English units)
D = Orifice diameter (ft).

Pipes smaller than 1 foot in diameter may be analyzed as a submerged orifice as long as H_o/D is greater than 1.5. Pipes greater than 1 foot in diameter should be analyzed as a discharge pipe with headwater and tailwater effects taken into account, not just as an orifice.

Flow through multiple orifices (see Figure 10-1 (c)) can be computed by summing the flow through individual orifices. For multiple orifices of the same size and under the influence of the same effective head, the total flow can be determined by multiplying the discharge for a single orifice by the number of openings.

10.3.2 Weirs

Relationships for sharp-crested, broad-crested, V-notch, and proportional weirs are provided in the following sections.

10.3.2.1 Sharp Crested Weirs

Typical sharp crested weirs are illustrated in Figure 10-2. Equation 10-3 provides the discharge relationship for sharp crested weirs with no end contractions (illustrated in Figure 10-2 (a)).

Equation 10-3

$$Q = C_{scw} L H^{1.5}$$

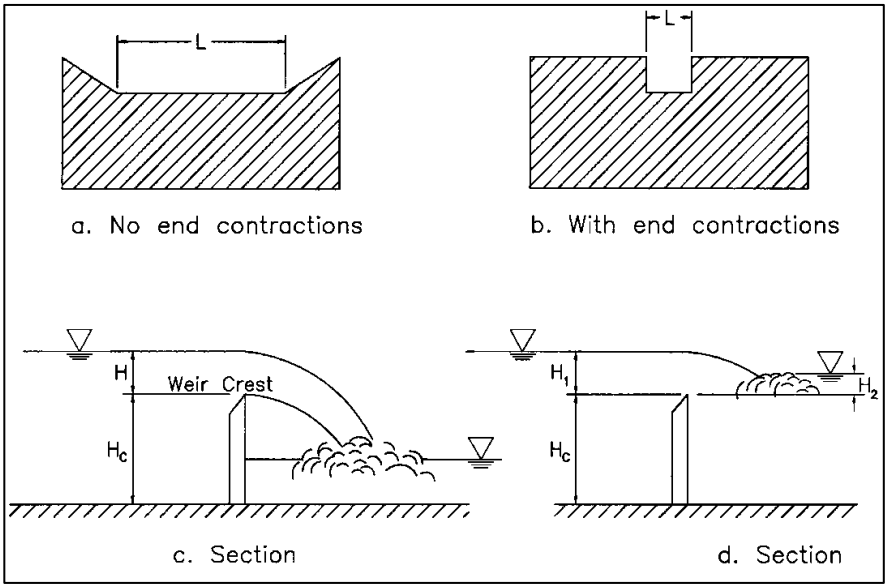
Where:
Q = Discharge (cfs)
L = Horizontal weir length (ft)
H = Head above weir crest excluding velocity head (ft)

$C_{SCW} = 3.27 + 0.4\ (H/H_C)$.

As indicated above, the value of the coefficient C_{SCW} is known to vary with the ratio H/H_c (see Figure 10-2 (c) for definition of terms). For values of the ratio H/H_c less than 0.3, a constant C_{SCW} of 3.33 (in English units) is often used.

Equation 10-4 provides the discharge equation for sharp-crested weirs with end contractions (illustrated in Figure 10-2 (b)). As indicated above, the value of the coefficient C_{SCW} is known to vary with the ratio H/Hc (see Figure 10-2 (c) for definition of terms). For values of the ratio H/H_c less than 0.3, a constant C_{SCW} of 3.33 (in English units) is often used.

Figure 10-2: Sharp Crested Weirs



Source: *HEC 22* [5]

Equation 10-4

$$Q = C_{scw}(L - 0.2H)H^{1.5}$$

Sharp crested weirs will be effected by submergence when the tailwater rises above the weir crest elevation, as shown in Figure 10-2 (d). The result will be that the discharge over the weir will be reduced. The discharge equation for a submerged sharp-crested weir is:

Equation 10-5

$$Q_s = Q_r\left(1 - \left({}^{H_2}/_{H_1}\right)^{1.5}\right)^{0.385}$$

Where:
Qs = Submerged flow (cfs)
Qr = Unsubmerged weir flow from Equation 10 3 or Equation 10 4 (cfs)
H1 = Upstream head above crest (ft)
H2 = Downstream head above crest (ft).

Flow over the top edge of a riser pipe is typically treated as flow over a sharp crested weir with no end constrictions. Equation 10-3 should be used for this case.

10.3.2.2 Broad-Crested Weir

The equation typically used for a broad-crested weir is:

Equation 10-6

$$Q = C_{BCW}LH^{1.5}$$

Where:

Q = Discharge, (ft^3/s)
C_{BCW} = Broad-crested weir coefficient, 2.34 to 3.32 (English units)
L = Broad-Crested weir length, (ft)
H = Head above weir crest (ft).

If the upstream edge of a broad-crested weir is so rounded as to prevent contraction and if the slope of the crest is as great as the loss of head due to friction, flow will pass through critical depth at the weir crest; this gives the maximum C value of 3.09 (in English units). For sharp corners on the broad crested weir, a minimum value of 2.62 (in English units) should be used. Additional information on C values as a function of weir crest breadth and head is given in Table 10-1.

Table 10-1: English Units-Broad-Crested Weir Coefficient C Values as a Function of Weir Crest

Broad-Crested Weir Coefficient C Values as a Function of Weir Crest Breadth and Head (coefficient has units of ft 0.5/sec)[1]											
Head[2](ft)	Breadth of Crest of Weir (ft)										
	0.5	0.75	1	1.5	2	2.5	3	4	5	10	15
0.2	2.8	2.75	2.69	2.62	2.54	2.48	2.44	2.38	2.34	2.49	2.68
0.4	2.92	2.8	2.72	2.64	2.61	2.6	2.58	2.54	2.5	2.56	2.7
0.6	3.08	2.89	2.75	2.64	2.61	2.6	2.68	2.69	2.7	2.7	2.7
0.8	3.3	3.04	2.85	2.68	2.6	2.6	2.67	2.68	2.68	2.69	2.64
1	3.32	3.14	2.98	2.75	2.66	2.64	2.65	2.67	2.68	2.68	2.63
1.2	3.32	3.2	3.08	2.86	2.7	2.65	2.64	2.67	2.66	2.69	2.64
1.4	3.32	3.26	3.2	2.92	2.77	2.68	2.64	2.65	2.65	2.67	2.64
1.6	3.32	3.29	3.28	3.07	2.89	2.75	2.68	2.66	2.65	2.64	2.63
1.8	3.32	3.32	3.31	3.07	2.88	2.74	2.68	2.66	2.65	2.64	2.63
2	3.32	3.31	3.3	3.03	2.85	2.76	2.72	2.68	2.65	2.64	2.63
2.5	3.32	3.32	3.31	3.28	3.07	2.89	2.81	2.72	2.67	2.64	2.63
3	3.32	3.32	3.32	3.32	3.2	3.05	2.92	2.73	2.66	2.64	2.63
3.5	3.32	3.32	3.32	3.32	3.32	3.19	2.97	2.76	2.68	2.64	2.63
4	3.32	3.32	3.32	3.32	3.32	3.32	3.07	2.79	2.7	2.64	2.63
4.5	3.32	3.32	3.32	3.32	3.32	3.32	3.32	2.88	2.74	2.64	2.63
5	3.32	3.32	3.32	3.32	3.32	3.32	3.32	3.07	2.79	2.64	2.63
5.5	3.32	3.32	3.32	3.32	3.32	3.32	3.32	3.32	2.88	2.64	2.63
Source: Brater, E.F. and King, H.W., Handbook of Hydraulics, 6th ed., 1976 [15] Measured at least 2.5 Hc upstream of the weir											

10.3.2.3 V- Notch Weir

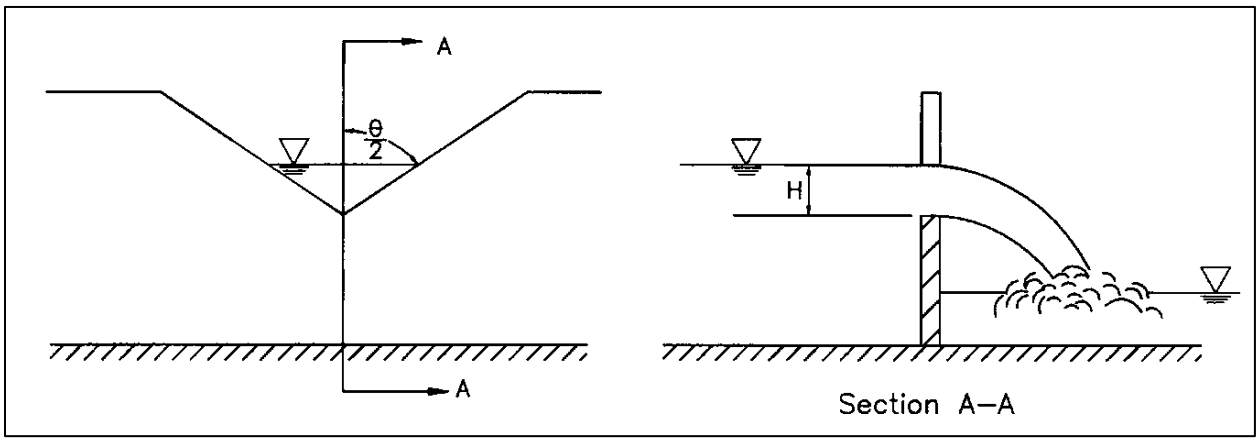
The discharge through a v-notch weir is shown in Figure 10-3 and can be calculated from the following equation:

Equation 10-7

$$Q = K_u[tan(\theta/2)]H^{2.5}$$

Where:
Q = Discharge (cfs)
θ = Angle of v-notch (degrees)
H = Head on apex of v-notch (ft)
Ku = 2.5 (English units).

Figure 10-3: V-Notch Weir



Source: *HEC 22* [5]

10.3.2.4 Proportional Weir

Although more complex to design and construct, a proportional weir may significantly reduce the required storage volume for a given site. The proportional weir is distinguished from other control devices by having a linear head-discharge relationship. This relationship is achieved by allowing the discharge area to vary nonlinearly with head. Design equations for proportional weirs are as follows: [16]

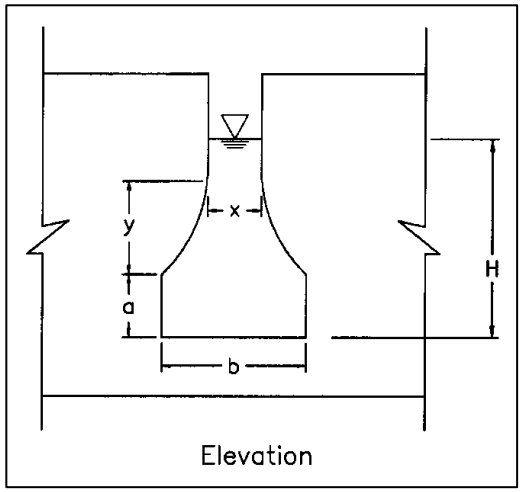
Equation 10-8

$$Q = K_u a^{0.5} b(H - a/3)$$

Where:
K_U = 4.96 (English units)
Q = Discharge (cfs)
H = Head above horizontal sill (ft).

Dimensions a, b, x, and y are shown in Figure 10-4.

Figure 10-4: Proportional Weir Dimensions



Source: *HEC 22* [5]

10.3.3 Discharge Pipes

Discharge pipes are often used as outlet structures for detention facilities. The design of these pipes can be for either single or multistage discharges. A single step discharge system would consist of a single culvert entrance system and would not be designed to carry emergency flows. A multistage inlet would involve the placement of a control structure at the inlet end of the pipe.

For single stage systems, the facility would be designed as if it were a simple culvert. Downstream boundary conditions are to be applied in the same manner as discussed in **Section 9** of this manual. A stage-discharge curve would be developed for the full range of flows that the structure would experience.

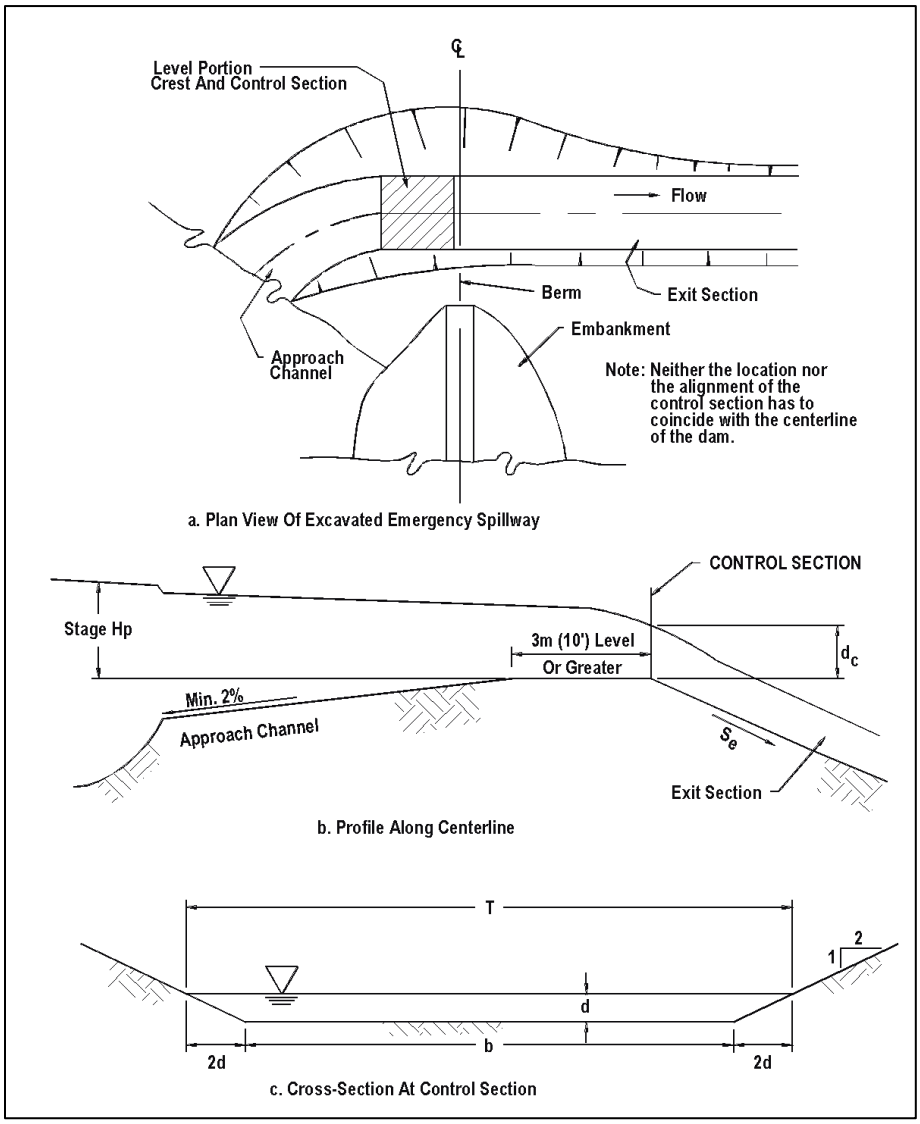
For multistage control structures, the inlet control structure would be designed considering the full range of flows. A stage-discharge curve would be developed for the full range of flows that the structure would experience. The design flows will typically be orifice flow through whatever shape the designer has chosen while the higher flows will typically be weir flow over the top of the control structure. Orifices can be designed using the equations in **Section 10.3.1** and weirs can be designed using the equations in **Section 10.3.2**. The pipe must be designed to carry all flows considered in the design of the control structure.

In designing a multistage structure, the designer would first develop peak discharges that must be passed through the facility. The second step would be to select a pipe that will pass the peak flow within the allowable headwater and develop a performance curve for the pipe. Thirdly, the designer would develop a stage-discharge curve for the inlet control structure, recognizing that the headwater for the discharge pipe will be the tailwater that needs to be considered in designing the inlet structure. Last, the designer would use the stage-discharge curve in the basin routing procedure.

10.3.4 Emergency Overflow Weirs

The purpose of an emergency overflow weir is to provide a controlled relief for storm flows in excess of the design discharge for the storage facility. An emergency overflow weir usually has a trapezoidal cross-section for ease of construction. Emergency overflow weirs that do not incorporate a spillway, comparable to the illustration in Figure 10-5, should be treated as a broad-crested weir. Spillway design should use the following equations.

Figure 10-5: Emergency Spillway Design Schematic



Source: *HEC 22* [5]

Equation 10-9 presents a relationship for computing the flow through a broad-crested emergency spillway. The dimensional terms in the equation are illustrated in Figure 10-5.

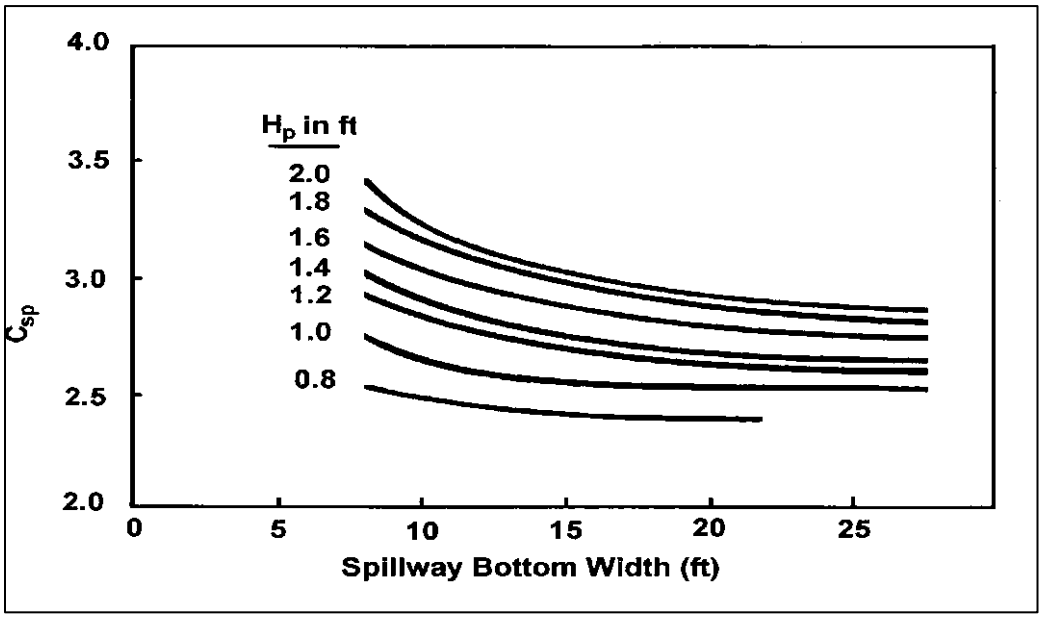
Equation 10-9

$$Q = C_{SP} b H_P{}^{1.5}$$

Where:
Q = Emergency spillway discharge (cfs)
C_{SP} = Discharge coefficient
b = Width of the emergency spillway (ft)
H_P = Effective head on the emergency spillway (ft).

The discharge coefficient, C_{SP}, in Equation 10-9 varies as a function of spillway bottom width and effective head. Figure 10-6 illustrates this relationship. Table 10-2 (modified from USDA, 1969) provides a tabulation of emergency spillway design parameters.

Figure 10-6: Discharge Coefficients for Emergency Spillways, English Units



Source: *HEC 22* [5]

The critical slopes of Table 10-2 are based upon an assumed n = 0.040 for turf cover of the spillway. For a paved spillway, the n should be assumed as 0.015. Equation 10-10 and Equation 10-11 can be used to compute the critical velocity and slope for spillway materials having other roughness values.

Equation 10-10

$$V_c = K_{SP}(Q/b)^{0.33}$$

Where:
V_c = Critical velocity at emergency spillway control section (ft/s)
Q = Emergency spillway discharge (cfs)
b = Width of the emergency spillway (ft)
K_{SP} = 3.18 (English units).

Equation 10-11

$$S_c = K'_{SP} n^2 [(V_c b)/Q]^{0.33}$$

Where:
S_c = Critical slope (ft/ft)
n = Manning's coefficient
V_c = Critical velocity at emergency spillway control section (ft/s)
Q = Emergency spillway discharge (cfs)
b = Width of the emergency spillway (ft)
K'_{SP} = 14.6 (English units).

Table 10-2: Emergency Spillway Design Parameters (English units)

H_p (ft)		Spillway Bottom Width, b, (ft)											
		8	10	12	14	16	18	20	22	24	26	28	30
0.8	Q	14	18	21	24	28	32	35	-	-	-	-	-
	V_c	3.6	3.6	3.6	3.7	3.7	3.7	3.7	-	-	-	-	-
	S_c	3.2	3.2	3.2	3.2	3.1	3.1	3.1	-	-	-	-	-
1	Q	22	26	31	36	41	46	51	56	61	66	70	75
	V_c	4.1	4.1	4.1	4.1	4.1	4.1	4.2	4.2	4.2	4.2	4.2	4.2
	S_c	3	3	3	3	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9
1.2	Q	31	37	44	50	56	63	70	76	82	88	95	101
	V_c	4.5	4.5	4.5	4.6	4.6	4.6	4.6	4.7	4.6	4.6	4.6	4.6
	S_c	2.8	2.8	2.8	2.8	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.6
1.4	Q	40	48	56	65	73	81	90	98	105	113	122	131
	V_c	4.9	4.9	4.9	4.9	5	5	5	5	5	5	5	5
	S_c	2.7	2.7	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6
1.6	Q	51	62	72	82	92	103	113	123	134	145	155	165
	V_c	5.2	5.2	5.3	5.3	5.3	5.3	5.3	5.4	5.4	5.4	5.4	5.4
	S_c	2.6	2.6	2.6	2.6	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.4
1.8	Q	64	76	89	102	115	127	140	152	164	176	188	200
	V_c	5.5	5.5	5.6	5.6	5.6	5.7	5.7	5.7	5.7	5.7	5.7	5.7
	S_c	2.5	2.5	2.5	2.4	2.4	2.4	2.4	2.4	2.4	2.3	2.3	2.3
2	Q	78	91	106	122	137	152	167	181	196	211	225	240
	V_c	5.8	5.8	5.8	5.9	6	6	6	6	6	6	6	6
	S_c	2.5	2.4	2.4	2.4	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3

NOTE:
1. For a given H_p, decreasing exit slope from S_c decreases spillway discharge, but increasing exit slope from S_c does not increase discharge.
2. If a slope S_e steeper than S_c is used, velocity V_e in the exit channel will increase according to the following relationship: $V_e = V_c(S_e/S_c)^{0.3}$
3. After Maryland SCS

Source: *HEC 22* [5]

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11 Lakes, Dams and Levees

11.1 Lakes and Dams

11.1.1 General Requirements

In the event that a property owner or developer desires to modify an existing pond or lake or desires to impound stormwater by filling or constructing an aboveground dam, thereby creating a lake, pond, lagoon or basin as part of the planned development of that property, the criteria listed below shall be met before city approval of the impoundment can be given. Ponds or lakes created by excavation of a channel area without erecting a dam above natural ground elevation or instream low water check dams are also subject to the criteria listed below, with the exception of spillway capacity requirements. The City Engineer has the final authority to determine the design criteria for a proposed dam, check dam or excavated lake. The dam safety requirements of the Texas Commission on Environmental Quality (TCEQ) and Federal Emergency Management Agency (FEMA) must also be met for the construction of dams, lakes, and other improvements.

11.1.2 Dam Design Criteria

A. The design criteria for a dam are dependent on the size and hazard classification of the dam. The size and hazard classification will be based on the recommended guidelines adopted by the TCEQ under Texas Water Code 12.052, which provides for the safe construction, maintenance, repair and removal of dams located in the State of Texas, and will be determined by the City Engineer based on information furnished by the owner. The following criteria will be used to classify a dam:
    1. Size. The classification for size is based on the height of the dam and storage capacity, whichever gives the larger size category. “Height” is defined as the distance between the top of the dam (minus the freeboard) and the existing streambed at the downstream toe. Storage is defined as the maximum water volume impounded at the top of the dam (minus the freeboard).
    2. Hazard potential. The hazard potential for a dam is based on the potential for loss of human life and property damage downstream from a dam in the event of failure. Hazard Potential Classifications are based on the potential for loss of life and for the extent of economic loss based on existing and potential development downstream of the dam.
    3. Spillway Design Flood. The classification of a dam based on the above criteria will be used to determine the Spillway Design Flood (SDF). The total capacity of a dam structure, including principal and emergency spillways, shall be adequate to pass the SDF without exceeding the top dam elevation. The SDF’s for various dam classifications are described by TCEQ Dam Safety Guidelines.
B. All design will be for the fully developed watershed contributing to the structure.
C. In all cases, the minimum principal spillway design capacity is a minimum of the 100-year design flood. In certain cases, a dam breach analysis may be required to determine the proper classification of the structure. For all structures requiring a spillway design flood equal to the Probable Maximum Flood (PMF), a dam breach analysis is required to determine the downstream consequences of a failure. All dams shall be constructed with a minimum freeboard of two feet

above SDF elevation and upstream development within the contour line determined by the emergency spillway crest elevation plus 2-feet, or the 100-year flood elevation (based on fully developed watershed conditions) plus 2-feet, whichever is greater.

D. Owners of significant and high hazard dams were required to submit an Emergency Action Plan in accordance with Title 30 Texas Administrative Code (TAC) Chapter 299, Dams and Reservoirs, §299.61(b).

11.1.3 Maintenance and Liability Criteria

The owner or developer shall retain their private ownership of the constructed lake, pond or lagoon or basin and shall assume full responsibility for the protection of the general public from any health or safety hazards related to the lake, pond or lagoon constructed. The owner or developer shall assume full responsibility for the maintenance of the lake, pond or lagoon or basin constructed. The owner or developer shall keep TCEQ advised of the currently responsible agent for this maintenance. All dams are required to be registered with TCEQ in accordance with the TCEQ Dam Safety Regulations.

11.1.4 Natural Resource Conservation Service Lakes

A. There are a number of NRCS (previously Soil Conservation Service) lakes within the City limits and extraterritorial jurisdiction of the City of New Braunfels. These lakes present complex issues of flood control, erosion control, maintenance, and floodplain management. These lakes were constructed to NRCS standards. The lakes are in private ownership, with maintenance provided by Comal County. Operation of the lakes is the responsibility of Comal County. The City of New Braunfels is responsible for floodplain management of those areas upstream, downstream and adjacent to the lakes. Operation and maintenance of the NRCS lakes shall remain the responsibility of others.

B. The City of New Braunfels shall control future development upstream, downstream and adjacent to all NRCS lakes. Planning for future development which impacts on, or is impacted by, NRCS lakes shall require that a detailed engineering study be performed to provide a technical basis for development and that the dam be upgraded as follows:

   1. Provide principal spillway capacity adequate to discharge the 100-year flood event based on fully developed watershed conditions.
   2. Provide total capacity of the dam structure, including principal and emergency spillways to accommodate the PMF.
   3. Manage existing flood storage capacity.
   4. Prohibit upstream development within the contour line determine by the emergency spillway crest elevation plus 2-feet, or the 100-year flood elevation (based on fully developed watershed conditions) plus 2-feet, whichever is greater.
   5. Restrict development and improvements within the floodplain established by a breach flow analysis from the dam to the downstream limits of the dam breach impact.

11.1.5 Additional Design Requirements

A. An engineering plan for such construction accomplished by complete drainage design information and sealed by a licensed professional engineer, shall be approved by the City of New Braunfels.

B. The spillway and any emergency overflow areas shall be located so that floodwaters will not inundate any permanent habitable structures.

C. The minimum SDF should be the 100-year, 24-hour storm regardless of critical inflow design storm peaks.
D. The design shall comply with all federal, state and county laws pertaining to the impoundment of surface water, including the design, construction, and safety of the impounding structure. Copies of any federal, state or county permits issued for proposed impoundments shall be submitted to the City Engineer.
E. Any existing NRCS structure or other dams which are included in the project drainage area shall comply with the applicable federal, state, county and city safety requirements for structures. Improvements may be required to upgrade the structure to the currently adopted guidelines. Before removing, enlarging or altering any existing lake, the applicant will furnish a study of the effects of the alteration upon flooding conditions both upstream and downstream. The study shall be prepared by a professional engineer and submitted to the City Engineer for approval prior to making the proposed alteration.
F. Any improvements to existing dams or lakes or construction of new impoundments shall be made at the expense of the developer, prior to completion of the adjacent street, utilities and drainage improvements, as provided for under the subdivision regulations.

11.2 Levees

In the event that developers or owners wish to build levees to protect an area from flooding, all applicable FEMA guidelines, State of Texas Dam Safety Guideline, and the following criteria apply:

A. Levees shall be designed to have freeboard requirements as specified by FEMA.
B. Levees shall be designed according to the Corps of Engineers' design criteria used for federally authorized levees, whether or not they are federally authorized.
C. Ring levees shall not be permitted.
D. If possible, provision shall be made to provide the permanent maintenance of levees either by a flood control district or similar governmental organization of by the existing property owner and all future owners, heirs or assigns, through the use of a maintenance agreement.
E. Levee systems shall be designed with interior drainage system to prevent flooding from local runoff contained within the system for the 100-year design flood.
F. Levee system shall have written operation procedures that address gate-closure conditions and an emergency warning plan. A copy of these procedures shall be furnished to the City Engineer.
G. Automated gate-closure systems shall have power from two independent sources and shall be capable of being operated manually.
H. All new levee systems shall have permanent positive closures to the required design elevation. Temporary closures involving sandbagging or other procedures requiring manual operations shall not be permitted.
I. Additional plan requirements including water surface profiles for the design flood and standard project flood; the top of the levee profile, definition of interior drainage facilities, including pump station and ponding areas; location of gravity outlets, gatewells and closure structures; and elevation-duration data on the receiving system.

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12 Site Erosion Control During Construction

12.1 Applicable Properties or Construction Sites

Private property owners, developers or builders shall be accountable for any erosion of their property or construction site which results in measurable accumulation of sedimentation in dedicated streets, alleys, any waterway or other private properties. Any accumulation or deposit of soil material beyond the limits of the property or in City streets, alleys or drainage facilities in an amount sufficient to constitute a threat to public safety and comfort as determined by the City Engineer shall constitute a violation. Sediment carried by stormwater runoff through these acres shall be prevented from entering storm drain systems and natural watercourses.

12.2 General Guidelines for Erosion Control Plan

A. Maximum use shall be made of vegetation to minimize soil loss. At a minimum, 70% established re-vegetation is required for residential subdivision developments that do not retain the natural vegetation. Vegetation measures should begin as soon as possible during construction in order to allow for establishment at construction termination.
B. Natural vegetation should be retained wherever possible.
C. Where inadequate natural vegetation exists or where it becomes necessary to remove existing natural vegetation, temporary controls should be installed promptly to minimize soil loss and ensure that erosion and sedimentation does not occur. The developer is responsible for maintenance of site erosion control devices until a sufficient vegetation cover has been provided or replaced as determined by the City Engineer. Periodic maintenance shall be performed by the developer to remove accumulated sediment that would otherwise inhibit the proper functioning of the erosion control devices. Storm Water Pollution Prevention Plans (SWPPP) are required to maintained on all permitted construction sites at all times.
D. During construction, erosion controls shall be used to slow drainage flow rate and prevent downstream sedimentation.
E. Erosion control elements should be implemented as soon as practical in the development process.
F. Waste or disposal areas and construction roads should be located and constructed in a manner that will minimize the amount of sediment entering streams.
G. Frequent fording of live streams will not be permitted; therefore, temporary bridges or other structures shall be used wherever an appreciable number of crossings of a stream are necessary.
H. When work areas or material sources are located in or adjacent to live streams, such areas shall be separated from the stream by a dike or other barrier to keep sediment from entering a flowing stream. Care shall be taken during the construction and removal of such barriers to minimize the sediment transport into a stream.
I. Should preventative measures fail to function effectively, the applicant shall act immediately to bring the erosion and/or siltation under control by whatever additional means are necessary.
J. Erosion control devices shall be placed to trap any losses from stockpiled topsoil. Some acceptable forms of site erosion control devices include, but are not limited to, silt fences, silt traps, geonetting and geotextiles. Hay bales are not permitted.

K. The selection and timing of the installation of erosion controls shall be based upon weather and seasonal conditions that could make certain controls not practicable.
L. Vegetation used for vegetative cover shall be suitable for local soil and weather conditions. Ground cover plants shall comply with listings from the Texas Agricultural Extension Service.
M. Runoff shall be diverted away from construction areas as much as possible.
N. Stripping of vegetation from project sites shall be phased so as to expose the minimum amount of area to soil erosion for the shortest possible period of time. Phasing shall also consider the varying requirements of an erosion control plan at different stages of construction and shall include the establishment of new vegetation or permanent erosion control measures.
O. Developers, builders, or owners of property shall install all utilities, including franchise utilities, before final acceptance of a subdivision, property and/or structure. Final acceptance will also be contingent upon having all necessary erosion control measures installed to minimize off-site sediment. At the discretion of the City Engineer; a site may be accepted without erosion control measures if perennial vegetative cover is actively growing.
P. SWPPP shall follow TCEQ rules.

12.3 Stream Bank Erosion

Erosion control will be provided along streams and drainage channels. Where bank stabilization or other erosion protection measures are required to protect streams and channels, the stream bank protection and erosion damage mitigation measures provided in this manual shall be utilized.

13 Water Quality Controls

13.1 Applicability

Permanent water quality controls for development located over Edwards Aquifer regulated zones shall comply with the latest Texas Commission on Environmental Quality (TCEQ) published rules and technical design guidance. Permanent water quality controls for new development outside of the Edwards Aquifer regulated zones shall meet the criteria in this manual if the following are met:

1. The development is located in the City's Jurisdiction; and,
2. The development is defined as Type 3; and,
3. The total impervious cover for the development will exceed 30% of the contiguous property as a result of the development.

13.2 Design Criteria

Permanent water quality best management practices (BMPs) shall be designed to provide adequate treatment of the water quality volume (WQV) in the City's Jurisdiction. The WQV is defined as the first one-half inch of runoff from all new impervious surfaces added to a site that does not replace existing impervious surfaces (Equation 13-1).

Equation 13-1

$$WQV\ (cubic\ feet) = \frac{0.5\ inches}{12\frac{inch}{foot}} \times (\ IC\ Area\ Post\ Construction - IC\ Area\ Pre\ Construction)(sq.ft.)$$

13.3 Treatment Methods

In order to provide adequate treatment, one of the following methods must be followed:

1. Detention Filtration: Detain the WQV in an earthen basin for at least 24 hours as described in this Section
2. Provide one or more BMPs that meet the requirements in TCEQ report publication RG-348 and/or subsequent addenda
3. Provide BMPs that are approved by the Engineering Division prior to submission of a development application.

The WQV may be reduced by applying for impervious cover credits and/or the use of Low Impact Development (LID) strategies. Impervious cover credits and LID strategies are defined in the City of New Braunfels LID Manual.

13.3.1 Detention Filtration

The following process determines detention filtration requirements:

1. Calculate the minimum extended detention volume using Equation 13-2. The water quality volume shall be increased by a safety factor of 20% to account for deposition of solids over time. A fixed vertical sediment depth marker shall be installed in the basin to indicate when sediment

accumulation meets or exceeds 20% of the water quality volume and sediment removal is required.

Equation 13-2

$$V = WQV * 1.2$$

2. The flow path from the inlet to the outlet of the extended detention basin should be twice as long as the width of the extended detention basin.
3. The 24-hour draw-down time should be achieved by installing the appropriate sized orifice on the outlet structure. No more than 50% of the extended detention volume shall drain from the facility within the first 12 hours. Outlet pipes shall be designed to prevent accumulated sediment from discharging from extended detention basin.
    a. If perforated pipe is used, then the size of the perforations should not be used for draw-down time design purposes, and a filter should be installed to prevent the perforations from clogging.
    b. If the discharge pipe extends through a concrete wall, then a sleeve is required in the wall, and a water proof sealant should be used to prevent leaks around the sleeve.
4. The extended detention basin may be installed offline from peak flow attenuating detention basins or incorporated into a detention basin

13.3.2 TCEQ Method

When a treatment method approved by TCEQ is utilized outside of the Edwards regulatory zones, the increase in TSS load resulting from all new impervious surfaces must be reduced by at least 70%. Calculation of the capture volume or minimum flow rate shall follow the method in the latest technical guidance on BMPs for the Edwards Aquifer Rules.

13.3.3 Alternative Methods

The Engineering Division prior to submitting a development application must approve all other methods. Alternative methods must show comparable treatment levels as the Detention Filtration or TCEQ Methods.

13.4 Maintenance

A maintenance schedule and plan for water quality controls shall be submitted to the Engineering Division prior to approval of construction plans. When included as part of a subdivided development, a maintenance bond shall be provided in accordance with Section 118-38 of the New Braunfels Code of Ordinances. Alternate methods may require additional monitoring and engineering studies to ensure compliance.

Chapter 58 – FLOODS[1]

Footnotes:

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Cross reference- Buildings and building regulations, ch. 14; civil emergencies, ch. 34; environment, ch. 50; fire prevention and protection, ch. 54; health and sanitation, ch. 62; planning, ch. 98; platting, ch. 118; utilities, ch. 130; vegetation, ch. 134; vehicles for hire, ch. 138; zoning, ch. 144.

State Law reference- Municipal water control, V.T.C.A., Local Government Code§ 401.001 et seq.; municipal drainage utility systems, V.T.C.A., Local Government Code§ 402.041 et seq.; city-county water control, V.T.C.A., Local Government Code§§ 411.002, 411.003; Flood Control and Insurance Act, V.T.C.A., Water Code§ 16.311 et seq.; contracts with conservation districts for flood control and drainage, V.T.C.A., Agriculture Code§ 201.152; disaster prevention, V.T.C.A., Government Code§

418.121 et seq.

ARTICLE I. - IN GENERAL

Secs. 58-1-58-25. - Reserved.

ARTICLE II. - FLOOD DAMAGE PREVENTIONl.1J

Footnotes:

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Editor's note- Ord. No. 2011-53, § 1, adopted June 27, 2011, repealed and reenacted article II in its entirety to read as herein set out. Formerly, article II pertained to similar subject matter and derived from Ord. No. 2010-04, § 1, adopted January 11, 2010.

Sec. 58-26. - Statutory authorization, findings of fact, purpose and methods.

58-26.1. *Statutory authorization.* The legislature of the state has in the Flood Control Insurance Act, V.T.C.A., Water Code§ 16.315, delegated the responsibility of local governmental units to adopt regulations designed to minimize flood losses. Therefore, the city does ordain as follows.

58-26.2. *Findings of fact.*

(1) The flood hazard areas of the city are subject to periodic inundation, which results in loss of life and property, health and safety hazards, disruption of commerce and governmental services, and extraordinary public expenditures for flood protection and relief, all of which adversely affect the public health, safety and general welfare.

(2) These flood losses are created by the cumulative effect of obstructions in floodplains which cause an increase in flood heights and velocities, and by the occupancy of flood hazard areas by uses vulnerable to floods and hazardous to other lands because they are inadequately elevated, floodproofed or otherwise protected from flood damage.

58-26.3. *Statement of purpose.* It is the purpose of this article to promote the public health, safety and general welfare and to minimize public and private losses due to flood conditions in specific areas by provisions designed to:

(1) Protect human life and health;

(2) Minimize expenditure of public money for costly flood control projects;

(3) Minimize the need for rescue and relief efforts associated with flooding and generally undertaken at the expense of the general public;

(4) Minimize prolonged business interruptions;

(5) Minimize damage to public facilities and utilities such as water and gas mains, electric, telephone and sewer lines, streets and bridges located in floodplains;

(6) Help maintain a stable tax base by providing for the sound use and development of flood-prone areas in such a manner as to minimize future flood blight areas; and

(7) Insure that potential buyers are notified that property is in a flood area.

58-26.4. *Methods of reducing flood losses.* In order to accomplish its purposes, this article uses the following methods:

(1) Restrict or prohibit uses that are dangerous to health, safety or property in times of flood, or cause excessive increases in flood heights or velocities;

(2) Require that uses vulnerable to floods, including facilities which serve such uses, be protected against flood damage at the time of initial construction;

(3) Control the alteration of natural floodplains, stream channels, and natural protective barriers, which are involved in the accommodation of flood waters;

(4) Control filling, grading, dredging and other development which may increase flood damage;

(5) Prevent or regulate the construction of flood barriers which will unnaturally divert flood waters or which may increase flood hazards to other lands.

(Ord. No. 2011-53, § 1, 6-27-11)

Sec. 58-27. - Definitions.

Unless specifically defined below, words or phrases used in this article shall be interpreted to give them the meaning they have in common usage and to give this article its most reasonable application.

Alluvial fan flooding means flooding occurring on the surface of an alluvial fan or similar landform which originates at the apex and is characterized by high-velocity flows; active processes of erosion, sediment transport, and deposition; and unpredictable flow paths.

Apex means a point on an alluvial fan or similar landform below which the flow path of the major stream that formed the fan becomes unpredictable and alluvial fan flooding can occur.

Appurtenant structure means a structure which is on the same parcel of property as the principal structure to be insured and the use of which is incidental to the use of the principal structure.

Area of future conditions flood hazard means the land area that would be inundated by the one- percent-annual chance (100-year) flood based on future conditions hydrology.

Area of shallow flooding means a designated AO, AH, AR/AO, AR/AH, or VO zone on a community's flood insurance rate map (FIRM) with a one percent or greater annual chance of flooding to an average depth of one to three feet where a clearly defined channel does not exist, where the path of flooding is unpredictable and where velocity flow may be evident. Such flooding is characterized by ponding or sheet flow.

Area of special flood hazard is the land in the floodplain within a community subject to a

one percent or greater chance of flooding in any given year. The area may be designated as Zone A on the flood hazard boundary map **(FHBM).** After detailed rate making has been completed in preparation for publication of the **FIRM,** Zone A usually is refined into Zones A, AO, AH, A1-30, AE, A99, AR, AR/A1-30, AR/AE, AR/AO, AR/AH, AR/A, VO, V1-30, VE or V.

Atlas 14 refers to rainfall data obtained from NOAA Atlas 14, Volume 11 Precipitation Frequency Atlas of Current United States published September 27, 2018 for the State of Texas.

Base flood means the flood having a one percent chance of being equaled or exceeded in any given year.

Base flood elevation (BFE) means the elevation shown on the flood insurance rate map (FIRM) and found in the accompanying flood insurance study (FIS) for Zones A, AE, AH, A1-A30, AR, V1-V30, or VE that indicates the water surface elevation resulting from the flood that has a one percent chance of equaling or exceeding that level in any given year. Also called the "Base flood."

Basement means any area of the building having its floor subgrade (below ground level) on all sides.

Breakaway wall means a wall that is not part of the structural support of the building and is intended through its design and construction to collapse under specific lateral loading forces, without causing damage to the elevated portion of the building or supporting foundation system.

Critical feature means an integral and readily identifiable part of a flood protection system, without which the flood protection provided by the entire system would be compromised.

Compensatory excavation means excavation to offset/mitigate lost floodplain volume due to fill placed in a special flood hazard area.

Development means any man-made change to improved and unimproved real estate, including but not limited to buildings or other structures, mining, dredging, filling, grading, paving, excavation or drilling operations or storage of equipment or materials.

Elevated building means, for insurance purposes, a non-basement building, which has its lowest elevated floor, raised above ground level by foundation walls, shear walls, posts, piers, pilings, or columns.

Existing construction means for the purposes of determining rates, structures for which the "start of construction" commenced before the effective date of the FIRM or before January 1, 1975, for FIRMs effective before that date. "Existing construction" may also be referred to as "existing structures."

Existing manufactured home park or subdivision means a manufactured home park or subdivision for which the construction of facilities for servicing the lots on which the manufactured homes are to be affixed (including, at a minimum, the installation of utilities, the construction of streets, and either final site grading or the pouring of concrete pads) is completed before the effective date of the floodplain management regulations adopted by a community.

Expansion to an existing manufactured home park or subdivision means the preparation of additional sites by the construction of facilities for servicing the lots on which the manufactured homes are to be affixed (including the installation of utilities, the construction of streets, and either final site grading or the pouring of concrete pads).

Flood or *flooding* means a general and temporary condition of partial or complete inundation of normally dry land areas from:

(1) The overflow of inland or tidal waters.

(2) The unusual and rapid accumulation or runoff of surface waters from any source.

Flood elevation study means an examination, evaluation and determination of flood hazards and,

if appropriate, corresponding water surface elevations, or an examination, evaluation and determination of mudslide (i.e., mudflow) and/or flood-related erosion hazards.

Flood insurance rate map (FIRM) means an official map of a community, on which the Federal Emergency Management Agency has delineated both the special flood hazard areas and the risk premium zones applicable to the community.

Flood insurance study (FIS). See "Flood elevation study."

Floodplain or *flood-prone area* means any and all land area adjoining the channel of a river, stream, lake, watercourse, marshy area, or other drainage element, which has been or may be inundated by stormwater runoff. The extent of the floodplain shall be determined by the crest of a flood having a one percent chance of occurrence in one year. (see definition of "Flooding").

Floodplain fill means earthen fill placed in the special flood hazard area for development within the floodplain based on a permit under applicable Federal, state, and local laws, ordinances, and regulations.

Floodplain management means the operation of an overall program of corrective and preventive measures for reducing flood damage, including but not limited to emergency preparedness plans, flood control works and floodplain management regulations.

Floodplain management regulations means zoning ordinances, subdivision regulations, building codes, health regulations, special purpose ordinances (such as a floodplain ordinance, grading ordinance and erosion control ordinance) and other applications of police power. The term describes such state or local regulations, in any combination thereof, which provide standards for the purpose of flood damage prevention and reduction.

Floodplain reclamation means the area in the special flood hazard area that can be potentially used for fill placement and future development based on a permit under applicable Federal, state, and local laws, ordinances, and regulations.

Flood protection system means those physical structural works for which funds have been authorized, appropriated, and expended and which have been constructed specifically to modify flooding in order to reduce the extent of the area within a community subject to a "special flood hazard" and the extent of the depths of associated flooding. Such a system typically includes hurricane tidal barriers, dams, reservoirs, levees or dikes. These specialized flood modifying works are those constructed in conformance with sound engineering standards.

Flood proofing means any combination of structural and non-structural additions, changes, or adjustments to structures which reduce or eliminate flood damage to real estate or improved real property, water and sanitary facilities, structures and their contents.

Floodway. See "Regulatory floodway."

Functionally dependent use means a use, which cannot perform its intended purpose unless it is located or carried out in close proximity to water. The term includes only docking facilities, port facilities that are necessary for the loading and unloading of cargo or passengers, and ship building and ship repair facilities, but does not include long-term storage or related manufacturing facilities.

Future condition means the condition of the watershed assumed to be fully built out based on zoning and/or future land use projections. See “Area of future conditions flood hazard.”

Highest adjacent grade means the highest natural elevation of the ground surface prior to construction next to the proposed walls of a structure.

Historic structure means any structure that is:

(1) Listed individually in the National Register of Historic Places (a listing maintained by the Department of Interior) or preliminarily determined by the Secretary of the Interior as meeting the requirements for individual listing on the National Register;

(2) Certified or preliminary determined by the Secretary of the Interior as contributing to the historical significance of a registered historic district or a district preliminary determined by the Secretary to qualify as a registered historic district;

(3) Individually listed on a state inventory of historic places in states with historic preservation programs which have been approved by the Secretary of the Interior; or

(4) Individually listed on a local inventory or historic places in communities with historic preservation programs that have been certified either:

a. By an approved state program as determined by the Secretary of the Interior; or

b. Directly by the Secretary of the Interior in states without approved programs.

Levee means a man-made structure, usually an earthen embankment, designed and constructed in accordance with sound engineering practices to contain, control, or divert the flow of water so as to provide protection from temporary flooding.

Levee system means a flood protection system which consists of a levee, or levees, and associated structures, such as closure and drainage devices, which are constructed and operated in accordance with sound engineering practices.

Lowest floor means the lowest floor of the lowest enclosed area (including basement). An unfinished or flood resistant enclosure, usable solely for parking or vehicles, building access or storage in an area other than a basement area is not considered a building's lowest floor; provided that such enclosure is not built so as to render the structure in violation of the applicable non-elevation design requirement of Section 60.3 of the National Flood Insurance Program regulations.

Manufactured home means a structure transportable in one or more sections, which is built on a permanent chassis and is designed for use with or without a permanent foundation when connected to the required utilities. The term "manufactured home" does not include a "recreational vehicle."

Manufactured home park or subdivision means a parcel (or contiguous parcels) of land divided into two or more manufactured home lots for rent or sale.

Mean sea *level* means, for purposes of the National Flood Insurance Program, the North American Vertical Datum (NAVO) of 1988 or other datum, to which base flood elevations shown on a community's flood insurance rate map are referenced.

New construction means, for the purpose of determining insurance rates, structures for which the "start of construction" commenced on or after the effective date of an initial FIRM or after December 31, 1974, whichever is later, and includes any subsequent improvements to such structures. For floodplain management purposes, "new construction" means structures for which the "start of construction" commenced on or after the effective date of a floodplain management regulation adopted by a community and includes any subsequent improvements to such structures.

New manufactured home park or subdivision means a manufactured home park or subdivision for which the construction of facilities for servicing the lots on which the manufactured homes are to be affixed (including at a minimum, the installation of utilities, the construction of streets, and either final site grading or the pouring of

concrete pads) is completed on or after the effective date of floodplain management regulations adopted by a community.

Pre-development conditions means the conditions of the site within the Special Flood Hazard Area before making any changes within the floodplain. Can also be referred to as Pre-Project Conditions

Post-development conditions means the conditions of the site either before or after construction is complete. Can also be referred to as Post-Project Conditions.

Recreational vehicle means a vehicle which is:

(1) Built on a single chassis;

(2) Four hundred square feet or less when measured at the largest horizontal projections;

(3) Designed to be self-propelled or permanently towable by a light duty truck; and

(4) Designed primarily not for use as a permanent dwelling but as temporary living quarters for recreational, camping, travel, or seasonal use.

Regulatory floodplain means the land within the community subject to a one (1) percent or greater chance of flooding in any given year assuming Ultimate Development has occurred throughout the contributing watershed, which the city or community will use to future regulate design and construction within their municipality.

Regulatory floodway means the channel of a river or other watercourse and the adjacent land areas that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation.

Regulatory water surface elevation means the water surface elevation within the community subject to a one (1) percent or greater chance of flooding in any given year assuming Ultimate Development has occurred throughout the contributing watershed, which the city or community will use to future regulate design and construction within their municipality.

Riverine means relating to, formed by, or resembling a river (including tributaries), stream, brook, etc.

Shaded-X means areas of moderate flood hazard from the principal source of flood in the area, determined to be within the limits of one percent and 0.2 percent annual chance floodplain. (Shaded Zone X is used on new and revised maps in place of Zone B).

Special flood hazard area. See "Area of special flood hazard."

Start of construction (for other than new construction or substantial improvements under the Coastal Barrier Resources Act [Pub. L. 97-348]), includes substantial improvement and means the date the building permit was issued, provided the actual start of construction, repair, reconstruction, rehabilitation, addition placement, or other improvement was within 180 days of the permit date. The actual start means either the first placement of permanent construction of a structure on a site, such as the pouring of slab or fop tings, the installation of piles, the construction of columns, or any work beyond the stage of excavation, or the placement of a manufactured home on a foundation. Permanent construction does not include land preparation, such as clearing, grading and filling; nor does it include the installation of streets and/or walk ways; nor does it include excavation for basement, footings, piers or foundations or the erection of temporary forms; nor does it include the installation on the property of accessory buildings, such as garages or sheds not occupied as dwelling units or not part of the main structure. For a substantial improvement, the actual start of construction means the first alteration of any wall, ceiling, floor, or other structural part of a building, whether or not that alteration affects the external dimensions

of the building.

Structure means, for floodplain management purposes, a walled and roofed building, including a gas or liquid storage tank, that is principally above ground, as well as a manufactured home.

Substantial damage means damage of any origin sustained by a structure whereby the cost of restoring the structure to its before damaged condition would equal or exceed 50 percent of the market value of the structure before the damage occurred.

Substantial improvement means any reconstruction, rehabilitation, addition, or other improvement of a structure, the cost of which equals or exceeds 50 percent of the market value of the structure before "start of construction" of the improvement. This term includes structures which have incurred "substantial damage", regardless of the actual repair work performed. The term does not, however, include either:

(1) Any project for improvement of a structure to correct existing violations of state or local health, sanitary, or safety code specifications which have been identified by the local code enforcement official and which are the minimum necessary to assure safe living conditions, or

(2) Any alteration of a "historic structure", provided that the alteration will not preclude the structure's continued designation as a "historic structure."

Ultimate development means a hypothetical condition where it is assumed the entire watershed is fully developed. Ultimate development can also refer to an urban watershed which is already fully developed, in which case, the existing conditions represents Ultimate Development. Also, see “Future Conditions”

Variance means a grant of relief by a community from the terms of a floodplain management regulation. (For full requirements see Section 60.6 of the National Flood Insurance Program regulations.)

Violation means the failure of a structure or other development to be fully compliant with the community's floodplain management regulations. A structure or other development without the elevation certificate, other certifications, or other evidence of compliance required in Section 60.3(b)(5), (c)(4), (c)(10), (d)(3), (e)(2), (e)(4), or (e)(5) is presumed to be in violation until such time as that documentation is provided.

Water surface elevation means the height, in relation to the North American Vertical Datum (NAVO) of 1988 (or other datum, where specified), of floods of various magnitudes and frequencies in the floodplains of coastal or riverine areas. See “*Regulatory water surface elevation.”*

(Ord. No. 2011-53, § 1, 6-27-11)

Sec. 58-28. - General provisions.

58-28.1. *Lands to which this article applies.* The article shall apply to all areas of and adjacent to special flood hazard within the jurisdiction of the city.

58-28.2. *Basis for establishing the areas of special flood hazard.*

The areas of special flood hazard identified by the Federal Emergency Management Agency in the current scientific and engineering report entitled "The Flood Insurance Study (FIS) for Comal County, Texas and Incorporated Areas," dated September 2, 2009, with accompanying flood insurance rate maps and/or flood boundary-floodway maps (FIRM and/or FBFM) dated September 2, 2009, and any revisions thereto are hereby adopted by reference and declared to be a part of this article; and

The areas of special flood hazard identified by the Federal Emergency Management Agency in the current scientific and engineering report entitled, "The Flood Insurance Study (FIS) for Guadalupe County, Texas and Incorporated Areas," dated November 2, 2007, with accompanying flood insurance rate maps and/or flood boundary-floodway maps (FIRM and/or FBFM) dated November 2, 2007, and any revisions thereto are hereby adopted by reference and declared to be part of this article.

The City requires the establishment of the one percent annual chance ultimate development conditions floodplain using Atlas 14 rainfall data as the regulatory floodplain. Until such time as such floodplain exists, it will be necessary ~~to~~ for development to utilize the above information from Comal and Guadalupe County and their Incorporated Areas to develop and establish the regulatory floodplain.

58-28.3. – Establishment of development permit. A floodplain development permit shall be required to ensure conformance with the provisions of this article.

58-28.4. *Compliance.* No structure or land shall hereafter be located, altered, or have its use changed without full compliance with the terms of this article and other applicable regulations.

58-28.5. *Abrogation and greater restrictions.* This article is not intended to repeal, abrogate, or impair any existing easements, covenants, or deed restrictions. However, where this article and another ordinance, easement, covenant, or deed restriction conflict or overlap, whichever imposes the more stringent restrictions shall prevail.

58-28.6. *Interpretation.* In the interpretation and application of this article, all provisions shall be:

(1) Considered as minimum requirements;

(2) Liberally construed in *favor* of the governing body; and

(3) Deemed neither to limit nor repeal any other powers granted under state statutes.

58-28.7. *Warning and disclaimer or liability.* The degree of flood protection required by this article is considered reasonable for regulatory purposes and is based on scientific and engineering considerations. On ~~rare~~ occasions, greater floods can and will occur and flood heights may be increased by man-made or natural causes. This article does not imply that land outside the areas of special flood hazards or uses permitted within such areas will be free from flooding or flood damages. This article shall not create liability on the part of the community or any official or employee thereof for any flood damages that result from reliance on this article or any administrative decision lawfully made hereunder.

(Ord. No. 2011-53, § 1, 6-27-11)

Sec. 58-29. - Administration.

58-29.1. *Designation of the floodplain administrator.* The City Engineer or his/her designee is hereby appointed the floodplain administrator to administer and implement the provisions of this article and other appropriate sections of 44 CFR (Emergency Management and Assistance - National Flood Insurance Program Regulations) pertaining to floodplain management.

58-29.2. *Duties and responsibilities of the floodplain administrator.* Duties and responsibilities of the floodplain administrator shall include, but not be limited to, the following:

(1) Maintain and hold open for public inspection all records pertaining to the provisions of this article.

(2) Collaborate with the Planning and Development Services Department on review of permit applications to determine whether to ensure that the proposed building site project, including the placement of manufactured homes and RVs, will be

reasonably safe from flooding.

(3) Collaborate with the Planning and Development Services Department to rReview, approve or deny all applications for development permits required by adoption of this article.

(4) Review permits for proposed development to assure that all necessary permits have been obtained from those federal, state or local governmental agencies (including Section 404 of the Federal Water Pollution Control Act Amendments of 1972, 33 U.S.C. 1334) from which prior approval is required.

(5) Where interpretation is needed as to the exact location of the boundaries of the areas of special flood hazards (for example, where there appears to be a conflict between a mapped boundary and actual field conditions) the floodplain administrator shall make the necessary interpretation.

(6) Notify, in riverine situations, adjacent communities and the state coordinating agency which is the Texas Water Development Board (TWDB) and also the Texas Commission on Environmental Quality (TCEQ), prior to any alteration or relocation of a watercourse, and submit evidence of such notification to the Federal Emergency Management Agency.

(7) Assure that the flood carrying capacity within the altered or relocated portion of any watercourse is maintained.

(8) When regulatory flood elevation data has not been provided in accordance with subsection 58-28.2, the floodplain administrator shall obtain, review and reasonably utilize any regulatory flood elevation data and floodway data available from a federal, state or other source, or request the engineer to develop such study in accordance to the guidelines specified by City of New Braunfels Drainage and Erosion Control Design manual (DCM), in order to administer the provisions of section 58-30.

(9) When a regulatory floodway has not been designated, the floodplain administrator must require that no new construction, substantial improvements, or other development (including fill) shall be permitted within Zones A1-30 and AE on the community's FIRM, unless it is demonstrated to the City that the cumulative effect of the proposed development, when combined with all other existing and anticipated development, will not increase the water surface elevation of the base flood more than one foot at any point within the community.

(10) Under the provisions of 44 CFR Chapter 1, Section 65.12, of the National Flood Insurance Program regulations, in some cases, a community may approve certain development in Zones A1-30, AE, AH on the community's FIRM which increases the water surface elevation of the base flood by more than one foot, provided that the community first completes all of the provisions required by Section 65.12.

(11) Any requirements necessary for the strength, stability or proper operation of an existing or proposed building, structure, electrical, gas, mechanical or plumbing system, or for the public safety, health and general welfare, not specifically covered by this chapter or the other technical codes, shall be determined by the floodplain administrator or his/her designee. In addition, other requirements to implement, clarify or set procedures to accomplish the intent of this chapter may be set in writing by the floodplain administrator and may be posted electronically for public access.

~~(11)~~

58-29.3. *Permit procedures.*

(1) Application for a floodplain development permit shall be presented to the floodplain administrator on forms furnished by him/her and may include, but not be limited to, plans in duplicate drawn to scale showing the location, dimensions, and elevation of proposed landscape alterations, existing and proposed structures, including the placement of manufactured homes and RVs, and the location of the foregoing in relation to areas of special flood hazard. Additionally, the following information is required:

a. Elevation (in relation to mean sea level), of the lowest floor (including basement) of all new and substantially improved structures;

b. Elevation in relation to mean sea level to which any nonresidential structure shall be floodproofed;

c. A certificate from a registered professional engineer or architect that the nonresidential floodproofed structure shall meet the floodproofing criteria of subsection 58-30.2(2);

d. Description of the extent to which any watercourse or natural drainage will be altered or relocated as a result of proposed development;

e. Maintain a record of all such information in accordance with subsection 58-29.2(1);

f. Detailed drawings for the proposed development. Drawings must clearly indicate that all provisions of these regulations will be met. On developments other than residential accessory buildings less than 150 square feet or other insignificant developments (carports, well houses, gazebos, etc.) drawings must be sealed by a licensed professional engineer or registered architect certifying that all provisions of these regulations will be met if the development is completed in accordance with the sealed drawings.

g. A topographic survey of the property to be developed. This requirement may be waived for fences or other insignificant types of development.

h. In cases where a determination must be made as to whether the construction is substantial improvement, additional information may need to be submitted as outlined in these regulations.

i. The top of the slab of the lowest habitable floor must be elevated to two feet or more above the regulatory floodplain elevation.

j. A form board survey with elevations signed by a registered public land surveyor (R.P.L.S.) will be required before framing begins. Approval must be given by the floodplain administrator or his/her designee to begin framing if the survey meets all requirements.

k. A completed elevation certificate with the necessary regulatory floodplain elevations, hydrological and hydraulic data as needed must be submitted when the structure is completed (completed and ready for habitation for residential structures).

l. All structures will be constructed and anchored to prevent flotation, collapse or lateral movement of the structure resulting from the hydrodynamic and hydrostatic loads, including the effect of buoyancy.

m. Construction shall use methods that will minimize flood damage and

construction materials and utility equipment that are resistant to flood damage. FEMA technical bulletins will serve as the guideline for this requirement.

n. Unless dry-proofed, enclosed areas below the regulatory floodplain elevation must be equipped with flood openings or vents capable of equalizing water levels and hydrostatic loads. Covers for these openings must not interfere with the equalization of water levels in the event of a flood and should minimize potential blockage by debris. FEMA Bulletin 1 or subsequent revisions shall serve as the guideline for this requirement. A licensed architect or licensed professional engineer shall certify the flood openings. (This can only be done within the floodplain not the floodway.

o. Thermal insulation used below the regulatory floodplain elevation shall be of a type that does not absorb water.

p. Water heaters, furnaces, air conditioning systems, electrical distribution panels and any other mechanical or electrical equipment must be elevated at least two feet above the regulatory floodplain elevation. Separate electrical circuits shall serve any level below the regulatory floodplain elevation and shall be dropped from above.

q. All air ducts, loose pipes, propane tanks and storage tanks located at or below the regulatory floodplain level shall be firmly anchored to prevent floatation. Tanks and ducts shall be vented to at least two feet above the regulatory floodplain elevation.

(2) The floodplain development permit application may be filed with the application for building permit or separately prior to application for building permit. The floodplain development permit application shall include the following information:

a. Completed floodplain development permit application form.

b. Applicable permit fees:

1. One-and two-family dwelling floodplain permit + ($.05/sf for residential) …. $100.00

2. Other than one- and two-family dwelling floodplain permit + ($.10/sf for commercial) …. $250.00.

~~2.~~3. Any other applicable fees in accordance with the current Fee Schedule.

c. ~~If filed separately prior to application for building permit. Three complete sets of p~~Plans, sealed by a Texas registered engineer, architect or land surveyor meeting (at minimum) requirements set forth in this chapter~~are needed~~.

(3) Approval or denial of a floodplain development permit by the floodplain administrator shall be based on all of the provisions of this article and the following relevant factors:

a. The danger to life and property due to flooding or erosion damage;

b. The susceptibility of the proposed facility and its contents to flood damage and the effect of such damage on the individual owner;

c. The danger that materials may be swept onto other lands to the injury of others;

d. The compatibility of the proposed use with existing and anticipated development;

e. The safety of access to the property in times of flood for ordinary and emergency vehicles;

f. The costs of providing governmental services during and after flood conditions including maintenance and repair of streets and bridges, and public utilities and facilities such as sewer, gas, electrical and water systems;

g. The expected heights, velocity, duration, rate of rise and sediment transport of the floodwaters and the effects of wave action, if applicable, expected at the site;

h. The necessity to the facility of a waterfront location, where applicable;

i. The availability of alternative locations, not subject to flooding or erosion damage, for the proposed use.

58-29.4. *Variance procedures*.

(1) The ~~construction board of appeals, as established by~~[MR1] City Council, shall hear and render judgment on requests for variances from the requirements of this article.

(2) The ~~construction board of appeals~~City Ciuncil shall hear and render judgment on an appeal only when it is alleged there is an error in any requirement, decision, or determination made by the floodplain administrator in the enforcement or administration of this article.

(3) Any person or persons aggrieved by the decision of the ~~construction board of appeals~~City Council may appeal such decision in the courts of competent jurisdiction.

(4) The floodplain administrator shall maintain a record of all actions involving an appeal and shall report variances to the Federal Emergency Management Agency upon request.

(5) Variances may be issued for the reconstruction, rehabilitation or restoration of structures listed on the National Register of Historic Places or the State Inventory of Historic Places, without regard to the procedures set forth in the remainder of this article.

(6) Variances may be issued for new construction and substantial improvements to be erected on a lot of one-half acre or less in size contiguous to and surrounded by lots with existing structures constructed below the regulatory floodplain level, providing the relevant factors in subsection 58-29.3(2) have been fully considered. As the lot size increases beyond the one-half acre, the technical justification required for issuing the variance increases.

(7) Upon consideration of the factors noted above and the intent of this article, the construction board of appeals may attach such conditions to the granting of variances as it deems necessary to further the purpose and objectives of this article (subsection 58-26.3).

(8) Variances shall not be issued within any designated floodway if any increase in flood levels during the base flood discharge would result.

(9) Variances may be issued for the repair or rehabilitation of historic structures upon a determination that the proposed repair or rehabilitation will not preclude the structure's continued designation as a historic structure and the variance is the minimum necessary to preserve the historic character and design of the structure.

(10) Prerequisites for granting variances:

a. Variances shall only be issued upon a determination that the variance is the

minimum necessary, considering the flood hazard, to afford relief.

b. Variances shall only be issued upon:

1. Showing a good and sufficient cause;

2. A determination that failure to grant the variance would result in exceptional hardship to the applicant, and

3. A determination that the granting of a variance will not result in increased flood heights, additional threats to public safety, extraordinary public expense, create nuisances, cause fraud on or victimization of the public, or conflict with existing local laws or ordinances.

c. Any application to which a variance is granted shall be given written notice that the structure will be permitted to be built with the lowest floor elevation below the base flood elevation, and that the cost of flood insurance will be commensurate with the increased risk resulting from the reduced lowest floor elevation.

(11) Variances may be issued by a community for new construction and substantial improvements and for other development necessary for the conduct of a functionally dependent use provided that:

a. The criteria outlined in subsections 58-29.4(1)-(9) are met, and

b. The structure or other development is protected by methods that minimize flood damages during the regulatory flood event and create no additional threats to public safety.

(Ord. No. 2011-53, § 1, 6-27-11)

Sec. 58-30. - Provisions for flood hazard reduction.

58-30.1. *General standards.* In all areas of special flood hazards the following provisions are required for all new construction and substantial improvements:

(1) All new construction or substantial improvements shall be designed (or modified) ~~and~~ to be adequately anchored to prevent flotation, collapse or lateral movement of the structure resulting from hydrodynamic and hydrostatic loads, including the effects of buoyancy;

(2) All new construction or substantial improvements shall be constructed by methods and practices that minimize flood damage;

(3) All new construction or substantial improvements shall be constructed with materials resistant to flood damage;

(4) All new construction or substantial improvements shall be constructed two feet above the regulatory floodplain elevation with electrical, heating, ventilation, plumbing, and air conditioning equipment and other service facilities that are designed and/or located so as to prevent water from entering or accumulating within the components during conditions of flooding;

(5) The total value of improvements, repairs, modifications, and additions to existing buildings are counted cumulatively;

(6) All new and replacement water supply systems shall be designed to minimize or eliminate infiltration of flood waters into the system;

(7) New and replacement sanitary sewage systems shall be designed to minimize or eliminate infiltration of flood waters into the system and discharge from the systems

into flood waters; and,

(8) On-site waste disposal systems shall be located to avoid impairment to them or contamination from them during flooding.

58-30.2. *Specific standards.* In all areas of special flood hazards where base flood elevation data has been provided as set forth in (i) subsection 58-28.2, (ii) subsection 58-29.2(8), or (iii) subsection 58- 30.3(3), the following provisions are required:

(1) *Residential construction.* New construction and substantial improvement of any residential structure shall have the lowest floor (including basement), elevated to a minimum of two feet above the regulatory floodplain elevation together with attendant utility and sanitary facilities. A registered professional engineer, architect, or land surveyor shall submit a certification to the floodplain administrator that the standard of this subsection as proposed in subsection 58-29.3(1)a., is satisfied.

(2) *Nonresidential construction.* New construction and substantial improvements of any commercial, industrial or other nonresidential structure shall either have the lowest floor (including basement) elevated to minimum of two feet or above the regulatory flood level or together with attendant utility and sanitary facilities, be designed so that below the regulatory flood level the structure is watertight with walls substantially impermeable to the passage of water and with structural components having the capability of resisting hydrostatic and hydrodynamic loads and effects of buoyancy. A registered professional engineer or architect shall develop and/or review structural design, specifications, and plans for the construction, and shall certify that the design and methods of construction are in accordance with accepted standards of practice as outlined in this subsection. A record of such certification which includes the specific elevation (in relation to mean sea level) to which such structures are floodproofed shall be maintained by the floodplain administrator.

(3) *Enclosures.* New construction and substantial improvements, with fully enclosed areas below the lowest floor that are usable solely for parking of vehicles, building access or storage in an area other than a basement and which are subject to flooding shall be designed to automatically equalize hydrostatic flood forces on exterior walls by allowing for the entry and exit of floodwaters. Designs for meeting this requirement must either be certified by a registered professional engineer or architect or meet or exceed the following minimum criteria:

a. A minimum of two openings on separate walls having a total net area of not less than one square inch for every square foot of enclosed area subject to flooding shall be provided.

b. The bottom of all openings shall be no higher than one foot above grade.

c. Openings may be equipped with screens, louvers, valves, or other coverings or devices provided that they permit the automatic entry and exit of floodwaters.

(4) Manufactured homes.

a. Require that all manufactured homes to be placed within Zone A on a community's FHBM or FIRM shall be installed using methods and practices which minimize flood damage. For the purposes of this requirement, manufactured homes must be elevated and anchored to resist flotation, collapse, or lateral movement. Methods of anchoring may include, but are not limited to, use of over-the-top or frame ties to ground anchors. This requirement is in addition to applicable state and local anchoring requirements for resisting

wind forces.

b. Require that manufactured homes that are placed or substantially improved within Zones A1-30, AH, and AE on the community's FIRM on sites (i) outside of a manufactured home park or subdivision, (ii) in a new manufactured home park or subdivision, (iii) in an expansion to an existing manufactured home park or subdivision, or (iv) in an existing manufactured home park or subdivision on which a manufactured home has incurred "substantial damage" as a result of a flood, be elevated on a permanent foundation such that the lowest floor of the manufactured home is elevated to minimum of two feet or above the regulatory floodplain elevation and be securely anchored to an adequately anchored foundation system to resist flotation, collapse, and lateral movement.

c. Require that manufactured homes be placed or substantially improved on sites in an existing manufactured home park or subdivision with Zones A1-30, AH, and AE on the community's FIRM that are not subject to the provisions of subsection (4) be elevated so that either:

1. The lowest floor of the manufactured home is at minimum of two feet or above the regulatory floodplain elevation, or

2. The manufactured home chassis is supported by reinforced piers or other foundation elements of at least equivalent strength that are no less than 36 inches in height above grade and be securely anchored to an adequately anchored foundation system to resist flotation, collapse, and lateral movement.

(5) *Recreational vehicles.* Recreational vehicles are not permitted within the regulatory floodway. Require that recreational vehicles placed on sites within Zones A1-30, AH, and AE on the community's FIRM either (i) be on the site for fewer than 180 consecutive days, or (ii) be fully licensed and ready for highway use, or (iii) meet the permit requirements of subsection 58-29.3 (1), and the elevation and anchoring requirements for "manufactured homes" in subsection (4). A recreational vehicle is ready for highway use if it is on its wheels or jacking system, is attached to the site only by quick disconnect type utilities and security devices, and has no permanently attached additions.

58-30.3. *Standards for subdivision proposals.*

(1) All subdivision proposals including the placement of manufactured home parks and subdivisions shall be consistent with subsections 58-26.2, 58-26.3 and 58-26.4.

(2) All proposals for the development of subdivisions including the placement of manufactured home parks and subdivisions shall meet floodplain development permit requirements of subsections 58-28.3, 58-29.3, and the provisions of section 58-30.

(3) Regulatory floodplain elevation data shall be generated for subdivision proposals and other proposed development including the placement of manufactured home parks and subdivisions which is greater than 50 lots or *five* acres, whichever is lesser, if not otherwise provided pursuant to subsection 58-28.2 or 58-29.2(8).

(4) All subdivision proposals including the placement of manufactured home parks and subdivisions shall have adequate drainage provided to reduce exposure to flood hazards.

(5) All subdivision proposals including the placement of manufactured home parks and subdivisions shall have public utilities and facilities such as sewer, gas, electrical

and water systems located and constructed to minimize or eliminate flood damage.

58-30.4. *Standards for areas of shallow flooding (AO/AH Zones).* Located within the areas of special flood hazard established in subsection 58-28.2, are areas designated as shallow flooding. These areas have special flood hazards associated with flood depths of one to three feet where a clearly defined channel does not exist, where the path of flooding is unpredictable, and where velocity flow may be evident. Such flooding is characterized by ponding or sheet flow; therefore, the following provisions apply:

(1) All new construction and substantial improvements of residential structures have the lowest floor (including basement) elevated to or above the base flood elevation or the highest adjacent grade at least as high as the depth number specified in feet on the community's FIRM (at least two feet if no depth number is specified).

(2) All new construction and substantial improvements of non-residential structures:

a. Have the lowest floor (including basement) elevated to or above the base flood elevation or the highest adjacent grade at least as high as the depth number specified in feet on the community's FIRM (at least two feet if no depth number is specified), or

b. Together with attendant utility and sanitary facilities be designed so that below the base specified flood depth in an AO Zone, or below the base flood elevation in an AH Zone, level the structure is watertight with walls substantially impermeable to the passage of water and with structural components having the capability of resisting hydrostatic and hydrodynamic loads of effects of buoyancy.

(3) A registered professional engineer or architect shall submit a certification to the floodplain administrator that the standards of this section, as proposed in subsection 58-29.3 are satisfied.

(4) Require within Zones AH or AO adequate drainage paths around structures on slopes, to guide flood waters around and away from proposed structures.

58-30.5. *Floodplains.* Any and all land area adjoining the channel of a river, stream, lake, watercourse, marshy area, or other drainage element, which has been or may be inundated by stormwater runoff. The extent of the floodplain shall be determined by the crest of a flood having a one percent chance of occurrence in one year. The following provisions shall apply:

(1) The City evaluated precipitation based on NOAA Atlas 14, Texas statewide precipitation study and updated the City's DCM with revised rainfall data. The one percent annual chance 24-hour rainfall depth for City is adopted to be 13.1 inches. Additional rainfall depth-duration-frequency values and intensity-duration-frequency values for the 2-year, 5-year, 10-year, 25-year, 50-year, 100-year and 500-year storm frequencies are included in the ~~DCM~~Drainage and Erosion Control Design Manual. The City requires all flood study submittals to be performed using rainfall data published in the DCM. In case of mapped floodplains where FEMA submittals are needed, the study should use the rainfall data used in the current effective FEMA models, as required by FEMA for their submittals. In addition to this, the City requires a separate analysis using the rainfall data published in the Drainage and Erosion Control Design Manual~~DCM~~, prepared for City's review and approval. Proposed conditions shall account for ultimate development of the watershed. All studies shall be in accordance with the Drainage and Erosion Control Design Manual.

(2) The one percent annual chance floodplain, also known as the 100-year floodplain is the area subject to one percent or greater chance of flooding in any given year,

as described in FEMA guidelines. These zones are typically represented as Zone A, AE, AH or AO on FEMA Flood Insurance Rate Maps (FIRM Panels) and are classified as High-Risk flood zones. Most FEMA FIRMs also identify areas of Medium-Risk flood zones classified as Zone X, which are printed with a shade and hence are also known as Shaded-X. Based on FEMA guidelines, the Shaded-X area can be delineated either using the 0.2 percent annual chance storm or the one percent annual chance storm based on Ultimate Development Conditions, also known as Future Conditions. For all future studies, the City has adopted the one percent annual chance Ultimate Development floodplain mapped using rainfall data published in the Drainage and Erosion Control Design Manual~~DCM~~, as the regulatory floodplain. Such floodplain is delineated based on flows developed by assuming the entire watershed is fully developed. The City's GIS portal provides information regarding future zoning projections, which can be used to determine fully developed conditions.

a) The City requires all new and re-studied FEMA floodplains to delineate the Shaded-X areas based on the one percent annual chance Ultimate Development conditions. The City's regulatory criteria will require all storm water management facilities or a combination of facilities, stream crossings, new-development or re-development in the floodplain to be designed for Ultimate Development Conditions.

b) The City requires demonstration of the elevation of fill placed in the one percent annual chance Ultimate Development floodplain for construction of habitable structures to be greater than the one percent annual chance Ultimate Development water surface elevation. This includes but is not restricted to back of lot elevations, finished floor elevations, drainage facilities etc.

c) The City requires all future drainage easements and crossings in the floodplains to be based on the one percent annual chance Ultimate Development conditions.

d) For drainage areas greater than 150 acres, the City requires a rainfall-runoff model (such as HEC-HMS or similar) to support engineering calculations used to develop the one percent annual chance flows. The City will issue a floodplain development permit upon receiving and reviewing a signed report from an engineer, licensed to practice in the State of Texas. The report shall consist of all supporting information, data and calculations and may be accompanied with exhibits to support their one percent annual chance Ultimate Development flows and floodplain delineation. The City permits floodplain reclamation if accompanied with a signed and sealed study which demonstrates no adverse impacts to any property outside of the requester and demonstrates a no-impact to the one percent annual chance Ultimate Development water surface elevation outside of the requestor's property limits.

e) For streams which have a drainage area greater than 150 acres and currently not-mapped by FEMA, the City requires the requestor to submit a flood study report which is signed and sealed by a Professional Engineer registered in the State of Texas, which establishes a one percent annual chance Ultimate Development floodplain along, within or adjacent to the project site and plat the floodplain delineation as a drainage easement.

(3) The stream setback limits[MR2], stream buffers, are different than the one percent annual chance floodplain. In some cases, the setback limits could be greater than the one percent annual chance Ultimate Development floodplain. Details for the

City's requirements for setbacks/buffers are illustrated in the Drainage and Erosion Control Design Manual~~DCM~~.

(4) The City's goal is conservation of floodplain areas, avoid potential impacts on structures adjacent to the currently mapped floodplains and ensure no net-loss of floodplain volume to preserve the area of conveyance. As such, the City will require Compensatory-Cut, also known as Compensatory-Excavation to offset/mitigate fill placed in the one percent annual chance Ultimate Development floodplain. The City permits floodplain reclamation if accompanied with a signed and sealed study which demonstrates no adverse impacts to any property outside of the requester and demonstrates a no-rise in the one percent annual chance Ultimate Development water surface elevation outside of the requestor's property limits. The City permits excavation in the floodplain to mitigate the increases to one percent annual chance Ultimate Development water surface elevations, in addition~~al~~ to excavation compensation along the same flooding source. All submittals will need a signed drawing by a licensed Professional Engineer (from the State of Texas) clearly marking the areas of Cut and Fill in the floodplain and should also include a table showing both volumes. The City will require the plan to show cut volume be equal to or greater than the volume of fill. Additionally, the compensatory excavation is only allowable within the same flooding source or stream on which floodplain reclamation is being requested within the general vicinity of the fill.

~~(4)~~a) If excavation is performed in the floodplain, the City requires a signed and sealed report/memo from a Professional Engineer registered to practice in the State of Texas to demonstrate excavation is performed outside of the Waters of the United States (WOUS) also known as Jurisdictional Waters, including an exhibit clearly showing the Jurisdictional Delineation. If WOUS are impacted by the project, the City will require coordination and approval from the US Army Corps of Engineers.

(5) If subsection 58-30.5(1) is satisfied, all new construction and substantial improvements shall comply with all applicable flood hazard reduction provisions of section 58-30.

(6) "No adverse impact" certification is required for all new construction in or adjacent to a stream designated with a regulatory floodplain.

58-30.6. *Floodways.* Located within areas of special flood hazard established in subsection 58-28.2, are areas designated as floodways. Since the floodway is an extremely hazardous area due to the velocity of flood waters which carry debris, potential projectiles and erosion potential, the following provisions shall apply:

(7) Encroachments are prohibited, including fill, new construction, substantial improvements and other development within the adopted regulatory floodway unless it has been demonstrated through hydrologic and hydraulic analyses performed in accordance with standard engineering practice that the proposed encroachment would not result in any increase in flood levels within the community during the occurrence of the regulatory flood discharge a "no-rise/no- impact" certification.

(8) If subsection 58-30.5(1) is satisfied, all new construction and substantial improvements shall comply with all applicable flood hazard reduction provisions of section 58-30.

~~(8)~~(9) Under the provisions of 44 CFR Chapter 1, Section 65.12, of the National Flood

Insurance Program Regulation, a community may permit encroachments within the adopted regulatory floodway that would result in an increase in base flood elevations, provided that the community first completes all of the provisions required by Section 65.12.

58-30.7. "No-rise/no-impact" certification. The engineering "no-rise/no-impact" certification and supporting technical data must stipulate no impact or no changes to 25-year water surface elevations, base flood elevations, regulatory floodway elevations, or regulatory floodway widths at the new cross-sections and at all existing cross-sections anywhere in the model. Therefore, the revised computer model should be run for a sufficient distance, typically 1,000 feet, upstream and downstream of the development site or at the discretion of the floodplain administrator to insure proper "no-rise/no-impact" certifications.

"No adverse impact" certification. The engineering "no adverse impact" certification and supporting technical data must stipulate no adverse impacts to any habitable structures within the regulatory floodplain at the new cross-sections and at all existing cross-sections anywhere in the model. Therefore, at the floodplain administrator's discretion, the revised computer model should be sufficiently extended upstream and downstream of the development site such that the Engineer can insure proper "no adverse impact" certifications.

The "no-rise/no adverse impact" supporting data should include, but may not be limited to:

(1) Copy of the currently effective FIS hydraulic models (legible hard copy and a disc (if available).

(2) Duplicate effective FIS hydraulic models (hard copy and a disc).

(3) Existing conditions hydrology models developed using Atlas 14 analysis (hard copy and a disc).

(4) Proposed conditions hydrology models developed using Atlas 14 analysis (hard copy and a disc).

(5) Ultimate development conditions (or future conditions) hydrology model developed using Atlas 14 rainfall data for the one percent annual chance flood event and its supporting data (hard copy and a disc).

(6) Existing conditions hydraulic models (hard copy and a disc).

(7) Proposed conditions hydraulics models (hard copy and a disc).

(8) Ultimate development conditions hydraulics model (hard copy and a disc).

(9) Annotated effective FIRM or FBFM and topographic map, showing regulatory floodplain and floodway boundaries, the additional cross-sections, and the site location along with the proposed topographic modifications.

(10) Documentation clearly stating analysis procedures. All modifications made to the duplicate effective hydraulic models to correctly represent existing conditions, as well as those made to the existing conditions models to represent proposed conditions should be well documented and submitted with all supporting data.

(11) Floodway analysis using Method 1 or Method 4 encroachment methodology as described in FEMA Guidelines and Specifications for Hydrologic and Hydraulic modeling

(12) Annotated effective floodway data table (from the FIS report).

(13) Statement defining source of additional cross-sections, topographic data, and

other supporting information.

(14) Cross-section plots of the additional cross sections for existing, proposed, and ultimate development conditions hydraulic models.

(15) Certified planimetric (boundary survey) information indicating the location of structures on the property.

(16) Hard copy of all output files.

(17) Clear explanation of how roughness parameters were obtained (if different from those used in the effective hydraulic models).

(18) Engineering certification.

(19) No wall enclosures over the allowed 120 square feet or breakaway walls within the floodway.

The "no rise or adverse impact" analysis along with supporting data and the original engineering certification must be reviewed by the floodplain administrator prior to issuing a development permit. The original effective FIS model, the duplicate effective FIS model, the existing conditions model, and the proposed conditions model should be reviewed for any changes in the base and regulatory flood elevations, base and regulatory floodplain widths, regulatory floodway elevations and floodway widths.

58-30.8. *Severability.* If any section, clause, sentence, or phrase of this article is held to be invalid or unconstitutional by any court of competent jurisdiction, then said holding shall in no way affect the validity of the remaining portions of this article.

58-30.9. *Penalties for non-compliance.* No structure or land shall hereafter be constructed, located, extended, converted, or altered without full compliance with the terms of this court order and other applicable regulations. Violation of the provisions of this court order by failure to comply with any of its requirements (including violations of conditions and safeguards established in connection with conditions) shall constitute a misdemeanor. Each and every day or portion thereof during which any violation or failure to comply is committed or continued shall be deemed a separate offense subject to a fine of not more than $2,000.00 for each day. And each offense upon conviction in a court of competent jurisdiction, and in addition shall pay all costs and expenses involved in the case. Nothing herein contained shall prevent the city from taking such other lawful action as is necessary to prevent or remedy any violation.

(Ord. No. 2011-53, § 1, 6-27-11)

Secs. 58-31-58-55. - Reserved.

ARTICLE III. - UNDERGROUND STORAGE TANK REGULATION

Sec. 58-56. - Definitions.

Edwards Recharge Zone. Generally, that area where the stratigraphic units constituting the Edwards Aquifer crop out, and including the outcrops of other formations in proximity to the Edwards Aquifer, where caves, sinkholes, faults, fractures, or other permeable features would create a potential for recharge of surface waters into the Edwards Aquifer. The recharge zone is identified as that area designated as such on official maps located in the offices of the Texas Natural Resource Conservation Commission (TNRCC) and the Edwards Aquifer Authority.

Tertiary protection. A method by which a third level of protection is provided for

underground storage tank systems by means of either 1) a physical level to be installed around a double-walled tank and piping system, designed to prevent a release of the regulated substance as defined by the Environmental Protection Agency from migrating into the environment, should such a release go undetected at the secondary containment level; or 2) equivalent technology, which shall include: a. continuous electronic leak detection for the entire system at a centralized location; b. site specific training; c. annual testing for system integrity; and d. reporting to the city sanitarian any release from the primary system.

Underground storage tank. Any one or combination of underground tanks and any connecting underground pipes used to contain an accumulation of regulated substances that is one percent or more under the natural level of the ground.

Underground storage tank system. An underground storage tank, all associated piping and ancillary equipment, spill and overfill prevention equipment, release detection equipment, corrosion protection system, secondary and tertiary containment equipment (as applicable), and all other related systems and equipment.

(Ord. No. 95-11, § 1(5-32), 3-13-95; Ord. No. 01-09, § I, 1-22-01)

Sec. 58-57. - Underground storage tanks.

(a) The installation of any new underground storage tank systems within the city limits of the City of New Braunfels and its extraterritorial jurisdiction is prohibited unless the underground storage tank system includes tertiary protection and meets all the requirements of this section.

(b) All new underground storage tanks shall meet the following standards:

(1) All new underground storage tank systems shall comply with this section and the most current regulations in 31 Texas Administrative Code, Chapter 334, Underground and Aboveground Storage Tanks, which is incorporated by reference as part of this chapter; and

(2) All new underground storage tanks shall require tertiary protection. A tertiary barrier shall consist of an artificially constructed material that is sufficiently thick and impermeable (at least 10-6 cm/sec or allow permeation at a rate of no more than 0.25 ounces per square foot per 24 hours for the regulated substance stored) and be able to direct a release to the monitoring point and permit its detection. The barrier material shall be compatible with the regulated substance stored so that a release from the underground storage tank system will not cause a deterioration of the barrier allowing a release to pass through undetected; or (and, if over the Edwards Recharge Zone)

(3) All new underground storage tank systems shall include a monitoring and leak detection system able to detect a release between the underground storage tank and the tertiary barrier. The monitoring and release detection system must be capable of detecting a two-tenths gallon per hour leak rate or a release of 150 gallons within 30 days such that the probability of detection shall be at least 90 percent and the probability of false alarm shall be no greater than five percent.

(4) In the event the new underground storage tank and underground storage tank system is located over the Edwards Recharge Zone, that facility shall comply with subsection 58-57(b)(1), (2) and (3).

(c) The property where a new underground storage tank is located shall contain a

reasonable amount of impermeable material on the surface of the ground and an emergency drainage system to direct regulated substances to a safe location and to prevent any regulated substance from leaking into the ground. The city fire marshal! may require curbs, scuppers, or a special drainage system to carry out the purpose of this section. The facility shall also be equipped with a hazardous material trap to prevent the discharge or leakage of regulated substances to public waterways, public sewers or adjoining property.

(Ord. No. 95-11, § I(5-33), 3-13-95; Ord. No. 01-09, § II, 1-22-01)

Sec. 58-58. - Reserved.

Sec. 58-59. - Nuisance.

The placement of any new underground storage tanks within the city limits or extraterritorial jurisdiction of the City of New Braunfels that are not in compliance with this section is hereby declared to be a nuisance.

(Ord. No. 01-09, § III, 1-22-01)

Sec. 58-60. - Penalty.

(a) *Criminal penalty.* It shall be unlawful and a Class C Misdemeanor for any person, firm, or corporation to violate any provision of this article. No culpable mental state shall be required and the requirement of a culpable mental state pursuant to Chapter 6.02 of the Texas Penal Code is hereby specifically negated. The fine for a violation of this article shall be not less than $500.00 nor more than $2,000.00. Each day the violation exist shall constitute a new offense.

(b) *Civil penalty.* Nothing in this article shall prohibit the City of New Braunfels from taking the appropriate civil action to enjoin and abate any action hereby prohibited.

(Ord. No. 01-09, § IV, 1-22-01)

City of New Braunfels

Planning Commission Agenda Item Report

550 Landa Street
New Braunfels, TX

6/1/2021

Agenda Item No. C)

PRESENTER:
Applicant: Chris Van Heerde, P.E., HMT Engineering & Surveying
Owner: Sandra Wunderlich
SUBJECT:
PZ21-0150 Public hearing and recommendation to City Council regarding a proposed rezoning of approximately 60.1 acres out of the J. Thompson Survey, A-608 and William H. Pate Survey, A-259 located east of the intersection of FM 1044 and Michelson Lane, from "APD" Agricultural/Pre-Development District to "ZH-A" Zero Lot Line Home District.
DEPARTMENT: Planning and Development Services
COUNCIL DISTRICTS IMPACTED: Council Districts 2 and 6

BACKGROUND INFORMATION:
Owner &
Applicant: HMT Engineering & Surveying (Chris Van Heerde, P.E.)
290 S. Castell Avenue, Suite 100
New Braunfels, TX 78130
(830) 625-8555 plats@hmtnb.com

Owner: Sandra Wunderlich
1440 Cross Street
New Braunfels, TX 78130

Staff Contact: Matthew Simmont
(830) 221-4058 msimmont@nbtexas.org

The approximately 60-acre tract is located east of the intersection of FM 1044 and Michelson Lane. The subject property has about 980 feet of frontage along FM 1044, is approximately 760 feet wide and extends southeast until it abuts the Laubach, Unit 1 and Voss Farms, Unit 5 residential subdivisions. The property is currently undeveloped.

The applicant is requesting a zoning change of the base zoning district from "APD" Agricultural/Pre-Development to "ZH-A" Zero Lot Line Home District. A district comparison chart (attached) shows the proposed zoning will allow for the development of a residential subdivision.

Surrounding Zoning and Land Use:
North - Across FM 1044, C-1B & APD / Single-family residence and undeveloped
South - Outside City Limits / Single family residences
East - APD and R-1A-6.6 / Single family residences and undeveloped
West - Across Michelson Lave, APD / Single family residences

ISSUE:

The current APD zoning district is intended for newly annexed areas, agricultural, farm and ranch uses and for areas where development is premature because a lack of utilities, capacity, or service, or where ultimate use has not been determined.

The proposed ZH-A district is intended for development of detached single-family residences on minimum 4,000 square-foot lots with 5-foot setbacks on both sides. Homes in ZH-A can also be zero-lot line (a.k.a. patio/garden homes) having one side building setback reduced to zero feet with a minimum 10-foot setback on the opposite side and accompanying maintenance easement for the neighbor.

The proposed rezoning is consistent with the following actions from Envision New Braunfels and the Workforce Housing Study:

- *Action 1.3:* Encourage balanced and fiscally responsible land use patterns.
- *Action 3.13:* Cultivate an environment where a healthy mix of different housing products at a range of sizes, affordability, densities, amenities and price points can be provided across the community as well as within individual developments.
- *Workforce Housing Study Recommendation:* Ensure through city zoning and other required legal entitlements related to housing construction that new types of housing products (small lot, duplex, townhome, etc.) are allowed by regulations.

The property is situated in the Walnut Springs Sub-Area, along a Transitional Mixed-Use Corridor and is near an Existing Outdoor Recreation Center.

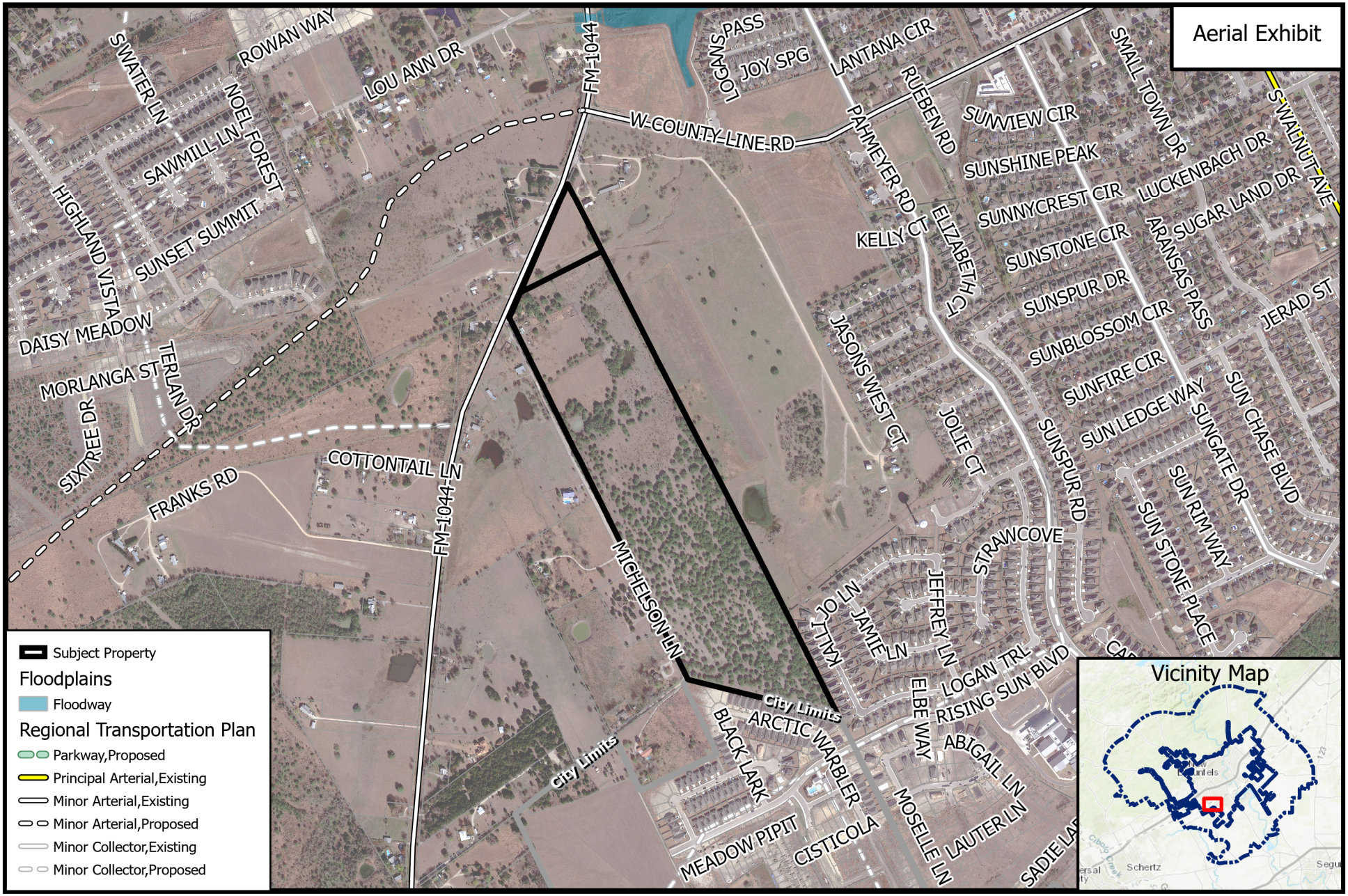
FISCAL IMPACT:
N/A
RECOMMENDATION:
Approval. The applicant's proposal to create a single-family residential development is consistent with ongoing development in the area and is supported by the Envision New Braunfels Comprehensive Plan and Workforce Housing Study.

Notification:
Public hearing notices were sent to owners of 40 properties within 200 feet of the request. No responses have been received at this time.

Resource Links:

- Chapter 144, Section 3.4-9. *"ZH-A" Zero Lot Line Home District* of the City's Code of Ordinances: <https://library.municode.com/tx/new_braunfels/codes/code_of_ordinances?nodeId=PTIICOOR_CH144ZO_ARTIIIZODI_S144-3.4ZODIREPRZOSUJU221987>

Attachments:
1. Aerial Map
2. Land Use Maps (Zoning, Existing Land Use, Future Land Use Plan)
3. District Comparison Chart
4. TIA Worksheet
5. Notification List, Map and Responses



PZ21-0150

Zone change from APD to ZHA

0 510 1,020 Feet

N

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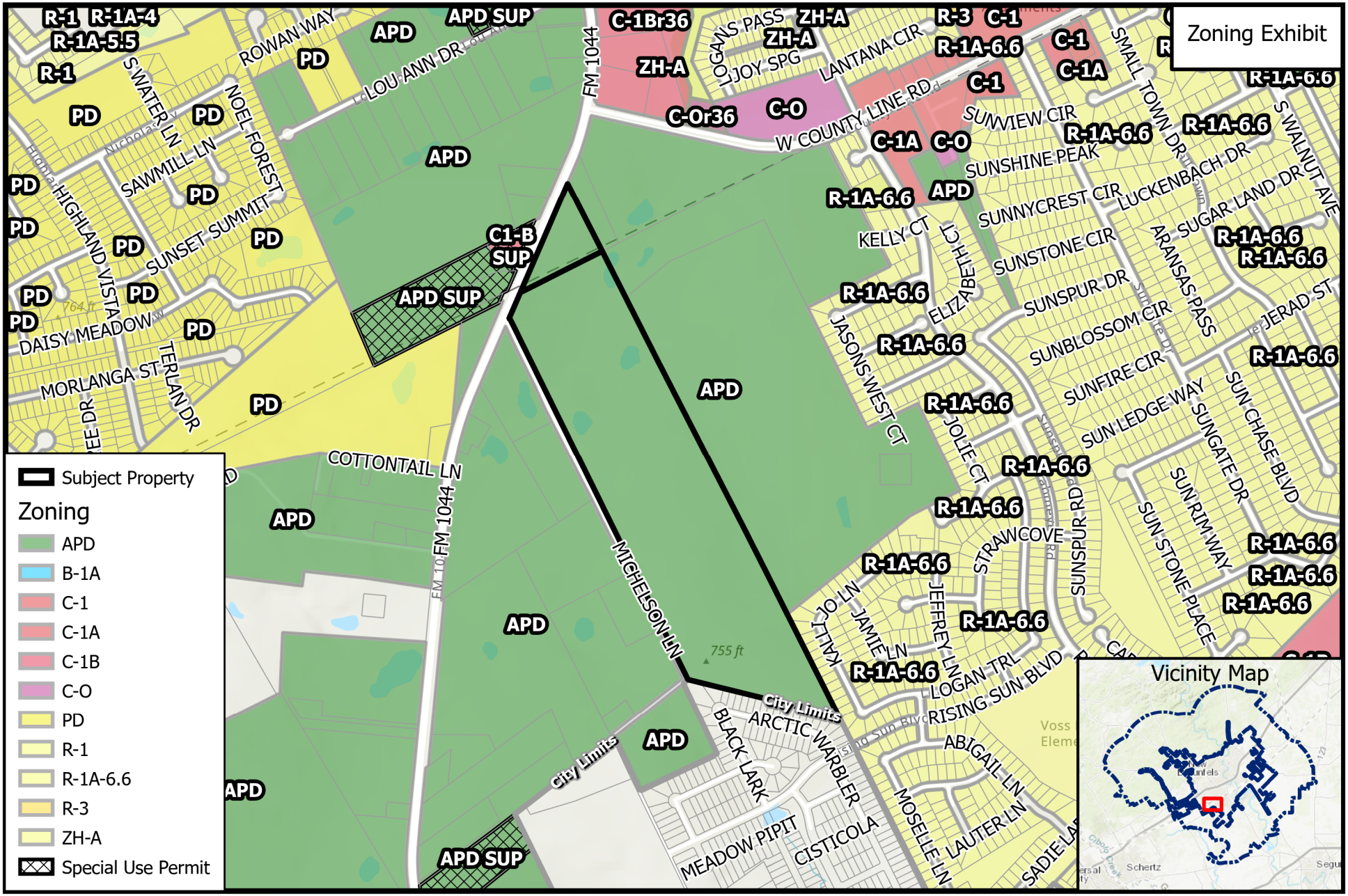
Source: City of New Braunfels Planning
Date: 5/11/2021

DISCLAIMER: This map and information contained in it were developed exclusively for use by the City of New Braunfels. Any use or reliance on this map by anyone else is at that party's risk and without liability to the City of New Braunfels, its officials or employees for any discrepancies, errors, or variances which may exist.



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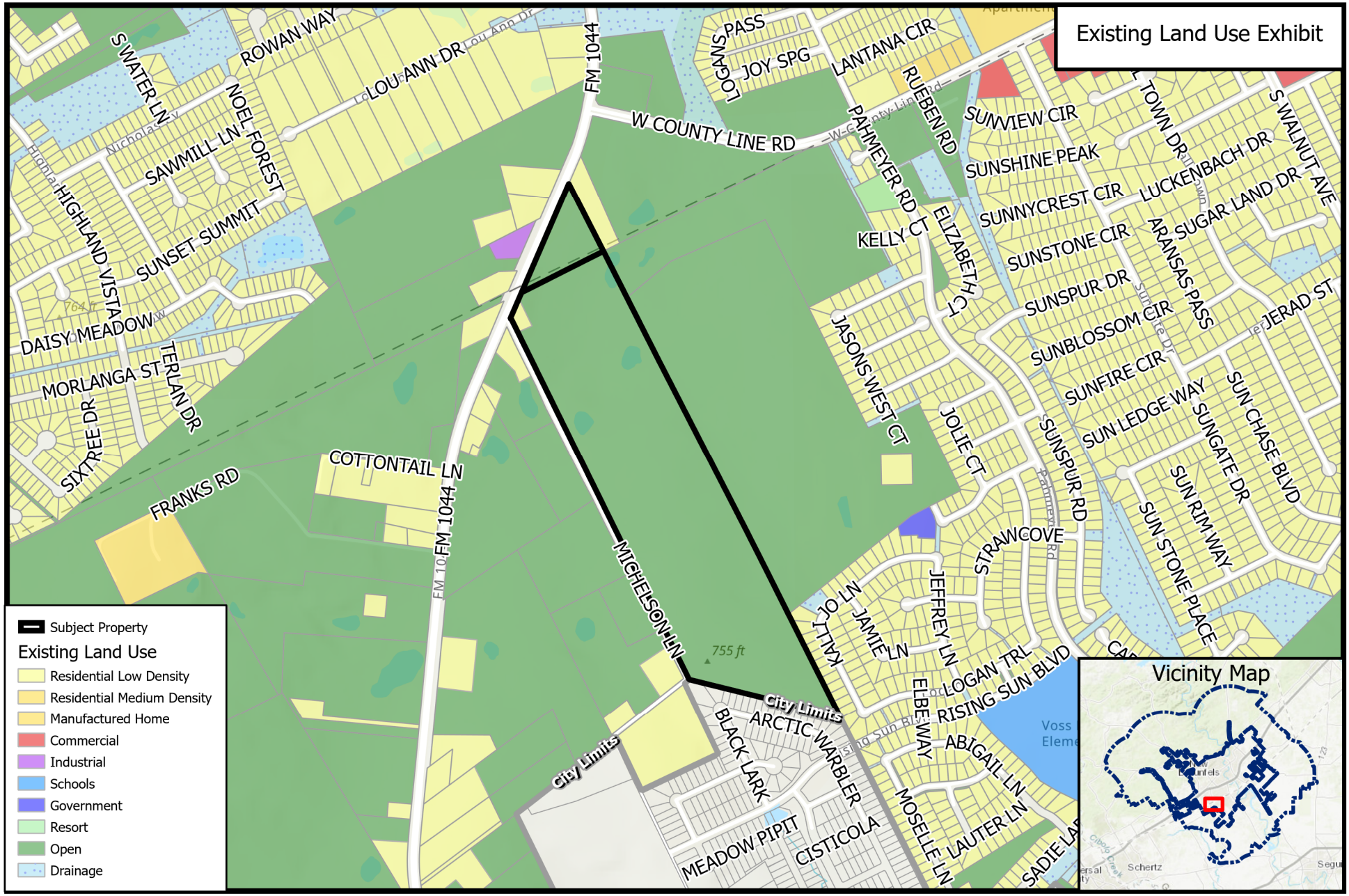

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EXISTING CENTERS

Centers are the middle, core or heart of an area. It is a point of activity and vitality. Centers come in many sizes and have different purposes or activities within. They may have endangered species habitat or aquifer recharge areas that require additional standards and consideration relating to future growth. It is envisioned that all centers be walkable, connected, and have a mix of uses. These centers must provide adequate infrastructure to support the commercial development present especially mobility and access for pedestrians, bicycles, vehicles and transit. Given the mixed-use nature of these centers, parking should be shared and not detract from the aesthetic of the area.

EMPLOYMENT CENTER

Employment Centers are mixed-use areas centered around office or industrial uses that can support significant employment.

MARKET CENTER

Market Centers are mixed-use areas anchored by a retail destination where surrounding residents go to get daily goods and services.

MEDICAL CENTER

Medical Centers are mixed-use areas centered around a medical destination such as a hospital or clinic.

CIVIC CENTER

Civic Centers are mixed-use areas centered around a civic destination such as City Hall, a library or a recreation center.

OUTDOOR RECREATION CENTER

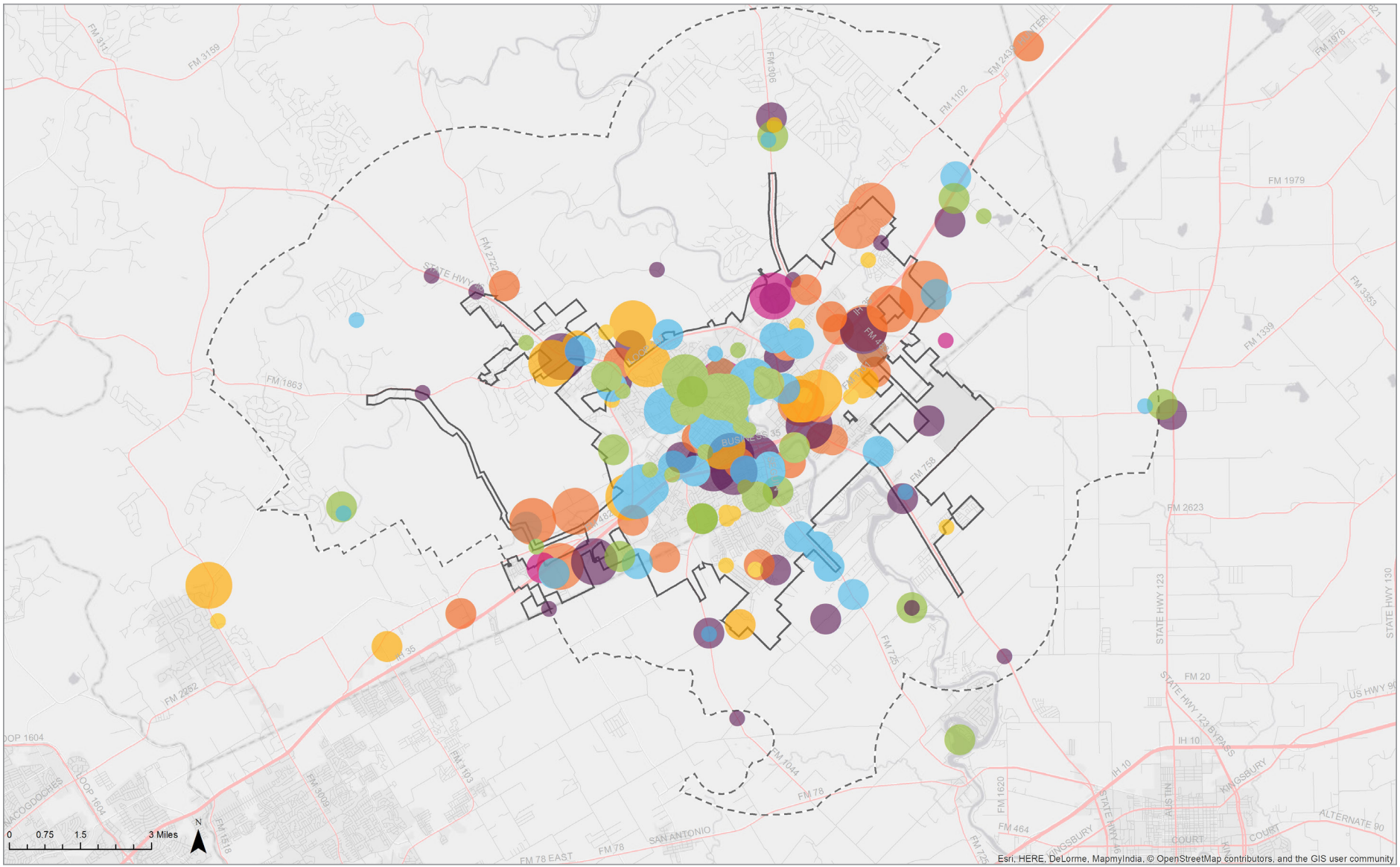
Outdoor Recreation Centers center around a public or private outdoor destination such as Landa Lake.

EDUCATION CENTER

Education Centers are mixed-use areas centered around an educational destination such as a K-12 school or university/college.

TOURIST/ENTERTAINMENT CENTER

Tourist/Entertainment Centers are mixed-use areas around an entertainment venue such as Gruene Hall or a tourist destination such as the Tube Chute.



The location of existing centers was determined through the analysis of previous studies and background documents, windshield surveys, and reviewed by City staff, Steering Committee members, and Plan Element Advisory Group members during a public workshop.

FUTURE LAND USE PLAN

A future land use plan is how land is envisioned to be. It establishes priorities for more detailed plans (sub area plans) and for detailed topical plans (such as parks and open spaces, trails and roads). It cannot be interpreted without the goals and actions of Envision New Braunfels.

TRANSITIONAL MIXED-USE CORRIDOR
Transitional Mixed-Use Corridors express an aspiration to retrofit existing auto-dominated retail corridors with a mix of uses and a variety of travel modes over time.

OUTDOOR RECREATION CENTER
Outdoor Recreation Centers are centered around a public or private outdoor destination like Fischer Park.

EMPLOYMENT CENTER
Employment Centers are mixed-use areas centered around office or industrial uses that can support significant employment.

MARKET CENTER
Market Centers are mixed-use areas anchored by a retail destination where surrounding residents go to get daily goods and services.

CIVIC CENTER
Civic Centers are mixed-use areas centered around a civic destination such as City Hall, a library or a recreation center.

SUB AREA 1
Sub Area 1 includes the Downtown, Gruene and the Mid-Century or older neighborhoods that surround them. It is home to the natural springs and headwaters of flowing rivers that have attracted New Braunfelsers to the town for centuries.

SUB AREA 2
Sub Area 2 refers to the neighborhoods and residential enclaves that have grown alongside the Hill Country landscape.

SUB AREA 3
Sub Area 3 includes a planned community offering a diversity of housing, distinct community centers and preserved Hill Country landscape features.

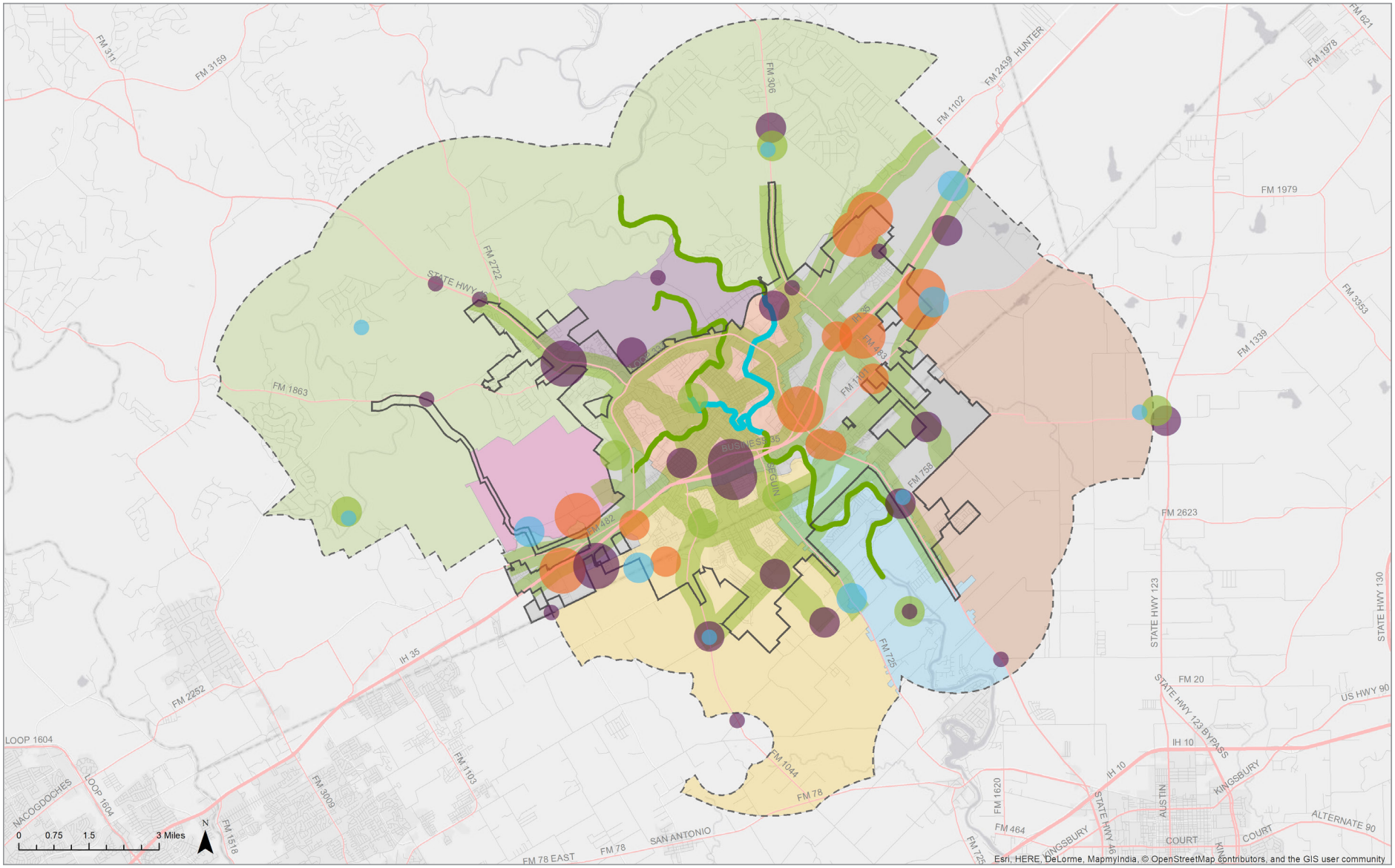
SUB AREA 4
At the heart of Sub Area 4 is Fischer Park. Proximity to IH-35, downtown and neighboring communities like McQueeney makes this area highly desirable and accessible.

SUB AREA 5
Sub Area 5 bridges together many communities east of IH-35. It includes the scenic landscape along both banks of the Guadalupe River between Highway 46 and FM 725.

SUB AREA 6
Sub Area 6 expresses an aspiration for conservation communities focused around maintaining and enhancing ecological integrity while allowing some level of development to occur.

SUB AREA 7
Sub Area 7 includes parts of the city currently being mined for natural resources. These sites may become parks and open space, mixed-use communities or new commercial or entertainment areas in the future.

SUB AREA 8
This fast-growing Sub Area includes many neighborhoods offering affordable places for young families to live.



A Comprehensive Plan shall not constitute zoning regulations or establish zoning district boundaries. Preferred future growth scenario combines Scenarios A and C per recommendations of the Envision New Braunfels Steering Committee (February 2018). Exact boundaries of sub areas, centers, and corridors may be zoomed and viewed online.

	Existing	Proposed
	APD	ZH-A
Accessory building/structure (see section 144-5.4)	P	P
Accessory dwelling (one accessory dwelling per lot, no kitchen)	P	P
Accounting, auditing, bookkeeping, and tax preparations		
Acid manufacture		
Adult day care (no overnight stay)		
Adult day care (with overnight stay)		
Aircraft support and related services		
Airport		
All-terrain vehicle (ATV) dealer/sales		
Ambulance service (private)		
Amphitheaters (outdoor live performances)		
Amusement devices/arcade (four or more devices)		
Amusement services or venues (indoors) (see section 144-5.13)		
Amusement services or venues (outdoors)		
Animal grooming shop		
Answering and message services		
Antique shop		
Appliance repair		
Archery range		
Armed services recruiting center		
Art dealer/gallery		
Artist or artisans studio		
Assembly/exhibition hall or areas		
Assisted living facility/retirement home		
Athletic fields		
Auction sales (non-vehicle)		
Auto body repair, garages (see section 144-5.11)		
Auto glass repair/tinting (see section 144-5.11)		
Auto interior shop/upholstery (see section 144-5.11)		
Auto leasing		
Auto muffler shop (see section 144-5.11)		
Auto or trailer sales rooms or yards (see section 144-5.12)		
Auto or truck sales rooms or yards—Primarily new (see section 144-5.12)		
Auto paint shop		
Auto repair as an accessory use to retail sales		
Auto repair garage (general) (see section 144-5.11)		
Auto supply store for new and factory rebuilt parts		
Auto tire repair/sales (indoor)		
Auto wrecking yards		
Automobile driving school (including defensive driving)		
Bakery (retail)		
Bank, savings and loan, or credit union		
Bar/tavern (no outdoor music)		
Bar/tavern		

Barber/beauty college (barber or cosmetology school or college)		
Barber/beauty shop, haircutting (non-college)		
Barns and farm equipment storage (related to agricultural uses)	P	P
Battery charging station		
Bed and breakfast inn (see section 144-5.6)		
Bicycle sales and/or repair		
Billiard/pool facility		
Bingo facility		
Bio-medical facilities		
Blacksmith or wagon shops		
Blooming or rolling mills		
Boarding house/lodging house		
Book binding		
Book store		
Bottling or distribution plants (milk)		
Bottling works		
Bowling alley/center (see section 144-5.13)		
Breweries/distilleries and manufacture of alcohol and alcoholic beverages		
Broadcast station (with tower) (see section 144-5.7)		
Bulk storage of gasoline, petroleum products, liquefied petroleum and flammable liquids (see section 5.27)		
Bus barns or lots		
Bus passenger stations		
Cabin or cottage (rental)		
Cabin or cottage (rental for more than 30 days)		
Cafeteria/cafe/delicatessen		
Campers' supplies		
Campgrounds		
Canning/preserving factories		
Car wash (self-service; automated)		
Car wash, full service (detail shop)		
Carpenter, cabinet, or pattern shops		
Carpet cleaning establishments		
Caterer		
Cement, lime, gypsum or plaster of Paris manufacture		
Cemetery and/or mausoleum	P	
Check cashing service		
Chemical laboratories (e.g., ammonia, bleaching powder)		
Chemical laboratories (not producing noxious fumes or odors)		
Child day care/children's nursery (business)		
Church/place of religious assembly	P	P
Cider mills		
Civic/conference center and facilities		
Cleaning, pressing and dyeing (non-explosive fluids used)		
Clinic (dental)		
Clinic (emergency care)		
Clinic (medical)		

Club (private)		
Coffee shop		
Cold storage plant		
Commercial amusement concessions and facilities		
Communication equipment—Installation and/or repair		
Community building (associated with residential uses)		P
Community home (see definition)	P	P
Computer and electronic sales		
Computer repair		
Concrete or asphalt mixing plants—Permanent		
Concrete or asphalt mixing plants—Temporary		
Confectionery store (retail)		
Consignment shop		
Contractor's office/sales, with outside storage including vehicles		
Contractor's temporary on-site construction office	P	P
Convenience store with gas sales		
Convenience store without gas sales		
Cotton ginning or baling works		
Country club (private)	P	
Credit agency		
Crematorium		
Curio shops		
Custom work shops		
Dance hall/dancing facility (see section 144-5.13)		
Day camp		
Department store		
Distillation of bones		
Dormitory (in which individual rooms are for rental)		
Drapery shop/blind shop		
Driving range		
Drug store/pharmacy		
Duplex/two-family/duplex condominiums		
Electrical generating plant		
Electrical repair shop		
Electrical substation		
Electronic assembly/high tech manufacturing		
Electroplating works		
Enameling works		
Engine repair/motor manufacturing re-manufacturing and/or repair		
Explosives manufacture or storage		
Exterminator service		
Fairground		
Family home adult care	P	P
Family home child care	P	P
Farmers market (produce market—wholesale)	P	
Farms, general (crops) (see chapter 6 and section 144-5.9)	P	P

Farms, general (livestock/ranch) (see chapter 6 and section 144-5.9)	P	P
Feed and grain store		
Fertilizer manufacture and storage		
Filling station (gasoline tanks must be below the ground)		
Florist		
Flour mills, feed mills, and grain processing	P	
Food or grocery store with gasoline sales		
Food or grocery store without gasoline sales		
Food processing (no outside public consumption)		
Forge (hand)		
Forge (power)		
Fraternal organization/civic club (private club)		
Freight terminal, rail/truck (when any storage of freight is wholly outside an enclosed building)		
Freight terminal, truck (all storage of freight in an enclosed building)		
Frozen food storage for individual or family use		
Funeral home/mortuary		
Furniture manufacture		
Furniture sales (indoor)		
Galvanizing works		
Garbage, offal or dead animal reduction or dumping		
Garden shops and greenhouses		
Gas manufacture		
Gas or oil wells		
Golf course (public or private)	P	P
Golf course (miniature)		
Government building or use with no outside storage (outside storage allowed in M-2 and M-2A)	P	P
Grain elevator	P	
Greenhouse (commercial)		
Handicraft shop		
Hardware store		
Hay, grain, and/or feed sales (wholesale)	P	
Health club (physical fitness; indoors only)		
Heating and air-conditioning sales/services		
Heavy load (farm) vehicle sales/repair (see section 144-5.14)		
Heavy manufacturing		
Heliport		
Hides/skins (tanning)		
Home occupation (see section 144-5.5)	P	P
Home repair and yard equipment retail and rental outlets		
Hospice		
Hospital, general (acute care/chronic care)		
Hospital, rehabilitation		
Hotel/motel		
Hotels/motels—Extended stay (residence hotels)		
Ice delivery stations (for storage and sale of ice at retail only)		

Ice plants		
Indoor or covered sports facility		
Industrial laundries		
Iron and steel manufacture		
Junkyards, including storage, sorting, baling or processing of rags		
Kiosk (providing a retail service)		
Laboratory equipment manufacturing		
Laundromat and laundry pickup stations		
Laundry, commercial (without self-serve)		
Laundry/dry cleaning (drop off/pick up)		
Laundry/washateria (self-serve)		
Lawnmower sales and/or repair		
Leather products manufacturing		
Light manufacturing		
Limousine/taxi service		
Livestock sales/auction	P	
Locksmith		
Lumber mill		
Lumberyard (see section 144-5.15)		
Lumberyard or building material sales (see section 144-5.15)		
Machine shop		
Maintenance/janitorial service		
Major appliance sales (indoor)		
Manufacture of carbon batteries		
Manufacture of paint, lacquer, oil, turpentine, varnish, enamel, etc.		
Manufacture of rubber, glucose, or dextrin		
Manufactured home—HUD Code compliant (see Texas Occupations Code ch. 1201)		
Manufactured home park—HUD Code compliant (see Texas Occupations Code ch. 1201)		
Manufactured home subdivision—HUD Code compliant (see Texas Occupations Code ch. 1201)		
Manufactured home sales		
Manufacturing and processes		
Manufacturing processes not listed		
Market (public, flea)		
Martial arts school		
Meat or fish packing/storage plants		
Medical supplies and equipment		
Metal fabrication shop		
Micro brewery (onsite mfg. and/or sales)		
Mini-warehouse/self-storage units (no boat and RV storage permitted)		
Mini-warehouse/self-storage units with outside boat and RV storage		
Monument, gravestone, or marble works (manufacture)		
Motion picture studio, commercial film		
Motion picture theater (indoors)		
Motion picture theater (outdoors, drive-in)		

Motorcycle dealer (primarily new/repair)		
Moving storage company		
Moving, transfer, or storage plant		
Multifamily (apartments/condominiums)		
Museum		
Natural resource extraction and mining		
Needlework shop		
Nonbulk storage of gasoline, petroleum products and liquefied petroleum		
Nursing/convalescent home/sanitarium		
Offices, brokerage services		
Offices, business or professional		
Offices, computer programming and data processing		
Offices, consulting		
Offices, engineering, architecture, surveying or similar		
Offices, health services		
Offices, insurance agency		
Offices, legal services, including court reporting		
Offices, medical offices		
Offices, real estate		
Offices, security/commodity brokers, dealers, exchanges and financial services		
Oil compounding and barreling plants		
One-family dwelling, detached	P	
Outside storage (as primary use)		
Paint manufacturing		
Paper or pulp manufacture		
Park and/or playground (private and public)	P	P
Parking lots (for passenger car only) (not as incidental to the main use)		
Parking structure/public garage		
Pawn shop		
Personal watercraft sales (primarily new/repair)		
Pet shop/supplies (less than 10,000 sq. ft.)		
Pet store (over 10,000 sq. ft.)		
Petroleum or its products (refining of)		
Photo engraving plant		
Photographic printing/duplicating/copy shop or printing shop		
Photographic studio (no sale of cameras or supplies)		
Photographic supply		
Plant nursery (no retail sales on site)	P	
Plant nursery (retail sales/outdoor storage)		
Plastic products molding/reshaping		
Plumbing shop		
Portable building sales		
Poultry killing or dressing for commercial purposes		
Propane sales (retail)		
Public recreation/services building for public park/playground areas		

Publishing/printing company (e.g., newspaper)		
Quick lube/oil change/minor inspection		
Radio/television shop, electronics, computer repair		
Railroad roundhouses or shops		
Rappelling facilities		
Recreation buildings (private)		
Recreation buildings (public)	P	P
Recycling kiosk		
Refreshment/beverage stand		
Rental or occupancy for less than one month (see section 144-5.17)		
Research lab (non-hazardous)		
Residential use in buildings with non-residential uses permitted in the district		
Restaurant/prepared food sales		
Restaurant with drive-through service		
Retail store and shopping center without drive-through service (50,000 sq. ft. bldg. or less)		
Retail store and shopping center with drive-through service (50,000 sq. ft. bldg. or less)		
Retail store and shopping center (more than 50,000 sq. ft. bldg.)		
Retirement home/home for the aged		
Rock crushers and rock quarries		
Rodeo grounds	P	
RV park		
RV/travel trailer sales		
Sand/gravel sales (storage or sales)		
School, K-12 public or private	P	P
School, vocational (business/commercial trade)		
Security monitoring company (no outside storage or installation)		
Security systems installation company		
Sexually oriented business (see chapter 18)		
Sheet metal shop		
Shoe repair shops		
Shooting gallery—Indoor (see section 144-5.13)		
Shooting range—Outdoor (see section 144-5.13)		
Shopping center		
Sign manufacturing/painting plant		
Single-family industrialized home (see section 144-5.8)	P	P
Smelting of tin, copper, zinc or iron ores		
Specialty shops in support of project guests and tourists		
Stables (as a business) (see chapter 6)	P	
Stables (private, accessory use) (see chapter 6)	P	
Steel furnaces		
Stockyards or slaughtering		
Stone/clay/glass manufacturing		
Storage—Exterior storage for boats and recreational vehicles		
Storage in bulk		
Structural iron or pipe works		

Studio for radio or television, without tower (see zoning district for tower authorization)		
Studios (art, dance, music, drama, reducing, photo, interior decorating, etc.)		
Sugar refineries		
Tailor shop (see home occupation)		
Tar distillation or manufacture		
Tattoo or body piercing studio		
Taxidermist		
Telecommunications towers/antennas (see section 144-5.7)		
Telemarketing agency		
Telephone exchange buildings (office only)		
Tennis court (commercial)		
Theater (non-motion picture; live drama)		
Tire sales (outdoors)		
Tool rental		
Townhouse (attached)		
Transfer station (refuse/pick-up)		
Travel agency		
Truck or transit terminal		
Truck stop		
Tuber entrance and takeout facilities (see section 144-5.13)		
University or college (public or private)		
Upholstery shop (non-auto)		
Used or second hand merchandise/furniture store		
Vacuum cleaner sales and repair		
Vehicle storage facility		
Veterinary hospital (no outside animal runs or kennels)		
Veterinary hospital (with outdoor animal runs or kennels that may not be used between the hours of 9:00 p.m. and 7:00 a.m.)		
Video rental/sales		
Warehouse/office and storage/distribution center		
Waterfront amusement facilities—Berthing facilities sales and rentals		
Waterfront amusement facilities—Boat fuel storage/dispensing facilities		
Waterfront amusement facilities—Boat landing piers/launching ramps		
Waterfront amusement facilities—Swimming/wading pools/bathhouses		
Water storage (surface, underground or overhead), water wells and pumping stations that are part of a public or municipal system	P	P
Welding shop		
Wholesale sales offices and sample rooms		
Wire or rod mills		
Wood distillation plants (charcoal, tar, turpentine, etc.)		
Woodworking shop (ornamental)		
Wool scouring		
Zero lot line/patio homes		P

CITY OF NEW BRAUNFELS TRAFFIC IMPACT ANALYSIS (TIA) WORKSHEET

Complete this worksheet as a requirement for zoning, master plan, plat and permit as specified in City of New Braunfels Code of Ordinances Sections 114-99 and 118-46.
Note: The Code provides the minimum information for a TIA report and it is recommended that a scoping meeting be scheduled with the Engineering Division.

Section 1: General Information

General Information			
Project Name: Wunderlich Tract			Date: 04/21/2021
Subdivision Plat Name:		Project Address/Location: FM 1044 & Michelson	
Location? ■ City of New Braunfels ☐ New Braunfels ETJ		■ Comal County	■ Guadalupe County
Owner Name: East Park Place, LLC		Owner Email: fred.heimer@sv-re.com	
Owner Address: 130 S. Seguin Ave, Suite 100, New Braunfels, TX 78130		Owner Phone: (210) 913-8720	
Preparer Company: HMT Engineering & Surveying			
Preparer Name: Chris Van Heerde, PE		Preparer Email: chrisvh@hmtnb.com	
Preparer Address: 290 S. Castell Ave, Suite 100, New Braunfels, TX 78130		Preparer Phone: (830) 625-8555	
TIA Report scoping meeting with City Engineering Division staff?	☐ Yes. Date: ■ No.	TIA Worksheet/Report approved with previous zoning, plan, plat or permit?	■ No. Complete Page 1 only. ☐ Yes. Complete Pages 1 and 2.

Application Type or Reason for TIA Worksheet/Report

■ Zoning/Concept Plan/Detail Plan ☐ Master Plan ☐ Preliminary Plat ☐ Final Plat ☐ Permit ☐ Other

TIA Submittal Type (A TIA Worksheet is required with all zoning, plan, plat and permit applications)

☐ TIA Worksheet Only (100 peak hour trips or less)
☐ TIA Worksheet Only – Previous TIA Report Approved
☐ TIA Worksheet Only – Previous TIA Report not required (supporting documentation may be required)
■ Level 1 TIA Report (101-500 peak hour trips)
☐ Level 2 TIA Report (501-1,000 peak hour trips)
☐ Level 3 TIA Report (1,001 or more peak hour trips)

Section 2: Proposed Land Use and Trip Information for Application

Unit	Land Use	ITE Code[1]	ITE Unit[2]	Est. Project Units	Critical Peak Hour	AM Peak Hour Rate	PM Peak Hour Rate	WKND Peak Hour Rate	Daily Trip Rate	AM Peak Hour Trips	PM Peak Hour Trips	WKND Peak Hour Trips	Daily Trips
1	Single-Family Detached Housing	210	Dwelling Units	252	PM	0.76	1	0.93	9.44	192	252	235	2379
Total from additional tabulation sheet (if necessary):													
Total:										192	252	235	2379

[1]*Institute of Transportation Engineers (ITE) Trip Generation*, 10th Edition or most recent; [2]E.g., Dwelling Units, Acres, Employees, KSF, etc.

Internal Use Only	Reviewed by:			Date:
	☐ TIA Worksheet is acceptable.	☐ TIA Worksheet requires corrections.	☐ TIA Report required.	☐ TIA Report not required.

Section 3: Approved TIA Worksheet/Report

Approved TIA Worksheet/Report				
Project Name:				
Preparer Company:	Preparer Name:			Date:
Type: ☐ TIA Worksheet Only	☐ Level 1 TIA Report	☐ Level 2 TIA Report	☐ Level 3 TIA Report	
Approved with: ☐ Zoning/Concept Plan/Detail Plan	☐ Master Plan	☐ Plat	☐ Permit	☐ Other

Section 4: Update to and Status of Land Use and Trip Information for Total Development with Approved TIA Worksheet/Report (All Subdivision Units)

Unit	Land Use	Status[3]	ITE Code[1]	ITE Unit[2]	Est. Project Units	Critical Peak Hour	AM Peak Hour Rate	PM Peak Hour Rate	WKND Peak Hour Rate	Daily Trip Rate	AM Peak Hour Trips	PM Peak Hour Trips	WKND Peak Hour Trips	Daily Trips
Total from additional tabulation sheet (if necessary):														
Total:														

[1]*Institute of Transportation Engineers (ITE) Trip Generation*, 10th Edition or most recent; [2]E.g., Dwelling Units, Acres, Employees, KSF, etc.;
[3]Specify current *approved* status of unit: PLAN – Zoning/Concept Plan/Detail Plan/Master Plan, PP – Preliminary Plat, FP – Final Plat, P – Permit, C – Completed, A – With this Application (current)

Section 5: Approved TIA Worksheet/Report Conformance

Approved TIA Conformance	AM Peak Hour Trips	PM Peak Hour Trips	WKD Peak Hour Trips	Daily Trips
Approved development total:				
Updated development total:				
Difference development total:				
New TIA Report Required?				
Increase in Peak Hour Trips over 100?	☐ Yes. New TIA Report required to be approved prior to approval. ☐ No.			

Section 6: Required TIA Mitigation Measures

Mitigation Measures	Unit
1.	
2.	
3.	
4.	

PLANNING COMMISSION – JUNE 1, 2021 – 6:00PM

Zoom Meeting

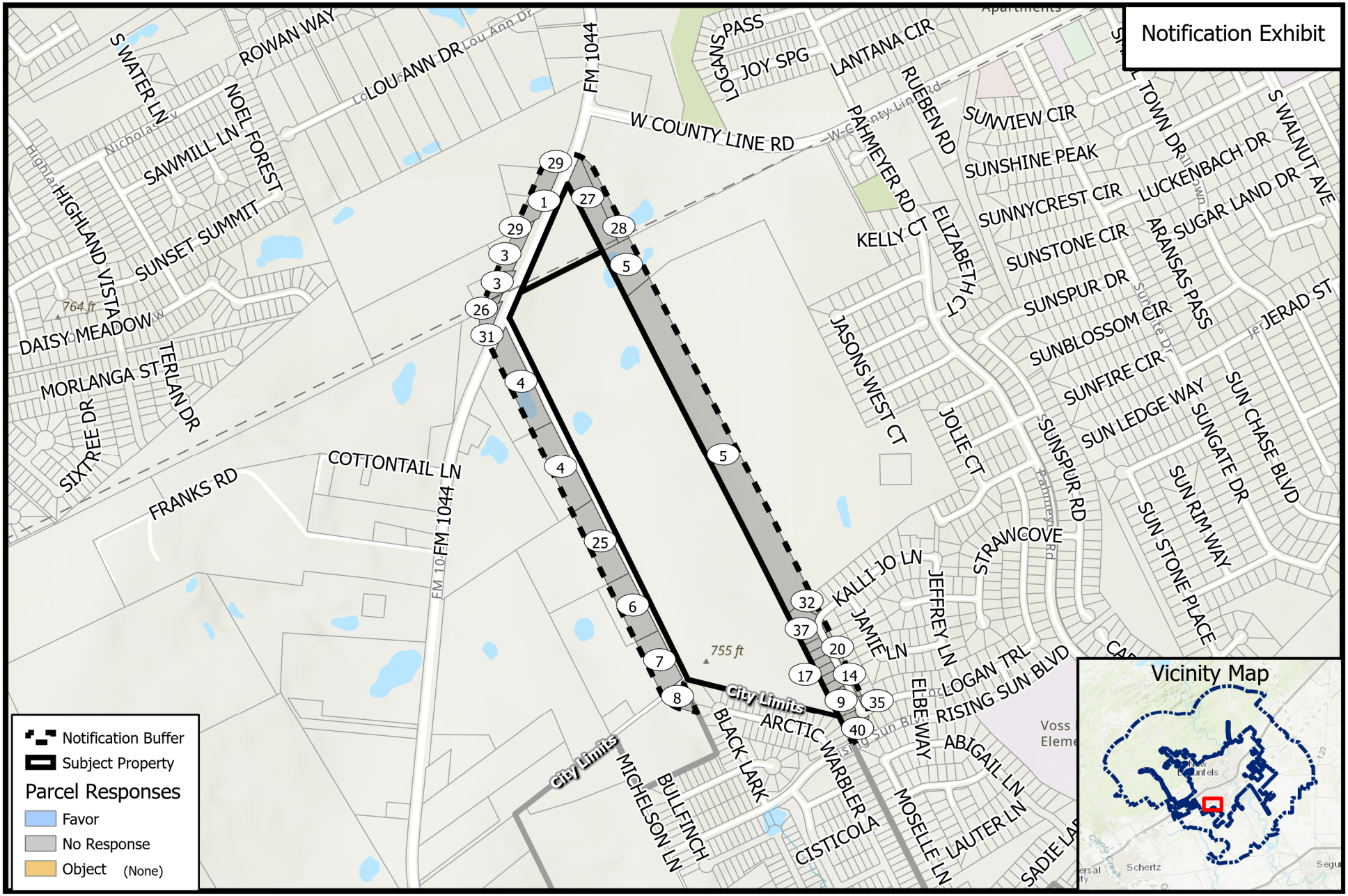
Applicant/Owner: HMT Engineering & Surveying
Address/Location: NE corner of FM 1044 & Michelson Ln

PROPOSED ZONE CHANGE – CASE #PZ21-0150

The circled numbers on the map correspond to the property owners listed below. All information is from the Appraisal District Records. The property under consideration is marked as "Subject Property".

1. CHRISTOPHERSON CRAIG & ALEXIS A PEREZ
2. DOYAL RODNEY & VIRGINIA R MCGOWEN
3. WOHLFAHRT RODGER W
4. LANGEN MARGARET J
5. ERWIN PAUL HENK TESTAMENTARY TRUST
6. GOMEZ CHRISTOPHER & LEAH A GOMEZ
7. KNUDSON ROBERT C & AZENETH
8. FREDERIKSEN RANDOLPH W & PENNY C
9. HERRERA KRISTEN V & GEORGE E
10. SCHLOMACH BENJAMIN MICHAEL
11. MARTIN MYRA R & JEFFREY L
12. MURPHY CARYN MARIE & JARED LOUIS
13. DITTER RYAN & KRYSTLE
14. GARZA KACE & KATIE GARZA
15. COOPER BARBARA M & NICHOLAS L
16. MEHL MICHAEL G & ALICIA M
17. QUINONES ALBERTO & AMY ALEMANY
18. ROJO ELIZABETH DEEGAN
19. WHALEN ELEANOR E
20. BATCHELOR BRADY M
21. UGOLETTI ENRICO A
22. MCDOW NICHOLAS A
23. HANGER GEORGE WILLIAM & KIMBERLY L RHYMER
24. WATKINS JOYCE A
25. ALBA JORGE & CHRISTOPHER J GOMEZ
26. WALSH FM 1044 DEVELOPMENT LLC
27. VOSS MATTHEW P
28. HENK ERWIN TESTAMENTARY TRUST
29. FEY CORRIE L M ET AL
30. CLAWSON CARLA
31. AGUILAR JOSE A & LAURA D
32. VOSS FARMS HOMEOWNERS ASSOCIATION INC
33. WITCRAFT DAVID & JESSICA
34. KOON DIANNA LYNN
35. SCROGGIN TYLER & SHASTA R
36. ATKINSON ELOY JR & CASSANDRA J FOX
37. RAY MICHAEL J & CANDACE K
38. SCROGGIN KIM T & JAMES H
39. FORD RICHIE ARMON & REBECCA PHELPS FORD
40. BRODEUR MEGAN

SEE MAP



PZ21-0150

Zone change from APD to ZHA

0 510 1,020 Feet

N

City of New Braunfels

Path:
\\chfs-1\Departments\Planning\ZoneChange-SUP-Replats\2021\PZ21-0150 - Wunderlich

Source: City of New Braunfels Planning
Date: 5/11/2021

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City of New Braunfels

Planning Commission Agenda Item Report

550 Landa Street
New Braunfels, TX

6/1/2021

Agenda Item No. D)

PRESENTER:
Applicant: City of New Braunfels
Owner: Gordon & Nancy Schroeder

SUBJECT:
PZ21-0155 Public hearing and recommendation to City Council regarding the proposed rezoning of Block 1 Lot 15 and a portion of Lot 14, Guada Coma Subdivision, addressed at 46 Guada Coma Drive, from "R-1A-6.6" Single-family District to "R-2A" Single-family and Two-family District.

DEPARTMENT: Planning and Development Services

COUNCIL DISTRICTS IMPACTED: Council District 5

BACKGROUND INFORMATION:

Applicant: City of New Braunfels
550 Landa Street
New Braunfels, TX 78130

Owner: Gordon & Nancy Schroeder
42 Guada Coma Drive
New Braunfels, TX 78130
(830) 743-0714 gdsnb50@protonmail.com

Staff Contact: Holly Mullins
(830) 221-4054 hmullins@nbtexas.org

The subject property is located in the Guada Coma neighborhood between the Guadalupe and Comal Rivers, west of downtown New Braunfels.

In 2006, in response to citizen input, City Council directed staff to evaluate areas of the City that were developed as single-family residential neighborhoods but were assigned a more intense zoning district. The area around Guada Coma Drive, zoned R-2 Single and Two-family District at that time, was one of the designated neighborhoods.

A neighborhood meeting held in early 2007 resulted in support from the majority of property owners for rezoning to R-1A-6.6. However, it was agreed that property owners who were opposed and owned lots large enough to accommodate a duplex (minimum 8,000 square feet) could opt out of the rezoning.

The Schroeders own two properties in the area and requested to opt out for both. Their home at 42 Guada Coma Drive was excluded from the rezoning, but the property at 46 Guada Coma Drive was inadvertently included.

Although the staff recommendation to City Council clearly lists this property as excluded, it was indicated as being rezoned to R-1A-6.6 on the map exhibit attached to the ordinance (Attachment 3).

Surrounding Zoning and Land Use:
North - R-1A-6.6 / Single-family residence
South - R-1A-6.6 / Property owners' common lot
East - Across Guadalupe River, R-2 / Undeveloped
West - Across Guada Coma Dr, R-1A-6.6 / Single-family residence

ISSUE:
An error in the executed Ordinance 2007-35 resulted in the inadvertent rezoning of property at 46 Guada Coma Drive. The City of New Braunfels initiated this rezoning request to correct the error. Because the original zoning of "R-2" is no longer an available zoning district, staff is recommending the property be rezoned to R-2A Single and Two-family District which is the current equivalent.

R-1A-6.6 allows single-family residential use with an option for an accessory dwelling unit (no full kitchen). R-2A allows two-family residential either attached as a duplex or in two separate structures.

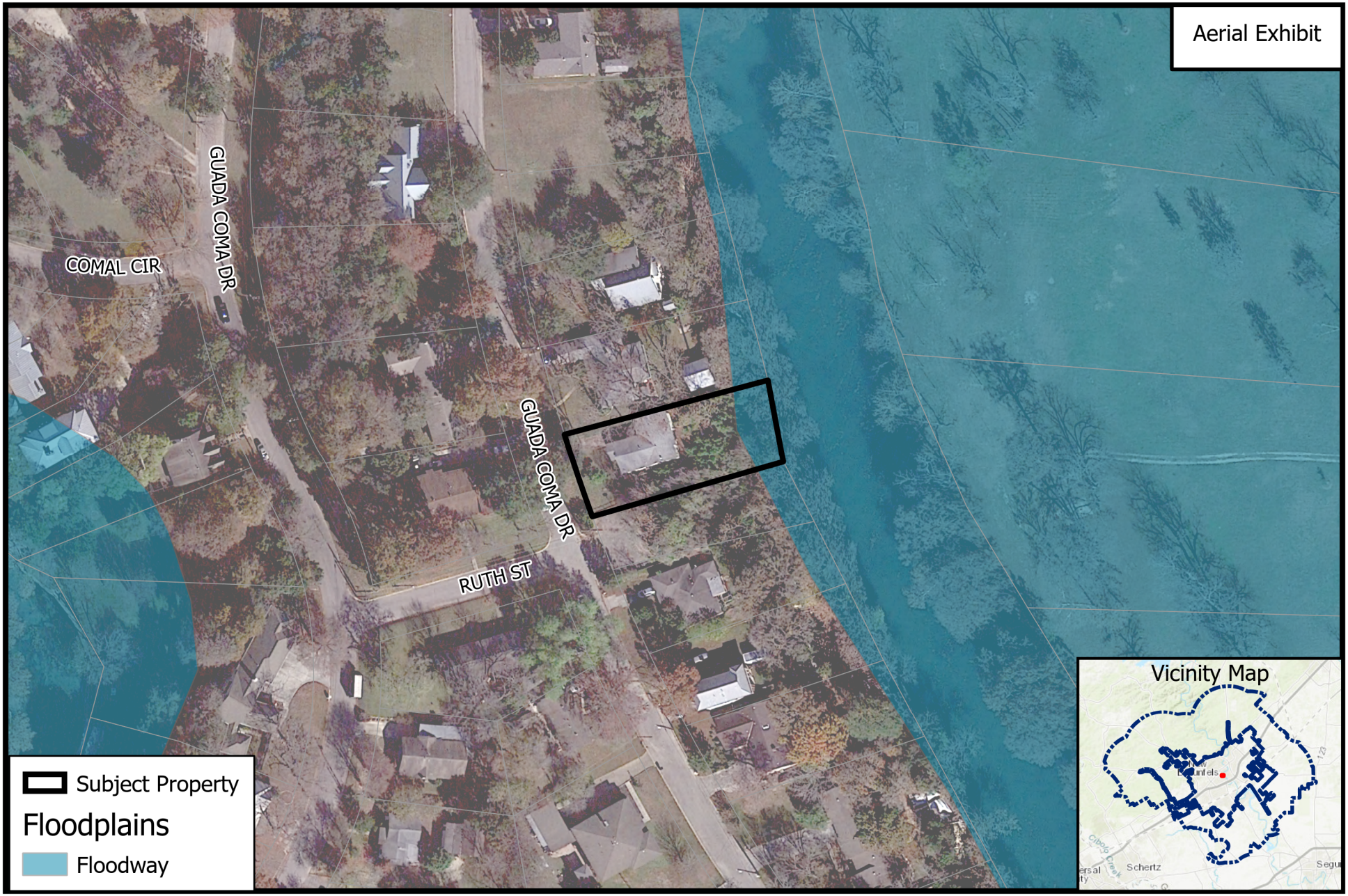
FISCAL IMPACT:
N/A

RECOMMENDATION:
Approval.

Notification:
Public hearing notices were sent to owners of 13 properties within 200 feet of the request. To date, no responses have been received.

Resource Links:
Sec. 144-3.4-3 R-2A Single-family and Two-family District
Sec. 144-3.4. - Zoning districts and regulations for property zoned subsequent to June 22, 1987. | Code of Ordinances | New Braunfels, TX | Municode Library <https://library.municode.com/tx/new_braunfels/codes/code_of_ordinances?nodeId=PTIICOOR_CH144ZO_ARTIIIZODI_S144-3.4ZODIREPRZOSUJU221987>

Attachments:
1. Aerial Map
2. Land Use Maps (Zoning, Existing, Future Land Use)
3. 2007 Rezoning Documents
4. Notification Map



PZ21-0155

R-1A-6.6 to R-2A

0 60 120 Feet

N

Path:
\\chfs-1\Departments\Planning\ZoneChange-SUP-Replats\2021\PZ21-0155 - 46 Guada

Source: City of New Braunfels Planning
Date: 5/11/2021

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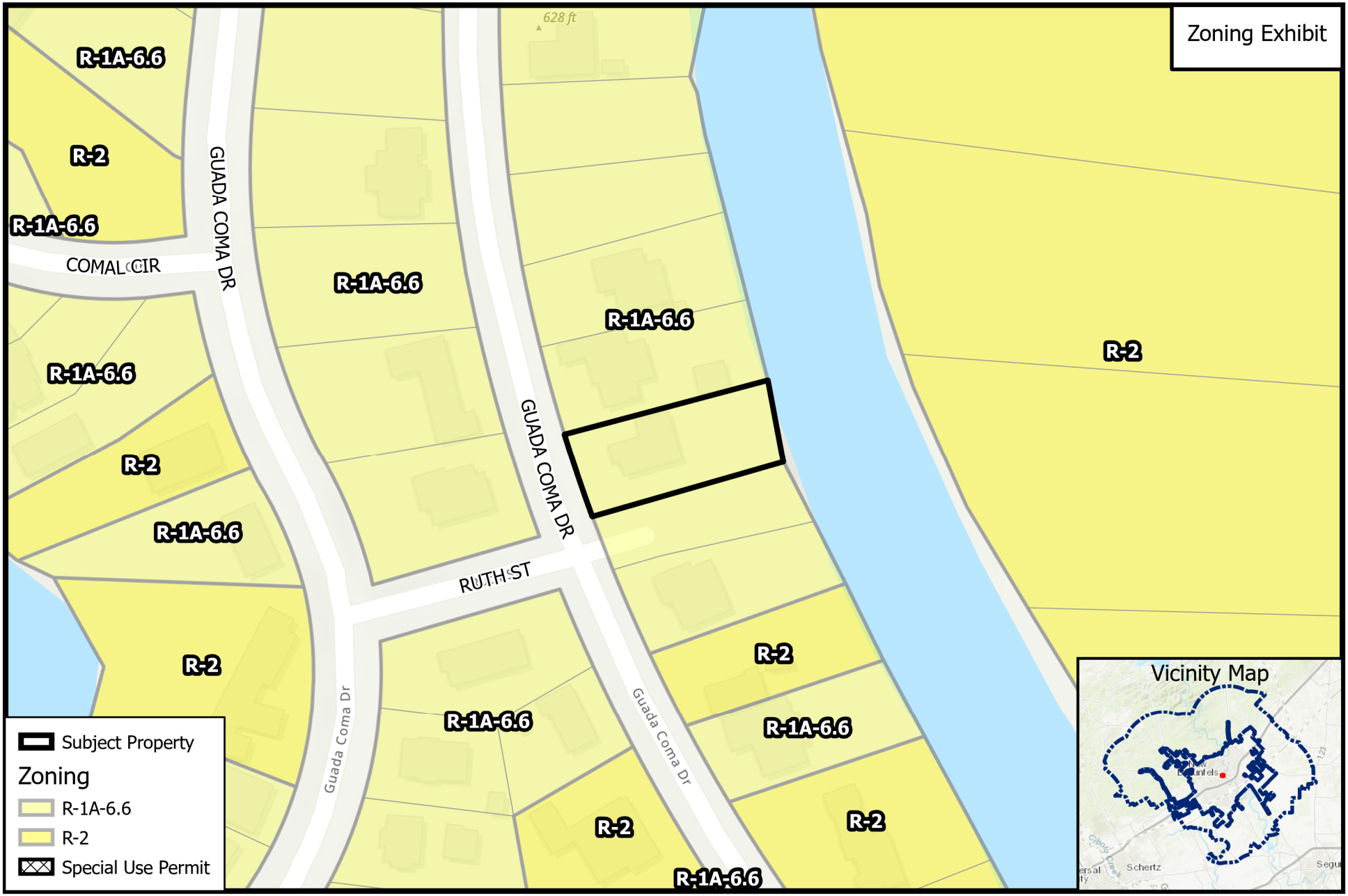

PZ21-0155
R-1A-6.6 to R-2A

0 60 120 Feet

N

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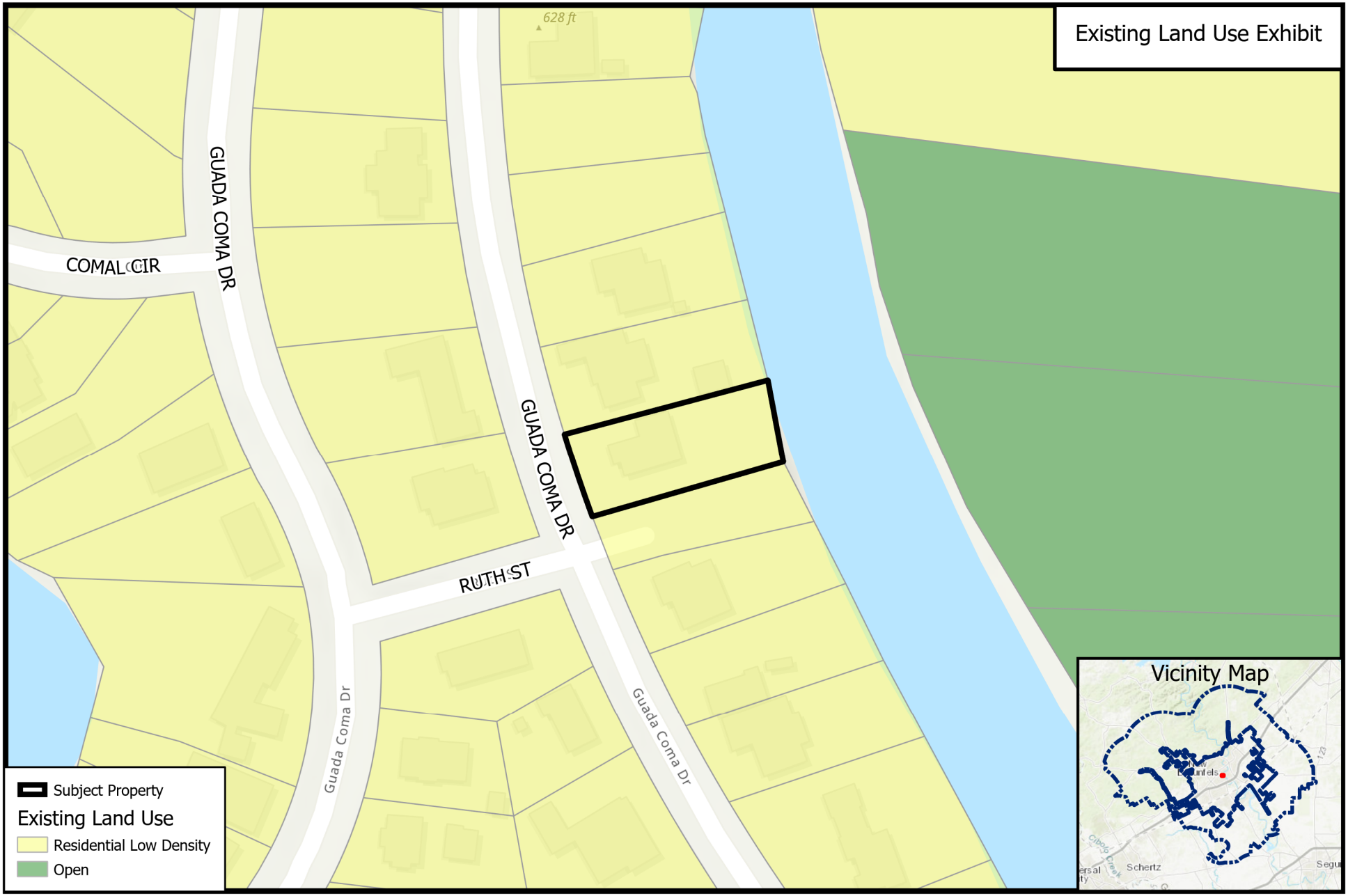
Path:
\\chfs-1\Departments\Planning\ZoneChange-SUP-Replats\2021\PZ21-0155 - 46 Guada

Source: City of New Braunfels Planning
Date: 5/11/2021



PZ21-0155

R-1A-6.6 to R-2A

0 60 120 Feet

N

Path:
\\chfs-1\Departments\Planning\ZoneChange-SUP-Replats\2021\PZ21-0155 - 46 Guada

Source: City of New Braunfels Planning
Date: 5/11/2021

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FUTURE LAND USE PLAN

A future land use plan is how land is envisioned to be. It establishes priorities for more detailed plans (sub area plans) and for detailed topical plans (such as parks and open spaces, trails and roads). It cannot be interpreted without the goals and actions of Envision New Braunfels.

TRANSITIONAL MIXED-USE CORRIDOR
Transitional Mixed-Use Corridors express an aspiration to retrofit existing auto-dominated retail corridors with a mix of uses and a variety of travel modes over time.

OUTDOOR RECREATION CENTER
Outdoor Recreation Centers are centered around a public or private outdoor destination like Fischer Park.

EMPLOYMENT CENTER
Employment Centers are mixed-use areas centered around office or industrial uses that can support significant employment.

MARKET CENTER
Market Centers are mixed-use areas anchored by a retail destination where surrounding residents go to get daily goods and services.

CIVIC CENTER
Civic Centers are mixed-use areas centered around a civic destination such as City Hall, a library or a recreation center.

SUB AREA 1 New Braunfels
Sub Area 1 includes the Downtown, Gruene and the Mid-Century or older neighborhoods that surround them. It is home to the natural springs and headwaters of flowing rivers that have attracted New Braunfelsers to the town for centuries.

SUB AREA 2 Oak Creek
Sub Area 2 refers to the neighborhoods and residential enclaves that have grown alongside the Hill Country landscape.

SUB AREA 3 Veramendi
Sub Area 3 includes a planned community offering a diversity of housing, distinct community centers and preserved Hill Country landscape features.

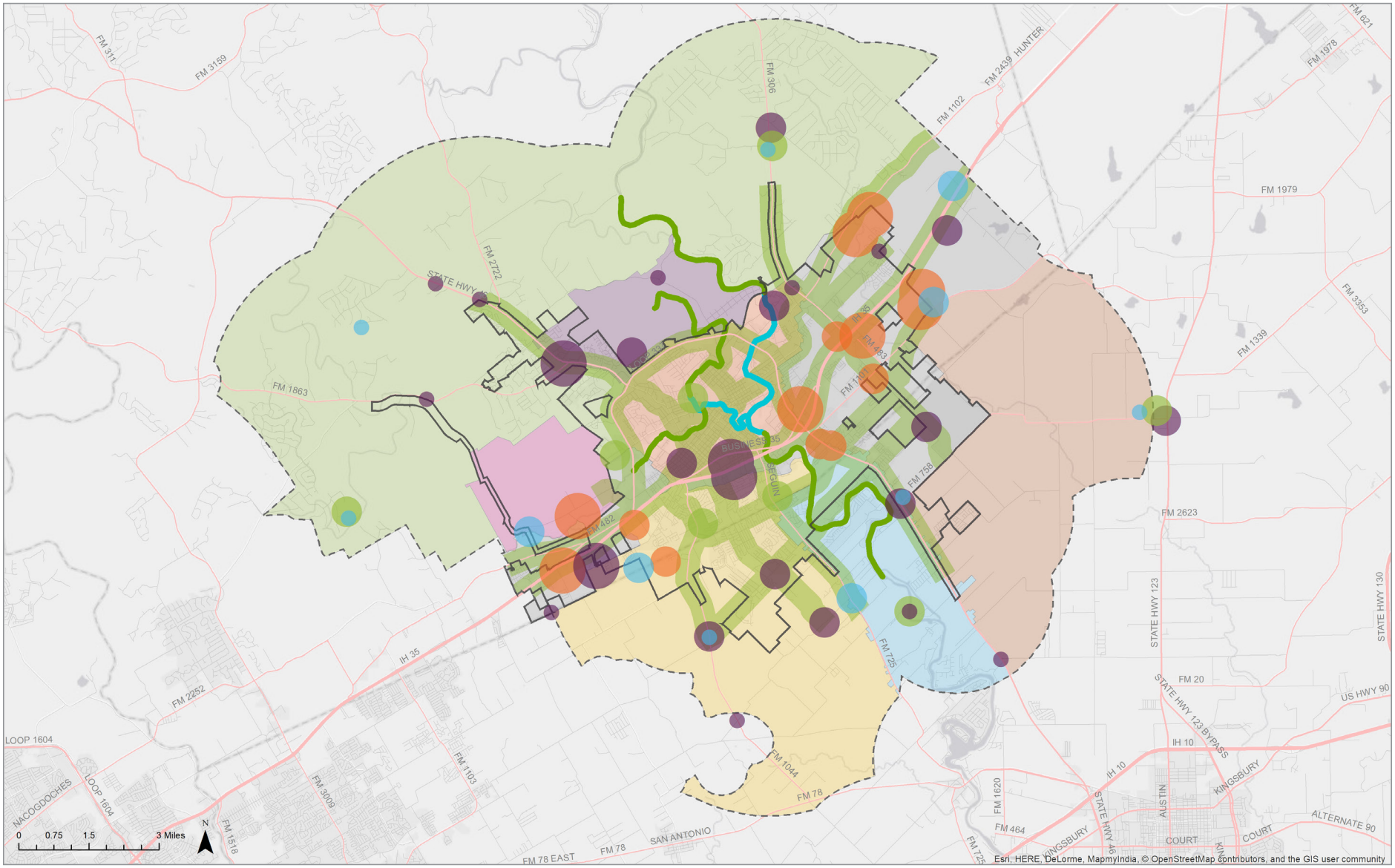
SUB AREA 4 Walnut Springs
At the heart of Sub Area 4 is Fischer Park. Proximity to IH-35, downtown and neighboring communities like McQueeney makes this area highly desirable and accessible.

SUB AREA 5 Dunlap
Sub Area 5 bridges together many communities east of IH-35. It includes the scenic landscape along both banks of the Guadalupe River between Highway 46 and FM 725.

SUB AREA 6 Hoffmann Lane
Sub Area 6 expresses an aspiration for conservation communities focused around maintaining and enhancing ecological integrity while allowing some level of development to occur.

SUB AREA 7 Krueger Canyon
Sub Area 7 includes parts of the city currently being mined for natural resources. These sites may become parks and open space, mixed-use communities or new commercial or entertainment areas in the future.

SUB AREA 8 Freiheit
This fast-growing Sub Area includes many neighborhoods offering affordable places for young families to live.



A Comprehensive Plan shall not constitute zoning regulations or establish zoning district boundaries. Preferred future growth scenario combines Scenarios A and C per recommendations of the Envision New Braunfels Steering Committee (February 2018). Exact boundaries of sub areas, centers, and corridors may be zoomed and viewed online.

COUNCIL AGENDA ITEM

SUBJECT MATTER/PROJECT:	REZONING OF CERTAIN LOTS IN THE GUADA COMA NEIGHBORHOOD		
ORIGINATING DEPARTMENT:	PLANNING	PRESENTER:	FRANK ROBBINS
COUNCIL DATE:	May 14, 2007	AGENDA #:	5(D)

AGENDA CAPTION:
SECOND AND FINAL READING OF AN ORDINANCE REZONING CERTAIN LOTS IN AN AREA BOUNDED GENERALLY BY COMAL AVENUE ON THE WEST, GARDEN STREET AND THE COMAL RIVER TO THE NORTH AND EAST, AND HAMPE STREET TO THE SOUTH, FROM "R-2 SINGLE & TWO-FAMILY DISTRICT" TO "R-1A-6.6 SINGLE-FAMILY DISTRICT".

APPLICANT/OWNER:

Applicant: City of New Braunfels

Current Owner(s): Various (see notification map)

BACKGROUND:

On April 23d on first reading, Council voted 6 – 1 to approve the ordinance and added one lot to the area to remain R-2.

The area includes about 117 lots. The area is currently zoned "R-2 Single & Two-Family District" and consists predominantly of single family homes.

This area is the fifth to be considered in the neighborhood protection program. All property owners within the proposed zone change area were invited to provide comments and speak to staff and attend a neighborhood meeting which was held on February 21, 2007, to answer questions and receive comments. The result of the meeting was a consensus that those property owners inside the subject area, with lots 8,000 square feet (8,500 for a corner lot) or greater and that are opposed, be taken out of the proposed rezoning area. See attachment 5 for a map of those opposed and in favor of the rezoning to R1A received as of 9:00 AM April 16, 2007.

Staff has been involved with conversations and meetings with a group that is interested in pursuing a duplex townhome project, similar to the two-unit Kamp Kendrick townhomes, on the properties identified as numbers 7 and 8 on the notification map. A rezoning to R-1A-6.6 would not allow the use of the proposed project.

Approved by a 5/1/1 vote

GENERAL INFORMATION:

Case # PZ04/07-1

Size: 4.5 acres

Surrounding Zoning and Land Use:

North - "R-2 Single & Two-Family District", "C-4 Resort Commercial District"/ Single-Family, Multifamily, Resort Commercial
South - "R-2 Single & Two-Family District", "C-2 General Business District"/ Single-Family, Institutional
East - "R-2 Single & Two-Family District" / Single-Family, Institutional, Vacant

Finance: _____ Agenda Item #: 5(D)

Attachments: ✓ Council Date: March 26, 2007

West - "C-2 General Business District" / Single-Family, Commercial

Comprehensive Plan Future Land Use Designation: Low Density Residential

Improvement(s): Water and wastewater are provided by NBU

NOTIFICATION:

267 notices were sent to property owners located within 200 feet of the subject property. Twenty-six responses were received favor (#'s 6, 10, 11, 16, 15, 17, 19, 21, 22, 30, 34, 35, 36, 43, 46, 51, 54, 60, 75, 138, 145, 147, 154, 164, 185 and 267), twenty of which are from inside the subject area. Thirty-one responses were received in opposition (#'s 1, 7, 8, 9, 18, 20, 23, 28, 40, 63, 64, 79, 81, 89, 90, 95, 108, 109, 113, 115, 134, 135, 169, 172, 187, 204, 206, 217, 248, 251 and 264), sixteen of which are from inside the subject area. The objection from #20 was received after the public hearing occurred at the Planning Commission meeting. See attachment 5 for the response map. 8.64% of the subject area responded in objection and 8.66% of the notified area within 200' responded in objection.

COMMISSION RECOMMENDATION:

The Planning Commission held a public hearing on April 3, 2007, and recommended approval of the zoning district with the exclusion of all properties that were in object to date, by a vote of 8-0-0.

STAFF RECOMMENDATION:

Staff recommended approval of the rezoning with the exception of the following properties:

Address	Map Number
439 Comal Avenue	1
511 Comal Avenue	7
539 Comal Avenue	8
545 Comal Avenue	9
106 Guada Coma	18
90 & 92 Comal Circle	23
84 Guada Coma	25
78 Guada Coma	28
641 Ashmore Avenue	40
39 Guada Coma	48
46 Guada Coma	61
42 Guada Coma	63
666 Simon Avenue	89
650 Simon Avenue	90

These lots are in opposition to the zone change, and are 8,000 square feet or greater, which by the R-2 Zoning District requirements are large enough to construct a duplex or two units.

PLANNING COMMISSIONERS AT THE HEARING:

1. Larry Alexander
2. Cheryl Casteel
3. O. Daniel Castillo
4. Fred Heimer
5. Judith Dykes-Hoffman
5. Sandy Nolte
6. Randy Vanstory, Vice Chairman
7. Mike Ybarra, Chairman

Finance: _____ Agenda Item #: _____

Attachments: _____ Council Date: March 26, 2007

ORDINANCE NO. 2007- 35

AN ORDINANCE REZONING CERTAIN LOTS IN AN AREA BOUNDED GENERALLY BY COMAL AVENUE ON THE WEST, GARDEN STREET AND THE COMAL RIVER TO THE NORTH AND EAST, AND HAMPE STREET TO THE SOUTH, FROM "R-2 SINGLE & TWO-FAMILY DISTRICT" TO "R-1A-6.6 SINGLE-FAMILY DISTRICT".

WHEREAS, the City Council of the City of New Braunfels has complied with all requirements of notice of public hearing as required by the Zoning Ordinance of the City of New Braunfels; and

WHEREAS, in keeping with the spirit and objectives of the "R-1A-6.6Single Family District", the City Council has given due consideration to all components of said district; and

WHEREAS, it is the intent of the City Council to provide harmony between existing zoning districts and proposed land uses; and

WHEREAS, the City Council desires to amend the Zoning Map by changing the zoning of an area bounded generally by Comal Avenue to the west, Garden Street and the Comal River to the North and East, and Hampe Street to the south, from "R-2 Single & Two-Family District" to "R-1A-6.6 Single Family District";

BE IT ORDAINED BY THE CITY COUNCIL OF THE CITY OF NEW BRAUNFELS:

SECTION 1

THAT, Sections 1.2-1 and 1.2-2, Chapter 144 of the New Braunfels Code of Ordinances and particularly the Zoning Map of the City of New Braunfels, are amended by changing the following described tract of land from "R-2 Single & Two-Family District" to "R-1A-6.6 Single Family District":

> "Being an area bounded generally by Comal Avenue to the west, Garden Street and the Comal River to the North and East, and Hampe Street to the south, as delineated on Exhibit "A".

SECTION 2

THAT all provisions of the Code of Ordinances of the City of New Braunfels not herein amended or repealed shall remain in full force and effect.

SECTION 3

THAT all other ordinances or parts of ordinances in conflict herewith are hereby repealed to the extent that they are in conflict.

SECTION 4

THAT if any provisions of this ordinance shall be held void or unconstitutional, it is hereby provided that all other parts of the same which are not held void or unconstitutional shall remain in full force and effect.

SECTION 5

THIS ordinance will take effect upon the third and final reading of same.

PASSED AND APPROVED: First Reading this 23rd day of April, 2007.

PASSED AND APPROVED: Second and Final Reading this 14th day of May, 2007.

CITY OF NEW BRAUNFELS

R. BRUCE BOYER, Mayor

ATTEST:

MICHAEL A. RESENDEZ, City Secretary

APPROVED AS TO FORM:

ALAN WAYLAND, City Attorney

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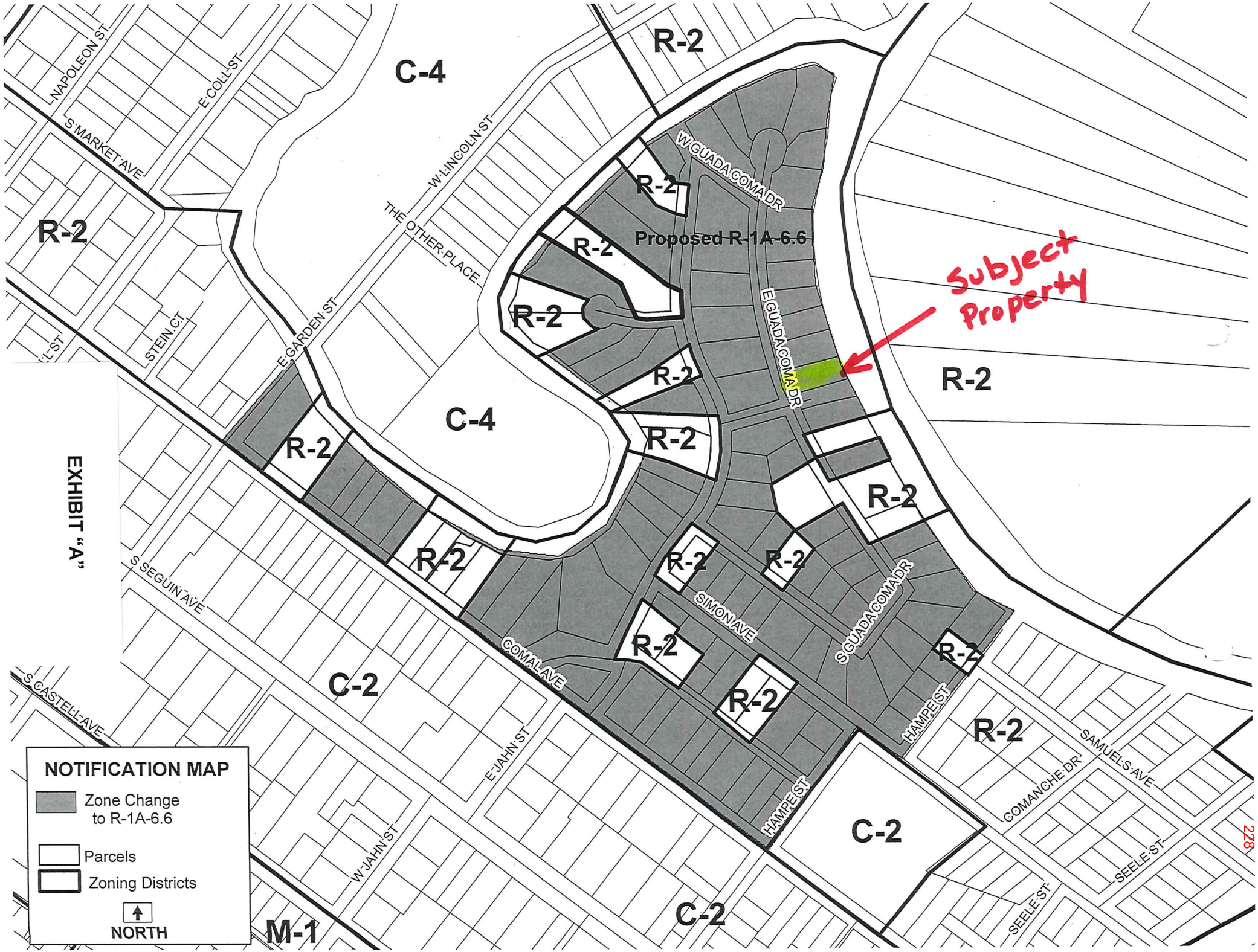


EXHIBIT "A"
Proposed R-1A-6.6
Subject Property
C-4
C-2
M-1
R-2
NOTIFICATION MAP
Zone Change to R-1A-6.6
Parcels
Zoning Districts
NORTH
NAPOLEON ST
E COLL ST
S MARKET AVE
W LINCOLN ST
THE OTHER PLACE
STEIN CT
E GARDEN ST
W GUADALCOMA DR
E GUADALCOMA DR
S GUADALCOMA DR
S SEGUIN AVE
COMAL AVE
SIMON AVE
HAMPE ST
S CASTELL AVE
E JAHN ST
W JAHN ST
COMANCHE DR
SAMUEL S AVE
SEELE ST
228

PLANNING COMMISSION – JUNE 1, 2021 – 6:00PM

Zoom Meeting

Applicant/Owner: City of New Braunfels

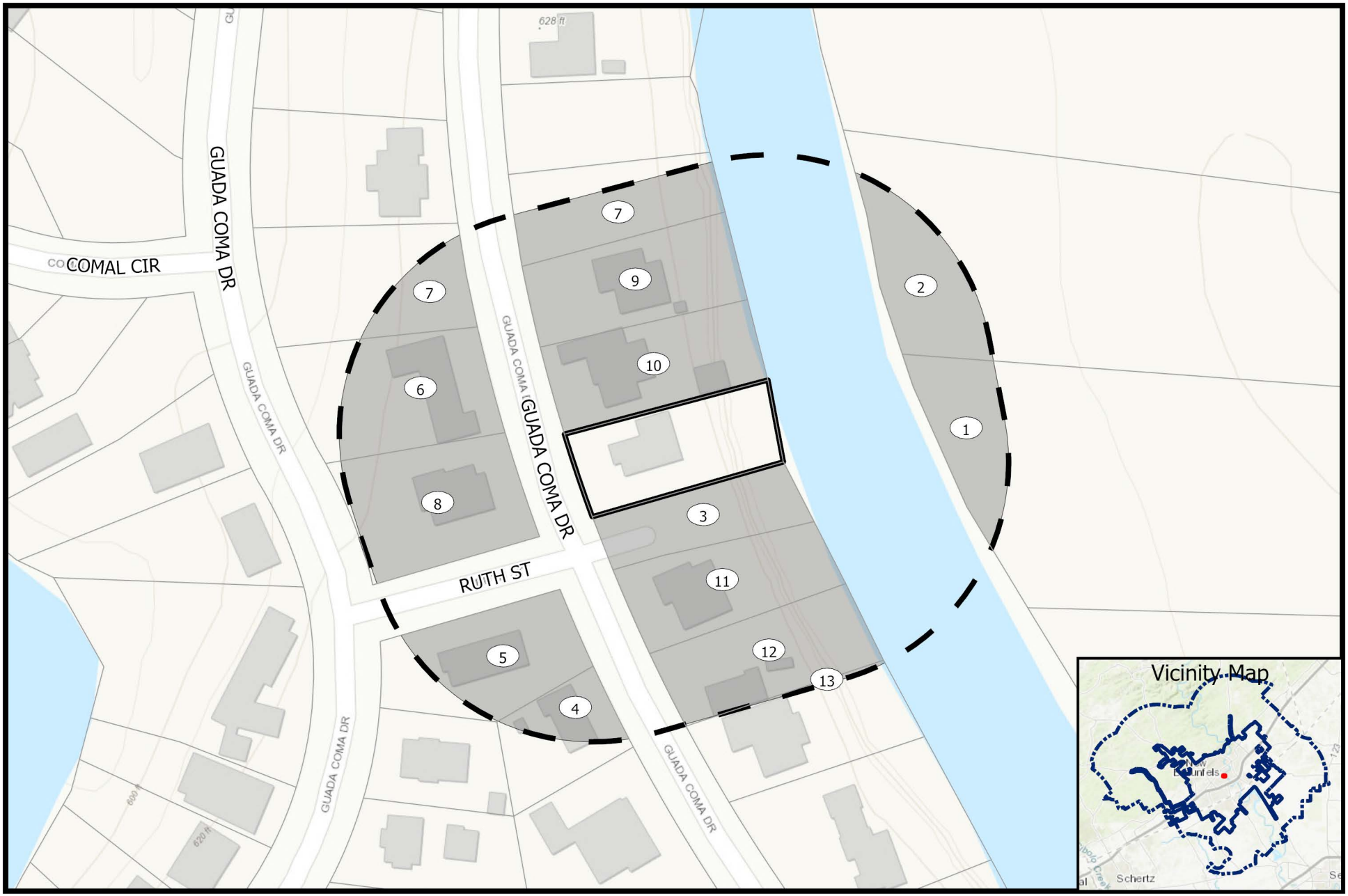
Address/Location: 46 Guada Coma

PROPOSED ZONE CHANGE – CASE #PZ21-0155

The circled numbers on the map correspond to the property owners listed below. All information is from the Appraisal District Records. The property under consideration is marked as "Subject Property".

1. OWENS JOSHUA
2. OWENS JOSHUA W
3. PROPERTY OWNER
4. CASTILLEJA JOSEPH A
5. GUZMAN REBEKKA J & ROY A
6. BERRY J R & ANN
7. GREEN ELMER L & ANN J
8. PREISS WELDON A & KARON
9. OLSON FAMILY TRUST
10. NELDACOM LLC
11. SNELL MARK C & PENNY S
12. SCHROEDER GORDON D & NANCY K M
13. EVANS JOHN R & LINDA F

SEE MAP



PZ21-0155

R-1A-6.6 to R-2A

0 60 120 Feet

N

Path:
\\chfs-1\Departments\Planning\ZoneChange-SUP-Replats\2021\SUP21-126 - RV Park -

Source: City of New Braunfels Planning
Date: 5/11/2021

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City of New Braunfels

Planning Commission Agenda Item Report

550 Landa Street
New Braunfels, TX

6/1/2021

Agenda Item No. E)

PRESENTER:
Applicant/Owner: Love's Travel Stops and Country Stores, Inc. (Brad Peck)

SUBJECT:
SUP21-123 Public hearing and recommendation to City Council regarding a proposed rezoning to apply a Special Use Permit to allow a truck stop in the "M-1A AH" Light Industrial, Airport Hazard Overlay District, addressed at 4001, 4023 and 4165 IH 35 North.

DEPARTMENT: Planning and Development Services

COUNCIL DISTRICTS IMPACTED: City Council District 4

BACKGROUND INFORMATION:

Applicant: Love's Travel Stops & Country Stores, Inc. (Brad Peck)
10601 N. Pennsylvania Avenue
Oklahoma City, OK 73120
(405) 463-8100 brad.peck@loves.com

Owners: Love's Travel Stops & Country Stores, Inc. (Brad Peck)
10601 N. Pennsylvania Avenue
Oklahoma City, OK 73120
(405) 463-8100 brad.peck@loves.com

MST 35 #6 (Mike Turner)
940 Eikel St.
New Braunfels, TX 78130
(830) 609-7446 mike@grandeice.com

Staff Contact: Matt Greene
(830) 221-4053 mgreene@nbtexas.org

The subject property is comprised of approximately 15 acres (Lots 1 & 2, Block 1, A-D Subdivision, Unit 2 and an unplatted parcel) situated on the north side of IH 35 along the access road between Oak Creek Way and Alligator Creek. It is zoned "M-1A AH" Light Industrial Airport Hazard Overlay District and is currently undeveloped.

The applicant is requesting approval of a Type 2 Special Use Permit (SUP) to allow a truck stop. The City's Zoning Ordinance defines a "Truck Stop" as an establishment engaged primarily in the fueling, servicing, repair, or parking of tractor trucks or similar heavy commercial vehicles, including the sale of accessories and equipment for such vehicles. A "truck stop" may also include overnight accommodations, showers, or

restaurant facilities primarily for the use of truck crews.

Prior to December of 2020, the City's Zoning Ordinance allowed truck stops as a use permitted by right in the C-3, M-1, M-2, MU-B, M-1A and M-2A Districts, however, the definition of "truck stop" stated they may only be located outside a two mile radius of another truck stop. A variance request for this same subject property was submitted in October of 2019 to allow a proposed truck stop to be located within a two-mile radius of another truck stop. The Zoning Board of Adjustment denied the waiver request in January of 2020.

A Zoning Ordinance amendment in December 2020 removed the proximity restriction between truck stops, adopted development and operational standards for truck stops to minimize potential negative impacts on surrounding property, and added the requirement for approval of an SUP prior to development of any new truck stop. An application for an SUP to allow a truck stop requires submittal of a site plan, landscaping plan, traffic impact analysis and feasibility study indicating the anticipated demand for truck fueling and overnight parking.

Required development standards for truck stops include a minimum setback of 300 feet from any property line used or zoned for a residential use including single-family, two-family, multifamily or manufactured home park use, as well as a 6-foot to 8-foot tall masonry wall, one 3-inch caliper shade tree per 15 linear feet and one 24-inch tall shrub every 5 feet.

The applicant's site plan and landscaping plan meet all the minimum required development and operation standards for truck stops. No portion of the developed site would be within 300 feet of residentially zoned or used property, and no closer than 330 feet from the nearest single-family residential lot in the Oak Creek Subdivision.

Uses associated with the applicant's proposed truck stop include:

- Convenience store with one attached restaurant with a drive-through, and one attached restaurant without a drive-through
- Speedco Truck Care Center (performs preventative maintenance and Department of Transportation (DOT) inspections)
- Passenger car fueling and parking areas
- Diesel truck fueling and parking areas
- Recreational vehicle (RV) parking areas and holding tank unloading facilities
- Dog park
- Caterpillar Truck Scale
- Propane tank

All of these proposed uses associated with/accessory to the truck stop are currently permitted as individual uses within the existing M-1A AH zoning district.

Overnight truck idling is prohibited unless specifically requested as part of the SUP application. The applicant in this case is not requesting allowance of overnight idling and will be required to provide signage indicating overnight idling is prohibited.

Page 2 of the applicant's attached feasibility study provides a summary as to why the applicant believes a truck stop is feasible and why the location was selected. Staff has noted there are existing truck stops in the vicinity: the T/A Truck Stop (formerly Rip Griffin Truck Stop) is located 0.66 of a mile to the east at the IH 35 access road and Conrads Lane intersection; and the Tex Best Travel Center Truck Stop is approximately 1 mile west located at the intersection of FM 306 and IH 35 access road.

The applicant's TIA report has not yet been approved by the City. There are outstanding comments including mitigation required due to a decrease in level of service below levels allowed in the City's Code of Ordinances during the Saturday peak hour on Oak Creek Way at the southbound IH 35 access road. Additionally, staff notes that while the delay at the driveway to the proposed development at the southbound IH 35 access road will be fully contained onsite, the owner of the property accepts responsibility for the delays at the driveway.

ISSUE:
Actions from Envision New Braunfels that relate to this request, either that support or discourage the proposed use, include:

- Action 1.8: Concentrate future investment in industrial and employment centers near existing and emerging hubs, such as the airport; and along existing high capacity transportation networks, such as Interstate Highway 35
- Action 1.11: Update policies and codes to achieve development patterns that implement the goals of this plan.
- Action 3.11: Target new industries that integrate well with the New Braunfels workforce, as well as industries with intact labor.
- Action 5.18: Work with local businesses to reduce exhaust pollutants from large transport and other commercial vehicles.
- Action 6.4: Consider how each new development project impacts the transportation system and ensure appropriate mitigation is implemented.

The property lies within the Oak Creek Sub Area near Existing Market and Employment Centers, and is in close proximity to a Future Employment Center. It lies along the IH-35 Transitional Mixed-Use Corridor.

FISCAL IMPACT:
N/A
RECOMMENDATION:
Staff's courtesy recommendation is pending completion of the outstanding TIA review comments that need to be addressed. The applicant will need to adequately address the TIA comments to meet the City's code requirements and obtain approval of the TIA prior to the SUP request appearing on a City Council meeting agenda.

Notification as required by state statute:
Public hearing notices were sent to 8 owners of property within 200 feet of the request. To date, staff has received no responses.

Resource Links:

- Chapter 144, Sec. 3.4-18 "M-1A" Light Industrial District of the City's Code of Ordinances:

  <https://library.municode.com/tx/new_braunfels/codes/code_of_ordinances?

- Chapter 144, Sec. 3.6 Special Use Permits of the City's Code of Ordinances

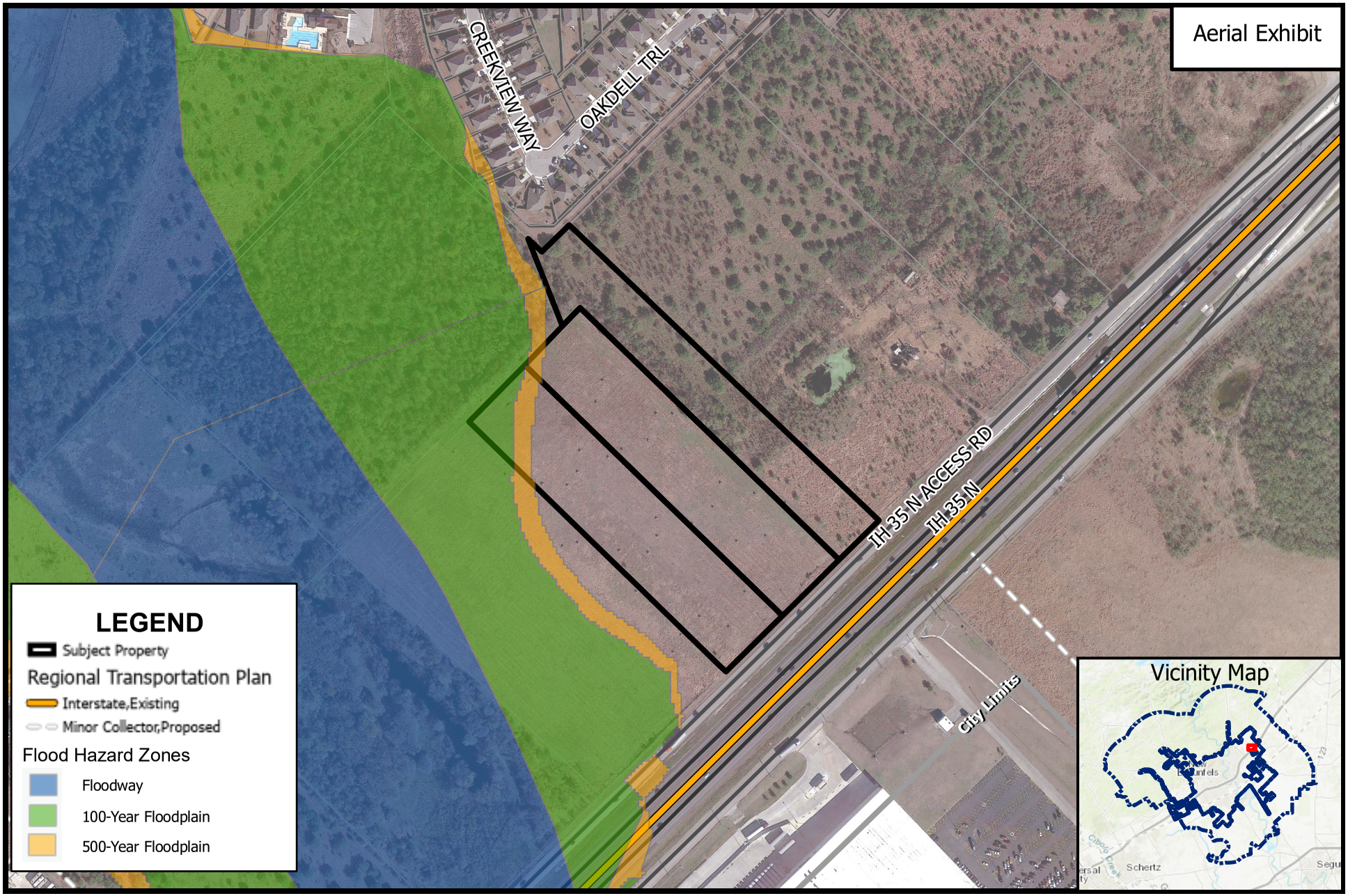
  <https://library.municode.com/tx/new_braunfels/codes/code_of_ordinances?

- Chapter 144, Sec. 144-5.27 Truck Stops of the City's Code of Ordinances

<http://www.nbtexas.org/DocumentCenter/View/20483/2020-78>

Attachments:

Aerial Map
Proposed Site Plan
Proposed Landscape Plan
Land Use Maps (Zoning, Existing and Future Land Use)
Traffic Impact Analysis
Feasibility Study
Notification List and Map



SUP21-123

Special Use Permit to allow for Truck Stop

0 210 420 Feet

N

Path:
\\CHFS-1\Departments\Planning\ZoneChange-SUP-Replats\2021\SUP21-123 - Love's Travel

Source: City of New Braunfels Planning
Date: 5/24/2021

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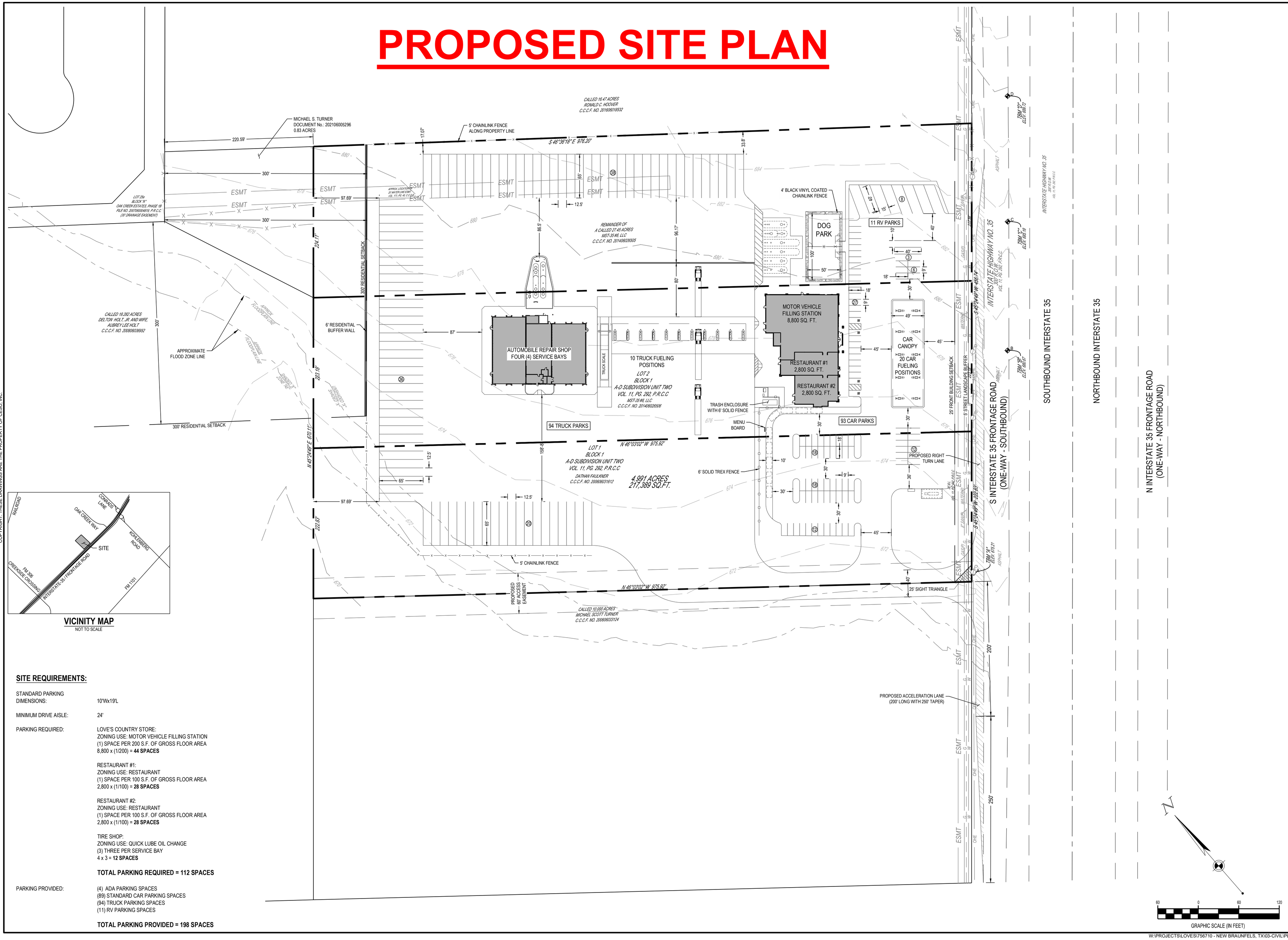
PROPOSED SITE PLAN



VICINITY MAP
NOT TO SCALE

SITE REQUIREMENTS:

STANDARD PARKING DIMENSIONS: 10'Wx19'L

MINIMUM DRIVE AISLE: 24'

PARKING REQUIRED:

LOVE'S COUNTRY STORE:
ZONING USE: MOTOR VEHICLE FILLING STATION
(1) SPACE PER 200 S.F. OF GROSS FLOOR AREA
8,800 x (1/200) = **44 SPACES**

RESTAURANT #1:
ZONING USE: RESTAURANT
(1) SPACE PER 100 S.F. OF GROSS FLOOR AREA
2,800 x (1/100) = **28 SPACES**

RESTAURANT #2:
ZONING USE: RESTAURANT
(1) SPACE PER 100 S.F. OF GROSS FLOOR AREA
2,800 x (1/100) = **28 SPACES**

TIRE SHOP:
ZONING USE: QUICK LUBE OIL CHANGE
(3) THREE PER SERVICE BAY
4 x 3 = **12 SPACES**

TOTAL PARKING REQUIRED = 112 SPACES

PARKING PROVIDED:
(4) ADA PARKING SPACES
(89) STANDARD CAR PARKING SPACES
(94) TRUCK PARKING SPACES
(11) RV PARKING SPACES

TOTAL PARKING PROVIDED = 198 SPACES

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Love's

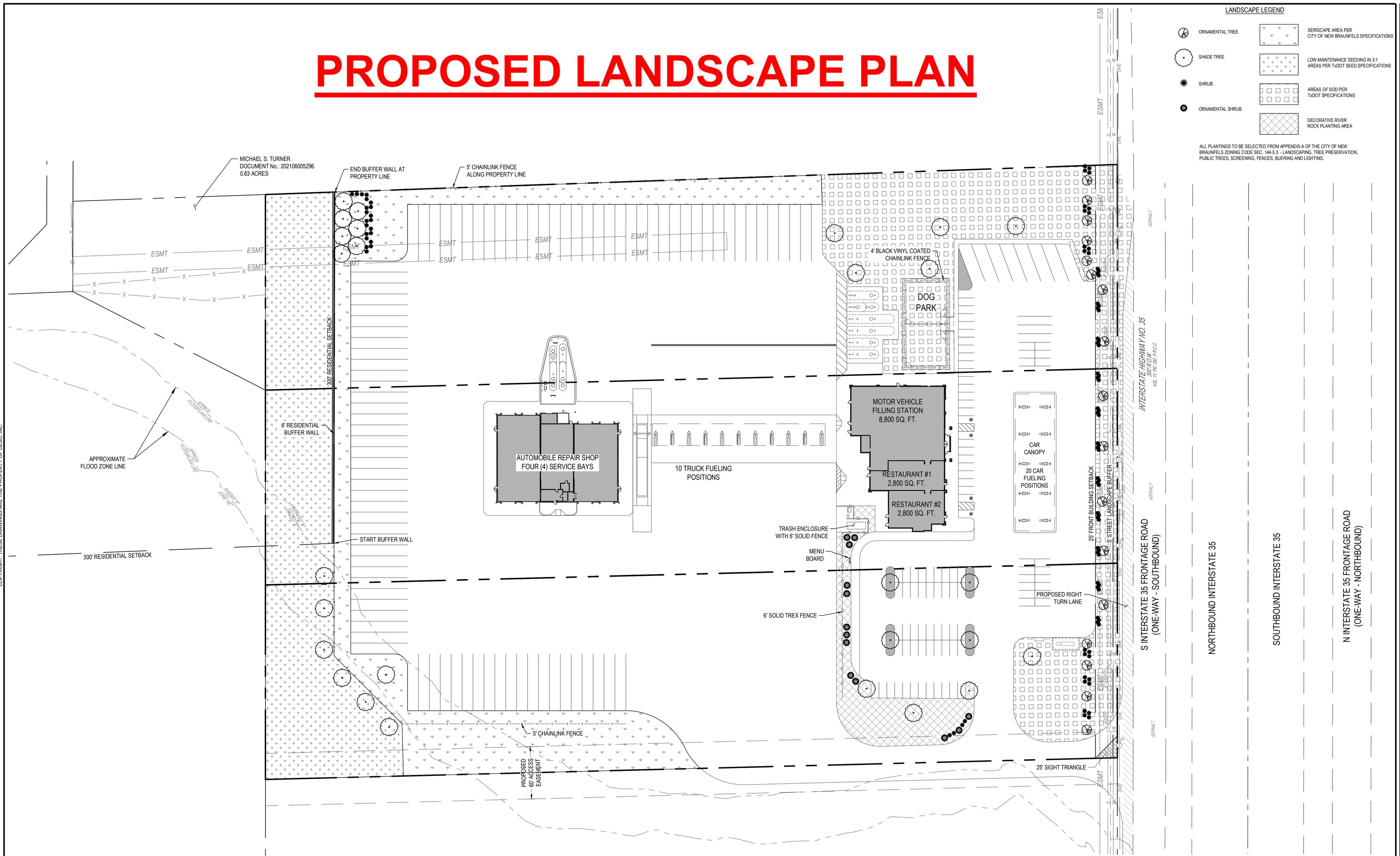
NO.	DATE	REVISION DESCRIPTION

LOVE'S TRAVEL STOPS
NEW BRAUNFELS
TEXAS
INTERSTATE 35 FRONTAGE ROAD

SPECIAL USE
SITE PLAN

ISSUE:
NOT FOR CONSTRUCTION
DATE:
05/24/2021
JOB NO.: 756710
DESIGN: DMT
DRAWN: DMT
CHECKED: MDF
SHEET NO.
SUP-1

PROPOSED LANDSCAPE PLAN



PLANT REQUIREMENTS		
CODE	REQUIRED	PROVIDED
FRONTAGE (680-FEET OF FRONTAGE)		
ONE (1) ORNAMENTAL TREE PER EVERY 40' OF FRONTAGE. ORNAMENTAL TREE USED DUE TO UTILITY LINES	17	17
FOUR (4) FIVE GALLON OR THREE-FOOT TALL SHRUB PER 40' OF FRONTANGE	68	68
PARKING LOTS		
ONE (1) TREE PER FOURTEEN (14) PARKING SPACES	14	14

PLANT MATERIAL LIST			
QTY.	PLANT NAME	INSTALLED SIZE	MIN. SPACING
17	ORNAMENTAL TREES	1.5"	20'
27	SHADE TREES	1.5"	20'
14	ORNAMENTAL SHRUB	ANY	ANY
93	SHRUB	3'	40'

ALL PLANTINGS TO BE SELECTED FROM APPENDIX A OF THE CITY OF NEW BRAUNFELS ZONING CODE SEC. 144-5.3. - LANDSCAPING, TREE PRESERVATION, PUBLIC TREES, SCREENING, FENCES, BUERING AND LIGHTING.

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Love's

NO.	DATE	REVISION DESCRIPTION

LOVE'S TRAVEL STOPS
NEW BRAUNFELS
TEXAS
INTERSTATE 35 FRONTAGE ROAD

SPECIAL USE LANDSCAPE PLAN

ISSUE:
NOT FOR CONSTRUCTION
DATE:
05/24/2021
JOB NO.: 756710
DESIGN: DMT
DRAWN: DMT
CHECKED: MDF
SHEET NO.
SUP-2

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CESO

TRAFFIC IMPACT STUDY

Love's Travel Stop – City of New Braunfels
Comal County, Texas
March 26th, 2021

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1. Executive Summary

1.1. Summary

This report is submitted on behalf of Love's Travel Stops in connection with its application to the City of New Braunfels, Comal County, Texas (TX) for Site Plan approval. The Traffic Impact Study (TIS) conducted by CESO, Inc. addresses the traffic related impacts associated with the proposed Love's Travel Stop; referred to herein as "Love's Development."

The proposed Love's Development is to be located at 4001, 4023, and 4165 S Interstate 35 Frontage Road, within the City of New Braunfels, Comal County, TX. The full buildout of the Love's Development is projected to have an 8,610 S.F. convenience store with 30 fueling stations (20 passenger car and 10 truck), approximately 2,670 S.F. fast-food restaurant with a drive-through window, approximately 2,610 S.F. fast-food restaurant without a drive-through window, and 4-bay tire store. The Love's Development is projected to have approximately 93 parking spaces for passenger vehicles, 11 parking spaces for recreational vehicles (RV's), and 94 parking spaces for semi-trucks.

The Love's Site Plan Application requests approval of the following access point:

- Full access connection to S Interstate 35 Frontage Road (referred to as "Love's Driveway") approximately 1600' south of the I-35 SB Off Ramp.

In addition, the Love's Site Plan Application requests approval to conduct work within the right-of-way for construction of the Site driveway. S Interstate 35 Frontage Road is under jurisdiction of the Texas Department of Transportation (TxDOT, San Antonio District).

This report presents the methodologies, analyses, and results of the Traffic Impact Study (TIS) for traffic generated by the proposed Love's Development. The purpose of the TIS was to identify and mitigate the traffic related impacts, if any, during the weekday AM, PM, and Saturday peak hours of operation for the proposed Love's Development.

The study parameters of this report were generated based upon the project scope, recent concept plan, and discussions with the City of New Braunfels and the Texas Department of Transportation (TxDOT, San Antonio District).

The Traffic Impact Study focused on evaluating the Existing, 2022 No-Build and 2022 Build traffic conditions near the Site represented by three (3) traffic scenarios. The traffic scenarios analyzed were:

Existing Traffic Scenario – Represents current (year 2021) traffic conditions during the weekday AM and PM Peak Hours of the adjacent roadway network. The Existing Traffic Scenario served as a baseline for comparison of the traffic impacts in relation to the proposed Love's Development.

2022 No-Build Traffic Scenario – Represents traffic conditions during the weekday AM and PM Peak Hours of the adjacent roadway network that would exist during year 2022, without the proposed Love's Development.

2022 Build Traffic Scenario – Represents traffic conditions during the weekday AM and PM Peak Hours of the adjacent roadway network that would exist during year 2022, with the proposed Love's Development constructed and fully operational.

1.2. Conclusions

Traffic counts were conducted by Gewalt Hamilton Associates, Inc. (GHA) on Thursday, March 4th, 2021 between the morning hours of 7:00 AM to 9:00 AM and evening hours of 4:00 PM to 6:00 PM and on Saturday, March 6th, 2021 between the hours of 11:00 AM to 1:00 PM at the following intersections:

- I-35 NB Off Ramp & N Interstate 35 Frontage Road (Yield Controlled).
- N Interstate 35 Frontage Road & Kohlenberg Road (Stop Sign Controlled).
- N Interstate 35 Frontage Road & Overpass (east side) (Yield Controlled).
- Kohlenberg Road & Overpass (east side) (Yield Controlled).
- Conrads Lane & Overpass/Access Driveway (west side) (Stop Sign Controlled).
- S Interstate 35 Frontage Road & Conrads Lane (Stop Sign Controlled).
- S Interstate 35 Frontage Road & Oak Creek Way (Stop Sign Controlled).
- I-35 SB Off Ramp & S Interstate 35 Frontage Road (Yield Controlled).

The weekday peak hours of the Traffic Impact Study roadway network were determined to occur between the hours of:

- 7:15 AM – 8:15 AM (AM Peak Hour).
- 4:30 PM – 5:30 PM (PM Peak Hour).
- 12:00 PM – 1:00 PM (Saturday Peak Hour).

The full buildout of the Love's Travel Stop is estimated to generate 8,324 trips per day on a typical weekday (4,162 inbound and 4,162 outbound), of which 486 trips will be generated during Weekday AM Peak Hour (250 inbound and 236 outbound), 484 trips will be generated during the Weekday PM Peak Hour (243 inbound and 241 outbound), and 679 trips will be generated during the Saturday Peak Hour (340 inbound and 339 outbound). ***Pass-by trips were included in the analysis. Internal Capture Rates were deducted in the analysis.***

Trips for the proposed Love's Development are anticipated to approach and depart the Love's Development following the directional distribution patterns illustrated on Figures 6.A-6.D (see pg. 31-34).

Synchro Version 11.0 HCM 6th Edition Signalized/TWSC methodology was used to analyze the current level of service at the key study intersections.

Under the **Existing Traffic Scenario**, all intersection movements operate at level of service (LOS) "D" or better conditions with the exception of the NBLTR movement at the intersection of Conrads Lane and the Overpass/Access Driveway which operates at LOS "F" during both the AM and PM Peak Hours, and the EBLR movement at the intersection of S Interstate 35 Frontage Road and Conrads Lane which operates at LOS "F" during both the PM and Saturday Peak Hours.

It should be noted, under the **2022 No-Build Traffic Scenario**, roadway improvements to the Kohlenberg Road and Conrads Lane interchanges will be completed and operational by April 2022. According to TxDOT's projected

schedule, the improvements will include demolishing the Conrads Lane/Kohlenberg Road overpass in early June 2021. In addition, the bridge is scheduled to open to traffic mid-October 2021. The improvements will include signalizing the Kohlenberg Road & N Interstate 35 Frontage Road interchange and Conrads Lane & S Interstate 35 Frontage Road interchange. The 2022 No-Build Traffic Scenario capacity analysis files include the improvements stated above with the assumption they would be completed by year 2022. Under the 2022 No-Build Traffic Scenario, all signal-controlled intersections operate at overall level of service (LOS) "C" or better conditions. In addition, all individual movements of stop-controlled intersections operate at level of service (LOS) "C" or better conditions.

Under the **2022 Build Traffic Scenario**, all signal-controlled intersections operate at overall level of service (LOS) "C" or better conditions. In addition, all individual movements of stop-controlled intersections operate at level of service (LOS) "C" or better conditions with the exception of the EBR movement at the intersection of S Interstate 35 Frontage Road and Love's Driveway which operates at level of service (LOS) "F" during the AM, PM, and Saturday Peak Hours. It should be noted, due to the high volume of through volumes traveling southbound on S Interstate 35 Frontage Road, longer gap periods are needed for vehicles exiting the Love's Development to be able to turn right out of the Site, therefore the reason for longer delay times. The recommended improvements include the construction of a SB to WB right-turn lane at the intersection of S Interstate 35 Frontage Road and Love's Driveway.

CESO conducted turn lane analyses for the study network and reached the following conclusions:

- Right-turn lane and left-turn lane analyses were completed using the capacity analyses results, queue length analyses results, and guidance from the Texas Department of Transportation (TxDOT) – *Access Management Manual* and *Roadside Design Manual*.

- According to TxDOT *Access Management Manual, Table 2-3,* a right-turn lane **is warranted** at the intersection of S Interstate 35 Frontage Road and Love's Driveway under the 2022 Build traffic condition.

- All studied locations have existing left-turn lanes for each approach. CESO did not find additional left-turn lanes to be warranted at any location.

CESO conducted queue length analyses for the study network and reached the following conclusions:

- During peak hours, it can be observed that customers will have to wait for longer gap periods on S Interstate 35 Frontage Road to be able to exit the development due to the high volume of advancing traffic along the mainline. Due to the need for longer gap periods, it can be observed that the EBR movement queue lengths at the Love's Driveway extend back into the development.

CESO conducted a weave analysis at the weaving section of the I-35 SB Off Ramp and S Interstate 35 Frontage Road and reached the following conclusion:

The weaving vehicles can enter the section in the left-most lane of S Interstate 35 Frontage Road and efficiently cross two (2) lanes to turn right into the Love's Driveway with little to no delay or congestion.

1.3. Summary of Recommendations

The following summary of recommendations was generated based upon the findings in the Traffic Impact Study.

2022 No-Build Traffic Scenario (Responsibility - Others):

- Improvements from TxDOT were applied to the 2022 No-Build Traffic Scenario. These improvements include:

    1. Demolishing the existing Conrads Lane/Kohlenberg Road overpass and constructing a new bridge for I-35.
    2. Widening and signalizing the Kohlenberg Road and N Interstate 35 Frontage Road interchange
    3. Widening and signalizing the Conrads Lane and S Interstate 35 Frontage Road interchange.

2022 Build Traffic Scenario (Responsibility - Love's Travel Stops):

S Interstate 35 Frontage Road and Love's Driveway:

- Construct Love's Driveway to permit right-in and right-out movements of passenger cars and trucks. Control Love's Driveway with one (1) stop sign. Provide one outbound right turn lane.

- Construct a SB to WB right-turn lane to accommodate 510' of storage plus a 100' taper.

2. Introduction

This report is submitted on behalf of Love's Travel Stops in connection with its application to the City of New Braunfels, Comal County, Texas (TX) for Site Plan approval. The Traffic Impact Study (TIS) conducted by CESO, Inc. identifies the traffic related impacts associated with the proposed Love's Development and presents recommendations for traffic mitigation.

The proposed Love's Development is to be located at 4001, 4023, and 4165 S Interstate 35 Frontage Road, within the City of New Braunfels, Comal County, TX. The full buildout of the Love's Development is projected to have an 8,610 S.F. convenience store with 30 fueling stations (20 passenger car and 10 truck), approximately 2,670 S.F. fast-food restaurant with a drive-through window, approximately 2,610 S.F. fast-food restaurant without a drive-through window, and 4-bay tire store. The Love's Development is projected to have approximately 93 parking spaces for passenger vehicles, 11 parking spaces for recreational vehicles (RV's), and 94 parking spaces for semi-trucks.

The use of the Site as a Love's Development will generate additional traffic on S Interstate 35 Frontage Road, N Interstate 35 Frontage Road, Conrads Lane, and Kohlenberg Road. Love's retained CESO, Inc. to prepare the Traffic Impact Study and present the details of a safe and efficient access system relating to Love's application for approval of the following access point:

- Full access connection to S Interstate 35 Frontage Road (referred to as "Love's Driveway") approximately 1600' south of the I-35 SB Off Ramp.

The Site Plan Application also requests approval to conduct work within the right-of-way for construction of the Site driveway.

This report presents the methodologies, analyses, and results of the Traffic Impact Study (TIS) for traffic generated by the proposed Love's Development. The purpose of the TIS was to identify and mitigate the traffic related impacts, if any, during the weekday AM, PM, and Saturday Peak Hours of operation for the proposed Love's Development.

The study parameters of this report were generated based upon the project scope, recent concept plan, and discussions with the City of New Braunfels and the Texas Department of Transportation (TxDOT, San Antonio District).

The following intersections were analyzed in the Traffic Impact Study:

- I-35 NB Off Ramp & N Interstate 35 Frontage Road (Yield Controlled).
- N Interstate 35 Frontage Road & Kohlenberg Road (Stop Sign Controlled).
- N Interstate 35 Frontage Road & Overpass (east side) (Yield Controlled).
- Kohlenberg Road & Overpass (east side) (Yield Controlled).
- Conrads Lane & Overpass/Access Driveway (west side) (Stop Sign Controlled).
- S Interstate 35 Frontage Road & Conrads Lane (Stop Sign Controlled).
- S Interstate 35 Frontage Road & Oak Creek Way (Stop Sign Controlled).
- I-35 SB Off Ramp & S Interstate 35 Frontage Road (Yield Controlled).

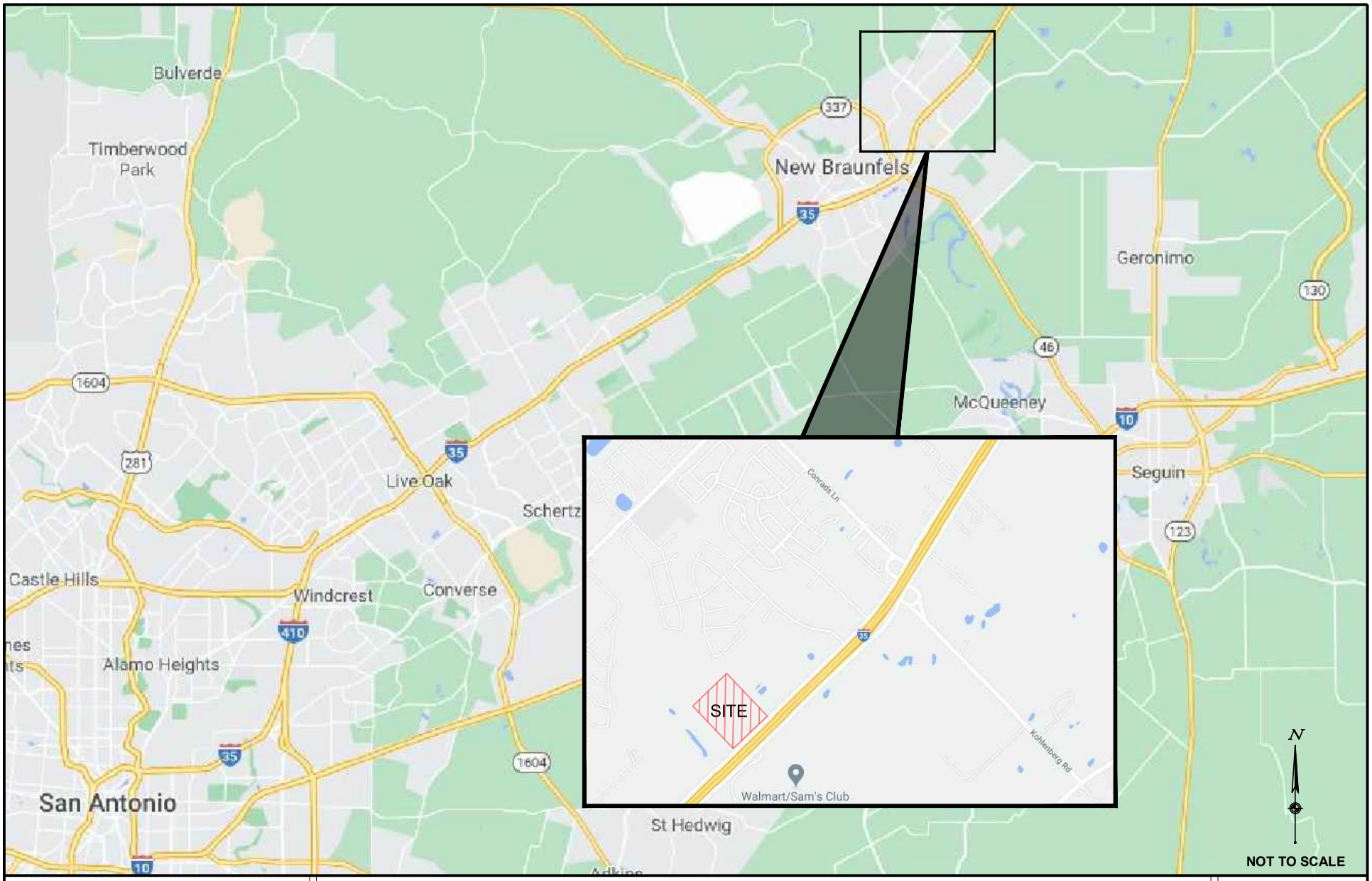
The Traffic Impact Study focused on evaluating the Existing, 2022 No-Build, and 2022 Build traffic conditions near the Site represented by three (3) traffic scenarios. The traffic scenarios analyzed were:

Existing Traffic Scenario – Represents current (year 2021) traffic conditions during weekday AM and PM Peak Hours of the adjacent roadway network. The Existing Traffic Scenario served as a baseline for comparison of the traffic impacts in relation to the proposed Love's Development.

2022 No-Build Traffic Scenario – Represents traffic conditions during the weekday AM and PM Peak Hours of the adjacent roadway network that would exist during year 2022, without the proposed Love's Development.

2022 Build Traffic Scenario – Represents traffic conditions during the weekday AM and PM Peak Hours of the adjacent roadway network that would exist during year 2022, with the proposed Love's Development constructed and fully operational.

Figure 1 illustrates the Site Location with respect to the study area and Figure 2 illustrates the Site Plan for the proposed Love's Development.



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SITE LOCATION

LOVE'S TRAVEL STOP DEVELOPMENT

CITY OF NEW BRAUNFELS COMAL COUNTY, TEXAS

FIGURE 1	
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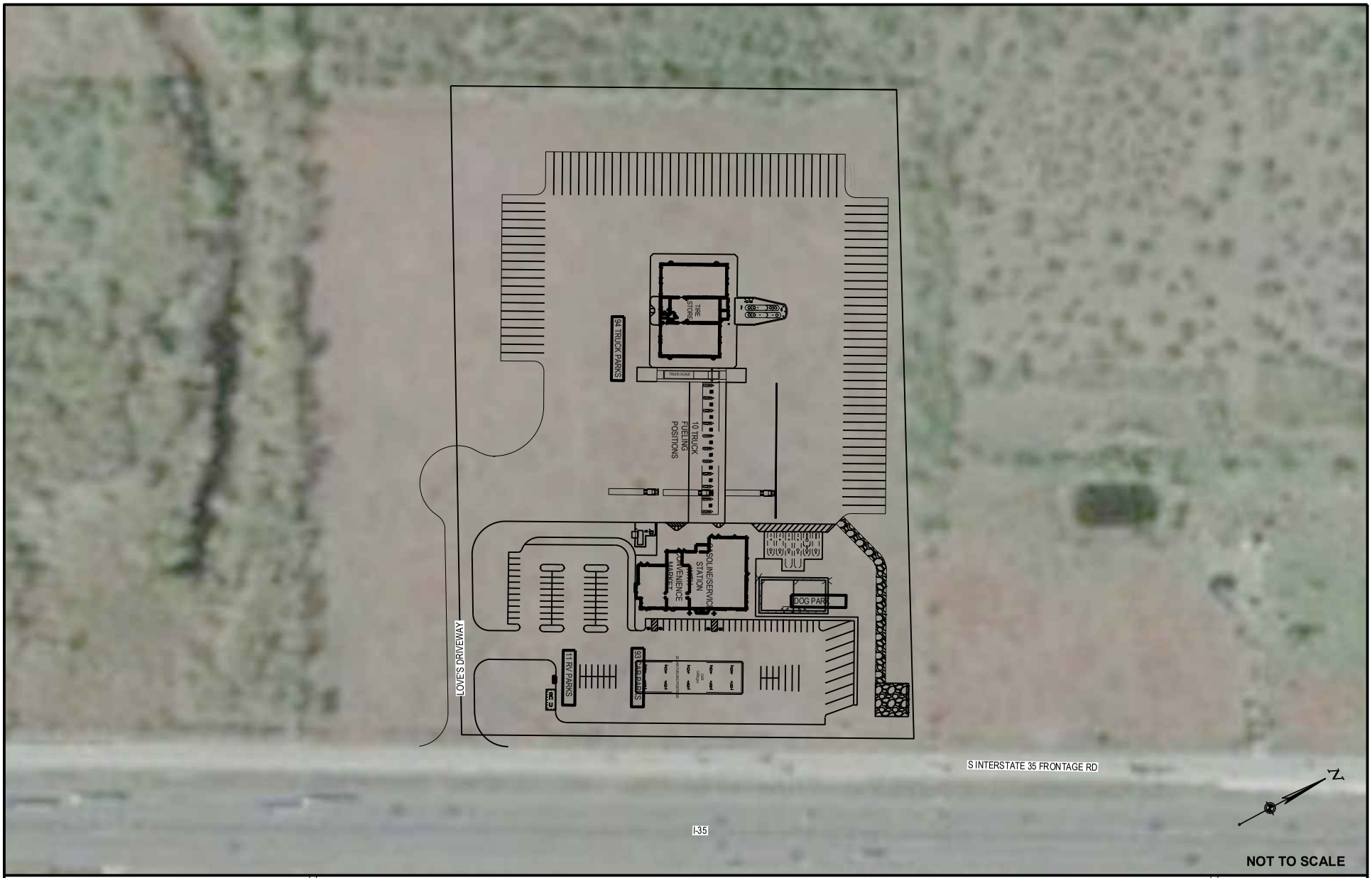

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SITE PLAN

LOVE'S TRAVEL STOP DEVELOPMENT

CITY OF NEW BRAUNFELS — COMAL COUNTY, TEXAS

FIGURE 2	
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2.1. Study Procedure

The following studies and analyses were undertaken:

1. Traffic counts were conducted by Gewalt Hamilton Associates, Inc. (GHA) on Thursday, March 4th, 2021 between the morning hours of 7:00 AM to 9:00 AM and evening hours of 4:00 PM to 6:00 PM and on Saturday, March 6th, 2021 between the hours of 11:00 AM to 1:00 PM at the following intersections:

    - I-35 NB Off Ramp & N Interstate 35 Frontage Road (Yield Controlled).
    - N Interstate 35 Frontage Road & Kohlenberg Road (Stop Sign Controlled).
    - N Interstate 35 Frontage Road & Overpass (east side) (Yield Controlled).
    - Kohlenberg Road & Overpass (east side) (Yield Controlled).
    - Conrads Lane & Overpass/Access Driveway (west side) (Stop Sign Controlled).
    - S Interstate 35 Frontage Road & Conrads Lane (Stop Sign Controlled).
    - S Interstate 35 Frontage Road & Oak Creek Way (Stop Sign Controlled).
    - I-35 SB Off Ramp & S Interstate 35 Frontage Road (Yield Controlled).

2. Due to the outbreak of the COVID-19 pandemic, counts collected during this time were factored per TxDOT's request. Due to the lack of recent traffic count data available on TxDOT's *Traffic Count Database System (TCDS)*, CESO assumed a 15 percent (%) adjustment factor (COVID factor of 1.15) and applied this to the existing volumes.

3. The Existing Weekday Peak Hour Traffic Volumes (Year 2021) – Cars and Trucks (Figure 4.A) were reviewed and balanced. The car and truck volumes listed in Figure 4.A were combined to form the Existing Weekday Peak Hour Traffic Volumes (Year 2021) – Total Volumes (Figure 4.B) for simplicity. Capacity analyses were then conducted to determine the capacity of the key study intersections under the Existing Traffic Scenario during AM, PM, and Saturday Peak Hours using Synchro Version 11.0 HCM 6th Edition TWSC methodology.

4. The 2022 No-Build Weekday Peak Hour Traffic Volumes – Cars and Trucks (Figure 5.A) were calculated by applying a growth rate to the Existing Weekday Peak Hour Traffic Volumes (Year 2021) – Cars and Trucks (Figure 4.A). Due to the lack of historical traffic count data available within the vicinity of the site on TxDOT's *Traffic Count Database System (TCDS)*, a growth rate of 1.0 percent (%) was assumed and applied for one (1) year to the volumes (growth factor of 1.01) in an effort to be conservative. The car and truck volumes shown on Figure 5.A were combined to form the 2022 No-Build Weekday Peak Hour Traffic Volumes – Total Volumes (Figure 5.B) for simplicity.

5. Capacity analyses of the 2022 No-Build Weekday Peak Hour Traffic Volumes – Total Volumes (Figure 5.B) were conducted to determine the capacity of the key study intersections under the 2022 No-Build Traffic Scenario during AM, PM, and Saturday Peak Hours using Synchro Version 11.0 HCM 6th Edition Signalized/TWSC methodology.

6. Directional distribution analyses were conducted to determine the potential distribution of patrons for the proposed Love's Development under the 2022 Build Traffic Scenario (Figures 6.A-6.D).

7. Analyses were conducted to determine the potential traffic volumes generated by the proposed Love's Development under the 2022 Build Traffic Scenario utilizing data provided in the Institute of Transportation Engineers' *Trip Generation Manual*, 10th Edition (see Table 5).

8. Addition of the Love's Development Generated Traffic Volumes (Figures 7.A-7.D) to the 2022 No-Build Weekday Peak Hour Traffic Volumes (Figures 5.A-5.B) was completed to reflect the 2022 Build Weekday Peak Hour Traffic Volumes (Figures 8.A-8.B).

9. Capacity analyses of the 2022 Build Weekday Peak Hour Traffic Volumes (Figures 8.A-8.B) were conducted to determine the capacity of the key study intersections under the 2022 Build Traffic Scenario during AM, PM, and Saturday Peak Hours using Synchro Version 11.0 HCM 6th Edition Signalized/TWSC methodology.

10. Turn lane analyses were completed to determine if left-turn lanes or right-turn lanes were required as a result of the Love's Development. Turn-lane analyses utilized TxDOT charts for unsignalized free-flowing approaches and capacity analyses results for signal-controlled intersections.

11. Queue length analyses were completed to determine if existing and proposed storage lengths accommodate the traffic queue lengths under the 2022 No-Build and 2022 Build traffic scenarios.

12. CESO conducted a Weave Analysis utilizing the 2022 Build Weekday Peak Hour Traffic Volumes – Total Volumes (Figure 8.B) and HCS Version 7.8.5 methodology.

13. Recommendations for roadway improvements were generated under the 2022 No-Build and 2022 Build Traffic Scenarios based upon the capacity analyses of the surrounding roadway network. Application of the recommendations and re-evaluation of the capacity at the key study intersections under the applicable traffic scenarios, during AM, PM, and Saturday Peak Hours, was completed using Synchro Version 11.0 HCM 6th Edition Signalized/TWSC methodology.

2.2. References

This report utilizes information from the following sources:

1. *Highway Capacity Manual, Sixth Edition: A Guide for Multimodal Mobility Analysis*. Transportation Research Board, Washington, D.C., 2016.

2. *Trip Generation Manual*. 10th ed. Washington, DC: Institute of Transportation Engineers, 2017.

3. Hooper, Kevin G. *Trip generation handbook: An ITE Proposed Recommended Practice*. Washington, D.C.: Institute of Transportation Engineers.

4. TxDOT. *TxDOT Traffic Count Database System (TCDS)*: [https://txdot.ms2soft.com/tcds/tsearch.asp?loc=Txdot&mod=TCDS]

5. Most recent Site Plan obtained from Love's.

6. "City of New Braunfels, Texas" 29°44'21.99" N and 98°4'0.54" W, *Google Earth*. November 22nd, 2019.

7. Texas Department of Transportation charts for left and right-turn/taper lanes.

3. Roadway and Traffic Conditions in the Vicinity of the Site

3.1. Study Location and Area Land Use

The Site is located at 4001, 4023, and 4165 S Interstate 35 Frontage Road, within the City of New Braunfels, Comal County, TX. Land use/zoning in the direct vicinity of the Site is primarily commercial business and residential.

3.2. Area Roadway Characteristics

I-35 – I-35 runs in the north/southbound direction in the vicinity of the Site. I-35 is a three-lane, two-way divided freeway throughout the studied segment. I-35 is classified as an Urban Interstate according to the TxDOT *Traffic Count Database System (TCDS).* I-35 is under jurisdiction of the Texas Department of Transportation (TxDOT, San Antonio District). The posted speed limit on I-35 is 70 mph.

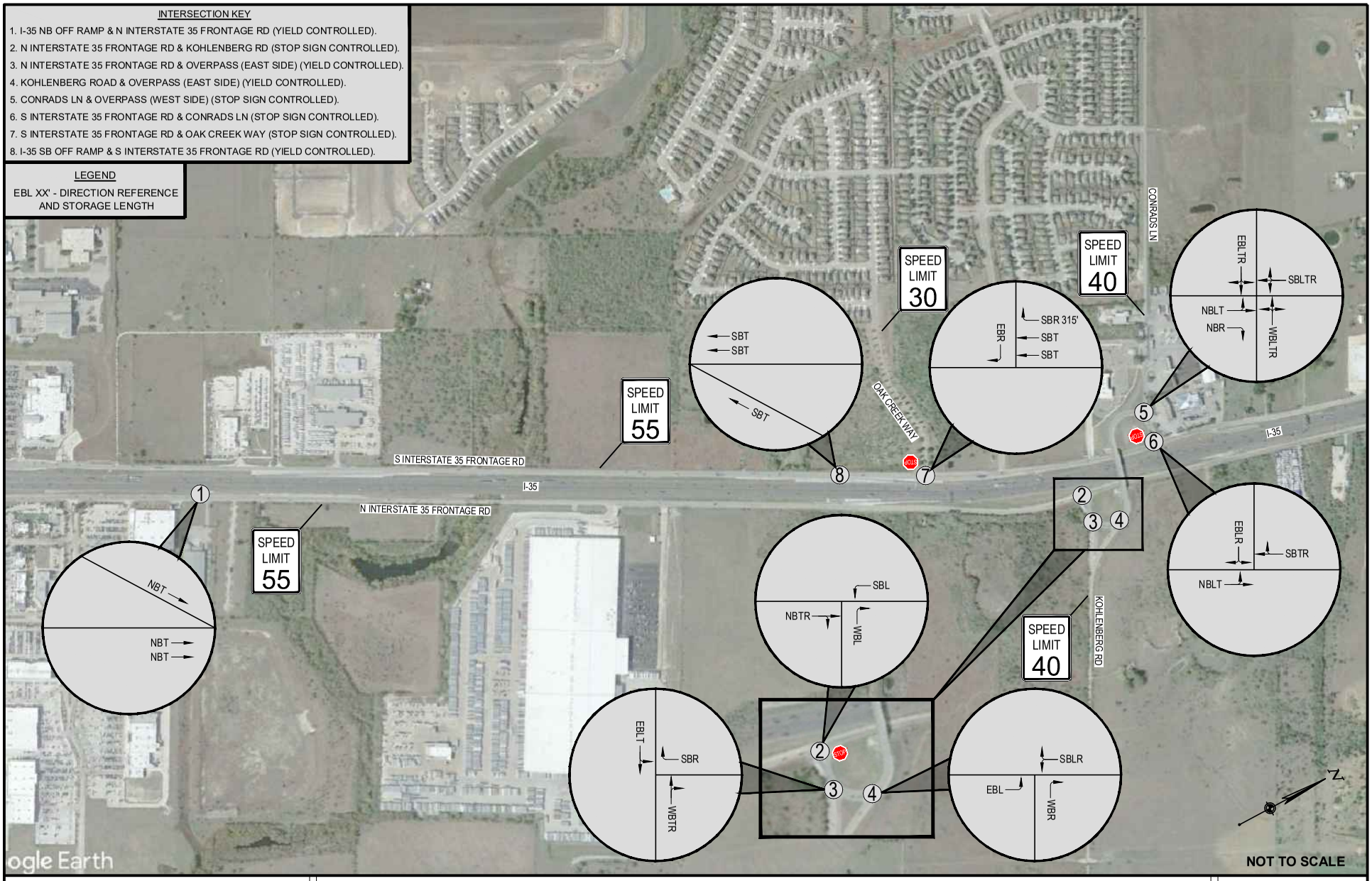
S Interstate 35 Frontage Road – S Interstate 35 Frontage Road runs in the southbound direction in the vicinity of the Site. S Interstate 35 Frontage Road is a one-way, two-lane roadway throughout the studied segment. S Interstate 35 Frontage Road is classified as a Major Collector according to the TxDOT *Traffic Count Database System (TCDS).* S Interstate 35 Frontage Road is under jurisdiction of the Texas Department of Transportation (TxDOT, San Antonio District). The posted speed limit on S Interstate 35 Frontage Road is 55 mph.

N Interstate 35 Frontage Road – N Interstate 35 Frontage Road runs in the northbound direction in the vicinity of the Site. N Interstate 35 Frontage Road is a one-way, two-lane roadway throughout the studied segment. N Interstate 35 Frontage Road is classified as a Major Collector according to the TxDOT *Traffic Count Database System (TCDS).* N Interstate 35 Frontage Road is under jurisdiction of the Texas Department of Transportation (TxDOT, San Antonio District). The posted speed limit on N Interstate 35 Frontage Road is 55 mph.

Conrads Lane – Conrads Lane runs in the east/westbound direction in the vicinity of the Site. Conrads Lane is a two-way, one-lane roadway throughout the studied segment. Conrads Lane is classified as a Minor Collector according to the TxDOT *Traffic Count Database System (TCDS)*. Conrads Lane is under jurisdiction of the City of New Braunfels. The posted speed limit on Conrads Lane is 40 mph.

Kohlenberg Road – Kohlenberg Road runs in the east/westbound direction in the vicinity of the Site. Kohlenberg Road is a two-way, one-lane roadway throughout the studied segment. Kohlenberg Road is classified as a Local Road according to the TxDOT *Traffic Count Database System (TCDS)*. Kohlenberg Road is under jurisdiction of the City of New Braunfels. The posted speed limit on Kohlenberg Road is 40 mph.

The Existing Transportation System is illustrated on Figure 3 of the report.



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EXISTING TRANSPORTATION SYSTEM

LOVE'S TRAVEL STOP DEVELOPMENT

CITY OF NEW BRAUNFELS — COMAL COUNTY, TEXAS

FIGURE 3	
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3.3. Existing Traffic Volumes

Traffic counts were conducted by Gewalt Hamilton Associates, Inc. (GHA) on Thursday, March 4th, 2021 between the morning hours of 7:00 AM to 9:00 AM and evening hours of 4:00 PM to 6:00 PM and on Saturday, March 6th, 2021 between the hours of 11:00 AM to 1:00 PM at the following intersections:

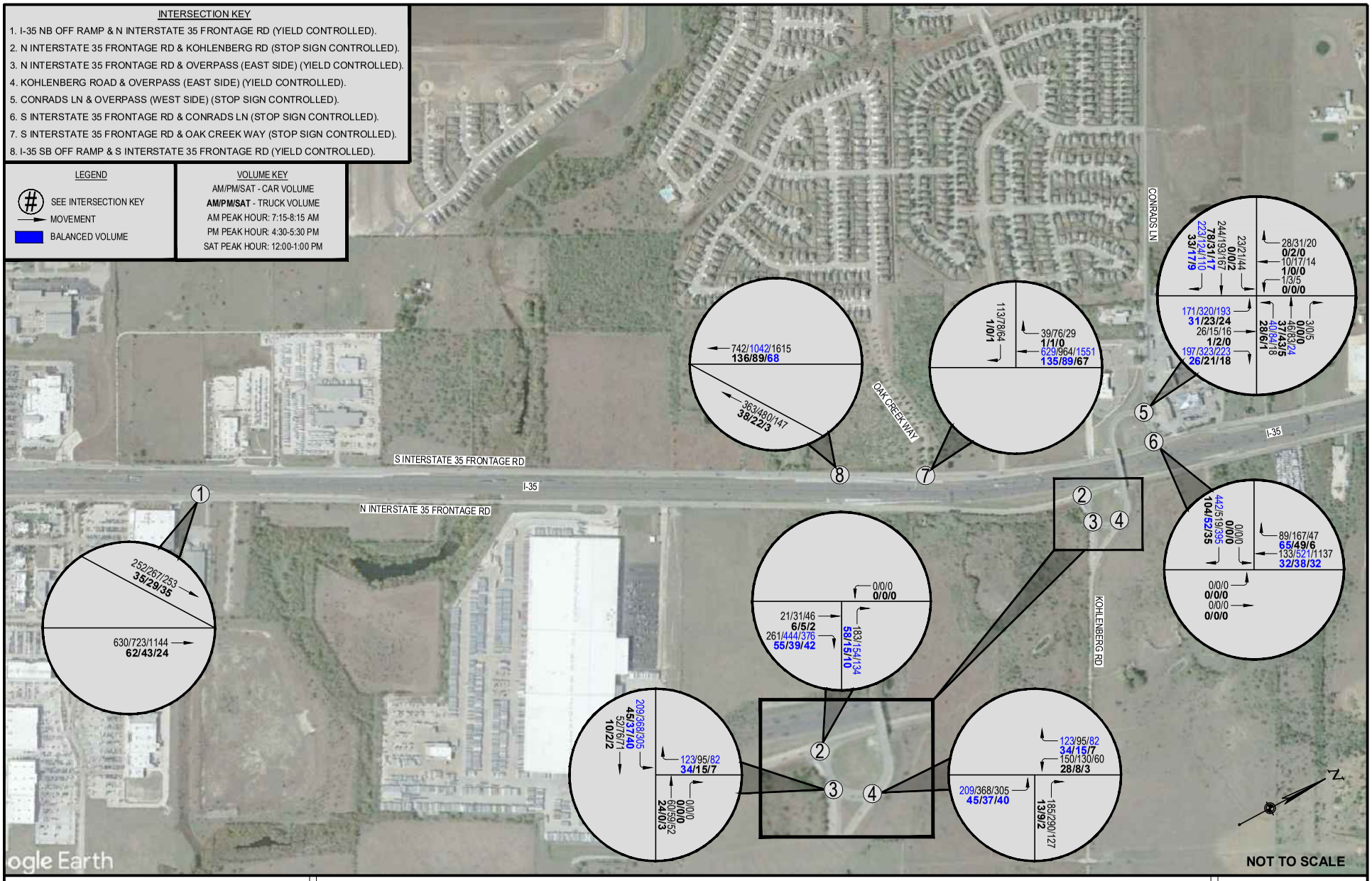
- I-35 NB Off Ramp & N Interstate 35 Frontage Road (Yield Controlled).
- N Interstate 35 Frontage Road & Kohlenberg Road (Stop Sign Controlled).
- N Interstate 35 Frontage Road & Overpass (east side) (Yield Controlled).
- Kohlenberg Road & Overpass (east side) (Yield Controlled).
- Conrads Lane & Overpass/Access Driveway (west side) (Stop Sign Controlled).
- S Interstate 35 Frontage Road & Conrads Lane (Stop Sign Controlled).
- S Interstate 35 Frontage Road & Oak Creek Way (Stop Sign Controlled).
- I-35 SB Off Ramp & S Interstate 35 Frontage Road (Yield Controlled).

The weekday peak hours of the Traffic Impact Study roadway network were determined to occur between the hours of:

- 7:15 AM – 8:15 AM (AM Peak Hour).
- 4:30 PM – 5:30 PM (PM Peak Hour).
- 12:00 PM – 1:00 PM (Saturday Peak Hour).

Traffic counts were conducted with schools in session for the season. Count data collected consists of turning movement counts with classification breakouts of lights, busses, single-unit trucks, and articulated trucks.

The Existing Traffic Count Data is located in Appendix A. The Existing Weekday Peak Hour Traffic Volumes (Year 2021) are illustrated on Figure 4.A (Cars and Trucks) and Figure 4.B (Total Volumes).



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EXISTING WEEKDAY PEAK HOUR TRAFFIC VOLUMES (YEAR 2021) - CARS & TRUCKS

LOVE'S TRAVEL STOP DEVELOPMENT

CITY OF NEW BRAUNFELS — COMAL COUNTY, TEXAS

FIGURE	4.A
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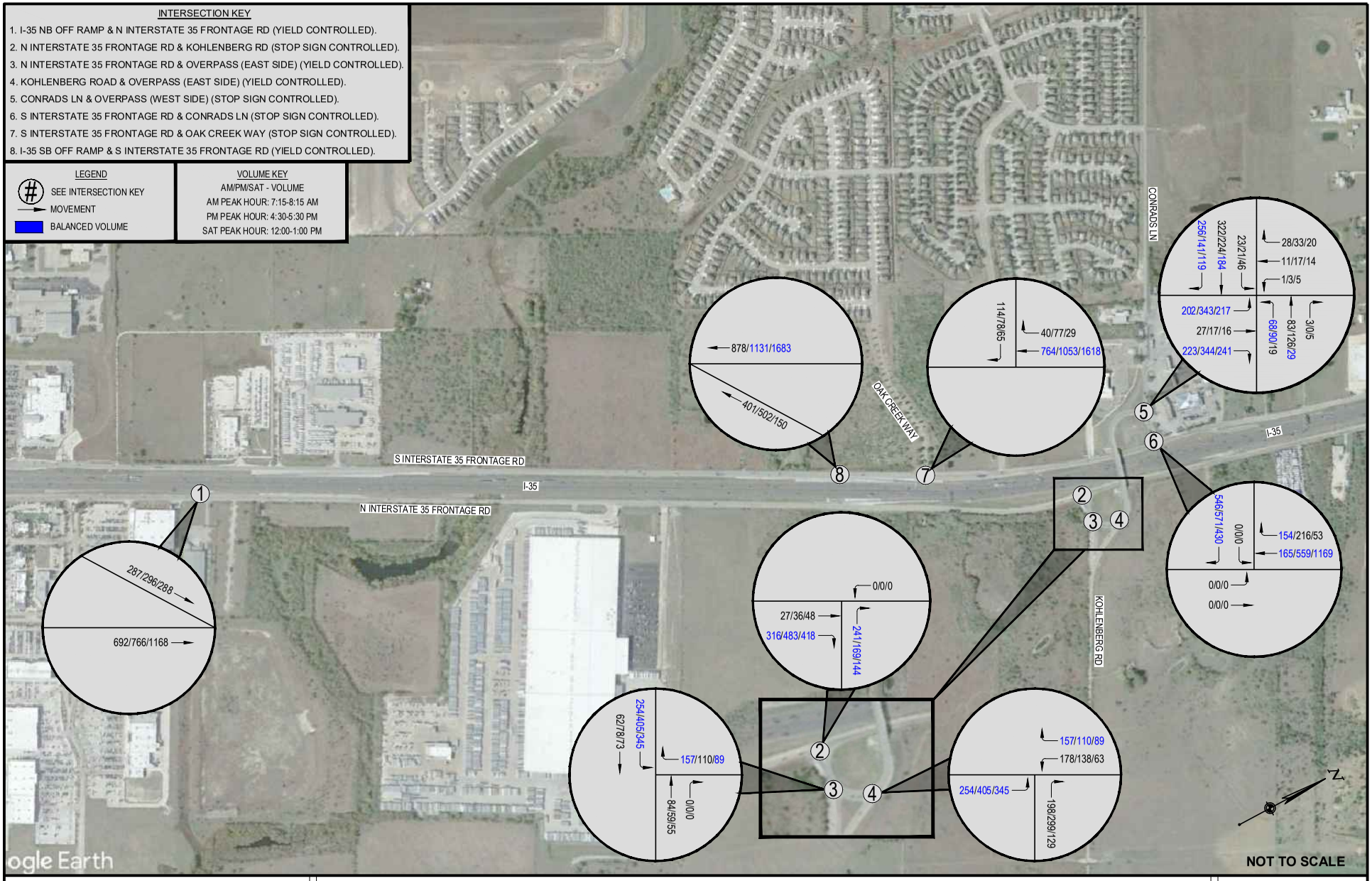

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EXISTING WEEKDAY PEAK HOUR TRAFFIC VOLUMES (YEAR 2021) - TOTAL VOLUMES

LOVE'S TRAVEL STOP DEVELOPMENT

CITY OF NEW BRAUNFELS — COMAL COUNTY, TEXAS

FIGURE	4.B
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3.4. Capacity Analysis Parameters

The capacity of an intersection (signalized or unsignalized) can best be described by its corresponding level of service (LOS). The level of service of an intersection is a qualitative measure of the various attributes of an intersection. There are six levels of service ranging from "ideal" free flow conditions at LOS "A," to forced or "breakdown" conditions at LOS "F." The level of service for signalized intersections is based upon the average stopped delay per vehicle for various movements within the intersection. Although volume capacity ratio (v/c) affects delay, there are other parameters that more strongly affect it, such as the quality of progression, length of green phases, cycle lengths, and others. Thus, for any given v/c ratio, a range of delay values may result, and vice versa.

The level of service for unsignalized intersections is based upon total delay. Total delay is defined in the *Highway Capacity Manual, Sixth Edition: A Guide for Multimodal Mobility Analysis*, as the total elapsed time from when a vehicle stops at the end of the queue until the vehicle departs from the stop line; this time includes the time required for the vehicle to travel from the last-in-queue position to the first-in-queue position. Table 1 summarizes the LOS definitions for unsignalized intersections. Throughout the report "unsignalized intersections" are commonly referred to as "stop controlled."

Table 1
Level of Service Criteria (Unsignalized Intersections)

Level of Service	Delay per Vehicle (Sec.)	Description
A	≤ 9.0	Little or no delay.
B	> 9.0 and ≤ 15.0	Short traffic delays.
C	> 15.0 and ≤ 25.0	Average traffic delays.
D	> 25.0 and ≤ 35.0	Long traffic delays.
E	> 35.0 and ≤ 50.0	Very long traffic delays.
F	≥ 50.0	Extreme traffic delays.

Source: *Highway Capacity Manual, Sixth Edition: A Guide for Multimodal Mobility Analysis*. Transportation Research Board.

Highway Capacity Manual 2016 (HCM 6th Edition) methodology was used in the Traffic Impact Study to remain consistent with "state-of-the-practice" professional standards. It is important to note that the Level of Service Criteria for unsignalized intersections is different than for signalized intersections. For example, a delay of 18 seconds yields level of service C under the unsignalized LOS criteria (see Table 1) while yielding level of service B under the signalized intersection LOS criteria (see Table 2).

Synchro Version 11.0 HCM 6th Edition Signalized/TWSC methodology was utilized to calculate delay and level of service values. Synchro Version 11.0 model parameters include traffic volumes, movements, peak hour factors, heavy vehicle percentage, speed limit, intersection traffic control, storage lengths, and taper lengths.

Table 2 summarizes the LOS definitions for signalized intersections.

Table 2
Level of Service Criteria (Signalized Intersections)

Level of Service	Delay per Vehicle (Sec.)	Description
A	< 10.0	Most vehicles do not stop at all.
B	> 10.0 and ≤ 20.0	More vehicles stop than with LOS A.
C	> 20.0 and ≤ 35.0	The number of vehicles stopping is significant, although many pass through without stopping.
D	> 35.0 and ≤ 55.0	Many Vehicles stop. Individual cycle failures are noticeable.
E	> 55.0 and ≤ 80.0	Considered to be the limit of acceptable delay. Individual cycle failures are frequent.
F	> 80.0	Unacceptable delay.

Source: *Highway Capacity Manual, Sixth Edition: A Guide for Multimodal Mobility Analysis*. Transportation Research Board.

3.5. Existing Traffic Scenario Capacity Analysis

Utilizing the Existing Weekday Peak Hour Traffic Volumes (Year 2021) shown on Figure 4.A and Figure 4.B, capacity calculations were performed for the key study intersections. All capacity calculations within the TIS followed procedures documented in the *Highway Capacity Manual, Sixth Edition: A Guide for Multimodal Mobility Analysis* (Transportation Research Board, 2016). The capacity analyses were completed using Synchro Version 11.0 with HCM 6th Edition TWSC methodology.

Under the Existing Traffic Scenario, capacity calculations were performed at the following intersections:

- N Interstate 35 Frontage Road & Kohlenberg Road (Stop Sign Controlled).
- Conrads Lane & Overpass/Access Driveway (west side) (Stop Sign Controlled).
- S Interstate 35 Frontage Road & Conrads Lane (Stop Sign Controlled).
- S Interstate 35 Frontage Road & Oak Creek Way (Stop Sign Controlled).

Capacity results were not completed for the following intersections since they operate as free-flow and will not have any delay:

- I-35 NB Off Ramp & N Interstate 35 Frontage Road (Yield Controlled).
- N Interstate 35 Frontage Road & Overpass (east side) (Yield Controlled).
- Kohlenberg Road & Overpass (east side) (Yield Controlled).
- I-35 SB Off Ramp & S Interstate 35 Frontage Road (Yield Controlled).

Table 3 summarizes the capacity analysis results for the Existing Traffic Scenario.

Table 3
Summary of Existing Traffic Scenario Capacity Analysis

Intersection →	Year →	2021 AM, PM, and Saturday Peak Hours						
	Volume →	Existing – Year 2021						
	Geometry →	Existing						
	Approach	Movement	AM Peak Hour		PM Peak Hour		Saturday Peak Hour	
			LOS	*Delay	LOS	*Delay	LOS	*Delay
N Interstate 35 Frontage Road & Kohlenberg Road (Stop Sign Controlled)	Intersection Overall →		---	---	---	---	---	---
	Westbound	R	B	11.8	B	11.7	B	11.1
Conrads Lane & Overpass/Access Driveway (Stop Sign Controlled)	Intersection Overall →		---	---	---	---	---	---
	Northbound	LTR	F	88.2	F	380.5	B	13.7
	Eastbound	LTR	A	7.4	A	7.5	A	7.4
	Westbound	LTR	B	10.0	A	8.5	A	8.0
	Southbound	LTR	B	13.2	B	13.9	B	11.6
S Interstate 35 Frontage Road & Conrads Lane (Stop Sign Controlled)	Intersection Overall →		---	---	---	---	---	---
	Eastbound	LR	D	26.9	F	263.6	F	705.5
S Interstate 35 Frontage Road & Oak Creek Way (Stop Sign Controlled)	Intersection Overall →		---	---	---	---	---	---
	Eastbound	R	B	12.7	B	14.4	C	21.4
*Delay in seconds L – Left T – Through R – Right								

Under the Existing Traffic Scenario, all intersection movements operate at level of service (LOS) "D" or better conditions with the exception of the NBLTR movement at the intersection of Conrads Lane and the Overpass/Access Driveway which operates at LOS "F" during both the AM and PM Peak Hours, and the EBLR movement at the intersection of S Interstate 35 Frontage Road and Conrads Lane which operates at LOS "F" during both the PM and Saturday Peak Hours.

The Existing Traffic Scenario Capacity Analysis Summary Sheets are contained in Appendix B of the report.

4. Estimates of 2022 No-Build Traffic in the Vicinity of the Site

4.1. 2022 No-Build Traffic Volumes

The 2022 No-Build Weekday Peak Hour Traffic Volumes shown on Figure 5.A and Figure 5.B were reached by increasing the Existing Weekday Peak Hour Traffic Volumes (Year 2021, Figure 4.A and Figure 4.B) by growth rates. Due to the lack of historical traffic count data available within the vicinity of the site on TxDOT's *Traffic Count Database System (TCDS)*, a growth rate of 1.0 percent (%) was assumed and applied for one (1) year to the volumes (growth factor of 1.01) in an effort to be conservative.

It should be noted, roadway improvements to the Kohlenberg Road and Conrads Lane interchanges will be completed and operational by April 2022. According to TxDOT's projected schedule, the improvements will include demolishing the Conrads Lane/Kohlenberg Road overpass in early June 2021. In addition, the bridge is scheduled to open to traffic mid-October 2021. The improvements will include signalizing the Kohlenberg Road & N Interstate 35 Frontage Road interchange and Conrads Lane & S Interstate 35 Frontage Road interchange. The 2022 No-Build Traffic Scenario capacity analysis files include the improvements stated above with the assumption they would be completed by year 2022.

4.2. 2022 No-Build Traffic Scenario Capacity Analysis

Utilizing the 2022 No-Build Weekday Peak Hour Traffic Volumes illustrated on Figure 5.A and Figure 5.B, capacity calculations were performed for the key study intersections. All capacity calculations within the TIS followed procedures documented in the *Highway Capacity Manual, Sixth Edition: A Guide for Multimodal Mobility Analysis* (Transportation Research Board, 2016). The capacity analyses were completed using Synchro Version 11.0 HCM 6th Edition TWSC methodology.

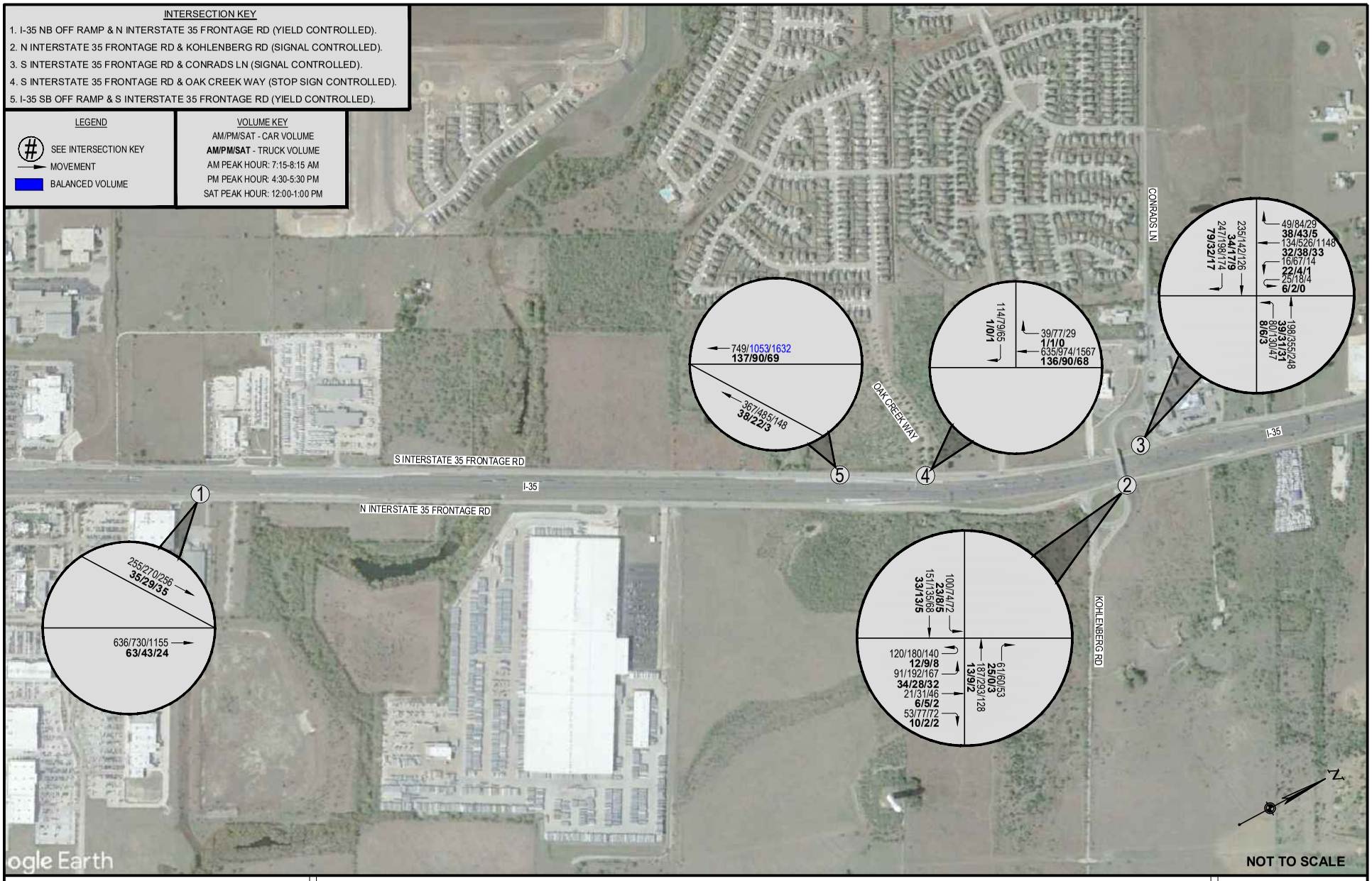
Table 4 summarizes the capacity analyses results for the 2022 No-Build Traffic Scenario.

Table 4
Summary of 2022 No-Build Traffic Scenario Capacity Analysis

Intersection →	Year →	2022 AM, PM, and Saturday Peak Hours						
	Volume →	No-Build – Year 2022						
	Geometry →	Existing						
	Approach	Movement	AM Peak Hour		PM Peak Hour		Saturday Peak Hour	
			LOS	*Delay	LOS	*Delay	LOS	*Delay
N Interstate 35 Frontage Road & Kohlenberg Road (Signal Controlled)	Intersection Overall →		C	33.1	C	29.7	C	24.6
	Eastbound	L	D	42.7	D	44.0	D	41.6
		LT	D	40.4	D	41.6	D	45.6
	Westbound	T	D	41.4	D	39.8	D	42.7
	Northbound	L	A	5.4	A	6.4	A	4.1
		T	A	5.1	A	5.2	A	3.3
S Interstate 35 Frontage Road & Conrads Lane (Signal Controlled)	Intersection Overall →		C	32.9	C	25.6	B	18.0
	Eastbound	T	D	40.0	D	42.0	D	42.5
	Westbound	L	D	42.7	D	40.6	D	39.7
		T	D	43.7	D	42.4	D	43.5
	Southbound	L	A	6.5	A	6.9	A	5.1
		T	A	6.5	A	8.1	A	8.5
S Interstate 35 Frontage Road & Oak Creek Way (Stop Sign Controlled)	Intersection Overall →		---	---	---	---	---	---
	Eastbound	R	B	12.8	B	14.5	C	21.8
*Delay in seconds L – Left T – Through R – Right								

Under the 2022 No-Build Traffic Scenario, all signal-controlled intersections operate at overall level of service (LOS) "C" or better conditions. In addition, all individual movements of stop-controlled intersections operate at level of service (LOS) "C" or better conditions.

The 2022 No-Build Traffic Scenario Capacity Analysis Summary Sheets are contained in Appendix C of the report.



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2022 NO-BUILD WEEKDAY PEAK HOUR TRAFFIC VOLUMES - CARS & TRUCKS

LOVE'S TRAVEL STOP DEVELOPMENT

CITY OF NEW BRAUNFELS COMAL COUNTY, TEXAS

FIGURE	5.A
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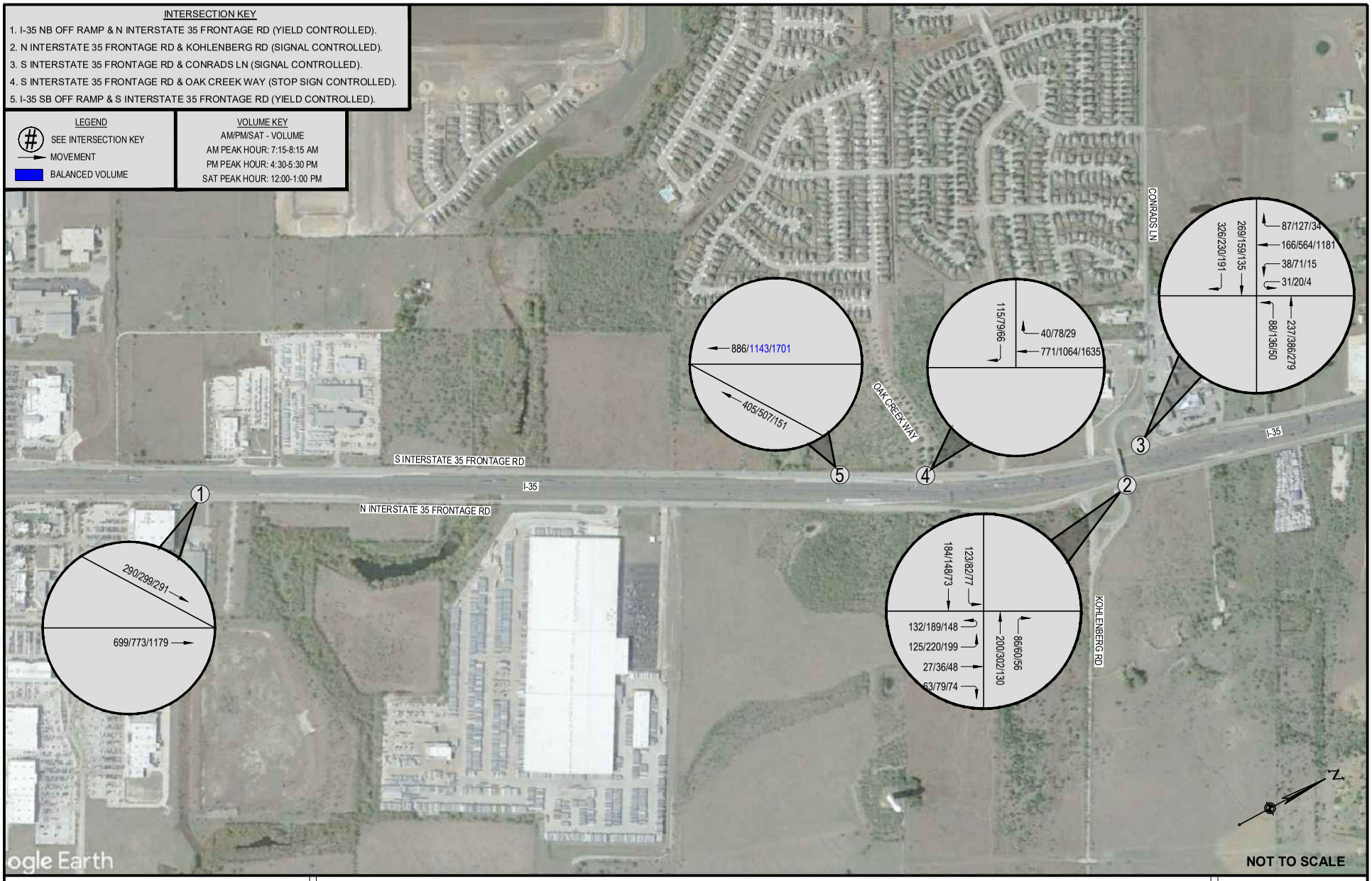

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2022 NO-BUILD WEEKDAY PEAK HOUR TRAFFIC VOLUMES - TOTAL VOLUMES

LOVE'S TRAVEL STOP DEVELOPMENT

CITY OF NEW BRAUNFELS — COMAL COUNTY, TEXAS

FIGURE	5.B
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5. Estimates of 2022 Build Traffic in the Vicinity of the Site

2022 Build Weekday Peak Hour Traffic Volumes (Figure 8.A and Figure 8.B) were calculated by adding the traffic estimated for the proposed Love's Development (Figures 7.A-7.D) to the 2022 No-Build Weekday Peak Hour Traffic Volumes (Figure 5.A and Figure 5.B). To analyze the impact of the Love's Development Weekday Generated Traffic Volumes (Table 5) on the Site access system and on the adjacent roadway system, capacity analyses were conducted for the Site driveway and key study intersections.

5.1. Love's Development Weekday Generated Traffic Volumes

Studies of similar developments throughout North America have shown that the amount of traffic generated will be functionally related to some unit of activity (i.e., number of fueling stations, gross floor area, etc.). In development, site traffic fluctuates substantially on different days and hours throughout the year. Therefore, it is imperative to select an appropriate hourly volume on which to base the design of the external roadway and site access facilities. The Weekday AM, PM, and Saturday Peak Hours were selected based on the adjacent street traffic during this hour.

The 2022 Build Traffic Scenario includes the proposed use of the Site as a Love's Development that consists of:

- Gasoline Service Station with Convenience Store consisting of 30 fueling positions (20 passenger car and 10 truck).
- Fast-Food Restaurant with Drive-through Window occupying approximately 2,670 S.F.
- Fast-Food Restaurant without Drive-through Window occupying approximately 2,610 S.F.
- Tire Store with 4-Service Bays

In addition, the Love's Development is projected to have approximately 93 parking spaces for passenger vehicles, 11 parking spaces for recreational vehicles (RV's), and 94 parking spaces for semi-trucks.

The traffic estimated for the proposed Love's Development that was added to the 2022 No-Build Weekday Peak Hour Traffic Volumes served as a basis for the capacity analysis and in the development of any potential recommended roadway improvements under the 2022 Build Traffic Scenario.

For analysis purposes, the base variable units for the trip-generation rates were number of fueling positions, KSF (3.4 KSF = 3,400 S.F.), and service bays. The Love's Development Weekday Peak Hour Generated Traffic Volumes (Table 5) were calculated by utilizing data contained in the Institute of Transportation Engineers (ITE) *Trip Generation Manual,* 10th Edition in combination with methods outlined in the (ITE) *Trip Generation Handbook*.

Internal Capture Rates were calculated using the methodology contained in the (ITE) *Trip Generation Handbook* and by using the NCHRP 684 Internal Trip Capture Estimation Tool spreadsheet. The ITE Multi-Use Development Internal Capture Summary Sheets are located in Appendix D of the report.

The Love's Development Weekday Generated Traffic Volumes are presented below in Table 5.

Table 5
Love's Development Weekday Peak Hour Generated Traffic Volumes

ITE Land Use Description	ITE Cat.	Size	Unit	Total Generated Trips															
				Weekday			Weekday AM Peak Hour				Weekday PM Peak Hour				Saturday Peak Hour			
				Trips			Trips				Trips				Trips			
				Tot	In	Out	[A]Tot	In	Out	[B]PB	[A]Tot	In	Out	[B]PB	[A]Tot	In	Out	[B]PB
Passenger Car																			
Gasoline/Service Station with Convenience Market	945	20	Fuel Pos.	4,108	2,054	2,054	250	48	46	156	280	63	61	156	386	85	85	216
ITE Cat. 945 Entering (%)/Exiting (%)				*100%*	*50%*	*50%*	*100%*	*51%*	*49%*	*[C]62%*	*100%*	*51%*	*49%*	*[C]56%*	*100%*	*50%*	*50%*	*[C]56%*
Internal Capture Applied				------	------	------	226	45	41	140	244	53	55	136	320	67	73	180
Internal Capture Rates				------	------	------	------	*6%*	*13%*	------	------	*15%*	*11%*	------	------	*20%*	*14%*	------
Fast-Food Restaurant with Drive-Through Window	934	2,670	S.F.	1,258	629	629	108	29	27	52	88	23	21	44	148	38	36	74
ITE Cat. 934 Entering (%)/Exiting (%)				*100%*	*50%*	*50%*	*100%*	*51%*	*49%*	*[C]49%*	*100%*	*52%*	*48%*	*[C]50%*	*100%*	*51%*	*49%*	*[C]50%*
Internal Capture Applied				------	------	------	88	21	23	44*	57	16	13	28	96	26	22	48
Internal Capture Rates				------	------	------	------	*26%*	*14%*	------	------	*29%*	*41%*	------	------	*29%*	*41%*	------
Fast-Food Restaurant without Drive-Through Window	933	2,610	S.F.	904	452	452	66	40	26	0	74	37	37	0	144	71	73	0
ITE Cat. 933 Entering (%)/Exiting (%)				*100%*	*50%*	*50%*	*100%*	*60%*	*40%*	*[C]0%*	*100%*	*50%*	*50%*	*[C]0%*	*100%*	*49%*	*51%*	*[C]0%*
Internal Capture Applied				------	------	------	52	30	22	0	48	26	22	0	93	50	43	0
Internal Capture Rates				------	------	------	------	*26%*	*14%*	------	------	*29%*	*41%*	------	------	*29%*	*41%*	------
Total (No Internal Capture Applied)				6,270	3,135	3,135	424	117	99	208	442	123	119	200	678	194	194	290
Total (Internal Capture Subtracted)				6,270	3,135	3,135	366	96	86	184	349	95	90	164	509	143	138	228
Truck/Semi-Trailer																			
Gasoline/Service Station with Convenience Market	945	10	Fuel Pos.	2,054	1,027	1,027	124	24	24	76	140	32	30	78	194	42	42	110
ITE Cat. 945 Entering (%)/Exiting (%)				*100%*	*50%*	*50%*	*100%*	*51%*	*49%*	*[C]62%*	*100%*	*51%*	*49%*	*[C]56%*	*100%*	*50%*	*50%*	*[C]56%*
Internal Capture Applied				------	------	------	112	22	20	70	121	26	27	68	161	34	37	90
Internal Capture Rates				------	------	------	------	*6%*	*13%*	------	------	*15%*	*11%*	------	------	*20%*	*14%*	------
Tire Store	848	4	Srv. Bay	------	------	------	8	5	3	0	14	6	8	0	11	5	6	0
ITE Cat. 848 Entering (%)/Exiting (%)				------	------	------	*100%*	*64%*	*36%*	*[C]0%*	*100%*	*42%*	*58%*	*[C]0%*	*100%*	*45%*	*55%*	*[C]0%*
Internal Capture Applied				------	------	------	8	5	3	0	14	6	8	0	9	4	5	0
Internal Capture Rates				------	------	------	------	*6%*	*13%*	------	------	*15%*	*11%*	------	------	*20%*	*14%*	------
Total (No Internal Capture Applied)				2,054	1,027	1,027	132	29	27	76	154	38	38	78	205	47	48	110
Total (Internal Capture Subtracted)				2,054	1,027	1,027	120	27	23	70	135	32	35	68	170	38	42	90
Net Trip Generation Summary				8,324	4,162	4,162	486	123	109	254	484	127	125	232	679	181	180	318

[A] – Primary Trips + Pass-by Trips, [B] – Pass-by Trips Generated, [C] – Percent (%) of [A]Tot, * - Rounded to even number

The full buildout of the Love's Travel Stop is estimated to generate 8,324 trips per day on a typical weekday (4,162 inbound and 4,162 outbound), of which 486 trips will be generated during Weekday AM Peak Hour (250 inbound and 236 outbound), 484 trips will be generated during the Weekday PM Peak Hour (243 inbound and 241 outbound), and 679 trips will be generated during the Saturday Peak Hour (340 inbound and 339 outbound).

Appendix D includes the trip generation calculations and ITE Trip Generation Category 848, 933, 934 and 945 Sheets utilized to calculate the values presented in Table 5.

5.2. Directional Distribution of Love's Development-Generated Traffic Volumes

The directional distribution of the development-generated traffic is a function of several variables. The assumptions and methods used in estimating the direction in which traffic will approach and depart the Site varies with several location-specific conditions such as:

- Size and type of the proposed development.
- Population distribution within the defined area of influence.
- Prevailing operating conditions on the existing street system.

The analysis of directional distribution is based on the observation that drivers normally will choose the fastest (not necessarily the most direct) routes to and from a given traffic generator. The internal trip assignment was based upon the proposed Site Plan and the understanding of a Love's Development operation. The traffic entering and exiting the travel stop will not always approach from the most direct route. The anticipated directional distribution of trips generated by the proposed Love's Development is shown in Table 6.

Table 6
Directional Distribution of Love's Development-Generated Traffic Volumes

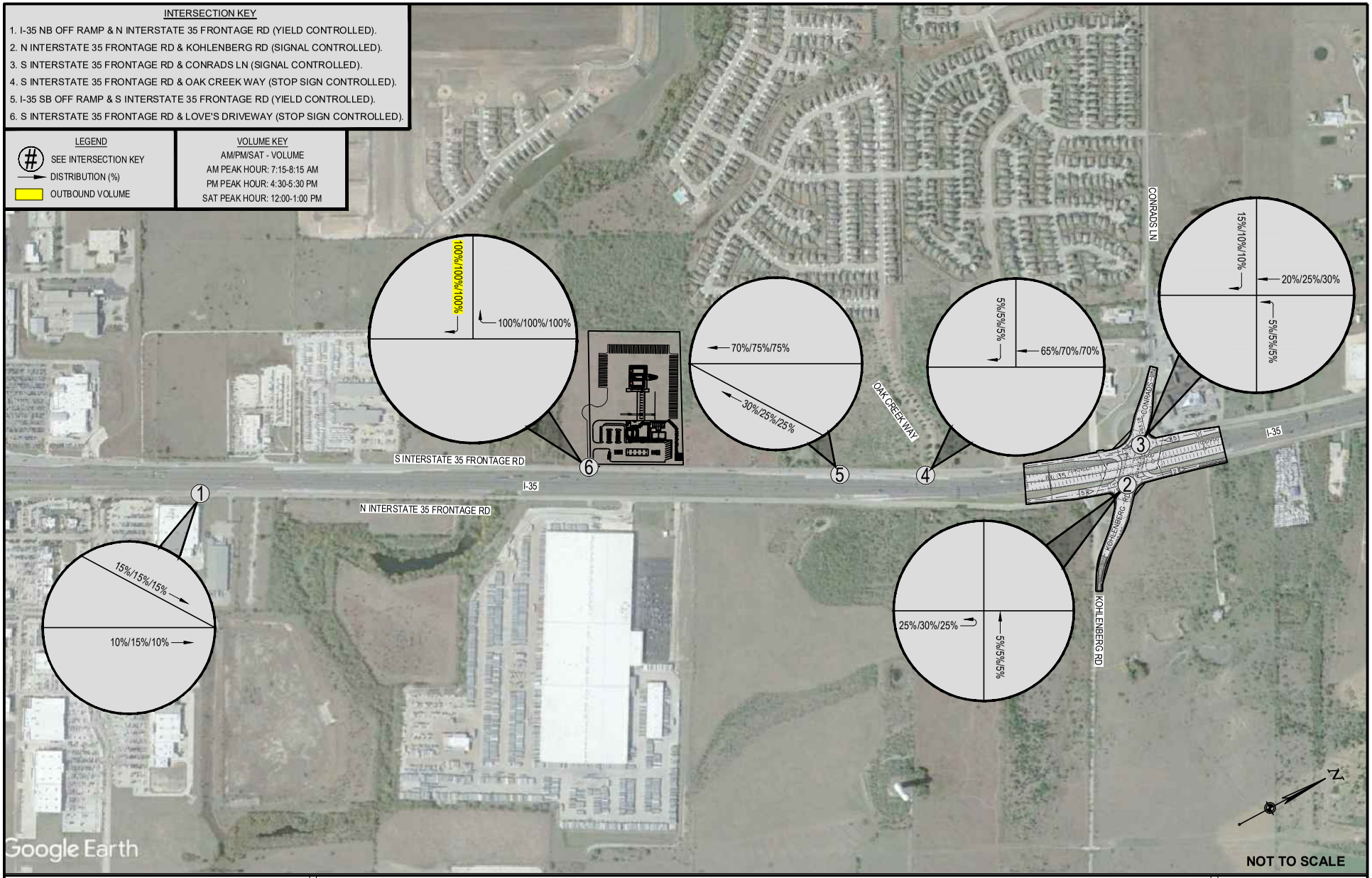
Route	Distribution Approach/Departure (Passenger Cars)		
	AM Peak Hour	PM Peak Hour	Saturday Peak Hour
Primary Trip Distribution - Cars (Figure 6.A)			
To/From the South via I-35	15%/15%	15%/15%	15%/15%
To/From the North via I-35	30%/30%	25%/25%	25%/25%
To/From the South via N. Interstate 35 Frontage Road	10%/10%	15%/15%	10%/10%
To/From the North via S. Interstate 35 Frontage Road	20%/20%	25%/25%	30%/30%
To/From the East via Kohlenberg Road	5%/5%	5%/5%	5%/5%
To/From the West via Conrads Lane	15%/15%	10%/10%	10%/10%
To/From the West via Oak Creek Way	5%/5%	5%/5%	5%/5%
TOTAL	**100%/100%**	**100%/100%**	**100%/100%**
Pass-by/Diverted Trip Distribution – Cars (Figures 6.B)			
Pass-by from the North/To the South via S. Interstate 35 Frontage Road	35%/35%	45%/45%	30%/30%
Diverted from the North via I-35/Back to the South via I-35	65%/65%	55%/55%	70%/70%
TOTAL	**100%/100%**	**100%/100%**	**100%/100%**

Table 6 – Continued.
Directional Distribution of Love's Development-Generated Traffic Volumes

Route	Distribution Approach/Departure (Trucks)		
	AM Peak Hour	PM Peak Hour	Saturday Peak Hour
Primary Trip Distribution - Trucks (Figure 6.C)			
To/From the South via I-35	20%/20%	20%/20%	25%/25%
To/From the North via I-35	30%/30%	25%/25%	25%/25%
To/From the South via N. Interstate 35 Frontage Road	15%/15%	15%/15%	15%/15%
To/From the North via S. Interstate 35 Frontage Road	10%/10%	15%/15%	10%/10%
To/From the East via Kohlenberg Road	10%/10%	5%/5%	5%/5%
To/From the West via Conrads Lane	15%/15%	20%/20%	20%/20%
TOTAL	**100%/100%**	**100%/100%**	**100%/100%**
Pass-by/Diverted Trip Distribution – Trucks (Figures 6.D)			
Pass-by from the North/To the South via S. Interstate 35 Frontage Road	20%/20%	20%/20%	25%/25%
Diverted from the North via I-35/Back to the South via I-35	80%/80%	80%/80%	75%/75%
TOTAL	**100%/100%**	**100%/100%**	**100%/100%**

Figures 6.A-6.D illustrate the primary/pass-by directional distributions for passenger cars and trucks.

Based upon the directional distributions listed in Table 6 and illustrated on Figures 6.A-6.D, the estimated Love's Development-Generated Weekday Peak Hour Traffic Volumes shown in Table 5 were distributed to the adjacent roadway system. The Love's Development Weekday Peak Hour Generated Traffic Volumes are illustrated on Figures 7.A-7.D.



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DIRECTIONAL DISTRIBUTION OF LOVE'S DEV. GENERATED TRAFFIC VOLUMES (CARS - PRIMARY)

LOVE'S TRAVEL STOP DEVELOPMENT

CITY OF NEW BRAUNFELS — COMAL COUNTY, TEXAS

FIGURE 6.A	
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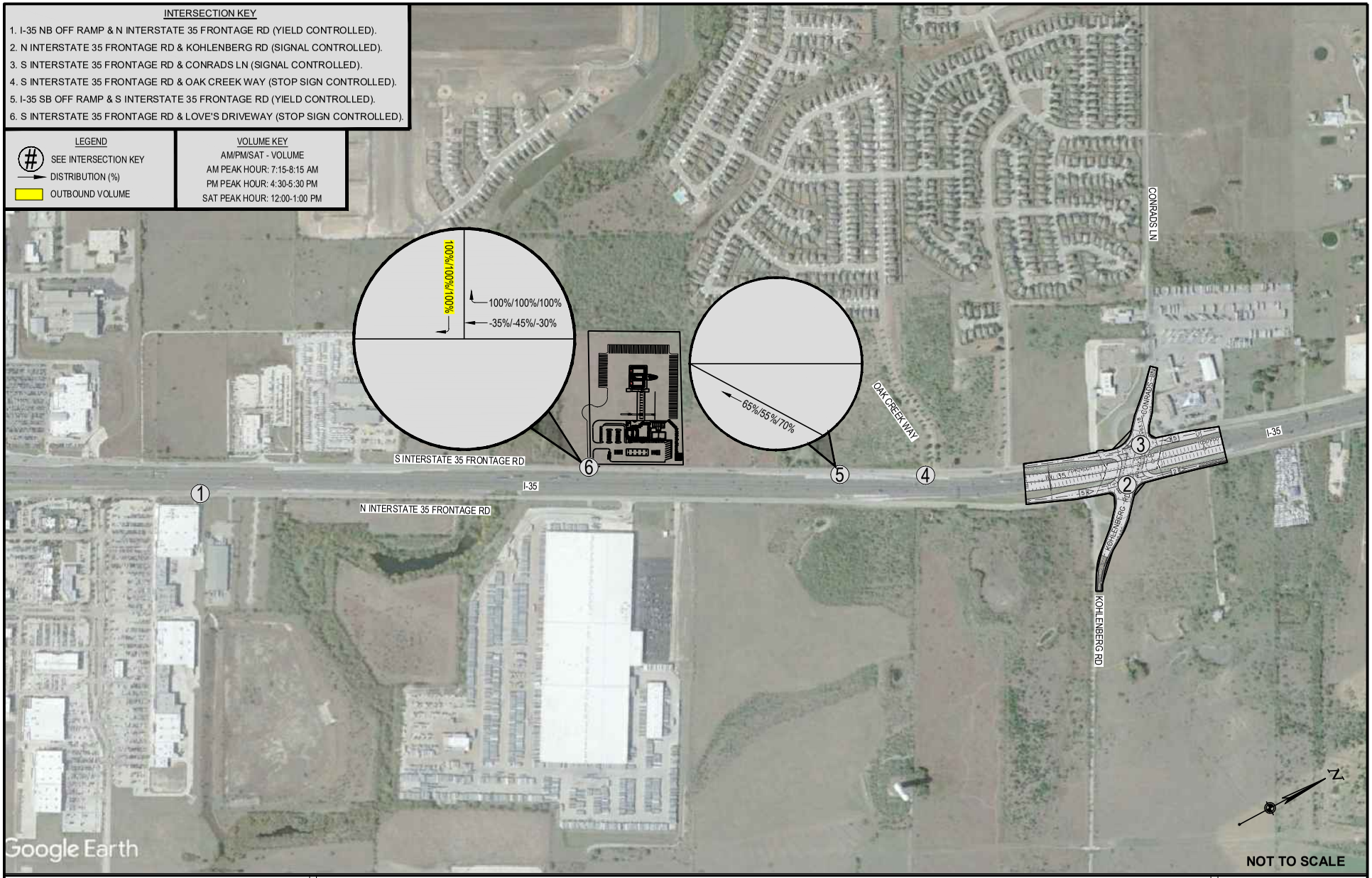

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DIRECTIONAL DISTRIBUTION OF LOVE'S DEV. GENERATED TRAFFIC VOLUMES (CARS - PASS-BY/DIVERTED)

LOVE'S TRAVEL STOP DEVELOPMENT

CITY OF NEW BRAUNFELS COMAL COUNTY, TEXAS

FIGURE 6.B	
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JOB NO.:	756710-01
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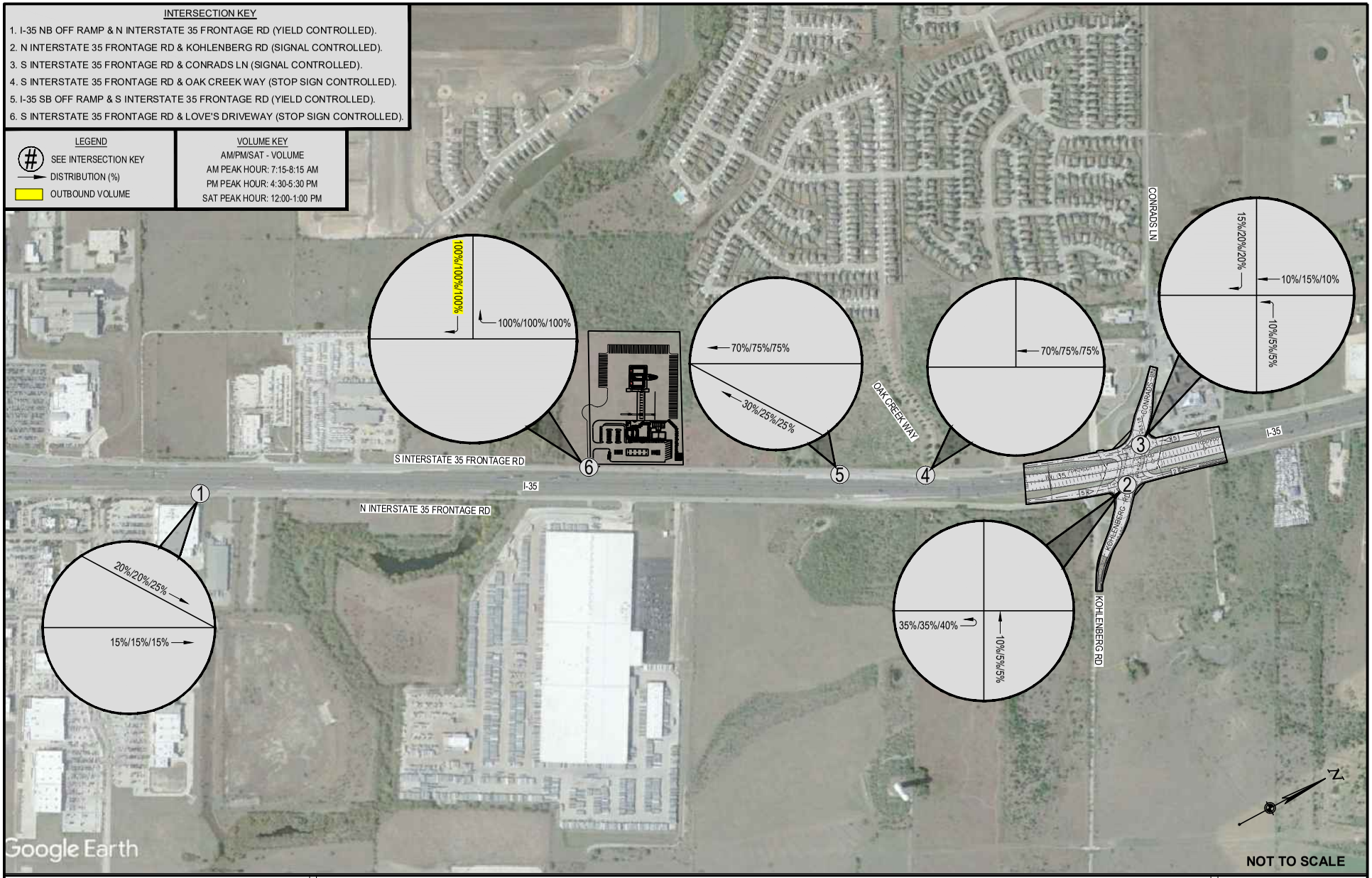

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DIRECTIONAL DISTRIBUTION OF LOVE'S DEV. GENERATED TRAFFIC VOLUMES (TRUCKS - PRIMARY)

LOVE'S TRAVEL STOP DEVELOPMENT

CITY OF NEW BRAUNFELS — COMAL COUNTY, TEXAS

FIGURE	6.C
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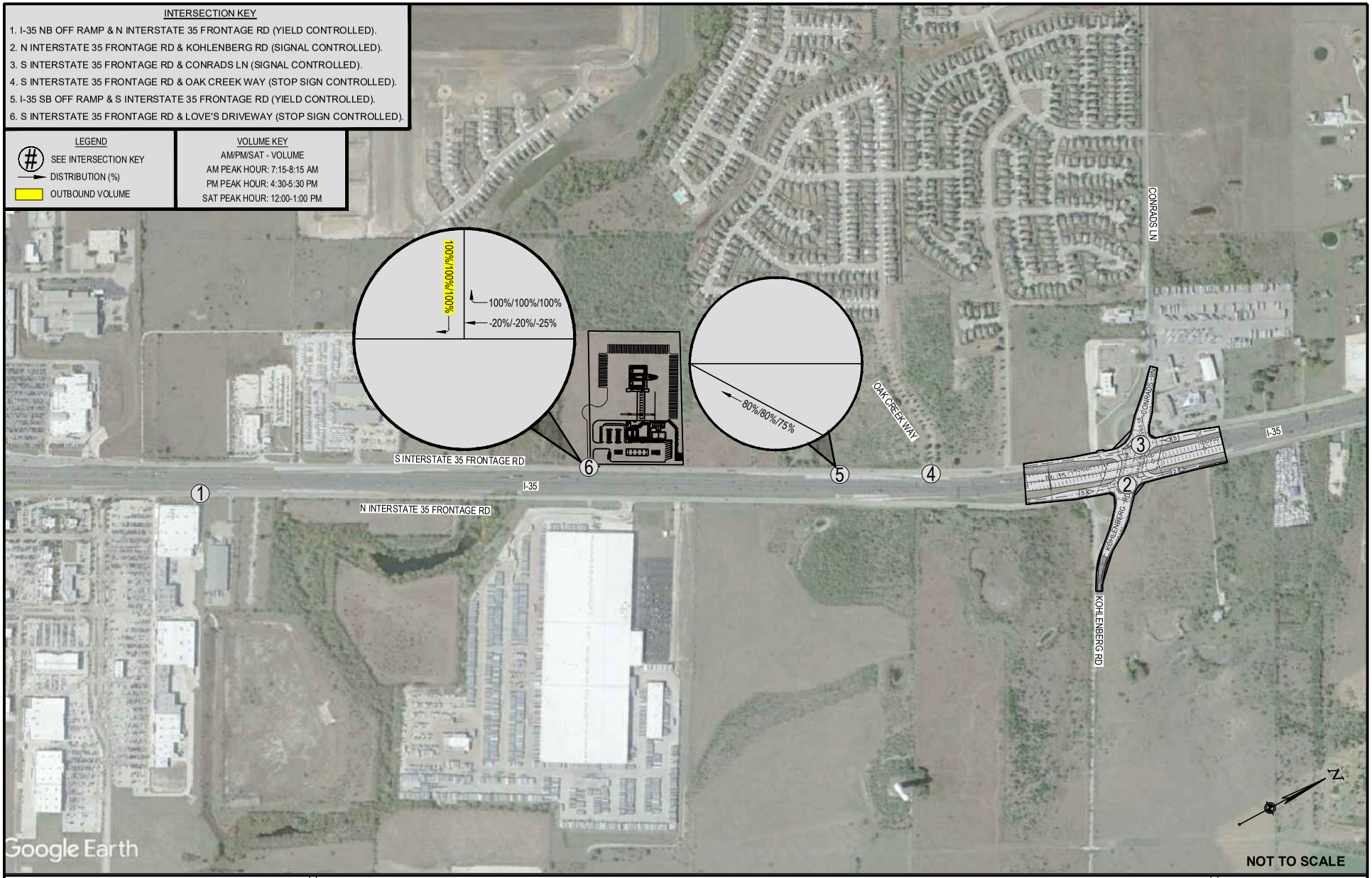

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DIRECTIONAL DISTRIBUTION OF LOVE'S DEV. GENERATED TRAFFIC VOLUMES (TRUCKS - PASS-BY/DIVERTED)

LOVE'S TRAVEL STOP DEVELOPMENT

CITY OF NEW BRAUNFELS COMAL COUNTY, TEXAS

FIGURE 6.D	
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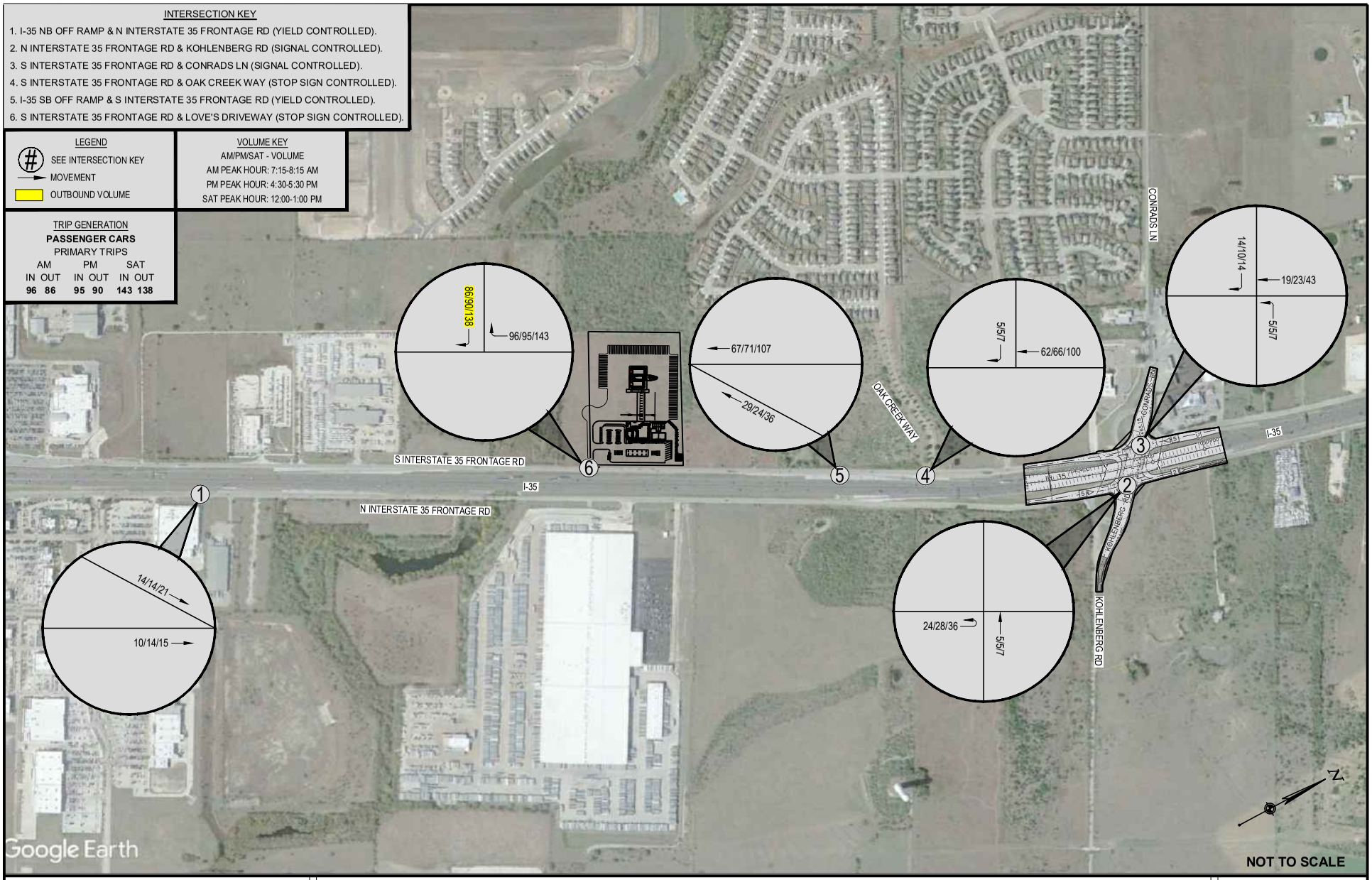

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LOVE'S DEVELOPMENT WEEKDAY PEAK HOUR TRAFFIC VOLUMES (CARS - PRIMARY)

LOVE'S TRAVEL STOP DEVELOPMENT

CITY OF NEW BRAUNFELS COMAL COUNTY, TEXAS

FIGURE 7.A	
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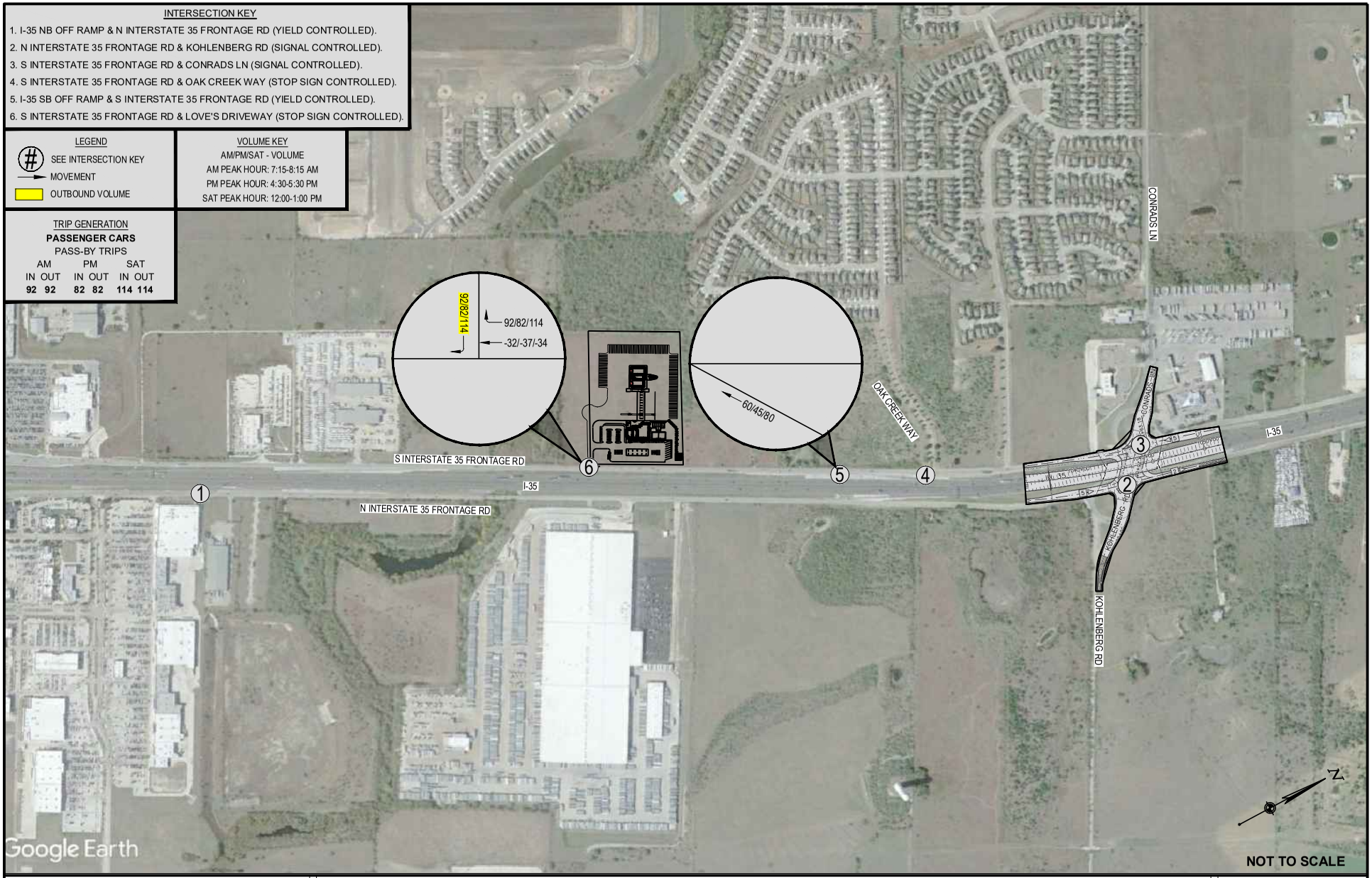

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LOVE'S DEVELOPMENT WEEKDAY PEAK HOUR TRAFFIC VOLUMES (CARS - PASS-BY/DIVERTED)

LOVE'S TRAVEL STOP DEVELOPMENT

CITY OF NEW BRAUNFELS COMAL COUNTY, TEXAS

FIGURE 7.B	
DATE:	3/26/2021
JOB NO.:	756710-01
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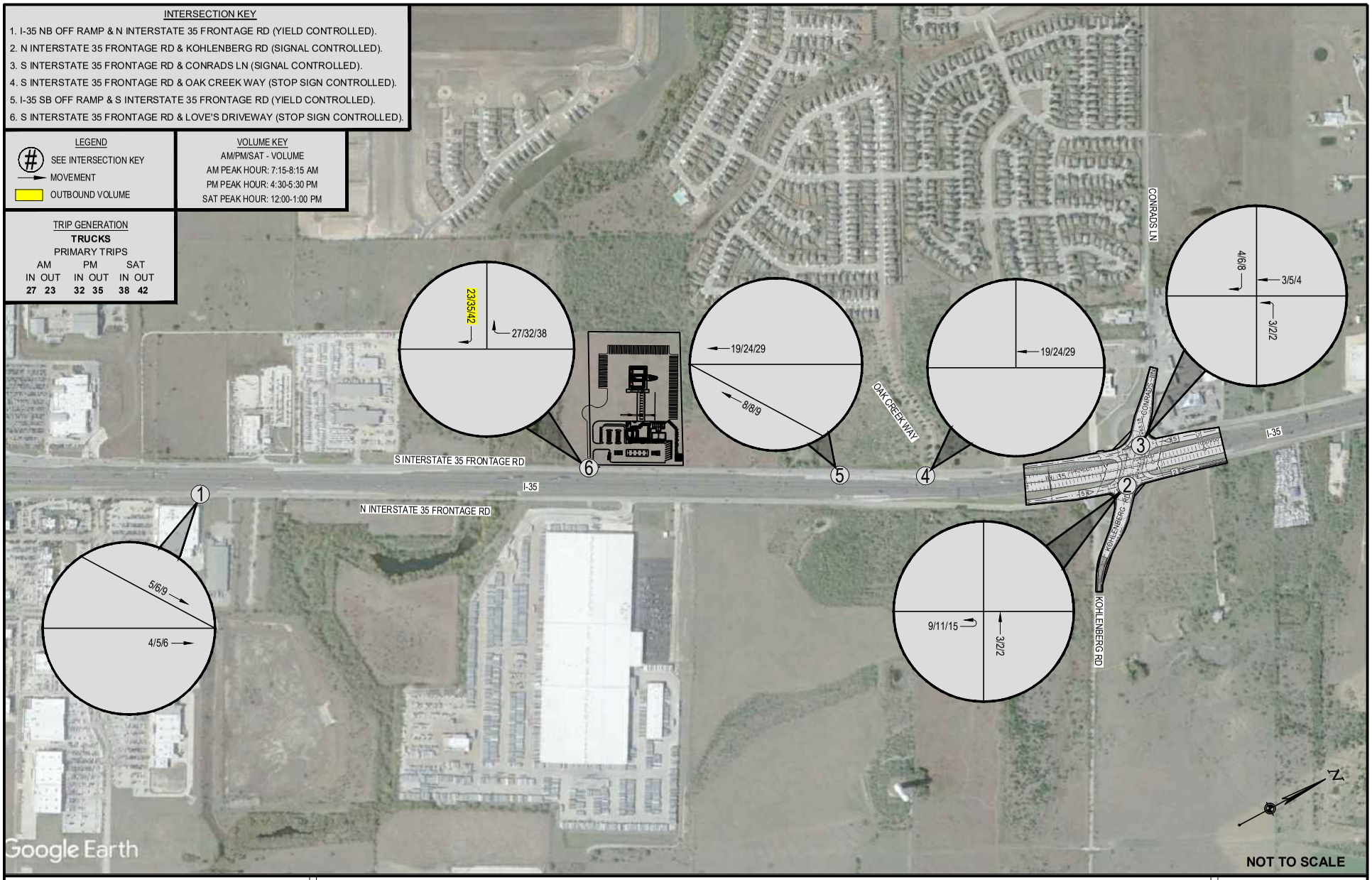

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LOVE'S DEVELOPMENT WEEKDAY PEAK HOUR TRAFFIC VOLUMES (TRUCKS - PRIMARY)

LOVE'S TRAVEL STOP DEVELOPMENT

CITY OF NEW BRAUNFELS — COMAL COUNTY, TEXAS

FIGURE	7.C
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JOB NO.:	756710-01
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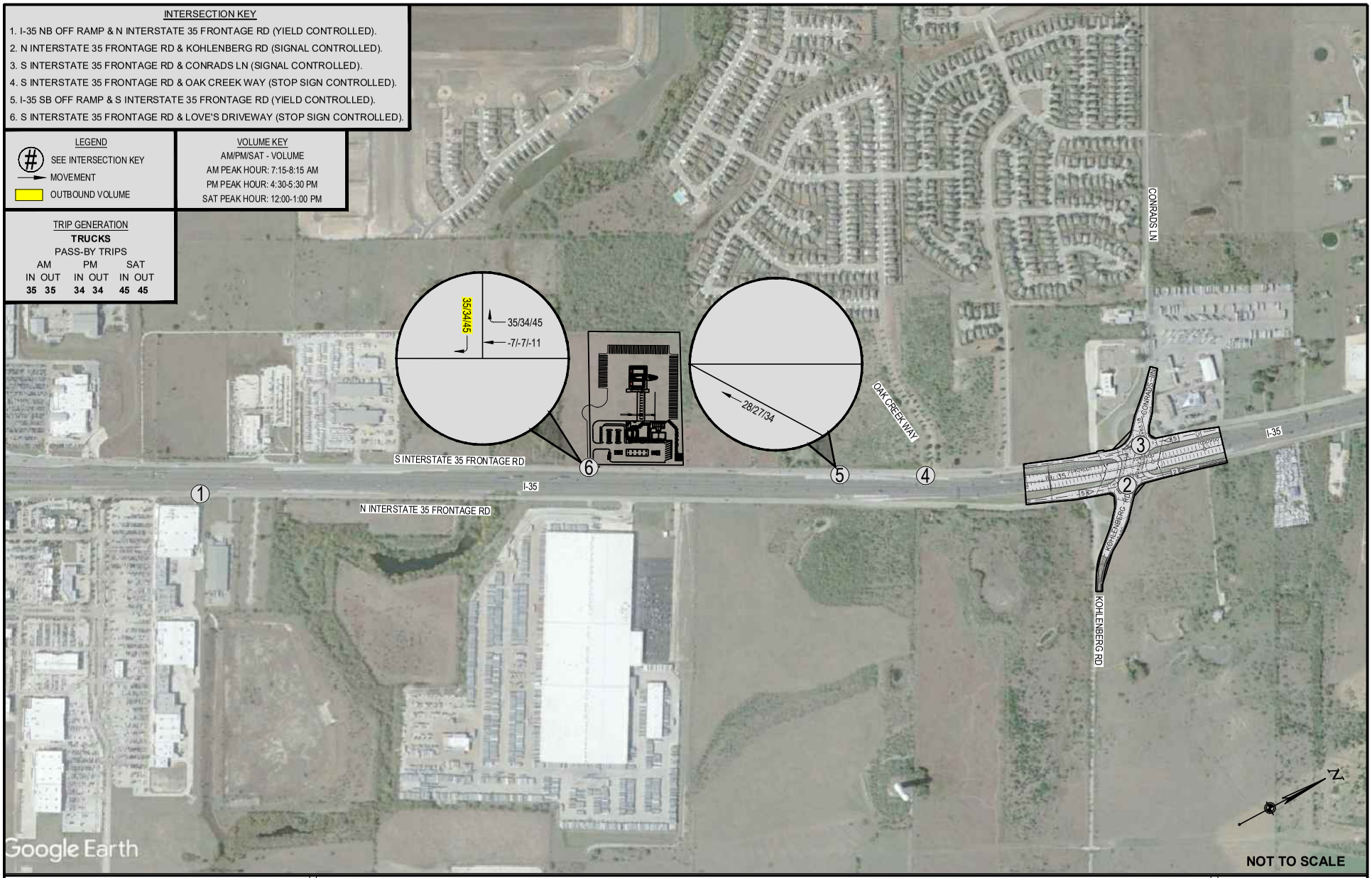

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LOVE'S DEVELOPMENT WEEKDAY PEAK HOUR TRAFFIC VOLUMES (TRUCKS - PASS-BY/DIVERTED)

LOVE'S TRAVEL STOP DEVELOPMENT

CITY OF NEW BRAUNFELS — COMAL COUNTY, TEXAS

FIGURE	7.D
DATE:	3/26/2021
JOB NO.:	756710-01
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5.3. 2022 Build Traffic Volumes

The 2022 Build Weekday Peak Hour Traffic Volumes (Figure 8.A and Figure 8.B) were calculated by adding the Love's Development-Generated Weekday Peak Hour Traffic Volumes (Figures 7.A-7.D) to the 2022 No-Build Weekday Peak Hour Traffic Volumes (Figure 5.A and Figure 5.B).

5.4. 2022 Build Traffic Scenario Capacity Analysis

Utilizing the 2022 Build Weekday Peak Hour Traffic Volumes illustrated on Figure 8.A and Figure 8.B, capacity calculations were performed for the key study intersections. All capacity calculations within the TIS followed procedures documented in the *Highway Capacity Manual, Sixth Edition: A Guide for Multimodal Mobility Analysis* (Transportation Research Board, 2016). The capacity analyses were completed using Synchro Version 11.0 HCM 6th Edition Signalized/TWSC methodology.

Table 7 summarizes the capacity analysis results for the 2022 Build Traffic Scenario.

Table 7
Summary of 2022 Build Traffic Scenario Capacity Analysis

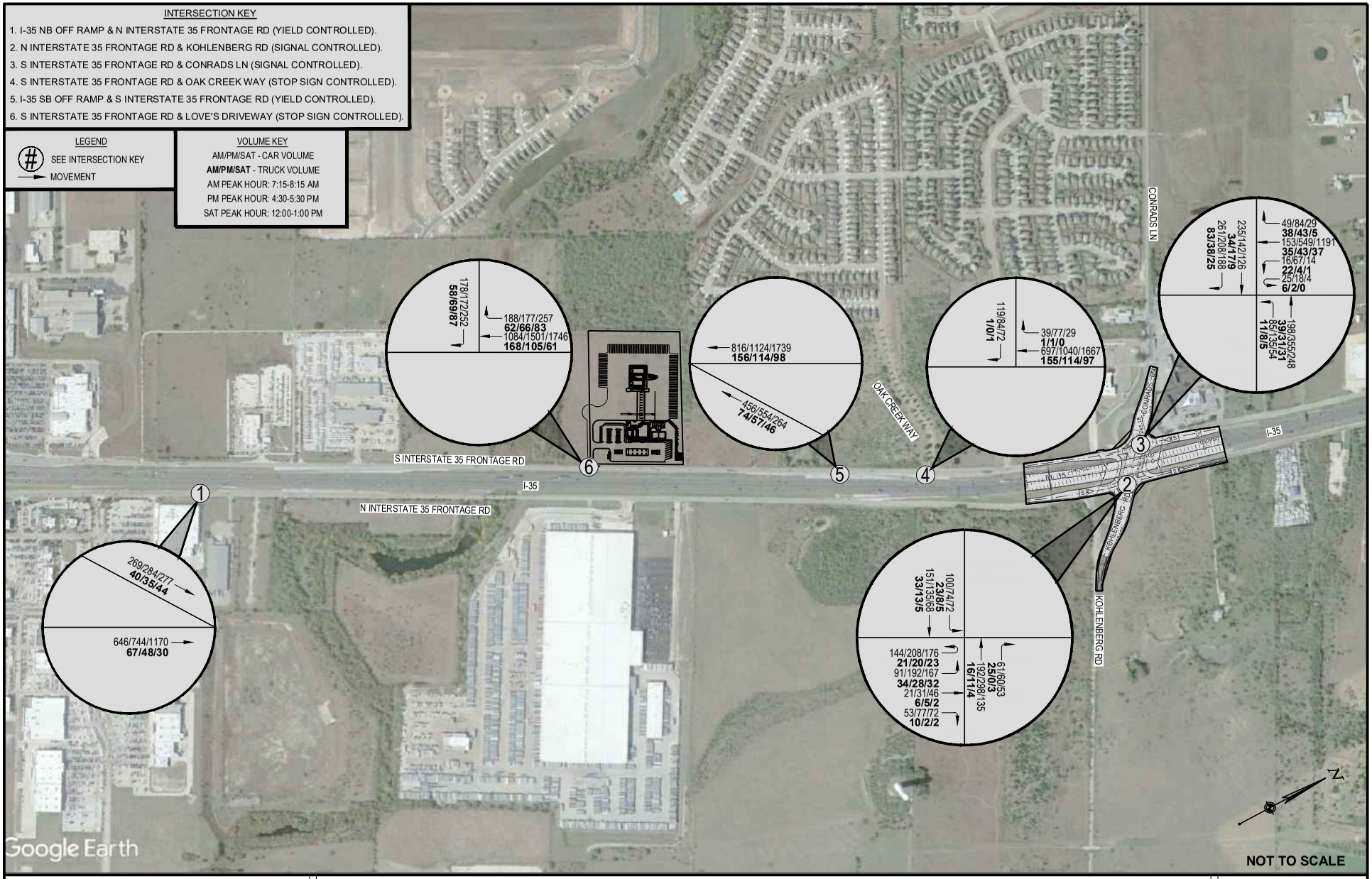
Intersection →	Year →	2022 AM, PM, and Saturday Peak Hours						
	Volume →	Build – Year 2022						
	Geometry →	Existing (Proposed)						
	Approach	Movement	AM Peak Hour		PM Peak Hour		Saturday Peak Hour	
			LOS	*Delay	LOS	*Delay	LOS	*Delay
N Interstate 35 Frontage Road & Kohlenberg Road (Signal Controlled)	Intersection Overall →		C	33.3	C	29.8	C	24.9
	Eastbound	L	D	42.7	D	44.1	D	41.6
		LT	D	40.4	D	41.6	D	45.6
	Westbound	T	D	41.3	D	39.7	D	42.5
	Northbound	L	A	6.0	A	6.5	A	4.2
		T	A	5.2	A	5.2	A	3.4
S Interstate 35 Frontage Road & Conrads Lane (Signal Controlled)	Intersection Overall →		C	32.3	C	25.4	B	18.1
	Eastbound	T	D	40.0	D	42.0	D	42.5
	Westbound	L	D	43.3	D	41.1	D	40.1
		T	D	43.6	D	42.4	D	43.4
	Southbound	L	A	6.5	A	6.9	A	5.1
		T	A	6.6	A	8.2	A	8.7
S Interstate 35 Frontage Road & Oak Creek Way (Stop Sign Controlled)	Intersection Overall →		---	---	---	---	---	---
	Eastbound	R	B	13.6	C	15.6	C	24.9
S Interstate 35 Frontage Road & Love's Driveway (Stop Sign Controlled)	Intersection Overall →		---	---	---	---	---	---
	Eastbound	R	F (E)	78.6 (40.9)	F (F)	225.7 (120.8)	F (F)	693.0 (401.6)
*Delay in seconds L – Left T – Through R – Right (X) – With Recommended Improvements								

Under the 2022 Build Traffic Scenario, all signal-controlled intersections operate at overall level of service (LOS) "C" or better conditions. In addition, all individual movements of stop-controlled intersections operate at level of service (LOS) "C" or better conditions with the exception of the EBR movement at the intersection of S Interstate 35 Frontage Road and Love's Driveway which operates at level of service (LOS) "F" during the AM, PM, and Saturday Peak Hours. It should be noted, due to the high volume of through volumes traveling southbound on S Interstate

35 Frontage Road, longer gap periods are needed for vehicles exiting the Love's Development to be able to turn right out of the Site, therefore the reason for longer delay times.

The recommended improvements include the construction of a SB to WB right-turn lane at the intersection of S Interstate 35 Frontage Road and Love's Driveway.

The 2022 Build Traffic Scenario Capacity Analysis Summary Sheets are contained in Appendix E of the report.



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2022 BUILD WEEKDAY PEAK HOUR TRAFFIC VOLUMES - CARS & TRUCKS

LOVE'S TRAVEL STOP DEVELOPMENT

CITY OF NEW BRAUNFELS — COMAL COUNTY, TEXAS

FIGURE	8.A
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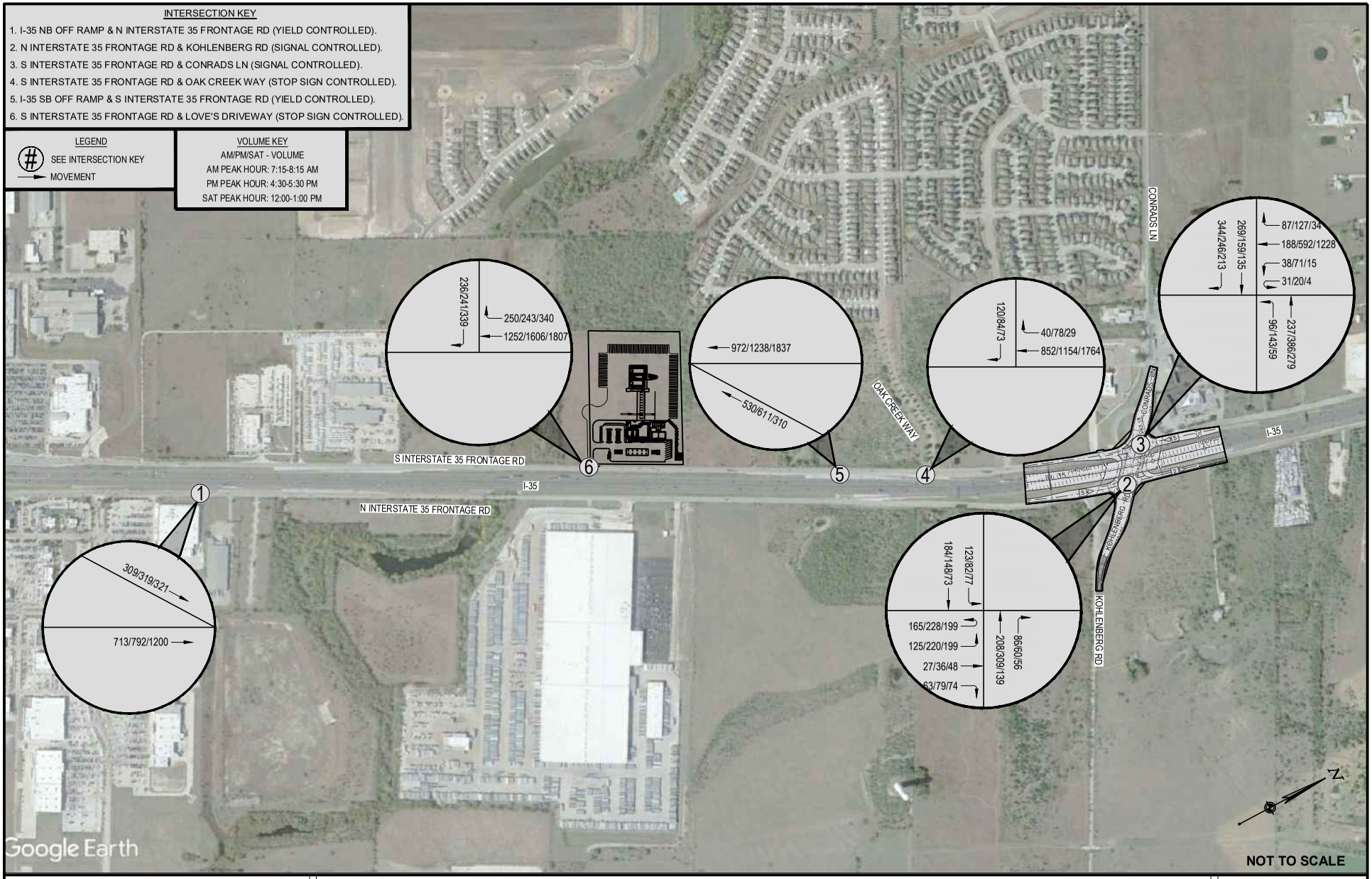

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2022 BUILD WEEKDAY PEAK HOUR TRAFFIC VOLUMES - TOTAL VOLUMES

LOVE'S TRAVEL STOP DEVELOPMENT

CITY OF NEW BRAUNFELS — COMAL COUNTY, TEXAS

FIGURE	8.B
DATE:	3/26/2021
JOB NO.:	756710-01
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6. Turn Lane Analysis

Right-turn lane and left-turn lane analyses were completed using the capacity analyses results, queue length analyses results, and guidance from the Texas Department of Transportation (TxDOT) – *Access Management Manual* and *Roadside Design Manual*.

6.1. Right-Turn Lane Analysis

Guidelines in the Texas Department of Transportation (TxDOT) – *Access Management Manual* and *Roadside Design Manual* were used for guidance in determining if a right-turn lane was warranted at the Site driveway. According to Table 2-3 of the TxDOT *Access Management Manual*, a right turn deceleration lane is required when the speed limit is > 45 mph and the right turn volume is > 50. Table 8 provides a summary of the data utilized in the review of the Site driveway for a right-turn lane.

Table 8
Right-Turn Lane Warrant Review

Intersection and Traffic Scenario	Lane	Advancing Traffic (AM/PM/Saturday)	Right-Turn (AM/PM/Saturday)	Method or Chart Used	Warranted
2022 Build Traffic Scenario					
S Interstate 35 Frontage Road and Love's Driveway	SBR	1502/1849/2147	250/243/340	Access Management Manual Table 2-3	**Yes/Yes/Yes**

6.2. Right-Turn Lane Warrant Review Summary

According to TxDOT *Access Management Manual, Table 2-3,* a right-turn lane **is warranted** at the intersection of S Interstate 35 Frontage Road and Love's Driveway under the 2022 Build traffic condition.

Appendix F of the report contains *Access Management Manual, Table 2-3* guidelines used in the right-turn warrant review.

6.3. Left-Turn Lane Analysis

All studied locations have existing left-turn lanes for each approach. CESO did not find additional left-turn lanes to be warranted at any location.

7. Queue Length Analysis

7.1. 95th Percentile Queue Lengths

The 95th percentile queue lengths were calculated using Synchro Version 11.0 in combination with SimTraffic. CESO reviewed the 2022 No-Build and 2022 Build Traffic Scenarios. The results of the analysis are listed below in Table 9 (AM Peak Hour), Table 10 (PM Peak Hour), and Table 11 (Saturday Peak Hour).

Table 9
AM Peak Hour Queue Length Analysis – Year 2022 No-Build and Build Traffic Scenarios

Location	Movement	Storage Length	2022 No-Build/Build Traffic Scenario Comparison	
			Queue Length	
			AM Peak Hour	
Traffic Scenario →			2022 NB	2022 BD
N Interstate 35 Frontage Road & Kohlenberg Road	EBL	---	103	98
	EBLT	---	135	128
	EBT	---	111	104
	WBT	---	63	75
	WBT	---	109	127
	WBT	---	83	92
	NBL	---	92	93
	NBT	---	24	25
	NBT	---	30	31
S Interstate 35 Frontage Road & Conrads Lane	EBT	---	116	118
	EBT	---	147	144
	EBT	---	112	114
	EBR	---	48	59
	WBL	---	99	123
	WBLT	---	171	178
	WBT	---	157	161
	SBL	---	9	18
	SBLT	---	114	111
	SBT	---	66	64
S Interstate 35 Frontage Road & Oak Creek Way	EBR	---	75	80
S Interstate 35 Frontage Road & Love's Driveway	EBR	---	---	177 (626)
	SBTR	---	---	14 (8)
(XX) – With Recommended Improvements				

Table 10
PM Peak Hour Queue Length Analysis – Year 2022 No-Build and Build Traffic Scenarios

Location	Movement	Storage Length	2022 No-Build/Build Traffic Scenario Comparison	
			Queue Length	
			PM Peak Hour	
Traffic Scenario →			2022 NB	2022 BD
N Interstate 35 Frontage Road & Kohlenberg Road	EBL	---	82	81
	EBLT	---	101	108
	EBT	---	92	94
	WBT	---	73	72
	WBT	---	133	136
	WBT	---	113	112
	NBL	---	108	107
	NBT	---	21	23
	NBT	---	33	32
S Interstate 35 Frontage Road & Conrads Lane	EBT	---	86	80
	EBT	---	104	108
	EBT	---	65	75
	EBR	---	48	40
	WBL	---	117	123
	WBLT	---	201	198
	WBT	---	192	188
	SBL	---	29	28
	SBLT	---	133	133
	SBT	---	119	120
S Interstate 35 Frontage Road & Oak Creek Way	EBR	---	67	80
S Interstate 35 Frontage Road & Love's Driveway	EBR	---	---	1096 (990)
	SBTR	---	---	5 (7)
(XX) – With Recommended Improvements				

Table 11
Saturday Peak Hour Queue Length Analysis – Year 2022 No-Build and Build Traffic Scenarios

Location	Movement	Storage Length	2022 No-Build/Build Traffic Scenario Comparison	
			Queue Length	
			Saturday Peak Hour	
Traffic Scenario →			2022 NB	2022 BD
N Interstate 35 Frontage Road & Kohlenberg Road	EBL	---	79	82
	EBLT	---	76	79
	EBT	---	45	44
	WBT	---	32	36
	WBT	---	89	85
	WBT	---	58	53
	NBL	---	96	92
	NBT	---	16	17
	NBT	---	25	23

Table 11 – Continued.
Saturday Peak Hour Queue Length Analysis – Year 2022 No-Build and Build Traffic Scenarios

Location	Movement	Storage Length	2022 No-Build/Build Traffic Scenario Comparison	
			Queue Length	
			Saturday Peak Hour	
Traffic Scenario →			2022 NB	2022 BD
S Interstate 35 Frontage Road & Conrads Lane	EBT	---	85	89
	EBT	---	85	86
	EBT	---	44	39
	EBR	---	34	54
	WBL	---	61	72
	WBLT	---	152	157
	WBT	---	142	144
	SBL	---	15	15
	SBLT	---	135	135
	SBT	---	141	143
S Interstate 35 Frontage Road & Oak Creek Way	EBR	---	90	129
S Interstate 35 Frontage Road & Love's Driveway	EBR	---	---	832 (869)
	SBTR	---	---	29
(XX) – With Recommended Improvements				

7.2. Queue Length Analysis Summary

CESO reviewed all study locations to determine if calculated queue lengths exceeded existing or proposed turn lane storage lengths. The queue length analysis revealed the following:

- During peak hours, it can be observed that customers will have to wait for longer gap periods on S Interstate 35 Frontage Road to be able to exit the development due to the high volume of advancing traffic along the mainline. Due to the need for longer gap periods, it can be observed that the EBR movement queue lengths at the Love's Driveway extend back into the development.

The Queue Length Summary Sheets are located in Appendix G of the report.

8. Weave Analysis

A two-sided weave analysis was completed for the I-35 SB Off Ramp to S Interstate 35 Frontage Road section using procedures documented in the *Highway Capacity Manual, Sixth Edition: A Guide for Multimodal Mobility Analysis* (Transportation Research Board, 2016). In a two-sided weaving segment, the ramp-to-freeway (RF) and freeway-to-ramp (FR) vehicles do not weave but the ramp-to-ramp (RR) vehicles must cross the path of freeway-to-freeway (FF) vehicles. In reality, the through freeway movement is not weaving in that vehicles do not need to change lanes and generally do not shift lane position in response to a desired exit leg. Thus, in two-sided weaving segments, only the ramp-to-ramp flow is considered to be weaving.

The following parameters were used in the weave analysis:

- Freeway Free-Flow Speed (FFS) of 55 mph.
- Freeway Peak Hour Factor (PHF) of 0.94.
- Ramp Free-Flow Speed (FFS) of 45 mph.
- Ramp Peak Hour Factor (PHF) of 0.94.
- Segment Length of 1935 feet.
- Interchange Density of 2.0 int/mi.

The weave analysis was completed with HCS Version 7.8.5 methodology. Table 12 summarizes the level of service (LOS), density (pc/mi/ln), and average speed (mi/h) results for the 2022 Build Traffic Scenario.

Table 12
Summary of Weave Analysis

Ramp Weave Analysis	AM Peak Hour			PM Peak Hour			Saturday Peak Hour		
	LOS	Density (pc/mi/ln)	Average Speed (mi/h)	LOS	Density (pc/mi/ln)	Average Speed (mi/h)	LOS	Density (pc/mi/ln)	Average Speed (mi/h)
I-35 SB Off Ramp to S Interstate 35 Frontage Road	B	21.1	48.8	C	24.2	48.3	C	27.6	47.3

8.1. Weave Analysis Summary

According to the results of the weave analysis it could be concluded that the weaving vehicles can enter the section in the left-most lane of S Interstate 35 Frontage Road and efficiently cross two (2) lanes to turn right into the Love's Driveway with little to no delay or congestion.

The Weave Analysis Summary Sheets are located in Appendix H of the report.

9. Summary of Recommendations

9.1. Recommendations

The following summary of recommendations was generated based upon the findings in the Traffic Impact Study.

2022 No-Build Traffic Scenario (Responsibility - Others):

- Improvements from TxDOT were applied to the 2022 No-Build Traffic Scenario. These improvements include:

    4. Demolishing the existing Conrads Lane/Kohlenberg Road overpass and constructing a new bridge for I-35.
    5. Widening and signalizing the Kohlenberg Road and N Interstate 35 Frontage Road interchange
    6. Widening and signalizing the Conrads Lane and S Interstate 35 Frontage Road interchange.

2022 Build Traffic Scenario (Responsibility - Love's Travel Stops):

S Interstate 35 Frontage Road and Love's Driveway:

- Construct Love's Driveway to permit right-in and right-out movements of passenger cars and trucks. Control Love's Driveway with one (1) stop sign. Provide one outbound right turn lane.

- Construct a SB to WB right-turn lane to accommodate 510' of storage plus a 100' taper.

APPENDIX A
EXISTING TRAFFIC COUNT DATA

I-35 NB Off Ramp & N Interstate 35 Frontage ... - TMC

Thu Mar 4, 2021
Full Length (7 AM-9 AM, 4 PM-6 PM)
All Classes (Lights, Articulated Trucks and Single-Unit Trucks, Buses)
All Movements
ID: 816095, Location: 29.732891, -98.073201

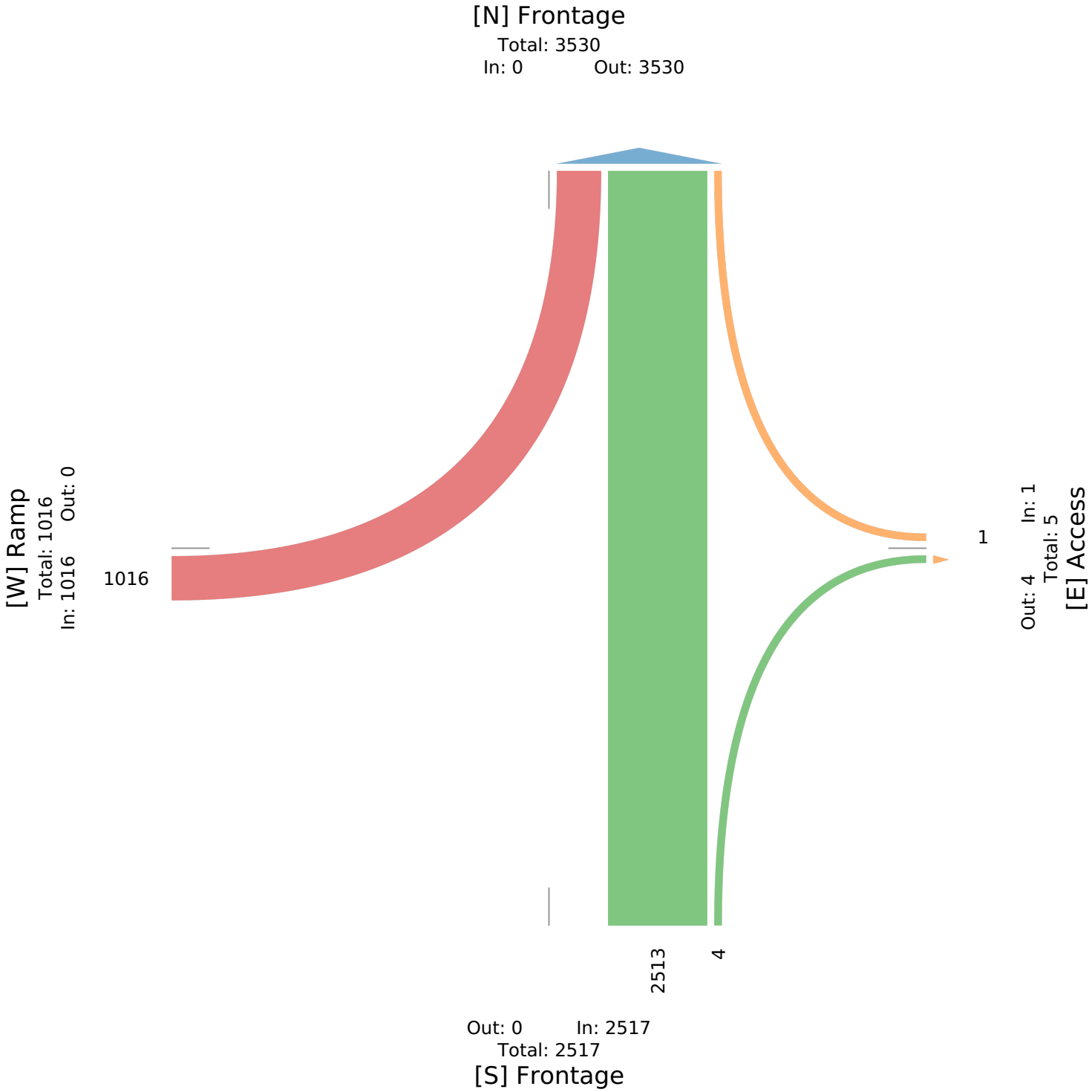
GEWALT HAMILTON ASSOCIATES, INC.
Provided by: Gewalt Hamilton Associates Inc.
625 Forest Edge Drive, Vernon Hills, IL, 60061, US

Leg Direction	Ramp Eastbound			Access Westbound			Frontage Northbound			
Time	T	L	**App**	R	U	**App**	R	T	**App**	**Int**
2021-03-04 7:00AM	0	44	**44**	0	0	**0**	0	137	**137**	**181**
7:15AM	0	62	**62**	0	0	**0**	0	146	**146**	**208**
7:30AM	0	59	**59**	0	0	**0**	0	177	**177**	**236**
7:45AM	0	63	**63**	0	0	**0**	0	135	**135**	**198**
Hourly Total	0	228	**228**	0	0	**0**	0	595	**595**	**823**
8:00AM	0	65	**65**	0	0	**0**	1	143	**144**	**209**
8:15AM	0	61	**61**	0	0	**0**	0	138	**138**	**199**
8:30AM	0	80	**80**	0	0	**0**	0	133	**133**	**213**
8:45AM	0	55	**55**	1	0	**1**	3	141	**144**	**200**
Hourly Total	0	261	**261**	1	0	**1**	4	555	**559**	**821**
4:00PM	0	81	**81**	0	0	**0**	0	188	**188**	**269**
4:15PM	0	76	**76**	0	0	**0**	0	187	**187**	**263**
4:30PM	0	73	**73**	0	0	**0**	0	168	**168**	**241**
4:45PM	0	58	**58**	0	0	**0**	0	152	**152**	**210**
Hourly Total	0	288	**288**	0	0	**0**	0	695	**695**	**983**
5:00PM	0	59	**59**	0	0	**0**	0	192	**192**	**251**
5:15PM	0	67	**67**	0	0	**0**	0	154	**154**	**221**
5:30PM	0	61	**61**	0	0	**0**	0	161	**161**	**222**
5:45PM	0	52	**52**	0	0	**0**	0	161	**161**	**213**
Hourly Total	0	239	**239**	0	0	**0**	0	668	**668**	**907**
Total	0	1016	**1016**	1	0	**1**	4	2513	**2517**	**3534**
% Approach	0%	100%	**-**	100%	0%	**-**	0.2%	99.8%	**-**	-
% Total	0%	28.7%	**28.7%**	0%	0%	**0%**	0.1%	71.1%	**71.2%**	-
Lights	0	891	**891**	1	0	**1**	4	2326	**2330**	3222
% Lights	0%	87.7%	**87.7%**	100%	0%	**100%**	100%	92.6%	**92.6%**	91.2%
Articulated Trucks and Single-Unit Trucks	0	123	**123**	0	0	**0**	0	184	**184**	307
% Articulated Trucks and Single-Unit Trucks	0%	12.1%	**12.1%**	0%	0%	**0%**	0%	7.3%	**7.3%**	8.7%
Buses	0	2	**2**	0	0	**0**	0	3	**3**	5
% Buses	0%	0.2%	**0.2%**	0%	0%	**0%**	0%	0.1%	**0.1%**	0.1%

*L: Left, R: Right, T: Thru, U: U-Turn

I-35 NB Off Ramp & N Interstate 35 Frontage ... - TMC
Thu Mar 4, 2021
Full Length (7 AM-9 AM, 4 PM-6 PM)
All Classes (Lights, Articulated Trucks and Single-Unit Trucks, Buses)
All Movements
ID: 816095, Location: 29.732891, -98.073201

GEWALT HAMILTON ASSOCIATES, INC.
Provided by: Gewalt Hamilton Associates Inc.
625 Forest Edge Drive, Vernon Hills, IL, 60061, US



I-35 NB Off Ramp & N Interstate 35 Frontage ... - TMC

Thu Mar 4, 2021
AM Peak (7:15 AM - 8:15 AM)
All Classes (Lights, Articulated Trucks and Single-Unit Trucks, Buses)
All Movements
ID: 816095, Location: 29.732891, -98.073201

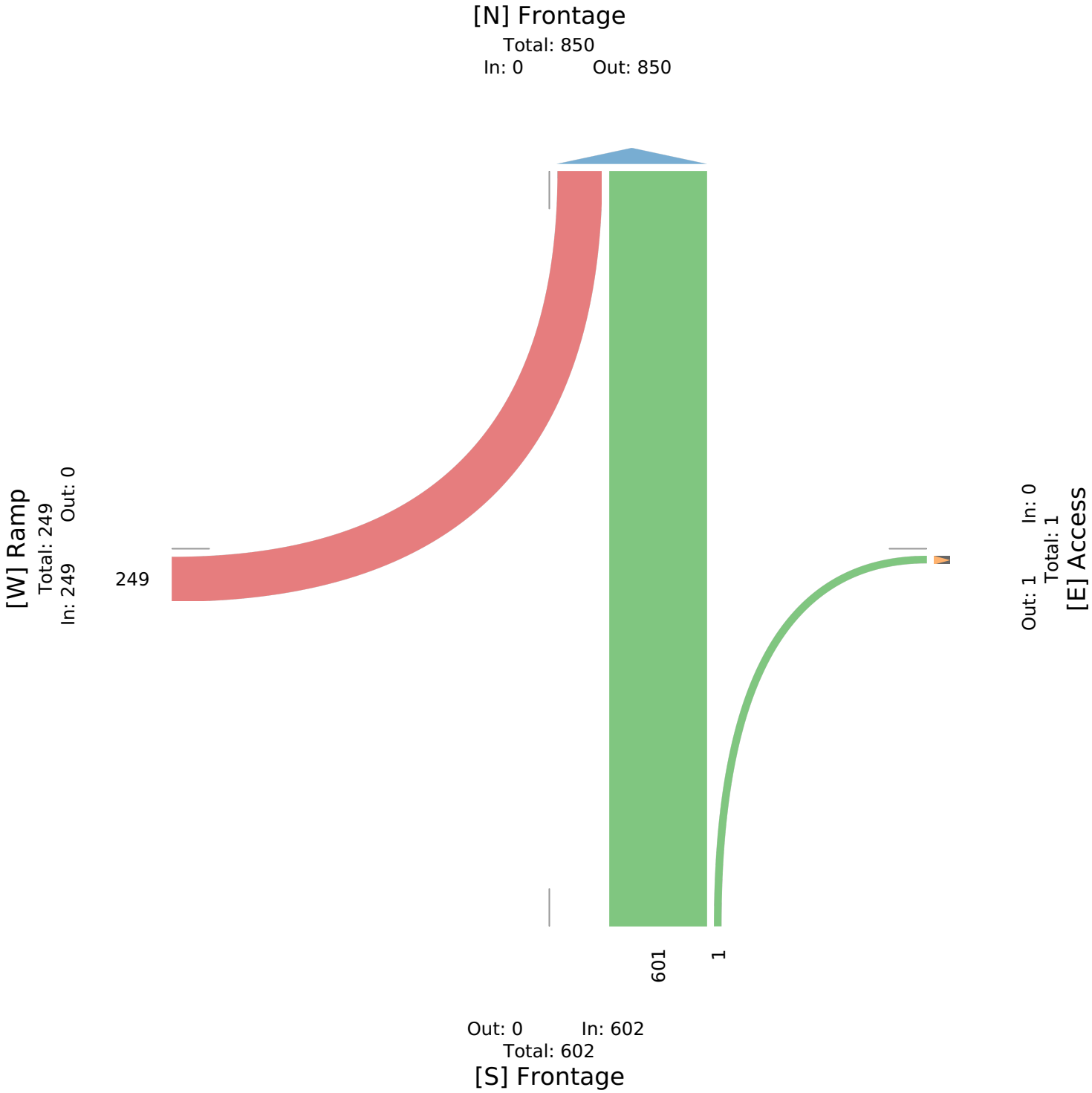
GEWALT HAMILTON ASSOCIATES, INC.
Provided by: Gewalt Hamilton Associates Inc.
625 Forest Edge Drive, Vernon Hills, IL, 60061, US

Leg Direction	Ramp Eastbound			Access Westbound			Frontage Northbound			
Time	T	L	**App**	R	U	**App**	R	T	**App**	**Int**
2021-03-04 7:15AM	0	62	**62**	0	0	**0**	0	146	**146**	**208**
7:30AM	0	59	**59**	0	0	**0**	0	177	**177**	**236**
7:45AM	0	63	**63**	0	0	**0**	0	135	**135**	**198**
8:00AM	0	65	**65**	0	0	**0**	1	143	**144**	**209**
Total	0	249	**249**	0	0	**0**	1	601	**602**	**851**
% Approach	0%	100%	**-**	0%	0%	**-**	0.2%	99.8%	**-**	-
% Total	0%	29.3%	**29.3%**	0%	0%	**0%**	0.1%	70.6%	**70.7%**	-
PHF	-	0.958	**0.958**	-	-	**-**	0.250	0.849	**0.850**	0.901
Lights	0	219	**219**	0	0	**0**	1	547	**548**	767
% Lights	0%	88.0%	**88.0%**	0%	0%	**-**	100%	91.0%	**91.0%**	90.1%
Articulated Trucks and Single-Unit Trucks	0	30	**30**	0	0	**0**	0	54	**54**	84
% Articulated Trucks and Single-Unit Trucks	0%	12.0%	**12.0%**	0%	0%	**-**	0%	9.0%	**9.0%**	9.9%
Buses	0	0	**0**	0	0	**0**	0	0	**0**	0
% Buses	0%	0%	**0%**	0%	0%	**-**	0%	0%	**0%**	0%

*L: Left, R: Right, T: Thru, U: U-Turn

I-35 NB Off Ramp & N Interstate 35 Frontage ... - TMC
Thu Mar 4, 2021
AM Peak (7:15 AM - 8:15 AM)
All Classes (Lights, Articulated Trucks and Single-Unit Trucks, Buses)
All Movements
ID: 816095, Location: 29.732891, -98.073201

Provided by: Gewalt Hamilton Associates Inc.
625 Forest Edge Drive, Vernon Hills, IL, 60061, US



I-35 NB Off Ramp & N Interstate 35 Frontage ... - TMC

Thu Mar 4, 2021
Forced Peak (4:30 PM - 5:30 PM)
All Classes (Lights, Articulated Trucks and Single-Unit Trucks, Buses)
All Movements
ID: 816095, Location: 29.732891, -98.073201

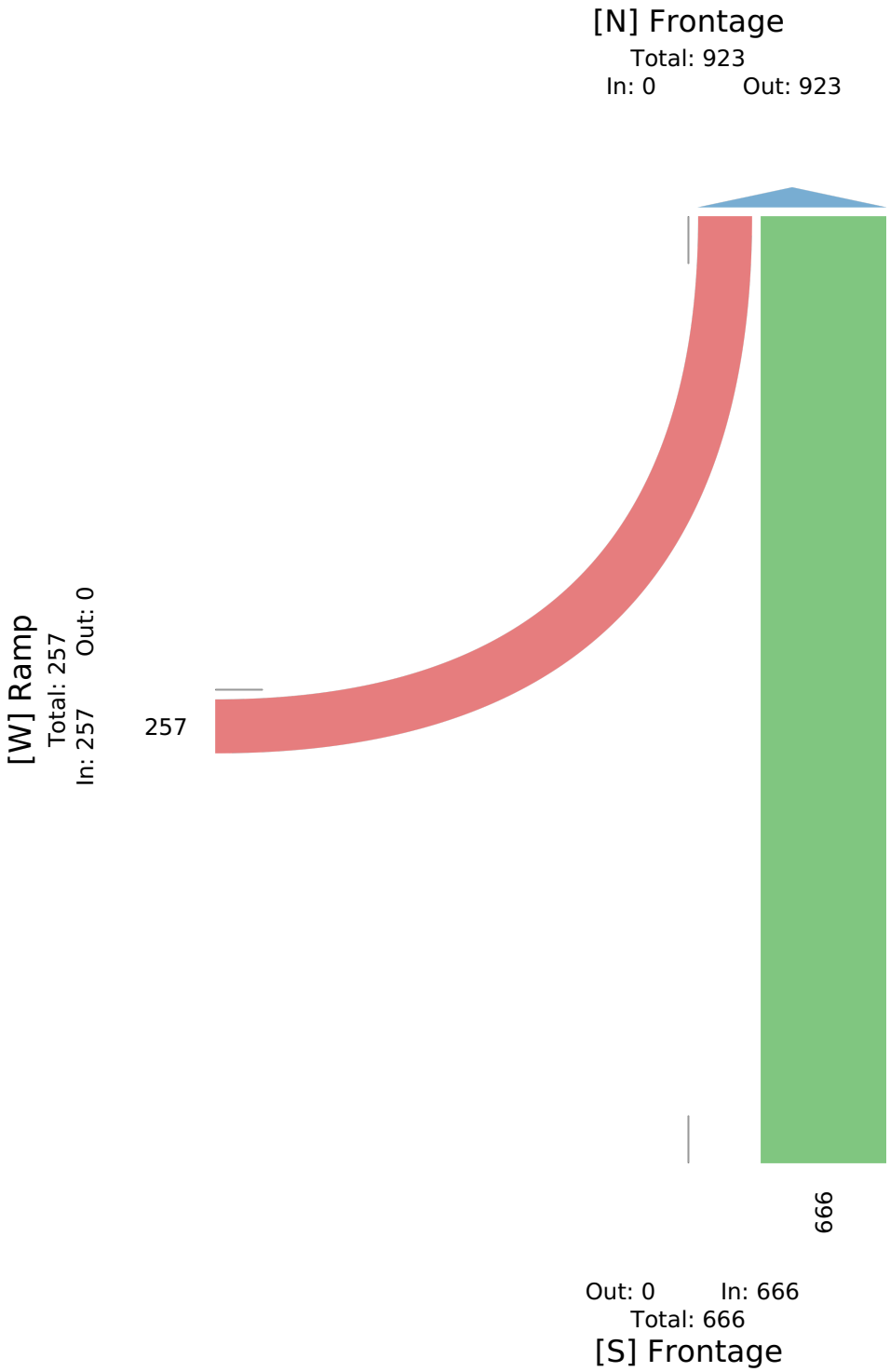
GEWALT HAMILTON ASSOCIATES, INC.
Provided by: Gewalt Hamilton Associates Inc.
625 Forest Edge Drive, Vernon Hills, IL, 60061, US

Leg	Ramp			Access			Frontage			
Direction	Eastbound			Westbound			Northbound			
Time	T	L	**App**	R	U	**App**	R	T	**App**	**Int**
2021-03-04 4:30PM	0	73	**73**	0	0	**0**	0	168	**168**	**241**
4:45PM	0	58	**58**	0	0	**0**	0	152	**152**	**210**
5:00PM	0	59	**59**	0	0	**0**	0	192	**192**	**251**
5:15PM	0	67	**67**	0	0	**0**	0	154	**154**	**221**
Total	0	257	**257**	0	0	**0**	0	666	**666**	**923**
% Approach	0%	100%	**-**	0%	0%	**-**	0%	100%	**-**	-
% Total	0%	27.8%	**27.8%**	0%	0%	**0%**	0%	72.2%	**72.2%**	-
PHF	-	0.880	**0.880**	-	-	**-**	-	0.867	**0.867**	0.919
Lights	0	232	**232**	0	0	**0**	0	629	**629**	861
% Lights	0%	90.3%	**90.3%**	0%	0%	**-**	0%	94.4%	**94.4%**	93.3%
Articulated Trucks and Single-Unit Trucks	0	24	**24**	0	0	**0**	0	36	**36**	60
% Articulated Trucks and Single-Unit Trucks	0%	9.3%	**9.3%**	0%	0%	**-**	0%	5.4%	**5.4%**	6.5%
Buses	0	1	**1**	0	0	**0**	0	1	**1**	2
% Buses	0%	0.4%	**0.4%**	0%	0%	**-**	0%	0.2%	**0.2%**	0.2%

*L: Left, R: Right, T: Thru, U: U-Turn

I-35 NB Off Ramp & N Interstate 35 Frontage ... - TMC
Thu Mar 4, 2021
Forced Peak (4:30 PM - 5:30 PM)
All Classes (Lights, Articulated Trucks and Single-Unit Trucks, Buses)
All Movements
ID: 816095, Location: 29.732891, -98.073201

Provided by: Gewalt Hamilton Associates Inc.
625 Forest Edge Drive, Vernon Hills, IL, 60061, US



N Interstate 35 Frontage Road & Kohlenberg R... - TMC

Thu Mar 4, 2021
Full Length (7 AM-9 AM, 4 PM-6 PM)
All Classes (Lights, Articulated Trucks and Single-Unit Trucks, Buses)
All Movements
ID: 816097, Location: 29.745942, -98.058107

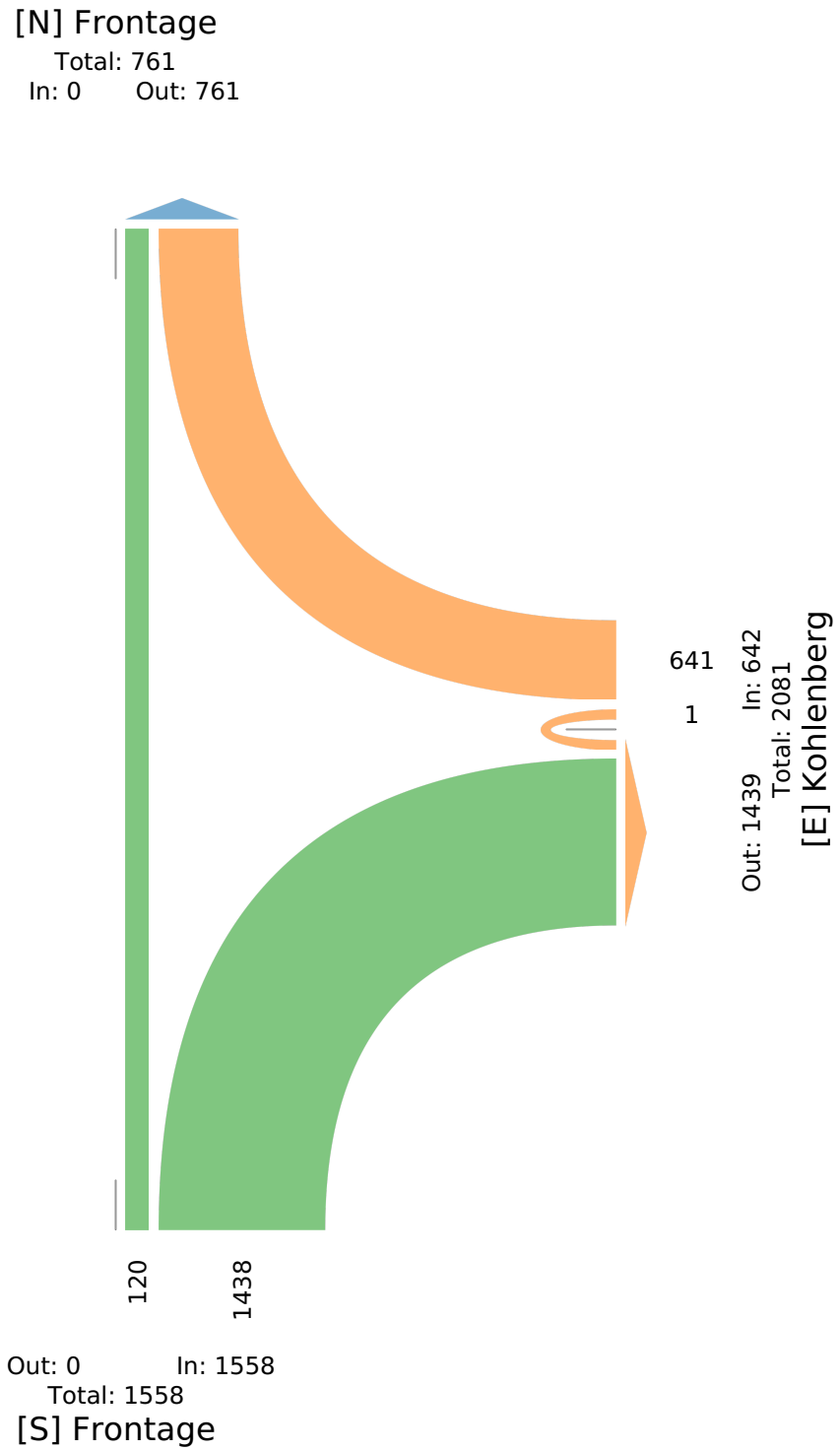
GEWALT HAMILTON ASSOCIATES, INC.
Provided by: Gewalt Hamilton Associates Inc.
625 Forest Edge Drive, Vernon Hills, IL, 60061, US

Leg Direction	Kohlenberg Westbound			Frontage Northbound			Frontage Southbound			
Time	R	U	**App**	R	T	**App**	L	U	**App**	**Int**
2021-03-04 7:00AM	43	0	**43**	53	6	**59**	0	0	**0**	**102**
7:15AM	54	0	**54**	63	6	**69**	0	0	**0**	**123**
7:30AM	64	0	**64**	59	5	**64**	0	0	**0**	**128**
7:45AM	50	0	**50**	69	4	**73**	0	0	**0**	**123**
Hourly Total	211	0	**211**	244	21	**265**	0	0	**0**	**476**
8:00AM	40	0	**40**	81	8	**89**	0	0	**0**	**129**
8:15AM	42	0	**42**	73	10	**83**	0	0	**0**	**125**
8:30AM	43	0	**43**	81	9	**90**	0	0	**0**	**133**
8:45AM	30	0	**30**	92	9	**101**	0	0	**0**	**131**
Hourly Total	155	0	**155**	327	36	**363**	0	0	**0**	**518**
4:00PM	33	0	**33**	126	7	**133**	0	0	**0**	**166**
4:15PM	26	0	**26**	128	10	**138**	0	0	**0**	**164**
4:30PM	30	0	**30**	113	6	**119**	0	0	**0**	**149**
4:45PM	33	0	**33**	96	9	**105**	0	0	**0**	**138**
Hourly Total	122	0	**122**	463	32	**495**	0	0	**0**	**617**
5:00PM	45	0	**45**	107	5	**112**	0	0	**0**	**157**
5:15PM	35	1	**36**	98	11	**109**	0	0	**0**	**145**
5:30PM	39	0	**39**	104	7	**111**	0	0	**0**	**150**
5:45PM	34	0	**34**	95	8	**103**	0	0	**0**	**137**
Hourly Total	153	1	**154**	404	31	**435**	0	0	**0**	**589**
Total	641	1	**642**	1438	120	**1558**	0	0	**0**	**2200**
% Approach	99.8%	0.2%	**-**	92.3%	7.7%	**-**	0%	0%	**-**	-
% Total	29.1%	0%	**29.2%**	65.4%	5.5%	**70.8%**	0%	0%	**0%**	-
Lights	529	1	**530**	1257	102	**1359**	0	0	**0**	1889
% Lights	82.5%	100%	**82.6%**	87.4%	85.0%	**87.2%**	0%	0%	**-**	85.9%
Articulated Trucks and Single-Unit Trucks	112	0	**112**	178	17	**195**	0	0	**0**	307
% Articulated Trucks and Single-Unit Trucks	17.5%	0%	**17.4%**	12.4%	14.2%	**12.5%**	0%	0%	**-**	14.0%
Buses	0	0	**0**	3	1	**4**	0	0	**0**	4
% Buses	0%	0%	**0%**	0.2%	0.8%	**0.3%**	0%	0%	**-**	0.2%

*L: Left, R: Right, T: Thru, U: U-Turn

N Interstate 35 Frontage Road & Kohlenberg R... - TMC
Thu Mar 4, 2021
Full Length (7 AM-9 AM, 4 PM-6 PM)
All Classes (Lights, Articulated Trucks and Single-Unit Trucks, Buses)
All Movements
ID: 816097, Location: 29.745942, -98.058107

GEWALT HAMILTON ASSOCIATES, INC.
Provided by: Gewalt Hamilton Associates Inc.
625 Forest Edge Drive, Vernon Hills, IL, 60061, US



N Interstate 35 Frontage Road & Kohlenberg R... - TMC

Thu Mar 4, 2021
Forced Peak (7:15 AM - 8:15 AM)
All Classes (Lights, Articulated Trucks and Single-Unit Trucks, Buses)
All Movements
ID: 816097, Location: 29.745942, -98.058107

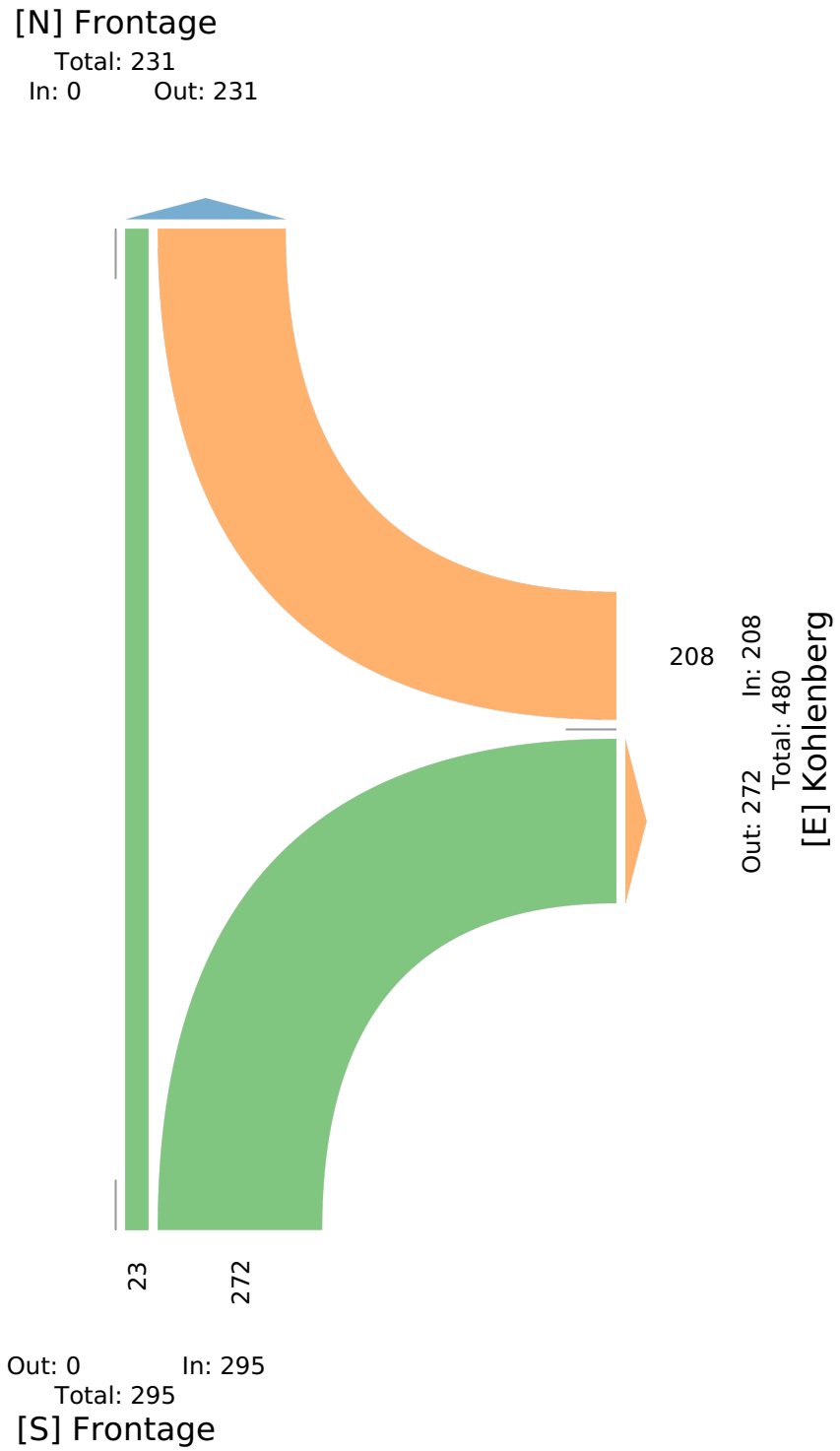
Provided by: Gewalt Hamilton Associates Inc.
625 Forest Edge Drive, Vernon Hills, IL, 60061, US

Leg Direction	Kohlenberg Westbound			Frontage Northbound			Frontage Southbound			
Time	R	U	**App**	R	T	**App**	L	U	**App**	**Int**
2021-03-04 7:15AM	54	0	**54**	63	6	**69**	0	0	**0**	**123**
7:30AM	64	0	**64**	59	5	**64**	0	0	**0**	**128**
7:45AM	50	0	**50**	69	4	**73**	0	0	**0**	**123**
8:00AM	40	0	**40**	81	8	**89**	0	0	**0**	**129**
Total	208	0	**208**	272	23	**295**	0	0	**0**	**503**
% Approach	100%	0%	**-**	92.2%	7.8%	**-**	0%	0%	**-**	-
% Total	41.4%	0%	**41.4%**	54.1%	4.6%	**58.6%**	0%	0%	**0%**	-
PHF	0.813	-	**0.813**	0.840	0.719	**0.829**	-	-	**-**	0.975
Lights	159	0	**159**	227	18	**245**	0	0	**0**	404
% Lights	76.4%	0%	**76.4%**	83.5%	78.3%	**83.1%**	0%	0%	**-**	80.3%
Articulated Trucks and Single-Unit Trucks	49	0	**49**	43	5	**48**	0	0	**0**	97
% Articulated Trucks and Single-Unit Trucks	23.6%	0%	**23.6%**	15.8%	21.7%	**16.3%**	0%	0%	**-**	19.3%
Buses	0	0	**0**	2	0	**2**	0	0	**0**	2
% Buses	0%	0%	**0%**	0.7%	0%	**0.7%**	0%	0%	**-**	0.4%

*L: Left, R: Right, T: Thru, U: U-Turn

N Interstate 35 Frontage Road & Kohlenberg R... - TMC
Thu Mar 4, 2021
Forced Peak (7:15 AM - 8:15 AM)
All Classes (Lights, Articulated Trucks and Single-Unit Trucks, Buses)
All Movements
ID: 816097, Location: 29.745942, -98.058107

Provided by: Gewalt Hamilton Associates Inc.
625 Forest Edge Drive, Vernon Hills, IL, 60061, US



N Interstate 35 Frontage Road & Kohlenberg R... - TMC

Thu Mar 4, 2021
Forced Peak (4:30 PM - 5:30 PM)
All Classes (Lights, Articulated Trucks and Single-Unit Trucks, Buses)
All Movements
ID: 816097, Location: 29.745942, -98.058107

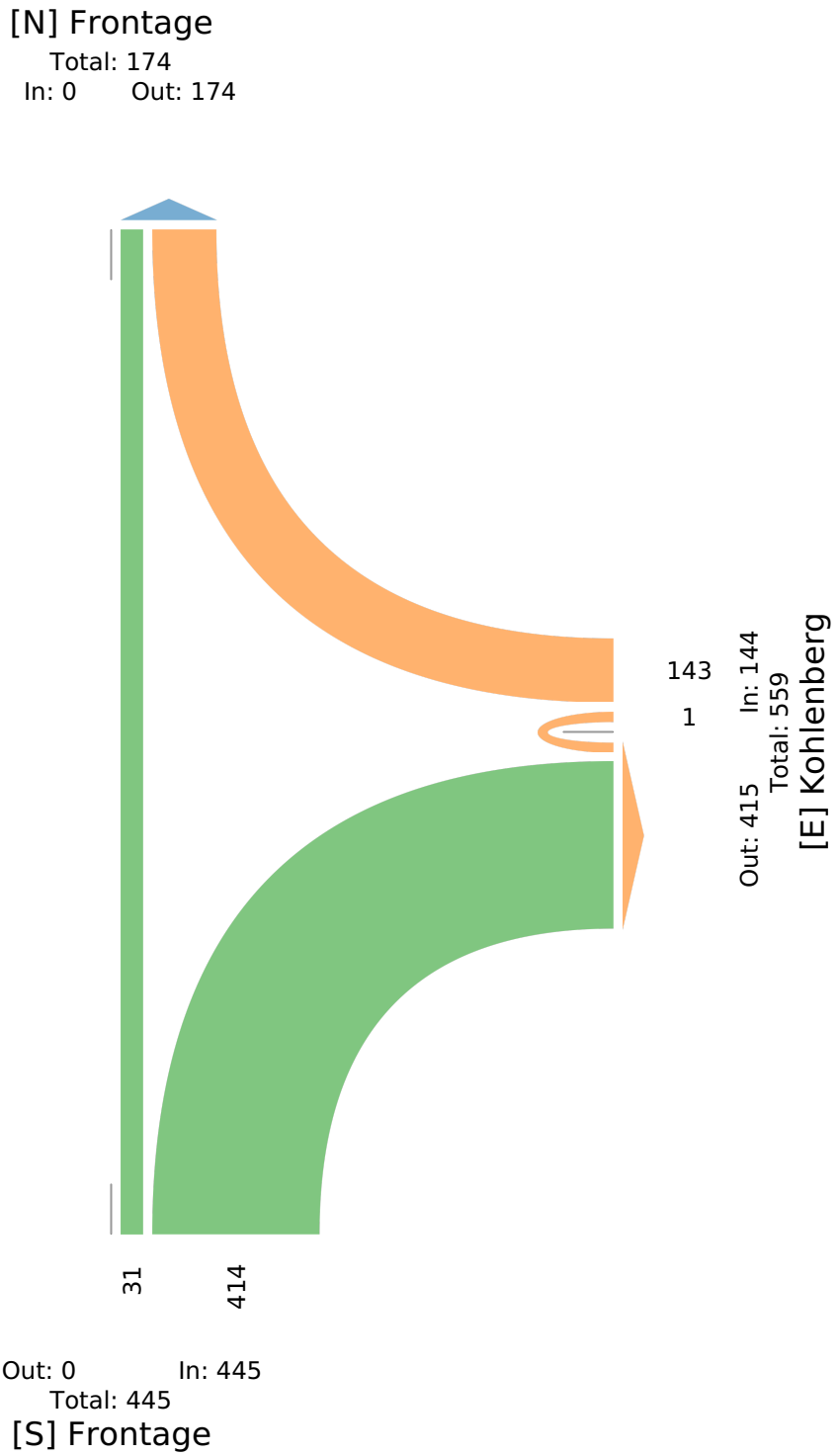
Provided by: Gewalt Hamilton Associates Inc.
625 Forest Edge Drive, Vernon Hills, IL, 60061, US

Leg Direction	Kohlenberg Westbound			Frontage Northbound			Frontage Southbound			
Time	R	U	**App**	R	T	**App**	L	U	**App**	**Int**
2021-03-04 4:30PM	30	0	**30**	113	6	**119**	0	0	**0**	**149**
4:45PM	33	0	**33**	96	9	**105**	0	0	**0**	**138**
5:00PM	45	0	**45**	107	5	**112**	0	0	**0**	**157**
5:15PM	35	1	**36**	98	11	**109**	0	0	**0**	**145**
Total	143	1	**144**	414	31	**445**	0	0	**0**	**589**
% Approach	99.3%	0.7%	**-**	93.0%	7.0%	**-**	0%	0%	**-**	-
% Total	24.3%	0.2%	**24.4%**	70.3%	5.3%	**75.6%**	0%	0%	**0%**	-
PHF	0.794	0.250	**0.800**	0.916	0.705	**0.935**	-	-	**-**	0.938
Lights	131	1	**132**	383	27	**410**	0	0	**0**	542
% Lights	91.6%	100%	**91.7%**	92.5%	87.1%	**92.1%**	0%	0%	**-**	92.0%
Articulated Trucks and Single-Unit Trucks	12	0	**12**	30	3	**33**	0	0	**0**	45
% Articulated Trucks and Single-Unit Trucks	8.4%	0%	**8.3%**	7.2%	9.7%	**7.4%**	0%	0%	**-**	7.6%
Buses	0	0	**0**	1	1	**2**	0	0	**0**	2
% Buses	0%	0%	**0%**	0.2%	3.2%	**0.4%**	0%	0%	**-**	0.3%

*L: Left, R: Right, T: Thru, U: U-Turn

N Interstate 35 Frontage Road & Kohlenberg R... - TMC
Thu Mar 4, 2021
Forced Peak (4:30 PM - 5:30 PM)
All Classes (Lights, Articulated Trucks and Single-Unit Trucks, Buses)
All Movements
ID: 816097, Location: 29.745942, -98.058107

Provided by: Gewalt Hamilton Associates Inc.
625 Forest Edge Drive, Vernon Hills, IL, 60061, US



N Interstate 35 Frontage Road & Overpass (ea... - TMC

Thu Mar 4, 2021
Full Length (7 AM-9 AM, 4 PM-6 PM)
All Classes (Lights, Articulated Trucks and Single-Unit Trucks, Buses)
All Movements
ID: 816098, Location: 29.745698, -98.057528

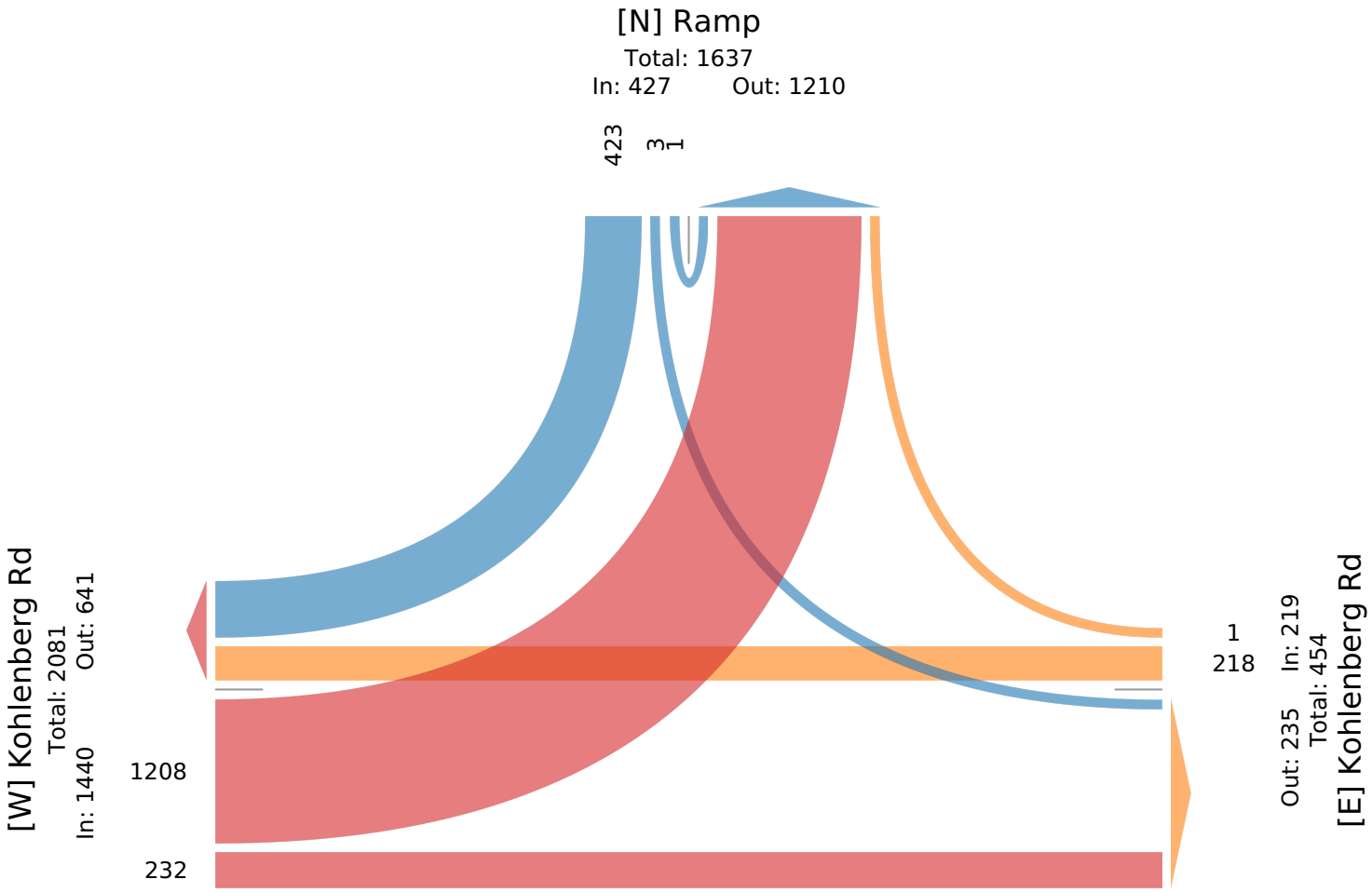
GEWALT HAMILTON ASSOCIATES, INC.
Provided by: Gewalt Hamilton Associates Inc.
625 Forest Edge Drive, Vernon Hills, IL, 60061, US

Leg	Kohlenberg Rd				Kohlenberg Rd				Ramp				
Direction	Eastbound				Westbound				Southbound				
Time	T	L	U	**App**	R	T	U	**App**	R	L	U	**App**	**Int**
2021-03-04 7:00AM	6	45	0	**51**	0	11	0	**11**	34	0	0	**34**	**96**
7:15AM	9	55	0	**64**	0	17	0	**17**	34	0	0	**34**	**115**
7:30AM	10	51	0	**61**	0	30	0	**30**	35	0	0	**35**	**126**
7:45AM	19	50	0	**69**	0	15	0	**15**	34	0	0	**34**	**118**
Hourly Total	44	201	0	**245**	0	73	0	**73**	137	0	0	**137**	**455**
8:00AM	16	64	0	**80**	1	11	0	**12**	29	0	0	**29**	**121**
8:15AM	12	62	0	**74**	0	9	0	**9**	30	1	0	**31**	**114**
8:30AM	9	70	0	**79**	0	13	0	**13**	31	0	0	**31**	**123**
8:45AM	8	85	0	**93**	0	6	0	**6**	25	0	0	**25**	**124**
Hourly Total	45	281	0	**326**	1	39	0	**40**	115	1	0	**116**	**482**
4:00PM	21	106	0	**127**	0	13	0	**13**	20	1	0	**21**	**161**
4:15PM	16	112	0	**128**	0	13	0	**13**	13	0	0	**13**	**154**
4:30PM	18	93	0	**111**	0	10	0	**10**	20	0	0	**20**	**141**
4:45PM	11	87	0	**98**	0	5	0	**5**	29	0	1	**30**	**133**
Hourly Total	66	398	0	**464**	0	41	0	**41**	82	1	1	**84**	**589**
5:00PM	23	84	0	**107**	0	22	0	**22**	23	0	0	**23**	**152**
5:15PM	16	84	0	**100**	0	14	0	**14**	22	1	0	**23**	**137**
5:30PM	21	82	0	**103**	0	16	0	**16**	23	0	0	**23**	**142**
5:45PM	17	78	0	**95**	0	13	0	**13**	21	0	0	**21**	**129**
Hourly Total	77	328	0	**405**	0	65	0	**65**	89	1	0	**90**	**560**
Total	232	1208	0	**1440**	1	218	0	**219**	423	3	1	**427**	**2086**
% Approach	16.1%	83.9%	0%	**-**	0.5%	99.5%	0%	**-**	99.1%	0.7%	0.2%	**-**	-
% Total	11.1%	57.9%	0%	**69.0%**	0%	10.5%	0%	**10.5%**	20.3%	0.1%	0%	**20.5%**	-
Lights	210	1048	0	**1258**	1	184	0	**185**	346	2	1	**349**	1792
% Lights	90.5%	86.8%	0%	**87.4%**	100%	84.4%	0%	**84.5%**	81.8%	66.7%	100%	**81.7%**	85.9%
Articulated Trucks and Single-Unit Trucks	22	158	0	**180**	0	34	0	**34**	77	1	0	**78**	292
% Articulated Trucks and Single-Unit Trucks	9.5%	13.1%	0%	**12.5%**	0%	15.6%	0%	**15.5%**	18.2%	33.3%	0%	**18.3%**	14.0%
Buses	0	2	0	**2**	0	0	0	**0**	0	0	0	**0**	2
% Buses	0%	0.2%	0%	**0.1%**	0%	0%	0%	**0%**	0%	0%	0%	**0%**	0.1%

*L: Left, R: Right, T: Thru, U: U-Turn

N Interstate 35 Frontage Road & Overpass (ea... - TMC
Thu Mar 4, 2021
Full Length (7 AM-9 AM, 4 PM-6 PM)
All Classes (Lights, Articulated Trucks and Single-Unit Trucks, Buses)
All Movements
ID: 816098, Location: 29.745698, -98.057528

GEWALT HAMILTON ASSOCIATES, INC.
Provided by: Gewalt Hamilton Associates Inc.
625 Forest Edge Drive, Vernon Hills, IL, 60061, US



N Interstate 35 Frontage Road & Overpass (ea... - TMC

Thu Mar 4, 2021
Forced Peak (7:15 AM - 8:15 AM)
All Classes (Lights, Articulated Trucks and Single-Unit Trucks, Buses)
All Movements
ID: 816098, Location: 29.745698, -98.057528

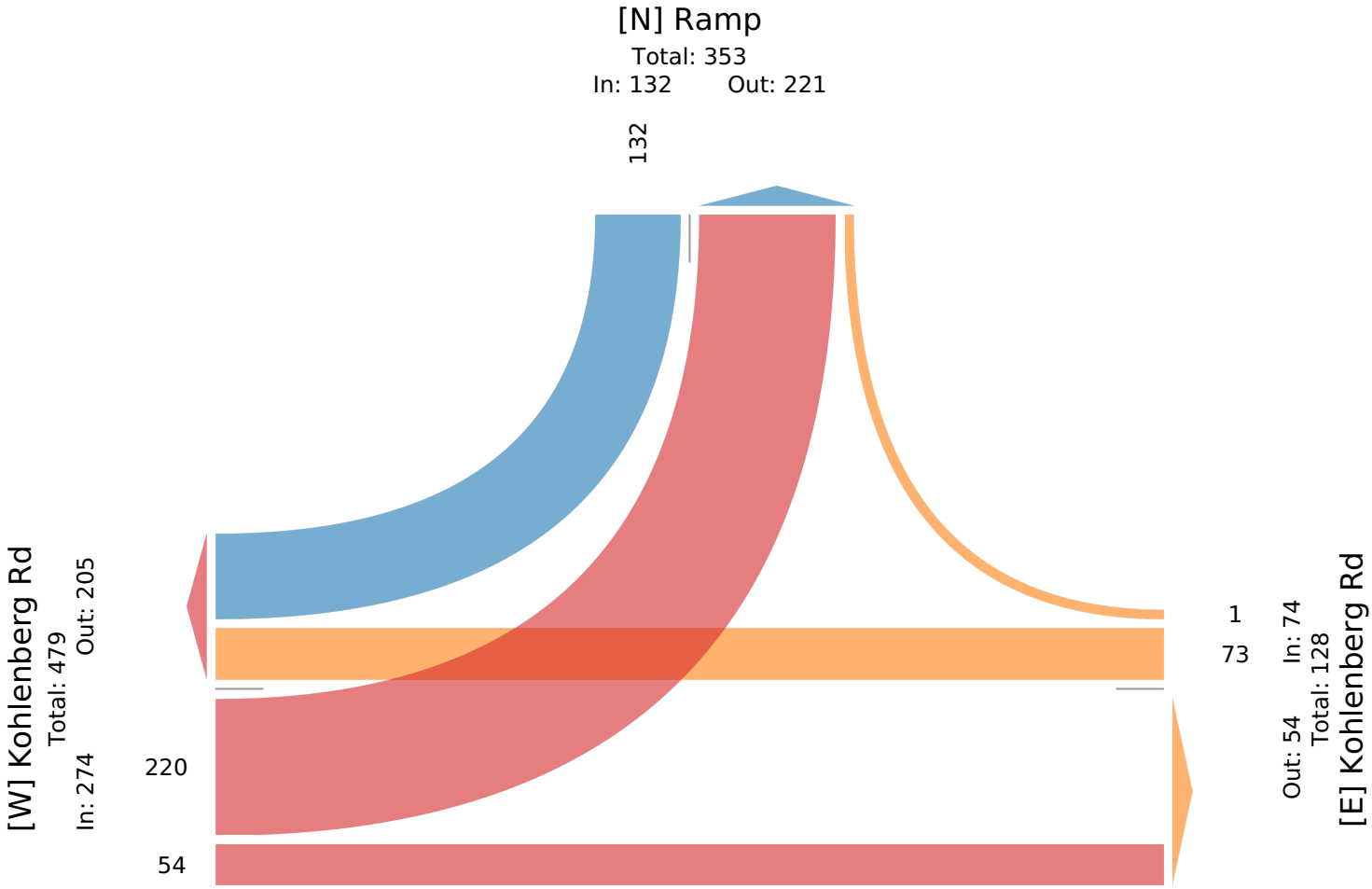
Provided by: Gewalt Hamilton Associates Inc.
625 Forest Edge Drive, Vernon Hills, IL, 60061, US

Leg	Kohlenberg Rd				Kohlenberg Rd				Ramp				
Direction	Eastbound				Westbound				Southbound				
Time	T	L	U	**App**	R	T	U	**App**	R	L	U	**App**	**Int**
2021-03-04 7:15AM	9	55	0	**64**	0	17	0	**17**	34	0	0	**34**	**115**
7:30AM	10	51	0	**61**	0	30	0	**30**	35	0	0	**35**	**126**
7:45AM	19	50	0	**69**	0	15	0	**15**	34	0	0	**34**	**118**
8:00AM	16	64	0	**80**	1	11	0	**12**	29	0	0	**29**	**121**
Total	54	220	0	**274**	1	73	0	**74**	132	0	0	**132**	**480**
% Approach	19.7%	80.3%	0%	**-**	1.4%	98.6%	0%	**-**	100%	0%	0%	**-**	-
% Total	11.3%	45.8%	0%	**57.1%**	0.2%	15.2%	0%	**15.4%**	27.5%	0%	0%	**27.5%**	-
PHF	0.711	0.859	-	**0.856**	0.250	0.608	-	**0.617**	0.943	-	-	**0.943**	0.952
Lights	45	181	0	**226**	1	52	0	**53**	103	0	0	**103**	382
% Lights	83.3%	82.3%	0%	**82.5%**	100%	71.2%	0%	**71.6%**	78.0%	0%	0%	**78.0%**	79.6%
Articulated Trucks and Single-Unit Trucks	9	37	0	**46**	0	21	0	**21**	29	0	0	**29**	96
% Articulated Trucks and Single-Unit Trucks	16.7%	16.8%	0%	**16.8%**	0%	28.8%	0%	**28.4%**	22.0%	0%	0%	**22.0%**	20.0%
Buses	0	2	0	**2**	0	0	0	**0**	0	0	0	**0**	2
% Buses	0%	0.9%	0%	**0.7%**	0%	0%	0%	**0%**	0%	0%	0%	**0%**	0.4%

*L: Left, R: Right, T: Thru, U: U-Turn

N Interstate 35 Frontage Road & Overpass (ea... - TMC
Thu Mar 4, 2021
Forced Peak (7:15 AM - 8:15 AM)
All Classes (Lights, Articulated Trucks and Single-Unit Trucks, Buses)
All Movements
ID: 816098, Location: 29.745698, -98.057528

Provided by: Gewalt Hamilton Associates Inc.
625 Forest Edge Drive, Vernon Hills, IL, 60061, US



N Interstate 35 Frontage Road & Overpass (ea... - TMC

Thu Mar 4, 2021
Forced Peak (4:30 PM - 5:30 PM)
All Classes (Lights, Articulated Trucks and Single-Unit Trucks, Buses)
All Movements
ID: 816098, Location: 29.745698, -98.057528

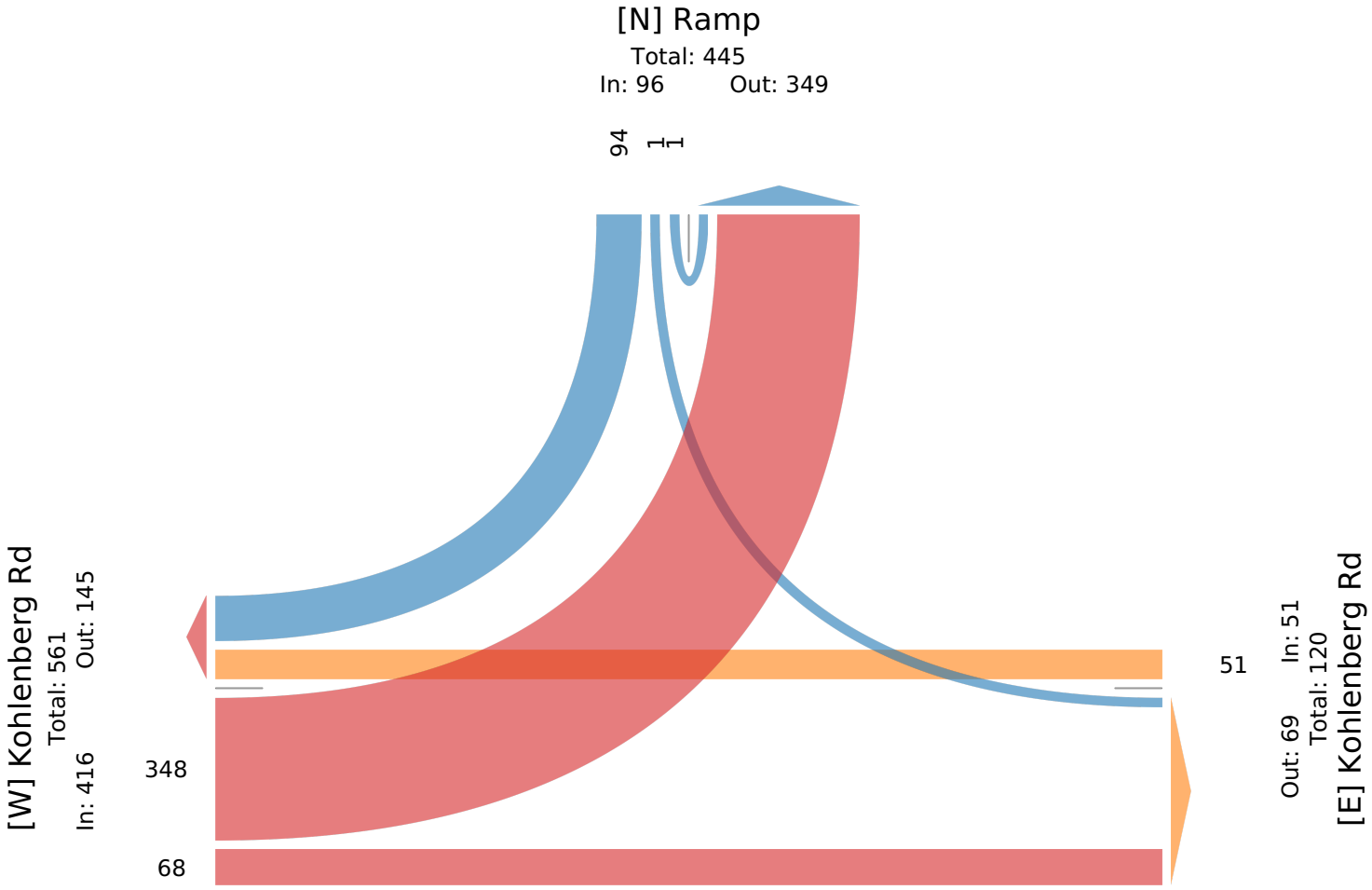
Provided by: Gewalt Hamilton Associates Inc.
625 Forest Edge Drive, Vernon Hills, IL, 60061, US

Leg Direction	Kohlenberg Rd Eastbound				Kohlenberg Rd Westbound				Ramp Southbound				
Time	T	L	U	**App**	R	T	U	**App**	R	L	U	**App**	**Int**
2021-03-04 4:30PM	18	93	0	**111**	0	10	0	**10**	20	0	0	**20**	**141**
4:45PM	11	87	0	**98**	0	5	0	**5**	29	0	1	**30**	**133**
5:00PM	23	84	0	**107**	0	22	0	**22**	23	0	0	**23**	**152**
5:15PM	16	84	0	**100**	0	14	0	**14**	22	1	0	**23**	**137**
Total	68	348	0	**416**	0	51	0	**51**	94	1	1	**96**	**563**
% Approach	16.3%	83.7%	0%	**-**	0%	100%	0%	**-**	97.9%	1.0%	1.0%	**-**	-
% Total	12.1%	61.8%	0%	**73.9%**	0%	9.1%	0%	**9.1%**	16.7%	0.2%	0.2%	**17.1%**	-
PHF	0.739	0.935	-	**0.937**	-	0.580	-	**0.580**	0.810	0.250	0.250	**0.800**	0.926
Lights	66	318	0	**384**	0	51	0	**51**	81	1	1	**83**	518
% Lights	97.1%	91.4%	0%	**92.3%**	0%	100%	0%	**100%**	86.2%	100%	100%	**86.5%**	92.0%
Articulated Trucks and Single-Unit Trucks	2	30	0	**32**	0	0	0	**0**	13	0	0	**13**	45
% Articulated Trucks and Single-Unit Trucks	2.9%	8.6%	0%	**7.7%**	0%	0%	0%	**0%**	13.8%	0%	0%	**13.5%**	8.0%
Buses	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	0
% Buses	0%	0%	0%	**0%**	0%	0%	0%	**0%**	0%	0%	0%	**0%**	0%

*L: Left, R: Right, T: Thru, U: U-Turn

N Interstate 35 Frontage Road & Overpass (ea... - TMC
Thu Mar 4, 2021
Forced Peak (4:30 PM - 5:30 PM)
All Classes (Lights, Articulated Trucks and Single-Unit Trucks, Buses)
All Movements
ID: 816098, Location: 29.745698, -98.057528

Provided by: Gewalt Hamilton Associates Inc.
625 Forest Edge Drive, Vernon Hills, IL, 60061, US



Kohlenberg Road & Overpass (east side) - TMC

Thu Mar 4, 2021
Full Length (7 AM-9 AM, 4 PM-6 PM)
All Classes (Lights, Articulated Trucks and Single-Unit Trucks, Buses)
All Movements
ID: 816099, Location: 29.746186, -98.057034

GEWALT HAMILTON ASSOCIATES, INC.
Provided by: Gewalt Hamilton Associates Inc.
625 Forest Edge Drive, Vernon Hills, IL, 60061, US

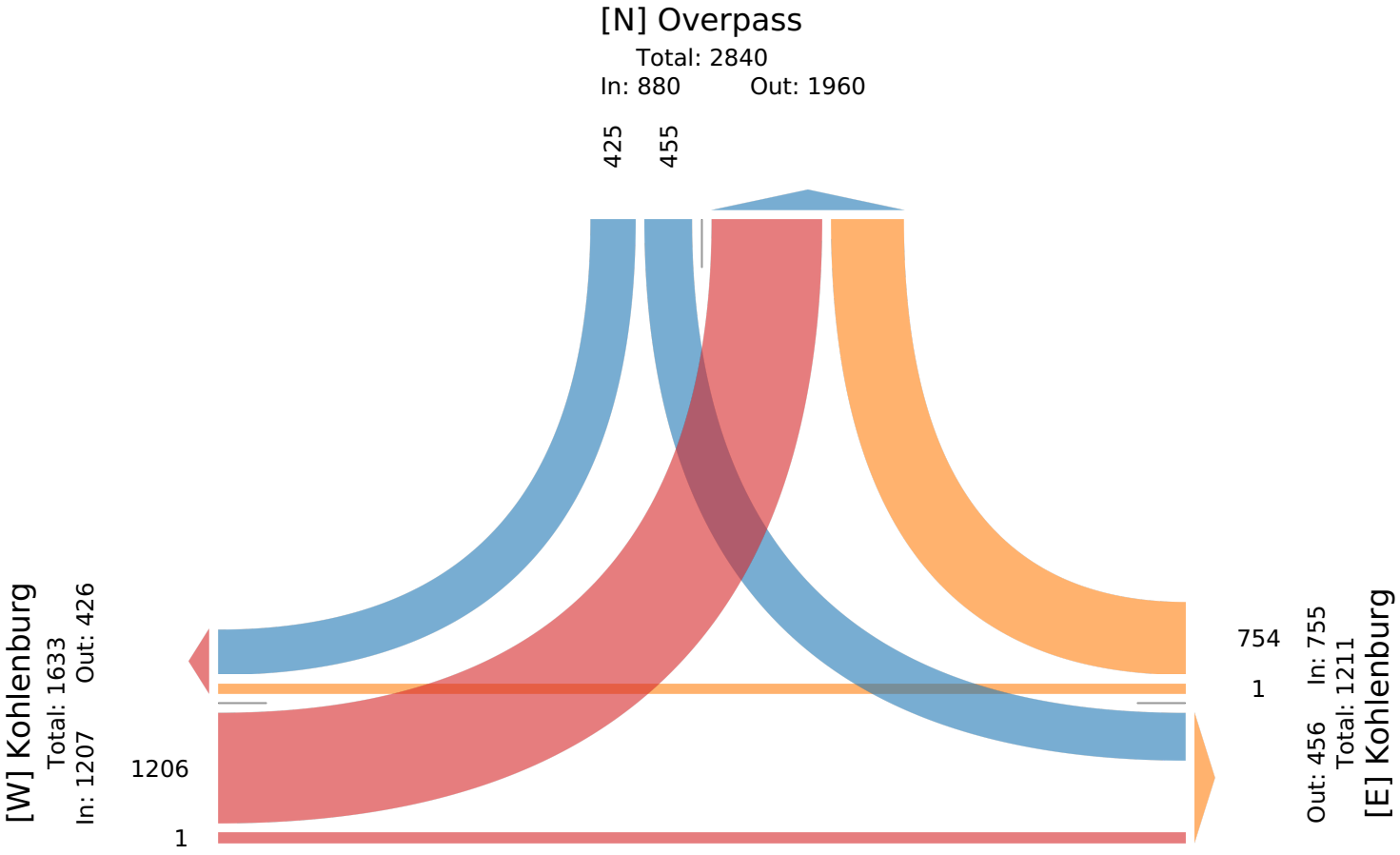
Leg	Kohlenburg				Kohlenburg				Overpass				
Direction	Eastbound				Westbound				Southbound				
Time	T	L	U	**App**	R	T	U	**App**	R	L	U	**App**	**Int**
2021-03-04 7:00AM	0	50	0	**50**	20	0	0	**20**	35	26	0	**61**	**131**
7:15AM	0	51	0	**51**	47	0	0	**47**	33	25	0	**58**	**156**
7:30AM	0	51	0	**51**	37	0	0	**37**	34	41	0	**75**	**163**
7:45AM	0	52	0	**52**	49	0	0	**49**	34	52	0	**86**	**187**
Hourly Total	0	204	0	**204**	153	0	0	**153**	136	144	0	**280**	**637**
8:00AM	1	64	0	**65**	38	0	0	**38**	29	36	0	**65**	**168**
8:15AM	0	61	0	**61**	29	0	0	**29**	32	18	0	**50**	**140**
8:30AM	0	71	0	**71**	16	0	0	**16**	31	24	0	**55**	**142**
8:45AM	0	82	0	**82**	33	0	0	**33**	25	21	0	**46**	**161**
Hourly Total	1	278	0	**279**	116	0	0	**116**	117	99	0	**216**	**611**
4:00PM	0	107	0	**107**	56	0	0	**56**	21	23	0	**44**	**207**
4:15PM	0	110	0	**110**	52	0	0	**52**	13	22	0	**35**	**197**
4:30PM	0	93	0	**93**	59	0	0	**59**	20	27	0	**47**	**199**
4:45PM	0	88	0	**88**	65	0	0	**65**	29	17	0	**46**	**199**
Hourly Total	0	398	0	**398**	232	0	0	**232**	83	89	0	**172**	**802**
5:00PM	0	87	0	**87**	56	0	0	**56**	23	33	0	**56**	**199**
5:15PM	0	82	0	**82**	80	0	0	**80**	23	43	0	**66**	**228**
5:30PM	0	81	0	**81**	63	0	0	**63**	23	14	0	**37**	**181**
5:45PM	0	76	0	**76**	54	1	0	**55**	20	33	0	**53**	**184**
Hourly Total	0	326	0	**326**	253	1	0	**254**	89	123	0	**212**	**792**
Total	1	1206	0	**1207**	754	1	0	**755**	425	455	0	**880**	**2842**
% Approach	0.1%	99.9%	0%	**-**	99.9%	0.1%	0%	**-**	48.3%	51.7%	0%	**-**	-
% Total	0%	42.4%	0%	**42.5%**	26.5%	0%	0%	**26.6%**	15.0%	16.0%	0%	**31.0%**	-
Lights	1	1048	0	**1049**	717	1	0	**718**	346	395	0	**741**	2508
% Lights	100%	86.9%	0%	**86.9%**	95.1%	100%	0%	**95.1%**	81.4%	86.8%	0%	**84.2%**	88.2%
Articulated Trucks and Single-Unit Trucks	0	156	0	**156**	27	0	0	**27**	79	58	0	**137**	320
% Articulated Trucks and Single-Unit Trucks	0%	12.9%	0%	**12.9%**	3.6%	0%	0%	**3.6%**	18.6%	12.7%	0%	**15.6%**	11.3%
Buses	0	2	0	**2**	10	0	0	**10**	0	2	0	**2**	14
% Buses	0%	0.2%	0%	**0.2%**	1.3%	0%	0%	**1.3%**	0%	0.4%	0%	**0.2%**	0.5%

*L: Left, R: Right, T: Thru, U: U-Turn

Kohlenberg Road & Overpass (east side) - TMC

Thu Mar 4, 2021
Full Length (7 AM-9 AM, 4 PM-6 PM)
All Classes (Lights, Articulated Trucks and Single-Unit Trucks, Buses)
All Movements
ID: 816099, Location: 29.746186, -98.057034

GEWALT HAMILTON ASSOCIATES, INC.
Provided by: Gewalt Hamilton Associates Inc.
625 Forest Edge Drive, Vernon Hills, IL, 60061, US



Kohlenberg Road & Overpass (east side) - TMC

Thu Mar 4, 2021
AM Peak (7:15 AM - 8:15 AM)
All Classes (Lights, Articulated Trucks and Single-Unit Trucks, Buses)
All Movements
ID: 816099, Location: 29.746186, -98.057034

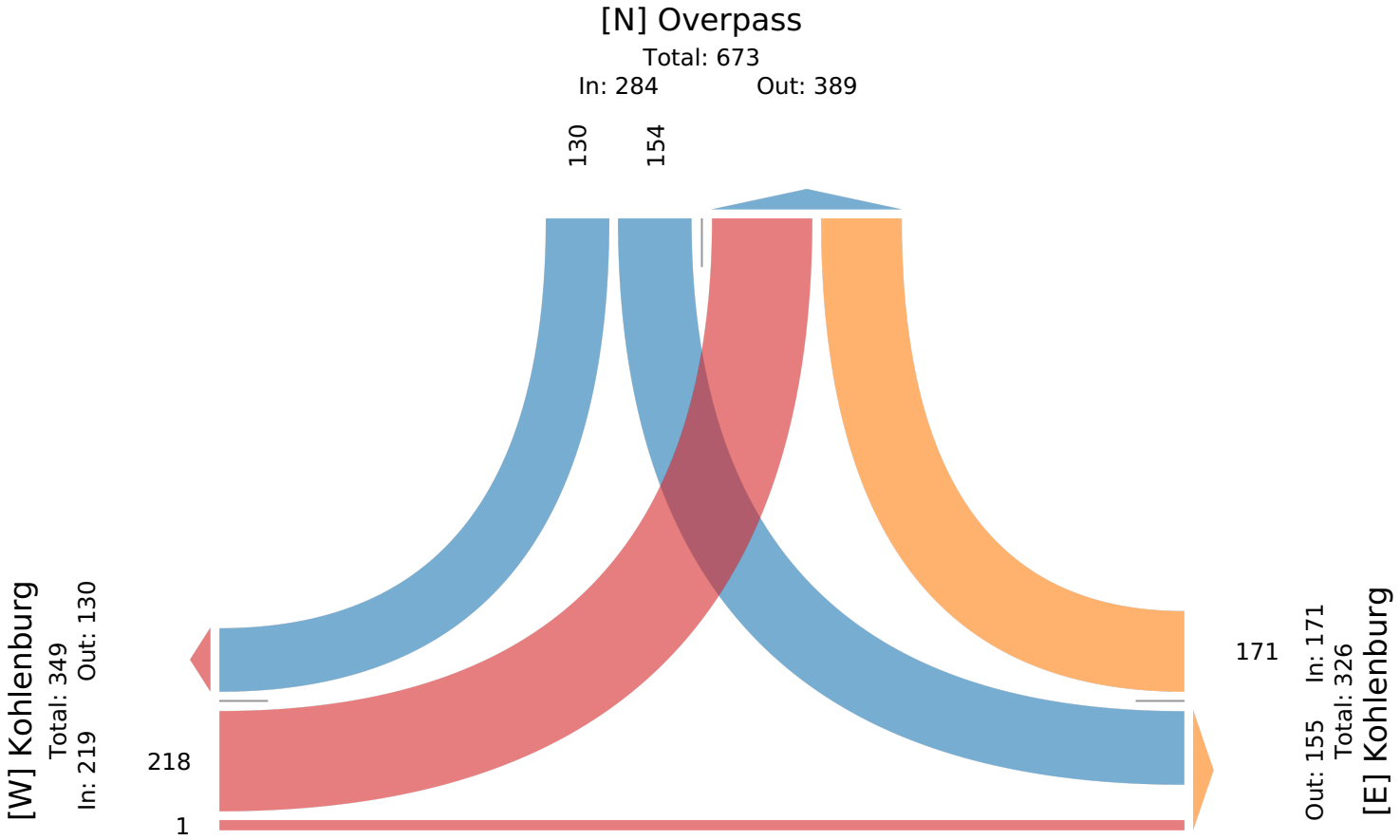
GEWALT HAMILTON ASSOCIATES, INC.
Provided by: Gewalt Hamilton Associates Inc.
625 Forest Edge Drive, Vernon Hills, IL, 60061, US

Leg	Kohlenburg				Kohlenburg				Overpass				
Direction	Eastbound				Westbound				Southbound				
Time	T	L	U	**App**	R	T	U	**App**	R	L	U	**App**	**Int**
2021-03-04 7:15AM	0	51	0	**51**	47	0	0	**47**	33	25	0	**58**	**156**
7:30AM	0	51	0	**51**	37	0	0	**37**	34	41	0	**75**	**163**
7:45AM	0	52	0	**52**	49	0	0	**49**	34	52	0	**86**	**187**
8:00AM	1	64	0	**65**	38	0	0	**38**	29	36	0	**65**	**168**
Total	1	218	0	**219**	171	0	0	**171**	130	154	0	**284**	**674**
% Approach	0.5%	99.5%	0%	**-**	100%	0%	0%	**-**	45.8%	54.2%	0%	**-**	-
% Total	0.1%	32.3%	0%	**32.5%**	25.4%	0%	0%	**25.4%**	19.3%	22.8%	0%	**42.1%**	-
PHF	0.250	0.852	-	**0.842**	0.872	-	-	**0.872**	0.956	0.740	-	**0.826**	0.901
Lights	1	181	0	**182**	160	0	0	**160**	101	130	0	**231**	573
% Lights	100%	83.0%	0%	**83.1%**	93.6%	0%	0%	**93.6%**	77.7%	84.4%	0%	**81.3%**	85.0%
Articulated Trucks and Single-Unit Trucks	0	35	0	**35**	8	0	0	**8**	29	24	0	**53**	96
% Articulated Trucks and Single-Unit Trucks	0%	16.1%	0%	**16.0%**	4.7%	0%	0%	**4.7%**	22.3%	15.6%	0%	**18.7%**	14.2%
Buses	0	2	0	**2**	3	0	0	**3**	0	0	0	**0**	5
% Buses	0%	0.9%	0%	**0.9%**	1.8%	0%	0%	**1.8%**	0%	0%	0%	**0%**	0.7%

*L: Left, R: Right, T: Thru, U: U-Turn

Kohlenberg Road & Overpass (east side) - TMC
Thu Mar 4, 2021
AM Peak (7:15 AM - 8:15 AM)
All Classes (Lights, Articulated Trucks and Single-Unit Trucks, Buses)
All Movements
ID: 816099, Location: 29.746186, -98.057034

Provided by: Gewalt Hamilton Associates Inc.
625 Forest Edge Drive, Vernon Hills, IL, 60061, US



Kohlenberg Road & Overpass (east side) - TMC

Thu Mar 4, 2021
PM Peak (4:30 PM - 5:30 PM) - Overall Peak Hour
All Classes (Lights, Articulated Trucks and Single-Unit Trucks, Buses)
All Movements
ID: 816099, Location: 29.746186, -98.057034

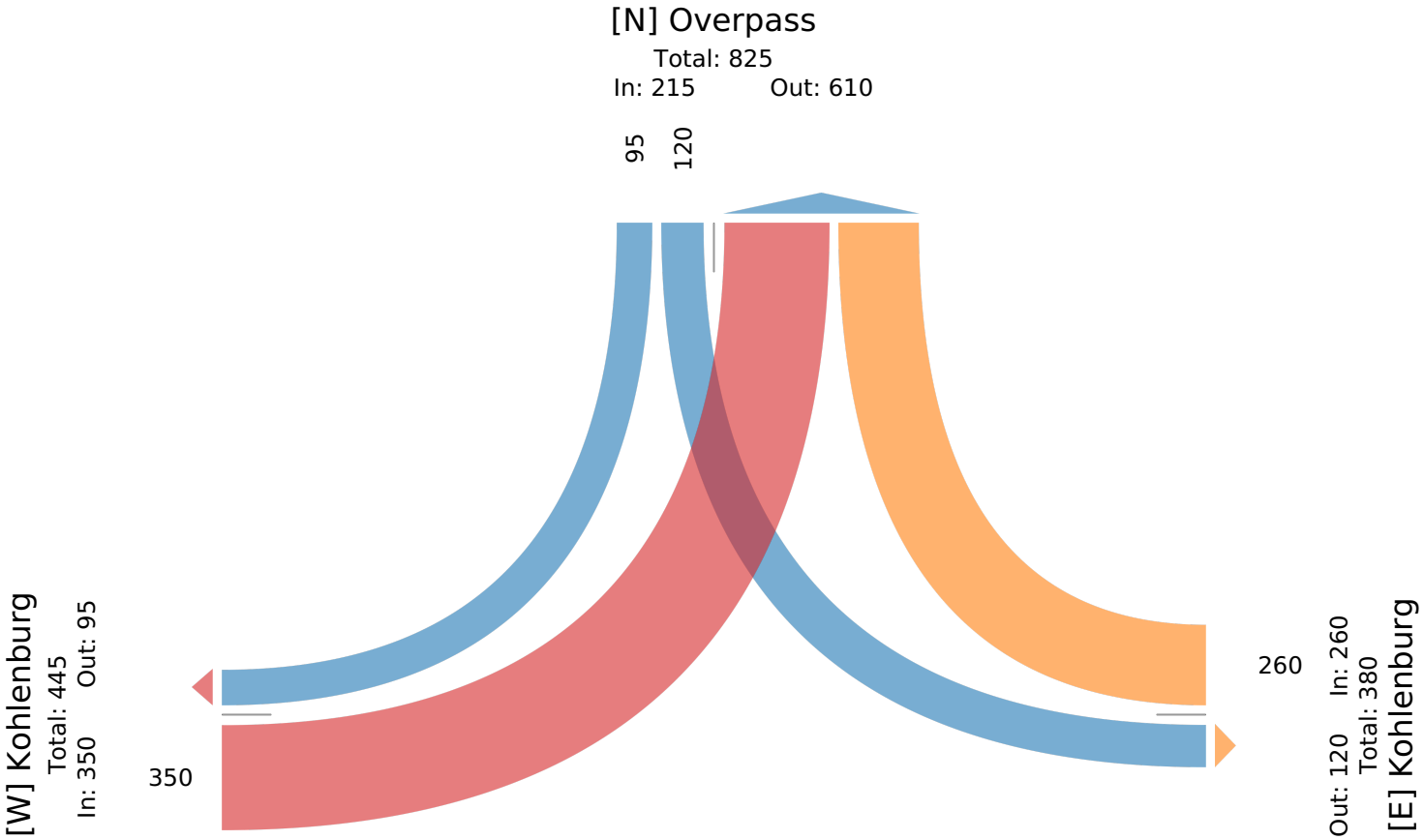
GEWALT HAMILTON ASSOCIATES, INC.
Provided by: Gewalt Hamilton Associates Inc.
625 Forest Edge Drive, Vernon Hills, IL, 60061, US

Leg	Kohlenburg				Kohlenburg				Overpass				
Direction	Eastbound				Westbound				Southbound				
Time	T	L	U	**App**	R	T	U	**App**	R	L	U	**App**	**Int**
2021-03-04 4:30PM	0	93	0	**93**	59	0	0	**59**	20	27	0	**47**	**199**
4:45PM	0	88	0	**88**	65	0	0	**65**	29	17	0	**46**	**199**
5:00PM	0	87	0	**87**	56	0	0	**56**	23	33	0	**56**	**199**
5:15PM	0	82	0	**82**	80	0	0	**80**	23	43	0	**66**	**228**
Total	0	350	0	**350**	260	0	0	**260**	95	120	0	**215**	**825**
% Approach	0%	100%	0%	**-**	100%	0%	0%	**-**	44.2%	55.8%	0%	**-**	-
% Total	0%	42.4%	0%	**42.4%**	31.5%	0%	0%	**31.5%**	11.5%	14.5%	0%	**26.1%**	-
PHF	-	0.941	-	**0.941**	0.813	-	-	**0.813**	0.819	0.698	-	**0.814**	0.905
Lights	0	320	0	**320**	252	0	0	**252**	83	113	0	**196**	768
% Lights	0%	91.4%	0%	**91.4%**	96.9%	0%	0%	**96.9%**	87.4%	94.2%	0%	**91.2%**	93.1%
Articulated Trucks and Single-Unit Trucks	0	30	0	**30**	4	0	0	**4**	12	5	0	**17**	51
% Articulated Trucks and Single-Unit Trucks	0%	8.6%	0%	**8.6%**	1.5%	0%	0%	**1.5%**	12.6%	4.2%	0%	**7.9%**	6.2%
Buses	0	0	0	**0**	4	0	0	**4**	0	2	0	**2**	6
% Buses	0%	0%	0%	**0%**	1.5%	0%	0%	**1.5%**	0%	1.7%	0%	**0.9%**	0.7%

*L: Left, R: Right, T: Thru, U: U-Turn

Kohlenberg Road & Overpass (east side) - TMC
Thu Mar 4, 2021
PM Peak (4:30 PM - 5:30 PM) - Overall Peak Hour
All Classes (Lights, Articulated Trucks and Single-Unit Trucks, Buses)
All Movements
ID: 816099, Location: 29.746186, -98.057034

GEWALT HAMILTON ASSOCIATES, INC.
Provided by: Gewalt Hamilton Associates Inc.
625 Forest Edge Drive, Vernon Hills, IL, 60061, US



Conrads Lane & Overpass (west side) - TMC

Thu Mar 4, 2021
Full Length (7 AM-9 AM, 4 PM-6 PM)
All Classes (Lights, Articulated Trucks and Single-Unit Trucks, Buses)
All Movements
ID: 816100, Location: 29.74803, -98.058311

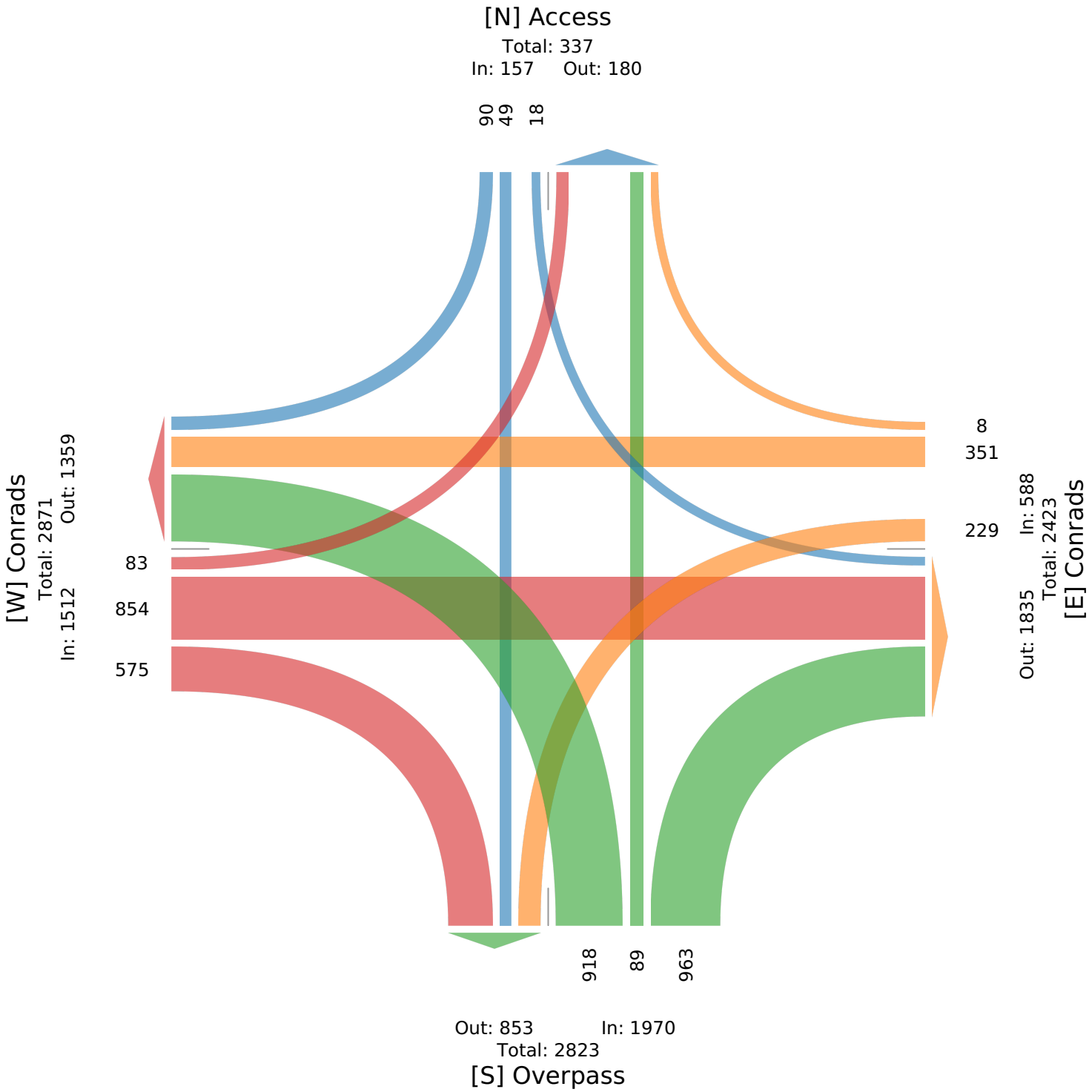
GEWALT HAMILTON ASSOCIATES, INC.
Provided by: Gewalt Hamilton Associates Inc.
625 Forest Edge Drive, Vernon Hills, IL, 60061, US

Leg / Direction	Conrads Eastbound					Conrads Westbound					Overpass Northbound					Access Southbound					
Time	R	T	L	U	App	R	T	L	U	App	R	T	L	U	App	R	T	L	U	App	Int
2021-03-04 7:00AM	46	61	3	0	**110**	0	20	12	0	**32**	35	6	34	0	**75**	3	3	1	0	**7**	**224**
7:15AM	47	91	9	0	**147**	1	18	6	0	**25**	42	7	45	0	**94**	10	3	1	0	**14**	**280**
7:30AM	66	63	8	0	**137**	1	15	13	0	**29**	44	7	35	0	**86**	5	1	0	0	**6**	**258**
7:45AM	55	63	3	0	**121**	1	19	19	0	**39**	58	6	39	0	**103**	5	5	0	0	**10**	**273**
Hourly Total	214	278	23	0	**515**	3	72	50	0	**125**	179	26	153	0	**358**	23	12	2	0	**37**	**1035**
8:00AM	48	63	0	0	**111**	0	20	15	0	**35**	44	4	47	0	**95**	4	1	0	0	**5**	**246**
8:15AM	34	47	5	0	**86**	0	24	10	0	**34**	41	7	55	0	**103**	5	3	2	0	**10**	**233**
8:30AM	40	63	7	0	**110**	0	12	12	0	**24**	44	7	32	0	**83**	4	4	1	0	**9**	**226**
8:45AM	26	36	3	0	**65**	1	14	14	0	**29**	61	4	50	0	**115**	3	2	2	0	**7**	**216**
Hourly Total	148	209	15	0	**372**	1	70	51	0	**122**	190	22	184	0	**396**	16	10	5	0	**31**	**921**
4:00PM	24	50	6	0	**80**	3	23	14	0	**40**	94	7	70	0	**171**	2	1	3	0	**6**	**297**
4:15PM	21	36	9	0	**66**	0	26	7	0	**33**	88	9	77	0	**174**	8	6	2	0	**16**	**289**
4:30PM	21	55	5	0	**81**	0	26	18	0	**44**	72	1	72	0	**145**	8	5	0	0	**13**	**283**
4:45PM	28	47	6	0	**81**	0	24	12	0	**36**	78	6	73	0	**157**	8	4	2	0	**14**	**288**
Hourly Total	94	188	26	0	**308**	3	99	51	0	**153**	332	23	292	0	**647**	26	16	7	0	**49**	**1157**
5:00PM	31	52	3	0	**86**	0	21	21	0	**42**	57	2	65	0	**124**	5	2	1	0	**8**	**260**
5:15PM	37	41	4	0	**82**	0	38	24	0	**62**	85	6	79	0	**170**	8	4	0	0	**12**	**326**
5:30PM	23	39	7	0	**69**	1	27	12	0	**40**	60	4	74	0	**138**	5	2	3	0	**10**	**257**
5:45PM	28	47	5	0	**80**	0	24	20	0	**44**	60	6	71	0	**137**	7	3	0	0	**10**	**271**
Hourly Total	119	179	19	0	**317**	1	110	77	0	**188**	262	18	289	0	**569**	25	11	4	0	**40**	**1114**
Total	575	854	83	0	**1512**	8	351	229	0	**588**	963	89	918	0	**1970**	90	49	18	0	**157**	**4227**
% Approach	38.0%	56.5%	5.5%	0%	-	1.4%	59.7%	38.9%	0%	-	48.9%	4.5%	46.6%	0%	-	57.3%	31.2%	11.5%	0%	-	-
% Total	13.6%	20.2%	2.0%	0%	**35.8%**	0.2%	8.3%	5.4%	0%	**13.9%**	22.8%	2.1%	21.7%	0%	**46.6%**	2.1%	1.2%	0.4%	0%	**3.7%**	-
Lights	502	659	82	0	**1243**	8	216	177	0	**401**	867	84	818	0	**1769**	87	43	17	0	**147**	3560
% Lights	87.3%	77.2%	98.8%	0%	**82.2%**	100%	61.5%	77.3%	0%	**68.2%**	90.0%	94.4%	89.1%	0%	**89.8%**	96.7%	87.8%	94.4%	0%	**93.6%**	84.2%
Articulated Trucks and Single-Unit Trucks	72	192	1	0	**265**	0	133	52	0	**185**	94	5	90	0	**189**	3	6	1	0	**10**	649
% Articulated Trucks and Single-Unit Trucks	12.5%	22.5%	1.2%	0%	**17.5%**	0%	37.9%	22.7%	0%	**31.5%**	9.8%	5.6%	9.8%	0%	**9.6%**	3.3%	12.2%	5.6%	0%	**6.4%**	15.4%
Buses	1	3	0	0	**4**	0	2	0	0	**2**	2	0	10	0	**12**	0	0	0	0	**0**	18
% Buses	0.2%	0.4%	0%	0%	**0.3%**	0%	0.6%	0%	0%	**0.3%**	0.2%	0%	1.1%	0%	**0.6%**	0%	0%	0%	0%	**0%**	0.4%

*L: Left, R: Right, T: Thru, U: U-Turn

Conrads Lane & Overpass (west side) - TMC
Thu Mar 4, 2021
Full Length (7 AM-9 AM, 4 PM-6 PM)
All Classes (Lights, Articulated Trucks and Single-Unit Trucks, Buses)
All Movements
ID: 816100, Location: 29.74803, -98.058311

Provided by: Gewalt Hamilton Associates Inc.
625 Forest Edge Drive, Vernon Hills, IL, 60061, US



Conrads Lane & Overpass (west side) - TMC

Thu Mar 4, 2021
AM Peak (7:15 AM - 8:15 AM)
All Classes (Lights, Articulated Trucks and Single-Unit Trucks, Buses)
All Movements
ID: 816100, Location: 29.74803, -98.058311

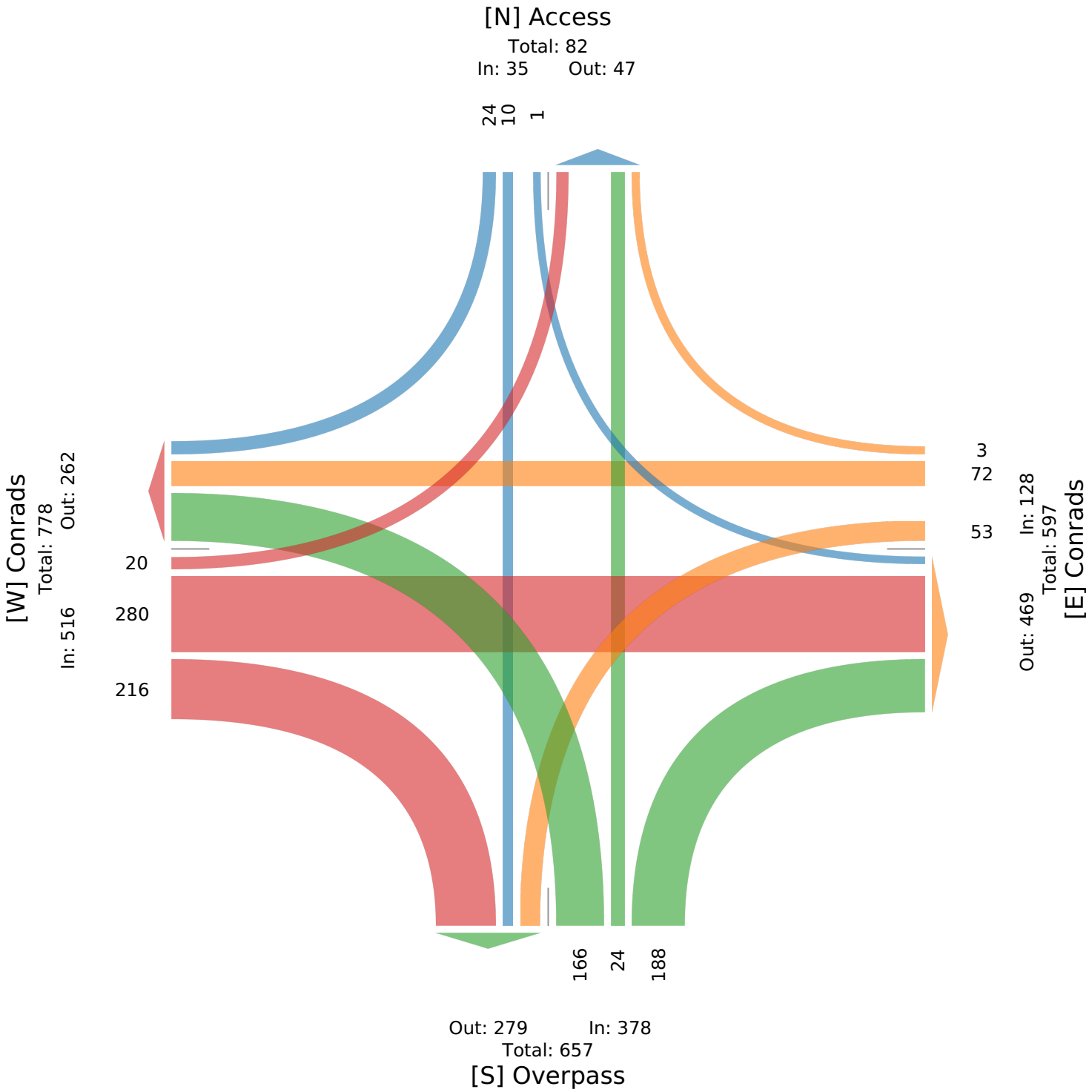
Provided by: Gewalt Hamilton Associates Inc.
625 Forest Edge Drive, Vernon Hills, IL, 60061, US

Leg	Conrads					Conrads					Overpass					Access					
Direction	Eastbound					Westbound					Northbound					Southbound					
Time	R	T	L	U	App	R	T	L	U	App	R	T	L	U	App	R	T	L	U	App	Int
2021-03-04 7:15AM	47	91	9	0	**147**	1	18	6	0	**25**	42	7	45	0	**94**	10	3	1	0	**14**	**280**
7:30AM	66	63	8	0	**137**	1	15	13	0	**29**	44	7	35	0	**86**	5	1	0	0	**6**	**258**
7:45AM	55	63	3	0	**121**	1	19	19	0	**39**	58	6	39	0	**103**	5	5	0	0	**10**	**273**
8:00AM	48	63	0	0	**111**	0	20	15	0	**35**	44	4	47	0	**95**	4	1	0	0	**5**	**246**
Total	216	280	20	0	**516**	3	72	53	0	**128**	188	24	166	0	**378**	24	10	1	0	**35**	**1057**
% Approach	41.9%	54.3%	3.9%	0%	-	2.3%	56.3%	41.4%	0%	-	49.7%	6.3%	43.9%	0%	-	68.6%	28.6%	2.9%	0%	-	-
% Total	20.4%	26.5%	1.9%	0%	**48.8%**	0.3%	6.8%	5.0%	0%	**12.1%**	17.8%	2.3%	15.7%	0%	**35.8%**	2.3%	0.9%	0.1%	0%	**3.3%**	-
PHF	0.818	0.769	0.556	-	**0.878**	0.750	0.900	0.697	-	**0.821**	0.810	0.857	0.883	-	**0.917**	0.600	0.500	0.250	-	**0.625**	0.944
Lights	187	212	20	0	**419**	3	40	29	0	**72**	167	23	142	0	**332**	24	9	1	0	**34**	857
% Lights	86.6%	75.7%	100%	0%	**81.2%**	100%	55.6%	54.7%	0%	**56.3%**	88.8%	95.8%	85.5%	0%	**87.8%**	100%	90.0%	100%	0%	**97.1%**	81.1%
Articulated Trucks and Single-Unit Trucks	29	67	0	0	**96**	0	31	24	0	**55**	20	1	20	0	**41**	0	1	0	0	**1**	193
% Articulated Trucks and Single-Unit Trucks	13.4%	23.9%	0%	0%	**18.6%**	0%	43.1%	45.3%	0%	**43.0%**	10.6%	4.2%	12.0%	0%	**10.8%**	0%	10.0%	0%	0%	**2.9%**	18.3%
Buses	0	1	0	0	**1**	0	1	0	0	**1**	1	0	4	0	**5**	0	0	0	0	**0**	7
% Buses	0%	0.4%	0%	0%	**0.2%**	0%	1.4%	0%	0%	**0.8%**	0.5%	0%	2.4%	0%	**1.3%**	0%	0%	0%	0%	**0%**	0.7%

*L: Left, R: Right, T: Thru, U: U-Turn

Conrads Lane & Overpass (west side) - TMC
Thu Mar 4, 2021
AM Peak (7:15 AM - 8:15 AM)
All Classes (Lights, Articulated Trucks and Single-Unit Trucks, Buses)
All Movements
ID: 816100, Location: 29.74803, -98.058311

Provided by: Gewalt Hamilton Associates Inc.
625 Forest Edge Drive, Vernon Hills, IL, 60061, US



Conrads Lane & Overpass (west side) - TMC

Thu Mar 4, 2021
Forced Peak (4:30 PM - 5:30 PM)
All Classes (Lights, Articulated Trucks and Single-Unit Trucks, Buses)
All Movements
ID: 816100, Location: 29.74803, -98.058311

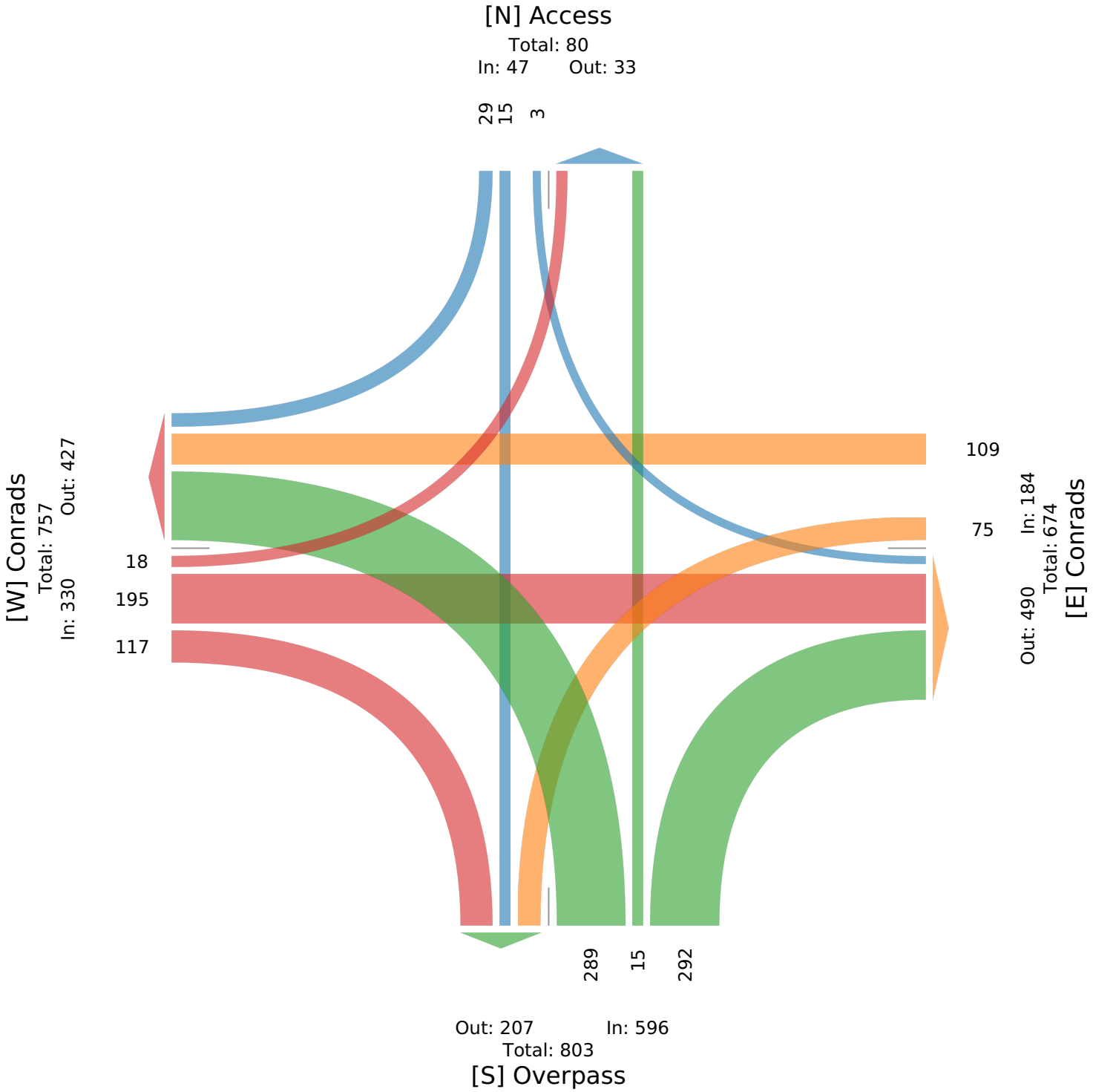
Provided by: Gewalt Hamilton Associates Inc.
625 Forest Edge Drive, Vernon Hills, IL, 60061, US

Leg	Conrads					Conrads					Overpass					Access					
Direction	Eastbound					Westbound					Northbound					Southbound					
Time	R	T	L	U	**App**	R	T	L	U	**App**	R	T	L	U	**App**	R	T	L	U	**App**	**Int**
2021-03-04 4:30PM	21	55	5	0	**81**	0	26	18	0	**44**	72	1	72	0	**145**	8	5	0	0	**13**	**283**
4:45PM	28	47	6	0	**81**	0	24	12	0	**36**	78	6	73	0	**157**	8	4	2	0	**14**	**288**
5:00PM	31	52	3	0	**86**	0	21	21	0	**42**	57	2	65	0	**124**	5	2	1	0	**8**	**260**
5:15PM	37	41	4	0	**82**	0	38	24	0	**62**	85	6	79	0	**170**	8	4	0	0	**12**	**326**
Total	117	195	18	0	**330**	0	109	75	0	**184**	292	15	289	0	**596**	29	15	3	0	**47**	**1157**
% Approach	35.5%	59.1%	5.5%	0%	**-**	0%	59.2%	40.8%	0%	**-**	49.0%	2.5%	48.5%	0%	**-**	61.7%	31.9%	6.4%	0%	**-**	-
% Total	10.1%	16.9%	1.6%	0%	**28.5%**	0%	9.4%	6.5%	0%	**15.9%**	25.2%	1.3%	25.0%	0%	**51.5%**	2.5%	1.3%	0.3%	0%	**4.1%**	-
PHF	0.791	0.886	0.750	-	**0.959**	-	0.717	0.781	-	**0.742**	0.859	0.625	0.915	-	**0.876**	0.906	0.750	0.375	-	**0.839**	0.887
Lights	106	168	18	0	**292**	0	72	70	0	**142**	274	13	269	0	**556**	27	15	3	0	**45**	1035
% Lights	90.6%	86.2%	100%	0%	**88.5%**	0%	66.1%	93.3%	0%	**77.2%**	93.8%	86.7%	93.1%	0%	**93.3%**	93.1%	100%	100%	0%	**95.7%**	89.5%
Articulated Trucks and Single-Unit Trucks	10	27	0	0	**37**	0	37	5	0	**42**	17	2	17	0	**36**	2	0	0	0	**2**	117
% Articulated Trucks and Single-Unit Trucks	8.5%	13.8%	0%	0%	**11.2%**	0%	33.9%	6.7%	0%	**22.8%**	5.8%	13.3%	5.9%	0%	**6.0%**	6.9%	0%	0%	0%	**4.3%**	10.1%
Buses	1	0	0	0	**1**	0	0	0	0	**0**	1	0	3	0	**4**	0	0	0	0	**0**	5
% Buses	0.9%	0%	0%	0%	**0.3%**	0%	0%	0%	0%	**0%**	0.3%	0%	1.0%	0%	**0.7%**	0%	0%	0%	0%	**0%**	0.4%

*L: Left, R: Right, T: Thru, U: U-Turn

Conrads Lane & Overpass (west side) - TMC
Thu Mar 4, 2021
Forced Peak (4:30 PM - 5:30 PM)
All Classes (Lights, Articulated Trucks and Single-Unit Trucks, Buses)
All Movements
ID: 816100, Location: 29.74803, -98.058311

GHA GEWALT HAMILTON ASSOCIATES, INC.
Provided by: Gewalt Hamilton Associates Inc.
625 Forest Edge Drive, Vernon Hills, IL, 60061, US



S Interstate 35 Frontage Road & Conrads Lane - TMC

Thu Mar 4, 2021
Full Length (7 AM-9 AM, 4 PM-6 PM)
All Classes (Lights, Articulated Trucks and Single-Unit Trucks, Buses)
All Movements
ID: 816101, Location: 29.747754, -98.057758

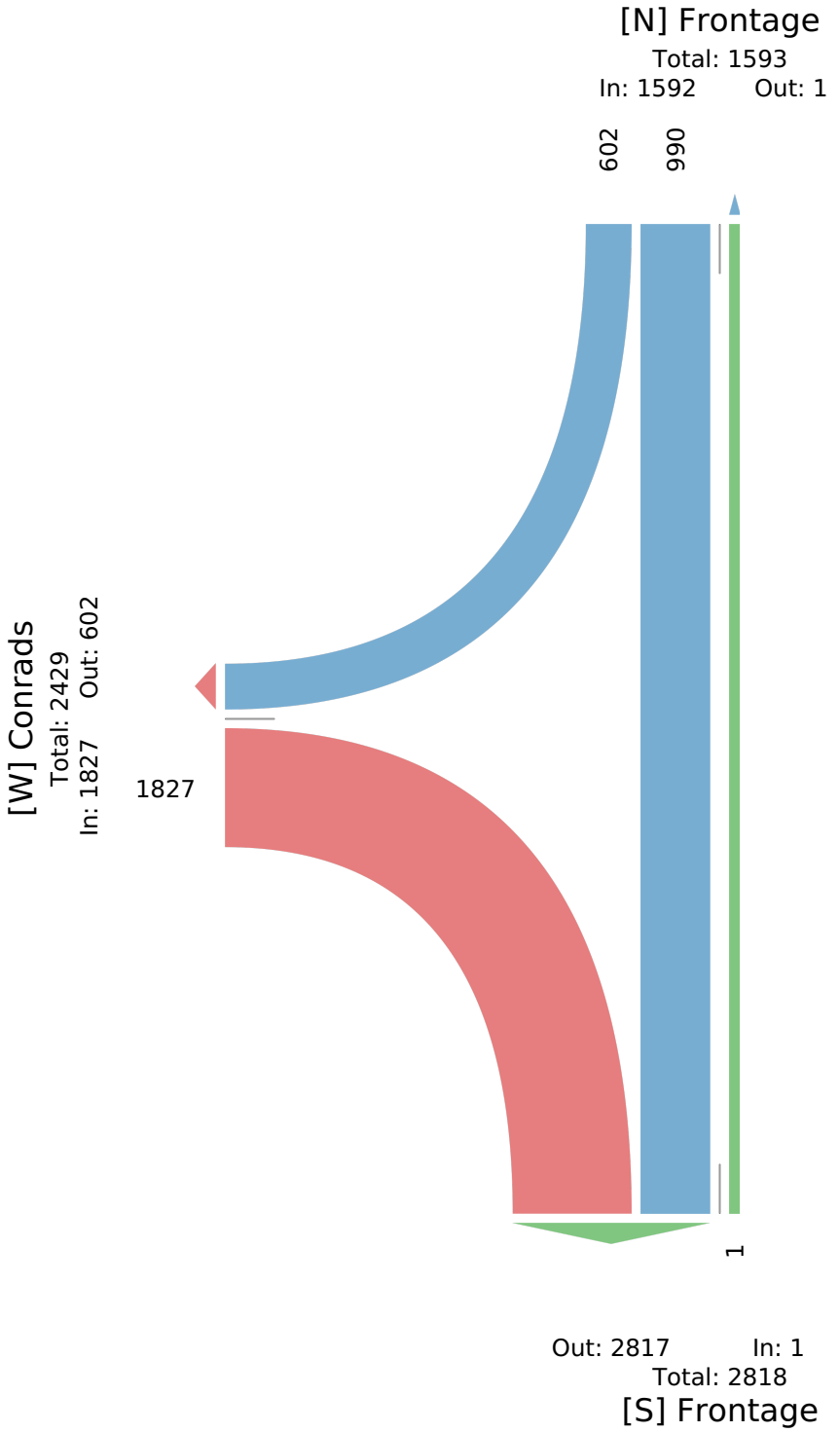
GEWALT HAMILTON ASSOCIATES, INC.
Provided by: Gewalt Hamilton Associates Inc.
625 Forest Edge Drive, Vernon Hills, IL, 60061, US

Leg	Conrads				Frontage				Frontage				
Direction	Eastbound				Northbound				Southbound				
Time	L	R	U	**App**	L	T	U	**App**	T	R	U	**App**	**Int**
2021-03-04 7:00AM	0	94	0	**94**	0	0	0	**0**	26	31	0	**57**	**151**
7:15AM	0	132	0	**132**	0	0	0	**0**	28	24	0	**52**	**184**
7:30AM	0	107	0	**107**	0	0	0	**0**	35	30	0	**65**	**172**
7:45AM	0	122	0	**122**	0	0	0	**0**	45	44	0	**89**	**211**
Hourly Total	0	455	0	**455**	0	0	0	**0**	134	129	0	**263**	**718**
8:00AM	0	105	0	**105**	0	1	0	**1**	35	34	0	**69**	**175**
8:15AM	0	94	0	**94**	0	0	0	**0**	28	33	0	**61**	**155**
8:30AM	0	106	0	**106**	0	0	0	**0**	35	25	0	**60**	**166**
8:45AM	0	97	0	**97**	0	0	0	**0**	28	31	0	**59**	**156**
Hourly Total	0	402	0	**402**	0	1	0	**1**	126	123	0	**249**	**652**
4:00PM	0	146	0	**146**	0	0	0	**0**	73	47	0	**120**	**266**
4:15PM	0	122	0	**122**	0	0	0	**0**	58	32	0	**90**	**212**
4:30PM	0	136	0	**136**	0	0	0	**0**	55	44	0	**99**	**235**
4:45PM	0	126	0	**126**	0	0	0	**0**	112	36	0	**148**	**274**
Hourly Total	0	530	0	**530**	0	0	0	**0**	298	159	0	**457**	**987**
5:00PM	0	102	0	**102**	0	0	0	**0**	160	44	0	**204**	**306**
5:15PM	0	128	0	**128**	0	0	0	**0**	126	64	0	**190**	**318**
5:30PM	0	101	0	**101**	0	0	0	**0**	89	40	0	**129**	**230**
5:45PM	0	109	0	**109**	0	0	0	**0**	57	43	0	**100**	**209**
Hourly Total	0	440	0	**440**	0	0	0	**0**	432	191	0	**623**	**1063**
Total	0	1827	0	**1827**	0	1	0	**1**	990	602	0	**1592**	**3420**
% Approach	0%	100%	0%	**-**	0%	100%	0%	**-**	62.2%	37.8%	0%	**-**	-
% Total	0%	53.4%	0%	**53.4%**	0%	0%	0%	**0%**	28.9%	17.6%	0%	**46.5%**	-
Lights	0	1539	0	**1539**	0	1	0	**1**	903	414	0	**1317**	2857
% Lights	0%	84.2%	0%	**84.2%**	0%	100%	0%	**100%**	91.2%	68.8%	0%	**82.7%**	83.5%
Articulated Trucks and Single-Unit Trucks	0	283	0	**283**	0	0	0	**0**	85	185	0	**270**	553
% Articulated Trucks and Single-Unit Trucks	0%	15.5%	0%	**15.5%**	0%	0%	0%	**0%**	8.6%	30.7%	0%	**17.0%**	16.2%
Buses	0	5	0	**5**	0	0	0	**0**	2	3	0	**5**	10
% Buses	0%	0.3%	0%	**0.3%**	0%	0%	0%	**0%**	0.2%	0.5%	0%	**0.3%**	0.3%

*L: Left, R: Right, T: Thru, U: U-Turn

S Interstate 35 Frontage Road & Conrads Lane - TMC
Thu Mar 4, 2021
Full Length (7 AM-9 AM, 4 PM-6 PM)
All Classes (Lights, Articulated Trucks and Single-Unit Trucks, Buses)
All Movements
ID: 816101, Location: 29.747754, -98.057758

GEWALT HAMILTON ASSOCIATES, INC.
Provided by: Gewalt Hamilton Associates Inc.
625 Forest Edge Drive, Vernon Hills, IL, 60061, US



S Interstate 35 Frontage Road & Conrads Lane - TMC

Thu Mar 4, 2021
AM Peak (7:15 AM - 8:15 AM)
All Classes (Lights, Articulated Trucks and Single-Unit Trucks, Buses)
All Movements
ID: 816101, Location: 29.747754, -98.057758

Provided by: Gewalt Hamilton Associates Inc.
625 Forest Edge Drive, Vernon Hills, IL, 60061, US

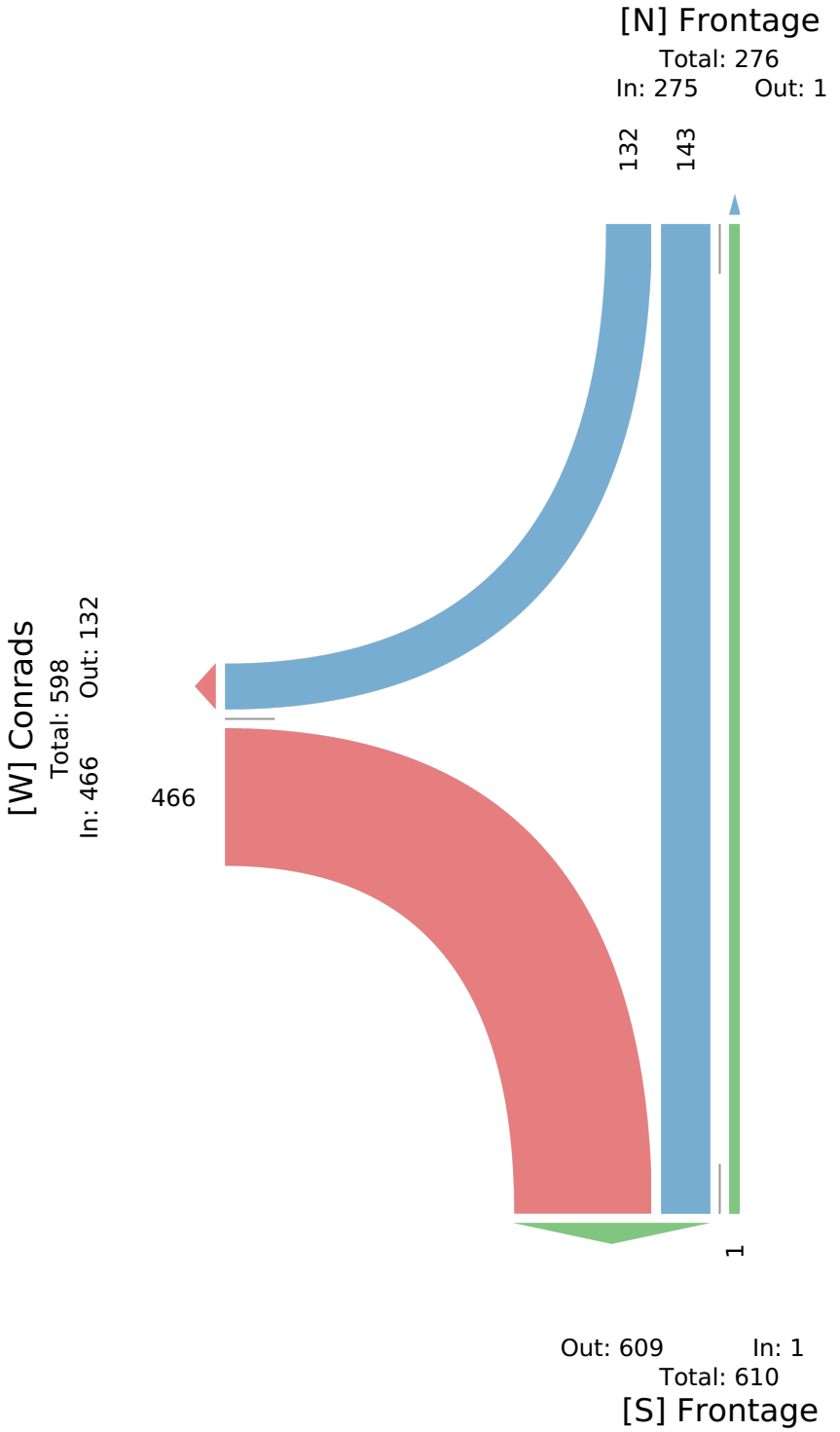
Leg	Conrads				Frontage				Frontage				
Direction	Eastbound				Northbound				Southbound				
Time	L	R	U	**App**	L	T	U	**App**	T	R	U	**App**	**Int**
2021-03-04 7:15AM	0	132	0	**132**	0	0	0	**0**	28	24	0	**52**	**184**
7:30AM	0	107	0	**107**	0	0	0	**0**	35	30	0	**65**	**172**
7:45AM	0	122	0	**122**	0	0	0	**0**	45	44	0	**89**	**211**
8:00AM	0	105	0	**105**	0	1	0	**1**	35	34	0	**69**	**175**
Total	0	466	0	**466**	0	1	0	**1**	143	132	0	**275**	**742**
% Approach	0%	100%	0%	**-**	0%	100%	0%	**-**	52.0%	48.0%	0%	**-**	-
% Total	0%	62.8%	0%	**62.8%**	0%	0.1%	0%	**0.1%**	19.3%	17.8%	0%	**37.1%**	-
PHF	-	0.883	-	**0.883**	-	0.250	-	**0.250**	0.794	0.750	-	**0.772**	0.879
Lights	0	376	0	**376**	0	1	0	**1**	116	77	0	**193**	570
% Lights	0%	80.7%	0%	**80.7%**	0%	100%	0%	**100%**	81.1%	58.3%	0%	**70.2%**	76.8%
Articulated Trucks and Single-Unit Trucks	0	88	0	**88**	0	0	0	**0**	27	54	0	**81**	169
% Articulated Trucks and Single-Unit Trucks	0%	18.9%	0%	**18.9%**	0%	0%	0%	**0%**	18.9%	40.9%	0%	**29.5%**	22.8%
Buses	0	2	0	**2**	0	0	0	**0**	0	1	0	**1**	3
% Buses	0%	0.4%	0%	**0.4%**	0%	0%	0%	**0%**	0%	0.8%	0%	**0.4%**	0.4%

*L: Left, R: Right, T: Thru, U: U-Turn

S Interstate 35 Frontage Road & Conrads Lane - TMC

Thu Mar 4, 2021
AM Peak (7:15 AM - 8:15 AM)
All Classes (Lights, Articulated Trucks and Single-Unit Trucks, Buses)
All Movements
ID: 816101, Location: 29.747754, -98.057758

GHA GEWALT HAMILTON ASSOCIATES, INC.
Provided by: Gewalt Hamilton Associates Inc.
625 Forest Edge Drive, Vernon Hills, IL, 60061, US



S Interstate 35 Frontage Road & Conrads Lane - TMC

Thu Mar 4, 2021
PM Peak (4:30 PM - 5:30 PM) - Overall Peak Hour
All Classes (Lights, Articulated Trucks and Single-Unit Trucks, Buses)
All Movements
ID: 816101, Location: 29.747754, -98.057758

Provided by: Gewalt Hamilton Associates Inc.
625 Forest Edge Drive, Vernon Hills, IL, 60061, US

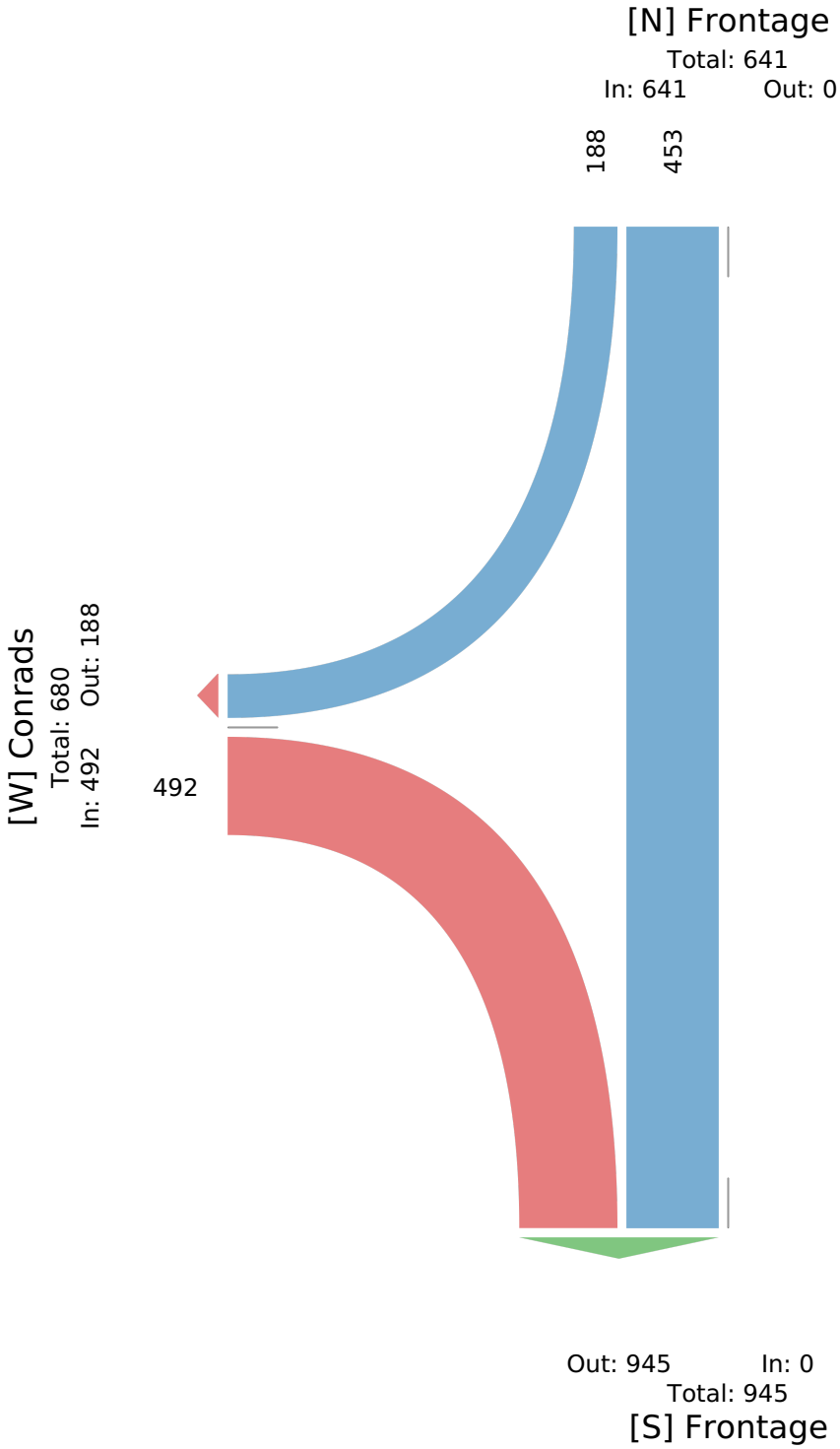
Leg	Conrads				Frontage				Frontage				
Direction	Eastbound				Northbound				Southbound				
Time	L	R	U	**App**	L	T	U	**App**	T	R	U	**App**	**Int**
2021-03-04 4:30PM	0	136	0	**136**	0	0	0	**0**	55	44	0	**99**	**235**
4:45PM	0	126	0	**126**	0	0	0	**0**	112	36	0	**148**	**274**
5:00PM	0	102	0	**102**	0	0	0	**0**	160	44	0	**204**	**306**
5:15PM	0	128	0	**128**	0	0	0	**0**	126	64	0	**190**	**318**
Total	0	492	0	**492**	0	0	0	**0**	453	188	0	**641**	**1133**
% Approach	0%	100%	0%	**-**	0%	0%	0%	**-**	70.7%	29.3%	0%	**-**	-
% Total	0%	43.4%	0%	**43.4%**	0%	0%	0%	**0%**	40.0%	16.6%	0%	**56.6%**	-
PHF	-	0.904	-	**0.904**	-	-	-	**-**	0.708	0.734	-	**0.786**	0.891
Lights	0	451	0	**451**	0	0	0	**0**	429	145	0	**574**	1025
% Lights	0%	91.7%	0%	**91.7%**	0%	0%	0%	**-**	94.7%	77.1%	0%	**89.5%**	90.5%
Articulated Trucks and Single-Unit Trucks	0	40	0	**40**	0	0	0	**0**	22	42	0	**64**	104
% Articulated Trucks and Single-Unit Trucks	0%	8.1%	0%	**8.1%**	0%	0%	0%	**-**	4.9%	22.3%	0%	**10.0%**	9.2%
Buses	0	1	0	**1**	0	0	0	**0**	2	1	0	**3**	4
% Buses	0%	0.2%	0%	**0.2%**	0%	0%	0%	**-**	0.4%	0.5%	0%	**0.5%**	0.4%

*L: Left, R: Right, T: Thru, U: U-Turn

S Interstate 35 Frontage Road & Conrads Lane - TMC

Thu Mar 4, 2021
PM Peak (4:30 PM - 5:30 PM) - Overall Peak Hour
All Classes (Lights, Articulated Trucks and Single-Unit Trucks, Buses)
All Movements
ID: 816101, Location: 29.747754, -98.057758

GHA GEWALT HAMILTON ASSOCIATES, INC.
Provided by: Gewalt Hamilton Associates Inc.
625 Forest Edge Drive, Vernon Hills, IL, 60061, US



S Interstate 35 Frontage Road & Oak Creek Way - TMC

Thu Mar 4, 2021
Full Length (7 AM-9 AM, 4 PM-6 PM)
All Classes (Lights, Articulated Trucks and Single-Unit Trucks, Buses)
All Movements
ID: 816103, Location: 29.74388, -98.061172

GEWALT HAMILTON ASSOCIATES, INC.
Provided by: Gewalt Hamilton Associates Inc.
625 Forest Edge Drive, Vernon Hills, IL, 60061, US

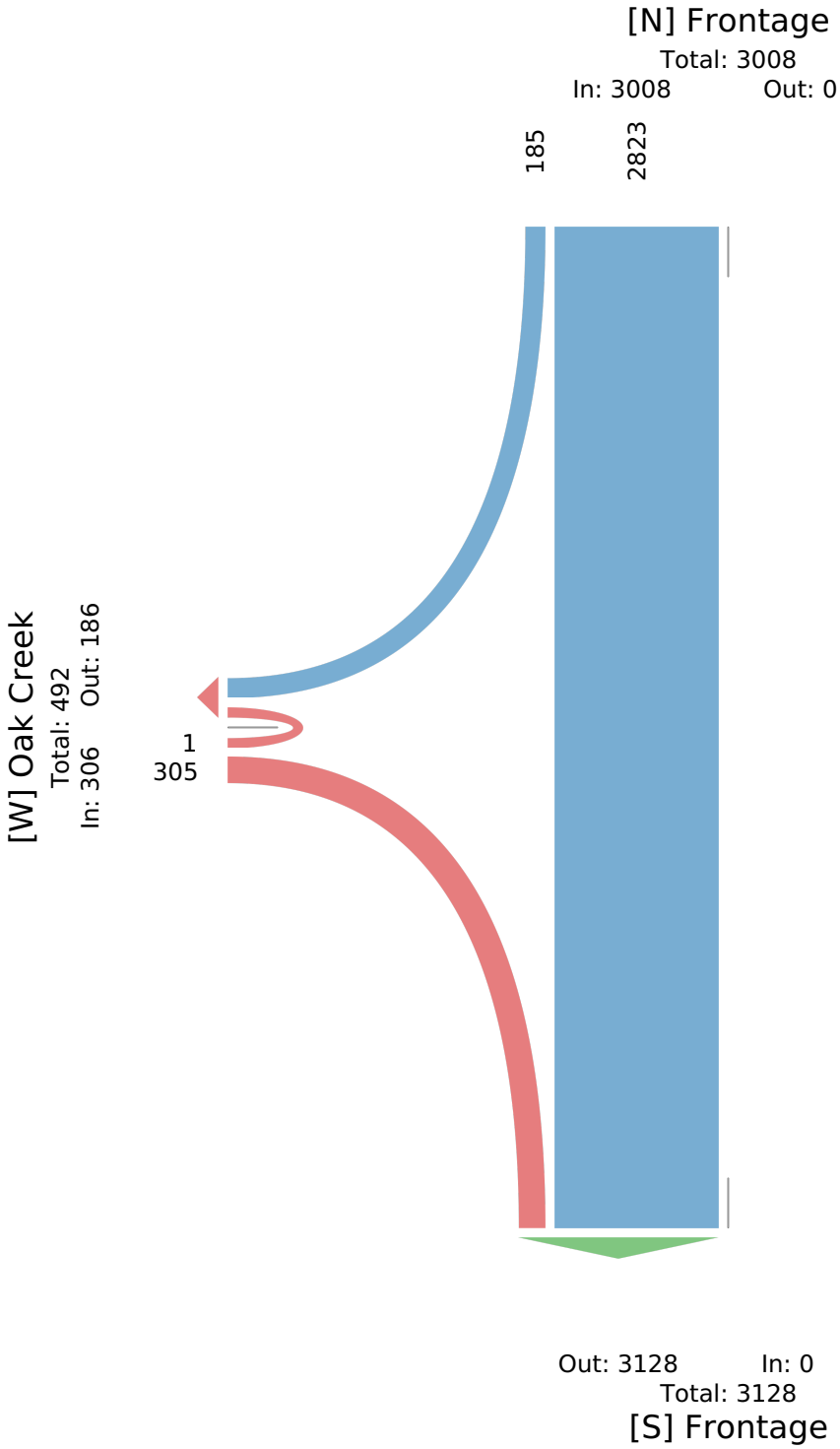
Leg Direction	Oak Creek Eastbound			Frontage Southbound			
Time	R	U	**App**	T	R	**App**	**Int**
2021-03-04 7:00AM	17	0	**17**	141	2	**143**	**160**
7:15AM	25	0	**25**	183	6	**189**	**214**
7:30AM	31	0	**31**	159	5	**164**	**195**
7:45AM	17	0	**17**	169	17	**186**	**203**
Hourly Total	90	0	**90**	652	30	**682**	**772**
8:00AM	26	1	**27**	146	7	**153**	**180**
8:15AM	20	0	**20**	128	5	**133**	**153**
8:30AM	20	0	**20**	154	7	**161**	**181**
8:45AM	18	0	**18**	135	7	**142**	**160**
Hourly Total	84	1	**85**	563	26	**589**	**674**
4:00PM	15	0	**15**	209	17	**226**	**241**
4:15PM	11	0	**11**	175	8	**183**	**194**
4:30PM	18	0	**18**	179	10	**189**	**207**
4:45PM	13	0	**13**	219	19	**238**	**251**
Hourly Total	57	0	**57**	782	54	**836**	**893**
5:00PM	22	0	**22**	257	15	**272**	**294**
5:15PM	15	0	**15**	247	23	**270**	**285**
5:30PM	20	0	**20**	168	18	**186**	**206**
5:45PM	17	0	**17**	154	19	**173**	**190**
Hourly Total	74	0	**74**	826	75	**901**	**975**
Total	305	1	**306**	2823	185	**3008**	**3314**
% Approach	99.7%	0.3%	**-**	93.8%	6.2%	**-**	-
% Total	9.2%	0%	**9.2%**	85.2%	5.6%	**90.8%**	-
Lights	301	1	**302**	2452	183	**2635**	2937
% Lights	98.7%	100%	**98.7%**	86.9%	98.9%	**87.6%**	88.6%
Articulated Trucks and Single-Unit Trucks	0	0	**0**	363	0	**363**	363
% Articulated Trucks and Single-Unit Trucks	0%	0%	**0%**	12.9%	0%	**12.1%**	11.0%
Buses	4	0	**4**	8	2	**10**	14
% Buses	1.3%	0%	**1.3%**	0.3%	1.1%	**0.3%**	0.4%

*R: Right, T: Thru, U: U-Turn

S Interstate 35 Frontage Road & Oak Creek Way - TMC

Thu Mar 4, 2021
Full Length (7 AM-9 AM, 4 PM-6 PM)
All Classes (Lights, Articulated Trucks and Single-Unit Trucks, Buses)
All Movements
ID: 816103, Location: 29.74388, -98.061172

Provided by: Gewalt Hamilton Associates Inc.
625 Forest Edge Drive, Vernon Hills, IL, 60061, US



S Interstate 35 Frontage Road & Oak Creek Way - TMC

Thu Mar 4, 2021
AM Peak (7:15 AM - 8:15 AM)
All Classes (Lights, Articulated Trucks and Single-Unit Trucks, Buses)
All Movements
ID: 816103, Location: 29.74388, -98.061172

Provided by: Gewalt Hamilton Associates Inc.
625 Forest Edge Drive, Vernon Hills, IL, 60061, US

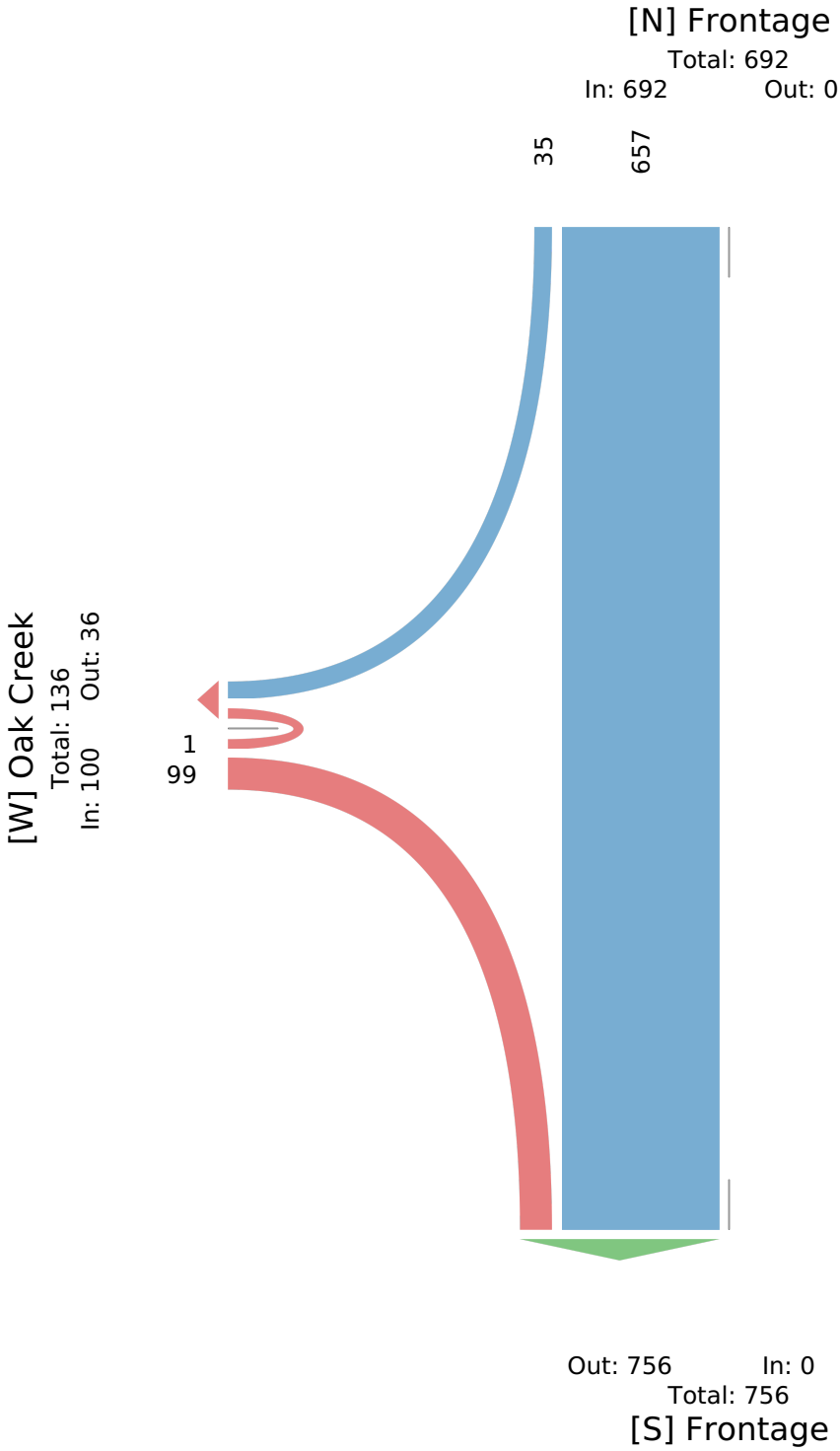
Leg	Oak Creek			Frontage			
Direction	Eastbound			Southbound			
Time	R	U	**App**	T	R	**App**	**Int**
2021-03-04 7:15AM	25	0	**25**	183	6	**189**	**214**
7:30AM	31	0	**31**	159	5	**164**	**195**
7:45AM	17	0	**17**	169	17	**186**	**203**
8:00AM	26	1	**27**	146	7	**153**	**180**
Total	99	1	**100**	657	35	**692**	**792**
% Approach	99.0%	1.0%	**-**	94.9%	5.1%	**-**	-
% Total	12.5%	0.1%	**12.6%**	83.0%	4.4%	**87.4%**	-
PHF	0.798	0.250	**0.806**	0.898	0.515	**0.915**	0.925
Lights	98	1	**99**	546	34	**580**	679
% Lights	99.0%	100%	**99.0%**	83.1%	97.1%	**83.8%**	85.7%
Articulated Trucks and Single-Unit Trucks	0	0	**0**	110	0	**110**	110
% Articulated Trucks and Single-Unit Trucks	0%	0%	**0%**	16.7%	0%	**15.9%**	13.9%
Buses	1	0	**1**	1	1	**2**	3
% Buses	1.0%	0%	**1.0%**	0.2%	2.9%	**0.3%**	0.4%

*R: Right, T: Thru, U: U-Turn

S Interstate 35 Frontage Road & Oak Creek Way - TMC

Thu Mar 4, 2021
AM Peak (7:15 AM - 8:15 AM)
All Classes (Lights, Articulated Trucks and Single-Unit Trucks, Buses)
All Movements
ID: 816103, Location: 29.74388, -98.061172

GEWALT HAMILTON ASSOCIATES, INC.
Provided by: Gewalt Hamilton Associates Inc.
625 Forest Edge Drive, Vernon Hills, IL, 60061, US



S Interstate 35 Frontage Road & Oak Creek Way - TMC

Thu Mar 4, 2021
PM Peak (4:30 PM - 5:30 PM) - Overall Peak Hour
All Classes (Lights, Articulated Trucks and Single-Unit Trucks, Buses)
All Movements
ID: 816103, Location: 29.74388, -98.061172

GEWALT HAMILTON ASSOCIATES, INC.
Provided by: Gewalt Hamilton Associates Inc.
625 Forest Edge Drive, Vernon Hills, IL, 60061, US

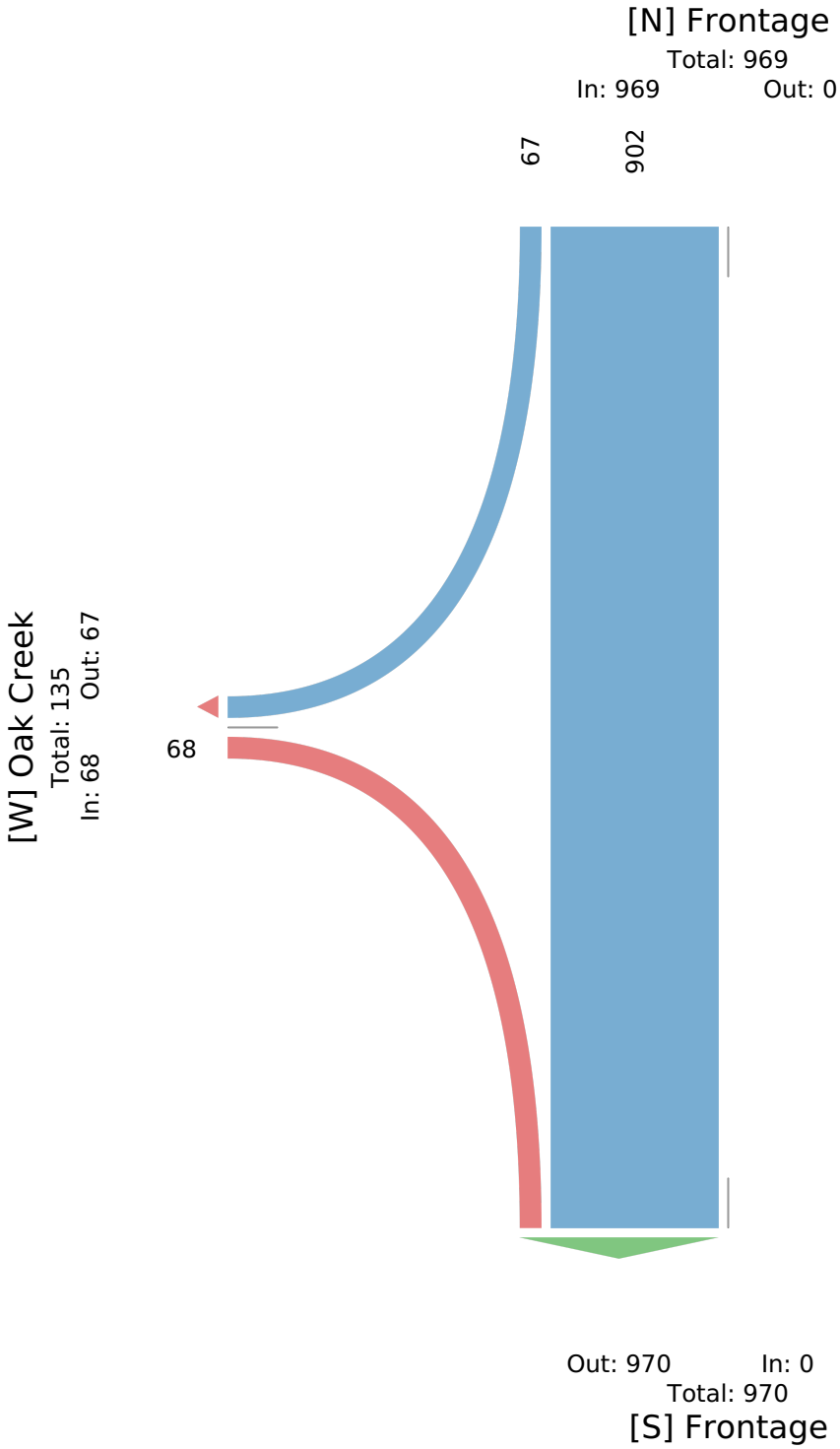
Leg Direction	Oak Creek Eastbound			Frontage Southbound			
Time	R	U	**App**	T	R	**App**	**Int**
2021-03-04 4:30PM	18	0	**18**	179	10	**189**	**207**
4:45PM	13	0	**13**	219	19	**238**	**251**
5:00PM	22	0	**22**	257	15	**272**	**294**
5:15PM	15	0	**15**	247	23	**270**	**285**
Total	68	0	**68**	902	67	**969**	**1037**
% Approach	100%	0%	**-**	93.1%	6.9%	**-**	-
% Total	6.6%	0%	**6.6%**	87.0%	6.5%	**93.4%**	-
PHF	0.773	-	**0.773**	0.877	0.728	**0.891**	0.882
Lights	68	0	**68**	838	66	**904**	972
% Lights	100%	0%	**100%**	92.9%	98.5%	**93.3%**	93.7%
Articulated Trucks and Single-Unit Trucks	0	0	**0**	61	0	**61**	61
% Articulated Trucks and Single-Unit Trucks	0%	0%	**0%**	6.8%	0%	**6.3%**	5.9%
Buses	0	0	**0**	3	1	**4**	4
% Buses	0%	0%	**0%**	0.3%	1.5%	**0.4%**	0.4%

*R: Right, T: Thru, U: U-Turn

S Interstate 35 Frontage Road & Oak Creek Way - TMC

Thu Mar 4, 2021
PM Peak (4:30 PM - 5:30 PM) - Overall Peak Hour
All Classes (Lights, Articulated Trucks and Single-Unit Trucks, Buses)
All Movements
ID: 816103, Location: 29.74388, -98.061172

Provided by: Gewalt Hamilton Associates Inc.
625 Forest Edge Drive, Vernon Hills, IL, 60061, US



- I-35 SB Off Ramp & S Interstate 35 Frontag... - ATR

Thu Mar 4, 2021
Full Length (7 AM-9 AM, 4 PM-6 PM)
All Classes (Lights, Articulated Trucks and Single-Unit Trucks, Buses)
All Channels
ID: 817644, Location: 29.743031, -98.062136

GEWALT HAMILTON ASSOCIATES, INC.
Provided by: Gewalt Hamilton Associates Inc.
625 Forest Edge Drive, Vernon Hills, IL, 60061, US

Leg Direction	North Southbound			
Time	Lane 1	Lane 2	**App**	**Int**
2021-03-04 7:00AM	154	53	**207**	**207**
7:15AM	207	87	**294**	**294**
7:30AM	198	86	**284**	**284**
7:45AM	184	102	**286**	**286**
Hourly Total	743	328	**1071**	**1071**
8:00AM	174	74	**248**	**248**
8:15AM	153	59	**212**	**212**
8:30AM	175	69	**244**	**244**
8:45AM	156	90	**246**	**246**
Hourly Total	658	292	**950**	**950**
4:00PM	219	106	**325**	**325**
4:15PM	192	99	**291**	**291**
4:30PM	207	99	**306**	**306**
4:45PM	226	118	**344**	**344**
Hourly Total	844	422	**1266**	**1266**
5:00PM	269	111	**380**	**380**
5:15PM	250	108	**358**	**358**
5:30PM	187	140	**327**	**327**
5:45PM	167	114	**281**	**281**
Hourly Total	873	473	**1346**	**1346**
Total	3118	1515	**4633**	**4633**
% Approach	67.3%	32.7%	**-**	-
% Total	67.3%	32.7%	**100%**	-
Lights	2712	1417	**4129**	4129
% Lights	87.0%	93.5%	**89.1%**	89.1%
Articulated Trucks and Single-Unit Trucks	394	95	**489**	489
% Articulated Trucks and Single-Unit Trucks	12.6%	6.3%	**10.6%**	10.6%
Buses	12	3	**15**	15
% Buses	0.4%	0.2%	**0.3%**	0.3%

- I-35 SB Off Ramp & S Interstate 35 Frontag... - ATR

Thu Mar 4, 2021
Full Length (7 AM-9 AM, 4 PM-6 PM)
All Classes (Lights, Articulated Trucks and Single-Unit Trucks, Buses)
All Channels
ID: 817644, Location: 29.743031, -98.062136

Provided by: Gewalt Hamilton Associates Inc.
625 Forest Edge Drive, Vernon Hills, IL, 60061, US

- I-35 SB Off Ramp & S Interstate 35 Frontag... - ATR

Thu Mar 4, 2021
AM Peak (7:15 AM - 8:15 AM)
All Classes (Lights, Articulated Trucks and Single-Unit Trucks, Buses)
All Channels
ID: 817644, Location: 29.743031, -98.062136

GEWALT HAMILTON ASSOCIATES, INC.
Provided by: Gewalt Hamilton Associates Inc.
625 Forest Edge Drive, Vernon Hills, IL, 60061, US

Leg Direction	North Southbound			
Time	Lane 1	Lane 2	**App**	**Int**
2021-03-04 7:15AM	207	87	**294**	**294**
7:30AM	198	86	**284**	**284**
7:45AM	184	102	**286**	**286**
8:00AM	174	74	**248**	**248**
Total	763	349	**1112**	**1112**
% Approach	68.6%	31.4%	**-**	-
% Total	68.6%	31.4%	**100%**	-
PHF	0.921	0.855	**0.946**	0.946
Lights	645	316	**961**	961
% Lights	84.5%	90.5%	**86.4%**	86.4%
Articulated Trucks and Single-Unit Trucks	116	32	**148**	148
% Articulated Trucks and Single-Unit Trucks	15.2%	9.2%	**13.3%**	13.3%
Buses	2	1	**3**	3
% Buses	0.3%	0.3%	**0.3%**	0.3%

- I-35 SB Off Ramp & S Interstate 35 Frontag... - ATR

Thu Mar 4, 2021
AM Peak (7:15 AM - 8:15 AM)
All Classes (Lights, Articulated Trucks and Single-Unit Trucks, Buses)
All Channels
ID: 817644, Location: 29.743031, -98.062136

Provided by: Gewalt Hamilton Associates Inc.
625 Forest Edge Drive, Vernon Hills, IL, 60061, US

- I-35 SB Off Ramp & S Interstate 35 Frontag... - ATR

Thu Mar 4, 2021
Forced Peak (4:30 PM - 5:30 PM)
All Classes (Lights, Articulated Trucks and Single-Unit Trucks, Buses)
All Channels
ID: 817644, Location: 29.743031, -98.062136

Provided by: Gewalt Hamilton Associates Inc.
625 Forest Edge Drive, Vernon Hills, IL, 60061, US

Leg Direction	North Southbound			
Time	Lane 1	Lane 2	**App**	**Int**
2021-03-04 4:30PM	207	99	**306**	**306**
4:45PM	226	118	**344**	**344**
5:00PM	269	111	**380**	**380**
5:15PM	250	108	**358**	**358**
Total	952	436	**1388**	**1388**
% Approach	68.6%	31.4%	**-**	-
% Total	68.6%	31.4%	**100%**	-
PHF	0.885	0.924	**0.913**	0.913
Lights	875	417	**1292**	1292
% Lights	91.9%	95.6%	**93.1%**	93.1%
Articulated Trucks and Single-Unit Trucks	74	18	**92**	92
% Articulated Trucks and Single-Unit Trucks	7.8%	4.1%	**6.6%**	6.6%
Buses	3	1	**4**	4
% Buses	0.3%	0.2%	**0.3%**	0.3%

- I-35 SB Off Ramp & S Interstate 35 Frontag... - ATR

Thu Mar 4, 2021
Forced Peak (4:30 PM - 5:30 PM)
All Classes (Lights, Articulated Trucks and Single-Unit Trucks, Buses)
All Channels
ID: 817644, Location: 29.743031, -98.062136

Provided by: Gewalt Hamilton Associates Inc.
625 Forest Edge Drive, Vernon Hills, IL, 60061, US

I-35 NB Off Ramp & N Interstate 35 Frontage ... - TMC

Sat Mar 6, 2021
Full Length (11 AM-1 PM)
All Classes (Lights, Articulated Trucks and Single-Unit Trucks, Buses)
All Movements
ID: 816107, Location: 29.732886, -98.073201

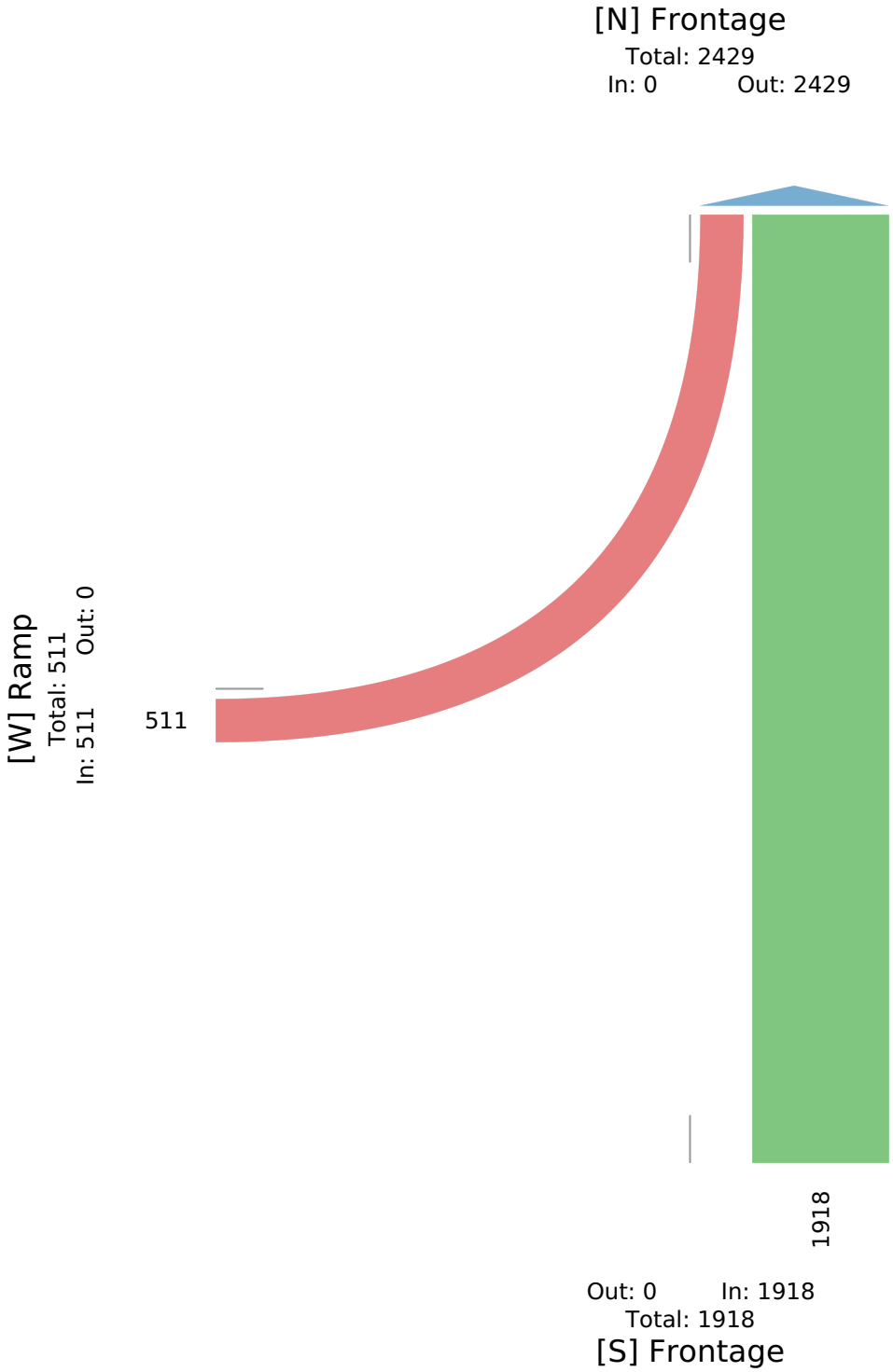
Provided by: Gewalt Hamilton Associates Inc.
625 Forest Edge Drive, Vernon Hills, IL, 60061, US

Leg Direction	Ramp Eastbound			Access Westbound			Frontage Northbound			
Time	L	T	**App**	R	U	**App**	T	R	**App**	**Int**
2021-03-06 11:00AM	61	0	**61**	0	0	**0**	203	0	**203**	**264**
11:15AM	80	0	**80**	0	0	**0**	242	0	**242**	**322**
11:30AM	67	0	**67**	0	0	**0**	242	0	**242**	**309**
11:45AM	53	0	**53**	0	0	**0**	215	0	**215**	**268**
Hourly Total	261	0	**261**	0	0	**0**	902	0	**902**	**1163**
12:00PM	61	0	**61**	0	0	**0**	274	0	**274**	**335**
12:15PM	72	0	**72**	0	0	**0**	249	0	**249**	**321**
12:30PM	49	0	**49**	0	0	**0**	235	0	**235**	**284**
12:45PM	68	0	**68**	0	0	**0**	258	0	**258**	**326**
Hourly Total	250	0	**250**	0	0	**0**	1016	0	**1016**	**1266**
Total	511	0	**511**	0	0	**0**	1918	0	**1918**	**2429**
% Approach	100%	0%	**-**	0%	0%	**-**	100%	0%	**-**	-
% Total	21.0%	0%	**21.0%**	0%	0%	**0%**	79.0%	0%	**79.0%**	-
Lights	449	0	**449**	0	0	**0**	1870	0	**1870**	2319
% Lights	87.9%	0%	**87.9%**	0%	0%	**-**	97.5%	0%	**97.5%**	95.5%
Articulated Trucks and Single-Unit Trucks	60	0	**60**	0	0	**0**	48	0	**48**	108
% Articulated Trucks and Single-Unit Trucks	11.7%	0%	**11.7%**	0%	0%	**-**	2.5%	0%	**2.5%**	4.4%
Buses	2	0	**2**	0	0	**0**	0	0	**0**	2
% Buses	0.4%	0%	**0.4%**	0%	0%	**-**	0%	0%	**0%**	0.1%

*L: Left, R: Right, T: Thru, U: U-Turn

I-35 NB Off Ramp & N Interstate 35 Frontage ... - TMC
Sat Mar 6, 2021
Full Length (11 AM-1 PM)
All Classes (Lights, Articulated Trucks and Single-Unit Trucks, Buses)
All Movements
ID: 816107, Location: 29.732886, -98.073201

Provided by: Gewalt Hamilton Associates Inc.
625 Forest Edge Drive, Vernon Hills, IL, 60061, US



I-35 NB Off Ramp & N Interstate 35 Frontage ... - TMC

Sat Mar 6, 2021
Midday Peak (WKND) (12 PM - 1 PM) - Overall Peak Hour
All Classes (Lights, Articulated Trucks and Single-Unit Trucks, Buses)
All Movements
ID: 816107, Location: 29.732886, -98.073201

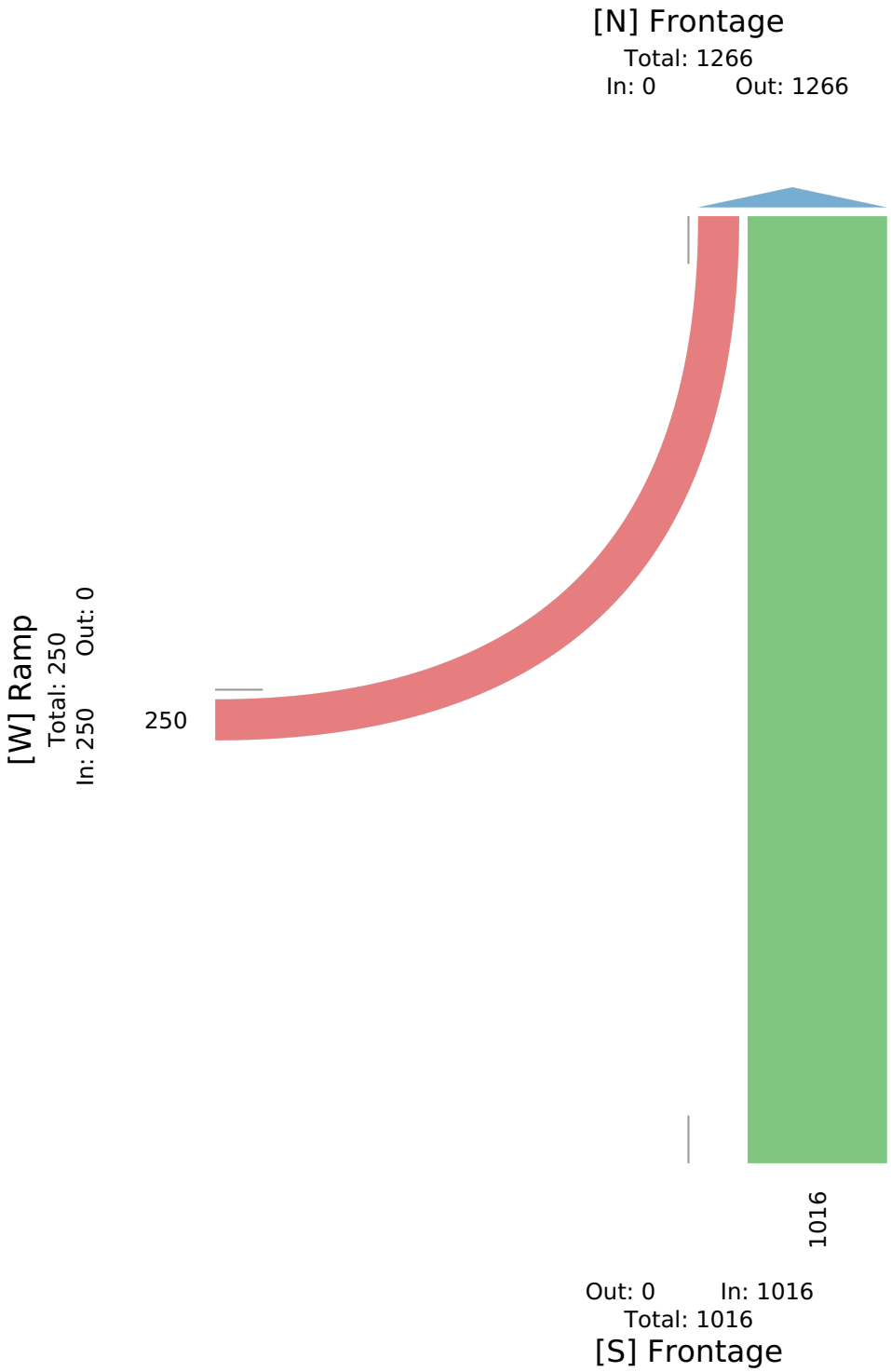
Provided by: Gewalt Hamilton Associates Inc.
625 Forest Edge Drive, Vernon Hills, IL, 60061, US

Leg	Ramp			Access			Frontage			
Direction	Eastbound			Westbound			Northbound			
Time	L	T	**App**	R	U	**App**	T	R	**App**	**Int**
2021-03-06 12:00PM	61	0	**61**	0	0	**0**	274	0	**274**	**335**
12:15PM	72	0	**72**	0	0	**0**	249	0	**249**	**321**
12:30PM	49	0	**49**	0	0	**0**	235	0	**235**	**284**
12:45PM	68	0	**68**	0	0	**0**	258	0	**258**	**326**
Total	250	0	**250**	0	0	**0**	1016	0	**1016**	**1266**
% Approach	100%	0%	**-**	0%	0%	**-**	100%	0%	**-**	-
% Total	19.7%	0%	**19.7%**	0%	0%	**0%**	80.3%	0%	**80.3%**	-
PHF	0.868	-	**0.868**	-	-	**-**	0.927	-	**0.927**	0.945
Lights	220	0	**220**	0	0	**0**	995	0	**995**	1215
% Lights	88.0%	0%	**88.0%**	0%	0%	**-**	97.9%	0%	**97.9%**	96.0%
Articulated Trucks and Single-Unit Trucks	28	0	**28**	0	0	**0**	21	0	**21**	49
% Articulated Trucks and Single-Unit Trucks	11.2%	0%	**11.2%**	0%	0%	**-**	2.1%	0%	**2.1%**	3.9%
Buses	2	0	**2**	0	0	**0**	0	0	**0**	2
% Buses	0.8%	0%	**0.8%**	0%	0%	**-**	0%	0%	**0%**	0.2%

*L: Left, R: Right, T: Thru, U: U-Turn

I-35 NB Off Ramp & N Interstate 35 Frontage ... - TMC
Sat Mar 6, 2021
Midday Peak (WKND) (12 PM - 1 PM) - Overall Peak Hour
All Classes (Lights, Articulated Trucks and Single-Unit Trucks, Buses)
All Movements
ID: 816107, Location: 29.732886, -98.073201

GEWALT HAMILTON ASSOCIATES, INC.
Provided by: Gewalt Hamilton Associates Inc.
625 Forest Edge Drive, Vernon Hills, IL, 60061, US



N Interstate 35 Frontage Road & Kohlenberg R... - TMC

Sat Mar 6, 2021
Full Length (11 AM-1 PM)
All Classes (Lights, Articulated Trucks and Single-Unit Trucks, Buses)
All Movements
ID: 816108, Location: 29.745942, -98.058107

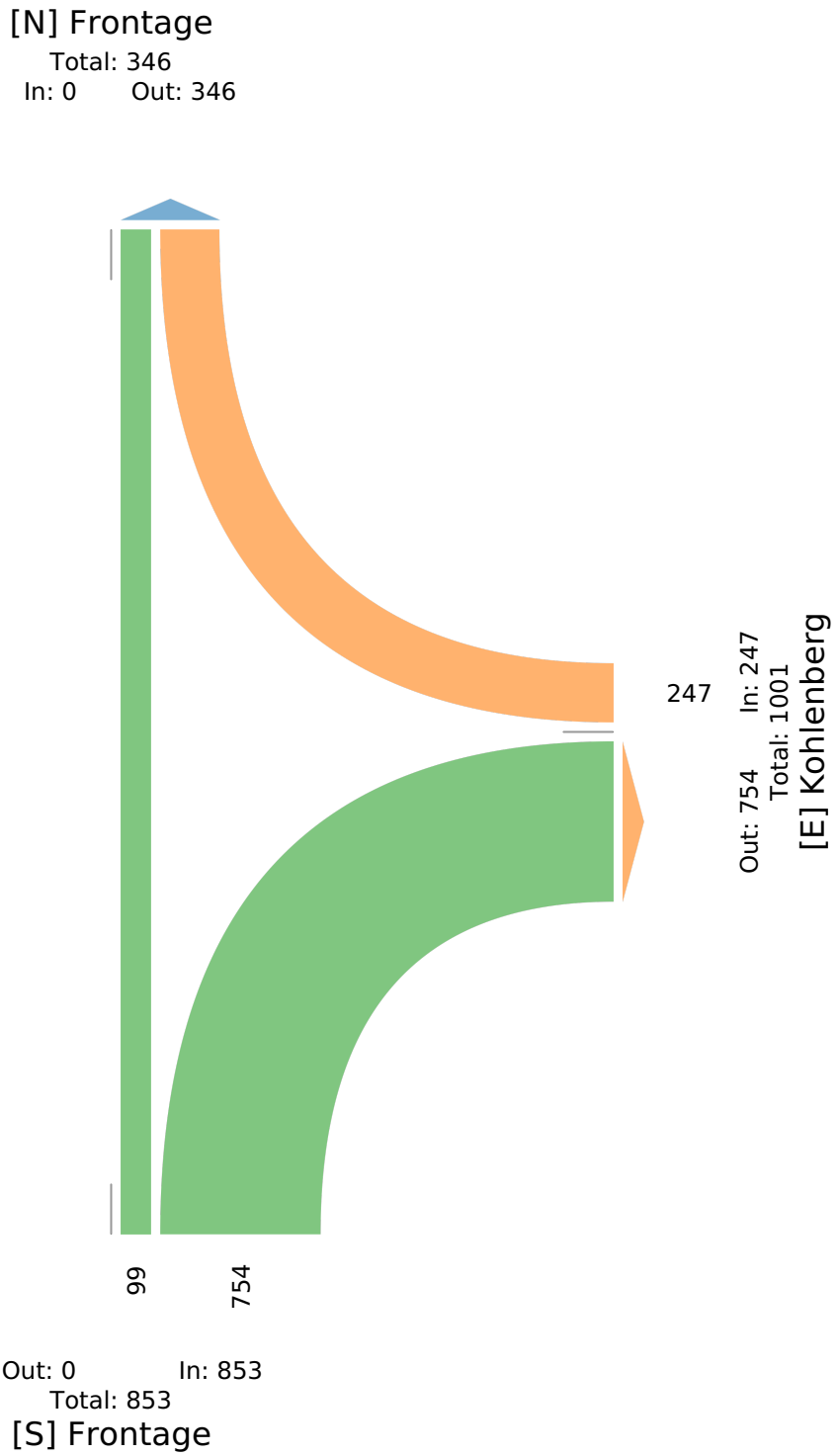
Provided by: Gewalt Hamilton Associates Inc.
625 Forest Edge Drive, Vernon Hills, IL, 60061, US

Leg Direction	Kohlenberg Westbound			Frontage Northbound			Frontage Southbound			
Time	R	U	**App**	R	T	**App**	L	U	**App**	**Int**
2021-03-06 11:00AM	42	0	**42**	85	15	**100**	0	0	**0**	**142**
11:15AM	19	0	**19**	106	14	**120**	0	0	**0**	**139**
11:30AM	33	0	**33**	100	13	**113**	0	0	**0**	**146**
11:45AM	31	0	**31**	101	15	**116**	0	0	**0**	**147**
Hourly Total	125	0	**125**	392	57	**449**	0	0	**0**	**574**
12:00PM	35	0	**35**	109	10	**119**	0	0	**0**	**154**
12:15PM	23	0	**23**	86	6	**92**	0	0	**0**	**115**
12:30PM	34	0	**34**	81	13	**94**	0	0	**0**	**128**
12:45PM	30	0	**30**	86	13	**99**	0	0	**0**	**129**
Hourly Total	122	0	**122**	362	42	**404**	0	0	**0**	**526**
Total	247	0	**247**	754	99	**853**	0	0	**0**	**1100**
% Approach	100%	0%	**-**	88.4%	11.6%	**-**	0%	0%	**-**	-
% Total	22.5%	0%	**22.5%**	68.5%	9.0%	**77.5%**	0%	0%	**0%**	-
Lights	224	0	**224**	692	92	**784**	0	0	**0**	1008
% Lights	90.7%	0%	**90.7%**	91.8%	92.9%	**91.9%**	0%	0%	**-**	91.6%
Articulated Trucks and Single-Unit Trucks	23	0	**23**	61	7	**68**	0	0	**0**	91
% Articulated Trucks and Single-Unit Trucks	9.3%	0%	**9.3%**	8.1%	7.1%	**8.0%**	0%	0%	**-**	8.3%
Buses	0	0	**0**	1	0	**1**	0	0	**0**	1
% Buses	0%	0%	**0%**	0.1%	0%	**0.1%**	0%	0%	**-**	0.1%

*L: Left, R: Right, T: Thru, U: U-Turn

N Interstate 35 Frontage Road & Kohlenberg R... - TMC
Sat Mar 6, 2021
Full Length (11 AM-1 PM)
All Classes (Lights, Articulated Trucks and Single-Unit Trucks, Buses)
All Movements
ID: 816108, Location: 29.745942, -98.058107

GEWALT HAMILTON ASSOCIATES, INC.
Provided by: Gewalt Hamilton Associates Inc.
625 Forest Edge Drive, Vernon Hills, IL, 60061, US



N Interstate 35 Frontage Road & Kohlenberg R... - TMC

Sat Mar 6, 2021
Forced Peak (12 PM - 1 PM)
All Classes (Lights, Articulated Trucks and Single-Unit Trucks, Buses)
All Movements
ID: 816108, Location: 29.745942, -98.058107

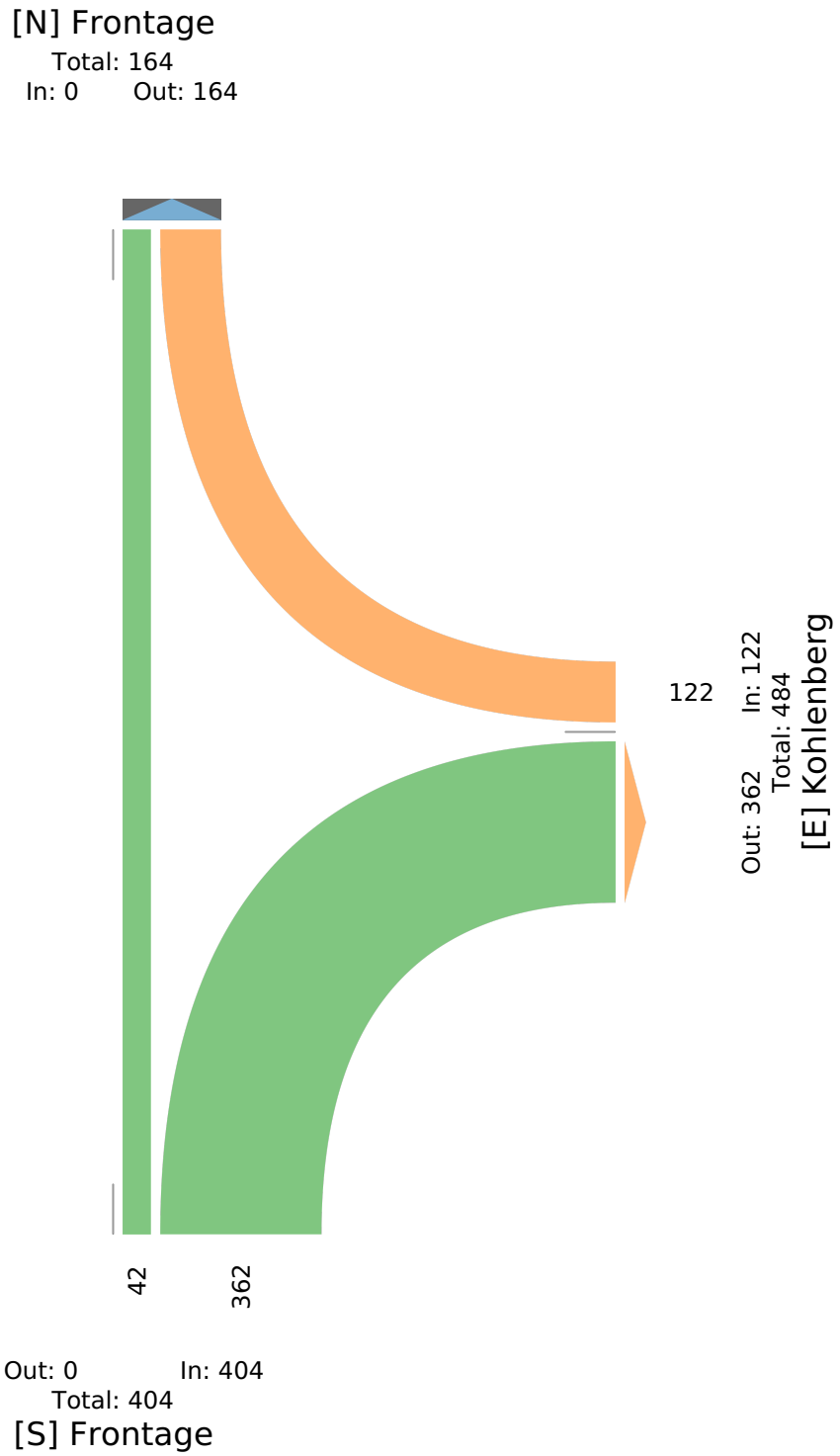
GEWALT HAMILTON ASSOCIATES, INC.
Provided by: Gewalt Hamilton Associates Inc.
625 Forest Edge Drive, Vernon Hills, IL, 60061, US

Leg Direction	Kohlenberg Westbound			Frontage Northbound			Frontage Southbound			
Time	R	U	**App**	R	T	**App**	L	U	**App**	**Int**
2021-03-06 12:00PM	35	0	**35**	109	10	**119**	0	0	**0**	**154**
12:15PM	23	0	**23**	86	6	**92**	0	0	**0**	**115**
12:30PM	34	0	**34**	81	13	**94**	0	0	**0**	**128**
12:45PM	30	0	**30**	86	13	**99**	0	0	**0**	**129**
Total	122	0	**122**	362	42	**404**	0	0	**0**	**526**
% Approach	100%	0%	**-**	89.6%	10.4%	**-**	0%	0%	**-**	-
% Total	23.2%	0%	**23.2%**	68.8%	8.0%	**76.8%**	0%	0%	**0%**	-
PHF	0.871	-	**0.871**	0.830	0.808	**0.849**	-	-	**-**	0.854
Lights	113	0	**113**	326	40	**366**	0	0	**0**	479
% Lights	92.6%	0%	**92.6%**	90.1%	95.2%	**90.6%**	0%	0%	**-**	91.1%
Articulated Trucks and Single-Unit Trucks	9	0	**9**	35	2	**37**	0	0	**0**	46
% Articulated Trucks and Single-Unit Trucks	7.4%	0%	**7.4%**	9.7%	4.8%	**9.2%**	0%	0%	**-**	8.7%
Buses	0	0	**0**	1	0	**1**	0	0	**0**	1
% Buses	0%	0%	**0%**	0.3%	0%	**0.2%**	0%	0%	**-**	0.2%

*L: Left, R: Right, T: Thru, U: U-Turn

N Interstate 35 Frontage Road & Kohlenberg R... - TMC
Sat Mar 6, 2021
Forced Peak (12 PM - 1 PM)
All Classes (Lights, Articulated Trucks and Single-Unit Trucks, Buses)
All Movements
ID: 816108, Location: 29.745942, -98.058107

GHA GEWALT HAMILTON ASSOCIATES, INC.
Provided by: Gewalt Hamilton Associates Inc.
625 Forest Edge Drive, Vernon Hills, IL, 60061, US



N Interstate 35 Frontage Road & Overpass (ea... - TMC

Sat Mar 6, 2021
Full Length (11 AM-1 PM)
All Classes (Lights, Articulated Trucks and Single-Unit Trucks, Buses)
All Movements
ID: 816109, Location: 29.745698, -98.057528

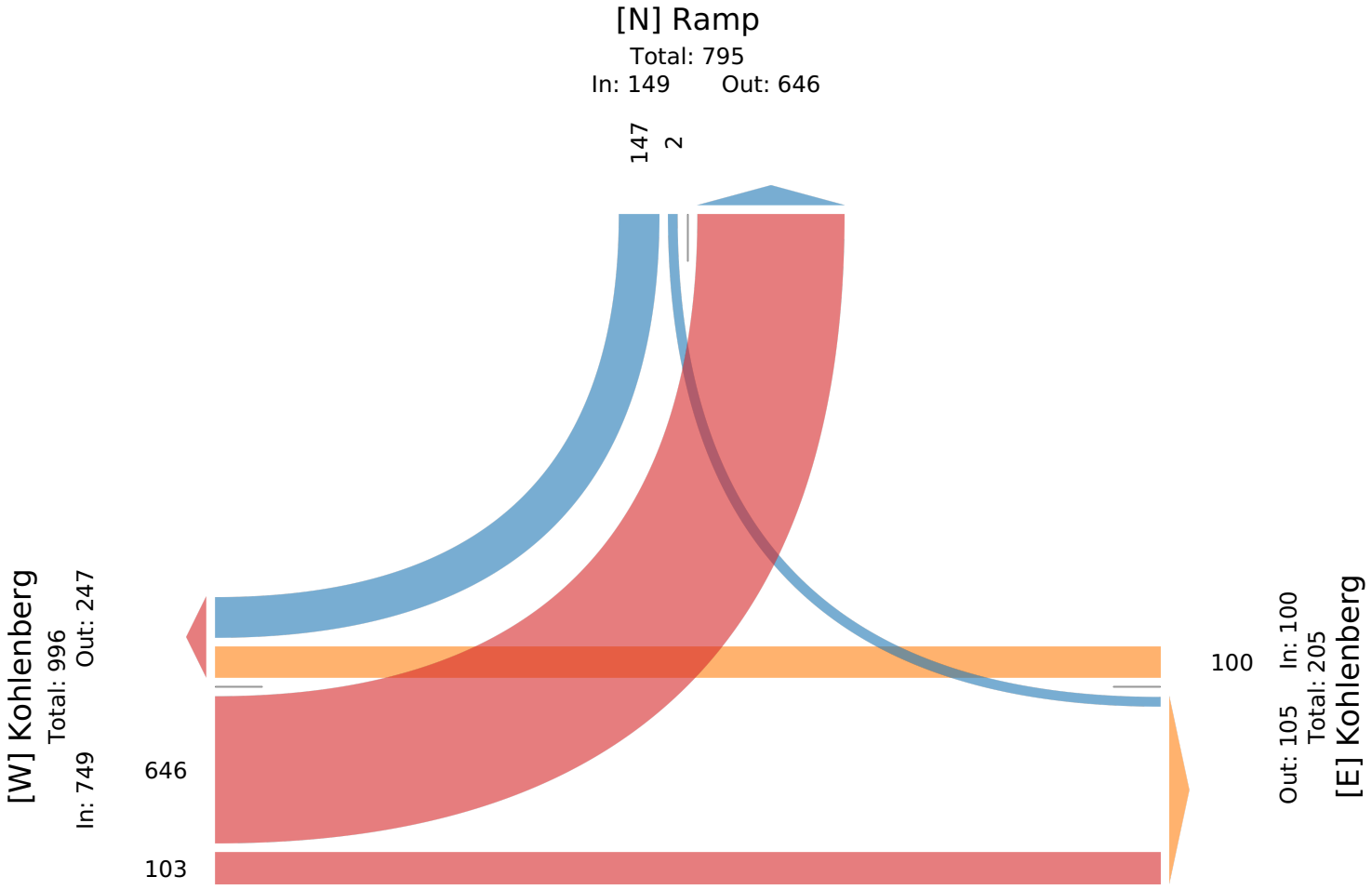
Provided by: Gewalt Hamilton Associates Inc.
625 Forest Edge Drive, Vernon Hills, IL, 60061, US

Leg	Kohlenberg				Kohlenberg				Ramp				
Direction	Eastbound				Westbound				Southbound				
Time	T	L	U	**App**	R	T	U	**App**	R	L	U	**App**	**Int**
2021-03-06 11:00AM	7	78	0	**85**	0	19	0	**19**	24	0	0	**24**	**128**
11:15AM	12	92	0	**104**	0	9	0	**9**	10	0	0	**10**	**123**
11:30AM	10	89	0	**99**	0	15	0	**15**	18	0	0	**18**	**132**
11:45AM	10	91	0	**101**	0	9	0	**9**	21	0	0	**21**	**131**
Hourly Total	39	350	0	**389**	0	52	0	**52**	73	0	0	**73**	**514**
12:00PM	17	90	0	**107**	0	12	0	**12**	24	2	0	**26**	**145**
12:15PM	13	74	0	**87**	0	9	0	**9**	13	0	0	**13**	**109**
12:30PM	16	64	0	**80**	0	15	0	**15**	21	0	0	**21**	**116**
12:45PM	18	68	0	**86**	0	12	0	**12**	16	0	0	**16**	**114**
Hourly Total	64	296	0	**360**	0	48	0	**48**	74	2	0	**76**	**484**
Total	103	646	0	**749**	0	100	0	**100**	147	2	0	**149**	**998**
% Approach	13.8%	86.2%	0%	**-**	0%	100%	0%	**-**	98.7%	1.3%	0%	**-**	-
% Total	10.3%	64.7%	0%	**75.1%**	0%	10.0%	0%	**10.0%**	14.7%	0.2%	0%	**14.9%**	-
Lights	100	588	0	**688**	0	95	0	**95**	130	2	0	**132**	915
% Lights	97.1%	91.0%	0%	**91.9%**	0%	95.0%	0%	**95.0%**	88.4%	100%	0%	**88.6%**	91.7%
Articulated Trucks and Single-Unit Trucks	3	58	0	**61**	0	5	0	**5**	17	0	0	**17**	83
% Articulated Trucks and Single-Unit Trucks	2.9%	9.0%	0%	**8.1%**	0%	5.0%	0%	**5.0%**	11.6%	0%	0%	**11.4%**	8.3%
Buses	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	0
% Buses	0%	0%	0%	**0%**	0%	0%	0%	**0%**	0%	0%	0%	**0%**	0%

*L: Left, R: Right, T: Thru, U: U-Turn

N Interstate 35 Frontage Road & Overpass (ea... - TMC
Sat Mar 6, 2021
Full Length (11 AM-1 PM)
All Classes (Lights, Articulated Trucks and Single-Unit Trucks, Buses)
All Movements
ID: 816109, Location: 29.745698, -98.057528

GEWALT HAMILTON ASSOCIATES, INC.
Provided by: Gewalt Hamilton Associates Inc.
625 Forest Edge Drive, Vernon Hills, IL, 60061, US



N Interstate 35 Frontage Road & Overpass (ea... - TMC

Sat Mar 6, 2021
Forced Peak (12 PM - 1 PM)
All Classes (Lights, Articulated Trucks and Single-Unit Trucks, Buses)
All Movements
ID: 816109, Location: 29.745698, -98.057528

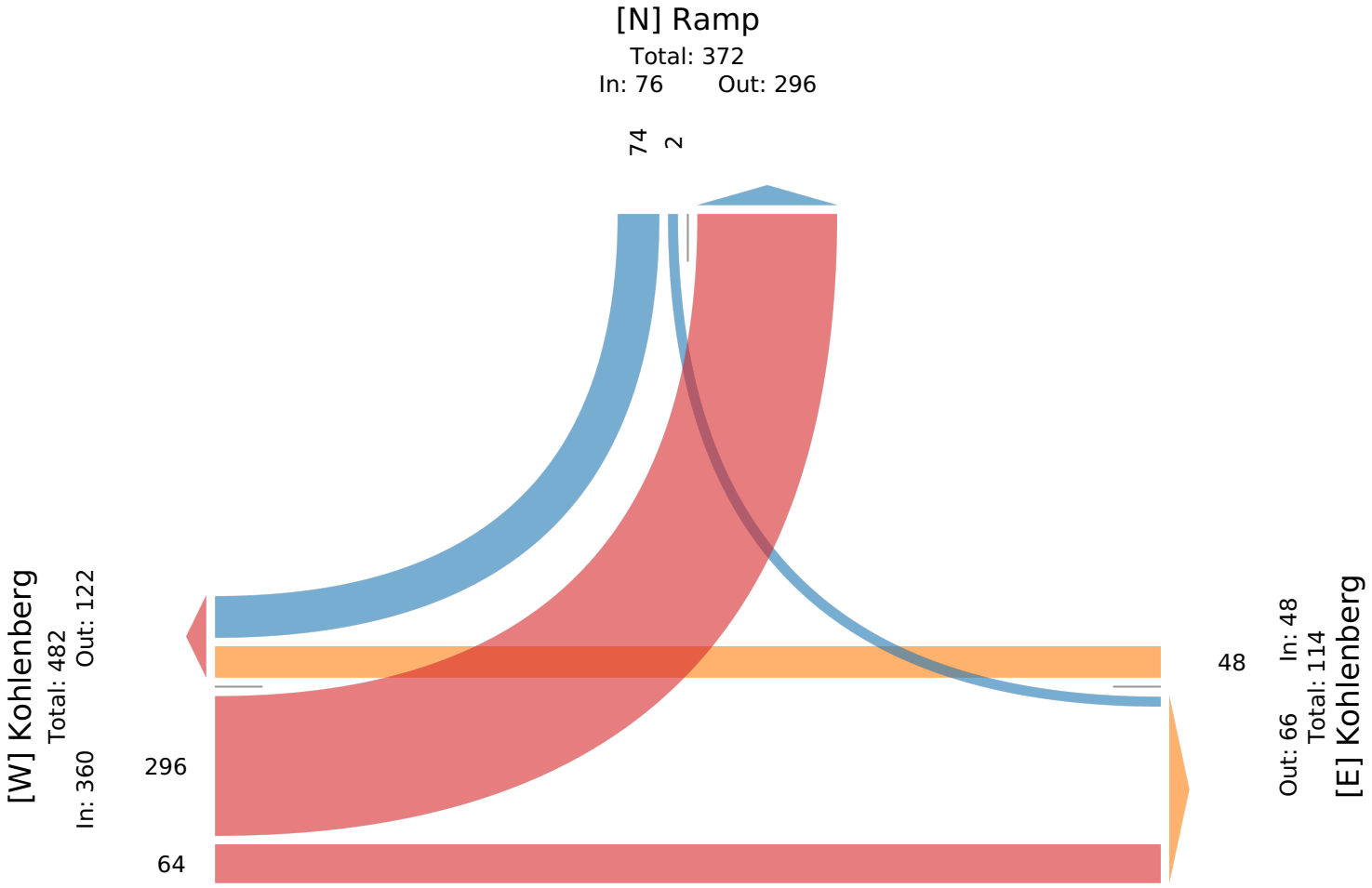
Provided by: Gewalt Hamilton Associates Inc.
625 Forest Edge Drive, Vernon Hills, IL, 60061, US

Leg	Kohlenberg				Kohlenberg				Ramp				
Direction	Eastbound				Westbound				Southbound				
Time	T	L	U	**App**	R	T	U	**App**	R	L	U	**App**	**Int**
2021-03-06 12:00PM	17	90	0	**107**	0	12	0	**12**	24	2	0	**26**	**145**
12:15PM	13	74	0	**87**	0	9	0	**9**	13	0	0	**13**	**109**
12:30PM	16	64	0	**80**	0	15	0	**15**	21	0	0	**21**	**116**
12:45PM	18	68	0	**86**	0	12	0	**12**	16	0	0	**16**	**114**
Total	64	296	0	**360**	0	48	0	**48**	74	2	0	**76**	**484**
% Approach	17.8%	82.2%	0%	**-**	0%	100%	0%	**-**	97.4%	2.6%	0%	**-**	-
% Total	13.2%	61.2%	0%	**74.4%**	0%	9.9%	0%	**9.9%**	15.3%	0.4%	0%	**15.7%**	-
PHF	0.889	0.822	-	**0.841**	-	0.800	-	**0.800**	0.771	0.250	-	**0.731**	0.834
Lights	62	262	0	**324**	0	45	0	**45**	68	2	0	**70**	439
% Lights	96.9%	88.5%	0%	**90.0%**	0%	93.8%	0%	**93.8%**	91.9%	100%	0%	**92.1%**	90.7%
Articulated Trucks and Single-Unit Trucks	2	34	0	**36**	0	3	0	**3**	6	0	0	**6**	45
% Articulated Trucks and Single-Unit Trucks	3.1%	11.5%	0%	**10.0%**	0%	6.3%	0%	**6.3%**	8.1%	0%	0%	**7.9%**	9.3%
Buses	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	0
% Buses	0%	0%	0%	**0%**	0%	0%	0%	**0%**	0%	0%	0%	**0%**	0%

*L: Left, R: Right, T: Thru, U: U-Turn

N Interstate 35 Frontage Road & Overpass (ea... - TMC
Sat Mar 6, 2021
Forced Peak (12 PM - 1 PM)
All Classes (Lights, Articulated Trucks and Single-Unit Trucks, Buses)
All Movements
ID: 816109, Location: 29.745698, -98.057528

GEWALT HAMILTON ASSOCIATES, INC.
Provided by: Gewalt Hamilton Associates Inc.
625 Forest Edge Drive, Vernon Hills, IL, 60061, US



Kohlenberg Road & Overpass (east side) - TMC

Sat Mar 6, 2021
Full Length (11 AM-1 PM)
All Classes (Lights, Articulated Trucks and Single-Unit Trucks, Buses)
All Movements
ID: 816110, Location: 29.746186, -98.057034

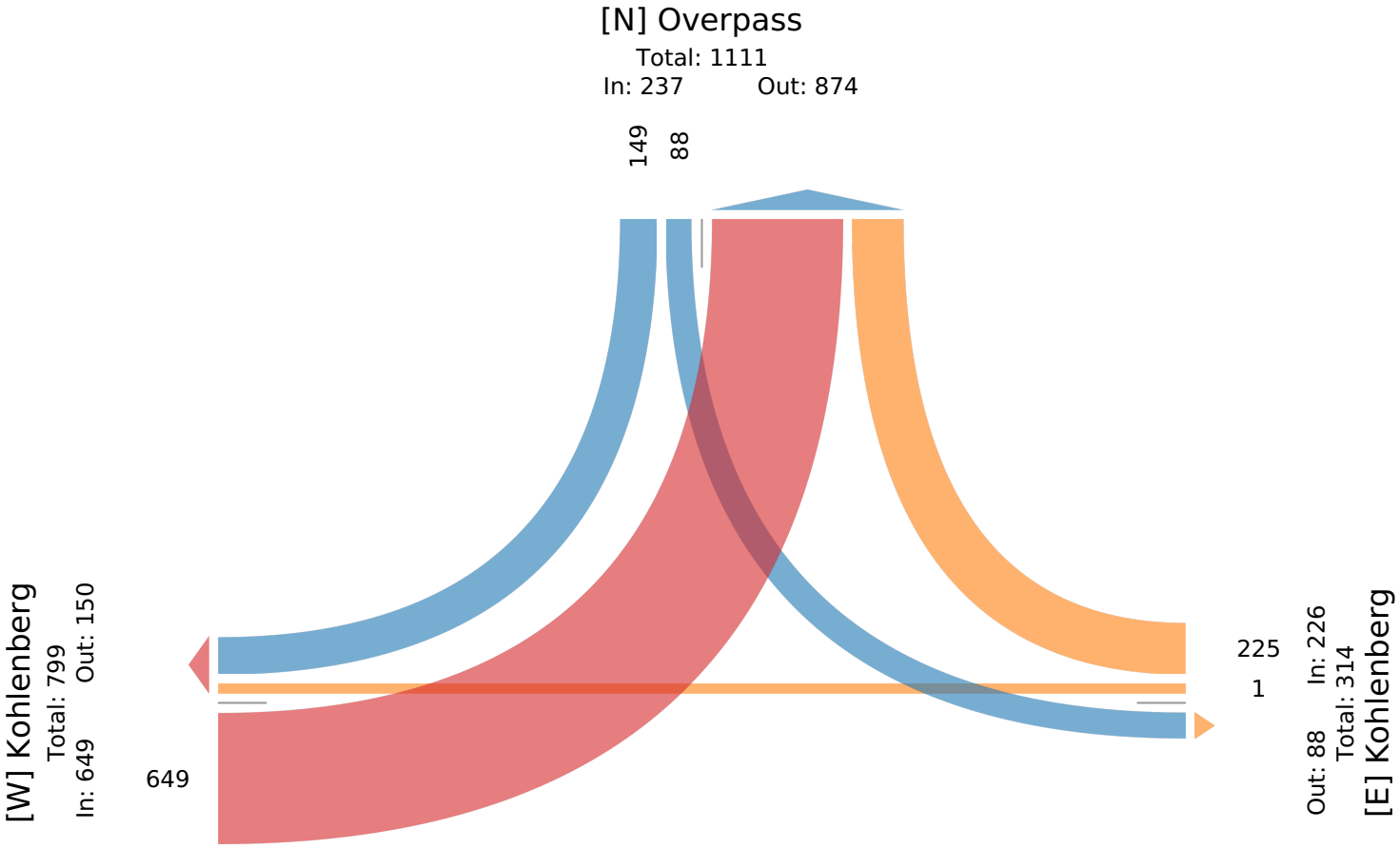
Provided by: Gewalt Hamilton Associates Inc.
625 Forest Edge Drive, Vernon Hills, IL, 60061, US

Leg	Kohlenberg				Kohlenberg				Overpass				
Direction	Eastbound				Westbound				Southbound				
Time	T	L	U	**App**	R	T	U	**App**	R	L	U	**App**	**Int**
2021-03-06 11:00AM	0	79	0	**79**	27	0	0	**27**	24	6	0	**30**	**136**
11:15AM	0	93	0	**93**	30	0	0	**30**	10	7	0	**17**	**140**
11:30AM	0	90	0	**90**	25	0	0	**25**	18	13	0	**31**	**146**
11:45AM	0	88	0	**88**	31	0	0	**31**	21	7	0	**28**	**147**
Hourly Total	0	350	0	**350**	113	0	0	**113**	73	33	0	**106**	**569**
12:00PM	0	90	0	**90**	22	1	0	**23**	25	12	0	**37**	**150**
12:15PM	0	72	0	**72**	27	0	0	**27**	13	13	0	**26**	**125**
12:30PM	0	65	0	**65**	30	0	0	**30**	21	14	0	**35**	**130**
12:45PM	0	72	0	**72**	33	0	0	**33**	17	16	0	**33**	**138**
Hourly Total	0	299	0	**299**	112	1	0	**113**	76	55	0	**131**	**543**
Total	0	649	0	**649**	225	1	0	**226**	149	88	0	**237**	**1112**
% Approach	0%	100%	0%	**-**	99.6%	0.4%	0%	**-**	62.9%	37.1%	0%	**-**	-
% Total	0%	58.4%	0%	**58.4%**	20.2%	0.1%	0%	**20.3%**	13.4%	7.9%	0%	**21.3%**	-
Lights	0	591	0	**591**	216	1	0	**217**	132	81	0	**213**	1021
% Lights	0%	91.1%	0%	**91.1%**	96.0%	100%	0%	**96.0%**	88.6%	92.0%	0%	**89.9%**	91.8%
Articulated Trucks and Single-Unit Trucks	0	58	0	**58**	9	0	0	**9**	17	7	0	**24**	91
% Articulated Trucks and Single-Unit Trucks	0%	8.9%	0%	**8.9%**	4.0%	0%	0%	**4.0%**	11.4%	8.0%	0%	**10.1%**	8.2%
Buses	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	0
% Buses	0%	0%	0%	**0%**	0%	0%	0%	**0%**	0%	0%	0%	**0%**	0%

*L: Left, R: Right, T: Thru, U: U-Turn

Kohlenberg Road & Overpass (east side) - TMC
Sat Mar 6, 2021
Full Length (11 AM-1 PM)
All Classes (Lights, Articulated Trucks and Single-Unit Trucks, Buses)
All Movements
ID: 816110, Location: 29.746186, -98.057034

Provided by: Gewalt Hamilton Associates Inc.
625 Forest Edge Drive, Vernon Hills, IL, 60061, US



Kohlenberg Road & Overpass (east side) - TMC

Sat Mar 6, 2021
Forced Peak (12 PM - 1 PM)
All Classes (Lights, Articulated Trucks and Single-Unit Trucks, Buses)
All Movements
ID: 816110, Location: 29.746186, -98.057034

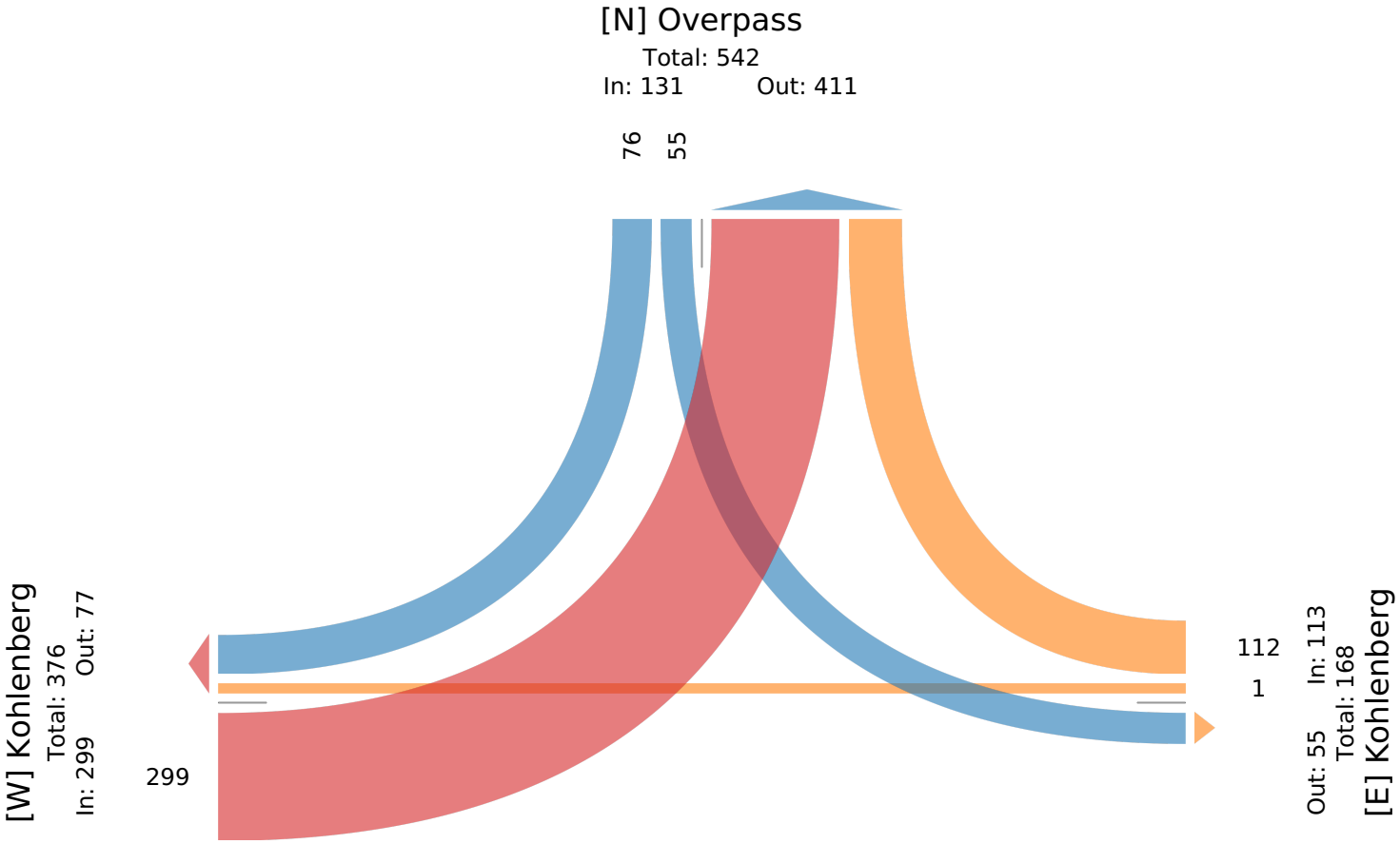
Provided by: Gewalt Hamilton Associates Inc.
625 Forest Edge Drive, Vernon Hills, IL, 60061, US

Leg	Kohlenberg				Kohlenberg				Overpass				
Direction	Eastbound				Westbound				Southbound				
Time	T	L	U	**App**	R	T	U	**App**	R	L	U	**App**	**Int**
2021-03-06 12:00PM	0	90	0	**90**	22	1	0	**23**	25	12	0	**37**	**150**
12:15PM	0	72	0	**72**	27	0	0	**27**	13	13	0	**26**	**125**
12:30PM	0	65	0	**65**	30	0	0	**30**	21	14	0	**35**	**130**
12:45PM	0	72	0	**72**	33	0	0	**33**	17	16	0	**33**	**138**
Total	0	299	0	**299**	112	1	0	**113**	76	55	0	**131**	**543**
% Approach	0%	100%	0%	**-**	99.1%	0.9%	0%	**-**	58.0%	42.0%	0%	**-**	-
% Total	0%	55.1%	0%	**55.1%**	20.6%	0.2%	0%	**20.8%**	14.0%	10.1%	0%	**24.1%**	-
PHF	-	0.831	-	**0.831**	0.848	0.250	-	**0.856**	0.760	0.859	-	**0.885**	0.905
Lights	0	265	0	**265**	110	1	0	**111**	70	52	0	**122**	498
% Lights	0%	88.6%	0%	**88.6%**	98.2%	100%	0%	**98.2%**	92.1%	94.5%	0%	**93.1%**	91.7%
Articulated Trucks and Single-Unit Trucks	0	34	0	**34**	2	0	0	**2**	6	3	0	**9**	45
% Articulated Trucks and Single-Unit Trucks	0%	11.4%	0%	**11.4%**	1.8%	0%	0%	**1.8%**	7.9%	5.5%	0%	**6.9%**	8.3%
Buses	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	0
% Buses	0%	0%	0%	**0%**	0%	0%	0%	**0%**	0%	0%	0%	**0%**	0%

*L: Left, R: Right, T: Thru, U: U-Turn

Kohlenberg Road & Overpass (east side) - TMC
Sat Mar 6, 2021
Forced Peak (12 PM - 1 PM)
All Classes (Lights, Articulated Trucks and Single-Unit Trucks, Buses)
All Movements
ID: 816110, Location: 29.746186, -98.057034

Provided by: Gewalt Hamilton Associates Inc.
625 Forest Edge Drive, Vernon Hills, IL, 60061, US



Conrads Lane & Overpass (west side) - TMC

Sat Mar 6, 2021
Full Length (11 AM-1 PM)
All Classes (Lights, Articulated Trucks and Single-Unit Trucks, Buses)
All Movements
ID: 816111, Location: 29.74803, -98.058311

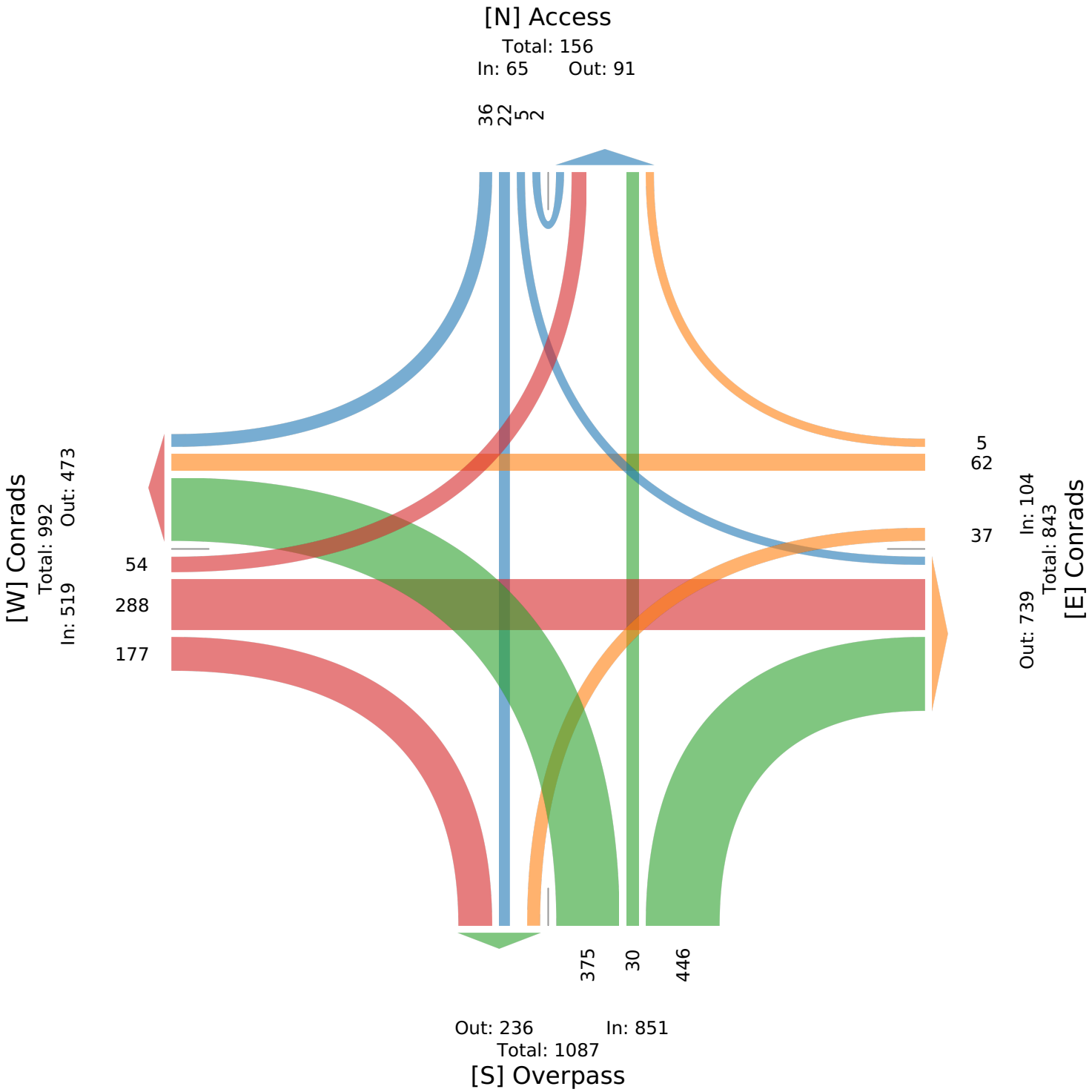
Provided by: Gewalt Hamilton Associates Inc.
625 Forest Edge Drive, Vernon Hills, IL, 60061, US

Leg	Conrads					Conrads					Overpass					Access					
Direction	Eastbound					Westbound					Northbound					Southbound					
Time	L	T	R	U	App	L	T	R	U	App	L	T	R	U	App	L	T	R	U	App	Int
2021-03-06 11:00AM	2	29	22	0	**53**	4	11	0	0	**15**	44	8	55	0	**107**	0	5	5	0	**10**	**185**
11:15AM	3	43	12	0	**58**	4	8	0	0	**12**	47	2	72	0	**121**	0	0	3	0	**3**	**194**
11:30AM	4	26	23	0	**53**	5	8	0	0	**13**	54	2	63	0	**119**	3	3	6	0	**12**	**197**
11:45AM	5	31	20	0	**56**	7	11	1	0	**19**	47	4	55	0	**106**	0	2	5	0	**7**	**188**
Hourly Total	14	129	77	0	**220**	20	38	1	0	**59**	192	16	245	0	**453**	3	10	19	0	**32**	**764**
12:00PM	7	38	22	0	**67**	10	4	1	0	**15**	36	6	51	0	**93**	1	5	5	1	**12**	**187**
12:15PM	9	33	21	0	**63**	3	3	0	0	**6**	43	5	56	0	**104**	0	0	1	0	**1**	**174**
12:30PM	12	42	28	0	**82**	1	11	2	0	**14**	55	1	45	0	**101**	1	6	6	1	**14**	**211**
12:45PM	12	46	29	0	**87**	3	6	1	0	**10**	49	2	49	0	**100**	0	1	5	0	**6**	**203**
Hourly Total	40	159	100	0	**299**	17	24	4	0	**45**	183	14	201	0	**398**	2	12	17	2	**33**	**775**
Total	54	288	177	0	**519**	37	62	5	0	**104**	375	30	446	0	**851**	5	22	36	2	**65**	**1539**
% Approach	10.4%	55.5%	34.1%	0%	-	35.6%	59.6%	4.8%	0%	-	44.1%	3.5%	52.4%	0%	-	7.7%	33.8%	55.4%	3.1%	-	-
% Total	3.5%	18.7%	11.5%	0%	**33.7%**	2.4%	4.0%	0.3%	0%	**6.8%**	24.4%	1.9%	29.0%	0%	**55.3%**	0.3%	1.4%	2.3%	0.1%	**4.2%**	-
Lights	51	257	159	0	**467**	32	50	5	0	**87**	344	28	412	0	**784**	5	21	35	2	**63**	1401
% Lights	94.4%	89.2%	89.8%	0%	**90.0%**	86.5%	80.6%	100%	0%	**83.7%**	91.7%	93.3%	92.4%	0%	**92.1%**	100%	95.5%	97.2%	100%	**96.9%**	91.0%
Articulated Trucks and Single-Unit Trucks	3	31	18	0	**52**	5	12	0	0	**17**	31	2	34	0	**67**	0	1	1	0	**2**	138
% Articulated Trucks and Single-Unit Trucks	5.6%	10.8%	10.2%	0%	**10.0%**	13.5%	19.4%	0%	0%	**16.3%**	8.3%	6.7%	7.6%	0%	**7.9%**	0%	4.5%	2.8%	0%	**3.1%**	9.0%
Buses	0	0	0	0	**0**	0	0	0	0	**0**	0	0	0	0	**0**	0	0	0	0	**0**	0
% Buses	0%	0%	0%	0%	**0%**	0%	0%	0%	0%	**0%**	0%	0%	0%	0%	**0%**	0%	0%	0%	0%	**0%**	0%

*L: Left, R: Right, T: Thru, U: U-Turn

Conrads Lane & Overpass (west side) - TMC
Sat Mar 6, 2021
Full Length (11 AM-1 PM)
All Classes (Lights, Articulated Trucks and Single-Unit Trucks, Buses)
All Movements
ID: 816111, Location: 29.74803, -98.058311

Provided by: Gewalt Hamilton Associates Inc.
625 Forest Edge Drive, Vernon Hills, IL, 60061, US



Conrads Lane & Overpass (west side) - TMC

Sat Mar 6, 2021
Midday Peak (WKND) (12 PM - 1 PM) - Overall Peak Hour
All Classes (Lights, Articulated Trucks and Single-Unit Trucks, Buses)
All Movements
ID: 816111, Location: 29.74803, -98.058311

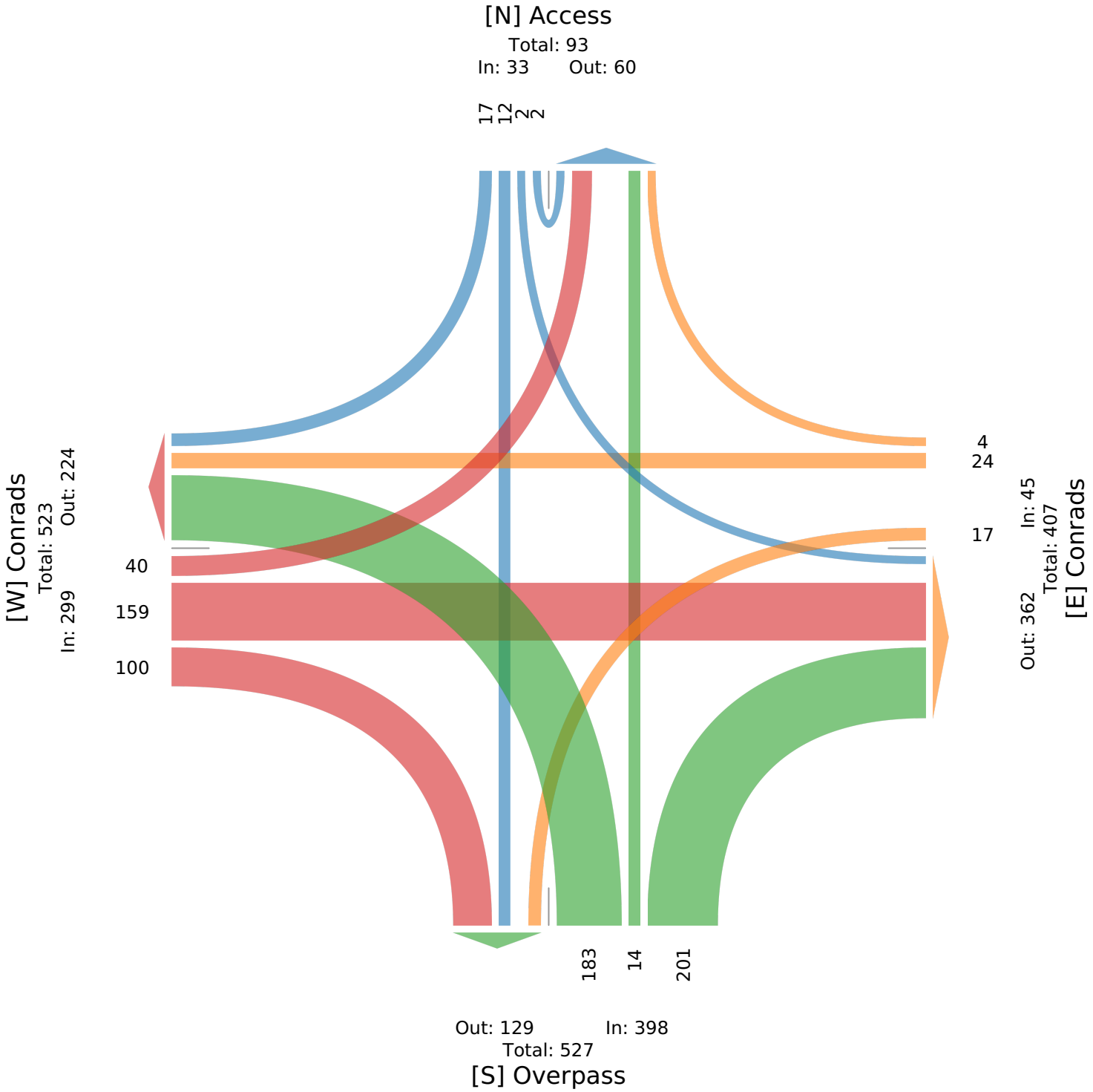
GEWALT HAMILTON ASSOCIATES, INC.
Provided by: Gewalt Hamilton Associates Inc.
625 Forest Edge Drive, Vernon Hills, IL, 60061, US

Leg	Conrads					Conrads					Overpass					Access					
Direction	Eastbound					Westbound					Northbound					Southbound					
Time	L	T	R	U	App	L	T	R	U	App	L	T	R	U	App	L	T	R	U	App	Int
2021-03-06 12:00PM	7	38	22	0	**67**	10	4	1	0	**15**	36	6	51	0	**93**	1	5	5	1	**12**	**187**
12:15PM	9	33	21	0	**63**	3	3	0	0	**6**	43	5	56	0	**104**	0	0	1	0	**1**	**174**
12:30PM	12	42	28	0	**82**	1	11	2	0	**14**	55	1	45	0	**101**	1	6	6	1	**14**	**211**
12:45PM	12	46	29	0	**87**	3	6	1	0	**10**	49	2	49	0	**100**	0	1	5	0	**6**	**203**
Total	40	159	100	0	**299**	17	24	4	0	**45**	183	14	201	0	**398**	2	12	17	2	**33**	**775**
% Approach	13.4%	53.2%	33.4%	0%	-	37.8%	53.3%	8.9%	0%	-	46.0%	3.5%	50.5%	0%	-	6.1%	36.4%	51.5%	6.1%	-	-
% Total	5.2%	20.5%	12.9%	0%	**38.6%**	2.2%	3.1%	0.5%	0%	**5.8%**	23.6%	1.8%	25.9%	0%	**51.4%**	0.3%	1.5%	2.2%	0.3%	**4.3%**	-
PHF	0.833	0.864	0.862	-	**0.859**	0.425	0.545	0.500	-	**0.750**	0.832	0.583	0.897	-	**0.957**	0.500	0.500	0.708	0.500	**0.589**	0.918
Lights	38	145	93	0	**276**	16	20	4	0	**40**	162	14	185	0	**361**	2	12	17	2	**33**	710
% Lights	95.0%	91.2%	93.0%	0%	**92.3%**	94.1%	83.3%	100%	0%	**88.9%**	88.5%	100%	92.0%	0%	**90.7%**	100%	100%	100%	100%	**100%**	91.6%
Articulated Trucks and Single-Unit Trucks	2	14	7	0	**23**	1	4	0	0	**5**	21	0	16	0	**37**	0	0	0	0	**0**	65
% Articulated Trucks and Single-Unit Trucks	5.0%	8.8%	7.0%	0%	**7.7%**	5.9%	16.7%	0%	0%	**11.1%**	11.5%	0%	8.0%	0%	**9.3%**	0%	0%	0%	0%	**0%**	8.4%
Buses	0	0	0	0	**0**	0	0	0	0	**0**	0	0	0	0	**0**	0	0	0	0	**0**	0
% Buses	0%	0%	0%	0%	**0%**	0%	0%	0%	0%	**0%**	0%	0%	0%	0%	**0%**	0%	0%	0%	0%	**0%**	0%

*L: Left, R: Right, T: Thru, U: U-Turn

Conrads Lane & Overpass (west side) - TMC
Sat Mar 6, 2021
Midday Peak (WKND) (12 PM - 1 PM) - Overall Peak Hour
All Classes (Lights, Articulated Trucks and Single-Unit Trucks, Buses)
All Movements
ID: 816111, Location: 29.74803, -98.058311

Provided by: Gewalt Hamilton Associates Inc.
625 Forest Edge Drive, Vernon Hills, IL, 60061, US



S Interstate 35 Frontage Road & Conrads Lane - TMC

Sat Mar 6, 2021
Full Length (11 AM-1 PM)
All Classes (Lights, Articulated Trucks and Single-Unit Trucks, Buses)
All Movements
ID: 816112, Location: 29.747754, -98.057758

GEWALT HAMILTON ASSOCIATES, INC.
Provided by: Gewalt Hamilton Associates Inc.
625 Forest Edge Drive, Vernon Hills, IL, 60061, US

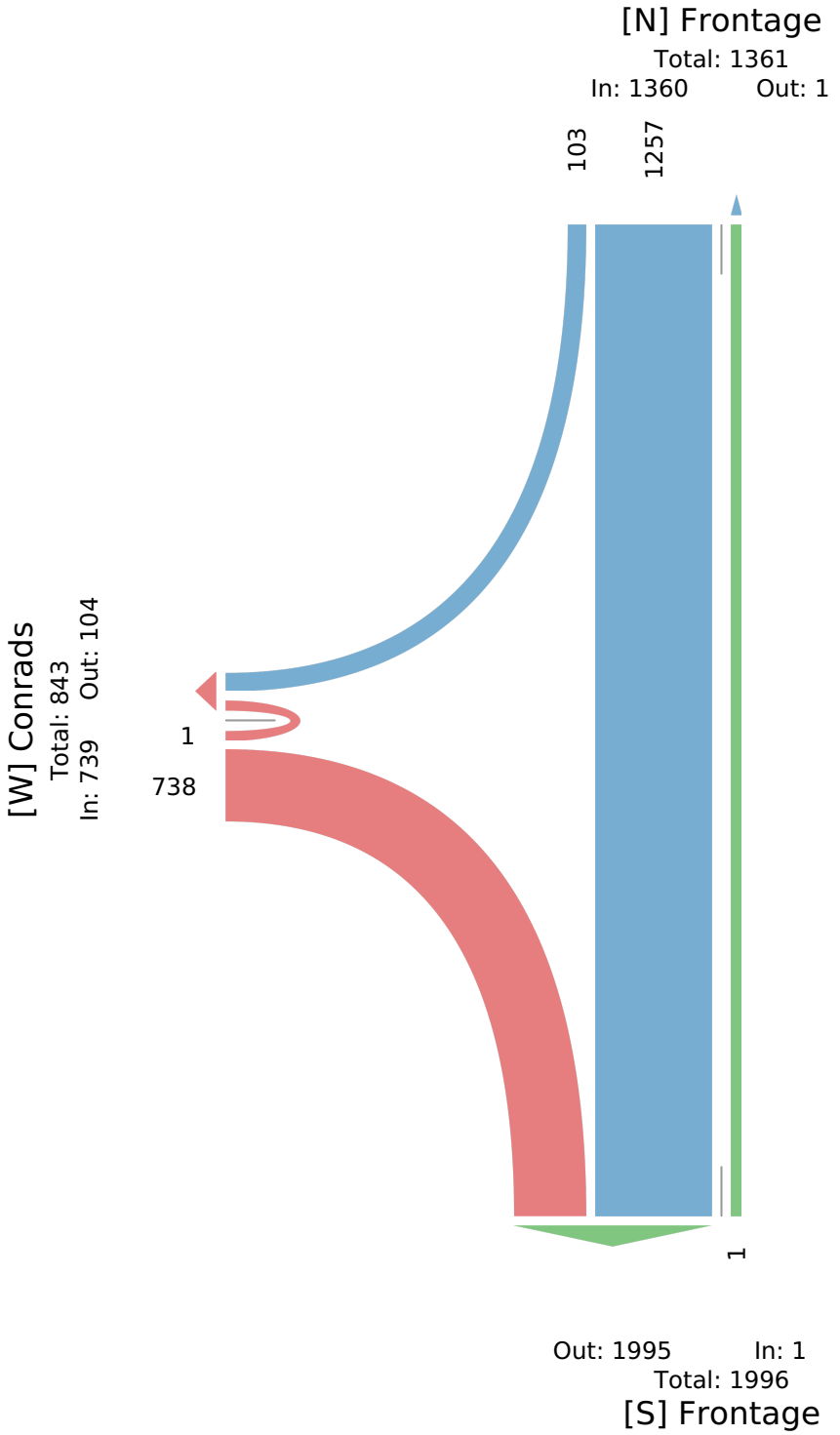
Leg	Conrads				Frontage				Frontage				
Direction	Eastbound				Northbound				Southbound				
Time	L	R	U	**App**	L	T	U	**App**	T	R	U	**App**	**Int**
2021-03-06 11:00AM	0	84	0	**84**	0	0	0	**0**	36	14	0	**50**	**134**
11:15AM	0	118	0	**118**	0	0	0	**0**	20	13	0	**33**	**151**
11:30AM	0	91	0	**91**	0	0	0	**0**	36	13	0	**49**	**140**
11:45AM	0	83	0	**83**	0	0	0	**0**	150	17	0	**167**	**250**
Hourly Total	0	376	0	**376**	0	0	0	**0**	242	57	0	**299**	**675**
12:00PM	0	92	1	**93**	0	0	0	**0**	243	15	0	**258**	**351**
12:15PM	0	92	0	**92**	0	0	0	**0**	247	7	0	**254**	**346**
12:30PM	0	84	0	**84**	0	1	0	**1**	265	14	0	**279**	**364**
12:45PM	0	94	0	**94**	0	0	0	**0**	260	10	0	**270**	**364**
Hourly Total	0	362	1	**363**	0	1	0	**1**	1015	46	0	**1061**	**1425**
Total	0	738	1	**739**	0	1	0	**1**	1257	103	0	**1360**	**2100**
% Approach	0%	99.9%	0.1%	**-**	0%	100%	0%	**-**	92.4%	7.6%	0%	**-**	-
% Total	0%	35.1%	0%	**35.2%**	0%	0%	0%	**0%**	59.9%	4.9%	0%	**64.8%**	-
Lights	0	673	1	**674**	0	1	0	**1**	1221	86	0	**1307**	1982
% Lights	0%	91.2%	100%	**91.2%**	0%	100%	0%	**100%**	97.1%	83.5%	0%	**96.1%**	94.4%
Articulated Trucks and Single-Unit Trucks	0	65	0	**65**	0	0	0	**0**	36	17	0	**53**	118
% Articulated Trucks and Single-Unit Trucks	0%	8.8%	0%	**8.8%**	0%	0%	0%	**0%**	2.9%	16.5%	0%	**3.9%**	5.6%
Buses	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	0
% Buses	0%	0%	0%	**0%**	0%	0%	0%	**0%**	0%	0%	0%	**0%**	0%

*L: Left, R: Right, T: Thru, U: U-Turn

S Interstate 35 Frontage Road & Conrads Lane - TMC

Sat Mar 6, 2021
Full Length (11 AM-1 PM)
All Classes (Lights, Articulated Trucks and Single-Unit Trucks, Buses)
All Movements
ID: 816112, Location: 29.747754, -98.057758

GEWALT HAMILTON ASSOCIATES, INC.
Provided by: Gewalt Hamilton Associates Inc.
625 Forest Edge Drive, Vernon Hills, IL, 60061, US



S Interstate 35 Frontage Road & Conrads Lane - TMC

Sat Mar 6, 2021
Midday Peak (WKND) (12 PM - 1 PM) - Overall Peak Hour
All Classes (Lights, Articulated Trucks and Single-Unit Trucks, Buses)
All Movements
ID: 816112, Location: 29.747754, -98.057758

Provided by: Gewalt Hamilton Associates Inc.
625 Forest Edge Drive, Vernon Hills, IL, 60061, US

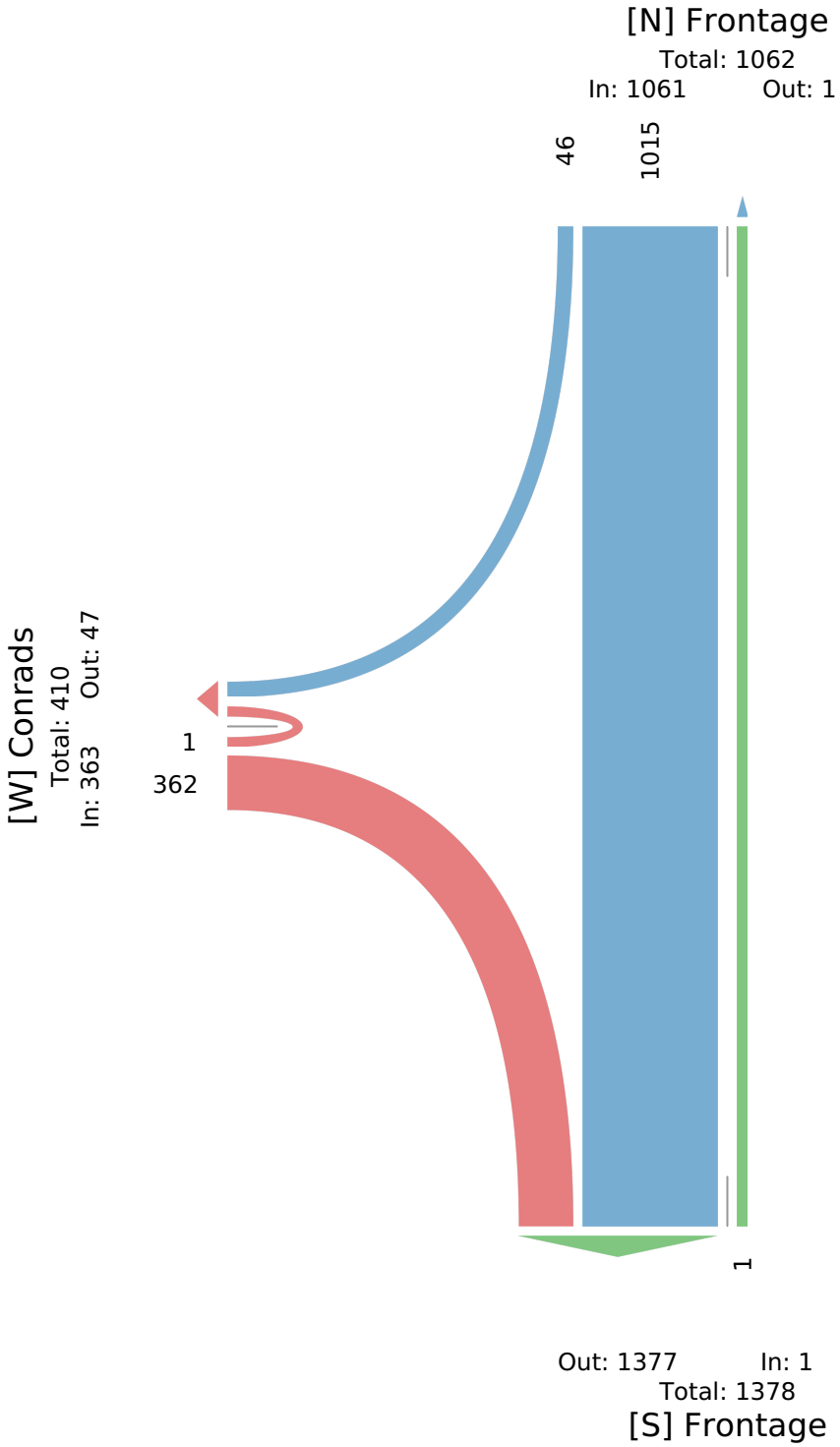
Leg	Conrads				Frontage				Frontage				
Direction	Eastbound				Northbound				Southbound				
Time	L	R	U	**App**	L	T	U	**App**	T	R	U	**App**	**Int**
2021-03-06 12:00PM	0	92	1	**93**	0	0	0	**0**	243	15	0	**258**	**351**
12:15PM	0	92	0	**92**	0	0	0	**0**	247	7	0	**254**	**346**
12:30PM	0	84	0	**84**	0	1	0	**1**	265	14	0	**279**	**364**
12:45PM	0	94	0	**94**	0	0	0	**0**	260	10	0	**270**	**364**
Total	0	362	1	**363**	0	1	0	**1**	1015	46	0	**1061**	**1425**
% Approach	0%	99.7%	0.3%	**-**	0%	100%	0%	**-**	95.7%	4.3%	0%	**-**	-
% Total	0%	25.4%	0.1%	**25.5%**	0%	0.1%	0%	**0.1%**	71.2%	3.2%	0%	**74.5%**	-
PHF	-	0.963	0.250	**0.965**	-	0.250	-	**0.250**	0.958	0.767	-	**0.951**	0.979
Lights	0	332	1	**333**	0	1	0	**1**	989	41	0	**1030**	1364
% Lights	0%	91.7%	100%	**91.7%**	0%	100%	0%	**100%**	97.4%	89.1%	0%	**97.1%**	95.7%
Articulated Trucks and Single-Unit Trucks	0	30	0	**30**	0	0	0	**0**	26	5	0	**31**	61
% Articulated Trucks and Single-Unit Trucks	0%	8.3%	0%	**8.3%**	0%	0%	0%	**0%**	2.6%	10.9%	0%	**2.9%**	4.3%
Buses	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	0
% Buses	0%	0%	0%	**0%**	0%	0%	0%	**0%**	0%	0%	0%	**0%**	0%

*L: Left, R: Right, T: Thru, U: U-Turn

S Interstate 35 Frontage Road & Conrads Lane - TMC

Sat Mar 6, 2021
Midday Peak (WKND) (12 PM - 1 PM) - Overall Peak Hour
All Classes (Lights, Articulated Trucks and Single-Unit Trucks, Buses)
All Movements
ID: 816112, Location: 29.747754, -98.057758

GEWALT HAMILTON ASSOCIATES, INC.
Provided by: Gewalt Hamilton Associates Inc.
625 Forest Edge Drive, Vernon Hills, IL, 60061, US



S Interstate 35 Frontage Road & Oak Creek Way - TMC

Sat Mar 6, 2021
Full Length (11 AM-1 PM)
All Classes (Lights, Articulated Trucks and Single-Unit Trucks, Buses)
All Movements
ID: 816113, Location: 29.74388, -98.061172

Provided by: Gewalt Hamilton Associates Inc.
625 Forest Edge Drive, Vernon Hills, IL, 60061, US

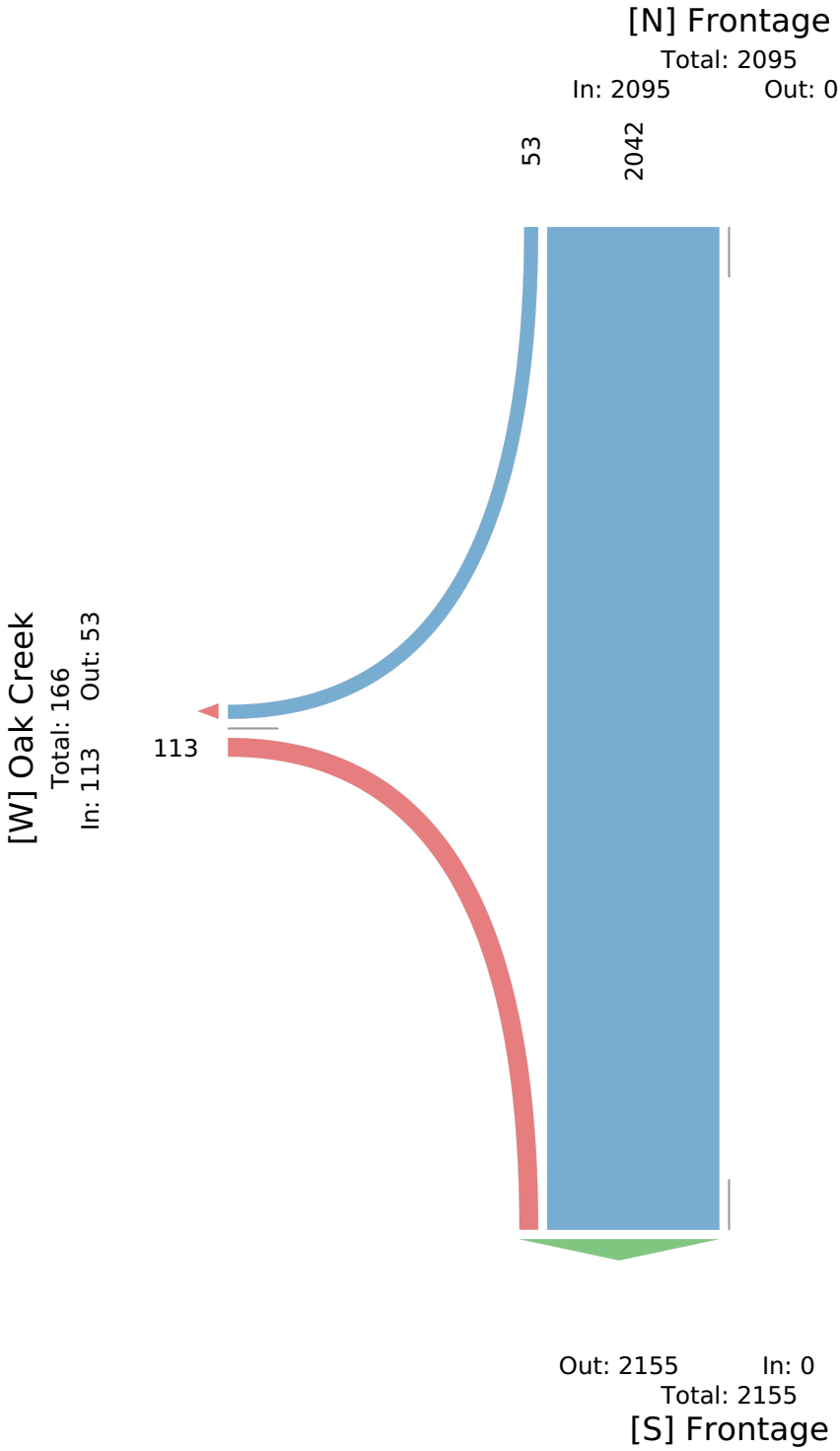
Leg Direction	Oak Creek Eastbound			Frontage Southbound			
Time	R	U	**App**	T	R	**App**	**Int**
2021-03-06 11:00AM	11	0	**11**	123	5	**128**	**139**
11:15AM	19	0	**19**	138	10	**148**	**167**
11:30AM	16	0	**16**	135	7	**142**	**158**
11:45AM	10	0	**10**	244	6	**250**	**260**
Hourly Total	56	0	**56**	640	28	**668**	**724**
12:00PM	18	0	**18**	342	6	**348**	**366**
12:15PM	15	0	**15**	346	6	**352**	**367**
12:30PM	10	0	**10**	351	4	**355**	**365**
12:45PM	14	0	**14**	363	9	**372**	**386**
Hourly Total	57	0	**57**	1402	25	**1427**	**1484**
Total	113	0	**113**	2042	53	**2095**	**2208**
% Approach	100%	0%	**-**	97.5%	2.5%	**-**	-
% Total	5.1%	0%	**5.1%**	92.5%	2.4%	**94.9%**	-
Lights	112	0	**112**	1941	53	**1994**	2106
% Lights	99.1%	0%	**99.1%**	95.1%	100%	**95.2%**	95.4%
Articulated Trucks and Single-Unit Trucks	1	0	**1**	101	0	**101**	102
% Articulated Trucks and Single-Unit Trucks	0.9%	0%	**0.9%**	4.9%	0%	**4.8%**	4.6%
Buses	0	0	**0**	0	0	**0**	0
% Buses	0%	0%	**0%**	0%	0%	**0%**	0%

*R: Right, T: Thru, U: U-Turn

S Interstate 35 Frontage Road & Oak Creek Way - TMC

Sat Mar 6, 2021
Full Length (11 AM-1 PM)
All Classes (Lights, Articulated Trucks and Single-Unit Trucks, Buses)
All Movements
ID: 816113, Location: 29.74388, -98.061172

Provided by: Gewalt Hamilton Associates Inc.
625 Forest Edge Drive, Vernon Hills, IL, 60061, US



S Interstate 35 Frontage Road & Oak Creek Way - TMC

Sat Mar 6, 2021
Midday Peak (WKND) (12 PM - 1 PM) - Overall Peak Hour
All Classes (Lights, Articulated Trucks and Single-Unit Trucks, Buses)
All Movements
ID: 816113, Location: 29.74388, -98.061172

Provided by: Gewalt Hamilton Associates Inc.
625 Forest Edge Drive, Vernon Hills, IL, 60061, US

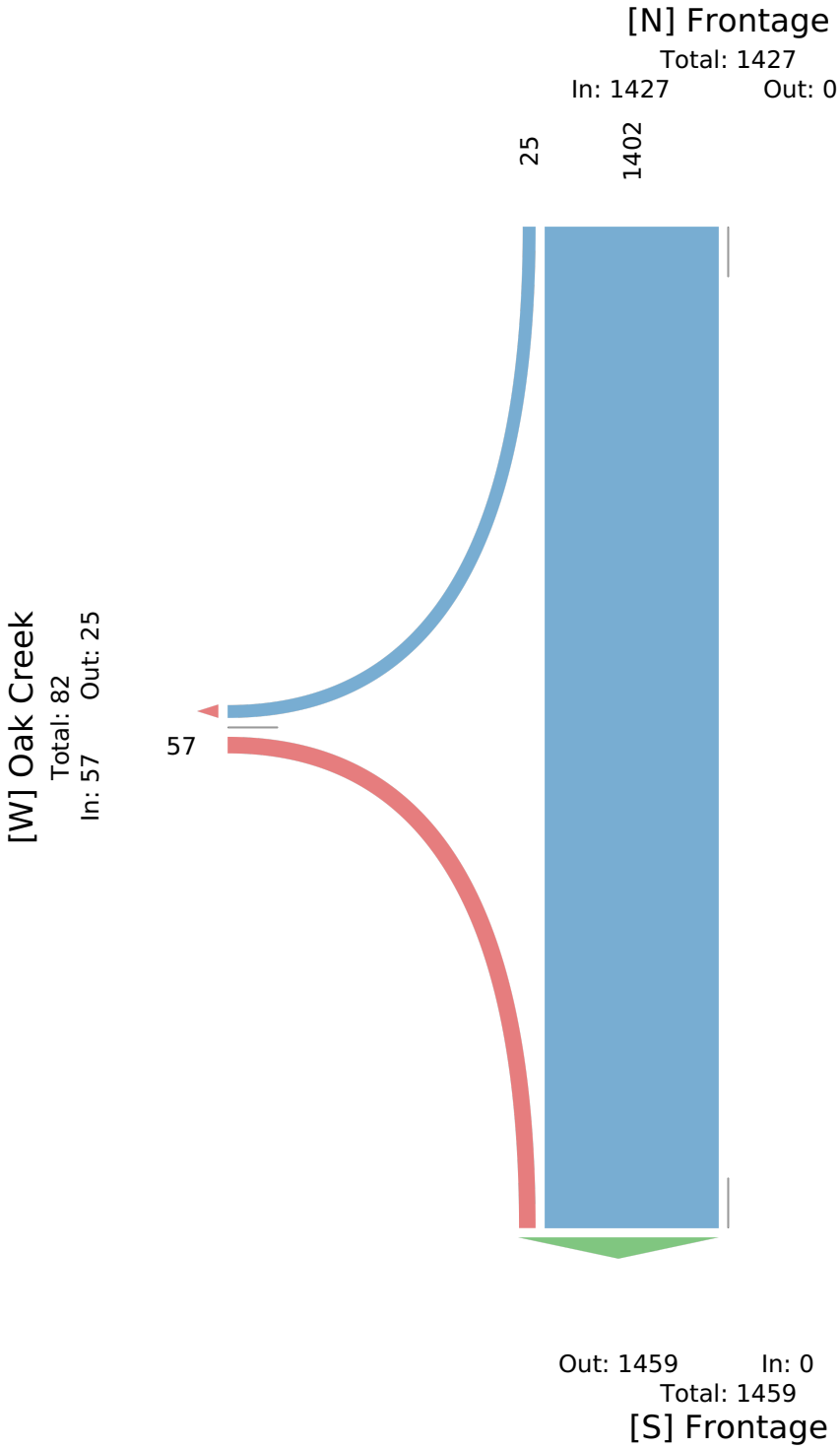
Leg Direction	Oak Creek Eastbound			Frontage Southbound			
Time	R	U	**App**	T	R	**App**	**Int**
2021-03-06 12:00PM	18	0	**18**	342	6	**348**	**366**
12:15PM	15	0	**15**	346	6	**352**	**367**
12:30PM	10	0	**10**	351	4	**355**	**365**
12:45PM	14	0	**14**	363	9	**372**	**386**
Total	57	0	**57**	1402	25	**1427**	**1484**
% Approach	100%	0%	**-**	98.2%	1.8%	**-**	-
% Total	3.8%	0%	**3.8%**	94.5%	1.7%	**96.2%**	-
PHF	0.792	-	**0.792**	0.966	0.694	**0.959**	0.961
Lights	56	0	**56**	1344	25	**1369**	1425
% Lights	98.2%	0%	**98.2%**	95.9%	100%	**95.9%**	96.0%
Articulated Trucks and Single-Unit Trucks	1	0	**1**	58	0	**58**	59
% Articulated Trucks and Single-Unit Trucks	1.8%	0%	**1.8%**	4.1%	0%	**4.1%**	4.0%
Buses	0	0	**0**	0	0	**0**	0
% Buses	0%	0%	**0%**	0%	0%	**0%**	0%

*R: Right, T: Thru, U: U-Turn

S Interstate 35 Frontage Road & Oak Creek Way - TMC

Sat Mar 6, 2021
Midday Peak (WKND) (12 PM - 1 PM) - Overall Peak Hour
All Classes (Lights, Articulated Trucks and Single-Unit Trucks, Buses)
All Movements
ID: 816113, Location: 29.74388, -98.061172

GEWALT HAMILTON ASSOCIATES, INC.
Provided by: Gewalt Hamilton Associates Inc.
625 Forest Edge Drive, Vernon Hills, IL, 60061, US



- I-35 SB Off Ramp & S Interstate 35 Frontag... - ATR

Sat Mar 6, 2021
Full Length (11 AM-1 PM)
All Classes (Lights, Articulated Trucks and Single-Unit Trucks, Buses)
All Channels
ID: 817646, Location: 29.743031, -98.062136

GEWALT HAMILTON ASSOCIATES, INC.
Provided by: Gewalt Hamilton Associates Inc.
625 Forest Edge Drive, Vernon Hills, IL, 60061, US

Leg Direction	North Southbound			
Time	Lane 1	Lane 2	**App**	**Int**
2021-03-06 11:00AM	134	140	**274**	**274**
11:15AM	153	126	**279**	**279**
11:30AM	152	152	**304**	**304**
11:45AM	247	82	**329**	**329**
Hourly Total	686	500	**1186**	**1186**
12:00PM	358	42	**400**	**400**
12:15PM	362	27	**389**	**389**
12:30PM	364	39	**403**	**403**
12:45PM	376	23	**399**	**399**
Hourly Total	1460	131	**1591**	**1591**
Total	2146	631	**2777**	**2777**
% Approach	77.3%	22.7%	**-**	-
% Total	77.3%	22.7%	**100%**	-
Lights	2046	615	**2661**	2661
% Lights	95.3%	97.5%	**95.8%**	95.8%
Articulated Trucks and Single-Unit Trucks	99	14	**113**	113
% Articulated Trucks and Single-Unit Trucks	4.6%	2.2%	**4.1%**	4.1%
Buses	1	2	**3**	3
% Buses	0%	0.3%	**0.1%**	0.1%

- I-35 SB Off Ramp & S Interstate 35 Frontag... - ATR

Sat Mar 6, 2021
Full Length (11 AM-1 PM)
All Classes (Lights, Articulated Trucks and Single-Unit Trucks, Buses)
All Channels
ID: 817646, Location: 29.743031, -98.062136

Provided by: Gewalt Hamilton Associates Inc.
625 Forest Edge Drive, Vernon Hills, IL, 60061, US

- I-35 SB Off Ramp & S Interstate 35 Frontag... - ATR

Sat Mar 6, 2021
Midday Peak (WKND) (12 PM - 1 PM) - Overall Peak Hour
All Classes (Lights, Articulated Trucks and Single-Unit Trucks, Buses)
All Channels
ID: 817646, Location: 29.743031, -98.062136

Provided by: Gewalt Hamilton Associates Inc.
625 Forest Edge Drive, Vernon Hills, IL, 60061, US

Leg Direction	North Southbound			
Time	Lane 1	Lane 2	**App**	**Int**
2021-03-06 12:00PM	358	42	**400**	**400**
12:15PM	362	27	**389**	**389**
12:30PM	364	39	**403**	**403**
12:45PM	376	23	**399**	**399**
Total	1460	131	**1591**	**1591**
% Approach	91.8%	8.2%	**-**	-
% Total	91.8%	8.2%	**100%**	-
PHF	0.971	0.780	**0.987**	0.987
Lights	1404	128	**1532**	1532
% Lights	96.2%	97.7%	**96.3%**	96.3%
Articulated Trucks and Single-Unit Trucks	55	3	**58**	58
% Articulated Trucks and Single-Unit Trucks	3.8%	2.3%	**3.6%**	3.6%
Buses	1	0	**1**	1
% Buses	0.1%	0%	**0.1%**	0.1%

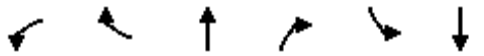
- I-35 SB Off Ramp & S Interstate 35 Frontag... - ATR
Sat Mar 6, 2021
Midday Peak (WKND) (12 PM - 1 PM) - Overall Peak Hour
All Classes (Lights, Articulated Trucks and Single-Unit Trucks, Buses)
All Channels
ID: 817646, Location: 29.743031, -98.062136

GEWALT HAMILTON ASSOCIATES, INC.
Provided by: Gewalt Hamilton Associates Inc.
625 Forest Edge Drive, Vernon Hills, IL, 60061, US

APPENDIX B
EXISTING TRAFFIC SCENARIO CAPACITY ANALYSIS SUMMARY SHEETS

Lanes, Volumes, Timings
3: N Interstate 35 Frontage Road & Kohlenberg Road

03/22/2021



Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	0	241	27	316	0	0
Future Volume (vph)	0	241	27	316	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.865	0.876			
Flt Protected						
Satd. Flow (prot)	0	1325	1418	0	0	0
Flt Permitted						
Satd. Flow (perm)	0	1325	1418	0	0	0
Link Speed (mph)	40		55			55
Link Distance (ft)	215		1729			1309
Travel Time (s)	3.7		21.4			16.2
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	24%	22%	17%	0%	0%
Adj. Flow (vph)	0	262	29	343	0	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	262	372	0	0	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(ft)	0		0			0
Link Offset(ft)	0		0			0
Crosswalk Width(ft)	16		16			16
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9		9	15	
Sign Control	Stop		Free			Free

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 42.5%		ICU Level of Service A	
Analysis Period (min) 15			

HCM 6th TWSC
3: N Interstate 35 Frontage Road & Kohlenberg Road 03/22/2021

Intersection	
Int Delay, s/veh	4.9

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	0	241	27	316	0	0
Future Vol, veh/h	0	241	27	316	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	0	24	22	17	0	0
Mvmt Flow	0	262	29	343	0	0

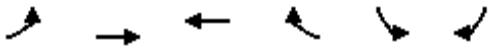
Major/Minor	Minor1		Major1	
Conflicting Flow All	-	201	0	0
Stage 1	-	-	-	-
Stage 2	-	-	-	-
Critical Hdwy	-	6.44	-	-
Critical Hdwy Stg 1	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-
Follow-up Hdwy	-	3.516	-	-
Pot Cap-1 Maneuver	0	787	-	-
Stage 1	0	-	-	-
Stage 2	0	-	-	-
Platoon blocked, %			-	-
Mov Cap-1 Maneuver	-	787	-	-
Mov Cap-2 Maneuver	-	-	-	-
Stage 1	-	-	-	-
Stage 2	-	-	-	-

Approach	WB	NB
HCM Control Delay, s	11.8	0
HCM LOS	B	

Minor Lane/Major Mvmt	NBT	NBR	WBLn1
Capacity (veh/h)	-	-	787
HCM Lane V/C Ratio	-	-	0.333
HCM Control Delay (s)	-	-	11.8
HCM Lane LOS	-	-	B
HCM 95th %tile Q(veh)	-	-	1.5

Lanes, Volumes, Timings
5: Kohlenberg Road & Overpass

03/22/2021

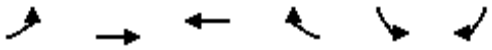


Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	254	62	84	0	0	157
Future Volume (vph)	254	62	84	0	0	157
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt						0.865
Flt Protected		0.961				
Satd. Flow (prot)	0	1553	1473	0	0	1347
Flt Permitted		0.961				
Satd. Flow (perm)	0	1553	1473	0	0	1347
Link Speed (mph)		40	40		25	
Link Distance (ft)		215	320		216	
Travel Time (s)		3.7	5.5		5.9	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	18%	16%	29%	0%	0%	22%
Adj. Flow (vph)	276	67	91	0	0	171
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	343	91	0	0	171
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(ft)		0	0		0	
Link Offset(ft)		0	0		0	
Crosswalk Width(ft)		16	16		16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15			9	15	9
Sign Control		Free	Free		Free	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 27.3%		ICU Level of Service A	
Analysis Period (min) 15			

Lanes, Volumes, Timings
7: Overpass & Kohlenberg Road

03/22/2021

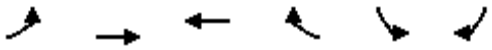


Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	254	0	0	198	178	157
Future Volume (vph)	254	0	0	198	178	157
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt				0.865	0.937	
Flt Protected	0.950				0.974	
Satd. Flow (prot)	1530	0	0	1536	1459	0
Flt Permitted	0.950				0.974	
Satd. Flow (perm)	1530	0	0	1536	1459	0
Link Speed (mph)		25	25		25	
Link Distance (ft)		216	386		243	
Travel Time (s)		5.9	10.5		6.6	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	18%	0%	0%	7%	16%	22%
Adj. Flow (vph)	276	0	0	215	193	171
Shared Lane Traffic (%)						
Lane Group Flow (vph)	276	0	0	215	364	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(ft)		12	0		12	
Link Offset(ft)		0	0		0	
Crosswalk Width(ft)		16	16		16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15			9	15	9
Sign Control		Yield	Free		Free	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 40.2%		ICU Level of Service A	
Analysis Period (min) 15			

Lanes, Volumes, Timings
8: Kohlenberg Road

03/22/2021

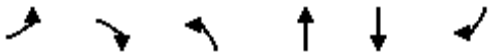


Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	0	62	84	198	178	0
Future Volume (vph)	0	62	84	198	178	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.905			
Flt Protected					0.950	
Satd. Flow (prot)	0	1638	1514	0	1556	0
Flt Permitted					0.950	
Satd. Flow (perm)	0	1638	1514	0	1556	0
Link Speed (mph)		40	40		30	
Link Distance (ft)		320	1526		386	
Travel Time (s)		5.5	26.0		8.8	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	16%	29%	7%	16%	0%
Adj. Flow (vph)	0	67	91	215	193	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	67	306	0	193	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(ft)		0	0		12	
Link Offset(ft)		0	0		0	
Crosswalk Width(ft)		16	16		16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15			9	15	9
Sign Control		Free	Yield		Free	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 33.1%		ICU Level of Service A	
Analysis Period (min) 15			

Lanes, Volumes, Timings
9: N Interstate 35 Frontage Road & I-35 NB Off Ramp

03/22/2021



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	287	0	0	692	0	0
Future Volume (vph)	287	0	0	692	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	0.95	1.00	1.00
Frt						
Flt Protected	0.950					
Satd. Flow (prot)	1612	0	0	3312	0	0
Flt Permitted	0.950					
Satd. Flow (perm)	1612	0	0	3312	0	0
Link Speed (mph)	45			55	55	
Link Distance (ft)	469			818	4824	
Travel Time (s)	7.1			10.1	59.8	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	12%	0%	0%	9%	0%	0%
Adj. Flow (vph)	312	0	0	752	0	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	312	0	0	752	0	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	12			0	0	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9	15			9
Sign Control	Yield			Free	Free	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 41.7%		ICU Level of Service A	
Analysis Period (min) 15			

Lanes, Volumes, Timings
13: S Interstate 35 Frontage Road & I-35 SB Off Ramp

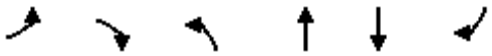
03/22/2021

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	401	0	0	0	0	878
Future Volume (vph)	401	0	0	0	0	878
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	0.95
Frt						
Flt Protected	0.950					
Satd. Flow (prot)	1656	0	0	0	0	3139
Flt Permitted	0.950					
Satd. Flow (perm)	1656	0	0	0	0	3139
Link Speed (mph)	45		55			30
Link Distance (ft)	349		5489			497
Travel Time (s)	5.3		68.0			11.3
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	9%	0%	0%	0%	0%	15%
Adj. Flow (vph)	436	0	0	0	0	954
Shared Lane Traffic (%)						
Lane Group Flow (vph)	436	0	0	0	0	954
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(ft)	12		0			0
Link Offset(ft)	0		0			0
Crosswalk Width(ft)	16		16			16
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9		9	15	
Sign Control	Yield		Free			Free

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 53.2%		ICU Level of Service A	
Analysis Period (min) 15			

Lanes, Volumes, Timings
15: S Interstate 35 Frontage Road & Conrads Lane

03/22/2021



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	0	546	0	0	165	154
Future Volume (vph)	0	546	0	0	165	154
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.865				0.935	
Flt Protected						
Satd. Flow (prot)	1381	0	0	0	1365	0
Flt Permitted						
Satd. Flow (perm)	1381	0	0	0	1365	0
Link Speed (mph)	40			55	55	
Link Distance (ft)	265			1796	1281	
Travel Time (s)	4.5			22.3	15.9	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	19%	0%	0%	19%	42%
Adj. Flow (vph)	0	593	0	0	179	167
Shared Lane Traffic (%)						
Lane Group Flow (vph)	593	0	0	0	346	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	12			0	0	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9	15			9
Sign Control	Stop			Free	Free	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 58.6%		ICU Level of Service B	
Analysis Period (min) 15			

HCM 6th TWSC
15: S Interstate 35 Frontage Road & Conrads Lane

03/22/2021

Intersection	
Int Delay, s/veh	17

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	0	546	0	0	165	154
Future Vol, veh/h	0	546	0	0	165	154
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Stop	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	0	19	0	0	19	42
Mvmt Flow	0	593	0	0	179	167

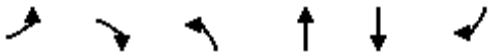
Major/Minor	Minor2			Major2	
Conflicting Flow All	263	263		-	0
Stage 1	263	-		-	-
Stage 2	0	-		-	-
Critical Hdwy	6.4	6.39		-	-
Critical Hdwy Stg 1	5.4	-		-	-
Critical Hdwy Stg 2	-	-		-	-
Follow-up Hdwy	3.5	3.471		-	-
Pot Cap-1 Maneuver	730	736		-	-
Stage 1	786	-		-	-
Stage 2	-	-		-	-
Platoon blocked, %				-	-
Mov Cap-1 Maneuver	730	736		-	-
Mov Cap-2 Maneuver	730	-		-	-
Stage 1	786	-		-	-
Stage 2	-	-		-	-

Approach	EB	SB
HCM Control Delay, s	26.9	0
HCM LOS	D	

Minor Lane/Major Mvmt	EBLn1	SBT	SBR
Capacity (veh/h)	736	-	-
HCM Lane V/C Ratio	0.806	-	-
HCM Control Delay (s)	26.9	-	-
HCM Lane LOS	D	-	-
HCM 95th %tile Q(veh)	8.5	-	-

Lanes, Volumes, Timings
17: S Interstate 35 Frontage Road & Oak Creek Way

03/22/2021



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	0	114	0	0	764	40
Future Volume (vph)	0	114	0	0	764	40
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0	0	0			315
Storage Lanes	0	1	0			1
Taper Length (ft)	25		25			
Lane Util. Factor	1.00	1.00	1.00	1.00	0.95	1.00
Frt		0.865				0.850
Flt Protected						
Satd. Flow (prot)	0	1627	0	0	3059	1568
Flt Permitted						
Satd. Flow (perm)	0	1627	0	0	3059	1568
Link Speed (mph)	30			55	55	
Link Distance (ft)	1047			497	1796	
Travel Time (s)	23.8			6.2	22.3	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	1%	0%	0%	18%	3%
Adj. Flow (vph)	0	124	0	0	830	43
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	124	0	0	830	43
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	0			0	0	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9	15			9
Sign Control	Stop			Free	Free	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 34.8%		ICU Level of Service A	
Analysis Period (min) 15			

HCM 6th TWSC
17: S Interstate 35 Frontage Road & Oak Creek Way

03/22/2021

Intersection	
Int Delay, s/veh	1.6

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	0	114	0	0	764	40
Future Vol, veh/h	0	114	0	0	764	40
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	-	315
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	0	1	0	0	18	3
Mvmt Flow	0	124	0	0	830	43

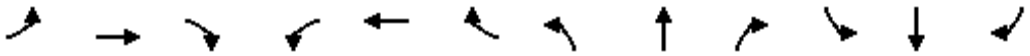
Major/Minor	Minor2			Major2	
Conflicting Flow All	-	415		-	0
Stage 1	-	-		-	-
Stage 2	-	-		-	-
Critical Hdwy	-	6.92		-	-
Critical Hdwy Stg 1	-	-		-	-
Critical Hdwy Stg 2	-	-		-	-
Follow-up Hdwy	-	3.31		-	-
Pot Cap-1 Maneuver	0	589		-	-
Stage 1	0	-		-	-
Stage 2	0	-		-	-
Platoon blocked, %				-	-
Mov Cap-1 Maneuver	-	589		-	-
Mov Cap-2 Maneuver	-	-		-	-
Stage 1	-	-		-	-
Stage 2	-	-		-	-

Approach	EB	SB
HCM Control Delay, s	12.7	0
HCM LOS	B	

Minor Lane/Major Mvmt	EBLn1	SBT	SBR
Capacity (veh/h)	589	-	-
HCM Lane V/C Ratio	0.21	-	-
HCM Control Delay (s)	12.7	-	-
HCM Lane LOS	B	-	-
HCM 95th %tile Q(veh)	0.8	-	-

Lanes, Volumes, Timings
19: Overpass/Access Driveway & Conrads Lane

03/22/2021



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	23	322	256	68	83	3	202	27	223	1	11	28
Future Volume (vph)	23	322	256	68	83	3	202	27	223	1	11	28
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.943			0.998			0.933			0.906	
Flt Protected		0.998			0.978			0.978			0.999	
Satd. Flow (prot)	0	1510	0	0	1302	0	0	1536	0	0	1678	0
Flt Permitted		0.998			0.978			0.978			0.999	
Satd. Flow (perm)	0	1510	0	0	1302	0	0	1536	0	0	1678	0
Link Speed (mph)		40			40			25			30	
Link Distance (ft)		1157			265			448			250	
Travel Time (s)		19.7			4.5			12.2			5.7	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	24%	13%	41%	45%	0%	15%	4%	12%	0%	9%	0%
Adj. Flow (vph)	25	350	278	74	90	3	220	29	242	1	12	30
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	653	0	0	167	0	0	491	0	0	43	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Free			Free			Stop			Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 78.0%		ICU Level of Service D	
Analysis Period (min) 15			

Intersection	
Int Delay, s/veh	33.1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	23	322	256	68	83	3	202	27	223	1	11	28
Future Vol, veh/h	23	322	256	68	83	3	202	27	223	1	11	28
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	Yield	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	0	24	13	41	45	0	15	4	12	0	9	0
Mvmt Flow	25	350	278	74	90	3	220	29	242	1	12	30

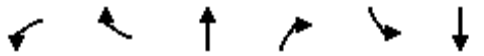
Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	93	0	0	628	0	0	800	780	489	794	918	92
Stage 1	-	-	-	-	-	-	539	539	-	240	240	-
Stage 2	-	-	-	-	-	-	261	241	-	554	678	-
Critical Hdwy	4.1	-	-	4.51	-	-	7.25	6.54	6.32	7.1	6.59	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.25	5.54	-	6.1	5.59	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.25	5.54	-	6.1	5.59	-
Follow-up Hdwy	2.2	-	-	2.569	-	-	3.635	4.036	3.408	3.5	4.081	3.3
Pot Cap-1 Maneuver	1514	-	-	792	-	-	288	324	559	308	264	971
Stage 1	-	-	-	-	-	-	504	519	-	768	694	-
Stage 2	-	-	-	-	-	-	716	702	-	520	441	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1514	-	-	792	-	-	243	284	559	146	232	971
Mov Cap-2 Maneuver	-	-	-	-	-	-	243	284	-	146	232	-
Stage 1	-	-	-	-	-	-	490	505	-	747	625	-
Stage 2	-	-	-	-	-	-	613	633	-	270	429	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.3	4.4	88.2	13.2
HCM LOS			F	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	464	1514	-	-	792	-	-	481
HCM Lane V/C Ratio	1.059	0.017	-	-	0.093	-	-	0.09
HCM Control Delay (s)	88.2	7.4	0	-	10	0	-	13.2
HCM Lane LOS	F	A	A	-	B	A	-	B
HCM 95th %tile Q(veh)	15.4	0.1	-	-	0.3	-	-	0.3

Lanes, Volumes, Timings
3: N Interstate 35 Frontage Road & Kohlenberg Road

03/22/2021



Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	0	169	36	483	0	0
Future Volume (vph)	0	169	36	483	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.865	0.874			
Flt Protected						
Satd. Flow (prot)	0	1508	1532	0	0	0
Flt Permitted						
Satd. Flow (perm)	0	1508	1532	0	0	0
Link Speed (mph)	40		55			55
Link Distance (ft)	215		1729			1309
Travel Time (s)	3.7		21.4			16.2
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	9%	14%	8%	0%	0%
Adj. Flow (vph)	0	184	39	525	0	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	184	564	0	0	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(ft)	0		0			0
Link Offset(ft)	0		0			0
Crosswalk Width(ft)	16		16			16
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9		9	15	
Sign Control	Stop		Free			Free

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 48.9%		ICU Level of Service A	
Analysis Period (min) 15			

HCM 6th TWSC
3: N Interstate 35 Frontage Road & Kohlenberg Road 03/22/2021

Intersection	
Int Delay, s/veh	2.9

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	0	169	36	483	0	0
Future Vol, veh/h	0	169	36	483	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	0	9	14	8	0	0
Mvmt Flow	0	184	39	525	0	0

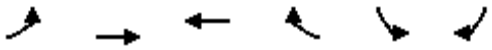
Major/Minor	Minor1		Major1	
Conflicting Flow All	-	302	0	0
Stage 1	-	-	-	-
Stage 2	-	-	-	-
Critical Hdwy	-	6.29	-	-
Critical Hdwy Stg 1	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-
Follow-up Hdwy	-	3.381	-	-
Pot Cap-1 Maneuver	0	721	-	-
Stage 1	0	-	-	-
Stage 2	0	-	-	-
Platoon blocked, %			-	-
Mov Cap-1 Maneuver	-	721	-	-
Mov Cap-2 Maneuver	-	-	-	-
Stage 1	-	-	-	-
Stage 2	-	-	-	-

Approach	WB	NB
HCM Control Delay, s	11.7	0
HCM LOS	B	

Minor Lane/Major Mvmt	NBT	NBR	WBLn1
Capacity (veh/h)	-	-	721
HCM Lane V/C Ratio	-	-	0.255
HCM Control Delay (s)	-	-	11.7
HCM Lane LOS	-	-	B
HCM 95th %tile Q(veh)	-	-	1

Lanes, Volumes, Timings
5: Kohlenberg Road & Overpass

03/22/2021

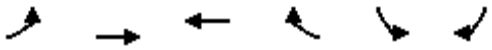


Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	405	78	59	0	0	110
Future Volume (vph)	405	78	59	0	0	110
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt						0.865
Flt Protected		0.960				
Satd. Flow (prot)	0	1688	1900	0	0	1442
Flt Permitted		0.960				
Satd. Flow (perm)	0	1688	1900	0	0	1442
Link Speed (mph)		40	40		25	
Link Distance (ft)		215	320		216	
Travel Time (s)		3.7	5.5		5.9	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	9%	3%	0%	0%	0%	14%
Adj. Flow (vph)	440	85	64	0	0	120
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	525	64	0	0	120
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(ft)		0	0		0	
Link Offset(ft)		0	0		0	
Crosswalk Width(ft)		16	16		16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15			9	15	9
Sign Control		Free	Free		Free	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 36.5%		ICU Level of Service A	
Analysis Period (min) 15			

Lanes, Volumes, Timings
7: Overpass & Kohlenberg Road

03/22/2021

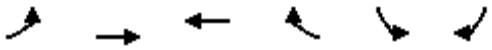


Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	405	0	0	299	138	110
Future Volume (vph)	405	0	0	299	138	110
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt				0.865	0.940	
Flt Protected	0.950				0.973	
Satd. Flow (prot)	1656	0	0	1596	1586	0
Flt Permitted	0.950				0.973	
Satd. Flow (perm)	1656	0	0	1596	1586	0
Link Speed (mph)		25	25		25	
Link Distance (ft)		216	386		243	
Travel Time (s)		5.9	10.5		6.6	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	9%	0%	0%	3%	6%	14%
Adj. Flow (vph)	440	0	0	325	150	120
Shared Lane Traffic (%)						
Lane Group Flow (vph)	440	0	0	325	270	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(ft)		12	0		12	
Link Offset(ft)		0	0		0	
Crosswalk Width(ft)		16	16		16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15			9	15	9
Sign Control		Yield	Free		Free	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 47.6%		ICU Level of Service A	
Analysis Period (min) 15			

Lanes, Volumes, Timings
8: Kohlenberg Road

03/22/2021

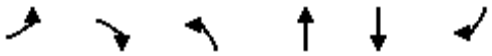


Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	0	78	59	299	138	0
Future Volume (vph)	0	78	59	299	138	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.887			
Flt Protected					0.950	
Satd. Flow (prot)	0	1845	1644	0	1703	0
Flt Permitted					0.950	
Satd. Flow (perm)	0	1845	1644	0	1703	0
Link Speed (mph)		40	40		30	
Link Distance (ft)		320	1526		386	
Travel Time (s)		5.5	26.0		8.8	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	3%	0%	3%	6%	0%
Adj. Flow (vph)	0	85	64	325	150	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	85	389	0	150	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(ft)		0	0		12	
Link Offset(ft)		0	0		0	
Crosswalk Width(ft)		16	16		16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15			9	15	9
Sign Control		Free	Yield		Free	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 35.9%		ICU Level of Service A	
Analysis Period (min) 15			

Lanes, Volumes, Timings
9: N Interstate 35 Frontage Road & I-35 NB Off Ramp

03/22/2021



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	296	0	0	766	0	0
Future Volume (vph)	296	0	0	766	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	0.95	1.00	1.00
Frt						
Flt Protected	0.950					
Satd. Flow (prot)	1641	0	0	3406	0	0
Flt Permitted	0.950					
Satd. Flow (perm)	1641	0	0	3406	0	0
Link Speed (mph)	45			55	55	
Link Distance (ft)	469			818	4824	
Travel Time (s)	7.1			10.1	59.8	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	10%	0%	0%	6%	0%	0%
Adj. Flow (vph)	322	0	0	833	0	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	322	0	0	833	0	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	12			0	0	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9	15			9
Sign Control	Yield			Free	Free	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 44.2%		ICU Level of Service A	
Analysis Period (min) 15			

Lanes, Volumes, Timings
13: S Interstate 35 Frontage Road & I-35 SB Off Ramp

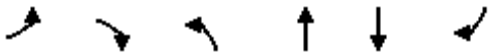
03/22/2021

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	502	0	0	0	0	1131
Future Volume (vph)	502	0	0	0	0	1131
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	0.95
Frt						
Flt Protected	0.950					
Satd. Flow (prot)	1736	0	0	0	0	3343
Flt Permitted	0.950					
Satd. Flow (perm)	1736	0	0	0	0	3343
Link Speed (mph)	45		55			30
Link Distance (ft)	349		5489			497
Travel Time (s)	5.3		68.0			11.3
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	4%	0%	0%	0%	0%	8%
Adj. Flow (vph)	546	0	0	0	0	1229
Shared Lane Traffic (%)						
Lane Group Flow (vph)	546	0	0	0	0	1229
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(ft)	12		0			0
Link Offset(ft)	0		0			0
Crosswalk Width(ft)	16		16			16
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9		9	15	
Sign Control	Yield		Free			Free

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 65.7%		ICU Level of Service C	
Analysis Period (min) 15			

Lanes, Volumes, Timings
15: S Interstate 35 Frontage Road & Conrads Lane

03/22/2021



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	0	571	0	0	559	216
Future Volume (vph)	0	571	0	0	559	216
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.865				0.962	
Flt Protected						
Satd. Flow (prot)	1508	0	0	0	1640	0
Flt Permitted						
Satd. Flow (perm)	1508	0	0	0	1640	0
Link Speed (mph)	40			55	55	
Link Distance (ft)	265			1796	1281	
Travel Time (s)	4.5			22.3	15.9	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	9%	0%	0%	7%	23%
Adj. Flow (vph)	0	621	0	0	608	235
Shared Lane Traffic (%)						
Lane Group Flow (vph)	621	0	0	0	843	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	12			0	0	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9	15			9
Sign Control	Stop			Free	Free	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 84.6%		ICU Level of Service E	
Analysis Period (min) 15			

Intersection	
Int Delay, s/veh	111.8

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	0	571	0	0	559	216
Future Vol, veh/h	0	571	0	0	559	216
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Stop	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	0	9	0	0	7	23
Mvmt Flow	0	621	0	0	608	235

Major/Minor	Minor2			Major2	
Conflicting Flow All	726	726		-	0
Stage 1	726	-		-	-
Stage 2	0	-		-	-
Critical Hdwy	6.4	6.29		-	-
Critical Hdwy Stg 1	5.4	-		-	-
Critical Hdwy Stg 2	-	-		-	-
Follow-up Hdwy	3.5	3.381		-	-
Pot Cap-1 Maneuver	394	~ 413		-	-
Stage 1	483	-		-	-
Stage 2	-	-		-	-
Platoon blocked, %				-	-
Mov Cap-1 Maneuver	394	~ 413		-	-
Mov Cap-2 Maneuver	394	-		-	-
Stage 1	483	-		-	-
Stage 2	-	-		-	-

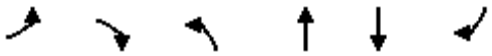
Approach	EB	SB
HCM Control Delay, s	263.6	0
HCM LOS	F	

Minor Lane/Major Mvmt	EBLn1	SBT	SBR
Capacity (veh/h)	413	-	-
HCM Lane V/C Ratio	1.503	-	-
HCM Control Delay (s)	263.6	-	-
HCM Lane LOS	F	-	-
HCM 95th %tile Q(veh)	33	-	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Lanes, Volumes, Timings
17: S Interstate 35 Frontage Road & Oak Creek Way

03/22/2021



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	0	78	0	0	1053	77
Future Volume (vph)	0	78	0	0	1053	77
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0	0	0			315
Storage Lanes	0	1	0			1
Taper Length (ft)	25		25			
Lane Util. Factor	1.00	1.00	1.00	1.00	0.95	1.00
Frt		0.865				0.850
Flt Protected						
Satd. Flow (prot)	0	1644	0	0	3343	1599
Flt Permitted						
Satd. Flow (perm)	0	1644	0	0	3343	1599
Link Speed (mph)	30			55	55	
Link Distance (ft)	1047			497	1796	
Travel Time (s)	23.8			6.2	22.3	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	0%	0%	0%	8%	1%
Adj. Flow (vph)	0	85	0	0	1145	84
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	85	0	0	1145	84
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	0			0	0	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9	15			9
Sign Control	Stop			Free	Free	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization	40.6%	ICU Level of Service	A
Analysis Period (min)	15		

HCM 6th TWSC
17: S Interstate 35 Frontage Road & Oak Creek Way

03/22/2021

Intersection	
Int Delay, s/veh	0.9

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	0	78	0	0	1053	77
Future Vol, veh/h	0	78	0	0	1053	77
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	-	315
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	0	0	0	0	8	1
Mvmt Flow	0	85	0	0	1145	84

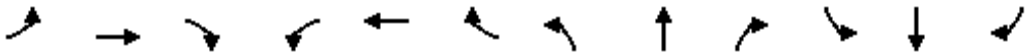
Major/Minor	Minor2		Major2	
Conflicting Flow All	-	573	-	0
Stage 1	-	-	-	-
Stage 2	-	-	-	-
Critical Hdwy	-	6.9	-	-
Critical Hdwy Stg 1	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-
Follow-up Hdwy	-	3.3	-	-
Pot Cap-1 Maneuver	0	468	-	-
Stage 1	0	-	-	-
Stage 2	0	-	-	-
Platoon blocked, %			-	-
Mov Cap-1 Maneuver	-	468	-	-
Mov Cap-2 Maneuver	-	-	-	-
Stage 1	-	-	-	-
Stage 2	-	-	-	-

Approach	EB	SB
HCM Control Delay, s	14.4	0
HCM LOS	B	

Minor Lane/Major Mvmt	EBLn1	SBT	SBR
Capacity (veh/h)	468	-	-
HCM Lane V/C Ratio	0.181	-	-
HCM Control Delay (s)	14.4	-	-
HCM Lane LOS	B	-	-
HCM 95th %tile Q(veh)	0.7	-	-

Lanes, Volumes, Timings
19: Overpass/Access Driveway & Conrads Lane

03/22/2021



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	21	224	141	90	126	0	343	17	344	3	17	33
Future Volume (vph)	21	224	141	90	126	0	343	17	344	3	17	33
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.951						0.934			0.915	
Flt Protected		0.997			0.980			0.976			0.997	
Satd. Flow (prot)	0	1601	0	0	1517	0	0	1624	0	0	1670	0
Flt Permitted		0.997			0.980			0.976			0.997	
Satd. Flow (perm)	0	1601	0	0	1517	0	0	1624	0	0	1670	0
Link Speed (mph)		40			40			25			30	
Link Distance (ft)		1157			265			448			250	
Travel Time (s)		19.7			4.5			12.2			5.7	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	14%	12%	7%	34%	0%	7%	12%	6%	0%	0%	6%
Adj. Flow (vph)	23	243	153	98	137	0	373	18	374	3	18	36
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	419	0	0	235	0	0	765	0	0	57	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Free			Free			Stop			Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 90.8%		ICU Level of Service E	
Analysis Period (min) 15			

HCM 6th TWSC
19: Overpass/Access Driveway & Conrads Lane

03/22/2021

Intersection	
Int Delay, s/veh	198.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		⇕			⇕			⇕			⇕	
Traffic Vol, veh/h	21	224	141	90	126	0	343	17	344	3	17	33
Future Vol, veh/h	21	224	141	90	126	0	343	17	344	3	17	33
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	Yield	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	0	14	12	7	34	0	7	12	6	0	0	6
Mvmt Flow	23	243	153	98	137	0	373	18	374	3	18	36

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	137	0	0	396	0	0	726	699	320	708	775	137
Stage 1	-	-	-	-	-	-	366	366	-	333	333	-
Stage 2	-	-	-	-	-	-	360	333	-	375	442	-
Critical Hdwy	4.1	-	-	4.17	-	-	7.17	6.62	6.26	7.1	6.5	6.26
Critical Hdwy Stg 1	-	-	-	-	-	-	6.17	5.62	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.17	5.62	-	6.1	5.5	-
Follow-up Hdwy	2.2	-	-	2.263	-	-	3.563	4.108	3.354	3.5	4	3.354
Pot Cap-1 Maneuver	1459	-	-	1136	-	-	~ 334	352	712	352	331	901
Stage 1	-	-	-	-	-	-	643	605	-	685	647	-
Stage 2	-	-	-	-	-	-	648	626	-	650	580	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1459	-	-	1136	-	-	~ 279	313	712	146	294	901
Mov Cap-2 Maneuver	-	-	-	-	-	-	~ 279	313	-	146	294	-
Stage 1	-	-	-	-	-	-	629	592	-	671	587	-
Stage 2	-	-	-	-	-	-	547	568	-	293	568	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.4	3.5	$ 380.5	13.9
HCM LOS			F	B

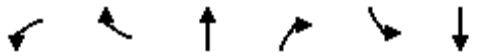
Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	431	1459	-	-	1136	-	-	461
HCM Lane V/C Ratio	1.775	0.016	-	-	0.086	-	-	0.125
HCM Control Delay (s)	$ 380.5	7.5	0	-	8.5	0	-	13.9
HCM Lane LOS	F	A	A	-	A	A	-	B
HCM 95th %tile Q(veh)	47.8	0	-	-	0.3	-	-	0.4

Notes

~: Volume exceeds capacity $: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

Lanes, Volumes, Timings
3: N Interstate 35 Frontage Road & Kohlenberg Road

03/22/2021



Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	0	144	48	418	0	0
Future Volume (vph)	0	144	48	418	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.865	0.879			
Flt Protected						
Satd. Flow (prot)	0	1536	1527	0	0	0
Flt Permitted						
Satd. Flow (perm)	0	1536	1527	0	0	0
Link Speed (mph)	40		55			55
Link Distance (ft)	215		1729			1309
Travel Time (s)	3.7		21.4			16.2
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	7%	4%	10%	0%	0%
Adj. Flow (vph)	0	157	52	454	0	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	157	506	0	0	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(ft)	0		0			0
Link Offset(ft)	0		0			0
Crosswalk Width(ft)	16		16			16
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9		9	15	
Sign Control	Stop		Free			Free

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 43.9%		ICU Level of Service A	
Analysis Period (min) 15			

HCM 6th TWSC
3: N Interstate 35 Frontage Road & Kohlenberg Road 03/22/2021

Intersection	
Int Delay, s/veh	2.6

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	0	144	48	418	0	0
Future Vol, veh/h	0	144	48	418	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	0	7	4	10	0	0
Mvmt Flow	0	157	52	454	0	0

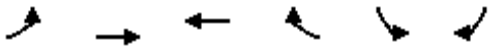
Major/Minor	Minor1		Major1	
Conflicting Flow All	-	279	0	0
Stage 1	-	-	-	-
Stage 2	-	-	-	-
Critical Hdwy	-	6.27	-	-
Critical Hdwy Stg 1	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-
Follow-up Hdwy	-	3.363	-	-
Pot Cap-1 Maneuver	0	748	-	-
Stage 1	0	-	-	-
Stage 2	0	-	-	-
Platoon blocked, %			-	-
Mov Cap-1 Maneuver	-	748	-	-
Mov Cap-2 Maneuver	-	-	-	-
Stage 1	-	-	-	-
Stage 2	-	-	-	-

Approach	WB	NB
HCM Control Delay, s	11.1	0
HCM LOS	B	

Minor Lane/Major Mvmt	NBT	NBR	WBLn1
Capacity (veh/h)	-	-	748
HCM Lane V/C Ratio	-	-	0.209
HCM Control Delay (s)	-	-	11.1
HCM Lane LOS	-	-	B
HCM 95th %tile Q(veh)	-	-	0.8

Lanes, Volumes, Timings
5: Kohlenberg Road & Overpass

03/22/2021

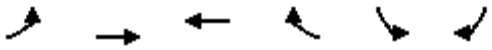


Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	345	73	55	0	0	89
Future Volume (vph)	345	73	55	0	0	89
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt						0.865
Flt Protected		0.960				
Satd. Flow (prot)	0	1652	1810	0	0	1522
Flt Permitted		0.960				
Satd. Flow (perm)	0	1652	1810	0	0	1522
Link Speed (mph)		40	40		25	
Link Distance (ft)		215	320		216	
Travel Time (s)		3.7	5.5		5.9	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	12%	3%	5%	0%	0%	8%
Adj. Flow (vph)	375	79	60	0	0	97
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	454	60	0	0	97
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(ft)		0	0		0	
Link Offset(ft)		0	0		0	
Crosswalk Width(ft)		16	16		16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15			9	15	9
Sign Control		Free	Free		Free	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 32.9%		ICU Level of Service A	
Analysis Period (min) 15			

Lanes, Volumes, Timings
7: Overpass & Kohlenberg Road

03/22/2021

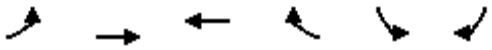


Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	345	0	0	129	63	89
Future Volume (vph)	345	0	0	129	63	89
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt				0.865	0.921	
Flt Protected	0.950				0.980	
Satd. Flow (prot)	1612	0	0	1611	1606	0
Flt Permitted	0.950				0.980	
Satd. Flow (perm)	1612	0	0	1611	1606	0
Link Speed (mph)		25	25		25	
Link Distance (ft)		216	386		243	
Travel Time (s)		5.9	10.5		6.6	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	12%	0%	0%	2%	5%	8%
Adj. Flow (vph)	375	0	0	140	68	97
Shared Lane Traffic (%)						
Lane Group Flow (vph)	375	0	0	140	165	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(ft)		12	0		12	
Link Offset(ft)		0	0		0	
Crosswalk Width(ft)		16	16		16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15			9	15	9
Sign Control		Yield	Free		Free	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 34.7%		ICU Level of Service A	
Analysis Period (min) 15			

Lanes, Volumes, Timings
8: Kohlenberg Road

03/22/2021

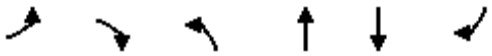


Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	0	73	55	129	63	0
Future Volume (vph)	0	73	55	129	63	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.905			
Flt Protected					0.950	
Satd. Flow (prot)	0	1845	1671	0	1719	0
Flt Permitted					0.950	
Satd. Flow (perm)	0	1845	1671	0	1719	0
Link Speed (mph)		40	40		30	
Link Distance (ft)		320	1526		386	
Travel Time (s)		5.5	26.0		8.8	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	3%	5%	2%	5%	0%
Adj. Flow (vph)	0	79	60	140	68	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	79	200	0	68	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(ft)		0	0		12	
Link Offset(ft)		0	0		0	
Crosswalk Width(ft)		16	16		16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15			9	15	9
Sign Control		Free	Yield		Free	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 21.0%		ICU Level of Service A	
Analysis Period (min) 15			

Lanes, Volumes, Timings
9: N Interstate 35 Frontage Road & I-35 NB Off Ramp

03/22/2021



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	288	0	0	1168	0	0
Future Volume (vph)	288	0	0	1168	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	0.95	1.00	1.00
Frt						
Flt Protected	0.950					
Satd. Flow (prot)	1612	0	0	3539	0	0
Flt Permitted	0.950					
Satd. Flow (perm)	1612	0	0	3539	0	0
Link Speed (mph)	45			55	55	
Link Distance (ft)	469			818	4824	
Travel Time (s)	7.1			10.1	59.8	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	12%	0%	0%	2%	0%	0%
Adj. Flow (vph)	313	0	0	1270	0	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	313	0	0	1270	0	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	12			0	0	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9	15			9
Sign Control	Yield			Free	Free	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 54.9%		ICU Level of Service A	
Analysis Period (min) 15			

Lanes, Volumes, Timings
13: S Interstate 35 Frontage Road & I-35 SB Off Ramp

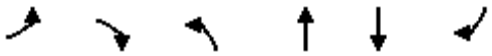
03/22/2021

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	150	0	0	0	0	1683
Future Volume (vph)	150	0	0	0	0	1683
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	0.95
Frt						
Flt Protected	0.950					
Satd. Flow (prot)	1770	0	0	0	0	3471
Flt Permitted	0.950					
Satd. Flow (perm)	1770	0	0	0	0	3471
Link Speed (mph)	45		55			30
Link Distance (ft)	349		5489			497
Travel Time (s)	5.3		68.0			11.3
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	2%	0%	0%	0%	0%	4%
Adj. Flow (vph)	163	0	0	0	0	1829
Shared Lane Traffic (%)						
Lane Group Flow (vph)	163	0	0	0	0	1829
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(ft)	12		0			0
Link Offset(ft)	0		0			0
Crosswalk Width(ft)	16		16			16
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9		9	15	
Sign Control	Yield		Free			Free

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 61.5%		ICU Level of Service B	
Analysis Period (min) 15			

Lanes, Volumes, Timings
15: S Interstate 35 Frontage Road & Conrads Lane

03/22/2021



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	0	430	0	0	1169	53
Future Volume (vph)	0	430	0	0	1169	53
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.865				0.994	
Flt Protected						
Satd. Flow (prot)	1522	0	0	0	1827	0
Flt Permitted						
Satd. Flow (perm)	1522	0	0	0	1827	0
Link Speed (mph)	40			55	55	
Link Distance (ft)	265			1796	1281	
Travel Time (s)	4.5			22.3	15.9	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	8%	0%	0%	3%	11%
Adj. Flow (vph)	0	467	0	0	1271	58
Shared Lane Traffic (%)						
Lane Group Flow (vph)	467	0	0	0	1329	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	12			0	0	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9	15			9
Sign Control	Stop			Free	Free	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 98.0%		ICU Level of Service F	
Analysis Period (min) 15			

Intersection	
Int Delay, s/veh	183.6

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	0	430	0	0	1169	53
Future Vol, veh/h	0	430	0	0	1169	53
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Stop	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	0	8	0	0	3	11
Mvmt Flow	0	467	0	0	1271	58

Major/Minor	Minor2			Major2	
Conflicting Flow All	1300	1300		-	0
Stage 1	1300	-		-	-
Stage 2	0	-		-	-
Critical Hdwy	6.4	6.28		-	-
Critical Hdwy Stg 1	5.4	-		-	-
Critical Hdwy Stg 2	-	-		-	-
Follow-up Hdwy	3.5	3.372		-	-
Pot Cap-1 Maneuver	180	~ 191		-	-
Stage 1	258	-		-	-
Stage 2	-	-		-	-
Platoon blocked, %				-	-
Mov Cap-1 Maneuver	180	~ 191		-	-
Mov Cap-2 Maneuver	180	-		-	-
Stage 1	258	-		-	-
Stage 2	-	-		-	-

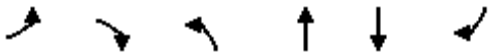
Approach	EB	SB
HCM Control Delay, s	$ 705.5	0
HCM LOS	F	

Minor Lane/Major Mvmt	EBLn1	SBT	SBR
Capacity (veh/h)	191	-	-
HCM Lane V/C Ratio	2.447	-	-
HCM Control Delay (s)	$ 705.5	-	-
HCM Lane LOS	F	-	-
HCM 95th %tile Q(veh)	39	-	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Lanes, Volumes, Timings
17: S Interstate 35 Frontage Road & Oak Creek Way

03/22/2021



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	0	65	0	0	1618	29
Future Volume (vph)	0	65	0	0	1618	29
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0	0	0			315
Storage Lanes	0	1	0			1
Taper Length (ft)	25		25			
Lane Util. Factor	1.00	1.00	1.00	1.00	0.95	1.00
Frt		0.865				0.850
Flt Protected						
Satd. Flow (prot)	0	1611	0	0	3471	1615
Flt Permitted						
Satd. Flow (perm)	0	1611	0	0	3471	1615
Link Speed (mph)	30			55	55	
Link Distance (ft)	1047			497	1796	
Travel Time (s)	23.8			6.2	22.3	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	2%	0%	0%	4%	0%
Adj. Flow (vph)	0	71	0	0	1759	32
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	71	0	0	1759	32
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	0			0	0	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9	15			9
Sign Control	Stop			Free	Free	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 55.4%		ICU Level of Service B	
Analysis Period (min) 15			

HCM 6th TWSC
17: S Interstate 35 Frontage Road & Oak Creek Way

03/22/2021

Intersection	
Int Delay, s/veh	0.8

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	0	65	0	0	1618	29
Future Vol, veh/h	0	65	0	0	1618	29
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	-	315
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	0	2	0	0	4	0
Mvmt Flow	0	71	0	0	1759	32

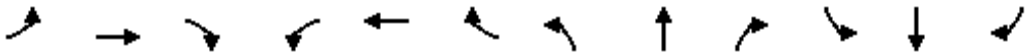
Major/Minor	Minor2		Major2	
Conflicting Flow All	-	880	-	0
Stage 1	-	-	-	-
Stage 2	-	-	-	-
Critical Hdwy	-	6.94	-	-
Critical Hdwy Stg 1	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-
Follow-up Hdwy	-	3.32	-	-
Pot Cap-1 Maneuver	0	290	-	-
Stage 1	0	-	-	-
Stage 2	0	-	-	-
Platoon blocked, %			-	-
Mov Cap-1 Maneuver	-	290	-	-
Mov Cap-2 Maneuver	-	-	-	-
Stage 1	-	-	-	-
Stage 2	-	-	-	-

Approach	EB	SB
HCM Control Delay, s	21.4	0
HCM LOS	C	

Minor Lane/Major Mvmt	EBLn1	SBT	SBR
Capacity (veh/h)	290	-	-
HCM Lane V/C Ratio	0.244	-	-
HCM Control Delay (s)	21.4	-	-
HCM Lane LOS	C	-	-
HCM 95th %tile Q(veh)	0.9	-	-

Lanes, Volumes, Timings
19: Overpass/Access Driveway & Conrads Lane

03/22/2021



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	46	184	119	19	29	5	217	16	241	5	14	20
Future Volume (vph)	46	184	119	19	29	5	217	16	241	5	14	20
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.954			0.988			0.931			0.929	
Flt Protected		0.993			0.982			0.978			0.994	
Satd. Flow (prot)	0	1667	0	0	1658	0	0	1593	0	0	1755	0
Flt Permitted		0.993			0.982			0.978			0.994	
Satd. Flow (perm)	0	1667	0	0	1658	0	0	1593	0	0	1755	0
Link Speed (mph)		40			40			25			30	
Link Distance (ft)		1157			265			448			250	
Travel Time (s)		19.7			4.5			12.2			5.7	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	4%	9%	8%	5%	17%	0%	11%	0%	7%	0%	0%	0%
Adj. Flow (vph)	50	200	129	21	32	5	236	17	262	5	15	22
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	379	0	0	58	0	0	515	0	0	42	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Free			Free			Stop			Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 61.8%		ICU Level of Service B	
Analysis Period (min) 15			

Intersection	
Int Delay, s/veh	8.1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	46	184	119	19	29	5	217	16	241	5	14	20
Future Vol, veh/h	46	184	119	19	29	5	217	16	241	5	14	20
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	Yield	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	4	9	8	5	17	0	11	0	7	0	0	0
Mvmt Flow	50	200	129	21	32	5	236	17	262	5	15	22

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	37	0	0	329	0	0	460	444	265	450	506	35
Stage 1	-	-	-	-	-	-	365	365	-	77	77	-
Stage 2	-	-	-	-	-	-	95	79	-	373	429	-
Critical Hdwy	4.14	-	-	4.15	-	-	7.21	6.5	6.27	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.21	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.21	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.236	-	-	2.245	-	-	3.599	4	3.363	3.5	4	3.3
Pot Cap-1 Maneuver	1561	-	-	1214	-	-	497	511	762	523	472	1044
Stage 1	-	-	-	-	-	-	636	627	-	937	835	-
Stage 2	-	-	-	-	-	-	890	833	-	652	587	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1561	-	-	1214	-	-	453	482	762	319	445	1044
Mov Cap-2 Maneuver	-	-	-	-	-	-	453	482	-	319	445	-
Stage 1	-	-	-	-	-	-	611	602	-	900	820	-
Stage 2	-	-	-	-	-	-	840	818	-	399	564	-

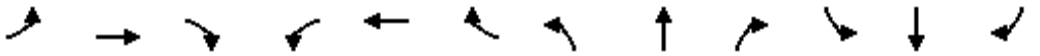
Approach	EB	WB	NB	SB
HCM Control Delay, s	1	2.9	13.7	11.6
HCM LOS			B	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	925	1561	-	-	1214	-	-	588
HCM Lane V/C Ratio	0.557	0.032	-	-	0.017	-	-	0.072
HCM Control Delay (s)	13.7	7.4	0	-	8	0	-	11.6
HCM Lane LOS	B	A	A	-	A	A	-	B
HCM 95th %tile Q(veh)	3.5	0.1	-	-	0.1	-	-	0.2

APPENDIX C
2022 NO-BUILD TRAFFIC SCENARIO
CAPACITY ANALYSIS SUMMARY SHEETS

Lanes, Volumes, Timings
2: N Interstate 35 Frontage Road & Kohlenberg Road

03/24/2021



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	123	184	0	0	200	86	125	27	63	0	0	0
Future Volume (vph)	123	184	0	0	200	86	125	27	63	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		275	0		0	0		0
Storage Lanes	1		0	0		1	2		1	0		0
Taper Length (ft)	25			25			150			25		
Lane Util. Factor	0.91	0.91	1.00	1.00	0.91	1.00	0.97	0.95	1.00	1.00	1.00	1.00
Frt						0.850			0.850			
Flt Protected	0.950	0.994					0.950					
Satd. Flow (prot)	1380	2910	0	0	4848	1272	2757	2959	1392	0	0	0
Flt Permitted	0.950	0.994					0.950					
Satd. Flow (perm)	1380	2910	0	0	4848	1272	2757	2959	1392	0	0	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)						93			73			
Link Speed (mph)		40			40			55			55	
Link Distance (ft)		263			1355			171			223	
Travel Time (s)		4.5			23.1			2.1			2.8	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	19%	18%	0%	0%	7%	27%	27%	22%	16%	0%	0%	0%
Adj. Flow (vph)	134	200	0	0	217	93	136	29	68	0	0	0
Shared Lane Traffic (%)	19%											
Lane Group Flow (vph)	109	225	0	0	217	93	136	29	68	0	0	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			24			24	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2			2	1	1	2	1			
Detector Template	Left	Thru			Thru	Right	Left	Thru	Right			
Leading Detector (ft)	20	100			100	20	20	100	20			
Trailing Detector (ft)	0	0			0	0	0	0	0			
Detector 1 Position(ft)	0	0			0	0	0	0	0			
Detector 1 Size(ft)	20	6			6	20	20	6	20			
Detector 1 Type	Cl+Ex	Cl+Ex			Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex			
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0			0.0	0.0	0.0	0.0	0.0			
Detector 1 Queue (s)	0.0	0.0			0.0	0.0	0.0	0.0	0.0			
Detector 1 Delay (s)	0.0	0.0			0.0	0.0	0.0	0.0	0.0			
Detector 2 Position(ft)		94			94			94				
Detector 2 Size(ft)		6			6			6				
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex				
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0				
Turn Type	Split	NA			NA	Perm	Perm	NA	Perm			
Protected Phases	4	4			8			2				

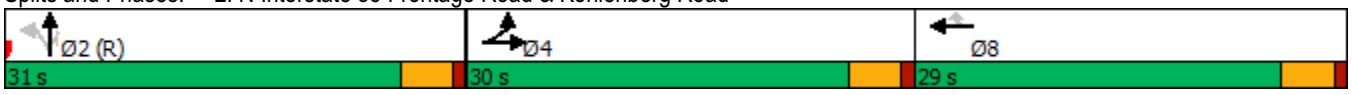
Lanes, Volumes, Timings
2: N Interstate 35 Frontage Road & Kohlenberg Road

03/24/2021

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases						8	2		2			
Detector Phase	4	4			8	8	2	2	2			
Switch Phase												
Minimum Initial (s)	5.0	5.0			5.0	5.0	5.0	5.0	5.0			
Minimum Split (s)	22.5	22.5			22.5	22.5	22.5	22.5	22.5			
Total Split (s)	30.0	30.0			29.0	29.0	31.0	31.0	31.0			
Total Split (%)	33.3%	33.3%			32.2%	32.2%	34.4%	34.4%	34.4%			
Maximum Green (s)	25.5	25.5			24.5	24.5	26.5	26.5	26.5			
Yellow Time (s)	3.5	3.5			3.5	3.5	3.5	3.5	3.5			
All-Red Time (s)	1.0	1.0			1.0	1.0	1.0	1.0	1.0			
Lost Time Adjust (s)	0.0	0.0			0.0	0.0	0.0	0.0	0.0			
Total Lost Time (s)	4.5	4.5			4.5	4.5	4.5	4.5	4.5			
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0	3.0			
Recall Mode	None	None			None	None	C-Max	C-Max	C-Max			
Walk Time (s)	7.0	7.0			7.0	7.0	7.0	7.0	7.0			
Flash Dont Walk (s)	11.0	11.0			11.0	11.0	11.0	11.0	11.0			
Pedestrian Calls (#/hr)	0	0			0	0	0	0	0			
Act Effct Green (s)	13.0	13.0			9.4	9.4	54.1	54.1	54.1			
Actuated g/C Ratio	0.14	0.14			0.10	0.10	0.60	0.60	0.60			
v/c Ratio	0.55	0.54			0.43	0.43	0.08	0.02	0.08			
Control Delay	17.6	11.8			40.1	14.8	8.9	9.1	2.7			
Queue Delay	0.0	0.0			0.0	0.0	0.0	0.0	0.0			
Total Delay	17.6	11.8			40.1	14.8	8.9	9.1	2.7			
LOS	B	B			D	B	A	A	A			
Approach Delay		13.7			32.5			7.2				
Approach LOS		B			C			A				

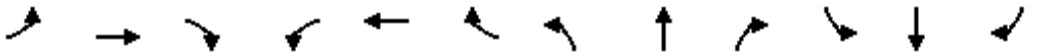
Intersection Summary			
Area Type:	Other		
Cycle Length: 90			
Actuated Cycle Length: 90			
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:, Start of Green			
Natural Cycle: 70			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.55			
Intersection Signal Delay: 18.6		Intersection LOS: B	
Intersection Capacity Utilization 31.9%		ICU Level of Service A	
Analysis Period (min) 15			

Splits and Phases: 2: N Interstate 35 Frontage Road & Kohlenberg Road



HCM 6th Signalized Intersection Summary
2: N Interstate 35 Frontage Road & Kohlenberg Road

03/24/2021



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	123	184	0	0	200	86	125	27	63	0	0	0
Future Volume (veh/h)	123	184	0	0	200	86	125	27	63	0	0	0
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0			
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00			
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			
Work Zone On Approach		No			No			No				
Adj Sat Flow, veh/h/ln	1618	1633	0	0	1796	1500	1500	1574	1663			
Adj Flow Rate, veh/h	111	232	0	0	217	0	136	29	0			
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92			
Percent Heavy Veh, %	19	18	0	0	7	27	27	22	16			
Cap, veh/h	167	354	0	0	380		1841	1986				
Arrive On Green	0.11	0.11	0.00	0.00	0.08	0.00	0.66	0.66	0.00			
Sat Flow, veh/h	1541	3266	0	0	5065	1271	2771	2991	1409			
Grp Volume(v), veh/h	111	232	0	0	217	0	136	29	0			
Grp Sat Flow(s),veh/h/ln	1541	1633	0	0	1635	1271	1386	1495	1409			
Q Serve(g_s), s	6.2	6.1	0.0	0.0	3.8	0.0	1.6	0.3	0.0			
Cycle Q Clear(g_c), s	6.2	6.1	0.0	0.0	3.8	0.0	1.6	0.3	0.0			
Prop In Lane	1.00		0.00	0.00		1.00	1.00		1.00			
Lane Grp Cap(c), veh/h	167	354	0	0	380		1841	1986				
V/C Ratio(X)	0.66	0.66	0.00	0.00	0.57		0.07	0.01				
Avail Cap(c_a), veh/h	437	926	0	0	1335		1841	1986				
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			
Upstream Filter(I)	0.93	0.93	0.00	0.00	1.00	0.00	1.00	1.00	0.00			
Uniform Delay (d), s/veh	38.6	38.5	0.0	0.0	40.1	0.0	5.3	5.1	0.0			
Incr Delay (d2), s/veh	4.2	1.9	0.0	0.0	1.4	0.0	0.1	0.0	0.0			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln	2.5	2.5	0.0	0.0	1.5	0.0	0.3	0.1	0.0			
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	42.7	40.4	0.0	0.0	41.4	0.0	5.4	5.1	0.0			
LnGrp LOS	D	D	A	A	D		A	A				
Approach Vol, veh/h		343			217	A		165	A			
Approach Delay, s/veh		41.2			41.4			5.4				
Approach LOS		D			D			A				
Timer - Assigned Phs		2		4				8				
Phs Duration (G+Y+Rc), s		64.3		14.2				11.5				
Change Period (Y+Rc), s		4.5		4.5				4.5				
Max Green Setting (Gmax), s		26.5		25.5				24.5				
Max Q Clear Time (g_c+I1), s		3.6		8.2				5.8				
Green Ext Time (p_c), s		0.5		1.5				1.2				

Intersection Summary	
HCM 6th Ctrl Delay	33.1
HCM 6th LOS	C

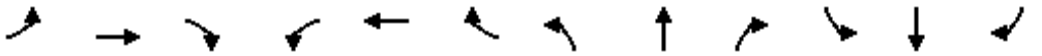
Notes

User approved volume balancing among the lanes for turning movement.

Unsignalized Delay for [NBR, WBR] is excluded from calculations of the approach delay and intersection delay.

Lanes, Volumes, Timings
3: S Interstate 35 Frontage Road & Conrads Lane/Kohlenberg Road

03/24/2021



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑↑	↱	↰	↑↑					↰	↑↑	↱
Traffic Volume (vph)	0	269	326	88	237	0	0	0	0	38	166	87
Future Volume (vph)	0	269	326	88	237	0	0	0	0	38	166	87
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		275	0		0	0		0	0		0
Storage Lanes	0		1	1		0	0		0	1		1
Taper Length (ft)	25			25			25			150		
Lane Util. Factor	1.00	0.91	1.00	0.91	0.91	1.00	1.00	1.00	1.00	0.91	0.91	1.00
Frt			0.850									0.850
Flt Protected				0.950	0.998					0.950	0.999	
Satd. Flow (prot)	0	4590	1302	1507	2982	0	0	0	0	1040	2882	1122
Flt Permitted				0.950	0.998					0.950	0.999	
Satd. Flow (perm)	0	4590	1302	1507	2982	0	0	0	0	1040	2882	1122
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			354									95
Link Speed (mph)		40			40			55			55	
Link Distance (ft)		1136			263			205			185	
Travel Time (s)		19.4			4.5			2.5			2.3	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	13%	24%	9%	16%	0%	0%	0%	0%	58%	19%	44%
Adj. Flow (vph)	0	292	354	96	258	0	0	0	0	41	180	95
Shared Lane Traffic (%)				10%						10%		
Lane Group Flow (vph)	0	292	354	86	268	0	0	0	0	37	184	95
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors		2	1	1	2					1	2	1
Detector Template		Thru	Right	Left	Thru					Left	Thru	Right
Leading Detector (ft)		100	20	20	100					20	100	20
Trailing Detector (ft)		0	0	0	0					0	0	0
Detector 1 Position(ft)		0	0	0	0					0	0	0
Detector 1 Size(ft)		6	20	20	6					20	6	20
Detector 1 Type		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex					Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)		0.0	0.0	0.0	0.0					0.0	0.0	0.0
Detector 1 Queue (s)		0.0	0.0	0.0	0.0					0.0	0.0	0.0
Detector 1 Delay (s)		0.0	0.0	0.0	0.0					0.0	0.0	0.0
Detector 2 Position(ft)		94			94						94	
Detector 2 Size(ft)		6			6						6	
Detector 2 Type		Cl+Ex			Cl+Ex						Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0						0.0	
Turn Type		NA	Perm	Split	NA					Perm	NA	Perm
Protected Phases		4		8	8						6	

Lanes, Volumes, Timings
3: S Interstate 35 Frontage Road & Conrads Lane/Kohlenberg Road

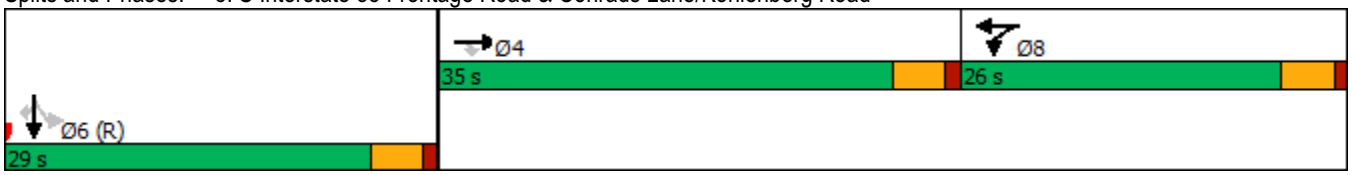
03/24/2021

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases			4							6		6
Detector Phase		4	4	8	8					6	6	6
Switch Phase												
Minimum Initial (s)		5.0	5.0	5.0	5.0					5.0	5.0	5.0
Minimum Split (s)		22.5	22.5	22.5	22.5					22.5	22.5	22.5
Total Split (s)		35.0	35.0	26.0	26.0					29.0	29.0	29.0
Total Split (%)		38.9%	38.9%	28.9%	28.9%					32.2%	32.2%	32.2%
Maximum Green (s)		30.5	30.5	21.5	21.5					24.5	24.5	24.5
Yellow Time (s)		3.5	3.5	3.5	3.5					3.5	3.5	3.5
All-Red Time (s)		1.0	1.0	1.0	1.0					1.0	1.0	1.0
Lost Time Adjust (s)		0.0	0.0	0.0	0.0					0.0	0.0	0.0
Total Lost Time (s)		4.5	4.5	4.5	4.5					4.5	4.5	4.5
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)		3.0	3.0	3.0	3.0					3.0	3.0	3.0
Recall Mode		None	None	None	None					C-Max	C-Max	C-Max
Walk Time (s)		7.0	7.0	7.0	7.0					7.0	7.0	7.0
Flash Dont Walk (s)		11.0	11.0	11.0	11.0					11.0	11.0	11.0
Pedestrian Calls (#/hr)		0	0	0	0					0	0	0
Act Effct Green (s)		13.3	13.3	13.5	13.5					49.6	49.6	49.6
Actuated g/C Ratio		0.15	0.15	0.15	0.15					0.55	0.55	0.55
v/c Ratio		0.43	0.72	0.38	0.60					0.06	0.12	0.14
Control Delay		35.8	12.5	27.6	29.1					13.2	11.9	4.1
Queue Delay		0.0	0.0	0.0	0.0					0.0	0.0	0.0
Total Delay		35.8	12.5	27.6	29.1					13.2	11.9	4.1
LOS		D	B	C	C					B	B	A
Approach Delay		23.0			28.7						9.7	
Approach LOS		C			C						A	

Intersection Summary

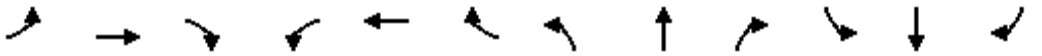
Area Type: Other
Cycle Length: 90
Actuated Cycle Length: 90
Offset: 0 (0%), Referenced to phase 2: and 6:SBTL, Start of Green
Natural Cycle: 70
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.72
Intersection Signal Delay: 21.4 Intersection LOS: C
Intersection Capacity Utilization 31.9% ICU Level of Service A
Analysis Period (min) 15

Splits and Phases: 3: S Interstate 35 Frontage Road & Conrads Lane/Kohlenberg Road



HCM 6th Signalized Intersection Summary
3: S Interstate 35 Frontage Road & Conrads Lane/Kohlenberg Road

03/24/2021



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	269	326	88	237	0	0	0	0	38	166	87
Future Volume (veh/h)	0	269	326	88	237	0	0	0	0	38	166	87
Initial Q (Qb), veh	0	0	0	0	0	0				0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00				1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00				1.00	1.00	1.00
Work Zone On Approach		No			No						No	
Adj Sat Flow, veh/h/ln	0	1707	1544	1767	1663	0				1040	1618	1248
Adj Flow Rate, veh/h	0	292	0	96	258	0				41	180	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92				0.92	0.92	0.92
Percent Heavy Veh, %	0	13	24	9	16	0				58	19	44
Cap, veh/h	0	475		193	381	0				628	2050	
Arrive On Green	0.00	0.10	0.00	0.04	0.04	0.00				0.63	0.63	0.00
Sat Flow, veh/h	0	4815	1309	1682	3326	0				991	3237	1058
Grp Volume(v), veh/h	0	292	0	96	258	0				41	180	0
Grp Sat Flow(s),veh/h/ln	0	1554	1309	1682	1663	0				991	1618	1058
Q Serve(g_s), s	0.0	5.4	0.0	5.0	6.9	0.0				1.4	1.9	0.0
Cycle Q Clear(g_c), s	0.0	5.4	0.0	5.0	6.9	0.0				1.4	1.9	0.0
Prop In Lane	0.00		1.00	1.00		0.00				1.00		1.00
Lane Grp Cap(c), veh/h	0	475		193	381	0				628	2050	
V/C Ratio(X)	0.00	0.61		0.50	0.68	0.00				0.07	0.09	
Avail Cap(c_a), veh/h	0	1580		402	794	0				628	2050	
HCM Platoon Ratio	1.00	1.00	1.00	0.33	0.33	1.00				1.00	1.00	1.00
Upstream Filter(I)	0.00	1.00	0.00	0.97	0.97	0.00				1.00	1.00	0.00
Uniform Delay (d), s/veh	0.0	38.7	0.0	40.8	41.7	0.0				6.3	6.4	0.0
Incr Delay (d2), s/veh	0.0	1.3	0.0	1.9	2.0	0.0				0.2	0.1	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0				0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	2.0	0.0	2.2	3.0	0.0				0.3	0.5	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	0.0	40.0	0.0	42.7	43.7	0.0				6.5	6.5	0.0
LnGrp LOS	A	D		D	D	A				A	A	
Approach Vol, veh/h		292	A		354						221	A
Approach Delay, s/veh		40.0			43.4						6.5	
Approach LOS		D			D						A	

Timer - Assigned Phs		4		6		8						
Phs Duration (G+Y+Rc), s		13.7		61.5		14.8						
Change Period (Y+Rc), s		4.5		4.5		4.5						
Max Green Setting (Gmax), s		30.5		24.5		21.5						
Max Q Clear Time (g_c+I1), s		7.4		3.9		8.9						
Green Ext Time (p_c), s		1.8		1.0		1.4						

Intersection Summary		
HCM 6th Ctrl Delay	32.9	
HCM 6th LOS	C	

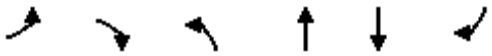
Notes

User approved volume balancing among the lanes for turning movement.

Unsignalized Delay for [EBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Lanes, Volumes, Timings
6: N Interstate 35 Frontage Road

03/24/2021



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	31	0	0	236	0	0
Future Volume (vph)	31	0	0	236	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	0.95	1.00	1.00
Frt						
Flt Protected	0.950					
Satd. Flow (prot)	1517	0	0	2935	0	0
Flt Permitted	0.950					
Satd. Flow (perm)	1517	0	0	2935	0	0
Link Speed (mph)	30			55	55	
Link Distance (ft)	262			223	1233	
Travel Time (s)	6.0			2.8	15.3	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	19%	0%	0%	23%	0%	0%
Adj. Flow (vph)	34	0	0	257	0	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	34	0	0	257	0	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	12			0	0	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9	15			9
Sign Control	Yield			Free	Free	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 16.5%		ICU Level of Service A	
Analysis Period (min) 15			

Lanes, Volumes, Timings
7: S Interstate 35 Frontage Road

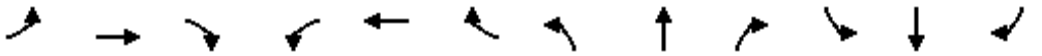
03/24/2021

Lane Group	WBL	WBR	NBL	NBT	NBR	SBL	SBT	SBR	SEL	SER
Lane Configurations										
Traffic Volume (vph)	0	0	0	0	0	31	291	0	0	0
Future Volume (vph)	0	0	0	0	0	31	291	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0	0	0		0	475		475	0	0
Storage Lanes	0	0	0		0	2		1	0	0
Taper Length (ft)	25		25			100			25	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.86	0.86	1.00	1.00
Frt										
Flt Protected						0.950				
Satd. Flow (prot)	0	0	0	0	0	1517	4952	0	0	0
Flt Permitted						0.950				
Satd. Flow (perm)	0	0	0	0	0	1517	4952	0	0	0
Link Speed (mph)	30			55			55		30	
Link Distance (ft)	262			185			1270		123	
Travel Time (s)	6.0			2.3			15.7		2.8	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	0%	0%	0%	0%	19%	32%	0%	0%	0%
Adj. Flow (vph)	0	0	0	0	0	34	316	0	0	0
Shared Lane Traffic (%)										
Lane Group Flow (vph)	0	0	0	0	0	34	316	0	0	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Right	Left	Left	Right	Left	Right
Median Width(ft)	0			12			12		0	
Link Offset(ft)	0			0			0		0	
Crosswalk Width(ft)	16			16			16		16	
Two way Left Turn Lane										
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9	15		9	15		9	15	9
Sign Control	Free			Free			Free		Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 7.6%		ICU Level of Service A	
Analysis Period (min) 15			

Lanes, Volumes, Timings
8: N Interstate 35 Frontage Road

03/24/2021

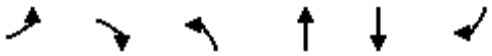


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	0	0	0	132	215	0	0	0	0
Future Volume (vph)	0	0	0	0	0	0	132	215	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		0	475		475	0		0
Storage Lanes	0		0	0		0	2		1	0		0
Taper Length (ft)	25			25			150			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.81	0.81	1.00	1.00	1.00
Frt												
Flt Protected							0.950					
Satd. Flow (prot)	0	0	0	0	0	0	1656	6256	0	0	0	0
Flt Permitted							0.950					
Satd. Flow (perm)	0	0	0	0	0	0	1656	6256	0	0	0	0
Link Speed (mph)		30			30			55			55	
Link Distance (ft)		266			141			6650			171	
Travel Time (s)		6.0			3.2			82.4			2.1	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	9%	23%	0%	0%	0%	0%
Adj. Flow (vph)	0	0	0	0	0	0	143	234	0	0	0	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	0	0	0	0	0	143	234	0	0	0	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Free			Stop			Free			Free	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 30.0%		ICU Level of Service A	
Analysis Period (min) 15			

Lanes, Volumes, Timings
9: N Interstate 35 Frontage Road & I-35 NB Off Ramp

03/24/2021



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	290	0	0	699	0	0
Future Volume (vph)	290	0	0	699	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	0.95	1.00	1.00
Frt						
Flt Protected	0.950					
Satd. Flow (prot)	1612	0	0	3312	0	0
Flt Permitted	0.950					
Satd. Flow (perm)	1612	0	0	3312	0	0
Link Speed (mph)	45			55	55	
Link Distance (ft)	469			818	6650	
Travel Time (s)	7.1			10.1	82.4	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	12%	0%	0%	9%	0%	0%
Adj. Flow (vph)	315	0	0	760	0	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	315	0	0	760	0	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	12			24	24	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9	15			9
Sign Control	Yield			Free	Free	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 42.1%		ICU Level of Service A	
Analysis Period (min) 15			

Lanes, Volumes, Timings
12: S Interstate 35 Frontage Road

03/24/2021

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	132	0	0	0	0	580
Future Volume (vph)	132	0	0	0	0	580
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	0.95
Frt						
Flt Protected	0.950					
Satd. Flow (prot)	1656	0	0	0	0	2983
Flt Permitted	0.950					
Satd. Flow (perm)	1656	0	0	0	0	2983
Link Speed (mph)	30		55			55
Link Distance (ft)	266		1391			205
Travel Time (s)	6.0		17.2			2.5
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	9%	0%	0%	0%	0%	21%
Adj. Flow (vph)	143	0	0	0	0	630
Shared Lane Traffic (%)						
Lane Group Flow (vph)	143	0	0	0	0	630
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(ft)	12		0			0
Link Offset(ft)	0		0			0
Crosswalk Width(ft)	16		16			16
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9		9	15	
Sign Control	Yield		Free			Free

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 30.0%		ICU Level of Service A	
Analysis Period (min) 15			

Lanes, Volumes, Timings
13: S Interstate 35 Frontage Road & I-35 SB Off Ramp

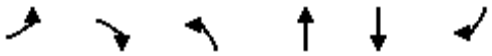
03/24/2021

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	405	0	0	0	0	886
Future Volume (vph)	405	0	0	0	0	886
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	0.95
Frt						
Flt Protected	0.950					
Satd. Flow (prot)	1656	0	0	0	0	3139
Flt Permitted	0.950					
Satd. Flow (perm)	1656	0	0	0	0	3139
Link Speed (mph)	45		55			30
Link Distance (ft)	349		5489			497
Travel Time (s)	5.3		68.0			11.3
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	9%	0%	0%	0%	0%	15%
Adj. Flow (vph)	440	0	0	0	0	963
Shared Lane Traffic (%)						
Lane Group Flow (vph)	440	0	0	0	0	963
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(ft)	12		0			0
Link Offset(ft)	0		0			0
Crosswalk Width(ft)	16		16			16
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9		9	15	
Sign Control	Yield		Free			Free

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 53.6%		ICU Level of Service A	
Analysis Period (min) 15			

Lanes, Volumes, Timings
17: S Interstate 35 Frontage Road & Oak Creek Way

03/24/2021



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	0	115	0	0	771	40
Future Volume (vph)	0	115	0	0	771	40
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0	0	0			315
Storage Lanes	0	1	0			1
Taper Length (ft)	25		25			
Lane Util. Factor	1.00	1.00	1.00	1.00	0.95	1.00
Frt		0.865				0.850
Flt Protected						
Satd. Flow (prot)	0	1627	0	0	3059	1568
Flt Permitted						
Satd. Flow (perm)	0	1627	0	0	3059	1568
Link Speed (mph)	30			55	55	
Link Distance (ft)	1047			497	1391	
Travel Time (s)	23.8			6.2	17.2	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	1%	0%	0%	18%	3%
Adj. Flow (vph)	0	125	0	0	838	43
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	125	0	0	838	43
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	0			0	0	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9	15			9
Sign Control	Stop			Free	Free	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 35.1%		ICU Level of Service A	
Analysis Period (min) 15			

HCM 6th TWSC
17: S Interstate 35 Frontage Road & Oak Creek Way

03/24/2021

Intersection	
Int Delay, s/veh	1.6

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	0	115	0	0	771	40
Future Vol, veh/h	0	115	0	0	771	40
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	-	315
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	0	1	0	0	18	3
Mvmt Flow	0	125	0	0	838	43

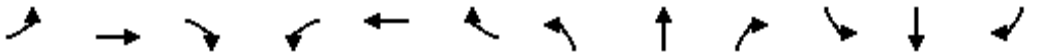
Major/Minor	Minor2			Major2	
Conflicting Flow All	-	419		-	0
Stage 1	-	-		-	-
Stage 2	-	-		-	-
Critical Hdwy	-	6.92		-	-
Critical Hdwy Stg 1	-	-		-	-
Critical Hdwy Stg 2	-	-		-	-
Follow-up Hdwy	-	3.31		-	-
Pot Cap-1 Maneuver	0	586		-	-
Stage 1	0	-		-	-
Stage 2	0	-		-	-
Platoon blocked, %				-	-
Mov Cap-1 Maneuver	-	586		-	-
Mov Cap-2 Maneuver	-	-		-	-
Stage 1	-	-		-	-
Stage 2	-	-		-	-

Approach	EB	SB
HCM Control Delay, s	12.8	0
HCM LOS	B	

Minor Lane/Major Mvmt	EBLn1	SBT	SBR
Capacity (veh/h)	586	-	-
HCM Lane V/C Ratio	0.213	-	-
HCM Control Delay (s)	12.8	-	-
HCM Lane LOS	B	-	-
HCM 95th %tile Q(veh)	0.8	-	-

Lanes, Volumes, Timings
2: N Interstate 35 Frontage Road & Kohlenberg Road

03/24/2021



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	82	148	0	0	302	60	220	36	79	0	0	0
Future Volume (vph)	82	148	0	0	302	60	220	36	79	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		275	0		0	0		0
Storage Lanes	1		0	0		2	1		1	0		0
Taper Length (ft)	25			25			150			25		
Lane Util. Factor	0.91	0.91	1.00	1.00	0.91	1.00	1.00	0.95	1.00	1.00	1.00	1.00
Frt						0.850			0.850			
Flt Protected	0.950	0.997					0.950					
Satd. Flow (prot)	1493	3161	0	0	5036	1615	1597	3167	1568	0	0	0
Flt Permitted	0.950	0.997					0.950					
Satd. Flow (perm)	1493	3161	0	0	5036	1615	1597	3167	1568	0	0	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)						73			86			
Link Speed (mph)		40			40			55			55	
Link Distance (ft)		263			471			171			223	
Travel Time (s)		4.5			8.0			2.1			2.8	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	10%	9%	0%	0%	3%	0%	13%	14%	3%	0%	0%	0%
Adj. Flow (vph)	89	161	0	0	328	65	239	39	86	0	0	0
Shared Lane Traffic (%)	10%											
Lane Group Flow (vph)	80	170	0	0	328	65	239	39	86	0	0	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2			2	1	1	2	1			
Detector Template	Left	Thru			Thru	Right	Left	Thru	Right			
Leading Detector (ft)	20	100			100	20	20	100	20			
Trailing Detector (ft)	0	0			0	0	0	0	0			
Detector 1 Position(ft)	0	0			0	0	0	0	0			
Detector 1 Size(ft)	20	6			6	20	20	6	20			
Detector 1 Type	Cl+Ex	Cl+Ex			Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex			
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0			0.0	0.0	0.0	0.0	0.0			
Detector 1 Queue (s)	0.0	0.0			0.0	0.0	0.0	0.0	0.0			
Detector 1 Delay (s)	0.0	0.0			0.0	0.0	0.0	0.0	0.0			
Detector 2 Position(ft)		94			94			94				
Detector 2 Size(ft)		6			6			6				
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex				
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0				
Turn Type	Split	NA			NA	Perm	Perm	NA	Perm			
Protected Phases	4	4			8			2				

Lanes, Volumes, Timings
2: N Interstate 35 Frontage Road & Kohlenberg Road

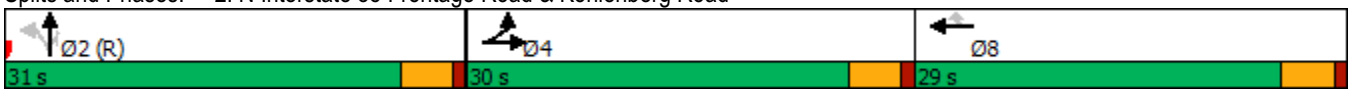
03/24/2021

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases						8	2		2			
Detector Phase	4	4			8	8	2	2	2			
Switch Phase												
Minimum Initial (s)	5.0	5.0			5.0	5.0	5.0	5.0	5.0			
Minimum Split (s)	22.5	22.5			22.5	22.5	22.5	22.5	22.5			
Total Split (s)	30.0	30.0			29.0	29.0	31.0	31.0	31.0			
Total Split (%)	33.3%	33.3%			32.2%	32.2%	34.4%	34.4%	34.4%			
Maximum Green (s)	25.5	25.5			24.5	24.5	26.5	26.5	26.5			
Yellow Time (s)	3.5	3.5			3.5	3.5	3.5	3.5	3.5			
All-Red Time (s)	1.0	1.0			1.0	1.0	1.0	1.0	1.0			
Lost Time Adjust (s)	0.0	0.0			0.0	0.0	0.0	0.0	0.0			
Total Lost Time (s)	4.5	4.5			4.5	4.5	4.5	4.5	4.5			
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0	3.0			
Recall Mode	None	None			None	None	C-Max	C-Max	C-Max			
Walk Time (s)	7.0	7.0			7.0	7.0	7.0	7.0	7.0			
Flash Dont Walk (s)	11.0	11.0			11.0	11.0	11.0	11.0	11.0			
Pedestrian Calls (#/hr)	0	0			0	0	0	0	0			
Act Effct Green (s)	10.6	10.6			11.4	11.4	54.6	54.6	54.6			
Actuated g/C Ratio	0.12	0.12			0.13	0.13	0.61	0.61	0.61			
v/c Ratio	0.46	0.46			0.52	0.24	0.25	0.02	0.09			
Control Delay	35.0	30.3			39.4	9.9	10.1	8.7	2.6			
Queue Delay	0.0	0.0			0.0	0.0	0.0	0.0	0.0			
Total Delay	35.0	30.3			39.4	9.9	10.1	8.7	2.6			
LOS	D	C			D	A	B	A	A			
Approach Delay		31.8			34.5			8.2				
Approach LOS		C			C			A				

Intersection Summary

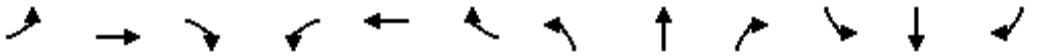
Area Type: Other
Cycle Length: 90
Actuated Cycle Length: 90
Offset: 16 (18%), Referenced to phase 2:NBTL and 6:, Start of Green
Natural Cycle: 70
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.52
Intersection Signal Delay: 24.3 Intersection LOS: C
Intersection Capacity Utilization 33.5% ICU Level of Service A
Analysis Period (min) 15

Splits and Phases: 2: N Interstate 35 Frontage Road & Kohlenberg Road



HCM 6th Signalized Intersection Summary
2: N Interstate 35 Frontage Road & Kohlenberg Road

03/24/2021



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	82	148	0	0	302	60	220	36	79	0	0	0
Future Volume (veh/h)	82	148	0	0	302	60	220	36	79	0	0	0
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0			
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00			
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			
Work Zone On Approach		No			No			No				
Adj Sat Flow, veh/h/ln	1752	1767	0	0	1856	1900	1707	1693	1856			
Adj Flow Rate, veh/h	83	169	0	0	328	0	239	39	0			
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92			
Percent Heavy Veh, %	10	9	0	0	3	0	13	14	3			
Cap, veh/h	137	290	0	0	528		1079	2134				
Arrive On Green	0.08	0.08	0.00	0.00	0.10	0.00	0.66	0.66	0.00			
Sat Flow, veh/h	1668	3533	0	0	5233	1610	1626	3216	1572			
Grp Volume(v), veh/h	83	169	0	0	328	0	239	39	0			
Grp Sat Flow(s),veh/h/ln	1668	1767	0	0	1689	1610	1626	1608	1572			
Q Serve(g_s), s	4.3	4.1	0.0	0.0	5.6	0.0	5.2	0.4	0.0			
Cycle Q Clear(g_c), s	4.3	4.1	0.0	0.0	5.6	0.0	5.2	0.4	0.0			
Prop In Lane	1.00		0.00	0.00		1.00	1.00		1.00			
Lane Grp Cap(c), veh/h	137	290	0	0	528		1079	2134				
V/C Ratio(X)	0.61	0.58	0.00	0.00	0.62		0.22	0.02				
Avail Cap(c_a), veh/h	473	1001	0	0	1379		1079	2134				
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			
Upstream Filter(I)	0.97	0.97	0.00	0.00	1.00	0.00	1.00	1.00	0.00			
Uniform Delay (d), s/veh	39.9	39.8	0.0	0.0	38.6	0.0	6.0	5.2	0.0			
Incr Delay (d2), s/veh	4.1	1.8	0.0	0.0	1.2	0.0	0.5	0.0	0.0			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln	1.9	1.8	0.0	0.0	2.3	0.0	1.4	0.1	0.0			
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	44.0	41.6	0.0	0.0	39.8	0.0	6.4	5.2	0.0			
LnGrp LOS	D	D	A	A	D		A	A				
Approach Vol, veh/h		252			328	A		278	A			
Approach Delay, s/veh		42.4			39.8			6.3				
Approach LOS		D			D			A				
Timer - Assigned Phs		2		4				8				
Phs Duration (G+Y+Rc), s		64.2		11.9				13.9				
Change Period (Y+Rc), s		4.5		4.5				4.5				
Max Green Setting (Gmax), s		26.5		25.5				24.5				
Max Q Clear Time (g_c+I1), s		7.2		6.3				7.6				
Green Ext Time (p_c), s		0.8		1.1				1.8				

Intersection Summary	
HCM 6th Ctrl Delay	29.7
HCM 6th LOS	C

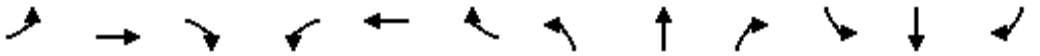
Notes

User approved volume balancing among the lanes for turning movement.

Unsignalized Delay for [NBR, WBR] is excluded from calculations of the approach delay and intersection delay.

Lanes, Volumes, Timings
3: S Interstate 35 Frontage Road & Conrads Lane/Kohlenberg Road

03/24/2021



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	159	230	136	386	0	0	0	0	71	564	127
Future Volume (vph)	0	159	230	136	386	0	0	0	0	71	564	127
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		275	0		0	0		0	0		0
Storage Lanes	0		2	1		0	0		0	1		1
Taper Length (ft)	25			25			25			150		
Lane Util. Factor	1.00	0.91	1.00	0.91	0.91	1.00	1.00	1.00	1.00	0.91	0.91	1.00
Frt			0.850									0.850
Flt Protected				0.950	0.998					0.950	0.999	
Satd. Flow (prot)	0	4673	1417	1579	3200	0	0	0	0	1550	3229	1205
Flt Permitted				0.950	0.998					0.950	0.999	
Satd. Flow (perm)	0	4673	1417	1579	3200	0	0	0	0	1550	3229	1205
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			250									138
Link Speed (mph)		40			40			55			55	
Link Distance (ft)		426			263			205			185	
Travel Time (s)		7.3			4.5			2.5			2.3	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	11%	14%	4%	8%	0%	0%	0%	0%	6%	7%	34%
Adj. Flow (vph)	0	173	250	148	420	0	0	0	0	77	613	138
Shared Lane Traffic (%)				10%						10%		
Lane Group Flow (vph)	0	173	250	133	435	0	0	0	0	69	621	138
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors		2	1	1	2					1	2	1
Detector Template		Thru	Right	Left	Thru					Left	Thru	Right
Leading Detector (ft)		100	20	20	100					20	100	20
Trailing Detector (ft)		0	0	0	0					0	0	0
Detector 1 Position(ft)		0	0	0	0					0	0	0
Detector 1 Size(ft)		6	20	20	6					20	6	20
Detector 1 Type		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex					Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)		0.0	0.0	0.0	0.0					0.0	0.0	0.0
Detector 1 Queue (s)		0.0	0.0	0.0	0.0					0.0	0.0	0.0
Detector 1 Delay (s)		0.0	0.0	0.0	0.0					0.0	0.0	0.0
Detector 2 Position(ft)		94			94						94	
Detector 2 Size(ft)		6			6						6	
Detector 2 Type		Cl+Ex			Cl+Ex						Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0						0.0	
Turn Type		NA	Perm	Split	NA					Perm	NA	Perm
Protected Phases		4		8	8						6	

Lanes, Volumes, Timings
3: S Interstate 35 Frontage Road & Conrads Lane/Kohlenberg Road

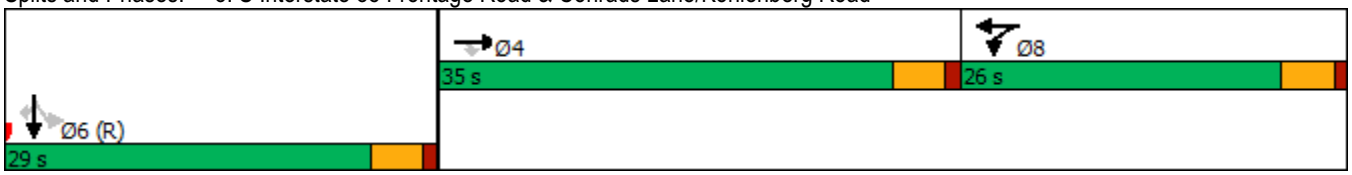
03/24/2021

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases			4							6		6
Detector Phase		4	4	8	8					6	6	6
Switch Phase												
Minimum Initial (s)		5.0	5.0	5.0	5.0					5.0	5.0	5.0
Minimum Split (s)		22.5	22.5	22.5	22.5					22.5	22.5	22.5
Total Split (s)		35.0	35.0	26.0	26.0					29.0	29.0	29.0
Total Split (%)		38.9%	38.9%	28.9%	28.9%					32.2%	32.2%	32.2%
Maximum Green (s)		30.5	30.5	21.5	21.5					24.5	24.5	24.5
Yellow Time (s)		3.5	3.5	3.5	3.5					3.5	3.5	3.5
All-Red Time (s)		1.0	1.0	1.0	1.0					1.0	1.0	1.0
Lost Time Adjust (s)		0.0	0.0	0.0	0.0					0.0	0.0	0.0
Total Lost Time (s)		4.5	4.5	4.5	4.5					4.5	4.5	4.5
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)		3.0	3.0	3.0	3.0					3.0	3.0	3.0
Recall Mode		None	None	None	None					C-Max	C-Max	C-Max
Walk Time (s)		7.0	7.0	7.0	7.0					7.0	7.0	7.0
Flash Dont Walk (s)		11.0	11.0	11.0	11.0					11.0	11.0	11.0
Pedestrian Calls (#/hr)		0	0	0	0					0	0	0
Act Effct Green (s)		9.8	9.8	18.0	18.0					48.7	48.7	48.7
Actuated g/C Ratio		0.11	0.11	0.20	0.20					0.54	0.54	0.54
v/c Ratio		0.34	0.66	0.42	0.68					0.08	0.36	0.19
Control Delay		38.1	14.0	54.8	59.4					12.9	13.9	3.6
Queue Delay		0.0	0.0	0.0	0.7					0.0	0.0	0.0
Total Delay		38.1	14.0	54.8	60.1					12.9	13.9	3.6
LOS		D	B	D	E					B	B	A
Approach Delay		23.9			58.8						12.1	
Approach LOS		C			E						B	

Intersection Summary

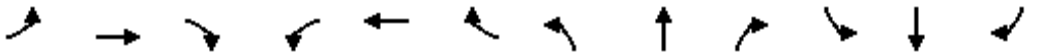
Area Type: Other
Cycle Length: 90
Actuated Cycle Length: 90
Offset: 0 (0%), Referenced to phase 2: and 6:SBTL, Start of Green, Master Intersection
Natural Cycle: 70
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.68
Intersection Signal Delay: 29.4 Intersection LOS: C
Intersection Capacity Utilization 33.5% ICU Level of Service A
Analysis Period (min) 15

Splits and Phases: 3: S Interstate 35 Frontage Road & Conrads Lane/Kohlenberg Road



HCM 6th Signalized Intersection Summary
3: S Interstate 35 Frontage Road & Conrads Lane/Kohlenberg Road

03/24/2021



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	159	230	136	386	0	0	0	0	71	564	127
Future Volume (veh/h)	0	159	230	136	386	0	0	0	0	71	564	127
Initial Q (Qb), veh	0	0	0	0	0	0				0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00				1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00				1.00	1.00	1.00
Work Zone On Approach		No			No						No	
Adj Sat Flow, veh/h/ln	0	1737	1693	1841	1781	0				1811	1796	1396
Adj Flow Rate, veh/h	0	173	0	148	420	0				77	613	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92				0.92	0.92	0.92
Percent Heavy Veh, %	0	11	14	4	8	0				6	7	34
Cap, veh/h	0	321		282	574	0				1071	2232	
Arrive On Green	0.00	0.07	0.00	0.05	0.05	0.00				0.62	0.62	0.00
Sat Flow, veh/h	0	4898	1434	1753	3563	0				1725	3593	1183
Grp Volume(v), veh/h	0	173	0	148	420	0				77	613	0
Grp Sat Flow(s),veh/h/ln	0	1581	1434	1753	1781	0				1725	1796	1183
Q Serve(g_s), s	0.0	3.2	0.0	7.4	10.5	0.0				1.6	7.0	0.0
Cycle Q Clear(g_c), s	0.0	3.2	0.0	7.4	10.5	0.0				1.6	7.0	0.0
Prop In Lane	0.00		1.00	1.00		0.00				1.00		1.00
Lane Grp Cap(c), veh/h	0	321		282	574	0				1071	2232	
V/C Ratio(X)	0.00	0.54		0.52	0.73	0.00				0.07	0.27	
Avail Cap(c_a), veh/h	0	1607		419	851	0				1071	2232	
HCM Platoon Ratio	1.00	1.00	1.00	0.33	0.33	1.00				1.00	1.00	1.00
Upstream Filter(I)	0.00	1.00	0.00	0.92	0.92	0.00				1.00	1.00	0.00
Uniform Delay (d), s/veh	0.0	40.6	0.0	39.3	40.7	0.0				6.8	7.8	0.0
Incr Delay (d2), s/veh	0.0	1.4	0.0	1.4	1.7	0.0				0.1	0.3	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0				0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	1.2	0.0	3.4	5.0	0.0				0.5	2.1	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	0.0	42.0	0.0	40.6	42.4	0.0				6.9	8.1	0.0
LnGrp LOS	A	D		D	D	A				A	A	
Approach Vol, veh/h		173	A		568						690	A
Approach Delay, s/veh		42.0			41.9						8.0	
Approach LOS		D			D						A	

Timer - Assigned Phs		4		6		8						
Phs Duration (G+Y+Rc), s		10.6		60.4		19.0						
Change Period (Y+Rc), s		4.5		4.5		4.5						
Max Green Setting (Gmax), s		30.5		24.5		21.5						
Max Q Clear Time (g_c+I1), s		5.2		9.0		12.5						
Green Ext Time (p_c), s		1.0		3.3		2.0						

Intersection Summary		
HCM 6th Ctrl Delay	25.6	
HCM 6th LOS	C	

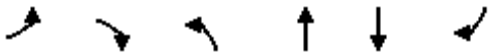
Notes

User approved volume balancing among the lanes for turning movement.

Unsignalized Delay for [EBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Lanes, Volumes, Timings
6: N Interstate 35 Frontage Road

03/24/2021



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	20	0	0	178	0	0
Future Volume (vph)	20	0	0	178	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	0.91	1.00	1.00
Frt						
Flt Protected	0.950					
Satd. Flow (prot)	1641	0	0	4848	0	0
Flt Permitted	0.950					
Satd. Flow (perm)	1641	0	0	4848	0	0
Link Speed (mph)	30			55	55	
Link Distance (ft)	262			223	1233	
Travel Time (s)	6.0			2.8	15.3	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	10%	0%	0%	7%	0%	0%
Adj. Flow (vph)	22	0	0	193	0	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	22	0	0	193	0	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	12			0	0	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9	15			9
Sign Control	Yield			Free	Free	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 13.4%		ICU Level of Service A	
Analysis Period (min) 15			

Lanes, Volumes, Timings
7: S Interstate 35 Frontage Road

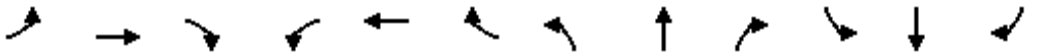
03/24/2021

Lane Group	WBL	WBR	NBL	NBT	NBR	SBL	SBT	SBR	SEL	SER
Lane Configurations										
Traffic Volume (vph)	0	0	0	0	0	20	762	0	0	0
Future Volume (vph)	0	0	0	0	0	20	762	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0	0	0		0	475		475	0	0
Storage Lanes	0	0	0		0	2		1	0	0
Taper Length (ft)	25		25			100			25	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.86	0.86	1.00	1.00
Frt										
Flt Protected						0.950				
Satd. Flow (prot)	0	0	0	0	0	1641	5888	0	0	0
Flt Permitted						0.950				
Satd. Flow (perm)	0	0	0	0	0	1641	5888	0	0	0
Link Speed (mph)	30			55			55		30	
Link Distance (ft)	262			185			1270		123	
Travel Time (s)	6.0			2.3			15.7		2.8	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	0%	0%	0%	0%	10%	11%	0%	0%	0%
Adj. Flow (vph)	0	0	0	0	0	22	828	0	0	0
Shared Lane Traffic (%)										
Lane Group Flow (vph)	0	0	0	0	0	22	828	0	0	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Right	Left	Left	Right	Left	Right
Median Width(ft)	0			12			12		0	
Link Offset(ft)	0			0			0		0	
Crosswalk Width(ft)	16			16			16		16	
Two way Left Turn Lane										
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9	15		9	15		9	15	9
Sign Control	Free			Free			Free		Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization	14.4%	ICU Level of Service	A
Analysis Period (min)	15		

Lanes, Volumes, Timings
8: N Interstate 35 Frontage Road

03/24/2021

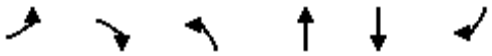


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	0	0	0	189	335	0	0	0	0
Future Volume (vph)	0	0	0	0	0	0	189	335	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		0	475		475	0		0
Storage Lanes	0		0	0		0	2		1	0		0
Taper Length (ft)	25			25			150			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.86	0.86	1.00	1.00	1.00
Frt												
Flt Protected							0.950					
Satd. Flow (prot)	0	0	0	0	0	0	1719	5942	0	0	0	0
Flt Permitted							0.950					
Satd. Flow (perm)	0	0	0	0	0	0	1719	5942	0	0	0	0
Link Speed (mph)		30			30			55			55	
Link Distance (ft)		266			141			6650			171	
Travel Time (s)		6.0			3.2			82.4			2.1	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	5%	10%	0%	0%	0%	0%
Adj. Flow (vph)	0	0	0	0	0	0	205	364	0	0	0	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	0	0	0	0	0	205	364	0	0	0	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Free			Stop			Free			Free	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 35.1%		ICU Level of Service A	
Analysis Period (min) 15			

Lanes, Volumes, Timings
9: N Interstate 35 Frontage Road & I-35 NB Off Ramp

03/24/2021



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	299	0	0	773	0	0
Future Volume (vph)	299	0	0	773	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	0.95	1.00	1.00
Frt						
Flt Protected	0.950					
Satd. Flow (prot)	1641	0	0	3406	0	0
Flt Permitted	0.950					
Satd. Flow (perm)	1641	0	0	3406	0	0
Link Speed (mph)	45			55	55	
Link Distance (ft)	469			818	6650	
Travel Time (s)	7.1			10.1	82.4	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	10%	0%	0%	6%	0%	0%
Adj. Flow (vph)	325	0	0	840	0	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	325	0	0	840	0	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	12			24	24	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9	15			9
Sign Control	Yield			Free	Free	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 44.6%		ICU Level of Service A	
Analysis Period (min) 15			

Lanes, Volumes, Timings
12: S Interstate 35 Frontage Road

03/24/2021

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	189	0	0	0	0	930
Future Volume (vph)	189	0	0	0	0	930
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	0.91
Frt						
Flt Protected	0.950					
Satd. Flow (prot)	1719	0	0	0	0	4803
Flt Permitted	0.950					
Satd. Flow (perm)	1719	0	0	0	0	4803
Link Speed (mph)	30		55			55
Link Distance (ft)	266		1391			205
Travel Time (s)	6.0		17.2			2.5
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	5%	0%	0%	0%	0%	8%
Adj. Flow (vph)	205	0	0	0	0	1011
Shared Lane Traffic (%)						
Lane Group Flow (vph)	205	0	0	0	0	1011
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(ft)	12		0			0
Link Offset(ft)	0		0			0
Crosswalk Width(ft)	16		16			16
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9		9	15	
Sign Control	Yield		Free			Free

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 35.1%		ICU Level of Service A	
Analysis Period (min) 15			

Lanes, Volumes, Timings
13: S Interstate 35 Frontage Road & I-35 SB Off Ramp

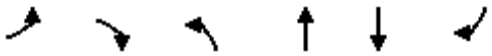
03/24/2021

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	507	0	0	0	0	1143
Future Volume (vph)	507	0	0	0	0	1143
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	0.95
Frt						
Flt Protected	0.950					
Satd. Flow (prot)	1736	0	0	0	0	3343
Flt Permitted	0.950					
Satd. Flow (perm)	1736	0	0	0	0	3343
Link Speed (mph)	45		55			30
Link Distance (ft)	349		5489			497
Travel Time (s)	5.3		68.0			11.3
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	4%	0%	0%	0%	0%	8%
Adj. Flow (vph)	551	0	0	0	0	1242
Shared Lane Traffic (%)						
Lane Group Flow (vph)	551	0	0	0	0	1242
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(ft)	12		0			0
Link Offset(ft)	0		0			0
Crosswalk Width(ft)	16		16			16
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9		9	15	
Sign Control	Yield		Free			Free

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 66.4%		ICU Level of Service C	
Analysis Period (min) 15			

Lanes, Volumes, Timings
17: S Interstate 35 Frontage Road & Oak Creek Way

03/24/2021



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	0	79	0	0	1064	78
Future Volume (vph)	0	79	0	0	1064	78
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0	0	0			315
Storage Lanes	0	1	0			1
Taper Length (ft)	25		25			
Lane Util. Factor	1.00	1.00	1.00	1.00	0.95	1.00
Frt		0.865				0.850
Flt Protected						
Satd. Flow (prot)	0	1644	0	0	3343	1599
Flt Permitted						
Satd. Flow (perm)	0	1644	0	0	3343	1599
Link Speed (mph)	30			55	55	
Link Distance (ft)	1047			497	1391	
Travel Time (s)	23.8			6.2	17.2	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	0%	0%	0%	8%	1%
Adj. Flow (vph)	0	86	0	0	1157	85
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	86	0	0	1157	85
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	0			0	0	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9	15			9
Sign Control	Stop			Free	Free	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization	41.0%	ICU Level of Service	A
Analysis Period (min)	15		

Intersection	
Int Delay, s/veh	0.9

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	0	79	0	0	1064	78
Future Vol, veh/h	0	79	0	0	1064	78
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	-	315
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	0	0	0	0	8	1
Mvmt Flow	0	86	0	0	1157	85

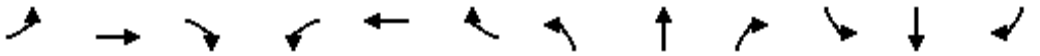
Major/Minor	Minor2		Major2	
Conflicting Flow All	-	579	-	0
Stage 1	-	-	-	-
Stage 2	-	-	-	-
Critical Hdwy	-	6.9	-	-
Critical Hdwy Stg 1	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-
Follow-up Hdwy	-	3.3	-	-
Pot Cap-1 Maneuver	0	463	-	-
Stage 1	0	-	-	-
Stage 2	0	-	-	-
Platoon blocked, %			-	-
Mov Cap-1 Maneuver	-	463	-	-
Mov Cap-2 Maneuver	-	-	-	-
Stage 1	-	-	-	-
Stage 2	-	-	-	-

Approach	EB	SB
HCM Control Delay, s	14.5	0
HCM LOS	B	

Minor Lane/Major Mvmt	EBLn1	SBT	SBR
Capacity (veh/h)	463	-	-
HCM Lane V/C Ratio	0.185	-	-
HCM Control Delay (s)	14.5	-	-
HCM Lane LOS	B	-	-
HCM 95th %tile Q(veh)	0.7	-	-

Lanes, Volumes, Timings
2: N Interstate 35 Frontage Road & Kohlenberg Road

03/24/2021



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	77	73	0	0	130	56	199	48	74	0	0	0
Future Volume (vph)	77	73	0	0	130	56	199	48	74	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		275	0		0	0		0
Storage Lanes	1		0	0		2	1		1	0		0
Taper Length (ft)	25			25			150			25		
Lane Util. Factor	0.91	0.91	1.00	1.00	0.91	1.00	1.00	0.95	1.00	1.00	1.00	1.00
Frt						0.850			0.850			
Flt Protected	0.950	0.986					0.950					
Satd. Flow (prot)	1550	3195	0	0	5085	1538	1556	3471	1568	0	0	0
Flt Permitted	0.950	0.986					0.950					
Satd. Flow (perm)	1550	3195	0	0	5085	1538	1556	3471	1568	0	0	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)						73			80			
Link Speed (mph)		40			40			55			55	
Link Distance (ft)		263			471			171			223	
Travel Time (s)		4.5			8.0			2.1			2.8	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	6%	7%	0%	0%	2%	5%	16%	4%	3%	0%	0%	0%
Adj. Flow (vph)	84	79	0	0	141	61	216	52	80	0	0	0
Shared Lane Traffic (%)	37%											
Lane Group Flow (vph)	53	110	0	0	141	61	216	52	80	0	0	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2			2	1	1	2	1			
Detector Template	Left	Thru			Thru	Right	Left	Thru	Right			
Leading Detector (ft)	20	100			100	20	20	100	20			
Trailing Detector (ft)	0	0			0	0	0	0	0			
Detector 1 Position(ft)	0	0			0	0	0	0	0			
Detector 1 Size(ft)	20	6			6	20	20	6	20			
Detector 1 Type	Cl+Ex	Cl+Ex			Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex			
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0			0.0	0.0	0.0	0.0	0.0			
Detector 1 Queue (s)	0.0	0.0			0.0	0.0	0.0	0.0	0.0			
Detector 1 Delay (s)	0.0	0.0			0.0	0.0	0.0	0.0	0.0			
Detector 2 Position(ft)		94			94			94				
Detector 2 Size(ft)		6			6			6				
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex				
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0				
Turn Type	Split	NA			NA	Perm	Perm	NA	Perm			
Protected Phases	4	4			8			2				

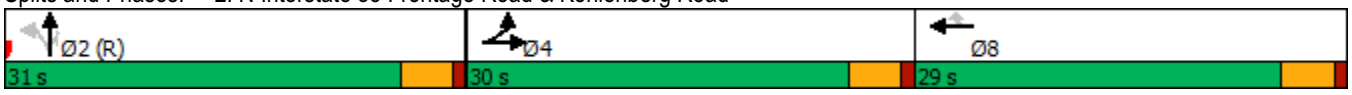
Lanes, Volumes, Timings
2: N Interstate 35 Frontage Road & Kohlenberg Road

03/24/2021

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases						8	2		2			
Detector Phase	4	4			8	8	2	2	2			
Switch Phase												
Minimum Initial (s)	5.0	5.0			5.0	5.0	5.0	5.0	5.0			
Minimum Split (s)	22.5	22.5			22.5	22.5	22.5	22.5	22.5			
Total Split (s)	30.0	30.0			29.0	29.0	31.0	31.0	31.0			
Total Split (%)	33.3%	33.3%			32.2%	32.2%	34.4%	34.4%	34.4%			
Maximum Green (s)	25.5	25.5			24.5	24.5	26.5	26.5	26.5			
Yellow Time (s)	3.5	3.5			3.5	3.5	3.5	3.5	3.5			
All-Red Time (s)	1.0	1.0			1.0	1.0	1.0	1.0	1.0			
Lost Time Adjust (s)	0.0	0.0			0.0	0.0	0.0	0.0	0.0			
Total Lost Time (s)	4.5	4.5			4.5	4.5	4.5	4.5	4.5			
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0	3.0			
Recall Mode	None	None			None	None	C-Max	C-Max	C-Max			
Walk Time (s)	7.0	7.0			7.0	7.0	7.0	7.0	7.0			
Flash Dont Walk (s)	11.0	11.0			11.0	11.0	11.0	11.0	11.0			
Pedestrian Calls (#/hr)	0	0			0	0	0	0	0			
Act Effct Green (s)	8.7	8.7			7.9	7.9	62.0	62.0	62.0			
Actuated g/C Ratio	0.10	0.10			0.09	0.09	0.69	0.69	0.69			
v/c Ratio	0.35	0.35			0.32	0.30	0.20	0.02	0.07			
Control Delay	24.2	20.7			40.1	11.8	6.8	6.0	1.9			
Queue Delay	0.0	0.0			0.0	0.0	0.0	0.0	0.0			
Total Delay	24.2	20.7			40.1	11.8	6.8	6.0	1.9			
LOS	C	C			D	B	A	A	A			
Approach Delay		21.8			31.6			5.5				
Approach LOS		C			C			A				

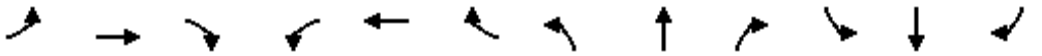
Intersection Summary			
Area Type:	Other		
Cycle Length: 90			
Actuated Cycle Length: 90			
Offset: 16 (18%), Referenced to phase 2:NBTL and 6:, Start of Green			
Natural Cycle: 70			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.35			
Intersection Signal Delay: 16.6		Intersection LOS: B	
Intersection Capacity Utilization 41.4%		ICU Level of Service A	
Analysis Period (min) 15			

Splits and Phases: 2: N Interstate 35 Frontage Road & Kohlenberg Road



HCM 6th Signalized Intersection Summary
2: N Interstate 35 Frontage Road & Kohlenberg Road

03/24/2021



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	77	73	0	0	130	56	199	48	74	0	0	0
Future Volume (veh/h)	77	73	0	0	130	56	199	48	74	0	0	0
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0			
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00			
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			
Work Zone On Approach		No			No			No				
Adj Sat Flow, veh/h/ln	1811	1796	0	0	1870	1826	1663	1841	1856			
Adj Flow Rate, veh/h	91	69	0	0	141	0	216	52	0			
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92			
Percent Heavy Veh, %	6	7	0	0	2	5	16	4	3			
Cap, veh/h	223	116	0	0	282		1156	2554				
Arrive On Green	0.06	0.06	0.00	0.00	0.06	0.00	0.73	0.73	0.00			
Sat Flow, veh/h	3450	1796	0	0	5274	1547	1584	3497	1572			
Grp Volume(v), veh/h	91	69	0	0	141	0	216	52	0			
Grp Sat Flow(s),veh/h/ln	1725	1796	0	0	1702	1547	1584	1749	1572			
Q Serve(g_s), s	2.3	3.4	0.0	0.0	2.4	0.0	3.8	0.4	0.0			
Cycle Q Clear(g_c), s	2.3	3.4	0.0	0.0	2.4	0.0	3.8	0.4	0.0			
Prop In Lane	1.00		0.00	0.00		1.00	1.00		1.00			
Lane Grp Cap(c), veh/h	223	116	0	0	282		1156	2554				
V/C Ratio(X)	0.41	0.60	0.00	0.00	0.50		0.19	0.02				
Avail Cap(c_a), veh/h	977	509	0	0	1390		1156	2554				
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			
Upstream Filter(I)	0.97	0.97	0.00	0.00	1.00	0.00	1.00	1.00	0.00			
Uniform Delay (d), s/veh	40.4	41.0	0.0	0.0	41.3	0.0	3.8	3.3	0.0			
Incr Delay (d2), s/veh	1.2	4.7	0.0	0.0	1.4	0.0	0.4	0.0	0.0			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln	1.0	1.6	0.0	0.0	1.0	0.0	0.8	0.1	0.0			
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	41.6	45.6	0.0	0.0	42.7	0.0	4.1	3.3	0.0			
LnGrp LOS	D	D	A	A	D		A	A				
Approach Vol, veh/h		160			141	A		268	A			
Approach Delay, s/veh		43.3			42.7			4.0				
Approach LOS		D			D			A				
Timer - Assigned Phs		2		4				8				
Phs Duration (G+Y+Rc), s		70.2		10.3				9.5				
Change Period (Y+Rc), s		4.5		4.5				4.5				
Max Green Setting (Gmax), s		26.5		25.5				24.5				
Max Q Clear Time (g_c+I1), s		5.8		5.4				4.4				
Green Ext Time (p_c), s		0.8		0.6				0.7				

Intersection Summary	
HCM 6th Ctrl Delay	24.6
HCM 6th LOS	C

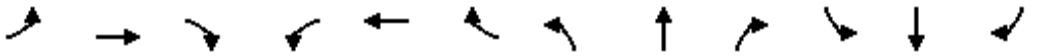
Notes

User approved volume balancing among the lanes for turning movement.

Unsignalized Delay for [NBR, WBR] is excluded from calculations of the approach delay and intersection delay.

Lanes, Volumes, Timings
3: S Interstate 35 Frontage Road & Conrads Lane/Kohlenberg Road

03/24/2021



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	135	191	50	279	0	0	0	0	15	1181	34
Future Volume (vph)	0	135	191	50	279	0	0	0	0	15	1181	34
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		275	0		0	0		0	0		0
Storage Lanes	0		2	1		0	0		0	1		1
Taper Length (ft)	25			25			25			150		
Lane Util. Factor	1.00	0.91	1.00	0.91	0.91	1.00	1.00	1.00	1.00	0.91	0.91	1.00
Frt			0.850									0.850
Flt Protected				0.950	0.999					0.950		
Satd. Flow (prot)	0	4848	1482	1550	3114	0	0	0	0	1535	3357	1404
Flt Permitted				0.950	0.999					0.950		
Satd. Flow (perm)	0	4848	1482	1550	3114	0	0	0	0	1535	3357	1404
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			208									73
Link Speed (mph)		40			40			55			55	
Link Distance (ft)		426			263			205			185	
Travel Time (s)		7.3			4.5			2.5			2.3	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	7%	9%	6%	11%	0%	0%	0%	0%	7%	3%	15%
Adj. Flow (vph)	0	147	208	54	303	0	0	0	0	16	1284	37
Shared Lane Traffic (%)				10%						10%		
Lane Group Flow (vph)	0	147	208	49	308	0	0	0	0	14	1286	37
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors		2	1	1	2					1	2	1
Detector Template		Thru	Right	Left	Thru					Left	Thru	Right
Leading Detector (ft)		100	20	20	100					20	100	20
Trailing Detector (ft)		0	0	0	0					0	0	0
Detector 1 Position(ft)		0	0	0	0					0	0	0
Detector 1 Size(ft)		6	20	20	6					20	6	20
Detector 1 Type		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex					Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)		0.0	0.0	0.0	0.0					0.0	0.0	0.0
Detector 1 Queue (s)		0.0	0.0	0.0	0.0					0.0	0.0	0.0
Detector 1 Delay (s)		0.0	0.0	0.0	0.0					0.0	0.0	0.0
Detector 2 Position(ft)		94			94						94	
Detector 2 Size(ft)		6			6						6	
Detector 2 Type		Cl+Ex			Cl+Ex						Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0						0.0	
Turn Type		NA	Perm	Split	NA					Perm	NA	Perm
Protected Phases		4		8	8						6	

Lanes, Volumes, Timings
3: S Interstate 35 Frontage Road & Conrads Lane/Kohlenberg Road

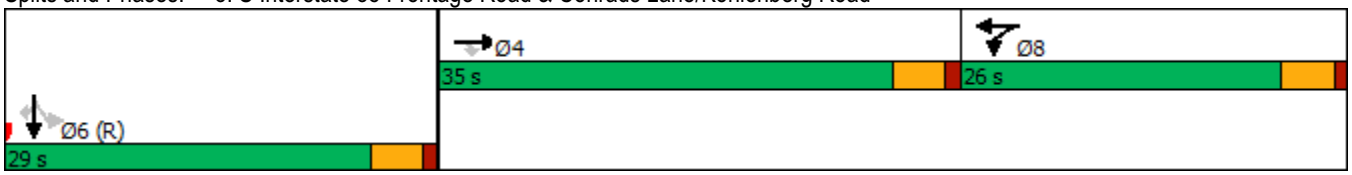
03/24/2021

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases			4							6		6
Detector Phase		4	4	8	8					6	6	6
Switch Phase												
Minimum Initial (s)		5.0	5.0	5.0	5.0					5.0	5.0	5.0
Minimum Split (s)		22.5	22.5	22.5	22.5					22.5	22.5	22.5
Total Split (s)		35.0	35.0	26.0	26.0					29.0	29.0	29.0
Total Split (%)		38.9%	38.9%	28.9%	28.9%					32.2%	32.2%	32.2%
Maximum Green (s)		30.5	30.5	21.5	21.5					24.5	24.5	24.5
Yellow Time (s)		3.5	3.5	3.5	3.5					3.5	3.5	3.5
All-Red Time (s)		1.0	1.0	1.0	1.0					1.0	1.0	1.0
Lost Time Adjust (s)		0.0	0.0	0.0	0.0					0.0	0.0	0.0
Total Lost Time (s)		4.5	4.5	4.5	4.5					4.5	4.5	4.5
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)		3.0	3.0	3.0	3.0					3.0	3.0	3.0
Recall Mode		None	None	None	None					C-Max	C-Max	C-Max
Walk Time (s)		7.0	7.0	7.0	7.0					7.0	7.0	7.0
Flash Dont Walk (s)		11.0	11.0	11.0	11.0					11.0	11.0	11.0
Pedestrian Calls (#/hr)		0	0	0	0					0	0	0
Act Effct Green (s)		9.0	9.0	14.3	14.3					53.2	53.2	53.2
Actuated g/C Ratio		0.10	0.10	0.16	0.16					0.59	0.59	0.59
v/c Ratio		0.30	0.62	0.20	0.62					0.02	0.65	0.04
Control Delay		38.3	14.0	51.9	58.6					10.3	15.5	0.9
Queue Delay		0.0	0.0	0.0	0.0					0.0	0.0	0.0
Total Delay		38.3	14.0	51.9	58.6					10.3	15.5	0.9
LOS		D	B	D	E					B	B	A
Approach Delay		24.1			57.7						15.0	
Approach LOS		C			E						B	

Intersection Summary

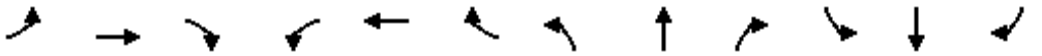
Area Type: Other
Cycle Length: 90
Actuated Cycle Length: 90
Offset: 0 (0%), Referenced to phase 2: and 6:SBTL, Start of Green, Master Intersection
Natural Cycle: 80
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.65
Intersection Signal Delay: 24.0 Intersection LOS: C
Intersection Capacity Utilization 41.4% ICU Level of Service A
Analysis Period (min) 15

Splits and Phases: 3: S Interstate 35 Frontage Road & Conrads Lane/Kohlenberg Road



HCM 6th Signalized Intersection Summary
3: S Interstate 35 Frontage Road & Conrads Lane/Kohlenberg Road

03/24/2021



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	135	191	50	279	0	0	0	0	15	1181	34
Future Volume (veh/h)	0	135	191	50	279	0	0	0	0	15	1181	34
Initial Q (Qb), veh	0	0	0	0	0	0				0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00				1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00				1.00	1.00	1.00
Work Zone On Approach		No			No						No	
Adj Sat Flow, veh/h/ln	0	1796	1767	1811	1737	0				1796	1856	1678
Adj Flow Rate, veh/h	0	147	0	54	303	0				16	1284	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92				0.92	0.92	0.92
Percent Heavy Veh, %	0	7	9	6	11	0				7	3	15
Cap, veh/h	0	289		215	434	0				1140	2472	
Arrive On Green	0.00	0.06	0.00	0.04	0.04	0.00				0.67	0.67	0.00
Sat Flow, veh/h	0	5065	1497	1725	3474	0				1711	3711	1422
Grp Volume(v), veh/h	0	147	0	54	303	0				16	1284	0
Grp Sat Flow(s),veh/h/ln	0	1635	1497	1725	1737	0				1711	1856	1422
Q Serve(g_s), s	0.0	2.6	0.0	2.7	7.7	0.0				0.3	15.9	0.0
Cycle Q Clear(g_c), s	0.0	2.6	0.0	2.7	7.7	0.0				0.3	15.9	0.0
Prop In Lane	0.00		1.00	1.00		0.00				1.00		1.00
Lane Grp Cap(c), veh/h	0	289		215	434	0				1140	2472	
V/C Ratio(X)	0.00	0.51		0.25	0.70	0.00				0.01	0.52	
Avail Cap(c_a), veh/h	0	1662		412	830	0				1140	2472	
HCM Platoon Ratio	1.00	1.00	1.00	0.33	0.33	1.00				1.00	1.00	1.00
Upstream Filter(I)	0.00	1.00	0.00	0.98	0.98	0.00				1.00	1.00	0.00
Uniform Delay (d), s/veh	0.0	41.1	0.0	39.1	41.5	0.0				5.1	7.7	0.0
Incr Delay (d2), s/veh	0.0	1.4	0.0	0.6	2.0	0.0				0.0	0.8	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0				0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	1.1	0.0	1.2	3.5	0.0				0.1	4.5	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	0.0	42.5	0.0	39.7	43.5	0.0				5.1	8.5	0.0
LnGrp LOS	A	D		D	D	A				A	A	
Approach Vol, veh/h		147	A		357						1300	A
Approach Delay, s/veh		42.5			42.9						8.4	
Approach LOS		D			D						A	

Timer - Assigned Phs		4		6		8						
Phs Duration (G+Y+Rc), s		9.8		64.5		15.7						
Change Period (Y+Rc), s		4.5		4.5		4.5						
Max Green Setting (Gmax), s		30.5		24.5		21.5						
Max Q Clear Time (g_c+I1), s		4.6		17.9		9.7						
Green Ext Time (p_c), s		0.8		4.0		1.5						

Intersection Summary		
HCM 6th Ctrl Delay	18.0	
HCM 6th LOS	B	

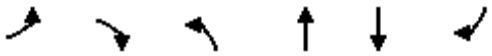
Notes

User approved volume balancing among the lanes for turning movement.

Unsignalized Delay for [EBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Lanes, Volumes, Timings
6: N Interstate 35 Frontage Road

03/24/2021



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	4	0	0	181	0	0
Future Volume (vph)	4	0	0	181	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	0.91	1.00	1.00
Frt						
Flt Protected	0.950					
Satd. Flow (prot)	1805	0	0	4893	0	0
Flt Permitted	0.950					
Satd. Flow (perm)	1805	0	0	4893	0	0
Link Speed (mph)	30			55	55	
Link Distance (ft)	262			223	1233	
Travel Time (s)	6.0			2.8	15.3	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	0%	0%	6%	0%	0%
Adj. Flow (vph)	4	0	0	197	0	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	4	0	0	197	0	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	12			0	0	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9	15			9
Sign Control	Yield			Free	Free	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 13.5%		ICU Level of Service A	
Analysis Period (min) 15			

Lanes, Volumes, Timings
7: S Interstate 35 Frontage Road

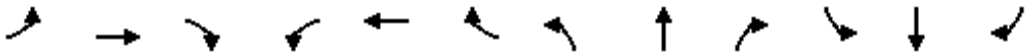
03/24/2021

Lane Group	WBL	WBR	NBL	NBT	NBR	SBL	SBT	SBR	SEL	SER
Lane Configurations										
Traffic Volume (vph)	0	0	0	0	0	4	1230	0	0	0
Future Volume (vph)	0	0	0	0	0	4	1230	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0	0	0		0	475		475	0	0
Storage Lanes	0	0	0		0	2		1	0	0
Taper Length (ft)	25		25			100			25	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.86	0.86	1.00	1.00
Frt										
Flt Protected						0.950				
Satd. Flow (prot)	0	0	0	0	0	1805	6346	0	0	0
Flt Permitted						0.950				
Satd. Flow (perm)	0	0	0	0	0	1805	6346	0	0	0
Link Speed (mph)	30			55			55		30	
Link Distance (ft)	262			185			1270		123	
Travel Time (s)	6.0			2.3			15.7		2.8	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	3%	0%	0%	0%
Adj. Flow (vph)	0	0	0	0	0	4	1337	0	0	0
Shared Lane Traffic (%)										
Lane Group Flow (vph)	0	0	0	0	0	4	1337	0	0	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Right	Left	Left	Right	Left	Right
Median Width(ft)	0			12			12		0	
Link Offset(ft)	0			0			0		0	
Crosswalk Width(ft)	16			16			16		16	
Two way Left Turn Lane										
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9	15		9	15		9	15	9
Sign Control	Free			Free			Free		Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 21.2%		ICU Level of Service A	
Analysis Period (min) 15			

Lanes, Volumes, Timings
8: N Interstate 35 Frontage Road

03/24/2021

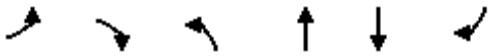


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	0	0	0	148	321	0	0	0	0
Future Volume (vph)	0	0	0	0	0	0	148	321	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		0	475		475	0		0
Storage Lanes	0		0	0		0	2		1	0		0
Taper Length (ft)	25			25			150			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.86	0.86	1.00	1.00	1.00
Frt												
Flt Protected							0.950					
Satd. Flow (prot)	0	0	0	0	0	0	1719	5888	0	0	0	0
Flt Permitted							0.950					
Satd. Flow (perm)	0	0	0	0	0	0	1719	5888	0	0	0	0
Link Speed (mph)		30			30			55			55	
Link Distance (ft)		266			141			6650			171	
Travel Time (s)		6.0			3.2			82.4			2.1	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	5%	11%	0%	0%	0%	0%
Adj. Flow (vph)	0	0	0	0	0	0	161	349	0	0	0	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	0	0	0	0	0	161	349	0	0	0	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Free			Stop			Free			Free	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization	42.3%	ICU Level of Service	A
Analysis Period (min)	15		

Lanes, Volumes, Timings
9: N Interstate 35 Frontage Road & I-35 NB Off Ramp

03/24/2021



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	291	0	0	1179	0	0
Future Volume (vph)	291	0	0	1179	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	0.95	1.00	1.00
Frt						
Flt Protected	0.950					
Satd. Flow (prot)	1612	0	0	3539	0	0
Flt Permitted	0.950					
Satd. Flow (perm)	1612	0	0	3539	0	0
Link Speed (mph)	45			55	55	
Link Distance (ft)	469			818	6650	
Travel Time (s)	7.1			10.1	82.4	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	12%	0%	0%	2%	0%	0%
Adj. Flow (vph)	316	0	0	1282	0	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	316	0	0	1282	0	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	12			24	24	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9	15			9
Sign Control	Yield			Free	Free	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 55.4%		ICU Level of Service B	
Analysis Period (min) 15			

Lanes, Volumes, Timings
12: S Interstate 35 Frontage Road

03/24/2021

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	148	0	0	0	0	1422
Future Volume (vph)	148	0	0	0	0	1422
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	0.91
Frt						
Flt Protected	0.950					
Satd. Flow (prot)	1719	0	0	0	0	4988
Flt Permitted	0.950					
Satd. Flow (perm)	1719	0	0	0	0	4988
Link Speed (mph)	30		55			55
Link Distance (ft)	266		1391			205
Travel Time (s)	6.0		17.2			2.5
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	5%	0%	0%	0%	0%	4%
Adj. Flow (vph)	161	0	0	0	0	1546
Shared Lane Traffic (%)						
Lane Group Flow (vph)	161	0	0	0	0	1546
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(ft)	12		0			0
Link Offset(ft)	0		0			0
Crosswalk Width(ft)	16		16			16
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9		9	15	
Sign Control	Yield		Free			Free

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 42.3%		ICU Level of Service A	
Analysis Period (min) 15			

Lanes, Volumes, Timings
13: S Interstate 35 Frontage Road & I-35 SB Off Ramp

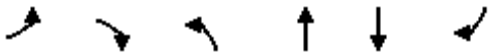
03/24/2021

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	151	0	0	0	0	1701
Future Volume (vph)	151	0	0	0	0	1701
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	0.95
Frt						
Flt Protected	0.950					
Satd. Flow (prot)	1770	0	0	0	0	3471
Flt Permitted	0.950					
Satd. Flow (perm)	1770	0	0	0	0	3471
Link Speed (mph)	45		55			30
Link Distance (ft)	349		5489			497
Travel Time (s)	5.3		68.0			11.3
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	2%	0%	0%	0%	0%	4%
Adj. Flow (vph)	164	0	0	0	0	1849
Shared Lane Traffic (%)						
Lane Group Flow (vph)	164	0	0	0	0	1849
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(ft)	12		0			0
Link Offset(ft)	0		0			0
Crosswalk Width(ft)	16		16			16
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9		9	15	
Sign Control	Yield		Free			Free

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 62.1%		ICU Level of Service B	
Analysis Period (min) 15			

Lanes, Volumes, Timings
17: S Interstate 35 Frontage Road & Oak Creek Way

03/24/2021



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	0	66	0	0	1635	29
Future Volume (vph)	0	66	0	0	1635	29
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0	0	0			315
Storage Lanes	0	1	0			1
Taper Length (ft)	25		25			
Lane Util. Factor	1.00	1.00	1.00	1.00	0.95	1.00
Frt		0.865				0.850
Flt Protected						
Satd. Flow (prot)	0	1611	0	0	3471	1615
Flt Permitted						
Satd. Flow (perm)	0	1611	0	0	3471	1615
Link Speed (mph)	30			55	55	
Link Distance (ft)	1047			497	1391	
Travel Time (s)	23.8			6.2	17.2	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	2%	0%	0%	4%	0%
Adj. Flow (vph)	0	72	0	0	1777	32
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	72	0	0	1777	32
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	0			0	0	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9	15			9
Sign Control	Stop			Free	Free	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization	55.9%	ICU Level of Service	B
Analysis Period (min)	15		

Intersection	
Int Delay, s/veh	0.8

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	0	66	0	0	1635	29
Future Vol, veh/h	0	66	0	0	1635	29
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	-	315
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	0	2	0	0	4	0
Mvmt Flow	0	72	0	0	1777	32

Major/Minor	Minor2		Major2	
Conflicting Flow All	-	889	-	0
Stage 1	-	-	-	-
Stage 2	-	-	-	-
Critical Hdwy	-	6.94	-	-
Critical Hdwy Stg 1	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-
Follow-up Hdwy	-	3.32	-	-
Pot Cap-1 Maneuver	0	286	-	-
Stage 1	0	-	-	-
Stage 2	0	-	-	-
Platoon blocked, %			-	-
Mov Cap-1 Maneuver	-	286	-	-
Mov Cap-2 Maneuver	-	-	-	-
Stage 1	-	-	-	-
Stage 2	-	-	-	-

Approach	EB	SB
HCM Control Delay, s	21.8	0
HCM LOS	C	

Minor Lane/Major Mvmt	EBLn1	SBT	SBR
Capacity (veh/h)	286	-	-
HCM Lane V/C Ratio	0.251	-	-
HCM Control Delay (s)	21.8	-	-
HCM Lane LOS	C	-	-
HCM 95th %tile Q(veh)	1	-	-

APPENDIX D
ITE TRIP GENERATION CAT. 848, 933, 934 AND 945 SHEETS AND ITE MULTI-USE DEVELOPMENT INTERNAL CAPTURE

Land Use: 848
Tire Store

Description

The primary business associated with a tire store is the sale and marketing of tires for automotive vehicles. Services offered by these stores usually include tire installation and repair, as well as other automotive maintenance or repair services and customer assistance. These stores generally do not contain large storage or warehouse areas. Automobile parts sales (Land Use 843), tire superstore (Land Use 849), and automobile parts and service center (Land Use 943) are related uses.

Additional Data

Time-of-day distribution data for this land use are presented in Appendix A. For the six general urban/suburban sites with data, the overall highest vehicle volumes during the AM and PM on a weekday were counted between 9:30 and 10:30 a.m. and 1:30 and 2:30 p.m., respectively.

The sites were surveyed in the 1980s, the 1990s, the 2000s, and the 2010s in Florida, Minnesota, New Jersey, New York, Oregon, Pennsylvania, South Dakota, Texas, and Wisconsin.

Source Numbers

328, 359, 438, 555, 571, 583, 599, 870, 886, 887, 959

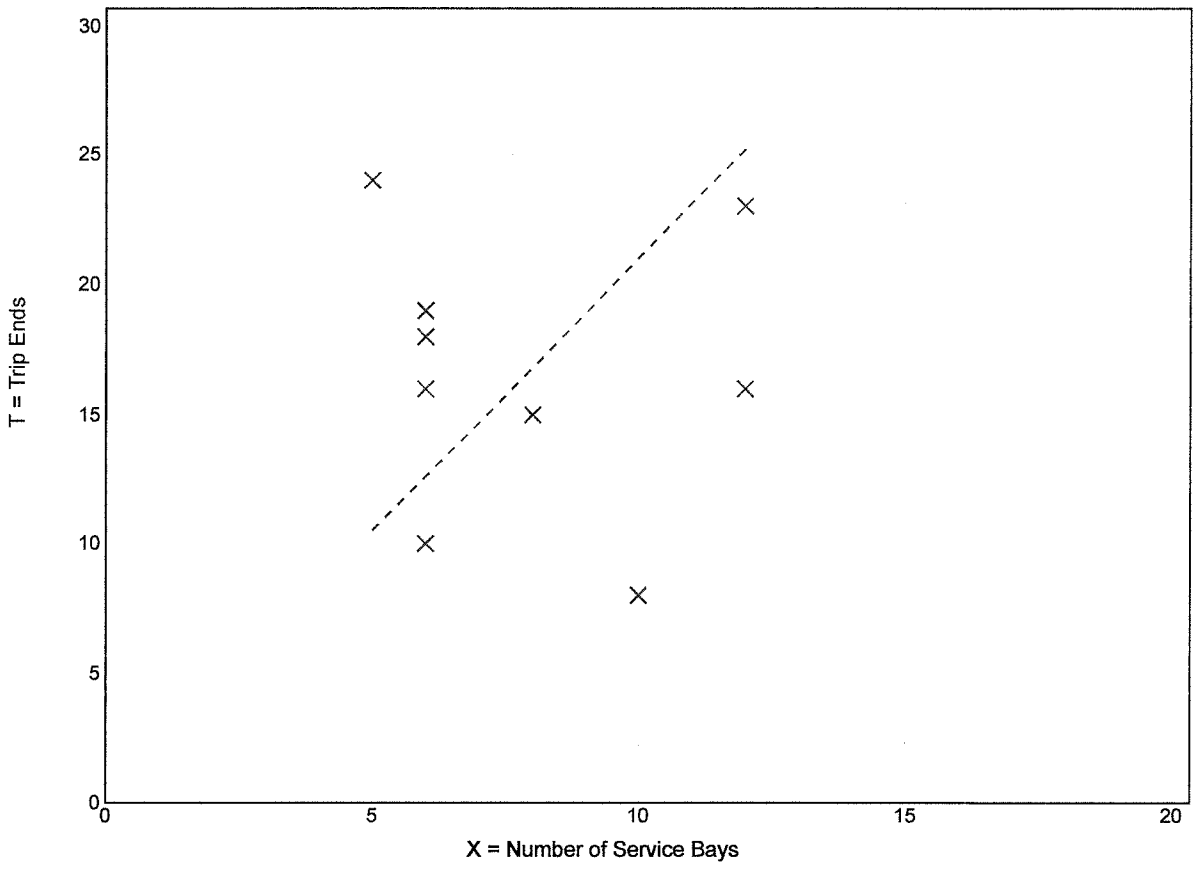
Tire Store
(848)

Vehicle Trip Ends vs: **Service Bays**
On a: **Weekday,**
Peak Hour of Adjacent Street Traffic,
One Hour Between 7 and 9 a.m.
Setting/Location: **General Urban/Suburban**
Number of Studies: 9
Avg. Num. of Service Bays: 8
Directional Distribution: 64% entering, 36% exiting

Vehicle Trip Generation per Service Bay

Average Rate	Range of Rates	Standard Deviation
2.10	0.80 - 4.80	1.10

Data Plot and Equation



Fitted Curve Equation: Not Given

R^2= ****

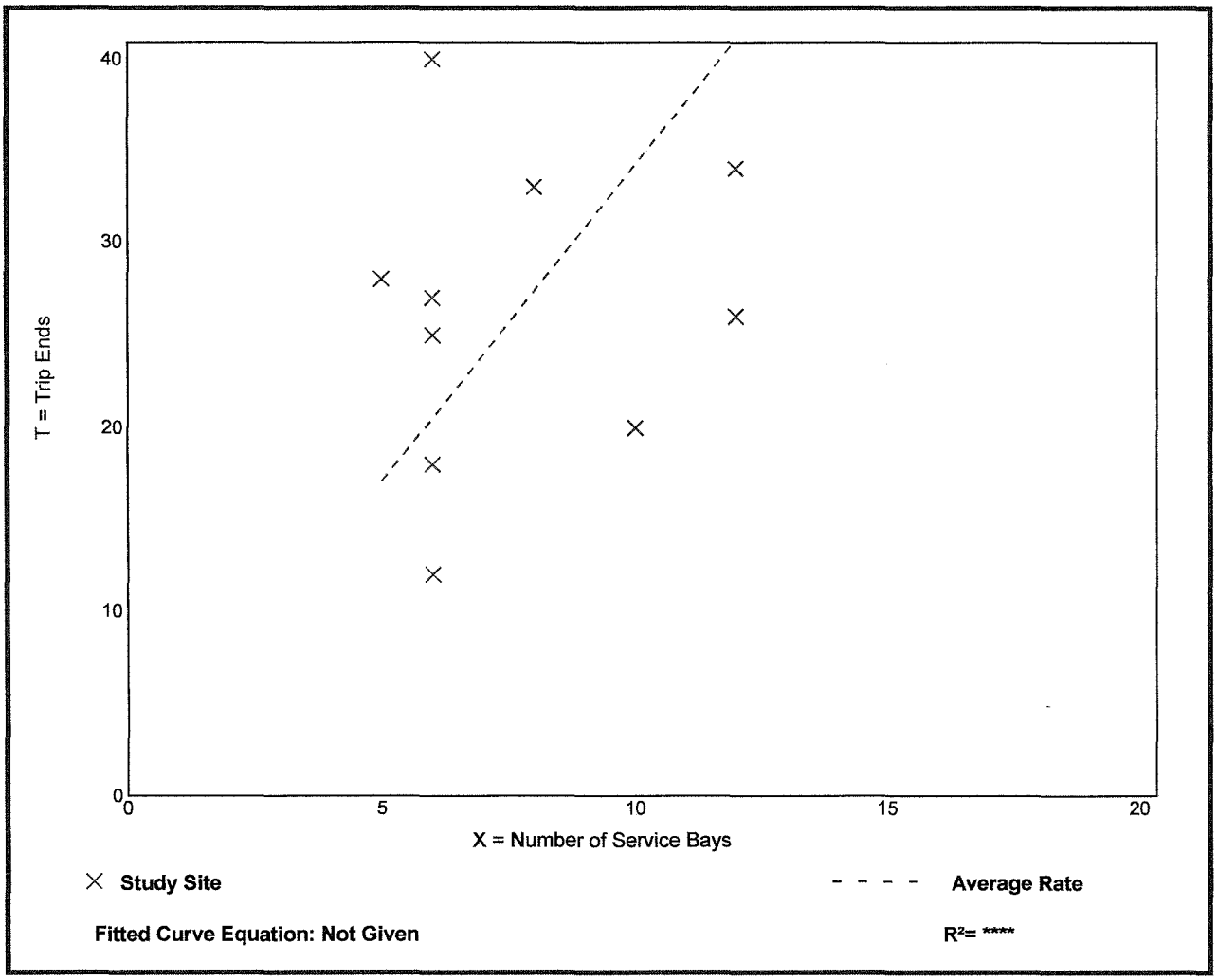
Tire Store
(848)

Vehicle Trip Ends vs: **Service Bays**
On a: **Weekday,**
Peak Hour of Adjacent Street Traffic,
One Hour Between 4 and 6 p.m.
Setting/Location: **General Urban/Suburban**
Number of Studies: 10
Avg. Num. of Service Bays: 8
Directional Distribution: 42% entering, 58% exiting

Vehicle Trip Generation per Service Bay

Average Rate	Range of Rates	Standard Deviation
3.42	2.00 - 6.67	1.51

Data Plot and Equation



Tire Store
(848)

Vehicle Trip Ends vs: **Service Bays**
On a: **Saturday, Peak Hour of Generator**

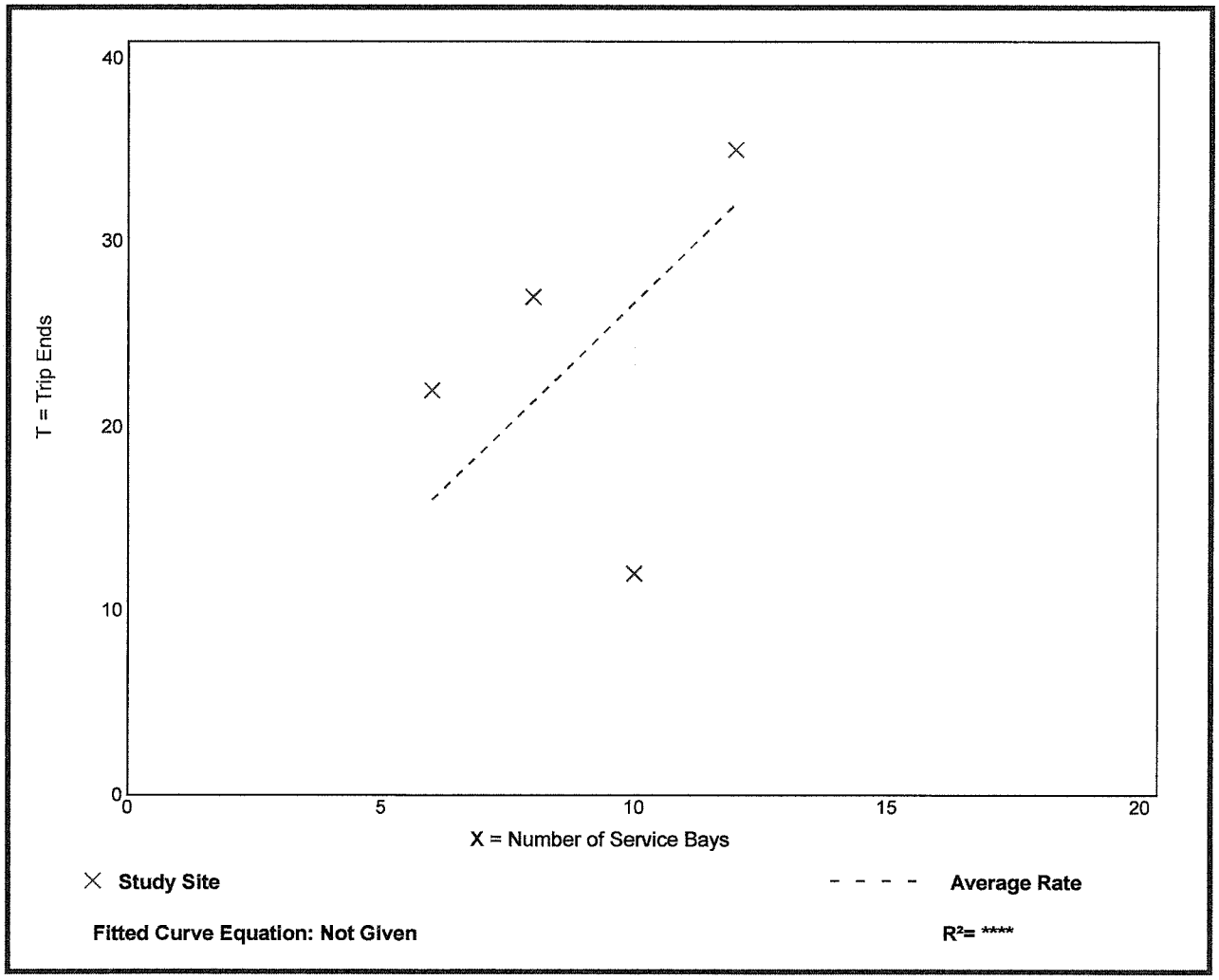
Setting/Location: **General Urban/Suburban**
Number of Studies: 4
Avg. Num. of Service Bays: 9
Directional Distribution: 45% entering, 55% exiting

Vehicle Trip Generation per Service Bay

Average Rate	Range of Rates	Standard Deviation
2.67	1.20 - 3.67	1.09

Data Plot and Equation

Caution – Small Sample Size



Fitted Curve Equation: Not Given

R^2= ****

Land Use: 933
Fast-Food Restaurant without Drive-Through Window

Description

This land use includes fast-food restaurants without drive-through windows. This type of restaurant is characterized by a large carry-out clientele, long hours of service (some are open for breakfast, all are open for lunch and dinner, some are open late at night or 24 hours a day) and high turnover rates for eat-in customers. These limited-service eating establishments do not provide table service. Patrons generally order at a cash register and pay before they eat. Fast casual restaurant (Land Use 930), high-turnover (sit-down) restaurant (Land Use 932), fast-food restaurant with drive-through window (Land Use 934), and fast-food restaurant with drive-through window and no indoor seating (Land Use 935) are related uses.

Additional Data

The outdoor seating area is not included in the overall gross floor area. Therefore, the number of seats may be a more reliable independent variable on which to establish trip generation rates for facilities having significant outdoor seating.

Time-of-day distribution data for this land use are presented in Appendix A. For the four general urban/suburban sites with data, the overall highest vehicle volumes during the AM and PM on a weekday were counted between 11:45 a.m. and 12:45 p.m. and 12:15 and 1:15 p.m., respectively.

The sites were surveyed in the 1980s and the 2010s in Alberta (CAN), California, Colorado, Connecticut, Maryland, Montana, and Texas.

Specialized Land Use Data

One study provided data for a yogurt shop without a drive-through (source 414). The trip generating characteristics of this site differed from the sites included in this land use; therefore, trip generation information for this site is presented here and was excluded from the data plots. The site had a gross floor area of 860 square feet. It generated 13 vehicle trips during the weekday PM peak hour of adjacent street traffic and 16 vehicle trips during the weekday PM peak hour of the generator.

Source Numbers

163, 247, 278, 319, 342, 414, 885, 977

Fast-Food Restaurant without Drive-Through Window
(933)

Vehicle Trip Ends vs: **1000 Sq. Ft. GFA**
On a: **Weekday**

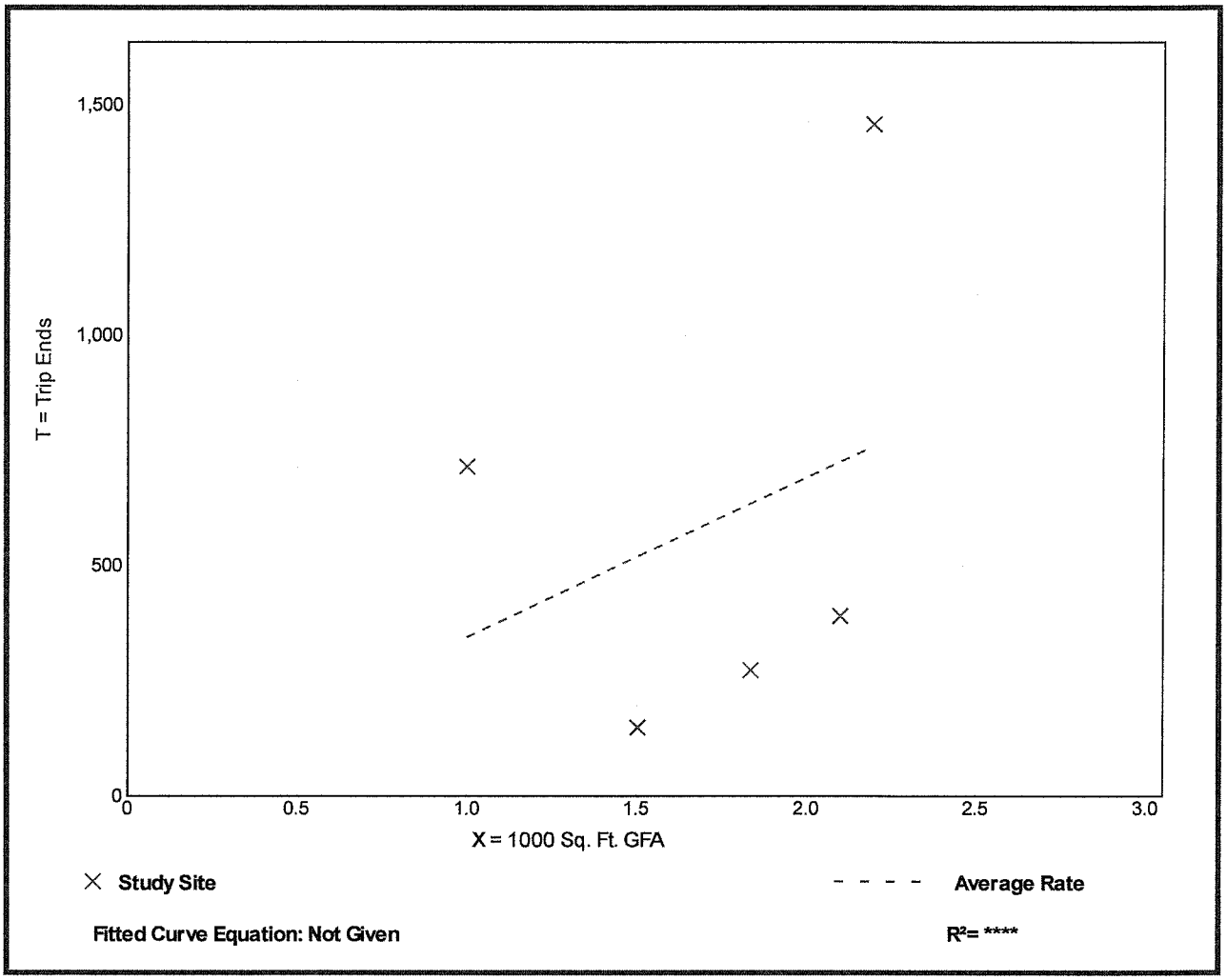
Setting/Location: **General Urban/Suburban**
Number of Studies: 5
1000 Sq. Ft. GFA: 2
Directional Distribution: 50% entering, 50% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
346.23	99.73 - 716.00	288.36

Data Plot and Equation

Caution – Small Sample Size



Fitted Curve Equation: Not Given

R^2= ****

Fast-Food Restaurant without Drive-Through Window
(933)

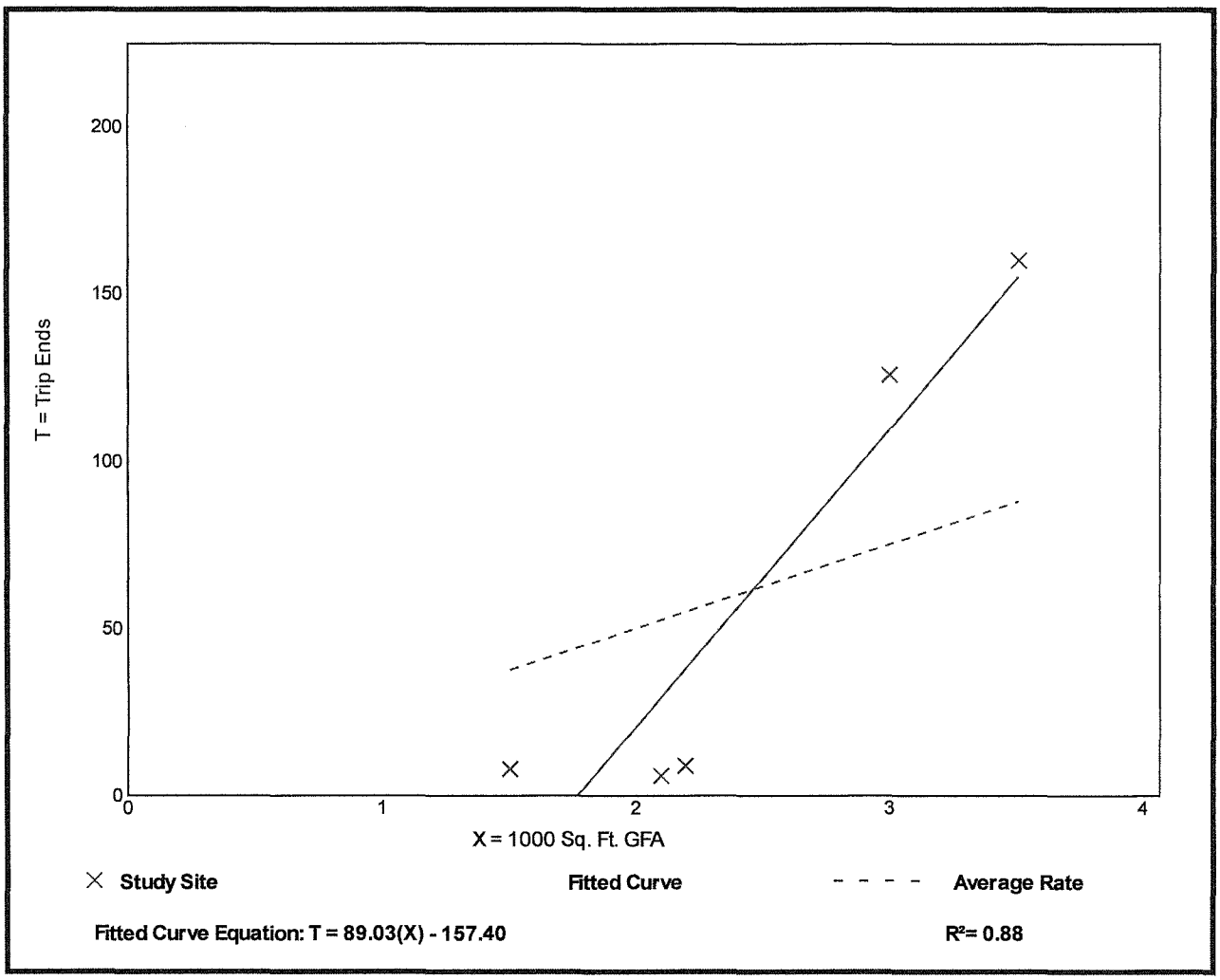
Vehicle Trip Ends vs: **1000 Sq. Ft. GFA**
On a: **Weekday,**
Peak Hour of Adjacent Street Traffic,
One Hour Between 7 and 9 a.m.
Setting/Location: **General Urban/Suburban**
Number of Studies: 5
1000 Sq. Ft. GFA: 2
Directional Distribution: 60% entering, 40% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
25.10	2.86 - 45.58	22.36

Data Plot and Equation

Caution – Small Sample Size



Fitted Curve Equation: T = 89.03(X) - 157.40

R^2= 0.88

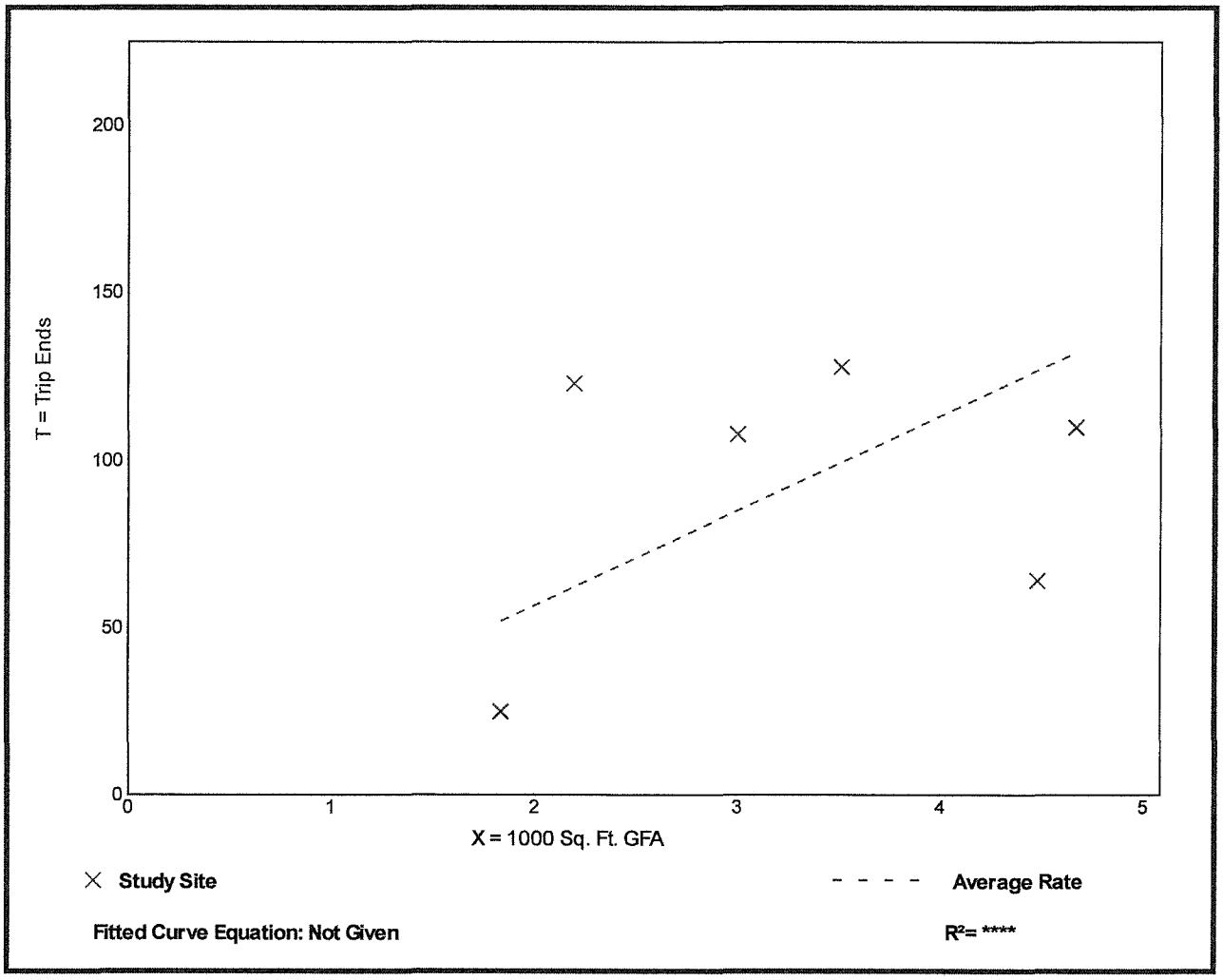
Fast-Food Restaurant without Drive-Through Window
(933)

Vehicle Trip Ends vs: **1000 Sq. Ft. GFA**
On a: **Weekday,**
Peak Hour of Adjacent Street Traffic,
One Hour Between 4 and 6 p.m.
Setting/Location: **General Urban/Suburban**
Number of Studies: 6
1000 Sq. Ft. GFA: 3
Directional Distribution: 50% entering, 50% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
28.34	13.62 - 56.01	14.56

Data Plot and Equation



Fitted Curve Equation: Not Given

R^2= ****

Fast-Food Restaurant without Drive-Through Window
(933)

Vehicle Trip Ends vs: **1000 Sq. Ft. GFA**
On a: **Saturday, Peak Hour of Generator**

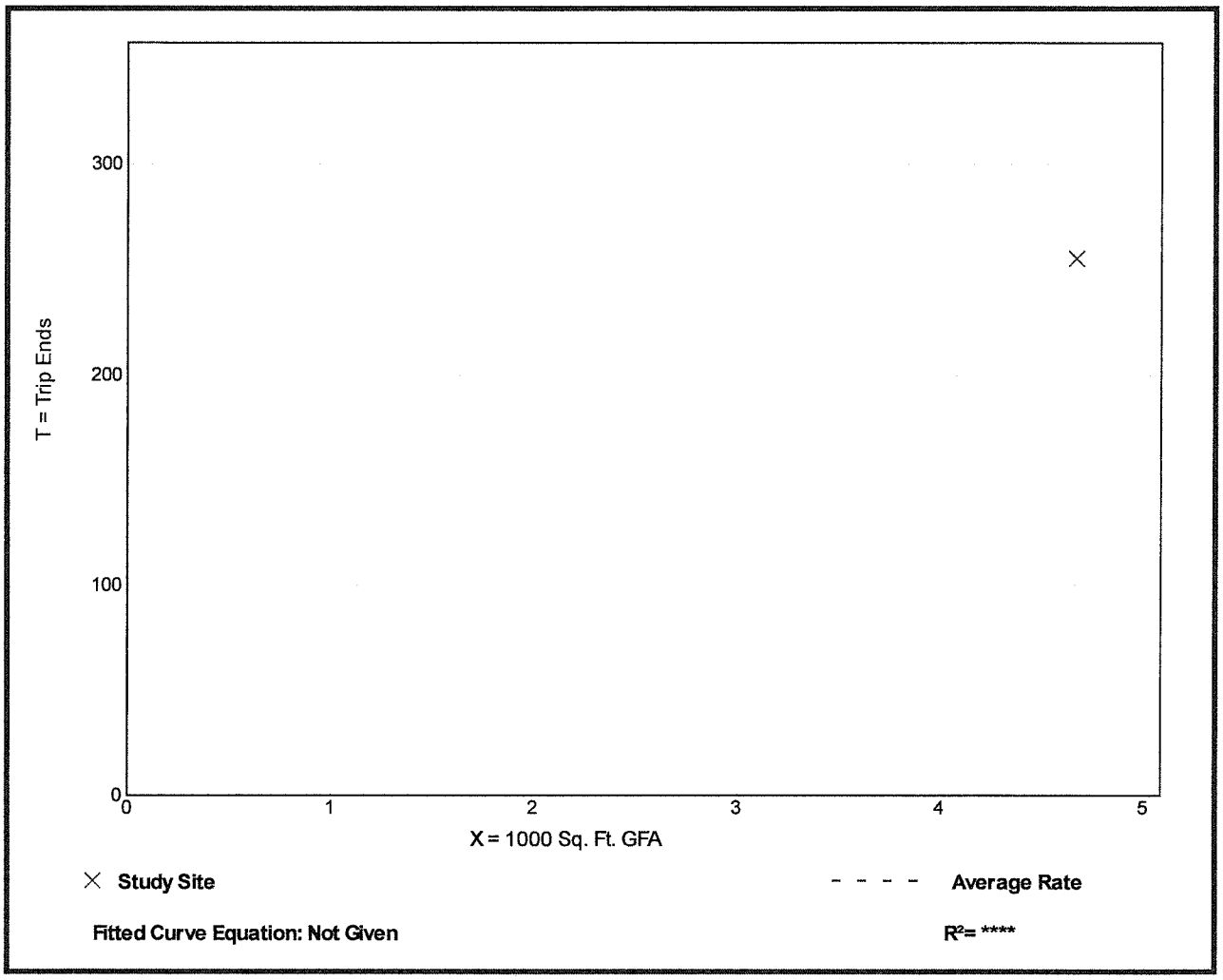
Setting/Location: **General Urban/Suburban**
Number of Studies: 1
1000 Sq. Ft. GFA: 5
Directional Distribution: 49% entering, 51% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
54.60	54.60 - 54.60	*

Data Plot and Equation

Caution – Small Sample Size



Fitted Curve Equation: Not Given

R^2= ****

Land Use: 934
Fast-Food Restaurant with Drive-Through Window

Description

This category includes fast-food restaurants with drive-through windows. This type of restaurant is characterized by a large drive-through clientele, long hours of service (some are open for breakfast, all are open for lunch and dinner, some are open late at night or 24 hours a day) and high turnover rates for eat-in customers. These limited-service eating establishments do not provide table service. Non-drive-through patrons generally order at a cash register and pay before they eat. Fast casual restaurant (Land Use 930), high-turnover (sit-down) restaurant (Land Use 932), fast-food restaurant without drive-through window (Land Use 933), and fast-food restaurant with drive-through window and no indoor seating (Land Use 935) are related uses.

Additional Data

Users should exercise caution when applying statistics during the AM peak periods, as the sites contained in the database for this land use may or may not be open for breakfast. In cases where it was confirmed that the sites were not open for breakfast, data for the AM peak hour of the adjacent street traffic were removed from the database.

The outdoor seating area is not included in the overall gross floor area. Therefore, the number of seats may be a more reliable independent variable on which to establish trip generation rates for facilities having significant outdoor seating.

Time-of-day distribution data for this land use for a weekday, Saturday, and Sunday are presented in Appendix A. For the 46 general urban/suburban sites with data, the overall highest vehicle volumes during the AM and PM on a weekday were counted between 11:45 a.m. and 12:45 p.m. and 12:00 and 1:00 p.m., respectively. For the one dense multi-use urban site with data, the same AM and PM peak hours were observed.

The sites were surveyed in the 1980s, the 1990s, the 2000s, and the 2010s in Alaska, Alberta (CAN), California, Colorado, Florida, Indiana, Kentucky, Maryland, Massachusetts, Minnesota, Montana, New Hampshire, New Jersey, New York, North Carolina, Ohio, Pennsylvania, South Dakota, Texas, Vermont, Virginia, Washington, and Wisconsin.

Source Numbers

163, 164, 168, 180, 181, 241, 245, 278, 294, 300, 301, 319, 338, 340, 342, 358, 389, 438, 502, 552, 577, 583, 584, 617, 640, 641, 704, 715, 728, 810, 866, 867, 869, 885, 886, 927, 935, 962, 977

Fast-Food Restaurant with Drive-Through Window
(934)

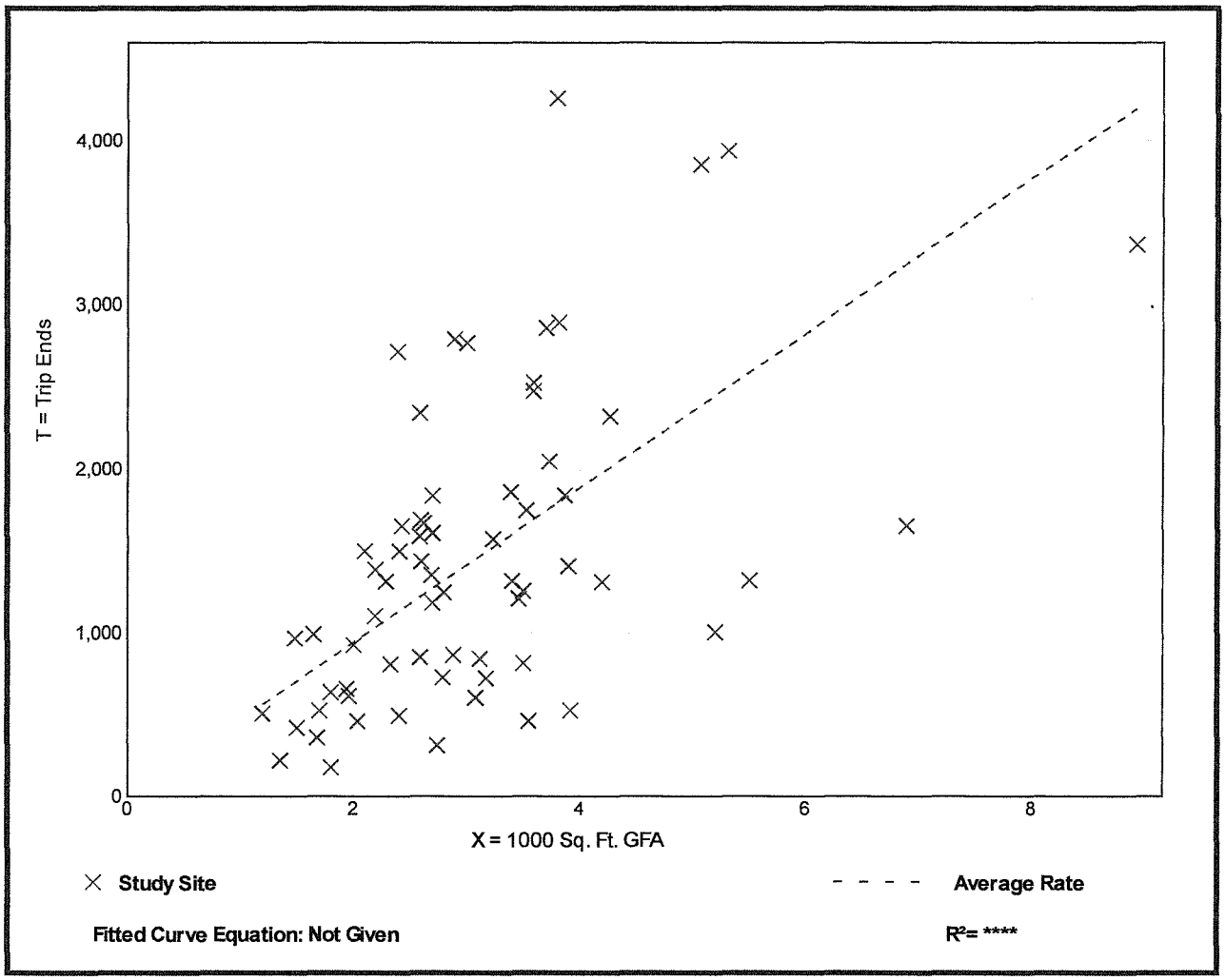
Vehicle Trip Ends vs: **1000 Sq. Ft. GFA**
On a: **Weekday**

Setting/Location: **General Urban/Suburban**
Number of Studies: 67
1000 Sq. Ft. GFA: 3
Directional Distribution: 50% entering, 50% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
470.95	98.89 - 1137.66	244.44

Data Plot and Equation



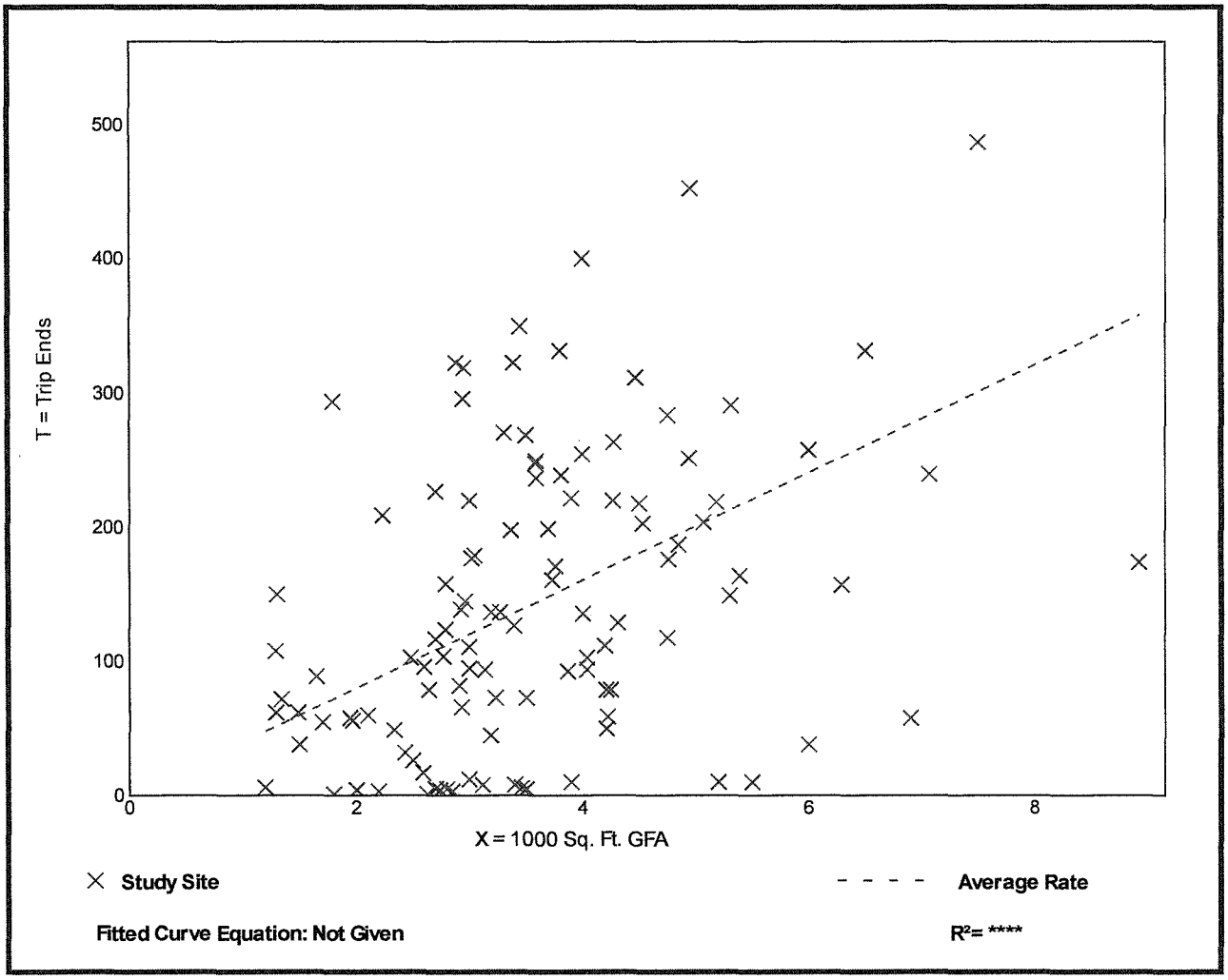
Fast-Food Restaurant with Drive-Through Window
(934)

Vehicle Trip Ends vs: **1000 Sq. Ft. GFA**
On a: **Weekday,**
Peak Hour of Adjacent Street Traffic,
One Hour Between 7 and 9 a.m.
Setting/Location: **General Urban/Suburban**
Number of Studies: 111
1000 Sq. Ft. GFA: 4
Directional Distribution: 51% entering, 49% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
40.19	0.38 - 164.25	28.78

Data Plot and Equation



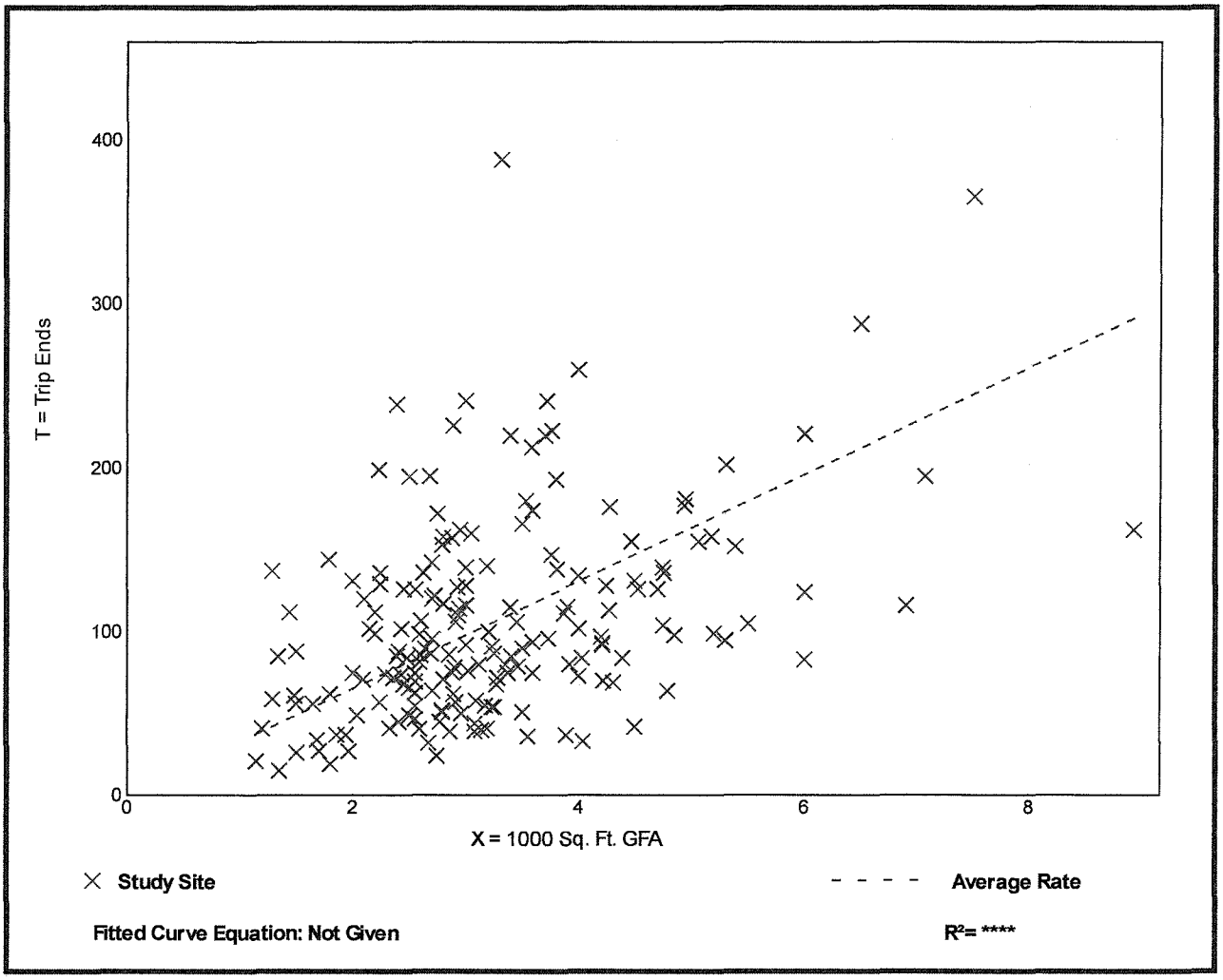
Fast-Food Restaurant with Drive-Through Window
(934)

Vehicle Trip Ends vs: **1000 Sq. Ft. GFA**
On a: **Weekday,**
Peak Hour of Adjacent Street Traffic,
One Hour Between 4 and 6 p.m.
Setting/Location: **General Urban/Suburban**
Number of Studies: 185
1000 Sq. Ft. GFA: 3
Directional Distribution: 52% entering, 48% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
32.67	8.17 - 117.22	17.87

Data Plot and Equation



Fast-Food Restaurant with Drive-Through Window
(934)

Vehicle Trip Ends vs: **1000 Sq. Ft. GFA**
On a: **Saturday, Peak Hour of Generator**

Setting/Location: **General Urban/Suburban**
Number of Studies: 54
1000 Sq. Ft. GFA: 4
Directional Distribution: 51% entering, 49% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
54.86	11.25 - 122.92	24.51

Data Plot and Equation

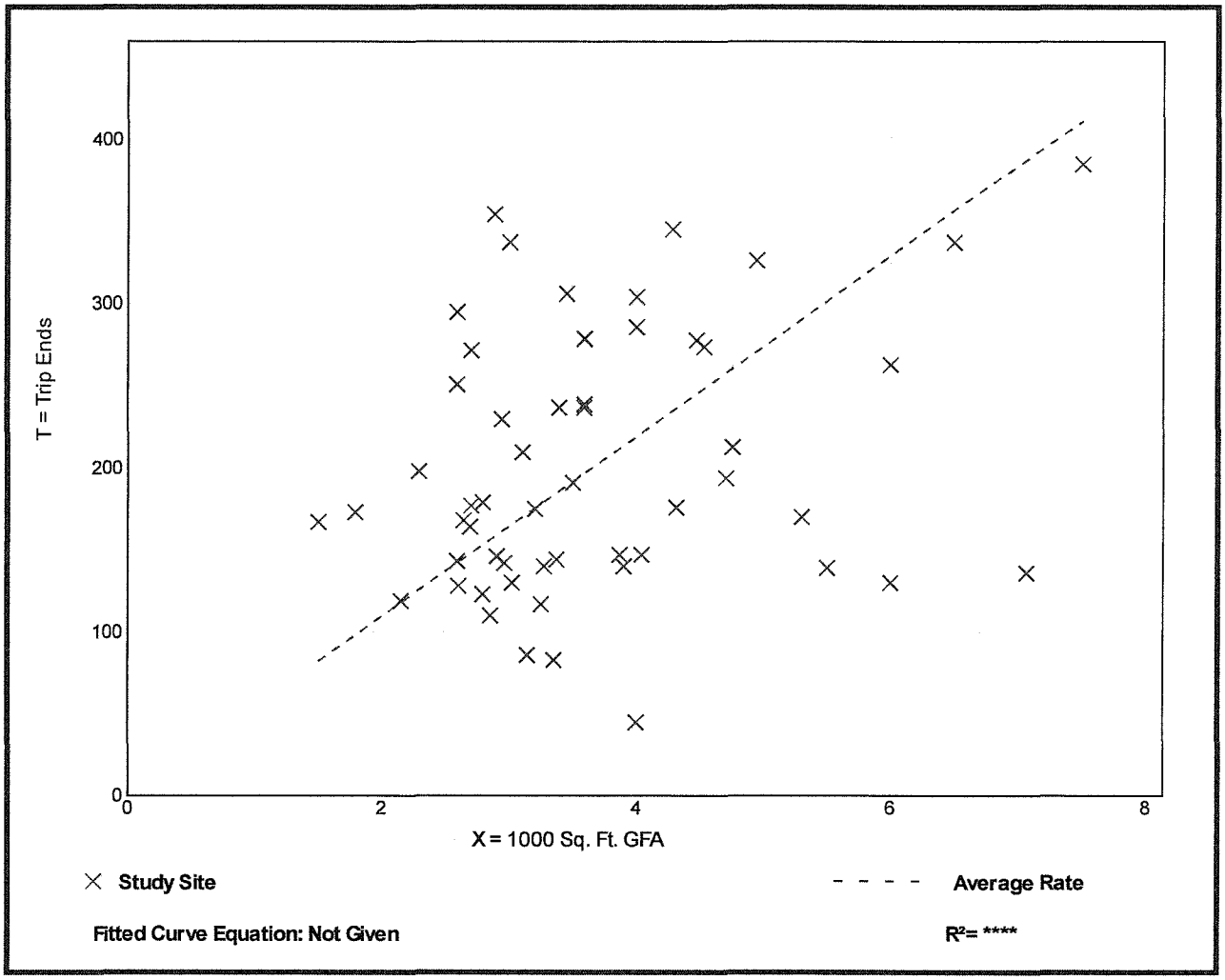


Table E.31 Pass-By and Non-Pass-By Trips Weekday, AM Peak Period
Land Use Code 934—Fast-Food Restaurant with Drive-Through Window

SEATS	SIZE (1,000 SQ. FT. GFA)	LOCATION	WEEKDAY SURVEY DATE	NO. OF INTERVIEWS	TIME PERIOD	PASS-BY TRIP (%)	NON-PASS-BY TRIPS (%)			ADJ. STREET PEAK HOUR VOLUME	SOURCE
							PRIMARY	DIVERTED	TOTAL		
—	<5	Chicago suburbs, IL	1987	84	7:00–9:00 a.m.	44	—	—	56	—	Kenig, O'Hara, Humes, Flock
88	1.4	Louisville area, KY	1993	—	7:00–9:00 a.m.	62	22	16	38	1,407	Barton-Aschman Assoc.
100	3.6	Louisville, KY	1993	—	7:00–9:00 a.m.	32	47	21	68	437	Barton-Aschman Assoc.
87	4.2	New Albany, IN	1993	—	7:00–9:00 a.m.	46	23	31	54	1,049	Barton-Aschman Assoc.
150	3.0	Louisville area, KY	1993	—	7:00–9:00 a.m.	43	14	43	57	2,903	Barton-Aschman Assoc.
—	3.3	varies	1996	—	6:00–9:00 a.m.	68	—	—	32	—	Oracle Engineering

Average Pass-By Trip Percentage: 49

"—" means no data were provided

Table E.32 Pass-By and Non-Pass-By Trips Weekday, PM Peak Period
Land Use Code 934—Fast-Food Restaurant with Drive-Through Window

SEATS	SIZE (1,000 SQ. FT. GFA)	LOCATION	WEEKDAY SURVEY DATE	NO. OF INTERVIEWS	TIME PERIOD	PASS-BY TRIP (%)	NON-PASS-BY TRIPS (%)			ADJ. STREET PEAK HOUR VOLUME	SOURCE
							PRIMARY	DIVERTED	TOTAL		
—	~2.6	Minn-St. Paul, MN	1987	50	3:00–7:00 p.m.	25	27	48	75	—	—
—	<5.0	Chicago suburbs, IL	1987	80	3:00–6:00 p.m.	38	—	—	62	—	Kenig, O'Hara, Humes, Flock
—	<5.0	Chicago suburbs, IL	1987	100	3:00–6:00 p.m.	55	—	—	45	—	Kenig, O'Hara, Humes, Flock
—	<5.0	Chicago suburbs, IL	1987	159	3:00–6:00 p.m.	56	—	—	44	—	Kenig, O'Hara, Humes, Flock
—	<5.0	Chicago suburbs, IL	1987	225	3:00–6:00 p.m.	48	—	—	52	—	Kenig, O'Hara, Humes, Flock
—	<5.0	Chicago suburbs, IL	1987	88	3:00–6:00 p.m.	35	—	—	65	—	Kenig, O'Hara, Humes, Flock
—	<5.0	Chicago suburbs, IL	1987	84	3:00–6:00 p.m.	44	—	—	56	—	Kenig, O'Hara, Humes, Flock
88	1.3	Louisville area, KY	1993	—	4:00–6:00 p.m.	68	22	10	32	2,055	Barton-Aschman Assoc.
120	1.9	Louisville area, KY	1993	33	4:00–6:00 p.m.	67	24	9	33	2,447	Barton-Aschman Assoc.
87	4.2	New Albany, IN	1993	—	4:00–6:00 p.m.	56	25	19	44	1,632	Barton-Aschman Assoc.
150	3.0	Louisville area, KY	1993	—	4:00–6:00 p.m.	31	31	38	69	4,250	Barton-Aschman Assoc.
—	3.1	Kissimmee, FL	1995	28	2:00–6:00 p.m.	71	—	—	29	—	TPD Inc.
—	3.1	Apopka, FL	1996	29	2:00–6:00 p.m.	38	—	—	62	—	TPD Inc.
—	2.8	Winter Springs, FL	1995	47	2:00–6:00 p.m.	66	—	—	34	—	TPD Inc.
—	4.3	Longwood, FL	1994	304	2:00–6:00 p.m.	62	—	—	38	—	TPD Inc.
—	3.2	Altamonte Springs, FL	1996	202	2:00–6:00 p.m.	40	39	21	60	—	TPD Inc.
—	2.9	Winter Park, FL	1996	271	2:00–6:00 p.m.	41	41	18	59	—	TPD Inc.
—	3.3*	several	1996	varies	4:00–6:00 p.m.	62	—	—	38	—	Oracle Engineering

*Average of several combined studies.

Average Pass-By Trip Percentage: 50

"—" means no data were provided

Land Use: 945
Gasoline/Service Station with Convenience Market

Description

This land use includes gasoline/service stations with convenience markets where the primary business is the fueling of motor vehicles. These service stations may also have ancillary facilities for servicing and repairing motor vehicles and may have a car wash. Some commonly sold convenience items are newspapers, coffee or other beverages, and snack items that are usually consumed in the car. The sites included in this land use category have the following two specific characteristics:

- The gross floor area of the convenience market is between 2,000 and 3,000 gross square feet
- The number of vehicle fueling positions is at least 10

Convenience market (Land Use 851), convenience market with gasoline pumps (Land Use 853), gasoline/service station (Land Use 944), truck stop (Land Use 950), and super convenience market/gas station (Land Use 960) are related uses.

Additional Data

The independent variable, vehicle fueling positions, is defined as the maximum number of vehicles that can be fueled simultaneously.

Gasoline/service stations in this land use include "pay-at-the-pump" and traditional fueling stations.

Time-of-day distribution data for this land use are presented in Appendix A. For the five general urban/suburban sites with data, the overall highest vehicle volumes during the AM and PM on a weekday were counted between 7:30 and 8:30 a.m. and 3:45 and 4:45 p.m., respectively.

A multi-variable regression analysis based on both the convenience market gross floor area (GFA) and the number of vehicle fueling positions (VFP) produced a series of fitted curve equations. The equations are in the form of:

Vehicle Trips = [(VFP Factor) x (Number of VFP)] + [(GFA Factor) x (GFA)] + (Constant)

The values for the VFP factor, GFA factor, and constant are presented in the following table for each time period for which a fitted curve equation could produce an R^2 value of at least 0.50.

Time Period	VFP Factor	GFA Factor	Constant	R^2
Weekday, AM Peak Hour of Generator	15.6	108	-295	0.62
Weekday, PM Peak Hour of Generator	Not Available			
Weekday, AM Peak Hour of Adjacent Street	15.7	97.3	-284	0.59
Weekday, PM Peak Hour of Adjacent Street	Not Available			

The sites were surveyed in the 1980s, the 1990s, the 2000s, and the 2010s in Alberta (CA), California, Connecticut, Florida, Indiana, Iowa, Kentucky, Minnesota, New Hampshire, New Jersey, Texas, and Wisconsin.

Source Numbers

245, 340, 350, 385, 440, 617, 813, 864, 865, 883, 888, 954, 960, 977

Gasoline/Service Station With Convenience Market
(945)

Vehicle Trip Ends vs: **Vehicle Fueling Positions**
On a: **Weekday**

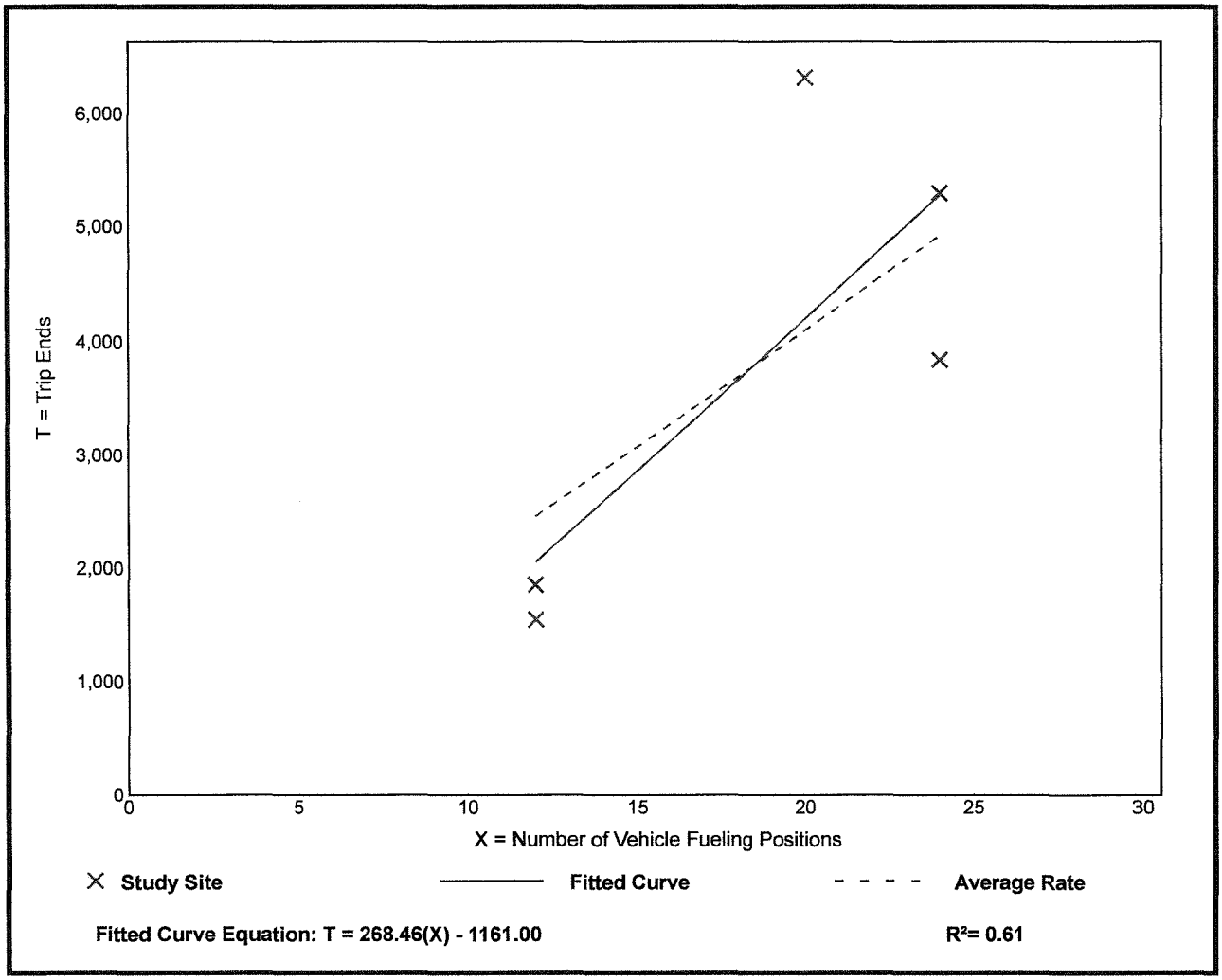
Setting/Location: **General Urban/Suburban**
Number of Studies: 5
Avg. Num. of Vehicle Fueling Positions: 18
Directional Distribution: 50% entering, 50% exiting

Vehicle Trip Generation per Vehicle Fueling Position

Average Rate	Range of Rates	Standard Deviation
205.36	129.50 - 316.45	73.80

Data Plot and Equation

Caution – Small Sample Size



Fitted Curve Equation: T = 268.46(X) - 1161.00

R^2= 0.61

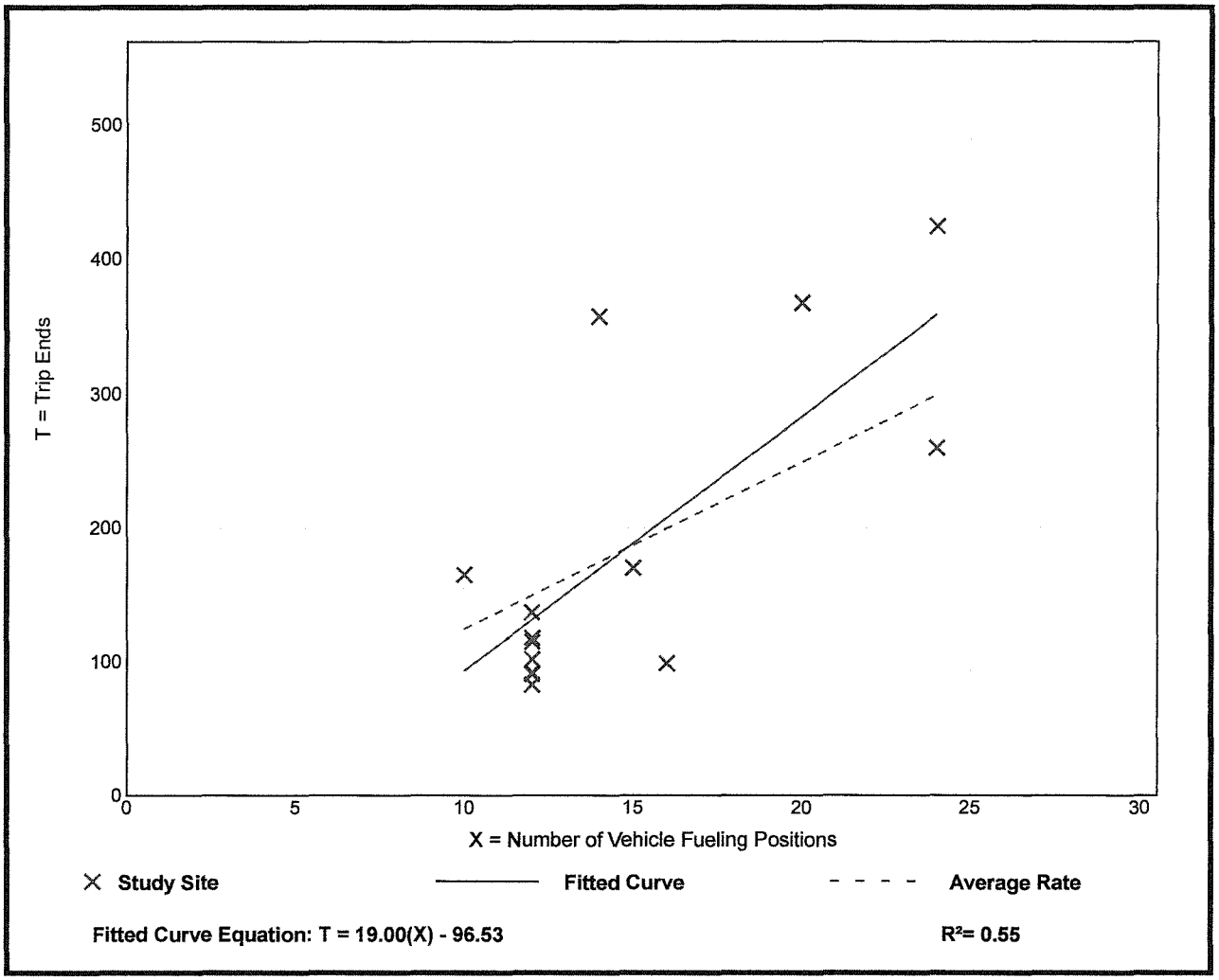
Gasoline/Service Station With Convenience Market
(945)

Vehicle Trip Ends vs: **Vehicle Fueling Positions**
On a: **Weekday,**
Peak Hour of Adjacent Street Traffic,
One Hour Between 7 and 9 a.m.
Setting/Location: **General Urban/Suburban**
Number of Studies: 14
Avg. Num. of Vehicle Fueling Positions: 15
Directional Distribution: 51% entering, 49% exiting

Vehicle Trip Generation per Vehicle Fueling Position

Average Rate	Range of Rates	Standard Deviation
12.47	6.19 - 25.57	5.56

Data Plot and Equation



Fitted Curve Equation: T = 19.00(X) - 96.53

R^2= 0.55

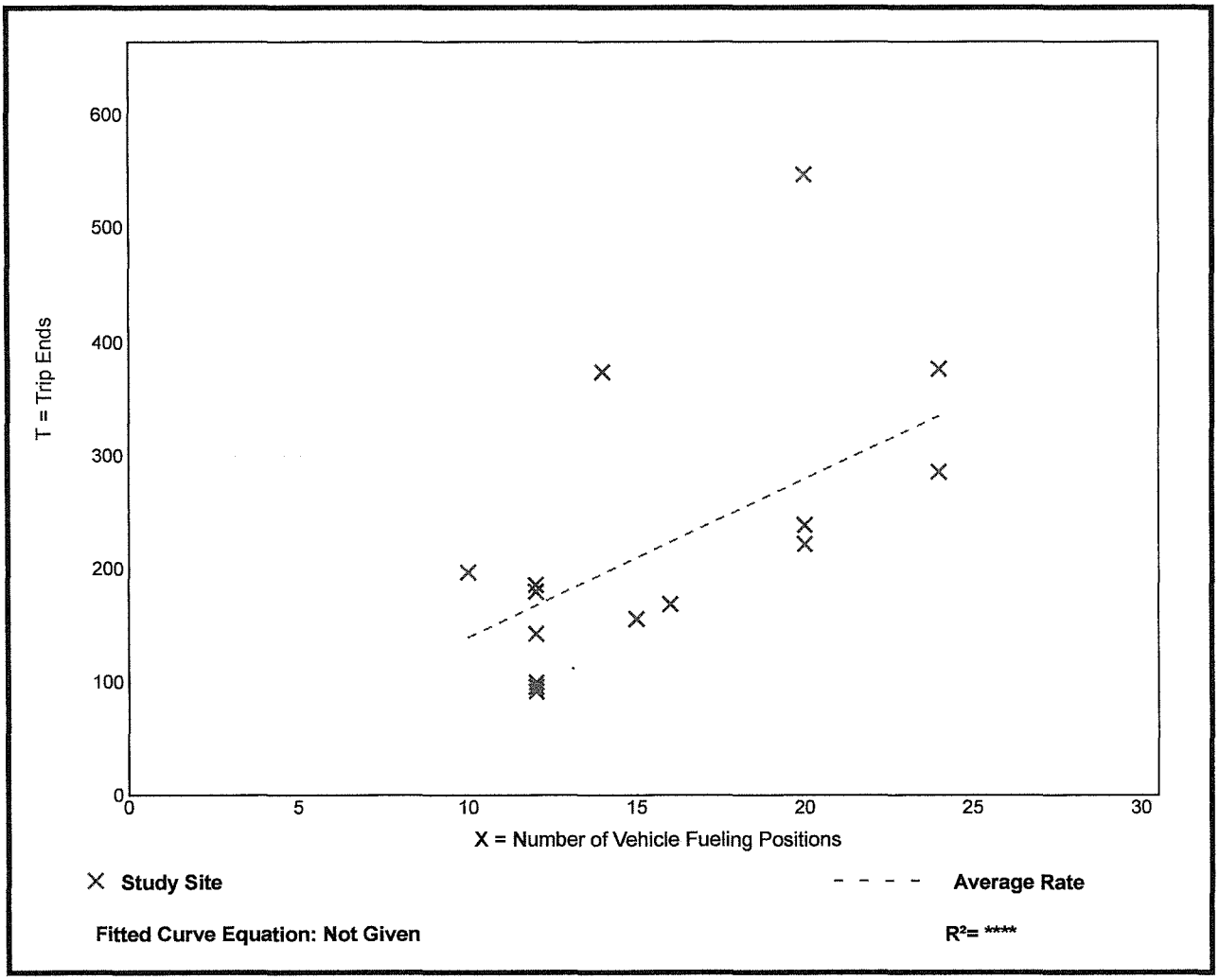
Gasoline/Service Station With Convenience Market
(945)

Vehicle Trip Ends vs: **Vehicle Fueling Positions**
On a: **Weekday,**
Peak Hour of Adjacent Street Traffic,
One Hour Between 4 and 6 p.m.
Setting/Location: **General Urban/Suburban**
Number of Studies: 16
Avg. Num. of Vehicle Fueling Positions: 15
Directional Distribution: 51% entering, 49% exiting

Vehicle Trip Generation per Vehicle Fueling Position

Average Rate	Range of Rates	Standard Deviation
13.99	7.67 - 27.35	6.18

Data Plot and Equation



Gasoline/Service Station With Convenience Market
(945)

Vehicle Trip Ends vs: **Vehicle Fueling Positions**
On a: **Saturday, Peak Hour of Generator**

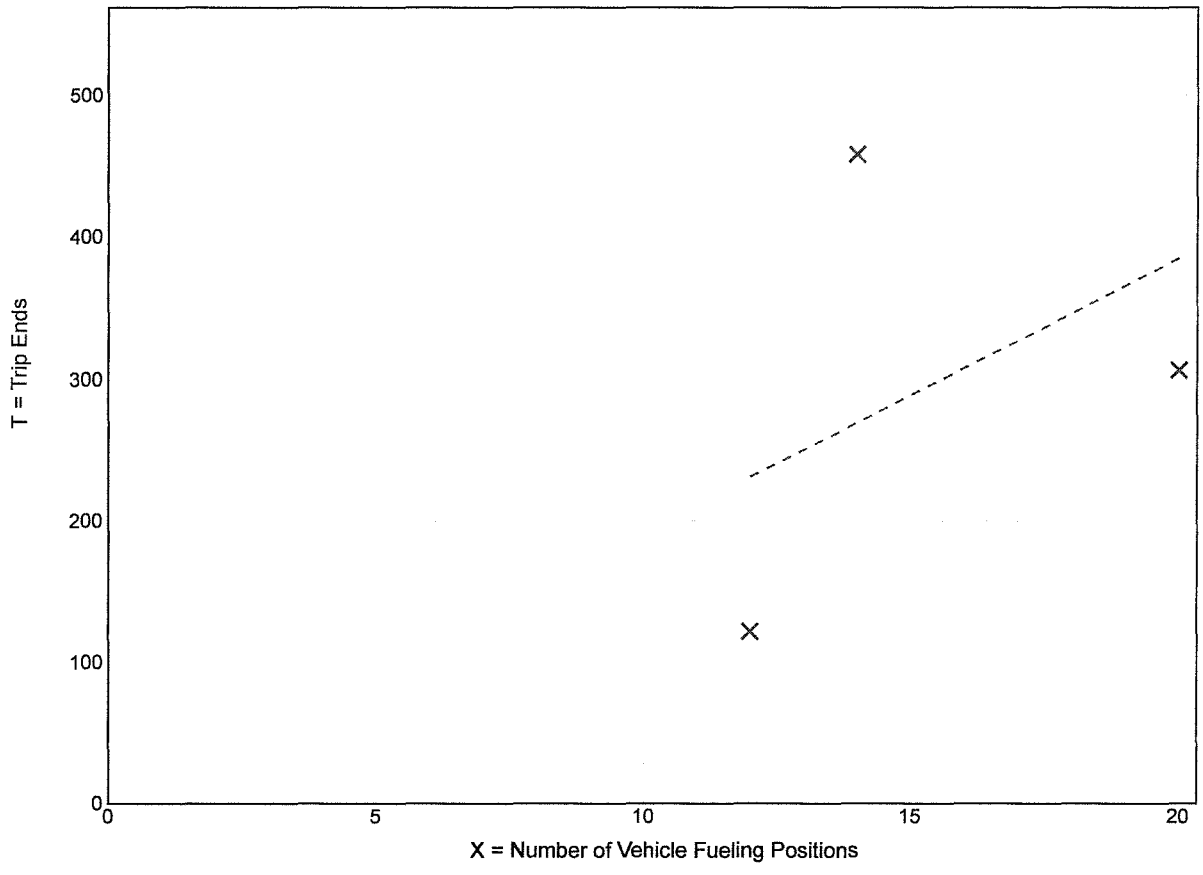
Setting/Location: **General Urban/Suburban**
Number of Studies: 3
Avg. Num. of Vehicle Fueling Positions: 15
Directional Distribution: 50% entering, 50% exiting

Vehicle Trip Generation per Vehicle Fueling Position

Average Rate	Range of Rates	Standard Deviation
19.28	10.17 - 32.71	11.18

Data Plot and Equation

Caution – Small Sample Size



Fitted Curve Equation: Not Given

R^2= ****

Table E.36 Pass-By and Non-Pass-By Trips Weekday, PM Peak Period Land Use Code 944—Gasoline/Service Station

SIZE (1,000 SQ. FT. GFA)	VEHICLE FUELING POSITIONS	LOCATION	WEEKDAY SURVEY DATE	NO. OF INTERVIEWS	TIME PERIOD	PASS-BY TRIP (%)	NON-PASS-BY TRIPS (%)			ADJ. STREET PEAK HOUR VOLUME	SOURCE
							PRIMARY	DIVERTED	TOTAL		
—	—	Chicago suburbs, IL	1987	48	3:00–7:00 p.m.	21	—	—	79	—	Kenig, O'Hara, Humes, Flock
—	—	Chicago suburbs, IL	1987	34	3:00–6:00 p.m.	25	—	—	75	—	Kenig, O'Hara, Humes, Flock
—	—	Chicago suburbs, IL	1987	42	3:00–6:00 p.m.	20	—	—	80	—	Kenig, O'Hara, Humes, Flock
2.3	6	Gaithersburg, MD	1992	55	4:00–6:00 p.m.	40	11	49	60	2,760	RBA
2.1	6	Bethesda, MD	1992	30	4:00–6:00 p.m.	53	20	27	47	1,060	RBA
1.7	6	Wheaton, MD	1992	18	4:00–6:00 p.m.	61	6	33	39	2,510	RBA
2.0	8	Gaithersburg, MD	1992	47	4:00–6:00 p.m.	62	23	15	38	2,635	RBA
1.2	6	Damascus, MD	1992	26	4:00–6:00 p.m.	58	11	31	42	1,020	RBA
0.3	12	Wheaton, MD	1992	52	4:00–6:00 p.m.	38	10	52	62	3,835	RBA

Average Pass-By Trip Percentage: 42
"—" means no data were provided

Table E.37 Pass-By and Non-Pass-By Trips Weekday, AM Peak Period Land Use Code 945—Gasoline/Service Station with Convenience Market

SIZE (1,000 SQ. FT. GFA)	VEHICLE FUELING POSITIONS	LOCATION	WEEKDAY SURVEY DATE	NO. OF INTERVIEWS	TIME PERIOD	PASS-BY TRIP (%)	NON-PASS-BY TRIPS (%)			ADJ. STREET PEAK HOUR VOLUME	SOURCE
							PRIMARY	DIVERTED	TOTAL		
0.8	8	Louisville area, KY	1993	61	7:00–9:00 a.m.	60	15	25	40	4,000	Barton-Aschman Assoc.
0.6	8	Louisville, KY	1993	48	7:00–9:00 a.m.	68	13	19	32	1,307	Barton-Aschman Assoc.
0.7	10	Louisville, KY	1993	47	7:00–9:00 a.m.	67	11	22	33	1,105	Barton-Aschman Assoc.
0.7	8	Louisville area, KY	1993	—	7:00–9:00 a.m.	56	22	22	44	1,211	Barton-Aschman Assoc.
0.7	10	Louisville area, KY	1993	—	7:00–9:00 a.m.	46	42	12	54	1,211	Barton-Aschman Assoc.
0.3	—	Louisville area, KY	1993	75	7:00–9:00 a.m.	72	15	13	28	—	Barton-Aschman Assoc.
0.8	8	Silver Spring, MD	1992	36	7:00–9:00 a.m.	47	14	39	53	3,095	RBA
0.4	8	Derwood, MD	1992	46	7:00–9:00 a.m.	75	0	25	25	3,770	RBA
2.2	8	Kensington, MD	1992	31	7:00–9:00 a.m.	47	34	19	53	1,785	RBA
1	8	Silver Spring, MD	1992	35	7:00–9:00 a.m.	78	9	13	22	7,080	RBA

Average Pass-By Trip Percentage: 62
"—" means no data were provided

Table E.38 Pass-By and Non-Pass-By Trips Weekday, PM Peak Period Land Use Code 945—Gasoline/Service Station with Convenience Market

SIZE (1,000 SQ. FT. GFA)	VEHICLE FUELING POSITIONS	LOCATION	WEEKDAY SURVEY DATE	NO. OF INTERVIEWS	TIME PERIOD	PASS-BY TRIP (%)	NON-PASS-BY TRIPS (%)			ADJ. STREET PEAK HOUR VOLUME	SOURCE
							PRIMARY	DIVERTED	TOTAL		
0.8	8	Louisville area, KY	1993	83	4:00–6:00 p.m.	52	8	40	48	4,965	Barton-Aschman Assoc.
0.6	8	Louisville, KY	1993	60	4:00–6:00 p.m.	53	20	27	47	1,491	Barton-Aschman Assoc.
0.7	10	Louisville, KY	1993	—	4:00–6:00 p.m.	57	19	24	43	1,812	Barton-Aschman Assoc.
0.7	8	Louisville area, KY	1993	—	4:00–6:00 p.m.	72	7	21	28	2,657	Barton-Aschman Assoc.
0.7	10	Louisville area, KY	1993	—	4:00–6:00 p.m.	55	16	29	45	2,657	Barton-Aschman Assoc.
0.8	8	Silver Spring, MD	1992	36	4:00–6:00 p.m.	67	14	19	33	3,095	RBA
0.4	8	Derwood, MD	1992	46	4:00–6:00 p.m.	46	11	43	54	3,770	RBA
2.1	8	Kensington, MD	1992	31	4:00–6:00 p.m.	52	13	35	48	1,785	RBA
1	8	Silver Spring, MD	1992	35	4:00–6:00 p.m.	54	3	43	46	7,080	RBA

Average Pass-By Trip Percentage: 56

"—" means no data were provided

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March 26, 2021

Traffic Impact Study – Proposed Love's Travel Stop

New Braunfels, Texas

CESO Trip Generation Calculations – 2022 Build Traffic Scenario:

ITE 848 – Tire Store

For Weekday → 50% Enter/50% Exit

Data N/A.

For AM Peak Hour → 64% Enter/36% Exit

2.10 x 4 Service Bays = 8.4 ≈ 8 Trips for Even Number

Primary Trips = 8 x 0.64 (64%) and 8 x 0.36 (36%) = 5 Trips Enter/3 Trips Exit

For PM Peak Hour → 42% Enter/58% Exit

3.42 x 4 Service Bays = 13.68 ≈ 14 Trips

Primary Trips = 14 x 0.42 (42%) and 14 x 0.58 (58%) = 6 Trips Enter/8 Trips Exit

For Saturday Peak Hour → 45% Enter/55% Exit

2.67 x 4 Service Bays = 10.68 ≈ 11 Trips

Primary Trips = 11 x 0.45 (45%) and 11 x 0.55 (55%) = 5 Trips Enter/6 Trips Exit

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CESO Trip Generation Calculations – 2022 Build Traffic Scenario:

ITE 933 – Fast-Food Restaurant without Drive-Through Window

For Weekday → 50% Enter/50% Exit

2.61 KSF x 346.23 = 903.66 ≈ 904 Trips for Even Number

904 Trips x 0.50 (50%) = 452 Trips Enter/452 Trips Exit

For AM Peak Hour → 60% Enter/40% Exit

2.61 KSF x 25.10 = 65.51 ≈ 66 Trips for Even Number

Pass-by Trips: 66 Trips x 0.0 (0%) = 0 Trips ≈ 0 Trips for Even Number

Primary Trips = 66 – 0 = 66 Trips

Primary Trips = 66 x 0.60 (60%) and 66 x 0.40 (40%) = 40 Trips Enter/26 Trips Exit

For PM Peak Hour → 50% Enter/50% Exit

2.61 KSF x 28.34 = 73.97 ≈ 74 Trips for Even Number

Pass-by Trips: 74 Trips x 0.0 (0%) = 0 Trips ≈ 0 Trips for Even Number

Primary Trips = 74 – 0 = 74 Trips

Primary Trips = 74 x 0.50 (50%) = 37 Trips Enter/37 Trips Exit

For Saturday Peak Hour → 49% Enter/51% Exit

2.61 KSF x 54.60 = 142.51 ≈ 144 Trips for Even Number

Pass-by Trips: 144 Trips x 0.0 (0%) = 0 Trips ≈ 0 Trips for Even Number

Primary Trips = 144 – 0 = 144 Trips

Primary Trips = 144 x 0.49 (49%) and 144 x 0.51 (51%) = 71 Trips Enter/73 Trips Exit

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CESO Trip Generation Calculations – 2022 Build Traffic Scenario:

ITE 934 – Fast-Food Restaurant with Drive-Through Window

For Weekday → 50% Enter/50% Exit

2.67 KSF x 470.95 =1,257.44 ≈ 1,258 Trips for Even Number

1,258 Trips x 0.50 (50%) = 629 Trips Enter/629 Trips Exit

For AM Peak Hour → 51% Enter/49% Exit

2.67 KSF x 40.19 = 107.30 ≈ 108 Trips for Even Number

Pass-by Trips: 108 Trips x 0.49 (49%) = 52.92 Trips ≈ 52 Trips for Even Number

Pass-by Trips: 52 x 0.50 (50%) = 26 Trips Enter/26 Trips Exit for Even Number

Primary Trips = 108 – 52 = 56 Trips

Primary Trips = 56 x 0.51 (51%) and 56 x 0.49 (49%) = 29 Trips Enter/27 Trips Exit

For PM Peak Hour → 52% Enter/48% Exit

2.67 KSF x 32.67 = 87.23 ≈ 88 Trips for Even Number

Pass-by Trips: 88 Trips x 0.50 (50%) = 44 Trips ≈ 44 Trips for Even Number

Pass-by Trips: 44 x 0.50 (50%) = 22 Trips Enter/22 Trips Exit for Even Number

Primary Trips = 88 – 44 = 44 Trips

Primary Trips = 44 x 0.52 (52%) and 44 x 0.48 (48%) = 23 Trips Enter/21 Trips Exit

For Saturday Peak Hour → 51% Enter/49% Exit

*NOTE: Pass-by data was unavailable for the Saturday Peak Hour. Therefore, the PM Peak Hour percentage was used.

2.67 KSF x 54.86 = 146.48 ≈ 148 Trips for Even Number

Pass-by Trips: 148 Trips x 0.50 (50%) = 74 Trips ≈ 74 Trips for Even Number

Pass-by Trips: 74 x 0.50 (50%) = 37 Trips Enter/37 Trips Exit for Even Number

Primary Trips = 148 – 74 = 74 Trips

Primary Trips = 74 x 0.51 (51%) and 74 x 0.49 (49%) = 38 Trips Enter/36 Trips Exit

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Traffic Impact Study – Proposed Love's Travel Stop

New Braunfels, Texas

CESO Trip Generation Calculations – 2022 Build Traffic Scenario:

ITE 945 – Gasoline/Service Station with Convenience Market

For Weekday → 50% Enter/50% Exit

20 Car Fuel Positions x 205.36 = 4,107.20 ≈ 4,108 Trips for Even Number

4,108 Trips x 0.50 (50%) = 2,054 Trips Enter/2,054 Trips Exit

For AM Peak Hour → 51% Enter/49% Exit

20 Car Fuel Positions x 12.47 = 249.40 ≈ 250 Trips

Pass-by Trips = 250 Trips x 0.62 (62%) = 156 Trips for Even Number

Pass-by Trips = 156 Trips x 0.50 (50%) = 78 Trips Enter/78 Trips Exit

Primary Trips = 250 – 156 = 94 Trips

Primary Trips = 94 x 0.51 (51%) and 94 x 0.49 (49%) = 48 Trips Enter/46 Trips Exit

For PM Peak Hour → 51% Enter/49% Exit

20 Car Fuel Positions x 13.99 = 279.80 ≈ 280 Trips

Pass-by Trips = 280 Trips x 0.56 (56%) = 156 Trips

Pass-by Trips = 156 Trips x 0.50 (50%) = 78 Trips Enter/78 Trips Exit

Primary Trips = 280 – 156 = 124 Trips

Primary Trips = 124 x 0.51 (51%) and 124 x 0.49 (49%) = 63 Trips Enter/61 Trips Exit

For Saturday Peak Hour → 50% Enter/50% Exit
*NOTE: Pass-by data was unavailable for the Saturday Peak Hour. Therefore, the PM Peak Hour percentage was used.

20 Car Fuel Positions x 19.28 = 385.60 ≈ 386 Trips

Pass-by Trips = 386 Trips x 0.56 (56%) = 216 Trips

Pass-by Trips = 216 Trips x 0.50 (50%) = 108 Trips Enter/108 Trips Exit

Primary Trips = 386 – 216 = 170 Trips

Primary Trips = 170 x 0.50 (50%) = 85 Trips Enter/85 Trips Exit

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Traffic Impact Study – Proposed Love's Travel Stop

New Braunfels, Texas

CESO Trip Generation Calculations – 2022 Build Traffic Scenario:

ITE 945 – Gasoline/Service Station with Convenience Market

For Weekday → 50% Enter/50% Exit

10 Truck Fuel Positions x 205.36 = 2053.60 ≈ 2,054 Trips for Even Number

2,054 Trips x 0.50 (50%) = 1,027 Trips Enter/1,027 Trips Exit

For AM Peak Hour → 51% Enter/49% Exit

10 Truck Fuel Positions x 12.47 = 124.70 ≈ 124 Trips

Pass-by Trips = 124 Trips x 0.62 (62%) = 76 Trips for Even Number

Pass-by Trips = 76 Trips x 0.50 (50%) = 38 Trips Enter/38 Trips Exit

Primary Trips = 124 – 76 = 48 Trips

Primary Trips = 48 x 0.51 (51%) and 48 x 0.49 (49%) = 24 Trips Enter/24 Trips Exit

For PM Peak Hour → 51% Enter/49% Exit

10 Truck Fuel Positions x 13.99 = 139.90 ≈ 140 Trips

Pass-by Trips = 140 Trips x 0.56 (56%) = 78 Trips

Pass-by Trips = 78 Trips x 0.50 (50%) = 39 Trips Enter/39 Trips Exit

Primary Trips = 140 – 78 = 62 Trips

Primary Trips = 62 x 0.51 (51%) and 62 x 0.49 (49%) = 32 Trips Enter/30 Trips Exit

For Saturday Peak Hour → 50% Enter/50% Exit
*NOTE: Pass-by data was unavailable for the Saturday Peak Hour. Therefore, the PM Peak Hour percentage was used.

10 Truck Fuel Positions x 19.28 = 192.80 ≈ 194 Trips

Pass-by Trips = 194 Trips x 0.56 (56%) = 110 Trips

Pass-by Trips = 110 Trips x 0.50 (50%) = 55 Trips Enter/55 Trips Exit

Primary Trips = 194 – 110 = 84 Trips

Primary Trips = 84 x 0.50 (50%) = 42 Trips Enter/42 Trips Exit

NCHRP 684 Internal Trip Capture Estimation Tool			
Project Name:	New Braunfels, TX Love's TIS	**Organization:**	CESO
Project Location:	New Braunfels, TX	**Performed By:**	TMC
Scenario Description:	Build Traffic Scenario	**Date:**	3/10/2021
Analysis Year:	2022	**Checked By:**	REM
Analysis Period:	**AM Street Peak Hour**	**Date:**	3/10/2021

Table 1-A: Base Vehicle-Trip Generation Estimates (Single-Use Site Estimate)

Land Use	Development Data (*For Information Only*)			Estimated Vehicle-Trips[3]		
	ITE LUCs[1]	Quantity	Units	Total	Entering	Exiting
Office				0		
Retail				382	193	189
Restaurant				174	95	79
Cinema/Entertainment				0		
Residential				0		
Hotel				0		
All Other Land Uses[2]				0		
				556	288	268

Table 2-A: Mode Split and Vehicle Occupancy Estimates

Land Use	Entering Trips			Exiting Trips		
	Veh. Occ.[4]	% Transit	% Non-Motorized	Veh. Occ.[4]	% Transit	% Non-Motorized
Office						
Retail						
Restaurant						
Cinema/Entertainment						
Residential						
Hotel						
All Other Land Uses[2]						

Table 3-A: Average Land Use Interchange Distances (Feet Walking Distance)

Origin (From)	Destination (To)					
	Office	Retail	Restaurant	Cinema/Entertainment	Residential	Hotel
Office						
Retail						
Restaurant						
Cinema/Entertainment						
Residential						
Hotel						

Table 4-A: Internal Person-Trip Origin-Destination Matrix*

Origin (From)	Destination (To)					
	Office	Retail	Restaurant	Cinema/Entertainment	Residential	Hotel
Office		0	0	0	0	0
Retail	0		25	0	0	0
Restaurant	0	11		0	0	0
Cinema/Entertainment	0	0	0		0	0
Residential	0	0	0	0		0
Hotel	0	0	0	0	0	

Table 5-A: Computations Summary

	Total	Entering	Exiting
All Person-Trips	556	288	268
Internal Capture Percentage	13%	13%	13%
External Vehicle-Trips[5]	484	252	232
External Transit-Trips[6]	0	0	0
External Non-Motorized Trips[6]	0	0	0

Table 6-A: Internal Trip Capture Percentages by Land Use

Land Use	Entering Trips	Exiting Trips
Office	N/A	N/A
Retail	6%	13%
Restaurant	26%	14%
Cinema/Entertainment	N/A	N/A
Residential	N/A	N/A
Hotel	N/A	N/A

[1]Land Use Codes (LUCs) from *Trip Generation Manual*, published by the Institute of Transportation Engineers.

[2]Total estimate for all other land uses at mixed-use development site is not subject to internal trip capture computations in this estimator.

[3]Enter trips assuming no transit or non-motorized trips (as assumed in ITE *Trip Generation Manual*).

[4]Enter vehicle occupancy assumed in Table 1-A vehicle trips. If vehicle occupancy changes for proposed mixed-use project, manual adjustments must be made to Tables 5-A, 9-A (O and D). Enter transit, non-motorized percentages that will result with proposed mixed-use project complete.

[5]Vehicle-trips computed using the mode split and vehicle occupancy values provided in Table 2-A.

[6]Person-Trips

*Indicates computation that has been rounded to the nearest whole number.

Estimation Tool Developed by the Texas A&M Transportation Institute - Version 2013.1

NCHRP 684 Internal Trip Capture Estimation Tool			
Project Name:	New Braunfels, TX Love's TIS	**Organization:**	CESO
Project Location:	New Braunfels, TX	**Performed By:**	TMC
Scenario Description:	Build Traffic Scenario	**Date:**	3/10/2021
Analysis Year:	2022	**Checked By:**	REM
Analysis Period:	**PM Street Peak Hour**	**Date:**	3/10/2021

Table 1-P: Base Vehicle-Trip Generation Estimates (Single-Use Site Estimate)

Land Use	Development Data (*For Information Only*)			Estimated Vehicle-Trips[3]		
	ITE LUCs[1]	Quantity	Units	Total	Entering	Exiting
Office				0		
Retail				434	218	216
Restaurant				162	82	80
Cinema/Entertainment				0		
Residential				0		
Hotel				0		
All Other Land Uses[2]				0		
				596	300	296

Table 2-P: Mode Split and Vehicle Occupancy Estimates

Land Use	Entering Trips			Exiting Trips		
	Veh. Occ.[4]	% Transit	% Non-Motorized	Veh. Occ.[4]	% Transit	% Non-Motorized
Office						
Retail						
Restaurant						
Cinema/Entertainment						
Residential						
Hotel						
All Other Land Uses[2]						

Table 3-P: Average Land Use Interchange Distances (Feet Walking Distance)

Origin (From)	Destination (To)					
	Office	Retail	Restaurant	Cinema/Entertainment	Residential	Hotel
Office						
Retail						
Restaurant						
Cinema/Entertainment						
Residential						
Hotel						

Table 4-P: Internal Person-Trip Origin-Destination Matrix*

Origin (From)	Destination (To)					
	Office	Retail	Restaurant	Cinema/Entertainment	Residential	Hotel
Office		0	0	0	0	0
Retail	0		24	0	0	0
Restaurant	0	33		0	0	0
Cinema/Entertainment	0	0	0		0	0
Residential	0	0	0	0		0
Hotel	0	0	0	0	0	

Table 5-P: Computations Summary

	Total	Entering	Exiting
All Person-Trips	596	300	296
Internal Capture Percentage	19%	19%	19%
External Vehicle-Trips[5]	482	243	239
External Transit-Trips[6]	0	0	0
External Non-Motorized Trips[6]	0	0	0

Table 6-P: Internal Trip Capture Percentages by Land Use

Land Use	Entering Trips	Exiting Trips
Office	N/A	N/A
Retail	15%	11%
Restaurant	29%	41%
Cinema/Entertainment	N/A	N/A
Residential	N/A	N/A
Hotel	N/A	N/A

[1]Land Use Codes (LUCs) from *Trip Generation Manual*, published by the Institute of Transportation Engineers.

[2]Total estimate for all other land uses at mixed-use development site is not subject to internal trip capture computations in this estimator.

[3]Enter trips assuming no transit or non-motorized trips (as assumed in ITE *Trip Generation Manual*).

[4]Enter vehicle occupancy assumed in Table 1-P vehicle trips. If vehicle occupancy changes for proposed mixed-use project, manual adjustments must be made

[5]Vehicle-trips computed using the mode split and vehicle occupancy values provided in Table 2-P.

[6]Person-Trips

*Indicates computation that has been rounded to the nearest whole number.

Estimation Tool Developed by the Texas A&M Transportation Institute - Version 2013.1

NCHRP 684 Internal Trip Capture Estimation Tool			
Project Name:	New Braunfels, TX Love's TIS	**Organization:**	CESO
Project Location:	New Braunfels, TX	**Performed By:**	TMC
Scenario Description:	Build Traffic Scenario	**Date:**	3/10/2021
Analysis Year:	2022	**Checked By:**	REM
Analysis Period:	**Saturday Street Peak Hour**	**Date:**	3/10/2021

Table 1-P: Base Vehicle-Trip Generation Estimates (Single-Use Site Estimate)

Land Use	Development Data (*For Information Only*)			Estimated Vehicle-Trips[3]		
	ITE LUCs[1]	Quantity	Units	Total	Entering	Exiting
Office				0		
Retail				591	295	296
Restaurant				292	146	146
Cinema/Entertainment				0		
Residential				0		
Hotel				0		
All Other Land Uses[2]				0		
				883	441	442

Table 2-P: Mode Split and Vehicle Occupancy Estimates

Land Use	Entering Trips			Exiting Trips		
	Veh. Occ.[4]	% Transit	% Non-Motorized	Veh. Occ.[4]	% Transit	% Non-Motorized
Office						
Retail						
Restaurant						
Cinema/Entertainment						
Residential						
Hotel						
All Other Land Uses[2]						

Table 3-P: Average Land Use Interchange Distances (Feet Walking Distance)

Origin (From)	Destination (To)					
	Office	Retail	Restaurant	Cinema/Entertainment	Residential	Hotel
Office						
Retail						
Restaurant						
Cinema/Entertainment						
Residential						
Hotel						

Table 4-P: Internal Person-Trip Origin-Destination Matrix*

Origin (From)	Destination (To)					
	Office	Retail	Restaurant	Cinema/Entertainment	Residential	Hotel
Office		0	0	0	0	0
Retail	0		42	0	0	0
Restaurant	0	60		0	0	0
Cinema/Entertainment	0	0	0		0	0
Residential	0	0	0	0		0
Hotel	0	0	0	0	0	

Table 5-P: Computations Summary

	Total	Entering	Exiting
All Person-Trips	883	441	442
Internal Capture Percentage	23%	23%	23%
External Vehicle-Trips[5]	679	339	340
External Transit-Trips[6]	0	0	0
External Non-Motorized Trips[6]	0	0	0

Table 6-P: Internal Trip Capture Percentages by Land Use

Land Use	Entering Trips	Exiting Trips
Office	N/A	N/A
Retail	20%	14%
Restaurant	29%	41%
Cinema/Entertainment	N/A	N/A
Residential	N/A	N/A
Hotel	N/A	N/A

[1]Land Use Codes (LUCs) from *Trip Generation Manual*, published by the Institute of Transportation Engineers.

[2]Total estimate for all other land uses at mixed-use development site is not subject to internal trip capture computations in this estimator.

[3]Enter trips assuming no transit or non-motorized trips (as assumed in ITE *Trip Generation Manual*).

[4]Enter vehicle occupancy assumed in Table 1-P vehicle trips. If vehicle occupancy changes for proposed mixed-use project, manual adjustments must be made

[5]Vehicle-trips computed using the mode split and vehicle occupancy values provided in Table 2-P.

[6]Person-Trips

*Indicates computation that has been rounded to the nearest whole number.

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March 17, 2021

Love's – New Braunfels, TX

AM Peak Hour

Passenger Cars

ITE CAT. 945	ENTER	EXIT	TOTAL
	126	124	250
Internal Capture (6% Enter / 13% Exit)	- 8	- 16	- 24
	118	108	226
Pass-By (62%)	73	67	140
Primary	45	41	86

ITE CAT. 934	ENTER	EXIT	TOTAL
	55	53	108
Internal Capture (26% Enter / 14% Exit)	- 14	- 7	- 21
	41	46	87
Pass-by (49%)	20	23	43
Primary	21	23	44

ITE CAT. 933	ENTER	EXIT	TOTAL
	40	26	66
Internal Capture (26% Enter / 14% Exit)	- 10	- 4	- 14
Primary	30	22	52

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March 17, 2021

Love's – New Braunfels, TX

PM Peak Hour

Passenger Cars

ITE CAT. 945	ENTER	EXIT	TOTAL
	141	139	280
Internal Capture (15% Enter / 11% Exit)	- 21	- 15	- 36
	120	124	244
Pass-By (56%)	67	69	136
Primary	53	55	108

ITE CAT. 934	ENTER	EXIT	TOTAL
	45	43	88
Internal Capture (29% Enter / 41% Exit)	- 13	- 18	- 31
	32	25	57
Pass-by (50%)	16	12	28
Primary	16	13	29

ITE CAT. 933	ENTER	EXIT	TOTAL
	37	37	74
Internal Capture (29% Enter / 41% Exit)	- 11	- 15	- 26
Primary	26	22	48

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March 17, 2021

Love's – New Braunfels, TX

Saturday Peak Hour

Passenger Cars

ITE CAT. 945	ENTER	EXIT	TOTAL
	193	193	386
Internal Capture (20% Enter / 14% Exit)	- 39	- 27	- 66
	154	166	320
Pass-By (56%)	87	93	180
Primary	67	73	140

ITE CAT. 934	ENTER	EXIT	TOTAL
	75	73	148
Internal Capture (29% Enter / 41% Exit)	- 22	- 30	- 52
	53	43	96
Pass-by (50%)	27	21	48
Primary	26	22	48

ITE CAT. 933	ENTER	EXIT	TOTAL
	71	73	144
Internal Capture (29% Enter / 41% Exit)	- 21	- 30	- 51
Primary	50	43	93

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March 17, 2021

Love's – New Braunfels, TX

AM Peak Hour

Trucks

ITE CAT. 945	ENTER	EXIT	TOTAL
	62	62	124
Internal Capture (6% Enter / 13% Exit)	- 4	- 8	- 12
	58	54	112
Pass-By (62%)	36	34	70
Primary	22	20	42

ITE CAT. 848	ENTER	EXIT	TOTAL
	5	3	8
Internal Capture (6% Enter / 13% Exit)	- 0	- 0	- 0
Primary	5	3	8

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March 17, 2021

Love's – New Braunfels, TX

PM Peak Hour

Trucks

ITE CAT. 945	ENTER	EXIT	TOTAL
	71	69	140
Internal Capture (15% Enter / 11% Exit)	- 11	- 8	- 19
	60	61	121
Pass-By (56%)	34	34	68
Primary	26	27	53

ITE CAT. 848	ENTER	EXIT	TOTAL
	6	8	14
Internal Capture (15% Enter / 11% Exit)	- 0	- 0	- 0
Primary	6	8	14

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March 17, 2021

Love's – New Braunfels, TX

Saturday Peak Hour

Trucks

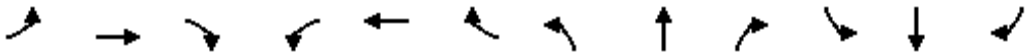
ITE CAT. 945	ENTER	EXIT	TOTAL
	97	97	194
Internal Capture (20% Enter / 14% Exit)	- 19	- 14	- 33
	78	83	161
Pass-By (56%)	44	46	90
Primary	34	37	71

ITE CAT. 848	ENTER	EXIT	TOTAL
	5	6	11
Internal Capture (20% Enter / 14% Exit)	- 1	- 1	- 2
Primary	4	5	9

APPENDIX E
2022 BUILD TRAFFIC SCENARIO
CAPACITY ANALYSIS SUMMARY SHEETS

Lanes, Volumes, Timings
2: N Interstate 35 Frontage Road & Kohlenberg Road

03/25/2021



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	123	184	0	0	208	86	125	27	63	0	0	0
Future Volume (vph)	123	184	0	0	208	86	125	27	63	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		275	0		0	0		0
Storage Lanes	1		0	0		2	1		1	0		0
Taper Length (ft)	25			25			150			25		
Lane Util. Factor	0.91	0.91	1.00	1.00	0.91	1.00	1.00	0.95	1.00	1.00	1.00	1.00
Frt						0.850			0.850			
Flt Protected	0.950	0.994					0.950					
Satd. Flow (prot)	1380	2910	0	0	4803	1252	1421	2959	1392	0	0	0
Flt Permitted	0.950	0.994					0.950					
Satd. Flow (perm)	1380	2910	0	0	4803	1252	1421	2959	1392	0	0	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)						93			73			
Link Speed (mph)		40			40			55			55	
Link Distance (ft)		263			471			171			223	
Travel Time (s)		4.5			8.0			2.1			2.8	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	19%	18%	0%	0%	8%	29%	27%	22%	16%	0%	0%	0%
Adj. Flow (vph)	134	200	0	0	226	93	136	29	68	0	0	0
Shared Lane Traffic (%)	19%											
Lane Group Flow (vph)	109	225	0	0	226	93	136	29	68	0	0	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2			2	1	1	2	1			
Detector Template	Left	Thru			Thru	Right	Left	Thru	Right			
Leading Detector (ft)	20	100			100	20	20	100	20			
Trailing Detector (ft)	0	0			0	0	0	0	0			
Detector 1 Position(ft)	0	0			0	0	0	0	0			
Detector 1 Size(ft)	20	6			6	20	20	6	20			
Detector 1 Type	Cl+Ex	Cl+Ex			Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex			
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0			0.0	0.0	0.0	0.0	0.0			
Detector 1 Queue (s)	0.0	0.0			0.0	0.0	0.0	0.0	0.0			
Detector 1 Delay (s)	0.0	0.0			0.0	0.0	0.0	0.0	0.0			
Detector 2 Position(ft)		94			94			94				
Detector 2 Size(ft)		6			6			6				
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex				
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0				
Turn Type	Split	NA			NA	Perm	Perm	NA	Perm			
Protected Phases	4	4			8			2				

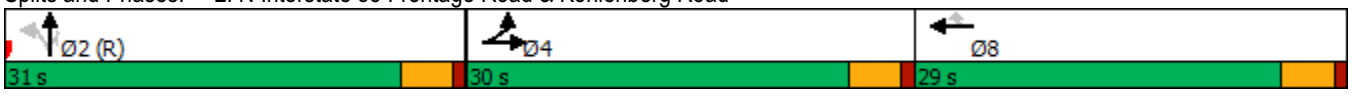
Lanes, Volumes, Timings
2: N Interstate 35 Frontage Road & Kohlenberg Road

03/25/2021

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases						8	2		2			
Detector Phase	4	4			8	8	2	2	2			
Switch Phase												
Minimum Initial (s)	5.0	5.0			5.0	5.0	5.0	5.0	5.0			
Minimum Split (s)	22.5	22.5			22.5	22.5	22.5	22.5	22.5			
Total Split (s)	30.0	30.0			29.0	29.0	31.0	31.0	31.0			
Total Split (%)	33.3%	33.3%			32.2%	32.2%	34.4%	34.4%	34.4%			
Maximum Green (s)	25.5	25.5			24.5	24.5	26.5	26.5	26.5			
Yellow Time (s)	3.5	3.5			3.5	3.5	3.5	3.5	3.5			
All-Red Time (s)	1.0	1.0			1.0	1.0	1.0	1.0	1.0			
Lost Time Adjust (s)	0.0	0.0			0.0	0.0	0.0	0.0	0.0			
Total Lost Time (s)	4.5	4.5			4.5	4.5	4.5	4.5	4.5			
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0	3.0			
Recall Mode	None	None			None	None	C-Max	C-Max	C-Max			
Walk Time (s)	7.0	7.0			7.0	7.0	7.0	7.0	7.0			
Flash Dont Walk (s)	11.0	11.0			11.0	11.0	11.0	11.0	11.0			
Pedestrian Calls (#/hr)	0	0			0	0	0	0	0			
Act Effct Green (s)	13.0	13.0			9.6	9.6	53.9	53.9	53.9			
Actuated g/C Ratio	0.14	0.14			0.11	0.11	0.60	0.60	0.60			
v/c Ratio	0.55	0.54			0.44	0.43	0.16	0.02	0.08			
Control Delay	17.9	12.1			40.2	14.7	10.0	9.2	2.8			
Queue Delay	0.0	0.0			0.0	0.0	0.0	0.0	0.0			
Total Delay	17.9	12.1			40.2	14.7	10.0	9.2	2.8			
LOS	B	B			D	B	A	A	A			
Approach Delay		14.0			32.8			7.8				
Approach LOS		B			C			A				

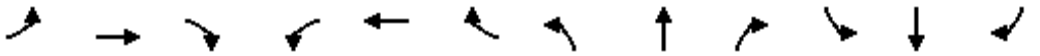
Intersection Summary			
Area Type:	Other		
Cycle Length: 90			
Actuated Cycle Length: 90			
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:, Start of Green			
Natural Cycle: 70			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.55			
Intersection Signal Delay: 19.1		Intersection LOS: B	
Intersection Capacity Utilization 33.0%		ICU Level of Service A	
Analysis Period (min) 15			

Splits and Phases: 2: N Interstate 35 Frontage Road & Kohlenberg Road



HCM 6th Signalized Intersection Summary
2: N Interstate 35 Frontage Road & Kohlenberg Road

03/25/2021



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	123	184	0	0	208	86	125	27	63	0	0	0
Future Volume (veh/h)	123	184	0	0	208	86	125	27	63	0	0	0
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0			
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00			
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			
Work Zone On Approach		No			No			No				
Adj Sat Flow, veh/h/ln	1618	1633	0	0	1781	1470	1500	1574	1663			
Adj Flow Rate, veh/h	111	232	0	0	226	0	136	29	0			
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92			
Percent Heavy Veh, %	19	18	0	0	8	29	27	22	16			
Cap, veh/h	167	354	0	0	390		945	1978				
Arrive On Green	0.11	0.11	0.00	0.00	0.08	0.00	0.66	0.66	0.00			
Sat Flow, veh/h	1541	3266	0	0	5024	1246	1428	2991	1409			
Grp Volume(v), veh/h	111	232	0	0	226	0	136	29	0			
Grp Sat Flow(s),veh/h/ln	1541	1633	0	0	1621	1246	1428	1495	1409			
Q Serve(g_s), s	6.2	6.1	0.0	0.0	4.0	0.0	3.2	0.3	0.0			
Cycle Q Clear(g_c), s	6.2	6.1	0.0	0.0	4.0	0.0	3.2	0.3	0.0			
Prop In Lane	1.00		0.00	0.00		1.00	1.00		1.00			
Lane Grp Cap(c), veh/h	167	354	0	0	390		945	1978				
V/C Ratio(X)	0.66	0.66	0.00	0.00	0.58		0.14	0.01				
Avail Cap(c_a), veh/h	437	926	0	0	1324		945	1978				
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			
Upstream Filter(I)	0.93	0.93	0.00	0.00	1.00	0.00	1.00	1.00	0.00			
Uniform Delay (d), s/veh	38.6	38.5	0.0	0.0	39.9	0.0	5.7	5.2	0.0			
Incr Delay (d2), s/veh	4.2	1.9	0.0	0.0	1.4	0.0	0.3	0.0	0.0			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln	2.5	2.5	0.0	0.0	1.6	0.0	0.7	0.1	0.0			
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	42.7	40.4	0.0	0.0	41.3	0.0	6.0	5.2	0.0			
LnGrp LOS	D	D	A	A	D		A	A				
Approach Vol, veh/h		343			226	A		165	A			
Approach Delay, s/veh		41.2			41.3			5.9				
Approach LOS		D			D			A				
Timer - Assigned Phs		2		4				8				
Phs Duration (G+Y+Rc), s		64.0		14.2				11.7				
Change Period (Y+Rc), s		4.5		4.5				4.5				
Max Green Setting (Gmax), s		26.5		25.5				24.5				
Max Q Clear Time (g_c+I1), s		5.2		8.2				6.0				
Green Ext Time (p_c), s		0.5		1.5				1.2				

Intersection Summary	
HCM 6th Ctrl Delay	33.3
HCM 6th LOS	C

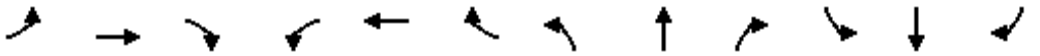
Notes

User approved volume balancing among the lanes for turning movement.

Unsignalized Delay for [NBR, WBR] is excluded from calculations of the approach delay and intersection delay.

Lanes, Volumes, Timings
3: S Interstate 35 Frontage Road & Conrads Lane/Kohlenberg Road

03/25/2021



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	269	344	96	237	0	0	0	0	38	188	87
Future Volume (vph)	0	269	344	96	237	0	0	0	0	38	188	87
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		275	0		0	0		0	0		0
Storage Lanes	0		2	1		0	0		0	1		1
Taper Length (ft)	25			25			25			150		
Lane Util. Factor	1.00	0.91	1.00	0.91	0.91	1.00	1.00	1.00	1.00	0.91	0.91	1.00
Frt			0.850									0.850
Flt Protected				0.950	0.998					0.950	0.999	
Satd. Flow (prot)	0	4590	1302	1480	2980	0	0	0	0	1040	2885	1122
Flt Permitted				0.950	0.998					0.950	0.999	
Satd. Flow (perm)	0	4590	1302	1480	2980	0	0	0	0	1040	2885	1122
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			374									95
Link Speed (mph)		40			40			55			55	
Link Distance (ft)		426			263			205			185	
Travel Time (s)		7.3			4.5			2.5			2.3	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	13%	24%	11%	16%	0%	0%	0%	0%	58%	19%	44%
Adj. Flow (vph)	0	292	374	104	258	0	0	0	0	41	204	95
Shared Lane Traffic (%)				10%						10%		
Lane Group Flow (vph)	0	292	374	94	268	0	0	0	0	37	208	95
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors		2	1	1	2					1	2	1
Detector Template		Thru	Right	Left	Thru					Left	Thru	Right
Leading Detector (ft)		100	20	20	100					20	100	20
Trailing Detector (ft)		0	0	0	0					0	0	0
Detector 1 Position(ft)		0	0	0	0					0	0	0
Detector 1 Size(ft)		6	20	20	6					20	6	20
Detector 1 Type		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex					Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)		0.0	0.0	0.0	0.0					0.0	0.0	0.0
Detector 1 Queue (s)		0.0	0.0	0.0	0.0					0.0	0.0	0.0
Detector 1 Delay (s)		0.0	0.0	0.0	0.0					0.0	0.0	0.0
Detector 2 Position(ft)		94			94						94	
Detector 2 Size(ft)		6			6						6	
Detector 2 Type		Cl+Ex			Cl+Ex						Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0						0.0	
Turn Type		NA	Perm	Split	NA					Perm	NA	Perm
Protected Phases		4		8	8						6	

Lanes, Volumes, Timings
3: S Interstate 35 Frontage Road & Conrads Lane/Kohlenberg Road

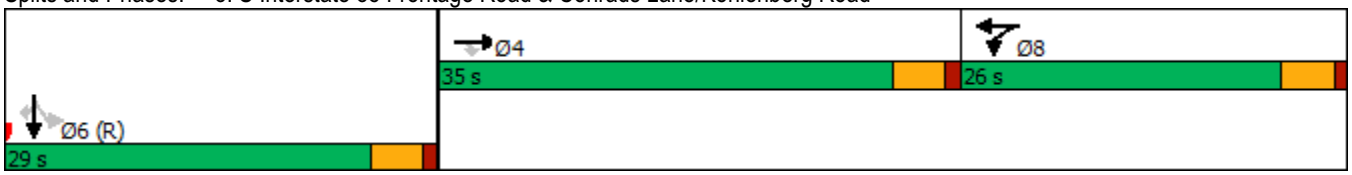
03/25/2021

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases			4							6		6
Detector Phase		4	4	8	8					6	6	6
Switch Phase												
Minimum Initial (s)		5.0	5.0	5.0	5.0					5.0	5.0	5.0
Minimum Split (s)		22.5	22.5	22.5	22.5					22.5	22.5	22.5
Total Split (s)		35.0	35.0	26.0	26.0					29.0	29.0	29.0
Total Split (%)		38.9%	38.9%	28.9%	28.9%					32.2%	32.2%	32.2%
Maximum Green (s)		30.5	30.5	21.5	21.5					24.5	24.5	24.5
Yellow Time (s)		3.5	3.5	3.5	3.5					3.5	3.5	3.5
All-Red Time (s)		1.0	1.0	1.0	1.0					1.0	1.0	1.0
Lost Time Adjust (s)		0.0	0.0	0.0	0.0					0.0	0.0	0.0
Total Lost Time (s)		4.5	4.5	4.5	4.5					4.5	4.5	4.5
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)		3.0	3.0	3.0	3.0					3.0	3.0	3.0
Recall Mode		None	None	None	None					C-Max	C-Max	C-Max
Walk Time (s)		7.0	7.0	7.0	7.0					7.0	7.0	7.0
Flash Dont Walk (s)		11.0	11.0	11.0	11.0					11.0	11.0	11.0
Pedestrian Calls (#/hr)		0	0	0	0					0	0	0
Act Effct Green (s)		13.7	13.7	13.5	13.5					49.3	49.3	49.3
Actuated g/C Ratio		0.15	0.15	0.15	0.15					0.55	0.55	0.55
v/c Ratio		0.42	0.73	0.42	0.60					0.06	0.13	0.14
Control Delay		35.4	12.4	28.2	28.5					13.4	12.2	4.1
Queue Delay		0.0	0.0	0.0	0.0					0.0	0.0	0.0
Total Delay		35.4	12.4	28.2	28.5					13.4	12.2	4.1
LOS		D	B	C	C					B	B	A
Approach Delay		22.5			28.4						10.1	
Approach LOS		C			C						B	

Intersection Summary

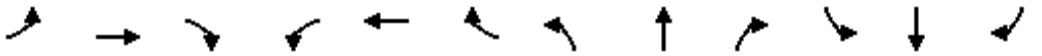
Area Type: Other
Cycle Length: 90
Actuated Cycle Length: 90
Offset: 0 (0%), Referenced to phase 2: and 6:SBTL, Start of Green, Master Intersection
Natural Cycle: 70
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.73
Intersection Signal Delay: 21.0 Intersection LOS: C
Intersection Capacity Utilization 33.0% ICU Level of Service A
Analysis Period (min) 15

Splits and Phases: 3: S Interstate 35 Frontage Road & Conrads Lane/Kohlenberg Road



HCM 6th Signalized Intersection Summary
3: S Interstate 35 Frontage Road & Conrads Lane/Kohlenberg Road

03/25/2021



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	269	344	96	237	0	0	0	0	38	188	87
Future Volume (veh/h)	0	269	344	96	237	0	0	0	0	38	188	87
Initial Q (Qb), veh	0	0	0	0	0	0				0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00				1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00				1.00	1.00	1.00
Work Zone On Approach		No			No						No	
Adj Sat Flow, veh/h/ln	0	1707	1544	1737	1663	0				1040	1618	1248
Adj Flow Rate, veh/h	0	292	0	104	258	0				41	204	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92				0.92	0.92	0.92
Percent Heavy Veh, %	0	13	24	11	16	0				58	19	44
Cap, veh/h	0	475		190	382	0				627	2050	
Arrive On Green	0.00	0.10	0.00	0.04	0.04	0.00				0.63	0.63	0.00
Sat Flow, veh/h	0	4815	1309	1654	3326	0				991	3237	1058
Grp Volume(v), veh/h	0	292	0	104	258	0				41	204	0
Grp Sat Flow(s),veh/h/ln	0	1554	1309	1654	1663	0				991	1618	1058
Q Serve(g_s), s	0.0	5.4	0.0	5.6	6.9	0.0				1.4	2.2	0.0
Cycle Q Clear(g_c), s	0.0	5.4	0.0	5.6	6.9	0.0				1.4	2.2	0.0
Prop In Lane	0.00		1.00	1.00		0.00				1.00		1.00
Lane Grp Cap(c), veh/h	0	475		190	382	0				627	2050	
V/C Ratio(X)	0.00	0.61		0.55	0.68	0.00				0.07	0.10	
Avail Cap(c_a), veh/h	0	1580		395	794	0				627	2050	
HCM Platoon Ratio	1.00	1.00	1.00	0.33	0.33	1.00				1.00	1.00	1.00
Upstream Filter(I)	0.00	1.00	0.00	0.95	0.95	0.00				1.00	1.00	0.00
Uniform Delay (d), s/veh	0.0	38.7	0.0	41.0	41.6	0.0				6.3	6.5	0.0
Incr Delay (d2), s/veh	0.0	1.3	0.0	2.3	2.0	0.0				0.2	0.1	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0				0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	2.0	0.0	2.4	3.0	0.0				0.3	0.6	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	0.0	40.0	0.0	43.3	43.6	0.0				6.5	6.6	0.0
LnGrp LOS	A	D		D	D	A				A	A	
Approach Vol, veh/h		292	A		362						245	A
Approach Delay, s/veh		40.0			43.5						6.6	
Approach LOS		D			D						A	

Timer - Assigned Phs		4		6		8						
Phs Duration (G+Y+Rc), s		13.7		61.5		14.8						
Change Period (Y+Rc), s		4.5		4.5		4.5						
Max Green Setting (Gmax), s		30.5		24.5		21.5						
Max Q Clear Time (g_c+I1), s		7.4		4.2		8.9						
Green Ext Time (p_c), s		1.8		1.1		1.4						

Intersection Summary		
HCM 6th Ctrl Delay	32.3	
HCM 6th LOS	C	

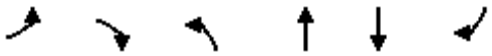
Notes

User approved volume balancing among the lanes for turning movement.

Unsignalized Delay for [EBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Lanes, Volumes, Timings
6: N Interstate 35 Frontage Road

03/25/2021



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	31	0	0	236	0	0
Future Volume (vph)	31	0	0	236	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	0.91	1.00	1.00
Frt						
Flt Protected	0.950					
Satd. Flow (prot)	1517	0	0	4217	0	0
Flt Permitted	0.950					
Satd. Flow (perm)	1517	0	0	4217	0	0
Link Speed (mph)	30			55	55	
Link Distance (ft)	262			223	1233	
Travel Time (s)	6.0			2.8	15.3	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	19%	0%	0%	23%	0%	0%
Adj. Flow (vph)	34	0	0	257	0	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	34	0	0	257	0	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	12			0	0	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9	15			9
Sign Control	Yield			Free	Free	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 14.6%		ICU Level of Service A	
Analysis Period (min) 15			

Lanes, Volumes, Timings
7: S Interstate 35 Frontage Road

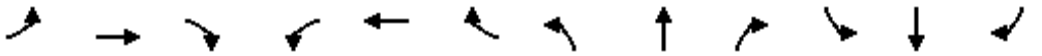
03/25/2021

Lane Group	WBL	WBR	NBL	NBT	NBR	SBL	SBT	SBR	SEL	SER
Lane Configurations										
Traffic Volume (vph)	0	0	0	0	0	31	313	0	0	0
Future Volume (vph)	0	0	0	0	0	31	313	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0	0	0		0	475		475	0	0
Storage Lanes	0	0	0		0	2		1	0	0
Taper Length (ft)	25		25			100			25	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.86	0.86	1.00	1.00
Frt										
Flt Protected						0.950				
Satd. Flow (prot)	0	0	0	0	0	1517	5028	0	0	0
Flt Permitted						0.950				
Satd. Flow (perm)	0	0	0	0	0	1517	5028	0	0	0
Link Speed (mph)	30			55			55		30	
Link Distance (ft)	262			185			1270		123	
Travel Time (s)	6.0			2.3			15.7		2.8	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	0%	0%	0%	0%	19%	30%	0%	0%	0%
Adj. Flow (vph)	0	0	0	0	0	34	340	0	0	0
Shared Lane Traffic (%)										
Lane Group Flow (vph)	0	0	0	0	0	34	340	0	0	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Right	Left	Left	Right	Left	Right
Median Width(ft)	0			12			12		0	
Link Offset(ft)	0			0			0		0	
Crosswalk Width(ft)	16			16			16		16	
Two way Left Turn Lane										
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9	15		9	15		9	15	9
Sign Control	Free			Free			Free		Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization	7.9%	ICU Level of Service	A
Analysis Period (min)	15		

Lanes, Volumes, Timings
8: N Interstate 35 Frontage Road

03/25/2021

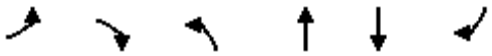


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	0	0	0	165	215	0	0	0	0
Future Volume (vph)	0	0	0	0	0	0	165	215	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		0	475		475	0		0
Storage Lanes	0		0	0		0	2		1	0		0
Taper Length (ft)	25			25			150			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.86	0.86	1.00	1.00	1.00
Frt												
Flt Protected							0.950					
Satd. Flow (prot)	0	0	0	0	0	0	1597	5314	0	0	0	0
Flt Permitted							0.950					
Satd. Flow (perm)	0	0	0	0	0	0	1597	5314	0	0	0	0
Link Speed (mph)		30			30			55			55	
Link Distance (ft)		266			141			6650			171	
Travel Time (s)		6.0			3.2			82.4			2.1	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	13%	23%	0%	0%	0%	0%
Adj. Flow (vph)	0	0	0	0	0	0	179	234	0	0	0	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	0	0	0	0	0	179	234	0	0	0	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Free			Stop			Free			Free	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 27.9%		ICU Level of Service A	
Analysis Period (min) 15			

Lanes, Volumes, Timings
9: N Interstate 35 Frontage Road & I-35 NB Off Ramp

03/25/2021



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	309	0	0	713	0	0
Future Volume (vph)	309	0	0	713	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	0.95	1.00	1.00
Frt						
Flt Protected	0.950					
Satd. Flow (prot)	1597	0	0	3312	0	0
Flt Permitted	0.950					
Satd. Flow (perm)	1597	0	0	3312	0	0
Link Speed (mph)	45			55	55	
Link Distance (ft)	469			818	6650	
Travel Time (s)	7.1			10.1	82.4	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	13%	0%	0%	9%	0%	0%
Adj. Flow (vph)	336	0	0	775	0	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	336	0	0	775	0	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	12			24	24	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9	15			9
Sign Control	Yield			Free	Free	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 43.5%		ICU Level of Service A	
Analysis Period (min) 15			

Lanes, Volumes, Timings
12: S Interstate 35 Frontage Road

03/25/2021

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	165	0	0	0	0	628
Future Volume (vph)	165	0	0	0	0	628
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	0.91
Frt						
Flt Protected	0.950					
Satd. Flow (prot)	1597	0	0	0	0	4287
Flt Permitted	0.950					
Satd. Flow (perm)	1597	0	0	0	0	4287
Link Speed (mph)	30		55			55
Link Distance (ft)	266		1391			205
Travel Time (s)	6.0		17.2			2.5
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	13%	0%	0%	0%	0%	21%
Adj. Flow (vph)	179	0	0	0	0	683
Shared Lane Traffic (%)						
Lane Group Flow (vph)	179	0	0	0	0	683
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(ft)	12		0			0
Link Offset(ft)	0		0			0
Crosswalk Width(ft)	16		16			16
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9		9	15	
Sign Control	Yield		Free			Free

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 27.9%		ICU Level of Service A	
Analysis Period (min) 15			

Lanes, Volumes, Timings
13: S Interstate 35 Frontage Road & I-35 SB Off Ramp

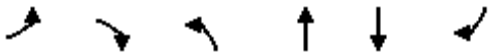
03/25/2021

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	530	0	0	0	0	972
Future Volume (vph)	530	0	0	0	0	972
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	0.95
Frt						
Flt Protected	0.950					
Satd. Flow (prot)	1583	0	0	0	0	3112
Flt Permitted	0.950					
Satd. Flow (perm)	1583	0	0	0	0	3112
Link Speed (mph)	45		55			30
Link Distance (ft)	349		2149			497
Travel Time (s)	5.3		26.6			11.3
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	14%	0%	0%	0%	0%	16%
Adj. Flow (vph)	576	0	0	0	0	1057
Shared Lane Traffic (%)						
Lane Group Flow (vph)	576	0	0	0	0	1057
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(ft)	12		0			0
Link Offset(ft)	0		0			0
Crosswalk Width(ft)	16		16			16
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9		9	15	
Sign Control	Yield		Free			Free

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 62.9%		ICU Level of Service B	
Analysis Period (min) 15			

Lanes, Volumes, Timings
17: S Interstate 35 Frontage Road & Oak Creek Way

03/25/2021



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	0	120	0	0	852	40
Future Volume (vph)	0	120	0	0	852	40
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0	0	0			315
Storage Lanes	0	1	0			1
Taper Length (ft)	25		25			
Lane Util. Factor	1.00	1.00	1.00	1.00	0.95	1.00
Frt		0.865				0.850
Flt Protected						
Satd. Flow (prot)	0	1627	0	0	3059	1568
Flt Permitted						
Satd. Flow (perm)	0	1627	0	0	3059	1568
Link Speed (mph)	30			55	55	
Link Distance (ft)	1047			497	1391	
Travel Time (s)	23.8			6.2	17.2	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	1%	0%	0%	18%	3%
Adj. Flow (vph)	0	130	0	0	926	43
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	130	0	0	926	43
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	0			0	0	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9	15			9
Sign Control	Stop			Free	Free	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 37.6%		ICU Level of Service A	
Analysis Period (min) 15			

Intersection	
Int Delay, s/veh	1.6

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	0	120	0	0	852	40
Future Vol, veh/h	0	120	0	0	852	40
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	-	315
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	0	1	0	0	18	3
Mvmt Flow	0	130	0	0	926	43

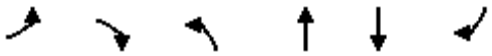
Major/Minor	Minor2			Major2	
Conflicting Flow All	-	463		-	0
Stage 1	-	-		-	-
Stage 2	-	-		-	-
Critical Hdwy	-	6.92		-	-
Critical Hdwy Stg 1	-	-		-	-
Critical Hdwy Stg 2	-	-		-	-
Follow-up Hdwy	-	3.31		-	-
Pot Cap-1 Maneuver	0	548		-	-
Stage 1	0	-		-	-
Stage 2	0	-		-	-
Platoon blocked, %				-	-
Mov Cap-1 Maneuver	-	548		-	-
Mov Cap-2 Maneuver	-	-		-	-
Stage 1	-	-		-	-
Stage 2	-	-		-	-

Approach	EB	SB
HCM Control Delay, s	13.6	0
HCM LOS	B	

Minor Lane/Major Mvmt	EBLn1	SBT	SBR
Capacity (veh/h)	548	-	-
HCM Lane V/C Ratio	0.238	-	-
HCM Control Delay (s)	13.6	-	-
HCM Lane LOS	B	-	-
HCM 95th %tile Q(veh)	0.9	-	-

Lanes, Volumes, Timings
23: S Interstate 35 Frontage Road & Love's Driveway

03/25/2021



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	0	236	0	0	1252	250
Future Volume (vph)	0	236	0	0	1252	250
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	0.95	0.95
Frt		0.865			0.975	
Flt Protected						
Satd. Flow (prot)	0	1315	0	0	3061	0
Flt Permitted						
Satd. Flow (perm)	0	1315	0	0	3061	0
Link Speed (mph)	30			55	55	
Link Distance (ft)	857			3340	2149	
Travel Time (s)	19.5			41.4	26.6	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	25%	0%	0%	13%	25%
Adj. Flow (vph)	0	257	0	0	1361	272
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	257	0	0	1633	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	0			0	0	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	60	60	15			9
Sign Control	Stop			Free	Free	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 63.9%		ICU Level of Service B	
Analysis Period (min) 15			

Intersection	
Int Delay, s/veh	10.7

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	0	236	0	0	1252	250
Future Vol, veh/h	0	236	0	0	1252	250
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	0	25	0	0	13	25
Mvmt Flow	0	257	0	0	1361	272

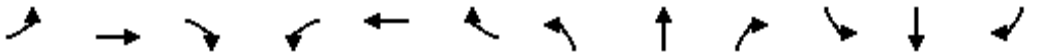
Major/Minor	Minor2		Major2	
Conflicting Flow All	-	817	-	0
Stage 1	-	-	-	-
Stage 2	-	-	-	-
Critical Hdwy	-	7.4	-	-
Critical Hdwy Stg 1	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-
Follow-up Hdwy	-	3.55	-	-
Pot Cap-1 Maneuver	0	275	-	-
Stage 1	0	-	-	-
Stage 2	0	-	-	-
Platoon blocked, %			-	-
Mov Cap-1 Maneuver	-	275	-	-
Mov Cap-2 Maneuver	-	-	-	-
Stage 1	-	-	-	-
Stage 2	-	-	-	-

Approach	EB	SB
HCM Control Delay, s	78.6	0
HCM LOS	F	

Minor Lane/Major Mvmt	EBLn1	SBT	SBR
Capacity (veh/h)	275	-	-
HCM Lane V/C Ratio	0.933	-	-
HCM Control Delay (s)	78.6	-	-
HCM Lane LOS	F	-	-
HCM 95th %tile Q(veh)	8.7	-	-

Lanes, Volumes, Timings
2: N Interstate 35 Frontage Road & Kohlenberg Road

03/26/2021



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	123	184	0	0	208	86	125	27	63	0	0	0
Future Volume (vph)	123	184	0	0	208	86	125	27	63	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		275	0		0	0		0
Storage Lanes	1		0	0		2	1		1	0		0
Taper Length (ft)	25			25			150			25		
Lane Util. Factor	0.91	0.91	1.00	1.00	0.91	1.00	1.00	0.95	1.00	1.00	1.00	1.00
Frt						0.850			0.850			
Flt Protected	0.950	0.994					0.950					
Satd. Flow (prot)	1380	2910	0	0	4803	1252	1421	2959	1392	0	0	0
Flt Permitted	0.950	0.994					0.950					
Satd. Flow (perm)	1380	2910	0	0	4803	1252	1421	2959	1392	0	0	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)						93			73			
Link Speed (mph)		40			40			55			55	
Link Distance (ft)		263			471			171			223	
Travel Time (s)		4.5			8.0			2.1			2.8	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	19%	18%	0%	0%	8%	29%	27%	22%	16%	0%	0%	0%
Adj. Flow (vph)	134	200	0	0	226	93	136	29	68	0	0	0
Shared Lane Traffic (%)	19%											
Lane Group Flow (vph)	109	225	0	0	226	93	136	29	68	0	0	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2			2	1	1	2	1			
Detector Template	Left	Thru			Thru	Right	Left	Thru	Right			
Leading Detector (ft)	20	100			100	20	20	100	20			
Trailing Detector (ft)	0	0			0	0	0	0	0			
Detector 1 Position(ft)	0	0			0	0	0	0	0			
Detector 1 Size(ft)	20	6			6	20	20	6	20			
Detector 1 Type	Cl+Ex	Cl+Ex			Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex			
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0			0.0	0.0	0.0	0.0	0.0			
Detector 1 Queue (s)	0.0	0.0			0.0	0.0	0.0	0.0	0.0			
Detector 1 Delay (s)	0.0	0.0			0.0	0.0	0.0	0.0	0.0			
Detector 2 Position(ft)		94			94			94				
Detector 2 Size(ft)		6			6			6				
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex				
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0				
Turn Type	Split	NA			NA	Perm	Perm	NA	Perm			
Protected Phases	4	4			8			2				

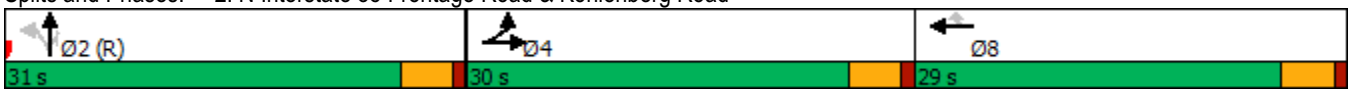
Lanes, Volumes, Timings
2: N Interstate 35 Frontage Road & Kohlenberg Road

03/26/2021

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases						8	2		2			
Detector Phase	4	4			8	8	2	2	2			
Switch Phase												
Minimum Initial (s)	5.0	5.0			5.0	5.0	5.0	5.0	5.0			
Minimum Split (s)	22.5	22.5			22.5	22.5	22.5	22.5	22.5			
Total Split (s)	30.0	30.0			29.0	29.0	31.0	31.0	31.0			
Total Split (%)	33.3%	33.3%			32.2%	32.2%	34.4%	34.4%	34.4%			
Maximum Green (s)	25.5	25.5			24.5	24.5	26.5	26.5	26.5			
Yellow Time (s)	3.5	3.5			3.5	3.5	3.5	3.5	3.5			
All-Red Time (s)	1.0	1.0			1.0	1.0	1.0	1.0	1.0			
Lost Time Adjust (s)	0.0	0.0			0.0	0.0	0.0	0.0	0.0			
Total Lost Time (s)	4.5	4.5			4.5	4.5	4.5	4.5	4.5			
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0	3.0			
Recall Mode	None	None			None	None	C-Max	C-Max	C-Max			
Walk Time (s)	7.0	7.0			7.0	7.0	7.0	7.0	7.0			
Flash Dont Walk (s)	11.0	11.0			11.0	11.0	11.0	11.0	11.0			
Pedestrian Calls (#/hr)	0	0			0	0	0	0	0			
Act Effct Green (s)	13.0	13.0			9.6	9.6	53.9	53.9	53.9			
Actuated g/C Ratio	0.14	0.14			0.11	0.11	0.60	0.60	0.60			
v/c Ratio	0.55	0.54			0.44	0.43	0.16	0.02	0.08			
Control Delay	17.9	12.1			40.2	14.7	10.0	9.2	2.8			
Queue Delay	0.0	0.0			0.0	0.0	0.0	0.0	0.0			
Total Delay	17.9	12.1			40.2	14.7	10.0	9.2	2.8			
LOS	B	B			D	B	A	A	A			
Approach Delay		14.0			32.8			7.8				
Approach LOS		B			C			A				

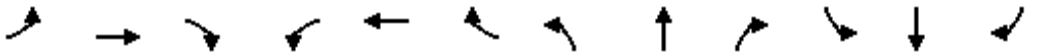
Intersection Summary			
Area Type:	Other		
Cycle Length: 90			
Actuated Cycle Length: 90			
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:, Start of Green			
Natural Cycle: 70			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.55			
Intersection Signal Delay: 19.1		Intersection LOS: B	
Intersection Capacity Utilization 33.0%		ICU Level of Service A	
Analysis Period (min) 15			

Splits and Phases: 2: N Interstate 35 Frontage Road & Kohlenberg Road



HCM 6th Signalized Intersection Summary
2: N Interstate 35 Frontage Road & Kohlenberg Road

03/26/2021



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	123	184	0	0	208	86	125	27	63	0	0	0
Future Volume (veh/h)	123	184	0	0	208	86	125	27	63	0	0	0
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0			
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00			
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			
Work Zone On Approach		No			No			No				
Adj Sat Flow, veh/h/ln	1618	1633	0	0	1781	1470	1500	1574	1663			
Adj Flow Rate, veh/h	111	232	0	0	226	0	136	29	0			
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92			
Percent Heavy Veh, %	19	18	0	0	8	29	27	22	16			
Cap, veh/h	167	354	0	0	390		945	1978				
Arrive On Green	0.11	0.11	0.00	0.00	0.08	0.00	0.66	0.66	0.00			
Sat Flow, veh/h	1541	3266	0	0	5024	1246	1428	2991	1409			
Grp Volume(v), veh/h	111	232	0	0	226	0	136	29	0			
Grp Sat Flow(s),veh/h/ln	1541	1633	0	0	1621	1246	1428	1495	1409			
Q Serve(g_s), s	6.2	6.1	0.0	0.0	4.0	0.0	3.2	0.3	0.0			
Cycle Q Clear(g_c), s	6.2	6.1	0.0	0.0	4.0	0.0	3.2	0.3	0.0			
Prop In Lane	1.00		0.00	0.00		1.00	1.00		1.00			
Lane Grp Cap(c), veh/h	167	354	0	0	390		945	1978				
V/C Ratio(X)	0.66	0.66	0.00	0.00	0.58		0.14	0.01				
Avail Cap(c_a), veh/h	437	926	0	0	1324		945	1978				
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			
Upstream Filter(I)	0.93	0.93	0.00	0.00	1.00	0.00	1.00	1.00	0.00			
Uniform Delay (d), s/veh	38.6	38.5	0.0	0.0	39.9	0.0	5.7	5.2	0.0			
Incr Delay (d2), s/veh	4.2	1.9	0.0	0.0	1.4	0.0	0.3	0.0	0.0			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln	2.5	2.5	0.0	0.0	1.6	0.0	0.7	0.1	0.0			
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	42.7	40.4	0.0	0.0	41.3	0.0	6.0	5.2	0.0			
LnGrp LOS	D	D	A	A	D		A	A				
Approach Vol, veh/h		343			226	A		165	A			
Approach Delay, s/veh		41.2			41.3			5.9				
Approach LOS		D			D			A				
Timer - Assigned Phs		2		4				8				
Phs Duration (G+Y+Rc), s		64.0		14.2				11.7				
Change Period (Y+Rc), s		4.5		4.5				4.5				
Max Green Setting (Gmax), s		26.5		25.5				24.5				
Max Q Clear Time (g_c+I1), s		5.2		8.2				6.0				
Green Ext Time (p_c), s		0.5		1.5				1.2				

Intersection Summary	
HCM 6th Ctrl Delay	33.3
HCM 6th LOS	C

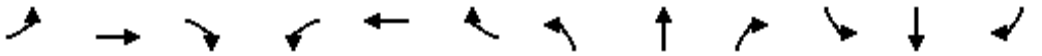
Notes

User approved volume balancing among the lanes for turning movement.

Unsignalized Delay for [NBR, WBR] is excluded from calculations of the approach delay and intersection delay.

Lanes, Volumes, Timings
3: S Interstate 35 Frontage Road & Conrads Lane/Kohlenberg Road

03/26/2021



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	269	344	96	237	0	0	0	0	38	188	87
Future Volume (vph)	0	269	344	96	237	0	0	0	0	38	188	87
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		275	0		0	0		0	0		0
Storage Lanes	0		2	1		0	0		0	1		1
Taper Length (ft)	25			25			25			150		
Lane Util. Factor	1.00	0.91	1.00	0.91	0.91	1.00	1.00	1.00	1.00	0.91	0.91	1.00
Frt			0.850									0.850
Flt Protected				0.950	0.998					0.950	0.999	
Satd. Flow (prot)	0	4590	1302	1480	2980	0	0	0	0	1040	2885	1122
Flt Permitted				0.950	0.998					0.950	0.999	
Satd. Flow (perm)	0	4590	1302	1480	2980	0	0	0	0	1040	2885	1122
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			374									95
Link Speed (mph)		40			40			55			55	
Link Distance (ft)		426			263			205			185	
Travel Time (s)		7.3			4.5			2.5			2.3	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	13%	24%	11%	16%	0%	0%	0%	0%	58%	19%	44%
Adj. Flow (vph)	0	292	374	104	258	0	0	0	0	41	204	95
Shared Lane Traffic (%)				10%						10%		
Lane Group Flow (vph)	0	292	374	94	268	0	0	0	0	37	208	95
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors		2	1	1	2					1	2	1
Detector Template		Thru	Right	Left	Thru					Left	Thru	Right
Leading Detector (ft)		100	20	20	100					20	100	20
Trailing Detector (ft)		0	0	0	0					0	0	0
Detector 1 Position(ft)		0	0	0	0					0	0	0
Detector 1 Size(ft)		6	20	20	6					20	6	20
Detector 1 Type		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex					Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)		0.0	0.0	0.0	0.0					0.0	0.0	0.0
Detector 1 Queue (s)		0.0	0.0	0.0	0.0					0.0	0.0	0.0
Detector 1 Delay (s)		0.0	0.0	0.0	0.0					0.0	0.0	0.0
Detector 2 Position(ft)		94			94						94	
Detector 2 Size(ft)		6			6						6	
Detector 2 Type		Cl+Ex			Cl+Ex						Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0						0.0	
Turn Type		NA	Perm	Split	NA					Perm	NA	Perm
Protected Phases		4		8	8						6	

Lanes, Volumes, Timings
3: S Interstate 35 Frontage Road & Conrads Lane/Kohlenberg Road

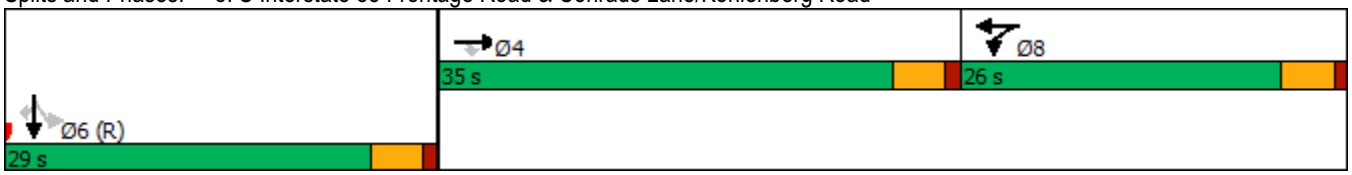
03/26/2021

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases			4							6		6
Detector Phase		4	4	8	8					6	6	6
Switch Phase												
Minimum Initial (s)		5.0	5.0	5.0	5.0					5.0	5.0	5.0
Minimum Split (s)		22.5	22.5	22.5	22.5					22.5	22.5	22.5
Total Split (s)		35.0	35.0	26.0	26.0					29.0	29.0	29.0
Total Split (%)		38.9%	38.9%	28.9%	28.9%					32.2%	32.2%	32.2%
Maximum Green (s)		30.5	30.5	21.5	21.5					24.5	24.5	24.5
Yellow Time (s)		3.5	3.5	3.5	3.5					3.5	3.5	3.5
All-Red Time (s)		1.0	1.0	1.0	1.0					1.0	1.0	1.0
Lost Time Adjust (s)		0.0	0.0	0.0	0.0					0.0	0.0	0.0
Total Lost Time (s)		4.5	4.5	4.5	4.5					4.5	4.5	4.5
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)		3.0	3.0	3.0	3.0					3.0	3.0	3.0
Recall Mode		None	None	None	None					C-Max	C-Max	C-Max
Walk Time (s)		7.0	7.0	7.0	7.0					7.0	7.0	7.0
Flash Dont Walk (s)		11.0	11.0	11.0	11.0					11.0	11.0	11.0
Pedestrian Calls (#/hr)		0	0	0	0					0	0	0
Act Effct Green (s)		13.7	13.7	13.5	13.5					49.3	49.3	49.3
Actuated g/C Ratio		0.15	0.15	0.15	0.15					0.55	0.55	0.55
v/c Ratio		0.42	0.73	0.42	0.60					0.06	0.13	0.14
Control Delay		35.4	12.4	28.2	28.5					13.4	12.2	4.1
Queue Delay		0.0	0.0	0.0	0.0					0.0	0.0	0.0
Total Delay		35.4	12.4	28.2	28.5					13.4	12.2	4.1
LOS		D	B	C	C					B	B	A
Approach Delay		22.5			28.4						10.1	
Approach LOS		C			C						B	

Intersection Summary

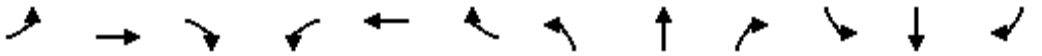
Area Type: Other
Cycle Length: 90
Actuated Cycle Length: 90
Offset: 0 (0%), Referenced to phase 2: and 6:SBTL, Start of Green, Master Intersection
Natural Cycle: 70
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.73
Intersection Signal Delay: 21.0 Intersection LOS: C
Intersection Capacity Utilization 33.0% ICU Level of Service A
Analysis Period (min) 15

Splits and Phases: 3: S Interstate 35 Frontage Road & Conrads Lane/Kohlenberg Road



HCM 6th Signalized Intersection Summary
3: S Interstate 35 Frontage Road & Conrads Lane/Kohlenberg Road

03/26/2021



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	269	344	96	237	0	0	0	0	38	188	87
Future Volume (veh/h)	0	269	344	96	237	0	0	0	0	38	188	87
Initial Q (Qb), veh	0	0	0	0	0	0				0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00				1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00				1.00	1.00	1.00
Work Zone On Approach		No			No						No	
Adj Sat Flow, veh/h/ln	0	1707	1544	1737	1663	0				1040	1618	1248
Adj Flow Rate, veh/h	0	292	0	104	258	0				41	204	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92				0.92	0.92	0.92
Percent Heavy Veh, %	0	13	24	11	16	0				58	19	44
Cap, veh/h	0	475		190	382	0				627	2050	
Arrive On Green	0.00	0.10	0.00	0.04	0.04	0.00				0.63	0.63	0.00
Sat Flow, veh/h	0	4815	1309	1654	3326	0				991	3237	1058
Grp Volume(v), veh/h	0	292	0	104	258	0				41	204	0
Grp Sat Flow(s),veh/h/ln	0	1554	1309	1654	1663	0				991	1618	1058
Q Serve(g_s), s	0.0	5.4	0.0	5.6	6.9	0.0				1.4	2.2	0.0
Cycle Q Clear(g_c), s	0.0	5.4	0.0	5.6	6.9	0.0				1.4	2.2	0.0
Prop In Lane	0.00		1.00	1.00		0.00				1.00		1.00
Lane Grp Cap(c), veh/h	0	475		190	382	0				627	2050	
V/C Ratio(X)	0.00	0.61		0.55	0.68	0.00				0.07	0.10	
Avail Cap(c_a), veh/h	0	1580		395	794	0				627	2050	
HCM Platoon Ratio	1.00	1.00	1.00	0.33	0.33	1.00				1.00	1.00	1.00
Upstream Filter(I)	0.00	1.00	0.00	0.95	0.95	0.00				1.00	1.00	0.00
Uniform Delay (d), s/veh	0.0	38.7	0.0	41.0	41.6	0.0				6.3	6.5	0.0
Incr Delay (d2), s/veh	0.0	1.3	0.0	2.3	2.0	0.0				0.2	0.1	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0				0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	2.0	0.0	2.4	3.0	0.0				0.3	0.6	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	0.0	40.0	0.0	43.3	43.6	0.0				6.5	6.6	0.0
LnGrp LOS	A	D		D	D	A				A	A	
Approach Vol, veh/h		292	A		362						245	A
Approach Delay, s/veh		40.0			43.5						6.6	
Approach LOS		D			D						A	

Timer - Assigned Phs		4		6		8						
Phs Duration (G+Y+Rc), s		13.7		61.5		14.8						
Change Period (Y+Rc), s		4.5		4.5		4.5						
Max Green Setting (Gmax), s		30.5		24.5		21.5						
Max Q Clear Time (g_c+I1), s		7.4		4.2		8.9						
Green Ext Time (p_c), s		1.8		1.1		1.4						

Intersection Summary		
HCM 6th Ctrl Delay	32.3	
HCM 6th LOS	C	

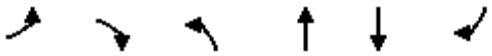
Notes

User approved volume balancing among the lanes for turning movement.

Unsignalized Delay for [EBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Lanes, Volumes, Timings
6: N Interstate 35 Frontage Road

03/26/2021



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	31	0	0	236	0	0
Future Volume (vph)	31	0	0	236	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	0.91	1.00	1.00
Frt						
Flt Protected	0.950					
Satd. Flow (prot)	1517	0	0	4217	0	0
Flt Permitted	0.950					
Satd. Flow (perm)	1517	0	0	4217	0	0
Link Speed (mph)	30			55	55	
Link Distance (ft)	262			223	1233	
Travel Time (s)	6.0			2.8	15.3	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	19%	0%	0%	23%	0%	0%
Adj. Flow (vph)	34	0	0	257	0	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	34	0	0	257	0	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	12			0	0	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9	15			9
Sign Control	Yield			Free	Free	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 14.6%		ICU Level of Service A	
Analysis Period (min) 15			

Lanes, Volumes, Timings
7: S Interstate 35 Frontage Road

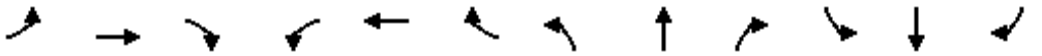
03/26/2021

Lane Group	WBL	WBR	NBL	NBT	NBR	SBL	SBT	SBR	SEL	SER
Lane Configurations										
Traffic Volume (vph)	0	0	0	0	0	31	313	0	0	0
Future Volume (vph)	0	0	0	0	0	31	313	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0	0	0		0	475		475	0	0
Storage Lanes	0	0	0		0	2		1	0	0
Taper Length (ft)	25		25			100			25	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.86	0.86	1.00	1.00
Frt										
Flt Protected						0.950				
Satd. Flow (prot)	0	0	0	0	0	1517	5028	0	0	0
Flt Permitted						0.950				
Satd. Flow (perm)	0	0	0	0	0	1517	5028	0	0	0
Link Speed (mph)	30			55			55		30	
Link Distance (ft)	262			185			1270		123	
Travel Time (s)	6.0			2.3			15.7		2.8	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	0%	0%	0%	0%	19%	30%	0%	0%	0%
Adj. Flow (vph)	0	0	0	0	0	34	340	0	0	0
Shared Lane Traffic (%)										
Lane Group Flow (vph)	0	0	0	0	0	34	340	0	0	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Right	Left	Left	Right	Left	Right
Median Width(ft)	0			12			12		0	
Link Offset(ft)	0			0			0		0	
Crosswalk Width(ft)	16			16			16		16	
Two way Left Turn Lane										
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9	15		9	15		9	15	9
Sign Control	Free			Free			Free		Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 7.9%		ICU Level of Service A	
Analysis Period (min) 15			

Lanes, Volumes, Timings
8: N Interstate 35 Frontage Road

03/26/2021

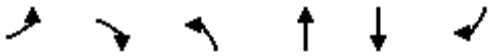


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	0	0	0	165	215	0	0	0	0
Future Volume (vph)	0	0	0	0	0	0	165	215	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		0	475		475	0		0
Storage Lanes	0		0	0		0	2		1	0		0
Taper Length (ft)	25			25			150			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.86	0.86	1.00	1.00	1.00
Frt												
Flt Protected							0.950					
Satd. Flow (prot)	0	0	0	0	0	0	1597	5314	0	0	0	0
Flt Permitted							0.950					
Satd. Flow (perm)	0	0	0	0	0	0	1597	5314	0	0	0	0
Link Speed (mph)		30			30			55			55	
Link Distance (ft)		266			141			6650			171	
Travel Time (s)		6.0			3.2			82.4			2.1	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	13%	23%	0%	0%	0%	0%
Adj. Flow (vph)	0	0	0	0	0	0	179	234	0	0	0	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	0	0	0	0	0	179	234	0	0	0	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Free			Stop			Free			Free	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 27.9%		ICU Level of Service A	
Analysis Period (min) 15			

Lanes, Volumes, Timings
9: N Interstate 35 Frontage Road & I-35 NB Off Ramp

03/26/2021



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	309	0	0	713	0	0
Future Volume (vph)	309	0	0	713	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	0.95	1.00	1.00
Frt						
Flt Protected	0.950					
Satd. Flow (prot)	1597	0	0	3312	0	0
Flt Permitted	0.950					
Satd. Flow (perm)	1597	0	0	3312	0	0
Link Speed (mph)	45			55	55	
Link Distance (ft)	469			818	6650	
Travel Time (s)	7.1			10.1	82.4	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	13%	0%	0%	9%	0%	0%
Adj. Flow (vph)	336	0	0	775	0	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	336	0	0	775	0	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	12			24	24	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9	15			9
Sign Control	Yield			Free	Free	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 43.5%		ICU Level of Service A	
Analysis Period (min) 15			

Lanes, Volumes, Timings
12: S Interstate 35 Frontage Road

03/26/2021

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	165	0	0	0	0	628
Future Volume (vph)	165	0	0	0	0	628
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	0.91
Frt						
Flt Protected	0.950					
Satd. Flow (prot)	1597	0	0	0	0	4287
Flt Permitted	0.950					
Satd. Flow (perm)	1597	0	0	0	0	4287
Link Speed (mph)	30		55			55
Link Distance (ft)	266		1391			205
Travel Time (s)	6.0		17.2			2.5
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	13%	0%	0%	0%	0%	21%
Adj. Flow (vph)	179	0	0	0	0	683
Shared Lane Traffic (%)						
Lane Group Flow (vph)	179	0	0	0	0	683
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(ft)	12		0			0
Link Offset(ft)	0		0			0
Crosswalk Width(ft)	16		16			16
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9		9	15	
Sign Control	Yield		Free			Free

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 27.9%		ICU Level of Service A	
Analysis Period (min) 15			

Lanes, Volumes, Timings
13: S Interstate 35 Frontage Road & I-35 SB Off Ramp

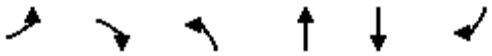
03/26/2021

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	530	0	0	0	0	972
Future Volume (vph)	530	0	0	0	0	972
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	0.95
Frt						
Flt Protected	0.950					
Satd. Flow (prot)	1583	0	0	0	0	3112
Flt Permitted	0.950					
Satd. Flow (perm)	1583	0	0	0	0	3112
Link Speed (mph)	45		55			30
Link Distance (ft)	349		2149			497
Travel Time (s)	5.3		26.6			11.3
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	14%	0%	0%	0%	0%	16%
Adj. Flow (vph)	576	0	0	0	0	1057
Shared Lane Traffic (%)						
Lane Group Flow (vph)	576	0	0	0	0	1057
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(ft)	12		0			0
Link Offset(ft)	0		0			0
Crosswalk Width(ft)	16		16			16
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9		9	15	
Sign Control	Yield		Free			Free

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 62.9%		ICU Level of Service B	
Analysis Period (min) 15			

Lanes, Volumes, Timings
17: S Interstate 35 Frontage Road & Oak Creek Way

03/26/2021



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	0	120	0	0	852	40
Future Volume (vph)	0	120	0	0	852	40
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0	0	0			315
Storage Lanes	0	1	0			1
Taper Length (ft)	25		25			
Lane Util. Factor	1.00	1.00	1.00	1.00	0.95	1.00
Frt		0.865				0.850
Flt Protected						
Satd. Flow (prot)	0	1627	0	0	3059	1568
Flt Permitted						
Satd. Flow (perm)	0	1627	0	0	3059	1568
Link Speed (mph)	30			55	55	
Link Distance (ft)	1047			497	1391	
Travel Time (s)	23.8			6.2	17.2	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	1%	0%	0%	18%	3%
Adj. Flow (vph)	0	130	0	0	926	43
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	130	0	0	926	43
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	0			0	0	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9	15			9
Sign Control	Stop			Free	Free	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 37.6%		ICU Level of Service A	
Analysis Period (min) 15			

Intersection	
Int Delay, s/veh	1.6

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	0	120	0	0	852	40
Future Vol, veh/h	0	120	0	0	852	40
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	-	315
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	0	1	0	0	18	3
Mvmt Flow	0	130	0	0	926	43

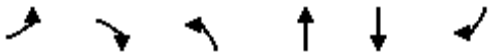
Major/Minor	Minor2			Major2	
Conflicting Flow All	-	463		-	0
Stage 1	-	-		-	-
Stage 2	-	-		-	-
Critical Hdwy	-	6.92		-	-
Critical Hdwy Stg 1	-	-		-	-
Critical Hdwy Stg 2	-	-		-	-
Follow-up Hdwy	-	3.31		-	-
Pot Cap-1 Maneuver	0	548		-	-
Stage 1	0	-		-	-
Stage 2	0	-		-	-
Platoon blocked, %				-	-
Mov Cap-1 Maneuver	-	548		-	-
Mov Cap-2 Maneuver	-	-		-	-
Stage 1	-	-		-	-
Stage 2	-	-		-	-

Approach	EB	SB
HCM Control Delay, s	13.6	0
HCM LOS	B	

Minor Lane/Major Mvmt	EBLn1	SBT	SBR
Capacity (veh/h)	548	-	-
HCM Lane V/C Ratio	0.238	-	-
HCM Control Delay (s)	13.6	-	-
HCM Lane LOS	B	-	-
HCM 95th %tile Q(veh)	0.9	-	-

Lanes, Volumes, Timings
23: S Interstate 35 Frontage Road & Love's Driveway

03/26/2021



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	0	236	0	0	1252	250
Future Volume (vph)	0	236	0	0	1252	250
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0	0	0			510
Storage Lanes	0	1	0			1
Taper Length (ft)	25		25			
Lane Util. Factor	1.00	1.00	1.00	1.00	0.95	1.00
Frt		0.865				0.850
Flt Protected						
Satd. Flow (prot)	0	1315	0	0	3195	1292
Flt Permitted						
Satd. Flow (perm)	0	1315	0	0	3195	1292
Link Speed (mph)	30			55	55	
Link Distance (ft)	857			3340	2149	
Travel Time (s)	19.5			41.4	26.6	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	25%	0%	0%	13%	25%
Adj. Flow (vph)	0	257	0	0	1361	272
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	257	0	0	1361	272
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	0			0	0	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	60	60	15			9
Sign Control	Stop			Free	Free	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 55.9%		ICU Level of Service B	
Analysis Period (min) 15			

HCM 6th TWSC
23: S Interstate 35 Frontage Road & Love's Driveway 03/26/2021

Intersection	
Int Delay, s/veh	5.6

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	0	236	0	0	1252	250
Future Vol, veh/h	0	236	0	0	1252	250
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	-	510
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	0	25	0	0	13	25
Mvmt Flow	0	257	0	0	1361	272

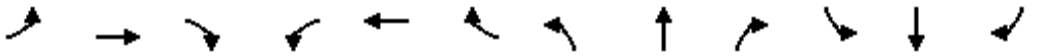
Major/Minor	Minor2		Major2	
Conflicting Flow All	-	681	-	0
Stage 1	-	-	-	-
Stage 2	-	-	-	-
Critical Hdwy	-	7.4	-	-
Critical Hdwy Stg 1	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-
Follow-up Hdwy	-	3.55	-	-
Pot Cap-1 Maneuver	0	343	-	-
Stage 1	0	-	-	-
Stage 2	0	-	-	-
Platoon blocked, %			-	-
Mov Cap-1 Maneuver	-	343	-	-
Mov Cap-2 Maneuver	-	-	-	-
Stage 1	-	-	-	-
Stage 2	-	-	-	-

Approach	EB	SB
HCM Control Delay, s	40.9	0
HCM LOS	E	

Minor Lane/Major Mvmt	EBLn1	SBT	SBR
Capacity (veh/h)	343	-	-
HCM Lane V/C Ratio	0.748	-	-
HCM Control Delay (s)	40.9	-	-
HCM Lane LOS	E	-	-
HCM 95th %tile Q(veh)	5.8	-	-

Lanes, Volumes, Timings
2: N Interstate 35 Frontage Road & Kohlenberg Road

03/25/2021



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	82	148	0	0	309	60	220	36	79	0	0	0
Future Volume (vph)	82	148	0	0	309	60	220	36	79	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		275	0		0	0		0
Storage Lanes	1		0	0		2	1		1	0		0
Taper Length (ft)	25			25			150			25		
Lane Util. Factor	0.91	0.91	1.00	1.00	0.91	1.00	1.00	0.95	1.00	1.00	1.00	1.00
Frt						0.850			0.850			
Flt Protected	0.950	0.997					0.950					
Satd. Flow (prot)	1493	3161	0	0	4988	1615	1597	3167	1568	0	0	0
Flt Permitted	0.950	0.997					0.950					
Satd. Flow (perm)	1493	3161	0	0	4988	1615	1597	3167	1568	0	0	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)						73			86			
Link Speed (mph)		40			40			55			55	
Link Distance (ft)		263			471			171			223	
Travel Time (s)		4.5			8.0			2.1			2.8	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	10%	9%	0%	0%	4%	0%	13%	14%	3%	0%	0%	0%
Adj. Flow (vph)	89	161	0	0	336	65	239	39	86	0	0	0
Shared Lane Traffic (%)	10%											
Lane Group Flow (vph)	80	170	0	0	336	65	239	39	86	0	0	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2			2	1	1	2	1			
Detector Template	Left	Thru			Thru	Right	Left	Thru	Right			
Leading Detector (ft)	20	100			100	20	20	100	20			
Trailing Detector (ft)	0	0			0	0	0	0	0			
Detector 1 Position(ft)	0	0			0	0	0	0	0			
Detector 1 Size(ft)	20	6			6	20	20	6	20			
Detector 1 Type	Cl+Ex	Cl+Ex			Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex			
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0			0.0	0.0	0.0	0.0	0.0			
Detector 1 Queue (s)	0.0	0.0			0.0	0.0	0.0	0.0	0.0			
Detector 1 Delay (s)	0.0	0.0			0.0	0.0	0.0	0.0	0.0			
Detector 2 Position(ft)		94			94			94				
Detector 2 Size(ft)		6			6			6				
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex				
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0				
Turn Type	Split	NA			NA	Perm	Perm	NA	Perm			
Protected Phases	4	4			8			2				

Lanes, Volumes, Timings
2: N Interstate 35 Frontage Road & Kohlenberg Road

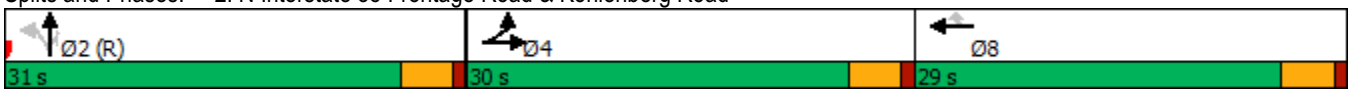
03/25/2021

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases						8	2		2			
Detector Phase	4	4			8	8	2	2	2			
Switch Phase												
Minimum Initial (s)	5.0	5.0			5.0	5.0	5.0	5.0	5.0			
Minimum Split (s)	22.5	22.5			22.5	22.5	22.5	22.5	22.5			
Total Split (s)	30.0	30.0			29.0	29.0	31.0	31.0	31.0			
Total Split (%)	33.3%	33.3%			32.2%	32.2%	34.4%	34.4%	34.4%			
Maximum Green (s)	25.5	25.5			24.5	24.5	26.5	26.5	26.5			
Yellow Time (s)	3.5	3.5			3.5	3.5	3.5	3.5	3.5			
All-Red Time (s)	1.0	1.0			1.0	1.0	1.0	1.0	1.0			
Lost Time Adjust (s)	0.0	0.0			0.0	0.0	0.0	0.0	0.0			
Total Lost Time (s)	4.5	4.5			4.5	4.5	4.5	4.5	4.5			
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0	3.0			
Recall Mode	None	None			None	None	C-Max	C-Max	C-Max			
Walk Time (s)	7.0	7.0			7.0	7.0	7.0	7.0	7.0			
Flash Dont Walk (s)	11.0	11.0			11.0	11.0	11.0	11.0	11.0			
Pedestrian Calls (#/hr)	0	0			0	0	0	0	0			
Act Effct Green (s)	10.6	10.6			11.6	11.6	54.4	54.4	54.4			
Actuated g/C Ratio	0.12	0.12			0.13	0.13	0.60	0.60	0.60			
v/c Ratio	0.46	0.46			0.53	0.24	0.25	0.02	0.09			
Control Delay	34.6	30.0			39.3	9.8	10.2	8.8	2.6			
Queue Delay	0.0	0.0			0.0	0.0	0.0	0.0	0.0			
Total Delay	34.6	30.0			39.3	9.8	10.2	8.8	2.6			
LOS	C	C			D	A	B	A	A			
Approach Delay		31.5			34.6			8.2				
Approach LOS		C			C			A				

Intersection Summary

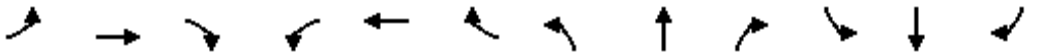
Area Type: Other
Cycle Length: 90
Actuated Cycle Length: 90
Offset: 16 (18%), Referenced to phase 2:NBTL and 6:, Start of Green
Natural Cycle: 70
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.53
Intersection Signal Delay: 24.4 Intersection LOS: C
Intersection Capacity Utilization 35.0% ICU Level of Service A
Analysis Period (min) 15

Splits and Phases: 2: N Interstate 35 Frontage Road & Kohlenberg Road



HCM 6th Signalized Intersection Summary
2: N Interstate 35 Frontage Road & Kohlenberg Road

03/25/2021



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	82	148	0	0	309	60	220	36	79	0	0	0
Future Volume (veh/h)	82	148	0	0	309	60	220	36	79	0	0	0
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0			
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00			
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			
Work Zone On Approach		No			No			No				
Adj Sat Flow, veh/h/ln	1752	1767	0	0	1841	1900	1707	1693	1856			
Adj Flow Rate, veh/h	83	169	0	0	336	0	239	39	0			
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92			
Percent Heavy Veh, %	10	9	0	0	4	0	13	14	3			
Cap, veh/h	137	290	0	0	536		1075	2126				
Arrive On Green	0.08	0.08	0.00	0.00	0.11	0.00	0.66	0.66	0.00			
Sat Flow, veh/h	1668	3533	0	0	5191	1610	1626	3216	1572			
Grp Volume(v), veh/h	83	169	0	0	336	0	239	39	0			
Grp Sat Flow(s),veh/h/ln	1668	1767	0	0	1675	1610	1626	1608	1572			
Q Serve(g_s), s	4.3	4.1	0.0	0.0	5.8	0.0	5.3	0.4	0.0			
Cycle Q Clear(g_c), s	4.3	4.1	0.0	0.0	5.8	0.0	5.3	0.4	0.0			
Prop In Lane	1.00		0.00	0.00		1.00	1.00		1.00			
Lane Grp Cap(c), veh/h	137	290	0	0	536		1075	2126				
V/C Ratio(X)	0.61	0.58	0.00	0.00	0.63		0.22	0.02				
Avail Cap(c_a), veh/h	473	1001	0	0	1368		1075	2126				
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			
Upstream Filter(I)	0.98	0.98	0.00	0.00	1.00	0.00	1.00	1.00	0.00			
Uniform Delay (d), s/veh	39.9	39.8	0.0	0.0	38.5	0.0	6.1	5.2	0.0			
Incr Delay (d2), s/veh	4.2	1.8	0.0	0.0	1.2	0.0	0.5	0.0	0.0			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln	1.9	1.8	0.0	0.0	2.3	0.0	1.4	0.1	0.0			
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	44.1	41.6	0.0	0.0	39.7	0.0	6.5	5.2	0.0			
LnGrp LOS	D	D	A	A	D		A	A				
Approach Vol, veh/h		252			336	A		278	A			
Approach Delay, s/veh		42.4			39.7			6.4				
Approach LOS		D			D			A				
Timer - Assigned Phs		2		4				8				
Phs Duration (G+Y+Rc), s		64.0		11.9				14.1				
Change Period (Y+Rc), s		4.5		4.5				4.5				
Max Green Setting (Gmax), s		26.5		25.5				24.5				
Max Q Clear Time (g_c+I1), s		7.3		6.3				7.8				
Green Ext Time (p_c), s		0.8		1.1				1.8				

Intersection Summary	
HCM 6th Ctrl Delay	29.8
HCM 6th LOS	C

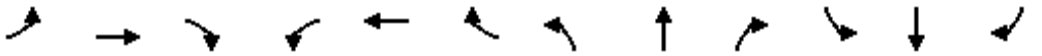
Notes

User approved volume balancing among the lanes for turning movement.

Unsignalized Delay for [NBR, WBR] is excluded from calculations of the approach delay and intersection delay.

Lanes, Volumes, Timings
3: S Interstate 35 Frontage Road & Conrads Lane/Kohlenberg Road

03/25/2021



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑↑	↱	↰	↰↑↑					↰	↰↑↑	↱
Traffic Volume (vph)	0	159	246	143	386	0	0	0	0	71	592	127
Future Volume (vph)	0	159	246	143	386	0	0	0	0	71	592	127
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		275	0		0	0		0	0		0
Storage Lanes	0		2	1		0	0		0	1		1
Taper Length (ft)	25			25			25			150		
Lane Util. Factor	1.00	0.91	1.00	0.91	0.91	1.00	1.00	1.00	1.00	0.91	0.91	1.00
Frt			0.850									0.850
Flt Protected				0.950	0.998					0.950	0.999	
Satd. Flow (prot)	0	4673	1404	1550	3198	0	0	0	0	1550	3229	1205
Flt Permitted				0.950	0.998					0.950	0.999	
Satd. Flow (perm)	0	4673	1404	1550	3198	0	0	0	0	1550	3229	1205
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			246									138
Link Speed (mph)		40			40			55			55	
Link Distance (ft)		426			263			205			185	
Travel Time (s)		7.3			4.5			2.5			2.3	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	11%	15%	6%	8%	0%	0%	0%	0%	6%	7%	34%
Adj. Flow (vph)	0	173	267	155	420	0	0	0	0	77	643	138
Shared Lane Traffic (%)				10%						10%		
Lane Group Flow (vph)	0	173	267	139	436	0	0	0	0	69	651	138
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors		2	1	1	2					1	2	1
Detector Template		Thru	Right	Left	Thru					Left	Thru	Right
Leading Detector (ft)		100	20	20	100					20	100	20
Trailing Detector (ft)		0	0	0	0					0	0	0
Detector 1 Position(ft)		0	0	0	0					0	0	0
Detector 1 Size(ft)		6	20	20	6					20	6	20
Detector 1 Type		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex					Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)		0.0	0.0	0.0	0.0					0.0	0.0	0.0
Detector 1 Queue (s)		0.0	0.0	0.0	0.0					0.0	0.0	0.0
Detector 1 Delay (s)		0.0	0.0	0.0	0.0					0.0	0.0	0.0
Detector 2 Position(ft)		94			94						94	
Detector 2 Size(ft)		6			6						6	
Detector 2 Type		Cl+Ex			Cl+Ex						Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0						0.0	
Turn Type		NA	Perm	Split	NA					Perm	NA	Perm
Protected Phases		4		8	8						6	

Lanes, Volumes, Timings
3: S Interstate 35 Frontage Road & Conrads Lane/Kohlenberg Road

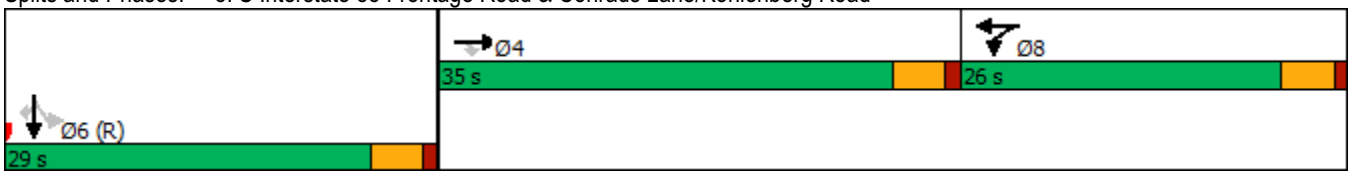
03/25/2021

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases			4							6		6
Detector Phase		4	4	8	8					6	6	6
Switch Phase												
Minimum Initial (s)		5.0	5.0	5.0	5.0					5.0	5.0	5.0
Minimum Split (s)		22.5	22.5	22.5	22.5					22.5	22.5	22.5
Total Split (s)		35.0	35.0	26.0	26.0					29.0	29.0	29.0
Total Split (%)		38.9%	38.9%	28.9%	28.9%					32.2%	32.2%	32.2%
Maximum Green (s)		30.5	30.5	21.5	21.5					24.5	24.5	24.5
Yellow Time (s)		3.5	3.5	3.5	3.5					3.5	3.5	3.5
All-Red Time (s)		1.0	1.0	1.0	1.0					1.0	1.0	1.0
Lost Time Adjust (s)		0.0	0.0	0.0	0.0					0.0	0.0	0.0
Total Lost Time (s)		4.5	4.5	4.5	4.5					4.5	4.5	4.5
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)		3.0	3.0	3.0	3.0					3.0	3.0	3.0
Recall Mode		None	None	None	None					C-Max	C-Max	C-Max
Walk Time (s)		7.0	7.0	7.0	7.0					7.0	7.0	7.0
Flash Dont Walk (s)		11.0	11.0	11.0	11.0					11.0	11.0	11.0
Pedestrian Calls (#/hr)		0	0	0	0					0	0	0
Act Effct Green (s)		10.7	10.7	18.0	18.0					47.8	47.8	47.8
Actuated g/C Ratio		0.12	0.12	0.20	0.20					0.53	0.53	0.53
v/c Ratio		0.31	0.70	0.45	0.68					0.08	0.38	0.20
Control Delay		36.5	16.5	53.2	58.0					13.8	14.9	3.8
Queue Delay		0.0	0.0	0.0	0.5					0.0	0.0	0.0
Total Delay		36.5	16.5	53.2	58.5					13.8	14.9	3.8
LOS		D	B	D	E					B	B	A
Approach Delay		24.4			57.2						13.0	
Approach LOS		C			E						B	

Intersection Summary

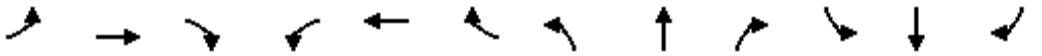
Area Type: Other
Cycle Length: 90
Actuated Cycle Length: 90
Offset: 0 (0%), Referenced to phase 2: and 6:SBTL, Start of Green, Master Intersection
Natural Cycle: 70
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.70
Intersection Signal Delay: 29.3 Intersection LOS: C
Intersection Capacity Utilization 35.0% ICU Level of Service A
Analysis Period (min) 15

Splits and Phases: 3: S Interstate 35 Frontage Road & Conrads Lane/Kohlenberg Road



HCM 6th Signalized Intersection Summary
3: S Interstate 35 Frontage Road & Conrads Lane/Kohlenberg Road

03/25/2021



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	159	246	143	386	0	0	0	0	71	592	127
Future Volume (veh/h)	0	159	246	143	386	0	0	0	0	71	592	127
Initial Q (Qb), veh	0	0	0	0	0	0				0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00				1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00				1.00	1.00	1.00
Work Zone On Approach		No			No						No	
Adj Sat Flow, veh/h/ln	0	1737	1678	1811	1781	0				1811	1796	1396
Adj Flow Rate, veh/h	0	173	0	155	420	0				77	643	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92				0.92	0.92	0.92
Percent Heavy Veh, %	0	11	15	6	8	0				6	7	34
Cap, veh/h	0	321		278	574	0				1071	2231	
Arrive On Green	0.00	0.07	0.00	0.05	0.05	0.00				0.62	0.62	0.00
Sat Flow, veh/h	0	4898	1422	1725	3563	0				1725	3593	1183
Grp Volume(v), veh/h	0	173	0	155	420	0				77	643	0
Grp Sat Flow(s),veh/h/ln	0	1581	1422	1725	1781	0				1725	1796	1183
Q Serve(g_s), s	0.0	3.2	0.0	7.9	10.5	0.0				1.6	7.4	0.0
Cycle Q Clear(g_c), s	0.0	3.2	0.0	7.9	10.5	0.0				1.6	7.4	0.0
Prop In Lane	0.00		1.00	1.00		0.00				1.00		1.00
Lane Grp Cap(c), veh/h	0	321		278	574	0				1071	2231	
V/C Ratio(X)	0.00	0.54		0.56	0.73	0.00				0.07	0.29	
Avail Cap(c_a), veh/h	0	1607		412	851	0				1071	2231	
HCM Platoon Ratio	1.00	1.00	1.00	0.33	0.33	1.00				1.00	1.00	1.00
Upstream Filter(I)	0.00	1.00	0.00	0.92	0.92	0.00				1.00	1.00	0.00
Uniform Delay (d), s/veh	0.0	40.6	0.0	39.5	40.7	0.0				6.8	7.9	0.0
Incr Delay (d2), s/veh	0.0	1.4	0.0	1.6	1.7	0.0				0.1	0.3	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0				0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	1.2	0.0	3.6	5.0	0.0				0.5	2.3	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	0.0	42.0	0.0	41.1	42.4	0.0				6.9	8.2	0.0
LnGrp LOS	A	D		D	D	A				A	A	
Approach Vol, veh/h		173	A		575						720	A
Approach Delay, s/veh		42.0			42.0						8.1	
Approach LOS		D			D						A	

Timer - Assigned Phs		4		6		8						
Phs Duration (G+Y+Rc), s		10.6		60.4		19.0						
Change Period (Y+Rc), s		4.5		4.5		4.5						
Max Green Setting (Gmax), s		30.5		24.5		21.5						
Max Q Clear Time (g_c+I1), s		5.2		9.4		12.5						
Green Ext Time (p_c), s		1.0		3.5		2.1						

Intersection Summary		
HCM 6th Ctrl Delay	25.4	
HCM 6th LOS	C	

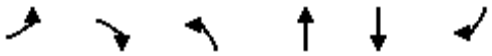
Notes

User approved volume balancing among the lanes for turning movement.

Unsignalized Delay for [EBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Lanes, Volumes, Timings
6: N Interstate 35 Frontage Road

03/25/2021



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	20	0	0	178	0	0
Future Volume (vph)	20	0	0	178	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	0.91	1.00	1.00
Frt						
Flt Protected	0.950					
Satd. Flow (prot)	1641	0	0	4848	0	0
Flt Permitted	0.950					
Satd. Flow (perm)	1641	0	0	4848	0	0
Link Speed (mph)	30			55	55	
Link Distance (ft)	262			223	1233	
Travel Time (s)	6.0			2.8	15.3	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	10%	0%	0%	7%	0%	0%
Adj. Flow (vph)	22	0	0	193	0	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	22	0	0	193	0	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	12			0	0	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9	15			9
Sign Control	Yield			Free	Free	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 13.4%		ICU Level of Service A	
Analysis Period (min) 15			

Lanes, Volumes, Timings
7: S Interstate 35 Frontage Road

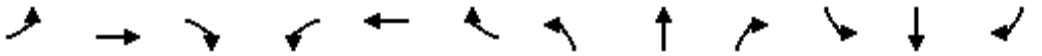
03/25/2021

Lane Group	WBL	WBR	NBL	NBT	NBR	SBL	SBT	SBR	SEL	SER
Lane Configurations										
Traffic Volume (vph)	0	0	0	0	0	20	790	0	0	0
Future Volume (vph)	0	0	0	0	0	20	790	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0	0	0		0	475		475	0	0
Storage Lanes	0	0	0		0	2		1	0	0
Taper Length (ft)	25		25			100			25	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.86	0.86	1.00	1.00
Frt										
Flt Protected						0.950				
Satd. Flow (prot)	0	0	0	0	0	1641	5888	0	0	0
Flt Permitted						0.950				
Satd. Flow (perm)	0	0	0	0	0	1641	5888	0	0	0
Link Speed (mph)	30			55			55		30	
Link Distance (ft)	262			185			1270		123	
Travel Time (s)	6.0			2.3			15.7		2.8	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	0%	0%	0%	0%	10%	11%	0%	0%	0%
Adj. Flow (vph)	0	0	0	0	0	22	859	0	0	0
Shared Lane Traffic (%)										
Lane Group Flow (vph)	0	0	0	0	0	22	859	0	0	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Right	Left	Left	Right	Left	Right
Median Width(ft)	0			12			12		0	
Link Offset(ft)	0			0			0		0	
Crosswalk Width(ft)	16			16			16		16	
Two way Left Turn Lane										
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9	15		9	15		9	15	9
Sign Control	Free			Free			Free		Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization	14.8%	ICU Level of Service	A
Analysis Period (min)	15		

Lanes, Volumes, Timings
8: N Interstate 35 Frontage Road

03/25/2021

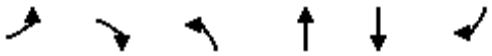


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	0	0	0	228	335	0	0	0	0
Future Volume (vph)	0	0	0	0	0	0	228	335	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		0	475		475	0		0
Storage Lanes	0		0	0		0	2		1	0		0
Taper Length (ft)	25			25			150			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.86	0.86	1.00	1.00	1.00
Frt												
Flt Protected							0.950					
Satd. Flow (prot)	0	0	0	0	0	0	1656	5942	0	0	0	0
Flt Permitted							0.950					
Satd. Flow (perm)	0	0	0	0	0	0	1656	5942	0	0	0	0
Link Speed (mph)		30			30			55			55	
Link Distance (ft)		266			141			6650			171	
Travel Time (s)		6.0			3.2			82.4			2.1	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	9%	10%	0%	0%	0%	0%
Adj. Flow (vph)	0	0	0	0	0	0	248	364	0	0	0	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	0	0	0	0	0	248	364	0	0	0	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Free			Stop			Free			Free	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 38.3%		ICU Level of Service A	
Analysis Period (min) 15			

Lanes, Volumes, Timings
9: N Interstate 35 Frontage Road & I-35 NB Off Ramp

03/25/2021



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	319	0	0	792	0	0
Future Volume (vph)	319	0	0	792	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	0.95	1.00	1.00
Frt						
Flt Protected	0.950					
Satd. Flow (prot)	1626	0	0	3406	0	0
Flt Permitted	0.950					
Satd. Flow (perm)	1626	0	0	3406	0	0
Link Speed (mph)	45			55	55	
Link Distance (ft)	469			818	6650	
Travel Time (s)	7.1			10.1	82.4	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	11%	0%	0%	6%	0%	0%
Adj. Flow (vph)	347	0	0	861	0	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	347	0	0	861	0	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	12			24	24	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9	15			9
Sign Control	Yield			Free	Free	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 46.2%		ICU Level of Service A	
Analysis Period (min) 15			

Lanes, Volumes, Timings
12: S Interstate 35 Frontage Road

03/25/2021

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	228	0	0	0	0	981
Future Volume (vph)	228	0	0	0	0	981
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	0.91
Frt						
Flt Protected	0.950					
Satd. Flow (prot)	1656	0	0	0	0	4759
Flt Permitted	0.950					
Satd. Flow (perm)	1656	0	0	0	0	4759
Link Speed (mph)	30		55			55
Link Distance (ft)	266		1391			205
Travel Time (s)	6.0		17.2			2.5
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	9%	0%	0%	0%	0%	9%
Adj. Flow (vph)	248	0	0	0	0	1066
Shared Lane Traffic (%)						
Lane Group Flow (vph)	248	0	0	0	0	1066
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(ft)	12		0			0
Link Offset(ft)	0		0			0
Crosswalk Width(ft)	16		16			16
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9		9	15	
Sign Control	Yield		Free			Free

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 38.3%		ICU Level of Service A	
Analysis Period (min) 15			

Lanes, Volumes, Timings
13: S Interstate 35 Frontage Road & I-35 SB Off Ramp

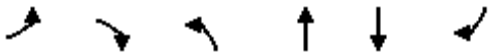
03/25/2021

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	611	0	0	0	0	1238
Future Volume (vph)	611	0	0	0	0	1238
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	0.95
Frt						
Flt Protected	0.950					
Satd. Flow (prot)	1656	0	0	0	0	3312
Flt Permitted	0.950					
Satd. Flow (perm)	1656	0	0	0	0	3312
Link Speed (mph)	45		55			30
Link Distance (ft)	349		2149			497
Travel Time (s)	5.3		26.6			11.3
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	9%	0%	0%	0%	0%	9%
Adj. Flow (vph)	664	0	0	0	0	1346
Shared Lane Traffic (%)						
Lane Group Flow (vph)	664	0	0	0	0	1346
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(ft)	12		0			0
Link Offset(ft)	0		0			0
Crosswalk Width(ft)	16		16			16
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9		9	15	
Sign Control	Yield		Free			Free

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 74.7%		ICU Level of Service D	
Analysis Period (min) 15			

Lanes, Volumes, Timings
17: S Interstate 35 Frontage Road & Oak Creek Way

03/25/2021



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	0	84	0	0	1154	78
Future Volume (vph)	0	84	0	0	1154	78
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0	0	0			315
Storage Lanes	0	1	0			1
Taper Length (ft)	25		25			
Lane Util. Factor	1.00	1.00	1.00	1.00	0.95	1.00
Frt		0.865				0.850
Flt Protected						
Satd. Flow (prot)	0	1644	0	0	3282	1599
Flt Permitted						
Satd. Flow (perm)	0	1644	0	0	3282	1599
Link Speed (mph)	30			55	55	
Link Distance (ft)	1047			497	1391	
Travel Time (s)	23.8			6.2	17.2	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	0%	0%	0%	10%	1%
Adj. Flow (vph)	0	91	0	0	1254	85
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	91	0	0	1254	85
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	0			0	0	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9	15			9
Sign Control	Stop			Free	Free	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization	43.8%	ICU Level of Service	A
Analysis Period (min)	15		

Intersection	
Int Delay, s/veh	1

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	0	84	0	0	1154	78
Future Vol, veh/h	0	84	0	0	1154	78
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	-	315
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	0	0	0	0	10	1
Mvmt Flow	0	91	0	0	1254	85

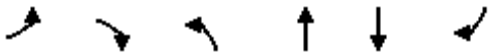
Major/Minor	Minor2			Major2	
Conflicting Flow All	-	627		-	0
Stage 1	-	-		-	-
Stage 2	-	-		-	-
Critical Hdwy	-	6.9		-	-
Critical Hdwy Stg 1	-	-		-	-
Critical Hdwy Stg 2	-	-		-	-
Follow-up Hdwy	-	3.3		-	-
Pot Cap-1 Maneuver	0	431		-	-
Stage 1	0	-		-	-
Stage 2	0	-		-	-
Platoon blocked, %				-	-
Mov Cap-1 Maneuver	-	431		-	-
Mov Cap-2 Maneuver	-	-		-	-
Stage 1	-	-		-	-
Stage 2	-	-		-	-

Approach	EB	SB
HCM Control Delay, s	15.6	0
HCM LOS	C	

Minor Lane/Major Mvmt	EBLn1	SBT	SBR
Capacity (veh/h)	431	-	-
HCM Lane V/C Ratio	0.212	-	-
HCM Control Delay (s)	15.6	-	-
HCM Lane LOS	C	-	-
HCM 95th %tile Q(veh)	0.8	-	-

Lanes, Volumes, Timings
23: S Interstate 35 Frontage Road & Love's Driveway

03/25/2021



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	0	241	0	0	1606	243
Future Volume (vph)	0	241	0	0	1606	243
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	0.95	0.95
Frt		0.865			0.980	
Flt Protected						
Satd. Flow (prot)	0	1274	0	0	3227	0
Flt Permitted						
Satd. Flow (perm)	0	1274	0	0	3227	0
Link Speed (mph)	30			55	55	
Link Distance (ft)	857			3340	2149	
Travel Time (s)	19.5			41.4	26.6	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	29%	0%	0%	7%	27%
Adj. Flow (vph)	0	262	0	0	1746	264
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	262	0	0	2010	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	0			0	0	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	60	60	60			60
Sign Control	Stop			Free	Free	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 73.7%		ICU Level of Service D	
Analysis Period (min) 15			

Intersection	
Int Delay, s/veh	26

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	0	241	0	0	1606	243
Future Vol, veh/h	0	241	0	0	1606	243
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	0	29	0	0	7	27
Mvmt Flow	0	262	0	0	1746	264

Major/Minor	Minor2			Major2	
Conflicting Flow All	-	1005		-	0
Stage 1	-	-		-	-
Stage 2	-	-		-	-
Critical Hdwy	-	7.48		-	-
Critical Hdwy Stg 1	-	-		-	-
Critical Hdwy Stg 2	-	-		-	-
Follow-up Hdwy	-	3.59		-	-
Pot Cap-1 Maneuver	0	~ 197		-	-
Stage 1	0	-		-	-
Stage 2	0	-		-	-
Platoon blocked, %				-	-
Mov Cap-1 Maneuver	-	~ 197		-	-
Mov Cap-2 Maneuver	-	-		-	-
Stage 1	-	-		-	-
Stage 2	-	-		-	-

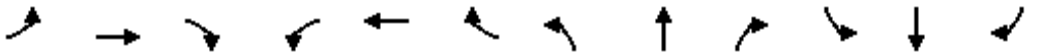
Approach	EB	SB
HCM Control Delay, s	225.7	0
HCM LOS	F	

Minor Lane/Major Mvmt	EBLn1	SBT	SBR
Capacity (veh/h)	197	-	-
HCM Lane V/C Ratio	1.33	-	-
HCM Control Delay (s)	225.7	-	-
HCM Lane LOS	F	-	-
HCM 95th %tile Q(veh)	14.8	-	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Lanes, Volumes, Timings
2: N Interstate 35 Frontage Road & Kohlenberg Road

03/26/2021



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	82	148	0	0	309	60	220	36	79	0	0	0
Future Volume (vph)	82	148	0	0	309	60	220	36	79	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		275	0		0	0		0
Storage Lanes	1		0	0		2	1		1	0		0
Taper Length (ft)	25			25			150			25		
Lane Util. Factor	0.91	0.91	1.00	1.00	0.91	1.00	1.00	0.95	1.00	1.00	1.00	1.00
Frt						0.850			0.850			
Flt Protected	0.950	0.997					0.950					
Satd. Flow (prot)	1493	3161	0	0	4988	1615	1597	3167	1568	0	0	0
Flt Permitted	0.950	0.997					0.950					
Satd. Flow (perm)	1493	3161	0	0	4988	1615	1597	3167	1568	0	0	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)						73			86			
Link Speed (mph)		40			40			55			55	
Link Distance (ft)		263			471			171			223	
Travel Time (s)		4.5			8.0			2.1			2.8	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	10%	9%	0%	0%	4%	0%	13%	14%	3%	0%	0%	0%
Adj. Flow (vph)	89	161	0	0	336	65	239	39	86	0	0	0
Shared Lane Traffic (%)	10%											
Lane Group Flow (vph)	80	170	0	0	336	65	239	39	86	0	0	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2			2	1	1	2	1			
Detector Template	Left	Thru			Thru	Right	Left	Thru	Right			
Leading Detector (ft)	20	100			100	20	20	100	20			
Trailing Detector (ft)	0	0			0	0	0	0	0			
Detector 1 Position(ft)	0	0			0	0	0	0	0			
Detector 1 Size(ft)	20	6			6	20	20	6	20			
Detector 1 Type	Cl+Ex	Cl+Ex			Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex			
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0			0.0	0.0	0.0	0.0	0.0			
Detector 1 Queue (s)	0.0	0.0			0.0	0.0	0.0	0.0	0.0			
Detector 1 Delay (s)	0.0	0.0			0.0	0.0	0.0	0.0	0.0			
Detector 2 Position(ft)		94			94			94				
Detector 2 Size(ft)		6			6			6				
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex				
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0				
Turn Type	Split	NA			NA	Perm	Perm	NA	Perm			
Protected Phases	4	4			8			2				

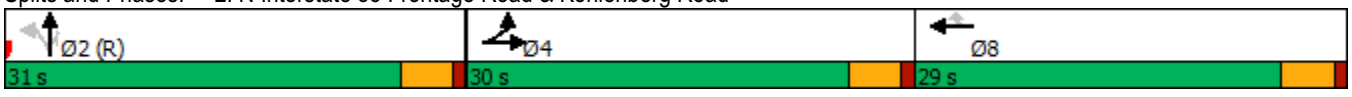
Lanes, Volumes, Timings
2: N Interstate 35 Frontage Road & Kohlenberg Road

03/26/2021

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases						8	2		2			
Detector Phase	4	4			8	8	2	2	2			
Switch Phase												
Minimum Initial (s)	5.0	5.0			5.0	5.0	5.0	5.0	5.0			
Minimum Split (s)	22.5	22.5			22.5	22.5	22.5	22.5	22.5			
Total Split (s)	30.0	30.0			29.0	29.0	31.0	31.0	31.0			
Total Split (%)	33.3%	33.3%			32.2%	32.2%	34.4%	34.4%	34.4%			
Maximum Green (s)	25.5	25.5			24.5	24.5	26.5	26.5	26.5			
Yellow Time (s)	3.5	3.5			3.5	3.5	3.5	3.5	3.5			
All-Red Time (s)	1.0	1.0			1.0	1.0	1.0	1.0	1.0			
Lost Time Adjust (s)	0.0	0.0			0.0	0.0	0.0	0.0	0.0			
Total Lost Time (s)	4.5	4.5			4.5	4.5	4.5	4.5	4.5			
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0	3.0			
Recall Mode	None	None			None	None	C-Max	C-Max	C-Max			
Walk Time (s)	7.0	7.0			7.0	7.0	7.0	7.0	7.0			
Flash Dont Walk (s)	11.0	11.0			11.0	11.0	11.0	11.0	11.0			
Pedestrian Calls (#/hr)	0	0			0	0	0	0	0			
Act Effct Green (s)	10.6	10.6			11.6	11.6	54.4	54.4	54.4			
Actuated g/C Ratio	0.12	0.12			0.13	0.13	0.60	0.60	0.60			
v/c Ratio	0.46	0.46			0.53	0.24	0.25	0.02	0.09			
Control Delay	34.6	30.0			39.3	9.8	10.2	8.8	2.6			
Queue Delay	0.0	0.0			0.0	0.0	0.0	0.0	0.0			
Total Delay	34.6	30.0			39.3	9.8	10.2	8.8	2.6			
LOS	C	C			D	A	B	A	A			
Approach Delay		31.5			34.6			8.2				
Approach LOS		C			C			A				

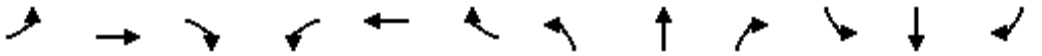
Intersection Summary			
Area Type:	Other		
Cycle Length: 90			
Actuated Cycle Length: 90			
Offset: 16 (18%), Referenced to phase 2:NBTL and 6:, Start of Green			
Natural Cycle: 70			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.53			
Intersection Signal Delay: 24.4		Intersection LOS: C	
Intersection Capacity Utilization 35.0%		ICU Level of Service A	
Analysis Period (min) 15			

Splits and Phases: 2: N Interstate 35 Frontage Road & Kohlenberg Road



HCM 6th Signalized Intersection Summary
2: N Interstate 35 Frontage Road & Kohlenberg Road

03/26/2021



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	82	148	0	0	309	60	220	36	79	0	0	0
Future Volume (veh/h)	82	148	0	0	309	60	220	36	79	0	0	0
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0			
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00			
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			
Work Zone On Approach		No			No			No				
Adj Sat Flow, veh/h/ln	1752	1767	0	0	1841	1900	1707	1693	1856			
Adj Flow Rate, veh/h	83	169	0	0	336	0	239	39	0			
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92			
Percent Heavy Veh, %	10	9	0	0	4	0	13	14	3			
Cap, veh/h	137	290	0	0	536		1075	2126				
Arrive On Green	0.08	0.08	0.00	0.00	0.11	0.00	0.66	0.66	0.00			
Sat Flow, veh/h	1668	3533	0	0	5191	1610	1626	3216	1572			
Grp Volume(v), veh/h	83	169	0	0	336	0	239	39	0			
Grp Sat Flow(s),veh/h/ln	1668	1767	0	0	1675	1610	1626	1608	1572			
Q Serve(g_s), s	4.3	4.1	0.0	0.0	5.8	0.0	5.3	0.4	0.0			
Cycle Q Clear(g_c), s	4.3	4.1	0.0	0.0	5.8	0.0	5.3	0.4	0.0			
Prop In Lane	1.00		0.00	0.00		1.00	1.00		1.00			
Lane Grp Cap(c), veh/h	137	290	0	0	536		1075	2126				
V/C Ratio(X)	0.61	0.58	0.00	0.00	0.63		0.22	0.02				
Avail Cap(c_a), veh/h	473	1001	0	0	1368		1075	2126				
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			
Upstream Filter(I)	0.98	0.98	0.00	0.00	1.00	0.00	1.00	1.00	0.00			
Uniform Delay (d), s/veh	39.9	39.8	0.0	0.0	38.5	0.0	6.1	5.2	0.0			
Incr Delay (d2), s/veh	4.2	1.8	0.0	0.0	1.2	0.0	0.5	0.0	0.0			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln	1.9	1.8	0.0	0.0	2.3	0.0	1.4	0.1	0.0			
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	44.1	41.6	0.0	0.0	39.7	0.0	6.5	5.2	0.0			
LnGrp LOS	D	D	A	A	D		A	A				
Approach Vol, veh/h		252			336	A		278	A			
Approach Delay, s/veh		42.4			39.7			6.4				
Approach LOS		D			D			A				
Timer - Assigned Phs		2		4				8				
Phs Duration (G+Y+Rc), s		64.0		11.9				14.1				
Change Period (Y+Rc), s		4.5		4.5				4.5				
Max Green Setting (Gmax), s		26.5		25.5				24.5				
Max Q Clear Time (g_c+I1), s		7.3		6.3				7.8				
Green Ext Time (p_c), s		0.8		1.1				1.8				

Intersection Summary	
HCM 6th Ctrl Delay	29.8
HCM 6th LOS	C

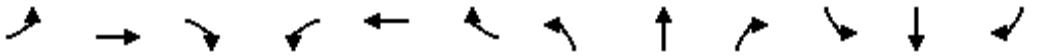
Notes

User approved volume balancing among the lanes for turning movement.

Unsignalized Delay for [NBR, WBR] is excluded from calculations of the approach delay and intersection delay.

Lanes, Volumes, Timings
3: S Interstate 35 Frontage Road & Conrads Lane/Kohlenberg Road

03/26/2021



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	159	246	143	386	0	0	0	0	71	592	127
Future Volume (vph)	0	159	246	143	386	0	0	0	0	71	592	127
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		275	0		0	0		0	0		0
Storage Lanes	0		2	1		0	0		0	1		1
Taper Length (ft)	25			25			25			150		
Lane Util. Factor	1.00	0.91	1.00	0.91	0.91	1.00	1.00	1.00	1.00	0.91	0.91	1.00
Frt			0.850									0.850
Flt Protected				0.950	0.998					0.950	0.999	
Satd. Flow (prot)	0	4673	1404	1550	3198	0	0	0	0	1550	3229	1205
Flt Permitted				0.950	0.998					0.950	0.999	
Satd. Flow (perm)	0	4673	1404	1550	3198	0	0	0	0	1550	3229	1205
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			246									138
Link Speed (mph)		40			40			55			55	
Link Distance (ft)		426			263			205			185	
Travel Time (s)		7.3			4.5			2.5			2.3	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	11%	15%	6%	8%	0%	0%	0%	0%	6%	7%	34%
Adj. Flow (vph)	0	173	267	155	420	0	0	0	0	77	643	138
Shared Lane Traffic (%)				10%						10%		
Lane Group Flow (vph)	0	173	267	139	436	0	0	0	0	69	651	138
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors		2	1	1	2					1	2	1
Detector Template		Thru	Right	Left	Thru					Left	Thru	Right
Leading Detector (ft)		100	20	20	100					20	100	20
Trailing Detector (ft)		0	0	0	0					0	0	0
Detector 1 Position(ft)		0	0	0	0					0	0	0
Detector 1 Size(ft)		6	20	20	6					20	6	20
Detector 1 Type		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex					Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)		0.0	0.0	0.0	0.0					0.0	0.0	0.0
Detector 1 Queue (s)		0.0	0.0	0.0	0.0					0.0	0.0	0.0
Detector 1 Delay (s)		0.0	0.0	0.0	0.0					0.0	0.0	0.0
Detector 2 Position(ft)		94			94						94	
Detector 2 Size(ft)		6			6						6	
Detector 2 Type		Cl+Ex			Cl+Ex						Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0						0.0	
Turn Type		NA	Perm	Split	NA					Perm	NA	Perm
Protected Phases		4		8	8						6	

Lanes, Volumes, Timings
3: S Interstate 35 Frontage Road & Conrads Lane/Kohlenberg Road

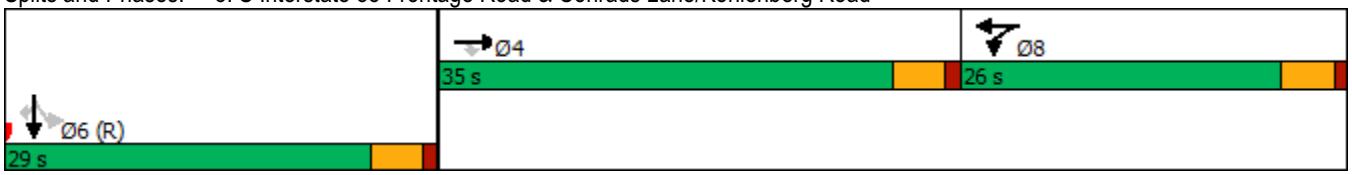
03/26/2021

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases			4							6		6
Detector Phase		4	4	8	8					6	6	6
Switch Phase												
Minimum Initial (s)		5.0	5.0	5.0	5.0					5.0	5.0	5.0
Minimum Split (s)		22.5	22.5	22.5	22.5					22.5	22.5	22.5
Total Split (s)		35.0	35.0	26.0	26.0					29.0	29.0	29.0
Total Split (%)		38.9%	38.9%	28.9%	28.9%					32.2%	32.2%	32.2%
Maximum Green (s)		30.5	30.5	21.5	21.5					24.5	24.5	24.5
Yellow Time (s)		3.5	3.5	3.5	3.5					3.5	3.5	3.5
All-Red Time (s)		1.0	1.0	1.0	1.0					1.0	1.0	1.0
Lost Time Adjust (s)		0.0	0.0	0.0	0.0					0.0	0.0	0.0
Total Lost Time (s)		4.5	4.5	4.5	4.5					4.5	4.5	4.5
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)		3.0	3.0	3.0	3.0					3.0	3.0	3.0
Recall Mode		None	None	None	None					C-Max	C-Max	C-Max
Walk Time (s)		7.0	7.0	7.0	7.0					7.0	7.0	7.0
Flash Dont Walk (s)		11.0	11.0	11.0	11.0					11.0	11.0	11.0
Pedestrian Calls (#/hr)		0	0	0	0					0	0	0
Act Effct Green (s)		10.7	10.7	18.0	18.0					47.8	47.8	47.8
Actuated g/C Ratio		0.12	0.12	0.20	0.20					0.53	0.53	0.53
v/c Ratio		0.31	0.70	0.45	0.68					0.08	0.38	0.20
Control Delay		36.5	16.5	53.2	58.0					13.8	14.9	3.8
Queue Delay		0.0	0.0	0.0	0.5					0.0	0.0	0.0
Total Delay		36.5	16.5	53.2	58.5					13.8	14.9	3.8
LOS		D	B	D	E					B	B	A
Approach Delay		24.4			57.2						13.0	
Approach LOS		C			E						B	

Intersection Summary

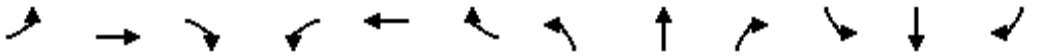
Area Type: Other
Cycle Length: 90
Actuated Cycle Length: 90
Offset: 0 (0%), Referenced to phase 2: and 6:SBTL, Start of Green, Master Intersection
Natural Cycle: 70
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.70
Intersection Signal Delay: 29.3 Intersection LOS: C
Intersection Capacity Utilization 35.0% ICU Level of Service A
Analysis Period (min) 15

Splits and Phases: 3: S Interstate 35 Frontage Road & Conrads Lane/Kohlenberg Road



HCM 6th Signalized Intersection Summary
3: S Interstate 35 Frontage Road & Conrads Lane/Kohlenberg Road

03/26/2021



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑↑	↱	↰	↓↑					↰	↓↑	↱
Traffic Volume (veh/h)	0	159	246	143	386	0	0	0	0	71	592	127
Future Volume (veh/h)	0	159	246	143	386	0	0	0	0	71	592	127
Initial Q (Qb), veh	0	0	0	0	0	0				0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00				1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00				1.00	1.00	1.00
Work Zone On Approach		No			No						No	
Adj Sat Flow, veh/h/ln	0	1737	1678	1811	1781	0				1811	1796	1396
Adj Flow Rate, veh/h	0	173	0	155	420	0				77	643	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92				0.92	0.92	0.92
Percent Heavy Veh, %	0	11	15	6	8	0				6	7	34
Cap, veh/h	0	321		278	574	0				1071	2231	
Arrive On Green	0.00	0.07	0.00	0.05	0.05	0.00				0.62	0.62	0.00
Sat Flow, veh/h	0	4898	1422	1725	3563	0				1725	3593	1183
Grp Volume(v), veh/h	0	173	0	155	420	0				77	643	0
Grp Sat Flow(s),veh/h/ln	0	1581	1422	1725	1781	0				1725	1796	1183
Q Serve(g_s), s	0.0	3.2	0.0	7.9	10.5	0.0				1.6	7.4	0.0
Cycle Q Clear(g_c), s	0.0	3.2	0.0	7.9	10.5	0.0				1.6	7.4	0.0
Prop In Lane	0.00		1.00	1.00		0.00				1.00		1.00
Lane Grp Cap(c), veh/h	0	321		278	574	0				1071	2231	
V/C Ratio(X)	0.00	0.54		0.56	0.73	0.00				0.07	0.29	
Avail Cap(c_a), veh/h	0	1607		412	851	0				1071	2231	
HCM Platoon Ratio	1.00	1.00	1.00	0.33	0.33	1.00				1.00	1.00	1.00
Upstream Filter(I)	0.00	1.00	0.00	0.92	0.92	0.00				1.00	1.00	0.00
Uniform Delay (d), s/veh	0.0	40.6	0.0	39.5	40.7	0.0				6.8	7.9	0.0
Incr Delay (d2), s/veh	0.0	1.4	0.0	1.6	1.7	0.0				0.1	0.3	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0				0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	1.2	0.0	3.6	5.0	0.0				0.5	2.3	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	0.0	42.0	0.0	41.1	42.4	0.0				6.9	8.2	0.0
LnGrp LOS	A	D		D	D	A				A	A	
Approach Vol, veh/h		173	A		575						720	A
Approach Delay, s/veh		42.0			42.0						8.1	
Approach LOS		D			D						A	

Timer - Assigned Phs		4		6		8			
Phs Duration (G+Y+Rc), s		10.6		60.4		19.0			
Change Period (Y+Rc), s		4.5		4.5		4.5			
Max Green Setting (Gmax), s		30.5		24.5		21.5			
Max Q Clear Time (g_c+I1), s		5.2		9.4		12.5			
Green Ext Time (p_c), s		1.0		3.5		2.1			

Intersection Summary	
HCM 6th Ctrl Delay	25.4
HCM 6th LOS	C

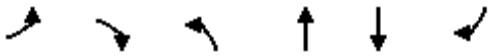
Notes

User approved volume balancing among the lanes for turning movement.

Unsignalized Delay for [EBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Lanes, Volumes, Timings
6: N Interstate 35 Frontage Road

03/26/2021



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	20	0	0	178	0	0
Future Volume (vph)	20	0	0	178	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	0.91	1.00	1.00
Frt						
Flt Protected	0.950					
Satd. Flow (prot)	1641	0	0	4848	0	0
Flt Permitted	0.950					
Satd. Flow (perm)	1641	0	0	4848	0	0
Link Speed (mph)	30			55	55	
Link Distance (ft)	262			223	1233	
Travel Time (s)	6.0			2.8	15.3	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	10%	0%	0%	7%	0%	0%
Adj. Flow (vph)	22	0	0	193	0	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	22	0	0	193	0	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	12			0	0	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9	15			9
Sign Control	Yield			Free	Free	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 13.4%		ICU Level of Service A	
Analysis Period (min) 15			

Lanes, Volumes, Timings
7: S Interstate 35 Frontage Road

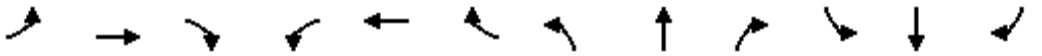
03/26/2021

Lane Group	WBL	WBR	NBL	NBT	NBR	SBL	SBT	SBR	SEL	SER
Lane Configurations										
Traffic Volume (vph)	0	0	0	0	0	20	790	0	0	0
Future Volume (vph)	0	0	0	0	0	20	790	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0	0	0		0	475		475	0	0
Storage Lanes	0	0	0		0	2		1	0	0
Taper Length (ft)	25		25			100			25	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.86	0.86	1.00	1.00
Frt										
Flt Protected						0.950				
Satd. Flow (prot)	0	0	0	0	0	1641	5888	0	0	0
Flt Permitted						0.950				
Satd. Flow (perm)	0	0	0	0	0	1641	5888	0	0	0
Link Speed (mph)	30			55			55		30	
Link Distance (ft)	262			185			1270		123	
Travel Time (s)	6.0			2.3			15.7		2.8	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	0%	0%	0%	0%	10%	11%	0%	0%	0%
Adj. Flow (vph)	0	0	0	0	0	22	859	0	0	0
Shared Lane Traffic (%)										
Lane Group Flow (vph)	0	0	0	0	0	22	859	0	0	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Right	Left	Left	Right	Left	Right
Median Width(ft)	0			12			12		0	
Link Offset(ft)	0			0			0		0	
Crosswalk Width(ft)	16			16			16		16	
Two way Left Turn Lane										
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9	15		9	15		9	15	9
Sign Control	Free			Free			Free		Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization	14.8%	ICU Level of Service	A
Analysis Period (min)	15		

Lanes, Volumes, Timings
8: N Interstate 35 Frontage Road

03/26/2021

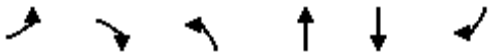


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	0	0	0	228	335	0	0	0	0
Future Volume (vph)	0	0	0	0	0	0	228	335	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		0	475		475	0		0
Storage Lanes	0		0	0		0	2		1	0		0
Taper Length (ft)	25			25			150			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.86	0.86	1.00	1.00	1.00
Frt												
Flt Protected							0.950					
Satd. Flow (prot)	0	0	0	0	0	0	1656	5942	0	0	0	0
Flt Permitted							0.950					
Satd. Flow (perm)	0	0	0	0	0	0	1656	5942	0	0	0	0
Link Speed (mph)		30			30			55			55	
Link Distance (ft)		266			141			6650			171	
Travel Time (s)		6.0			3.2			82.4			2.1	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	9%	10%	0%	0%	0%	0%
Adj. Flow (vph)	0	0	0	0	0	0	248	364	0	0	0	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	0	0	0	0	0	248	364	0	0	0	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Free			Stop			Free			Free	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 38.3%		ICU Level of Service A	
Analysis Period (min) 15			

Lanes, Volumes, Timings
9: N Interstate 35 Frontage Road & I-35 NB Off Ramp

03/26/2021



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	319	0	0	792	0	0
Future Volume (vph)	319	0	0	792	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	0.95	1.00	1.00
Frt						
Flt Protected	0.950					
Satd. Flow (prot)	1626	0	0	3406	0	0
Flt Permitted	0.950					
Satd. Flow (perm)	1626	0	0	3406	0	0
Link Speed (mph)	45			55	55	
Link Distance (ft)	469			818	6650	
Travel Time (s)	7.1			10.1	82.4	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	11%	0%	0%	6%	0%	0%
Adj. Flow (vph)	347	0	0	861	0	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	347	0	0	861	0	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	12			24	24	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9	15			9
Sign Control	Yield			Free	Free	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 46.2%		ICU Level of Service A	
Analysis Period (min) 15			

Lanes, Volumes, Timings
12: S Interstate 35 Frontage Road

03/26/2021

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	228	0	0	0	0	981
Future Volume (vph)	228	0	0	0	0	981
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	0.91
Frt						
Flt Protected	0.950					
Satd. Flow (prot)	1656	0	0	0	0	4759
Flt Permitted	0.950					
Satd. Flow (perm)	1656	0	0	0	0	4759
Link Speed (mph)	30		55			55
Link Distance (ft)	266		1391			205
Travel Time (s)	6.0		17.2			2.5
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	9%	0%	0%	0%	0%	9%
Adj. Flow (vph)	248	0	0	0	0	1066
Shared Lane Traffic (%)						
Lane Group Flow (vph)	248	0	0	0	0	1066
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(ft)	12		0			0
Link Offset(ft)	0		0			0
Crosswalk Width(ft)	16		16			16
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9		9	15	
Sign Control	Yield		Free			Free

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 38.3%		ICU Level of Service A	
Analysis Period (min) 15			

Lanes, Volumes, Timings
13: S Interstate 35 Frontage Road & I-35 SB Off Ramp

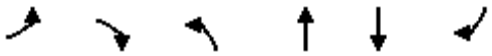
03/26/2021

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	611	0	0	0	0	1238
Future Volume (vph)	611	0	0	0	0	1238
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	0.95
Frt						
Flt Protected	0.950					
Satd. Flow (prot)	1656	0	0	0	0	3312
Flt Permitted	0.950					
Satd. Flow (perm)	1656	0	0	0	0	3312
Link Speed (mph)	45		55			30
Link Distance (ft)	349		2149			497
Travel Time (s)	5.3		26.6			11.3
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	9%	0%	0%	0%	0%	9%
Adj. Flow (vph)	664	0	0	0	0	1346
Shared Lane Traffic (%)						
Lane Group Flow (vph)	664	0	0	0	0	1346
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(ft)	12		0			0
Link Offset(ft)	0		0			0
Crosswalk Width(ft)	16		16			16
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9		9	15	
Sign Control	Yield		Free			Free

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 74.7%		ICU Level of Service D	
Analysis Period (min) 15			

Lanes, Volumes, Timings
17: S Interstate 35 Frontage Road & Oak Creek Way

03/26/2021



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	0	84	0	0	1154	78
Future Volume (vph)	0	84	0	0	1154	78
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0	0	0			315
Storage Lanes	0	1	0			1
Taper Length (ft)	25		25			
Lane Util. Factor	1.00	1.00	1.00	1.00	0.95	1.00
Frt		0.865				0.850
Flt Protected						
Satd. Flow (prot)	0	1644	0	0	3282	1599
Flt Permitted						
Satd. Flow (perm)	0	1644	0	0	3282	1599
Link Speed (mph)	30			55	55	
Link Distance (ft)	1047			497	1391	
Travel Time (s)	23.8			6.2	17.2	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	0%	0%	0%	10%	1%
Adj. Flow (vph)	0	91	0	0	1254	85
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	91	0	0	1254	85
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	0			0	0	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9	15			9
Sign Control	Stop			Free	Free	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization	43.8%	ICU Level of Service	A
Analysis Period (min)	15		

HCM 6th TWSC
17: S Interstate 35 Frontage Road & Oak Creek Way 03/26/2021

Intersection	
Int Delay, s/veh	1

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	0	84	0	0	1154	78
Future Vol, veh/h	0	84	0	0	1154	78
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	-	315
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	0	0	0	0	10	1
Mvmt Flow	0	91	0	0	1254	85

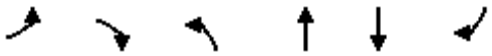
Major/Minor	Minor2			Major2	
Conflicting Flow All	-	627		-	0
Stage 1	-	-		-	-
Stage 2	-	-		-	-
Critical Hdwy	-	6.9		-	-
Critical Hdwy Stg 1	-	-		-	-
Critical Hdwy Stg 2	-	-		-	-
Follow-up Hdwy	-	3.3		-	-
Pot Cap-1 Maneuver	0	431		-	-
Stage 1	0	-		-	-
Stage 2	0	-		-	-
Platoon blocked, %				-	-
Mov Cap-1 Maneuver	-	431		-	-
Mov Cap-2 Maneuver	-	-		-	-
Stage 1	-	-		-	-
Stage 2	-	-		-	-

Approach	EB	SB
HCM Control Delay, s	15.6	0
HCM LOS	C	

Minor Lane/Major Mvmt	EBLn1	SBT	SBR
Capacity (veh/h)	431	-	-
HCM Lane V/C Ratio	0.212	-	-
HCM Control Delay (s)	15.6	-	-
HCM Lane LOS	C	-	-
HCM 95th %tile Q(veh)	0.8	-	-

Lanes, Volumes, Timings
23: S Interstate 35 Frontage Road & Love's Driveway

03/26/2021



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	0	241	0	0	1606	243
Future Volume (vph)	0	241	0	0	1606	243
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0	0	0			510
Storage Lanes	0	1	0			1
Taper Length (ft)	25		25			
Lane Util. Factor	1.00	1.00	1.00	1.00	0.95	1.00
Frt		0.865				0.850
Flt Protected						
Satd. Flow (prot)	0	1274	0	0	3374	1272
Flt Permitted						
Satd. Flow (perm)	0	1274	0	0	3374	1272
Link Speed (mph)	30			55	55	
Link Distance (ft)	857			3340	2149	
Travel Time (s)	19.5			41.4	26.6	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	29%	0%	0%	7%	27%
Adj. Flow (vph)	0	262	0	0	1746	264
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	262	0	0	1746	264
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	0			0	0	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	60	60	60			60
Sign Control	Stop			Free	Free	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization	66.0%	ICU Level of Service	C
Analysis Period (min)	15		

HCM 6th TWSC
23: S Interstate 35 Frontage Road & Love's Driveway

03/26/2021

Intersection	
Int Delay, s/veh	13.9

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	0	241	0	0	1606	243
Future Vol, veh/h	0	241	0	0	1606	243
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	-	510
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	0	29	0	0	7	27
Mvmt Flow	0	262	0	0	1746	264

Major/Minor	Minor2		Major2	
Conflicting Flow All	-	873	-	0
Stage 1	-	-	-	-
Stage 2	-	-	-	-
Critical Hdwy	-	7.48	-	-
Critical Hdwy Stg 1	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-
Follow-up Hdwy	-	3.59	-	-
Pot Cap-1 Maneuver	0	~ 245	-	-
Stage 1	0	-	-	-
Stage 2	0	-	-	-
Platoon blocked, %			-	-
Mov Cap-1 Maneuver	-	~ 245	-	-
Mov Cap-2 Maneuver	-	-	-	-
Stage 1	-	-	-	-
Stage 2	-	-	-	-

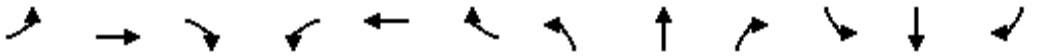
Approach	EB	SB
HCM Control Delay, s	120.8	0
HCM LOS	F	

Minor Lane/Major Mvmt	EBLn1	SBT	SBR
Capacity (veh/h)	245	-	-
HCM Lane V/C Ratio	1.069	-	-
HCM Control Delay (s)	120.8	-	-
HCM Lane LOS	F	-	-
HCM 95th %tile Q(veh)	11	-	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Lanes, Volumes, Timings
2: N Interstate 35 Frontage Road & Kohlenberg Road

03/25/2021



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	77	73	0	0	139	56	199	48	74	0	0	0
Future Volume (vph)	77	73	0	0	139	56	199	48	74	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		275	0		0	0		0
Storage Lanes	1		0	0		2	1		1	0		0
Taper Length (ft)	25			25			150			25		
Lane Util. Factor	0.91	0.91	1.00	1.00	0.91	1.00	1.00	0.95	1.00	1.00	1.00	1.00
Frt						0.850			0.850			
Flt Protected	0.950	0.986					0.950					
Satd. Flow (prot)	1550	3195	0	0	5036	1538	1612	3471	1568	0	0	0
Flt Permitted	0.950	0.986					0.950					
Satd. Flow (perm)	1550	3195	0	0	5036	1538	1612	3471	1568	0	0	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)						73			80			
Link Speed (mph)		40			40			55			55	
Link Distance (ft)		263			471			171			223	
Travel Time (s)		4.5			8.0			2.1			2.8	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	6%	7%	0%	0%	3%	5%	12%	4%	3%	0%	0%	0%
Adj. Flow (vph)	84	79	0	0	151	61	216	52	80	0	0	0
Shared Lane Traffic (%)	37%											
Lane Group Flow (vph)	53	110	0	0	151	61	216	52	80	0	0	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2			2	1	1	2	1			
Detector Template	Left	Thru			Thru	Right	Left	Thru	Right			
Leading Detector (ft)	20	100			100	20	20	100	20			
Trailing Detector (ft)	0	0			0	0	0	0	0			
Detector 1 Position(ft)	0	0			0	0	0	0	0			
Detector 1 Size(ft)	20	6			6	20	20	6	20			
Detector 1 Type	Cl+Ex	Cl+Ex			Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex			
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0			0.0	0.0	0.0	0.0	0.0			
Detector 1 Queue (s)	0.0	0.0			0.0	0.0	0.0	0.0	0.0			
Detector 1 Delay (s)	0.0	0.0			0.0	0.0	0.0	0.0	0.0			
Detector 2 Position(ft)		94			94			94				
Detector 2 Size(ft)		6			6			6				
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex				
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0				
Turn Type	Split	NA			NA	Perm	Perm	NA	Perm			
Protected Phases	4	4			8			2				

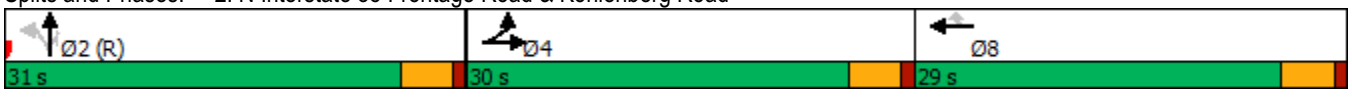
Lanes, Volumes, Timings
2: N Interstate 35 Frontage Road & Kohlenberg Road

03/25/2021

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases						8	2		2			
Detector Phase	4	4			8	8	2	2	2			
Switch Phase												
Minimum Initial (s)	5.0	5.0			5.0	5.0	5.0	5.0	5.0			
Minimum Split (s)	22.5	22.5			22.5	22.5	22.5	22.5	22.5			
Total Split (s)	30.0	30.0			29.0	29.0	31.0	31.0	31.0			
Total Split (%)	33.3%	33.3%			32.2%	32.2%	34.4%	34.4%	34.4%			
Maximum Green (s)	25.5	25.5			24.5	24.5	26.5	26.5	26.5			
Yellow Time (s)	3.5	3.5			3.5	3.5	3.5	3.5	3.5			
All-Red Time (s)	1.0	1.0			1.0	1.0	1.0	1.0	1.0			
Lost Time Adjust (s)	0.0	0.0			0.0	0.0	0.0	0.0	0.0			
Total Lost Time (s)	4.5	4.5			4.5	4.5	4.5	4.5	4.5			
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0	3.0			
Recall Mode	None	None			None	None	C-Max	C-Max	C-Max			
Walk Time (s)	7.0	7.0			7.0	7.0	7.0	7.0	7.0			
Flash Dont Walk (s)	11.0	11.0			11.0	11.0	11.0	11.0	11.0			
Pedestrian Calls (#/hr)	0	0			0	0	0	0	0			
Act Effct Green (s)	8.7	8.7			8.1	8.1	61.8	61.8	61.8			
Actuated g/C Ratio	0.10	0.10			0.09	0.09	0.69	0.69	0.69			
v/c Ratio	0.35	0.35			0.33	0.30	0.20	0.02	0.07			
Control Delay	18.2	14.7			40.2	11.6	6.8	6.1	1.9			
Queue Delay	0.0	0.0			0.0	0.0	0.0	0.0	0.0			
Total Delay	18.2	14.7			40.2	11.6	6.8	6.1	1.9			
LOS	B	B			D	B	A	A	A			
Approach Delay		15.8			31.9			5.6				
Approach LOS		B			C			A				

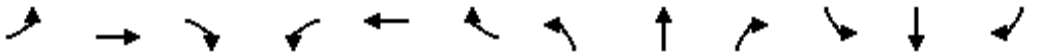
Intersection Summary			
Area Type:	Other		
Cycle Length: 90			
Actuated Cycle Length: 90			
Offset: 10 (11%), Referenced to phase 2:NBTL and 6:, Start of Green			
Natural Cycle: 70			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.35			
Intersection Signal Delay: 15.6		Intersection LOS: B	
Intersection Capacity Utilization 43.6%		ICU Level of Service A	
Analysis Period (min) 15			

Splits and Phases: 2: N Interstate 35 Frontage Road & Kohlenberg Road



HCM 6th Signalized Intersection Summary
2: N Interstate 35 Frontage Road & Kohlenberg Road

03/25/2021



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	77	73	0	0	139	56	199	48	74	0	0	0
Future Volume (veh/h)	77	73	0	0	139	56	199	48	74	0	0	0
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0			
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00			
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			
Work Zone On Approach		No			No			No				
Adj Sat Flow, veh/h/ln	1811	1796	0	0	1856	1826	1722	1841	1856			
Adj Flow Rate, veh/h	91	69	0	0	151	0	216	52	0			
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92			
Percent Heavy Veh, %	6	7	0	0	3	5	12	4	3			
Cap, veh/h	223	116	0	0	296		1193	2543				
Arrive On Green	0.06	0.06	0.00	0.00	0.06	0.00	0.73	0.73	0.00			
Sat Flow, veh/h	3450	1796	0	0	5233	1547	1640	3497	1572			
Grp Volume(v), veh/h	91	69	0	0	151	0	216	52	0			
Grp Sat Flow(s),veh/h/ln	1725	1796	0	0	1689	1547	1640	1749	1572			
Q Serve(g_s), s	2.3	3.4	0.0	0.0	2.6	0.0	3.7	0.4	0.0			
Cycle Q Clear(g_c), s	2.3	3.4	0.0	0.0	2.6	0.0	3.7	0.4	0.0			
Prop In Lane	1.00		0.00	0.00		1.00	1.00		1.00			
Lane Grp Cap(c), veh/h	223	116	0	0	296		1193	2543				
V/C Ratio(X)	0.41	0.60	0.00	0.00	0.51		0.18	0.02				
Avail Cap(c_a), veh/h	977	509	0	0	1379		1193	2543				
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			
Upstream Filter(I)	0.97	0.97	0.00	0.00	1.00	0.00	1.00	1.00	0.00			
Uniform Delay (d), s/veh	40.4	41.0	0.0	0.0	41.1	0.0	3.9	3.4	0.0			
Incr Delay (d2), s/veh	1.2	4.7	0.0	0.0	1.4	0.0	0.3	0.0	0.0			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln	1.0	1.6	0.0	0.0	1.1	0.0	0.8	0.1	0.0			
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	41.6	45.6	0.0	0.0	42.5	0.0	4.2	3.4	0.0			
LnGrp LOS	D	D	A	A	D		A	A				
Approach Vol, veh/h		160			151	A		268	A			
Approach Delay, s/veh		43.3			42.5			4.0				
Approach LOS		D			D			A				
Timer - Assigned Phs		2		4				8				
Phs Duration (G+Y+Rc), s		69.9		10.3				9.8				
Change Period (Y+Rc), s		4.5		4.5				4.5				
Max Green Setting (Gmax), s		26.5		25.5				24.5				
Max Q Clear Time (g_c+I1), s		5.7		5.4				4.6				
Green Ext Time (p_c), s		0.8		0.6				0.8				

Intersection Summary	
HCM 6th Ctrl Delay	24.9
HCM 6th LOS	C

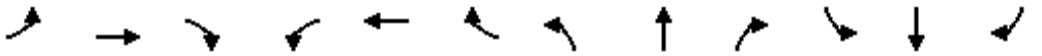
Notes

User approved volume balancing among the lanes for turning movement.

Unsignalized Delay for [NBR, WBR] is excluded from calculations of the approach delay and intersection delay.

Lanes, Volumes, Timings
3: S Interstate 35 Frontage Road & Conrads Lane/Kohlenberg Road

03/25/2021



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	135	213	59	279	0	0	0	0	15	1228	34
Future Volume (vph)	0	135	213	59	279	0	0	0	0	15	1228	34
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		275	0		0	0		0	0		0
Storage Lanes	0		2	1		0	0		0	1		1
Taper Length (ft)	25			25			25			150		
Lane Util. Factor	1.00	0.91	1.00	0.91	0.91	1.00	1.00	1.00	1.00	0.91	0.91	1.00
Frt			0.850									0.850
Flt Protected				0.950	0.999					0.950		
Satd. Flow (prot)	0	4848	1482	1521	3114	0	0	0	0	1535	3357	1404
Flt Permitted				0.950	0.999					0.950		
Satd. Flow (perm)	0	4848	1482	1521	3114	0	0	0	0	1535	3357	1404
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			232									73
Link Speed (mph)		40			40			55			55	
Link Distance (ft)		426			263			205			185	
Travel Time (s)		7.3			4.5			2.5			2.3	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	7%	9%	8%	11%	0%	0%	0%	0%	7%	3%	15%
Adj. Flow (vph)	0	147	232	64	303	0	0	0	0	16	1335	37
Shared Lane Traffic (%)				10%						10%		
Lane Group Flow (vph)	0	147	232	58	309	0	0	0	0	14	1337	37
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors		2	1	1	2					1	2	1
Detector Template		Thru	Right	Left	Thru					Left	Thru	Right
Leading Detector (ft)		100	20	20	100					20	100	20
Trailing Detector (ft)		0	0	0	0					0	0	0
Detector 1 Position(ft)		0	0	0	0					0	0	0
Detector 1 Size(ft)		6	20	20	6					20	6	20
Detector 1 Type		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex					Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)		0.0	0.0	0.0	0.0					0.0	0.0	0.0
Detector 1 Queue (s)		0.0	0.0	0.0	0.0					0.0	0.0	0.0
Detector 1 Delay (s)		0.0	0.0	0.0	0.0					0.0	0.0	0.0
Detector 2 Position(ft)		94			94						94	
Detector 2 Size(ft)		6			6						6	
Detector 2 Type		Cl+Ex			Cl+Ex						Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0						0.0	
Turn Type		NA	Perm	Split	NA					Perm	NA	Perm
Protected Phases		4		8	8						6	

Lanes, Volumes, Timings
3: S Interstate 35 Frontage Road & Conrads Lane/Kohlenberg Road

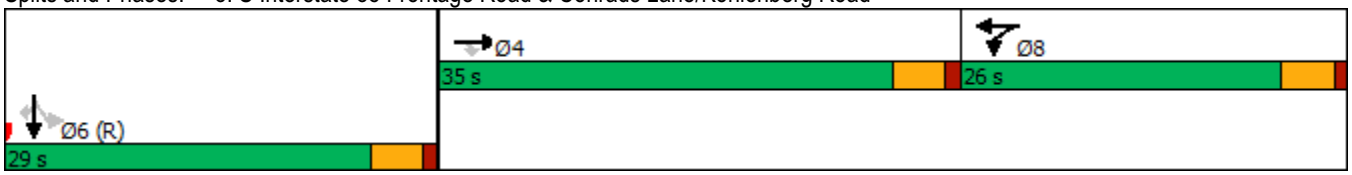
03/25/2021

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases			4							6		6
Detector Phase		4	4	8	8					6	6	6
Switch Phase												
Minimum Initial (s)		5.0	5.0	5.0	5.0					5.0	5.0	5.0
Minimum Split (s)		22.5	22.5	22.5	22.5					22.5	22.5	22.5
Total Split (s)		35.0	35.0	26.0	26.0					29.0	29.0	29.0
Total Split (%)		38.9%	38.9%	28.9%	28.9%					32.2%	32.2%	32.2%
Maximum Green (s)		30.5	30.5	21.5	21.5					24.5	24.5	24.5
Yellow Time (s)		3.5	3.5	3.5	3.5					3.5	3.5	3.5
All-Red Time (s)		1.0	1.0	1.0	1.0					1.0	1.0	1.0
Lost Time Adjust (s)		0.0	0.0	0.0	0.0					0.0	0.0	0.0
Total Lost Time (s)		4.5	4.5	4.5	4.5					4.5	4.5	4.5
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)		3.0	3.0	3.0	3.0					3.0	3.0	3.0
Recall Mode		None	None	None	None					C-Max	C-Max	C-Max
Walk Time (s)		7.0	7.0	7.0	7.0					7.0	7.0	7.0
Flash Dont Walk (s)		11.0	11.0	11.0	11.0					11.0	11.0	11.0
Pedestrian Calls (#/hr)		0	0	0	0					0	0	0
Act Effct Green (s)		9.2	9.2	14.3	14.3					53.0	53.0	53.0
Actuated g/C Ratio		0.10	0.10	0.16	0.16					0.59	0.59	0.59
v/c Ratio		0.30	0.65	0.24	0.62					0.02	0.68	0.04
Control Delay		38.0	14.0	46.5	51.8					10.5	16.4	0.9
Queue Delay		0.0	0.0	0.0	0.0					0.0	0.0	0.0
Total Delay		38.0	14.0	46.5	51.8					10.5	16.4	0.9
LOS		D	B	D	D					B	B	A
Approach Delay		23.3			50.9						15.9	
Approach LOS		C			D						B	

Intersection Summary

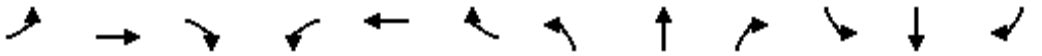
Area Type: Other
Cycle Length: 90
Actuated Cycle Length: 90
Offset: 0 (0%), Referenced to phase 2: and 6:SBTL, Start of Green, Master Intersection
Natural Cycle: 80
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.68
Intersection Signal Delay: 23.2 Intersection LOS: C
Intersection Capacity Utilization 43.6% ICU Level of Service A
Analysis Period (min) 15

Splits and Phases: 3: S Interstate 35 Frontage Road & Conrads Lane/Kohlenberg Road



HCM 6th Signalized Intersection Summary
3: S Interstate 35 Frontage Road & Conrads Lane/Kohlenberg Road

03/25/2021



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	135	213	59	279	0	0	0	0	15	1228	34
Future Volume (veh/h)	0	135	213	59	279	0	0	0	0	15	1228	34
Initial Q (Qb), veh	0	0	0	0	0	0				0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00				1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00				1.00	1.00	1.00
Work Zone On Approach		No			No						No	
Adj Sat Flow, veh/h/ln	0	1796	1767	1781	1737	0				1796	1856	1678
Adj Flow Rate, veh/h	0	147	0	64	303	0				16	1335	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92				0.92	0.92	0.92
Percent Heavy Veh, %	0	7	9	8	11	0				7	3	15
Cap, veh/h	0	289		212	435	0				1139	2471	
Arrive On Green	0.00	0.06	0.00	0.04	0.04	0.00				0.67	0.67	0.00
Sat Flow, veh/h	0	5065	1497	1697	3474	0				1711	3711	1422
Grp Volume(v), veh/h	0	147	0	64	303	0				16	1335	0
Grp Sat Flow(s),veh/h/ln	0	1635	1497	1697	1737	0				1711	1856	1422
Q Serve(g_s), s	0.0	2.6	0.0	3.3	7.7	0.0				0.3	16.9	0.0
Cycle Q Clear(g_c), s	0.0	2.6	0.0	3.3	7.7	0.0				0.3	16.9	0.0
Prop In Lane	0.00		1.00	1.00		0.00				1.00		1.00
Lane Grp Cap(c), veh/h	0	289		212	435	0				1139	2471	
V/C Ratio(X)	0.00	0.51		0.30	0.70	0.00				0.01	0.54	
Avail Cap(c_a), veh/h	0	1662		405	830	0				1139	2471	
HCM Platoon Ratio	1.00	1.00	1.00	0.33	0.33	1.00				1.00	1.00	1.00
Upstream Filter(I)	0.00	1.00	0.00	0.98	0.98	0.00				1.00	1.00	0.00
Uniform Delay (d), s/veh	0.0	41.1	0.0	39.3	41.5	0.0				5.1	7.8	0.0
Incr Delay (d2), s/veh	0.0	1.4	0.0	0.8	2.0	0.0				0.0	0.9	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0				0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	1.1	0.0	1.4	3.5	0.0				0.1	4.8	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	0.0	42.5	0.0	40.1	43.4	0.0				5.1	8.7	0.0
LnGrp LOS	A	D		D	D	A				A	A	
Approach Vol, veh/h		147	A		367						1351	A
Approach Delay, s/veh		42.5			42.9						8.7	
Approach LOS		D			D						A	

Timer - Assigned Phs				4		6		8				
Phs Duration (G+Y+Rc), s				9.8		64.4		15.8				
Change Period (Y+Rc), s				4.5		4.5		4.5				
Max Green Setting (Gmax), s				30.5		24.5		21.5				
Max Q Clear Time (g_c+I1), s				4.6		18.9		9.7				
Green Ext Time (p_c), s				0.8		3.7		1.5				

Intersection Summary		
HCM 6th Ctrl Delay	18.1	
HCM 6th LOS	B	

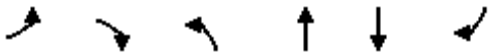
Notes

User approved volume balancing among the lanes for turning movement.

Unsignalized Delay for [EBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Lanes, Volumes, Timings
6: N Interstate 35 Frontage Road

03/25/2021



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	4	0	0	181	0	0
Future Volume (vph)	4	0	0	181	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	0.91	1.00	1.00
Frt						
Flt Protected	0.950					
Satd. Flow (prot)	1805	0	0	4893	0	0
Flt Permitted	0.950					
Satd. Flow (perm)	1805	0	0	4893	0	0
Link Speed (mph)	30			55	55	
Link Distance (ft)	262			223	1233	
Travel Time (s)	6.0			2.8	15.3	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	0%	0%	6%	0%	0%
Adj. Flow (vph)	4	0	0	197	0	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	4	0	0	197	0	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	12			0	0	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9	15			9
Sign Control	Yield			Free	Free	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 13.5%		ICU Level of Service A	
Analysis Period (min) 15			

Lanes, Volumes, Timings
7: S Interstate 35 Frontage Road

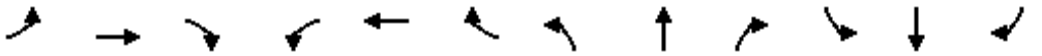
03/25/2021

Lane Group	WBL	WBR	NBL	NBT	NBR	SBL	SBT	SBR	SEL	SER
Lane Configurations										
Traffic Volume (vph)	0	0	0	0	0	4	1277	0	0	0
Future Volume (vph)	0	0	0	0	0	4	1277	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0	0	0		0	475		475	0	0
Storage Lanes	0	0	0		0	2		1	0	0
Taper Length (ft)	25		25			100			25	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.86	0.86	1.00	1.00
Frt										
Flt Protected						0.950				
Satd. Flow (prot)	0	0	0	0	0	1805	6346	0	0	0
Flt Permitted						0.950				
Satd. Flow (perm)	0	0	0	0	0	1805	6346	0	0	0
Link Speed (mph)	30			55			55		30	
Link Distance (ft)	262			185			1270		123	
Travel Time (s)	6.0			2.3			15.7		2.8	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	3%	0%	0%	0%
Adj. Flow (vph)	0	0	0	0	0	4	1388	0	0	0
Shared Lane Traffic (%)										
Lane Group Flow (vph)	0	0	0	0	0	4	1388	0	0	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Right	Left	Left	Right	Left	Right
Median Width(ft)	0			12			12		0	
Link Offset(ft)	0			0			0		0	
Crosswalk Width(ft)	16			16			16		16	
Two way Left Turn Lane										
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9	15		9	15		9	15	9
Sign Control	Free			Free			Free		Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 21.8%		ICU Level of Service A	
Analysis Period (min) 15			

Lanes, Volumes, Timings
8: N Interstate 35 Frontage Road

03/25/2021

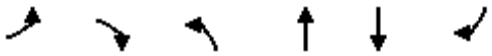


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	0	0	0	199	321	0	0	0	0
Future Volume (vph)	0	0	0	0	0	0	199	321	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		0	475		475	0		0
Storage Lanes	0		0	0		0	2		1	0		0
Taper Length (ft)	25			25			150			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.86	0.86	1.00	1.00	1.00
Frt												
Flt Protected							0.950					
Satd. Flow (prot)	0	0	0	0	0	0	1612	5888	0	0	0	0
Flt Permitted							0.950					
Satd. Flow (perm)	0	0	0	0	0	0	1612	5888	0	0	0	0
Link Speed (mph)		30			30			55			55	
Link Distance (ft)		266			141			6650			171	
Travel Time (s)		6.0			3.2			82.4			2.1	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	12%	11%	0%	0%	0%	0%
Adj. Flow (vph)	0	0	0	0	0	0	216	349	0	0	0	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	0	0	0	0	0	216	349	0	0	0	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Free			Stop			Free			Free	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization	46.7%	ICU Level of Service	A
Analysis Period (min)	15		

Lanes, Volumes, Timings
9: N Interstate 35 Frontage Road & I-35 NB Off Ramp

03/25/2021



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	321	0	0	1200	0	0
Future Volume (vph)	321	0	0	1200	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	0.95	1.00	1.00
Frt						
Flt Protected	0.950					
Satd. Flow (prot)	1583	0	0	3539	0	0
Flt Permitted	0.950					
Satd. Flow (perm)	1583	0	0	3539	0	0
Link Speed (mph)	45			55	55	
Link Distance (ft)	469			818	6650	
Travel Time (s)	7.1			10.1	82.4	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	14%	0%	0%	2%	0%	0%
Adj. Flow (vph)	349	0	0	1304	0	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	349	0	0	1304	0	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	12			24	24	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9	15			9
Sign Control	Yield			Free	Free	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 57.6%		ICU Level of Service B	
Analysis Period (min) 15			

Lanes, Volumes, Timings
12: S Interstate 35 Frontage Road

03/25/2021

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	199	0	0	0	0	1500
Future Volume (vph)	199	0	0	0	0	1500
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	0.91
Frt						
Flt Protected	0.950					
Satd. Flow (prot)	1612	0	0	0	0	4988
Flt Permitted	0.950					
Satd. Flow (perm)	1612	0	0	0	0	4988
Link Speed (mph)	30		55			55
Link Distance (ft)	266		1391			205
Travel Time (s)	6.0		17.2			2.5
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	12%	0%	0%	0%	0%	4%
Adj. Flow (vph)	216	0	0	0	0	1630
Shared Lane Traffic (%)						
Lane Group Flow (vph)	216	0	0	0	0	1630
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(ft)	12		0			0
Link Offset(ft)	0		0			0
Crosswalk Width(ft)	16		16			16
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9		9	15	
Sign Control	Yield		Free			Free

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 46.7%		ICU Level of Service A	
Analysis Period (min) 15			

Lanes, Volumes, Timings
13: S Interstate 35 Frontage Road & I-35 SB Off Ramp

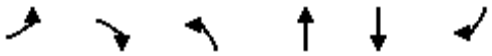
03/25/2021

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	310	0	0	0	0	1837
Future Volume (vph)	310	0	0	0	0	1837
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	0.95
Frt						
Flt Protected	0.950					
Satd. Flow (prot)	1570	0	0	0	0	3438
Flt Permitted	0.950					
Satd. Flow (perm)	1570	0	0	0	0	3438
Link Speed (mph)	45		55			30
Link Distance (ft)	349		2149			497
Travel Time (s)	5.3		26.6			11.3
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	15%	0%	0%	0%	0%	5%
Adj. Flow (vph)	337	0	0	0	0	1997
Shared Lane Traffic (%)						
Lane Group Flow (vph)	337	0	0	0	0	1997
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(ft)	12		0			0
Link Offset(ft)	0		0			0
Crosswalk Width(ft)	16		16			16
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9		9	15	
Sign Control	Yield		Free			Free

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 74.6%		ICU Level of Service D	
Analysis Period (min) 15			

Lanes, Volumes, Timings
17: S Interstate 35 Frontage Road & Oak Creek Way

03/25/2021



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	0	73	0	0	1764	29
Future Volume (vph)	0	73	0	0	1764	29
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0	0	0			315
Storage Lanes	0	1	0			1
Taper Length (ft)	25		25			
Lane Util. Factor	1.00	1.00	1.00	1.00	0.95	1.00
Frt		0.865				0.850
Flt Protected						
Satd. Flow (prot)	0	1627	0	0	3438	1615
Flt Permitted						
Satd. Flow (perm)	0	1627	0	0	3438	1615
Link Speed (mph)	30			55	55	
Link Distance (ft)	1047			497	1391	
Travel Time (s)	23.8			6.2	17.2	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	1%	0%	0%	5%	0%
Adj. Flow (vph)	0	79	0	0	1917	32
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	79	0	0	1917	32
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	0			0	0	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9	15			9
Sign Control	Stop			Free	Free	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 59.9%		ICU Level of Service B	
Analysis Period (min) 15			

HCM 6th TWSC
17: S Interstate 35 Frontage Road & Oak Creek Way

03/25/2021

Intersection	
Int Delay, s/veh	1

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	0	73	0	0	1764	29
Future Vol, veh/h	0	73	0	0	1764	29
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	-	315
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	0	1	0	0	5	0
Mvmt Flow	0	79	0	0	1917	32

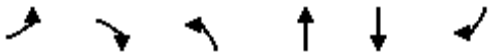
Major/Minor	Minor2			Major2	
Conflicting Flow All	-	959		-	0
Stage 1	-	-		-	-
Stage 2	-	-		-	-
Critical Hdwy	-	6.92		-	-
Critical Hdwy Stg 1	-	-		-	-
Critical Hdwy Stg 2	-	-		-	-
Follow-up Hdwy	-	3.31		-	-
Pot Cap-1 Maneuver	0	259		-	-
Stage 1	0	-		-	-
Stage 2	0	-		-	-
Platoon blocked, %				-	-
Mov Cap-1 Maneuver	-	259		-	-
Mov Cap-2 Maneuver	-	-		-	-
Stage 1	-	-		-	-
Stage 2	-	-		-	-

Approach	EB	SB
HCM Control Delay, s	24.9	0
HCM LOS	C	

Minor Lane/Major Mvmt	EBLn1	SBT	SBR
Capacity (veh/h)	259	-	-
HCM Lane V/C Ratio	0.306	-	-
HCM Control Delay (s)	24.9	-	-
HCM Lane LOS	C	-	-
HCM 95th %tile Q(veh)	1.3	-	-

Lanes, Volumes, Timings
23: S Interstate 35 Frontage Road & Love's Driveway

03/25/2021



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	0	339	0	0	1807	340
Future Volume (vph)	0	339	0	0	1807	340
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	0.95	0.95
Frt		0.865			0.976	
Flt Protected						
Satd. Flow (prot)	0	1304	0	0	3314	0
Flt Permitted						
Satd. Flow (perm)	0	1304	0	0	3314	0
Link Speed (mph)	30			55	55	
Link Distance (ft)	857			3340	2149	
Travel Time (s)	19.5			41.4	26.6	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	26%	0%	0%	3%	24%
Adj. Flow (vph)	0	368	0	0	1964	370
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	368	0	0	2334	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	0			0	0	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9	15			9
Sign Control	Stop			Free	Free	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 88.5%		ICU Level of Service E	
Analysis Period (min) 15			

Intersection	
Int Delay, s/veh	94.5

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	0	339	0	0	1807	340
Future Vol, veh/h	0	339	0	0	1807	340
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	0	26	0	0	3	24
Mvmt Flow	0	368	0	0	1964	370

Major/Minor	Minor2			Major2	
Conflicting Flow All	-	1167		-	0
Stage 1	-	-		-	-
Stage 2	-	-		-	-
Critical Hdwy	-	7.42		-	-
Critical Hdwy Stg 1	-	-		-	-
Critical Hdwy Stg 2	-	-		-	-
Follow-up Hdwy	-	3.56		-	-
Pot Cap-1 Maneuver	0	~ 154		-	-
Stage 1	0	-		-	-
Stage 2	0	-		-	-
Platoon blocked, %				-	-
Mov Cap-1 Maneuver	-	~ 154		-	-
Mov Cap-2 Maneuver	-	-		-	-
Stage 1	-	-		-	-
Stage 2	-	-		-	-

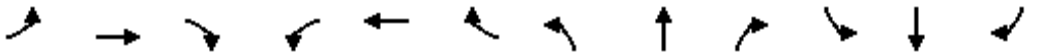
Approach	EB	SB
HCM Control Delay, s	$ 693	0
HCM LOS	F	

Minor Lane/Major Mvmt	EBLn1	SBT	SBR
Capacity (veh/h)	154	-	-
HCM Lane V/C Ratio	2.393	-	-
HCM Control Delay (s)	$ 693	-	-
HCM Lane LOS	F	-	-
HCM 95th %tile Q(veh)	31.2	-	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Lanes, Volumes, Timings
2: N Interstate 35 Frontage Road & Kohlenberg Road

03/26/2021



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	77	73	0	0	139	56	199	48	74	0	0	0
Future Volume (vph)	77	73	0	0	139	56	199	48	74	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		275	0		0	0		0
Storage Lanes	1		0	0		2	1		1	0		0
Taper Length (ft)	25			25			150			25		
Lane Util. Factor	0.91	0.91	1.00	1.00	0.91	1.00	1.00	0.95	1.00	1.00	1.00	1.00
Frt						0.850			0.850			
Flt Protected	0.950	0.986					0.950					
Satd. Flow (prot)	1550	3195	0	0	5036	1538	1612	3471	1568	0	0	0
Flt Permitted	0.950	0.986					0.950					
Satd. Flow (perm)	1550	3195	0	0	5036	1538	1612	3471	1568	0	0	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)						73			80			
Link Speed (mph)		40			40			55			55	
Link Distance (ft)		263			471			171			223	
Travel Time (s)		4.5			8.0			2.1			2.8	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	6%	7%	0%	0%	3%	5%	12%	4%	3%	0%	0%	0%
Adj. Flow (vph)	84	79	0	0	151	61	216	52	80	0	0	0
Shared Lane Traffic (%)	37%											
Lane Group Flow (vph)	53	110	0	0	151	61	216	52	80	0	0	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2			2	1	1	2	1			
Detector Template	Left	Thru			Thru	Right	Left	Thru	Right			
Leading Detector (ft)	20	100			100	20	20	100	20			
Trailing Detector (ft)	0	0			0	0	0	0	0			
Detector 1 Position(ft)	0	0			0	0	0	0	0			
Detector 1 Size(ft)	20	6			6	20	20	6	20			
Detector 1 Type	Cl+Ex	Cl+Ex			Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex			
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0			0.0	0.0	0.0	0.0	0.0			
Detector 1 Queue (s)	0.0	0.0			0.0	0.0	0.0	0.0	0.0			
Detector 1 Delay (s)	0.0	0.0			0.0	0.0	0.0	0.0	0.0			
Detector 2 Position(ft)		94			94			94				
Detector 2 Size(ft)		6			6			6				
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex				
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0				
Turn Type	Split	NA			NA	Perm	Perm	NA	Perm			
Protected Phases	4	4			8			2				

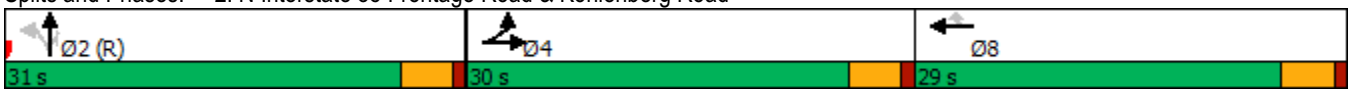
Lanes, Volumes, Timings
2: N Interstate 35 Frontage Road & Kohlenberg Road

03/26/2021

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases						8	2		2			
Detector Phase	4	4			8	8	2	2	2			
Switch Phase												
Minimum Initial (s)	5.0	5.0			5.0	5.0	5.0	5.0	5.0			
Minimum Split (s)	22.5	22.5			22.5	22.5	22.5	22.5	22.5			
Total Split (s)	30.0	30.0			29.0	29.0	31.0	31.0	31.0			
Total Split (%)	33.3%	33.3%			32.2%	32.2%	34.4%	34.4%	34.4%			
Maximum Green (s)	25.5	25.5			24.5	24.5	26.5	26.5	26.5			
Yellow Time (s)	3.5	3.5			3.5	3.5	3.5	3.5	3.5			
All-Red Time (s)	1.0	1.0			1.0	1.0	1.0	1.0	1.0			
Lost Time Adjust (s)	0.0	0.0			0.0	0.0	0.0	0.0	0.0			
Total Lost Time (s)	4.5	4.5			4.5	4.5	4.5	4.5	4.5			
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0	3.0			
Recall Mode	None	None			None	None	C-Max	C-Max	C-Max			
Walk Time (s)	7.0	7.0			7.0	7.0	7.0	7.0	7.0			
Flash Dont Walk (s)	11.0	11.0			11.0	11.0	11.0	11.0	11.0			
Pedestrian Calls (#/hr)	0	0			0	0	0	0	0			
Act Effct Green (s)	8.7	8.7			8.1	8.1	61.8	61.8	61.8			
Actuated g/C Ratio	0.10	0.10			0.09	0.09	0.69	0.69	0.69			
v/c Ratio	0.35	0.35			0.33	0.30	0.20	0.02	0.07			
Control Delay	18.2	14.7			40.2	11.6	6.8	6.1	1.9			
Queue Delay	0.0	0.0			0.0	0.0	0.0	0.0	0.0			
Total Delay	18.2	14.7			40.2	11.6	6.8	6.1	1.9			
LOS	B	B			D	B	A	A	A			
Approach Delay		15.8			31.9			5.6				
Approach LOS		B			C			A				

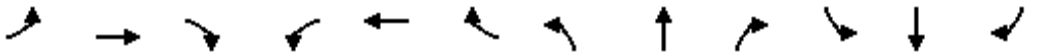
Intersection Summary			
Area Type:	Other		
Cycle Length: 90			
Actuated Cycle Length: 90			
Offset: 10 (11%), Referenced to phase 2:NBTL and 6:, Start of Green			
Natural Cycle: 70			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.35			
Intersection Signal Delay: 15.6		Intersection LOS: B	
Intersection Capacity Utilization 43.6%		ICU Level of Service A	
Analysis Period (min) 15			

Splits and Phases: 2: N Interstate 35 Frontage Road & Kohlenberg Road



HCM 6th Signalized Intersection Summary
2: N Interstate 35 Frontage Road & Kohlenberg Road

03/26/2021



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	77	73	0	0	139	56	199	48	74	0	0	0
Future Volume (veh/h)	77	73	0	0	139	56	199	48	74	0	0	0
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0			
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00			
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			
Work Zone On Approach		No			No			No				
Adj Sat Flow, veh/h/ln	1811	1796	0	0	1856	1826	1722	1841	1856			
Adj Flow Rate, veh/h	91	69	0	0	151	0	216	52	0			
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92			
Percent Heavy Veh, %	6	7	0	0	3	5	12	4	3			
Cap, veh/h	223	116	0	0	296		1193	2543				
Arrive On Green	0.06	0.06	0.00	0.00	0.06	0.00	0.73	0.73	0.00			
Sat Flow, veh/h	3450	1796	0	0	5233	1547	1640	3497	1572			
Grp Volume(v), veh/h	91	69	0	0	151	0	216	52	0			
Grp Sat Flow(s),veh/h/ln	1725	1796	0	0	1689	1547	1640	1749	1572			
Q Serve(g_s), s	2.3	3.4	0.0	0.0	2.6	0.0	3.7	0.4	0.0			
Cycle Q Clear(g_c), s	2.3	3.4	0.0	0.0	2.6	0.0	3.7	0.4	0.0			
Prop In Lane	1.00		0.00	0.00		1.00	1.00		1.00			
Lane Grp Cap(c), veh/h	223	116	0	0	296		1193	2543				
V/C Ratio(X)	0.41	0.60	0.00	0.00	0.51		0.18	0.02				
Avail Cap(c_a), veh/h	977	509	0	0	1379		1193	2543				
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			
Upstream Filter(I)	0.97	0.97	0.00	0.00	1.00	0.00	1.00	1.00	0.00			
Uniform Delay (d), s/veh	40.4	41.0	0.0	0.0	41.1	0.0	3.9	3.4	0.0			
Incr Delay (d2), s/veh	1.2	4.7	0.0	0.0	1.4	0.0	0.3	0.0	0.0			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln	1.0	1.6	0.0	0.0	1.1	0.0	0.8	0.1	0.0			
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	41.6	45.6	0.0	0.0	42.5	0.0	4.2	3.4	0.0			
LnGrp LOS	D	D	A	A	D		A	A				
Approach Vol, veh/h		160			151	A		268	A			
Approach Delay, s/veh		43.3			42.5			4.0				
Approach LOS		D			D			A				
Timer - Assigned Phs		2		4				8				
Phs Duration (G+Y+Rc), s		69.9		10.3				9.8				
Change Period (Y+Rc), s		4.5		4.5				4.5				
Max Green Setting (Gmax), s		26.5		25.5				24.5				
Max Q Clear Time (g_c+I1), s		5.7		5.4				4.6				
Green Ext Time (p_c), s		0.8		0.6				0.8				

Intersection Summary	
HCM 6th Ctrl Delay	24.9
HCM 6th LOS	C

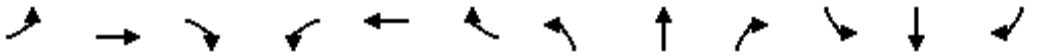
Notes

User approved volume balancing among the lanes for turning movement.

Unsignalized Delay for [NBR, WBR] is excluded from calculations of the approach delay and intersection delay.

Lanes, Volumes, Timings
3: S Interstate 35 Frontage Road & Conrads Lane/Kohlenberg Road

03/26/2021



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	135	213	59	279	0	0	0	0	15	1228	34
Future Volume (vph)	0	135	213	59	279	0	0	0	0	15	1228	34
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		275	0		0	0		0	0		0
Storage Lanes	0		2	1		0	0		0	1		1
Taper Length (ft)	25			25			25			150		
Lane Util. Factor	1.00	0.91	1.00	0.91	0.91	1.00	1.00	1.00	1.00	0.91	0.91	1.00
Frt			0.850									0.850
Flt Protected				0.950	0.999					0.950		
Satd. Flow (prot)	0	4848	1482	1521	3114	0	0	0	0	1535	3357	1404
Flt Permitted				0.950	0.999					0.950		
Satd. Flow (perm)	0	4848	1482	1521	3114	0	0	0	0	1535	3357	1404
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			232									73
Link Speed (mph)		40			40			55			55	
Link Distance (ft)		426			263			205			185	
Travel Time (s)		7.3			4.5			2.5			2.3	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	7%	9%	8%	11%	0%	0%	0%	0%	7%	3%	15%
Adj. Flow (vph)	0	147	232	64	303	0	0	0	0	16	1335	37
Shared Lane Traffic (%)				10%						10%		
Lane Group Flow (vph)	0	147	232	58	309	0	0	0	0	14	1337	37
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors		2	1	1	2					1	2	1
Detector Template		Thru	Right	Left	Thru					Left	Thru	Right
Leading Detector (ft)		100	20	20	100					20	100	20
Trailing Detector (ft)		0	0	0	0					0	0	0
Detector 1 Position(ft)		0	0	0	0					0	0	0
Detector 1 Size(ft)		6	20	20	6					20	6	20
Detector 1 Type		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex					Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)		0.0	0.0	0.0	0.0					0.0	0.0	0.0
Detector 1 Queue (s)		0.0	0.0	0.0	0.0					0.0	0.0	0.0
Detector 1 Delay (s)		0.0	0.0	0.0	0.0					0.0	0.0	0.0
Detector 2 Position(ft)		94			94						94	
Detector 2 Size(ft)		6			6						6	
Detector 2 Type		Cl+Ex			Cl+Ex						Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0						0.0	
Turn Type		NA	Perm	Split	NA					Perm	NA	Perm
Protected Phases		4		8	8						6	

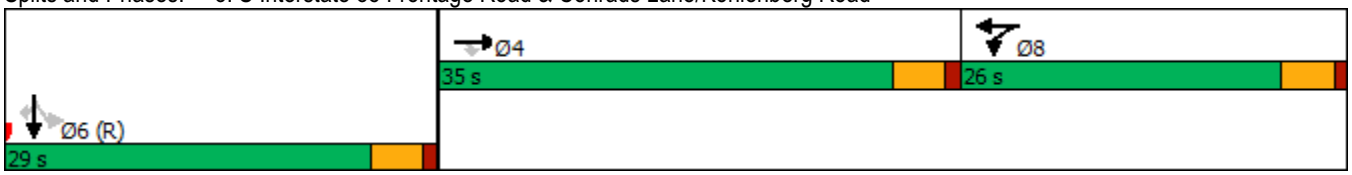
Lanes, Volumes, Timings
3: S Interstate 35 Frontage Road & Conrads Lane/Kohlenberg Road

03/26/2021

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases			4							6		6
Detector Phase		4	4	8	8					6	6	6
Switch Phase												
Minimum Initial (s)		5.0	5.0	5.0	5.0					5.0	5.0	5.0
Minimum Split (s)		22.5	22.5	22.5	22.5					22.5	22.5	22.5
Total Split (s)		35.0	35.0	26.0	26.0					29.0	29.0	29.0
Total Split (%)		38.9%	38.9%	28.9%	28.9%					32.2%	32.2%	32.2%
Maximum Green (s)		30.5	30.5	21.5	21.5					24.5	24.5	24.5
Yellow Time (s)		3.5	3.5	3.5	3.5					3.5	3.5	3.5
All-Red Time (s)		1.0	1.0	1.0	1.0					1.0	1.0	1.0
Lost Time Adjust (s)		0.0	0.0	0.0	0.0					0.0	0.0	0.0
Total Lost Time (s)		4.5	4.5	4.5	4.5					4.5	4.5	4.5
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)		3.0	3.0	3.0	3.0					3.0	3.0	3.0
Recall Mode		None	None	None	None					C-Max	C-Max	C-Max
Walk Time (s)		7.0	7.0	7.0	7.0					7.0	7.0	7.0
Flash Dont Walk (s)		11.0	11.0	11.0	11.0					11.0	11.0	11.0
Pedestrian Calls (#/hr)		0	0	0	0					0	0	0
Act Effct Green (s)		9.2	9.2	14.3	14.3					53.0	53.0	53.0
Actuated g/C Ratio		0.10	0.10	0.16	0.16					0.59	0.59	0.59
v/c Ratio		0.30	0.65	0.24	0.62					0.02	0.68	0.04
Control Delay		38.0	14.0	46.5	51.8					10.5	16.4	0.9
Queue Delay		0.0	0.0	0.0	0.0					0.0	0.0	0.0
Total Delay		38.0	14.0	46.5	51.8					10.5	16.4	0.9
LOS		D	B	D	D					B	B	A
Approach Delay		23.3			50.9						15.9	
Approach LOS		C			D						B	

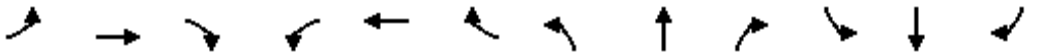
Intersection Summary			
Area Type:	Other		
Cycle Length: 90			
Actuated Cycle Length: 90			
Offset: 0 (0%), Referenced to phase 2: and 6:SBTL, Start of Green, Master Intersection			
Natural Cycle: 80			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.68			
Intersection Signal Delay: 23.2		Intersection LOS: C	
Intersection Capacity Utilization 43.6%		ICU Level of Service A	
Analysis Period (min) 15			

Splits and Phases: 3: S Interstate 35 Frontage Road & Conrads Lane/Kohlenberg Road



HCM 6th Signalized Intersection Summary
3: S Interstate 35 Frontage Road & Conrads Lane/Kohlenberg Road

03/26/2021



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	135	213	59	279	0	0	0	0	15	1228	34
Future Volume (veh/h)	0	135	213	59	279	0	0	0	0	15	1228	34
Initial Q (Qb), veh	0	0	0	0	0	0				0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00				1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00				1.00	1.00	1.00
Work Zone On Approach		No			No						No	
Adj Sat Flow, veh/h/ln	0	1796	1767	1781	1737	0				1796	1856	1678
Adj Flow Rate, veh/h	0	147	0	64	303	0				16	1335	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92				0.92	0.92	0.92
Percent Heavy Veh, %	0	7	9	8	11	0				7	3	15
Cap, veh/h	0	289		212	435	0				1139	2471	
Arrive On Green	0.00	0.06	0.00	0.04	0.04	0.00				0.67	0.67	0.00
Sat Flow, veh/h	0	5065	1497	1697	3474	0				1711	3711	1422
Grp Volume(v), veh/h	0	147	0	64	303	0				16	1335	0
Grp Sat Flow(s),veh/h/ln	0	1635	1497	1697	1737	0				1711	1856	1422
Q Serve(g_s), s	0.0	2.6	0.0	3.3	7.7	0.0				0.3	16.9	0.0
Cycle Q Clear(g_c), s	0.0	2.6	0.0	3.3	7.7	0.0				0.3	16.9	0.0
Prop In Lane	0.00		1.00	1.00		0.00				1.00		1.00
Lane Grp Cap(c), veh/h	0	289		212	435	0				1139	2471	
V/C Ratio(X)	0.00	0.51		0.30	0.70	0.00				0.01	0.54	
Avail Cap(c_a), veh/h	0	1662		405	830	0				1139	2471	
HCM Platoon Ratio	1.00	1.00	1.00	0.33	0.33	1.00				1.00	1.00	1.00
Upstream Filter(I)	0.00	1.00	0.00	0.98	0.98	0.00				1.00	1.00	0.00
Uniform Delay (d), s/veh	0.0	41.1	0.0	39.3	41.5	0.0				5.1	7.8	0.0
Incr Delay (d2), s/veh	0.0	1.4	0.0	0.8	2.0	0.0				0.0	0.9	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0				0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	1.1	0.0	1.4	3.5	0.0				0.1	4.8	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	0.0	42.5	0.0	40.1	43.4	0.0				5.1	8.7	0.0
LnGrp LOS	A	D		D	D	A				A	A	
Approach Vol, veh/h		147	A		367						1351	A
Approach Delay, s/veh		42.5			42.9						8.7	
Approach LOS		D			D						A	

Timer - Assigned Phs		4		6		8						
Phs Duration (G+Y+Rc), s		9.8		64.4		15.8						
Change Period (Y+Rc), s		4.5		4.5		4.5						
Max Green Setting (Gmax), s		30.5		24.5		21.5						
Max Q Clear Time (g_c+I1), s		4.6		18.9		9.7						
Green Ext Time (p_c), s		0.8		3.7		1.5						

Intersection Summary		
HCM 6th Ctrl Delay	18.1	
HCM 6th LOS	B	

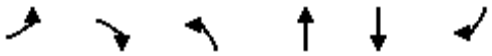
Notes

User approved volume balancing among the lanes for turning movement.

Unsignalized Delay for [EBR, SBR] is excluded from calculations of the approach delay and intersection delay.

Lanes, Volumes, Timings
6: N Interstate 35 Frontage Road

03/26/2021



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	4	0	0	181	0	0
Future Volume (vph)	4	0	0	181	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	0.91	1.00	1.00
Frt						
Flt Protected	0.950					
Satd. Flow (prot)	1805	0	0	4893	0	0
Flt Permitted	0.950					
Satd. Flow (perm)	1805	0	0	4893	0	0
Link Speed (mph)	30			55	55	
Link Distance (ft)	262			223	1233	
Travel Time (s)	6.0			2.8	15.3	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	0%	0%	6%	0%	0%
Adj. Flow (vph)	4	0	0	197	0	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	4	0	0	197	0	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	12			0	0	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9	15			9
Sign Control	Yield			Free	Free	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 13.5%		ICU Level of Service A	
Analysis Period (min) 15			

Lanes, Volumes, Timings
7: S Interstate 35 Frontage Road

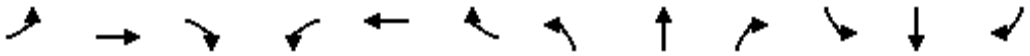
03/26/2021

Lane Group	WBL	WBR	NBL	NBT	NBR	SBL	SBT	SBR	SEL	SER
Lane Configurations										
Traffic Volume (vph)	0	0	0	0	0	4	1277	0	0	0
Future Volume (vph)	0	0	0	0	0	4	1277	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0	0	0		0	475		475	0	0
Storage Lanes	0	0	0		0	2		1	0	0
Taper Length (ft)	25		25			100			25	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.86	0.86	1.00	1.00
Frt										
Flt Protected						0.950				
Satd. Flow (prot)	0	0	0	0	0	1805	6346	0	0	0
Flt Permitted						0.950				
Satd. Flow (perm)	0	0	0	0	0	1805	6346	0	0	0
Link Speed (mph)	30			55			55		30	
Link Distance (ft)	262			185			1270		123	
Travel Time (s)	6.0			2.3			15.7		2.8	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	3%	0%	0%	0%
Adj. Flow (vph)	0	0	0	0	0	4	1388	0	0	0
Shared Lane Traffic (%)										
Lane Group Flow (vph)	0	0	0	0	0	4	1388	0	0	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Right	Left	Left	Right	Left	Right
Median Width(ft)	0			12			12		0	
Link Offset(ft)	0			0			0		0	
Crosswalk Width(ft)	16			16			16		16	
Two way Left Turn Lane										
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9	15		9	15		9	15	9
Sign Control	Free			Free			Free		Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 21.8%		ICU Level of Service A	
Analysis Period (min) 15			

Lanes, Volumes, Timings
8: N Interstate 35 Frontage Road

03/26/2021

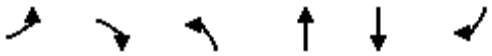


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	0	0	0	199	321	0	0	0	0
Future Volume (vph)	0	0	0	0	0	0	199	321	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		0	475		475	0		0
Storage Lanes	0		0	0		0	2		1	0		0
Taper Length (ft)	25			25			150			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.86	0.86	1.00	1.00	1.00
Frt												
Flt Protected							0.950					
Satd. Flow (prot)	0	0	0	0	0	0	1612	5888	0	0	0	0
Flt Permitted							0.950					
Satd. Flow (perm)	0	0	0	0	0	0	1612	5888	0	0	0	0
Link Speed (mph)		30			30			55			55	
Link Distance (ft)		266			141			6650			171	
Travel Time (s)		6.0			3.2			82.4			2.1	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	12%	11%	0%	0%	0%	0%
Adj. Flow (vph)	0	0	0	0	0	0	216	349	0	0	0	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	0	0	0	0	0	216	349	0	0	0	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Free			Stop			Free			Free	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization	46.7%	ICU Level of Service	A
Analysis Period (min)	15		

Lanes, Volumes, Timings
9: N Interstate 35 Frontage Road & I-35 NB Off Ramp

03/26/2021



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	321	0	0	1200	0	0
Future Volume (vph)	321	0	0	1200	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	0.95	1.00	1.00
Frt						
Flt Protected	0.950					
Satd. Flow (prot)	1583	0	0	3539	0	0
Flt Permitted	0.950					
Satd. Flow (perm)	1583	0	0	3539	0	0
Link Speed (mph)	45			55	55	
Link Distance (ft)	469			818	6650	
Travel Time (s)	7.1			10.1	82.4	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	14%	0%	0%	2%	0%	0%
Adj. Flow (vph)	349	0	0	1304	0	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	349	0	0	1304	0	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	12			24	24	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9	15			9
Sign Control	Yield			Free	Free	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 57.6%		ICU Level of Service B	
Analysis Period (min) 15			

Lanes, Volumes, Timings
12: S Interstate 35 Frontage Road

03/26/2021

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	199	0	0	0	0	1500
Future Volume (vph)	199	0	0	0	0	1500
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	0.91
Frt						
Flt Protected	0.950					
Satd. Flow (prot)	1612	0	0	0	0	4988
Flt Permitted	0.950					
Satd. Flow (perm)	1612	0	0	0	0	4988
Link Speed (mph)	30		55			55
Link Distance (ft)	266		1391			205
Travel Time (s)	6.0		17.2			2.5
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	12%	0%	0%	0%	0%	4%
Adj. Flow (vph)	216	0	0	0	0	1630
Shared Lane Traffic (%)						
Lane Group Flow (vph)	216	0	0	0	0	1630
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(ft)	12		0			0
Link Offset(ft)	0		0			0
Crosswalk Width(ft)	16		16			16
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9		9	15	
Sign Control	Yield		Free			Free

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 46.7%		ICU Level of Service A	
Analysis Period (min) 15			

Lanes, Volumes, Timings
13: S Interstate 35 Frontage Road & I-35 SB Off Ramp

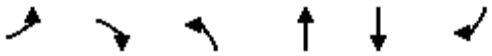
03/26/2021

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	310	0	0	0	0	1837
Future Volume (vph)	310	0	0	0	0	1837
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	0.95
Frt						
Flt Protected	0.950					
Satd. Flow (prot)	1570	0	0	0	0	3438
Flt Permitted	0.950					
Satd. Flow (perm)	1570	0	0	0	0	3438
Link Speed (mph)	45		55			30
Link Distance (ft)	349		2149			497
Travel Time (s)	5.3		26.6			11.3
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	15%	0%	0%	0%	0%	5%
Adj. Flow (vph)	337	0	0	0	0	1997
Shared Lane Traffic (%)						
Lane Group Flow (vph)	337	0	0	0	0	1997
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(ft)	12		0			0
Link Offset(ft)	0		0			0
Crosswalk Width(ft)	16		16			16
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9		9	15	
Sign Control	Yield		Free			Free

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 74.6%		ICU Level of Service D	
Analysis Period (min) 15			

Lanes, Volumes, Timings
17: S Interstate 35 Frontage Road & Oak Creek Way

03/26/2021



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	0	73	0	0	1764	29
Future Volume (vph)	0	73	0	0	1764	29
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0	0	0			315
Storage Lanes	0	1	0			1
Taper Length (ft)	25		25			
Lane Util. Factor	1.00	1.00	1.00	1.00	0.95	1.00
Frt		0.865				0.850
Flt Protected						
Satd. Flow (prot)	0	1627	0	0	3438	1615
Flt Permitted						
Satd. Flow (perm)	0	1627	0	0	3438	1615
Link Speed (mph)	30			55	55	
Link Distance (ft)	1047			497	1391	
Travel Time (s)	23.8			6.2	17.2	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	1%	0%	0%	5%	0%
Adj. Flow (vph)	0	79	0	0	1917	32
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	79	0	0	1917	32
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	0			0	0	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9	15			9
Sign Control	Stop			Free	Free	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 59.9%		ICU Level of Service B	
Analysis Period (min) 15			

HCM 6th TWSC
17: S Interstate 35 Frontage Road & Oak Creek Way 03/26/2021

Intersection	
Int Delay, s/veh	1

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	0	73	0	0	1764	29
Future Vol, veh/h	0	73	0	0	1764	29
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	-	315
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	0	1	0	0	5	0
Mvmt Flow	0	79	0	0	1917	32

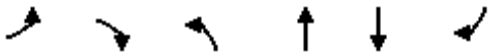
Major/Minor	Minor2		Major2	
Conflicting Flow All	-	959	-	0
Stage 1	-	-	-	-
Stage 2	-	-	-	-
Critical Hdwy	-	6.92	-	-
Critical Hdwy Stg 1	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-
Follow-up Hdwy	-	3.31	-	-
Pot Cap-1 Maneuver	0	259	-	-
Stage 1	0	-	-	-
Stage 2	0	-	-	-
Platoon blocked, %			-	-
Mov Cap-1 Maneuver	-	259	-	-
Mov Cap-2 Maneuver	-	-	-	-
Stage 1	-	-	-	-
Stage 2	-	-	-	-

Approach	EB	SB
HCM Control Delay, s	24.9	0
HCM LOS	C	

Minor Lane/Major Mvmt	EBLn1	SBT	SBR
Capacity (veh/h)	259	-	-
HCM Lane V/C Ratio	0.306	-	-
HCM Control Delay (s)	24.9	-	-
HCM Lane LOS	C	-	-
HCM 95th %tile Q(veh)	1.3	-	-

Lanes, Volumes, Timings
23: S Interstate 35 Frontage Road & Love's Driveway

03/26/2021



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	0	339	0	0	1807	340
Future Volume (vph)	0	339	0	0	1807	340
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0	0	0			510
Storage Lanes	0	1	0			1
Taper Length (ft)	25		25			
Lane Util. Factor	1.00	1.00	1.00	1.00	0.95	1.00
Frt		0.865				0.850
Flt Protected						
Satd. Flow (prot)	0	1304	0	0	3505	1302
Flt Permitted						
Satd. Flow (perm)	0	1304	0	0	3505	1302
Link Speed (mph)	30			55	55	
Link Distance (ft)	857			3340	2149	
Travel Time (s)	19.5			41.4	26.6	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	26%	0%	0%	3%	24%
Adj. Flow (vph)	0	368	0	0	1964	370
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	368	0	0	1964	370
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	0			0	0	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9	15			9
Sign Control	Stop			Free	Free	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization	77.6%	ICU Level of Service	D
Analysis Period (min)	15		

Intersection	
Int Delay, s/veh	54.8

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	0	339	0	0	1807	340
Future Vol, veh/h	0	339	0	0	1807	340
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	-	510
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	0	26	0	0	3	24
Mvmt Flow	0	368	0	0	1964	370

Major/Minor	Minor2		Major2	
Conflicting Flow All	-	982	-	0
Stage 1	-	-	-	-
Stage 2	-	-	-	-
Critical Hdwy	-	7.42	-	-
Critical Hdwy Stg 1	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-
Follow-up Hdwy	-	3.56	-	-
Pot Cap-1 Maneuver	0	~ 209	-	-
Stage 1	0	-	-	-
Stage 2	0	-	-	-
Platoon blocked, %			-	-
Mov Cap-1 Maneuver	-	~ 209	-	-
Mov Cap-2 Maneuver	-	-	-	-
Stage 1	-	-	-	-
Stage 2	-	-	-	-

Approach	EB	SB
HCM Control Delay, s	$ 401.6	0
HCM LOS	F	

Minor Lane/Major Mvmt	EBLn1	SBT	SBR
Capacity (veh/h)	209	-	-
HCM Lane V/C Ratio	1.763	-	-
HCM Control Delay (s)	$ 401.6	-	-
HCM Lane LOS	F	-	-
HCM 95th %tile Q(veh)	25.4	-	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

APPENDIX F
TURN LANE WARRANT GUIDELINES

where heavy left-turn movements take place, but also occur where left-turn movements enter or leave driveways serving adjacent land development. As with left-turn movements, right-turn movements pose problems at both driveways and street intersections. Right-turn movements increase conflicts, delays, and crashes, particularly where a speed differential of 10 mph or more exists between the speed of through traffic and the vehicles that are turning right.

Table 2-3 presents thresholds for auxiliary lanes. These thresholds represent examples of where left turn and right turn lanes should be considered. Refer to the TxDOT *Roadway Design Manual*, Chapter 3, for proper acceleration and deceleration lengths.

Table 2-3: Auxiliary Lane Thresholds

Median Type	Left Turn to or from Property		Right Turn to or from Property (5)	
	Acceleration	Deceleration	Acceleration	Deceleration
Non-Traversable (Raised Median)	(2)	All	Right turn egress > 200 vph (4)	◆ > 45 mph where right turn volume is > 50 vph (3) ◆ ≤ 45 where right turn volume is > 60 vph (3)
Traversable (Undivided Road)	(2)	(1)	Same as above	Same as Above

(1) Refer to Table 3-11, TxDOT *Roadway Design Manual*, for alternative left-turn-bay operational considerations.

(2) A left-turn acceleration lane may be required if it would provide a benefit to the safety and operation of the roadway. A left-turn acceleration lane would interfere with the left-turn ingress movements to any other access connection.

(3) Additional right-turn considerations:

- ◆ Conditions for providing an exclusive right-turn lane when the right-turn traffic volume projections are less than indicated in Table 2-3:
  - High crash experience
  - Heavier than normal peak flow movements on the main roadway
  - Large volume of truck traffic
  - Highways where sight distance is limited
- ◆ Conditions for NOT requiring a right-turn lane where right-turn volumes are more than indicated in Table 2-3:
  - Dense or built-out corridor where space is limited
  - Where queues of stopped vehicles would block the access to the right turn lane
  - Where sufficient length of property width is not available for the appropriate design

(4) The acceleration lane should not interfere with any downstream access connection.

- ◆ The distance from the end of the acceleration lane taper to the next unsignalized downstream access connection should be equal to or greater than the distances found in Table 2-2.
- ◆ Additionally, if the next access connection is signalized, the distance from the end of the acceleration lane taper to the back of the 90th percentile queue should be greater than or equal to the distances found Table 2-2.

(5) Continuous right-turn lanes can provide mobility benefits both for through movements and for the turning vehicles.[a] Access connections within a continuous right turn lane should meet the spacing requirements found in Table 2-2. However, when combined with crossing left in movements, a continuous right-turn lane can introduce additional operational conflicts.

Right-Turn Deceleration Lanes. Figure 3-4 illustrates a right-turn deceleration lane. The length of a single right-turn deceleration lane is the same as that for a single left-turn lane (see Table 3-3). However, the minimum queue storage is 30 ft for right-turn lanes. The length for a dual right-turn lane is the same as for a dual left-turn lane (see Table 3-4). Refer to the TxDOT Access Management *Manual* for guidelines as to when to consider a right-turn deceleration lane.

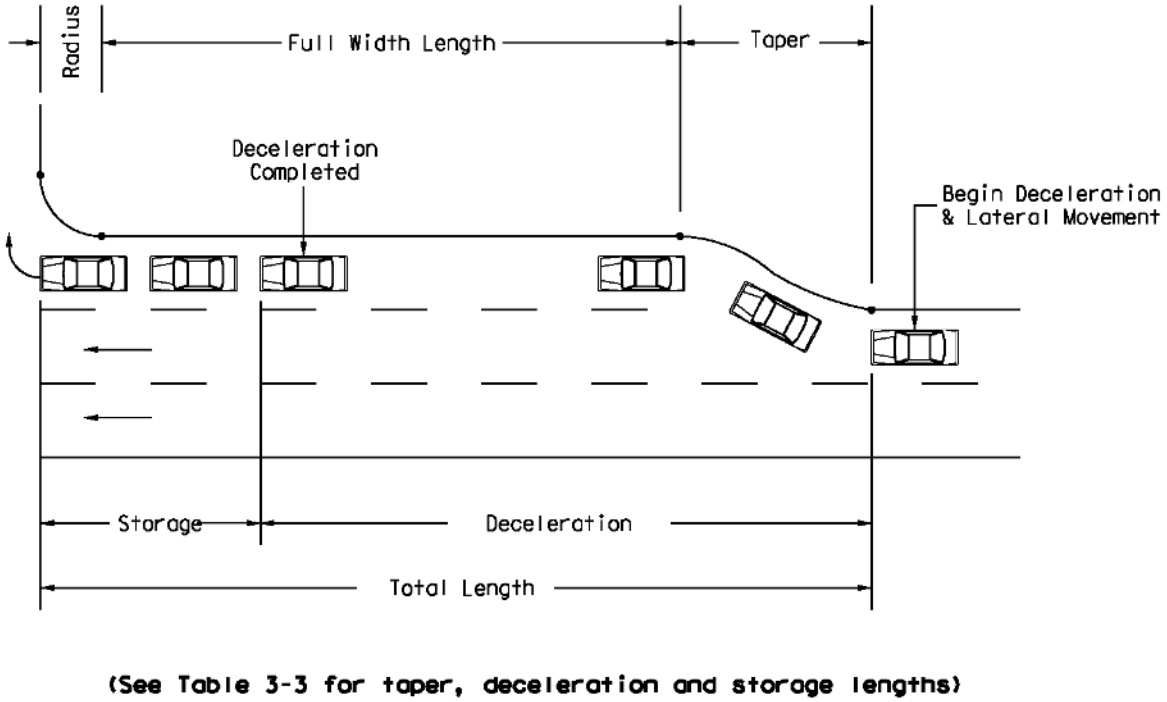


Figure 3-4. Lengths of Right-Turn Deceleration Lanes.

Right-Turn Acceleration Lanes. Acceleration lanes typically are not used on urban streets. See Section 5, Figure 3-10 for acceleration distances and taper lengths if an acceleration lane may be necessary.

Auxiliary Lanes on Crest Vertical Curves

When an intersection or driveway is located beyond the crest of a vertical curve, the designer should check the driver's view of the left-turn or right-turn lane as they approach the beginning of the taper. It is suggested that this preview time be at least two seconds. An auxiliary lane that is longer than the deceleration distance plus queue storage length may be a consideration, if practical, in these situations.

Table 3-3: Lengths of Single Left-Turn Lanes on Urban Streets[1]

(US Customary)						
Speed (mph)	**Deceleration Length[2] (ft.)**	**Taper Length (ft.)**	**Storage Length (ft.)**			
			Signalized		**Non-Signalized**	
			Calculated	**Minimum[4]**	**Calculated**	**Minimum[4]**
40	275	50	See footnote 3	100	See footnote 5	100
45	345	100	See footnote 3	100	See footnote 5	100
50	425	100	See footnote 3	100	See footnote 5	100
55	510	100	See footnote 3	100	See footnote 5	100
60	605	100	See footnote 3	100	See footnote 5	100
(Metric)						
Speed (km/h)	**Deceleration Length[2] (m)**	**Taper Length (m)**	**Storage Length (m)**			
			Signalized		**Non-Signalized**	
			Calculated	**Minimum[4]**	**Calculated**	**Minimum[4]**
50	50	15	See footnote 3	30	See footnote 5	30
65	85	15	See footnote 3	30	See footnote 5	30
80	130	30	See footnote 3	30	See footnote 5	30
95	185	30	See footnote 3	30	See footnote 5	30
100	205	30	See footnote 3	30	See footnote 5	30
110	245	30	See footnote 3	30	See footnote 5	30

[1] The minimum length of a left-turn lane is the sum of the deceleration length plus queue storage. In order to determine the design length, the deceleration plus storage length must be calculated for peak and off-peak periods, the longest total length will be the minimum design length.

[2] See Deceleration Length discussion immediately following Table 3-3.

[3] See Storage Length Calculations discussion immediately following Table 3-3A.

[4] The minimum storage length shall apply when: 1) the required queue storage length calculated is less than the minimum length, or 2) there is no rational method for estimating the left-turn volume.

[5] The calculated queue storage at unsignalized location using a traffic model or simulation model or by the following:

L = (V/30)(2)(S)

Where: (V/30) is the left-turn volume in a two-minute interval and other terms are as defined in the Storage Length Calculations discussion immediately following Table 3-3A.

APPENDIX G
QUEUE LENGTH SUMMARY SHEETS

Queuing and Blocking Report
Baseline

03/25/2021

Intersection: 2: N Interstate 35 Frontage Road & Kohlenberg Road

Movement	EB	EB	EB	WB	WB	WB	NB	NB	NB
Directions Served	L	LT	T	T	T	T	L	T	T
Maximum Queue (ft)	126	159	136	91	126	109	90	47	56
Average Queue (ft)	43	71	43	22	54	26	42	4	6
95th Queue (ft)	103	135	111	63	109	83	92	24	30
Link Distance (ft)	201	201	201	377	377		76	76	76
Upstream Blk Time (%)		0					5	0	0
Queuing Penalty (veh)		0					2	0	0
Storage Bay Dist (ft)						275			
Storage Blk Time (%)									
Queuing Penalty (veh)									

Intersection: 3: S Interstate 35 Frontage Road & Conrads Lane/Kohlenberg Road

Movement	EB	EB	EB	EB	WB	WB	WB	SB	SB	SB
Directions Served	T	T	T	R	L	LT	T	L	LT	T
Maximum Queue (ft)	134	173	145	109	129	195	183	16	119	97
Average Queue (ft)	63	85	41	8	48	99	87	1	56	20
95th Queue (ft)	116	147	112	48	99	171	157	9	114	66
Link Distance (ft)	340	340			201	201	201	95	95	95
Upstream Blk Time (%)					0	0	0		3	0
Queuing Penalty (veh)					0	0	0		2	0
Storage Bay Dist (ft)			275	275						
Storage Blk Time (%)										
Queuing Penalty (veh)										

Intersection: 6: N Interstate 35 Frontage Road

Movement	EB	NB
Directions Served	L	T
Maximum Queue (ft)	36	12
Average Queue (ft)	2	0
95th Queue (ft)	18	9
Link Distance (ft)	218	138
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 7: S Interstate 35 Frontage Road

Movement	SB	SB
Directions Served	T	T
Maximum Queue (ft)	59	7
Average Queue (ft)	6	0
95th Queue (ft)	34	7
Link Distance (ft)	1238	1238
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 8: N Interstate 35 Frontage Road

Movement	NB
Directions Served	T
Maximum Queue (ft)	86
Average Queue (ft)	7
95th Queue (ft)	39
Link Distance (ft)	
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	475
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 9: N Interstate 35 Frontage Road & I-35 NB Off Ramp

Movement	EB
Directions Served	L
Maximum Queue (ft)	179
Average Queue (ft)	79
95th Queue (ft)	144
Link Distance (ft)	453
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 12: S Interstate 35 Frontage Road

Movement	WB	SB	SB	SB
Directions Served	L	T	T	T
Maximum Queue (ft)	70	7	15	27
Average Queue (ft)	23	0	1	1
95th Queue (ft)	57	7	11	11
Link Distance (ft)	223	121	121	121
Upstream Blk Time (%)				0
Queuing Penalty (veh)				0
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 13: S Interstate 35 Frontage Road & I-35 SB Off Ramp

Movement	WB	SB
Directions Served	L	T
Maximum Queue (ft)	222	6
Average Queue (ft)	79	0
95th Queue (ft)	159	5
Link Distance (ft)	311	444
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 17: S Interstate 35 Frontage Road & Oak Creek Way

Movement	EB
Directions Served	R
Maximum Queue (ft)	100
Average Queue (ft)	41
95th Queue (ft)	75
Link Distance (ft)	991
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 21: Bend

Movement	NW	NW
Directions Served	T	
Maximum Queue (ft)	25	8
Average Queue (ft)	1	0
95th Queue (ft)	27	8
Link Distance (ft)	340	340
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Network Summary

Network wide Queuing Penalty: 6

Queuing and Blocking Report

03/25/2021

Intersection: 2: N Interstate 35 Frontage Road & Kohlenberg Road

Movement	EB	EB	EB	WB	WB	WB	NB	NB	NB
Directions Served	L	LT	T	T	T	T	L	T	T
Maximum Queue (ft)	98	127	126	103	151	133	98	36	53
Average Queue (ft)	36	57	43	29	78	47	64	4	8
95th Queue (ft)	82	101	92	73	133	113	108	21	33
Link Distance (ft)	201	201	201	377	377		76	76	76
Upstream Blk Time (%)							9		0
Queuing Penalty (veh)							8		0
Storage Bay Dist (ft)						275			
Storage Blk Time (%)									
Queuing Penalty (veh)									

Intersection: 3: S Interstate 35 Frontage Road & Conrads Lane/Kohlenberg Road

Movement	EB	EB	EB	EB	WB	WB	WB	SB	SB	SB
Directions Served	T	T	T	R	L	LT	T	L	LT	T
Maximum Queue (ft)	108	125	94	91	132	211	209	63	125	122
Average Queue (ft)	37	54	18	8	69	139	128	4	91	66
95th Queue (ft)	86	104	65	48	117	201	192	29	133	119
Link Distance (ft)	340	340			201	201	201	95	95	95
Upstream Blk Time (%)						1	1	0	10	3
Queuing Penalty (veh)						3	1	0	18	5
Storage Bay Dist (ft)			275	275						
Storage Blk Time (%)										
Queuing Penalty (veh)										

Intersection: 6: N Interstate 35 Frontage Road

Movement	EB
Directions Served	L
Maximum Queue (ft)	22
Average Queue (ft)	1
95th Queue (ft)	10
Link Distance (ft)	218
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 7: S Interstate 35 Frontage Road

Movement	SB	SB
Directions Served	T	T
Maximum Queue (ft)	138	64
Average Queue (ft)	29	5
95th Queue (ft)	93	33
Link Distance (ft)	1238	1238
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 8: N Interstate 35 Frontage Road

Movement	NB
Directions Served	T
Maximum Queue (ft)	132
Average Queue (ft)	20
95th Queue (ft)	82
Link Distance (ft)	
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	475
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 9: N Interstate 35 Frontage Road & I-35 NB Off Ramp

Movement	EB
Directions Served	L
Maximum Queue (ft)	217
Average Queue (ft)	87
95th Queue (ft)	162
Link Distance (ft)	453
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 12: S Interstate 35 Frontage Road

Movement	WB	SB	SB	SB
Directions Served	L	T	T	T
Maximum Queue (ft)	130	5	9	38
Average Queue (ft)	50	0	0	2
95th Queue (ft)	99	4	6	21
Link Distance (ft)	223	121	121	121
Upstream Blk Time (%)	0			0
Queuing Penalty (veh)	0			0
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 13: S Interstate 35 Frontage Road & I-35 SB Off Ramp

Movement	WB	SB	SB
Directions Served	L	T	T
Maximum Queue (ft)	315	19	7
Average Queue (ft)	137	1	0
95th Queue (ft)	269	12	5
Link Distance (ft)	311	444	444
Upstream Blk Time (%)	1		
Queuing Penalty (veh)	0		
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 17: S Interstate 35 Frontage Road & Oak Creek Way

Movement	EB
Directions Served	R
Maximum Queue (ft)	86
Average Queue (ft)	35
95th Queue (ft)	67
Link Distance (ft)	991
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Network Summary

Network wide Queuing Penalty: 35

Queuing and Blocking Report

03/25/2021

Intersection: 2: N Interstate 35 Frontage Road & Kohlenberg Road

Movement	EB	EB	EB	WB	WB	WB	NB	NB	NB
Directions Served	L	LT	T	T	T	T	L	T	T
Maximum Queue (ft)	100	104	74	54	101	92	96	28	35
Average Queue (ft)	31	32	12	9	41	13	46	3	6
95th Queue (ft)	79	76	45	32	89	58	96	16	25
Link Distance (ft)	201	201	201	377	377		76	76	76
Upstream Blk Time (%)							3		
Queuing Penalty (veh)							3		
Storage Bay Dist (ft)						275			
Storage Blk Time (%)									
Queuing Penalty (veh)									

Intersection: 3: S Interstate 35 Frontage Road & Conrads Lane/Kohlenberg Road

Movement	EB	EB	EB	EB	WB	WB	WB	SB	SB	SB
Directions Served	T	T	T	R	L	LT	T	L	LT	T
Maximum Queue (ft)	107	103	78	55	78	171	164	31	124	134
Average Queue (ft)	44	41	10	5	26	94	84	1	105	95
95th Queue (ft)	85	85	44	34	61	152	142	15	135	141
Link Distance (ft)	340	340			201	201	201	95	95	95
Upstream Blk Time (%)						0	0	0	14	8
Queuing Penalty (veh)						0	0	0	42	25
Storage Bay Dist (ft)			275	275						
Storage Blk Time (%)										
Queuing Penalty (veh)										

Intersection: 6: N Interstate 35 Frontage Road

Movement	EB
Directions Served	L
Maximum Queue (ft)	3
Average Queue (ft)	0
95th Queue (ft)	3
Link Distance (ft)	218
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 7: S Interstate 35 Frontage Road

Movement	SB	SB
Directions Served	T	T
Maximum Queue (ft)	160	150
Average Queue (ft)	58	28
95th Queue (ft)	138	101
Link Distance (ft)	1238	1238
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 8: N Interstate 35 Frontage Road

Movement	NB
Directions Served	T
Maximum Queue (ft)	55
Average Queue (ft)	6
95th Queue (ft)	33
Link Distance (ft)	
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	475
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 9: N Interstate 35 Frontage Road & I-35 NB Off Ramp

Movement	EB	NB
Directions Served	L	T
Maximum Queue (ft)	477	8
Average Queue (ft)	247	0
95th Queue (ft)	488	8
Link Distance (ft)	453	802
Upstream Blk Time (%)	11	
Queuing Penalty (veh)	0	
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 12: S Interstate 35 Frontage Road

Movement	WB	SB	SB	SB
Directions Served	L	T	T	T
Maximum Queue (ft)	142	11	45	70
Average Queue (ft)	62	0	1	4
95th Queue (ft)	119	11	17	32
Link Distance (ft)	223	121	121	121
Upstream Blk Time (%)			0	0
Queuing Penalty (veh)			0	0
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 13: S Interstate 35 Frontage Road & I-35 SB Off Ramp

Movement	WB
Directions Served	L
Maximum Queue (ft)	147
Average Queue (ft)	53
95th Queue (ft)	114
Link Distance (ft)	311
Upstream Blk Time (%)	0
Queuing Penalty (veh)	0
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 17: S Interstate 35 Frontage Road & Oak Creek Way

Movement	EB
Directions Served	R
Maximum Queue (ft)	110
Average Queue (ft)	45
95th Queue (ft)	90
Link Distance (ft)	991
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Network Summary

Network wide Queuing Penalty: 69

Queuing and Blocking Report
Baseline

03/25/2021

Intersection: 2: N Interstate 35 Frontage Road & Kohlenberg Road

Movement	EB	EB	EB	WB	WB	WB	NB	NB	NB
Directions Served	L	LT	T	T	T	T	L	T	T
Maximum Queue (ft)	115	158	129	103	162	128	92	53	54
Average Queue (ft)	40	66	42	29	60	26	44	5	6
95th Queue (ft)	98	128	104	75	127	92	93	25	31
Link Distance (ft)	201	201	201	377	377		76	76	76
Upstream Blk Time (%)		0	0				5	0	0
Queuing Penalty (veh)		0	0				3	0	0
Storage Bay Dist (ft)						275			
Storage Blk Time (%)									
Queuing Penalty (veh)									

Intersection: 3: S Interstate 35 Frontage Road & Conrads Lane/Kohlenberg Road

Movement	EB	EB	EB	EB	WB	WB	WB	SB	SB	SB
Directions Served	T	T	T	R	L	LT	T	L	LT	T
Maximum Queue (ft)	138	163	132	109	158	208	192	42	116	92
Average Queue (ft)	64	86	43	10	60	103	89	2	55	20
95th Queue (ft)	118	144	114	59	123	178	161	18	111	64
Link Distance (ft)	340	340			201	201	201	95	95	95
Upstream Blk Time (%)					0	1	0		3	0
Queuing Penalty (veh)					0	1	0		2	0
Storage Bay Dist (ft)			275	275						
Storage Blk Time (%)										
Queuing Penalty (veh)										

Intersection: 6: N Interstate 35 Frontage Road

Movement	EB	NB	NB	NB
Directions Served	L	T	T	T
Maximum Queue (ft)	41	5	2	2
Average Queue (ft)	3	0	0	0
95th Queue (ft)	21	5	2	2
Link Distance (ft)	218	138	138	138
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 7: S Interstate 35 Frontage Road

Movement	SB	SB
Directions Served	T	T
Maximum Queue (ft)	75	6
Average Queue (ft)	5	0
95th Queue (ft)	35	4
Link Distance (ft)	1238	1238
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 8: N Interstate 35 Frontage Road

Movement	NB
Directions Served	T
Maximum Queue (ft)	112
Average Queue (ft)	10
95th Queue (ft)	57
Link Distance (ft)	
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	475
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 9: N Interstate 35 Frontage Road & I-35 NB Off Ramp

Movement	EB
Directions Served	L
Maximum Queue (ft)	242
Average Queue (ft)	96
95th Queue (ft)	178
Link Distance (ft)	453
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 12: S Interstate 35 Frontage Road

Movement	WB	SB	SB	SB
Directions Served	L	T	T	T
Maximum Queue (ft)	94	10	20	47
Average Queue (ft)	30	0	1	2
95th Queue (ft)	71	7	14	27
Link Distance (ft)	223	121	121	121
Upstream Blk Time (%)				0
Queuing Penalty (veh)				0
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 13: S Interstate 35 Frontage Road & I-35 SB Off Ramp

Movement	WB	SB	SB
Directions Served	L	T	T
Maximum Queue (ft)	356	22	2
Average Queue (ft)	187	1	0
95th Queue (ft)	354	12	2
Link Distance (ft)	311	444	444
Upstream Blk Time (%)	9		
Queuing Penalty (veh)	0		
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 17: S Interstate 35 Frontage Road & Oak Creek Way

Movement	EB
Directions Served	R
Maximum Queue (ft)	109
Average Queue (ft)	45
95th Queue (ft)	80
Link Distance (ft)	991
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 23: S Interstate 35 Frontage Road & Love's Driveway

Movement	EB	SB
Directions Served	R	TR
Maximum Queue (ft)	231	33
Average Queue (ft)	97	1
95th Queue (ft)	177	14
Link Distance (ft)	817	2094
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Network Summary

Network wide Queuing Penalty: 6

Queuing and Blocking Report

03/25/2021

Intersection: 2: N Interstate 35 Frontage Road & Kohlenberg Road

Movement	EB	EB	EB	WB	WB	WB	NB	NB	NB
Directions Served	L	LT	T	T	T	T	L	T	T
Maximum Queue (ft)	100	126	121	96	149	123	96	48	56
Average Queue (ft)	38	61	46	32	79	47	62	4	7
95th Queue (ft)	81	108	94	72	136	112	107	23	32
Link Distance (ft)	201	201	201	377	377		76	76	76
Upstream Blk Time (%)							9	0	0
Queuing Penalty (veh)							7	0	0
Storage Bay Dist (ft)						275			
Storage Blk Time (%)									
Queuing Penalty (veh)									

Intersection: 3: S Interstate 35 Frontage Road & Conrads Lane/Kohlenberg Road

Movement	EB	EB	EB	EB	B21	WB	WB	WB	SB	SB	SB
Directions Served	T	T	T	R	T	L	LT	T	L	LT	T
Maximum Queue (ft)	102	129	105	80	2	134	205	202	58	123	121
Average Queue (ft)	38	59	21	7	0	73	139	128	4	93	67
95th Queue (ft)	80	108	75	40	2	123	198	188	28	133	120
Link Distance (ft)	340	340			682	201	201	201	95	95	95
Upstream Blk Time (%)						0	1	1	0	9	3
Queuing Penalty (veh)						0	2	1	0	19	5
Storage Bay Dist (ft)			275	275							
Storage Blk Time (%)											
Queuing Penalty (veh)											

Intersection: 6: N Interstate 35 Frontage Road

Movement	EB
Directions Served	L
Maximum Queue (ft)	20
Average Queue (ft)	1
95th Queue (ft)	10
Link Distance (ft)	218
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 7: S Interstate 35 Frontage Road

Movement	SB	SB
Directions Served	T	T
Maximum Queue (ft)	125	79
Average Queue (ft)	25	4
95th Queue (ft)	82	30
Link Distance (ft)	1238	1238
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 8: N Interstate 35 Frontage Road

Movement	NB
Directions Served	T
Maximum Queue (ft)	127
Average Queue (ft)	19
95th Queue (ft)	75
Link Distance (ft)	
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	475
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 9: N Interstate 35 Frontage Road & I-35 NB Off Ramp

Movement	EB
Directions Served	L
Maximum Queue (ft)	291
Average Queue (ft)	114
95th Queue (ft)	229
Link Distance (ft)	453
Upstream Blk Time (%)	0
Queuing Penalty (veh)	0
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 12: S Interstate 35 Frontage Road

Movement	WB	SB	SB	SB
Directions Served	L	T	T	T
Maximum Queue (ft)	153	8	23	17
Average Queue (ft)	61	0	1	1
95th Queue (ft)	116	6	10	12
Link Distance (ft)	223	121	121	121
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 13: S Interstate 35 Frontage Road & I-35 SB Off Ramp

Movement	WB	SB	SB
Directions Served	L	T	T
Maximum Queue (ft)	371	41	8
Average Queue (ft)	317	3	0
95th Queue (ft)	429	20	7
Link Distance (ft)	311	444	444
Upstream Blk Time (%)	66		
Queuing Penalty (veh)	0		
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 17: S Interstate 35 Frontage Road & Oak Creek Way

Movement	EB
Directions Served	R
Maximum Queue (ft)	108
Average Queue (ft)	41
95th Queue (ft)	80
Link Distance (ft)	991
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 21: Bend

Movement	NW
Directions Served	T
Maximum Queue (ft)	18
Average Queue (ft)	1
95th Queue (ft)	18
Link Distance (ft)	340
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 23: S Interstate 35 Frontage Road & Love's Driveway

Movement	EB	SB
Directions Served	R	TR
Maximum Queue (ft)	879	9
Average Queue (ft)	758	0
95th Queue (ft)	1096	5
Link Distance (ft)	817	2094
Upstream Blk Time (%)	72	
Queuing Penalty (veh)	0	
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Network Summary

Network wide Queuing Penalty: 34

Queuing and Blocking Report

03/25/2021

Intersection: 2: N Interstate 35 Frontage Road & Kohlenberg Road

Movement	EB	EB	EB	WB	WB	WB	NB	NB	NB
Directions Served	L	LT	T	T	T	T	L	T	T
Maximum Queue (ft)	104	101	73	62	106	87	90	31	35
Average Queue (ft)	31	35	10	11	38	12	44	3	5
95th Queue (ft)	82	79	44	36	85	53	92	17	23
Link Distance (ft)	201	201	201	377	377		76	76	76
Upstream Blk Time (%)							3		
Queuing Penalty (veh)							2		
Storage Bay Dist (ft)						275			
Storage Blk Time (%)									
Queuing Penalty (veh)									

Intersection: 3: S Interstate 35 Frontage Road & Conrads Lane/Kohlenberg Road

Movement	EB	EB	EB	EB	WB	WB	WB	SB	SB	SB
Directions Served	T	T	T	R	L	LT	T	L	LT	T
Maximum Queue (ft)	112	112	71	91	86	183	170	27	132	139
Average Queue (ft)	43	41	7	10	31	95	81	1	107	97
95th Queue (ft)	89	86	39	54	72	157	144	15	135	143
Link Distance (ft)	340	340			201	201	201	95	95	95
Upstream Blk Time (%)						0	0	0	15	9
Queuing Penalty (veh)						0	0	0	47	30
Storage Bay Dist (ft)			275	275						
Storage Blk Time (%)										
Queuing Penalty (veh)										

Intersection: 6: N Interstate 35 Frontage Road

Movement	EB	NB
Directions Served	L	T
Maximum Queue (ft)	9	6
Average Queue (ft)	0	0
95th Queue (ft)	6	6
Link Distance (ft)	218	138
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 7: S Interstate 35 Frontage Road

Movement	SB	SB	SB
Directions Served	T	T	T
Maximum Queue (ft)	13	210	179
Average Queue (ft)	1	67	34
95th Queue (ft)	18	160	116
Link Distance (ft)		1238	1238
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)	475		
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 8: N Interstate 35 Frontage Road

Movement	NB	NB
Directions Served	L	T
Maximum Queue (ft)	17	58
Average Queue (ft)	1	5
95th Queue (ft)	13	31
Link Distance (ft)		
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)	475	475
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 9: N Interstate 35 Frontage Road & I-35 NB Off Ramp

Movement	EB
Directions Served	L
Maximum Queue (ft)	508
Average Queue (ft)	391
95th Queue (ft)	616
Link Distance (ft)	453
Upstream Blk Time (%)	49
Queuing Penalty (veh)	0
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 12: S Interstate 35 Frontage Road

Movement	WB	SB	SB	SB
Directions Served	L	T	T	T
Maximum Queue (ft)	187	25	51	68
Average Queue (ft)	89	1	3	7
95th Queue (ft)	161	14	27	42
Link Distance (ft)	223	121	121	121
Upstream Blk Time (%)	0	0	0	0
Queuing Penalty (veh)	0	0	0	0
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 13: S Interstate 35 Frontage Road & I-35 SB Off Ramp

Movement	WB	SB	SB
Directions Served	L	T	T
Maximum Queue (ft)	372	31	10
Average Queue (ft)	331	2	0
95th Queue (ft)	403	14	7
Link Distance (ft)	311	444	444
Upstream Blk Time (%)	87		
Queuing Penalty (veh)	0		
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 17: S Interstate 35 Frontage Road & Oak Creek Way

Movement	EB	SB
Directions Served	R	T
Maximum Queue (ft)	170	2
Average Queue (ft)	58	0
95th Queue (ft)	129	2
Link Distance (ft)	991	1334
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 23: S Interstate 35 Frontage Road & Love's Driveway

Movement	EB	SB	SB
Directions Served	R	T	TR
Maximum Queue (ft)	722	25	63
Average Queue (ft)	416	2	4
95th Queue (ft)	832	15	29
Link Distance (ft)	817	2094	2094
Upstream Blk Time (%)	10		
Queuing Penalty (veh)	0		
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Network Summary

Network wide Queuing Penalty: 80

Queuing and Blocking Report
Baseline

03/26/2021

Intersection: 2: N Interstate 35 Frontage Road & Kohlenberg Road

Movement	EB	EB	EB	WB	WB	WB	NB	NB	NB
Directions Served	L	LT	T	T	T	T	L	T	T
Maximum Queue (ft)	126	177	148	96	142	118	90	33	57
Average Queue (ft)	37	68	42	26	57	27	45	3	7
95th Queue (ft)	95	131	109	65	117	91	95	17	33
Link Distance (ft)	201	201	201	377	377		76	76	76
Upstream Blk Time (%)		0	0				5		0
Queuing Penalty (veh)		0	0				3		0
Storage Bay Dist (ft)						275			
Storage Blk Time (%)									
Queuing Penalty (veh)									

Intersection: 3: S Interstate 35 Frontage Road & Conrads Lane/Kohlenberg Road

Movement	EB	EB	EB	EB	WB	WB	WB	SB	SB	SB
Directions Served	T	T	T	R	L	LT	T	L	LT	T
Maximum Queue (ft)	127	175	131	156	151	204	192	26	110	89
Average Queue (ft)	60	87	39	15	56	104	93	2	57	26
95th Queue (ft)	112	146	105	82	118	174	166	16	111	69
Link Distance (ft)	340	340			201	201	201	95	95	95
Upstream Blk Time (%)					0	1	0		3	0
Queuing Penalty (veh)					0	1	0		3	0
Storage Bay Dist (ft)			275	275						
Storage Blk Time (%)				0						
Queuing Penalty (veh)				0						

Intersection: 6: N Interstate 35 Frontage Road

Movement	EB	NB	NB
Directions Served	L	T	T
Maximum Queue (ft)	23	6	12
Average Queue (ft)	1	0	0
95th Queue (ft)	12	0	10
Link Distance (ft)	218	138	138
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 7: S Interstate 35 Frontage Road

Movement	SB	SB
Directions Served	T	T
Maximum Queue (ft)	75	7
Average Queue (ft)	6	0
95th Queue (ft)	37	7
Link Distance (ft)	1238	1238
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 8: N Interstate 35 Frontage Road

Movement	NB
Directions Served	T
Maximum Queue (ft)	80
Average Queue (ft)	9
95th Queue (ft)	47
Link Distance (ft)	
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	475
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 9: N Interstate 35 Frontage Road & I-35 NB Off Ramp

Movement	EB
Directions Served	L
Maximum Queue (ft)	238
Average Queue (ft)	96
95th Queue (ft)	185
Link Distance (ft)	453
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 12: S Interstate 35 Frontage Road

Movement	WB	SB	SB	SB
Directions Served	L	T	T	T
Maximum Queue (ft)	127	16	9	19
Average Queue (ft)	34	1	0	1
95th Queue (ft)	84	10	7	13
Link Distance (ft)	223	121	121	121
Upstream Blk Time (%)	0			
Queuing Penalty (veh)	0			
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 13: S Interstate 35 Frontage Road & I-35 SB Off Ramp

Movement	WB	SB	SB
Directions Served	L	T	T
Maximum Queue (ft)	362	50	26
Average Queue (ft)	197	3	1
95th Queue (ft)	355	22	17
Link Distance (ft)	311	444	444
Upstream Blk Time (%)	9		
Queuing Penalty (veh)	0		
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 17: S Interstate 35 Frontage Road & Oak Creek Way

Movement	EB
Directions Served	R
Maximum Queue (ft)	106
Average Queue (ft)	44
95th Queue (ft)	82
Link Distance (ft)	991
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 23: S Interstate 35 Frontage Road & Love's Driveway

Movement	EB	SB
Directions Served	R	T
Maximum Queue (ft)	526	12
Average Queue (ft)	275	1
95th Queue (ft)	626	8
Link Distance (ft)	803	2094
Upstream Blk Time (%)	5	
Queuing Penalty (veh)	0	
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Network Summary

Network wide Queuing Penalty: 7

Queuing and Blocking Report

03/26/2021

Intersection: 2: N Interstate 35 Frontage Road & Kohlenberg Road

Movement	EB	EB	EB	WB	WB	WB	NB	NB	NB
Directions Served	L	LT	T	T	T	T	L	T	T
Maximum Queue (ft)	94	128	116	98	150	126	95	40	54
Average Queue (ft)	35	58	44	29	79	48	62	3	7
95th Queue (ft)	77	104	91	74	133	113	103	20	30
Link Distance (ft)	201	201	201	377	377		76	76	76
Upstream Blk Time (%)			0				8	0	0
Queuing Penalty (veh)			0				7	0	0
Storage Bay Dist (ft)						275			
Storage Blk Time (%)									
Queuing Penalty (veh)									

Intersection: 3: S Interstate 35 Frontage Road & Conrads Lane/Kohlenberg Road

Movement	EB	EB	EB	EB	WB	WB	WB	SB	SB	SB
Directions Served	T	T	T	R	L	LT	T	L	LT	T
Maximum Queue (ft)	92	126	119	88	148	205	201	51	127	119
Average Queue (ft)	34	57	18	9	70	136	126	4	92	70
95th Queue (ft)	75	103	69	49	124	195	190	28	133	118
Link Distance (ft)	340	340			201	201	201	95	95	95
Upstream Blk Time (%)						1	1	0	9	3
Queuing Penalty (veh)						1	1	0	17	6
Storage Bay Dist (ft)			275	275						
Storage Blk Time (%)										
Queuing Penalty (veh)										

Intersection: 6: N Interstate 35 Frontage Road

Movement	EB
Directions Served	L
Maximum Queue (ft)	14
Average Queue (ft)	1
95th Queue (ft)	8
Link Distance (ft)	218
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 7: S Interstate 35 Frontage Road

Movement	SB	SB
Directions Served	T	T
Maximum Queue (ft)	113	80
Average Queue (ft)	23	5
95th Queue (ft)	81	39
Link Distance (ft)	1238	1238
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 8: N Interstate 35 Frontage Road

Movement	NB
Directions Served	T
Maximum Queue (ft)	128
Average Queue (ft)	18
95th Queue (ft)	77
Link Distance (ft)	
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	475
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 9: N Interstate 35 Frontage Road & I-35 NB Off Ramp

Movement	EB
Directions Served	L
Maximum Queue (ft)	252
Average Queue (ft)	103
95th Queue (ft)	208
Link Distance (ft)	453
Upstream Blk Time (%)	0
Queuing Penalty (veh)	0
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 12: S Interstate 35 Frontage Road

Movement	WB	SB	SB	SB
Directions Served	L	T	T	T
Maximum Queue (ft)	138	2	17	40
Average Queue (ft)	64	0	1	2
95th Queue (ft)	120	2	10	22
Link Distance (ft)	223	121	121	121
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 13: S Interstate 35 Frontage Road & I-35 SB Off Ramp

Movement	WB	SB	SB
Directions Served	L	T	T
Maximum Queue (ft)	373	35	29
Average Queue (ft)	320	3	2
95th Queue (ft)	426	18	16
Link Distance (ft)	311	444	444
Upstream Blk Time (%)	66		
Queuing Penalty (veh)	0		
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 17: S Interstate 35 Frontage Road & Oak Creek Way

Movement	EB
Directions Served	R
Maximum Queue (ft)	98
Average Queue (ft)	42
95th Queue (ft)	82
Link Distance (ft)	991
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 21: Bend

Movement	NW
Directions Served	T
Maximum Queue (ft)	27
Average Queue (ft)	1
95th Queue (ft)	27
Link Distance (ft)	340
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 23: S Interstate 35 Frontage Road & Love's Driveway

Movement	EB	SB
Directions Served	R	T
Maximum Queue (ft)	863	5
Average Queue (ft)	796	0
95th Queue (ft)	990	7
Link Distance (ft)	803	2094
Upstream Blk Time (%)	81	
Queuing Penalty (veh)	0	
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Network Summary

Network wide Queuing Penalty: 32

Queuing and Blocking Report

03/26/2021

Intersection: 2: N Interstate 35 Frontage Road & Kohlenberg Road

Movement	EB	EB	EB	WB	WB	WB	NB	NB	NB
Directions Served	L	LT	T	T	T	T	L	T	T
Maximum Queue (ft)	98	112	78	57	106	83	90	26	43
Average Queue (ft)	30	31	9	9	40	12	44	3	6
95th Queue (ft)	78	77	41	34	87	55	92	15	26
Link Distance (ft)	201	201	201	377	377		76	76	76
Upstream Blk Time (%)		0					3		
Queuing Penalty (veh)		0					3		
Storage Bay Dist (ft)						275			
Storage Blk Time (%)									
Queuing Penalty (veh)									

Intersection: 3: S Interstate 35 Frontage Road & Conrads Lane/Kohlenberg Road

Movement	EB	EB	EB	EB	WB	WB	WB	SB	SB	SB
Directions Served	T	T	T	R	L	LT	T	L	LT	T
Maximum Queue (ft)	93	100	80	113	108	176	167	34	127	138
Average Queue (ft)	40	42	9	12	30	93	80	1	103	98
95th Queue (ft)	78	84	42	60	72	152	139	15	137	145
Link Distance (ft)	340	340			201	201	201	95	95	95
Upstream Blk Time (%)					0	0	0	0	12	10
Queuing Penalty (veh)					0	0	0	0	40	33
Storage Bay Dist (ft)			275	275						
Storage Blk Time (%)										
Queuing Penalty (veh)										

Intersection: 6: N Interstate 35 Frontage Road

Movement	EB
Directions Served	L
Maximum Queue (ft)	12
Average Queue (ft)	1
95th Queue (ft)	7
Link Distance (ft)	218
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 7: S Interstate 35 Frontage Road

Movement	SB	SB
Directions Served	T	T
Maximum Queue (ft)	177	166
Average Queue (ft)	53	33
95th Queue (ft)	134	109
Link Distance (ft)	1238	1238
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 8: N Interstate 35 Frontage Road

Movement	NB	NB
Directions Served	L	T
Maximum Queue (ft)	22	83
Average Queue (ft)	1	7
95th Queue (ft)	20	43
Link Distance (ft)		
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)	475	475
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 9: N Interstate 35 Frontage Road & I-35 NB Off Ramp

Movement	EB	NB
Directions Served	L	T
Maximum Queue (ft)	510	15
Average Queue (ft)	381	1
95th Queue (ft)	617	9
Link Distance (ft)	453	802
Upstream Blk Time (%)	50	
Queuing Penalty (veh)	0	
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 12: S Interstate 35 Frontage Road

Movement	WB	SB	SB	SB
Directions Served	L	T	T	T
Maximum Queue (ft)	199	10	54	103
Average Queue (ft)	93	0	4	11
95th Queue (ft)	164	6	29	55
Link Distance (ft)	223	121	121	121
Upstream Blk Time (%)	0			0
Queuing Penalty (veh)	0			0
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 13: S Interstate 35 Frontage Road & I-35 SB Off Ramp

Movement	WB	SB	SB
Directions Served	L	T	T
Maximum Queue (ft)	367	25	8
Average Queue (ft)	330	1	0
95th Queue (ft)	405	12	6
Link Distance (ft)	311	444	444
Upstream Blk Time (%)	85		
Queuing Penalty (veh)	0		
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 17: S Interstate 35 Frontage Road & Oak Creek Way

Movement	EB	SB
Directions Served	R	T
Maximum Queue (ft)	158	139
Average Queue (ft)	58	5
95th Queue (ft)	118	139
Link Distance (ft)	991	1334
Upstream Blk Time (%)		0
Queuing Penalty (veh)		0
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 23: S Interstate 35 Frontage Road & Love's Driveway

Movement	EB
Directions Served	R
Maximum Queue (ft)	862
Average Queue (ft)	835
95th Queue (ft)	861
Link Distance (ft)	803
Upstream Blk Time (%)	100
Queuing Penalty (veh)	0
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Network Summary

Network wide Queuing Penalty: 76

APPENDIX H
WEAVE ANALYSIS SUMMARY SHEETS

HCS7 Freeway Weaving Report

Project Information

Analyst	TMC	Date	3/26/2021
Agency	CESO, Inc.	Analysis Year	2022
Jurisdiction	TxDOT San Antonio District	Time Period Analyzed	2022 Build AM Peak Hour
Project Description	I-35 SB Off Ramp to S Interstate 35 Frontage Road	Unit	United States Customary

Geometric Data

Number of Lanes (N), ln	2	Segment Type	Highway/CD Roadway
Segment Length (L_S), ft	1935	Number of Maneuver Lanes (N_{WL}), ln	0
Weaving Configuration	Two-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Rolling	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	1
Interchange Density (ID), int/mi	2.00	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	886	405	125	125
Peak Hour Factor (PHF)	0.94	0.94	0.94	0.94
Total Trucks, %	15.00	9.00	29.00	21.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.769	0.917	0.775	0.704
Flow Rate (v_i), pc/h	1226	470	172	189

Weaving Flow Rate (v_w), pc/h	172	Freeway Max Capacity (c_{IFL}), pc/h/ln	2250
Non-Weaving Flow Rate (v_{NW}), pc/h	1885	Density-Based Capacity (c_{IWL}), pc/h/ln	1899
Total Flow Rate (v), pc/h	2057	Demand Flow-Based Capacity (c_{IW}), pc/h	-
Volume Ratio (VR)	0.084	Weaving Segment Capacity (c_W), veh/h	3028
Minimum Lane Change Rate (LC_{MIN}), lc/h	172	Adjusted Weaving Area Capacity, pc/h	3798
Maximum Weaving Length (L_{MAX}), ft	6517	Volume-to-Capacity Ratio (v/c)	0.54

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	729	Average Weaving Speed (S_W), mi/h	49.1
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	1052	Average Non-Weaving Speed (S_{NW}), mi/h	48.8
Weaving Lane Change Rate (LC_W), lc/h	324	Average Speed (S), mi/h	48.8
Weaving Lane Change Rate (LC_{All}), lc/h	1376	Density (D), pc/mi/ln	21.1
Weaving Intensity Factor (W)	0.173	Level of Service (LOS)	B

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HCS7 Freeway Weaving Report

Project Information

Analyst	TMC	Date	3/26/2021
Agency	CESO, Inc.	Analysis Year	2022
Jurisdiction	TxDOT San Antonio District	Time Period Analyzed	2022 Build PM Peak Hour
Project Description	I-35 SB Off Ramp to S Interstate 35 Frontage Road	Unit	United States Customary

Geometric Data

Number of Lanes (N), ln	2	Segment Type	Highway/CD Roadway
Segment Length (L_S), ft	1935	Number of Maneuver Lanes (N_{WL}), ln	0
Weaving Configuration	Two-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Rolling	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	1
Interchange Density (ID), int/mi	2.00	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	1143	507	104	139
Peak Hour Factor (PHF)	0.94	0.94	0.94	0.94
Total Trucks, %	8.00	4.00	34.00	22.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.862	0.962	0.746	0.694
Flow Rate (v_i), pc/h	1411	561	148	213

Weaving Flow Rate (v_w), pc/h	148	Freeway Max Capacity (c_{IFL}), pc/h/ln	2250
Non-Weaving Flow Rate (v_{NW}), pc/h	2185	Density-Based Capacity (c_{IWL}), pc/h/ln	1915
Total Flow Rate (v), pc/h	2333	Demand Flow-Based Capacity (c_{IW}), pc/h	-
Volume Ratio (VR)	0.063	Weaving Segment Capacity (c_W), veh/h	3306
Minimum Lane Change Rate (LC_{MIN}), lc/h	148	Adjusted Weaving Area Capacity, pc/h	3829
Maximum Weaving Length (L_{MAX}), ft	6316	Volume-to-Capacity Ratio (v/c)	0.61

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	846	Average Weaving Speed (S_W), mi/h	49.0
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	1114	Average Non-Weaving Speed (S_{NW}), mi/h	48.3
Weaving Lane Change Rate (LC_W), lc/h	300	Average Speed (S), mi/h	48.3
Weaving Lane Change Rate (LC_{All}), lc/h	1414	Density (D), pc/mi/ln	24.2
Weaving Intensity Factor (W)	0.176	Level of Service (LOS)	C

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HCS7 Freeway Weaving Report

Project Information

Analyst	TMC	Date	3/26/2021
Agency	CESO, Inc.	Analysis Year	2022
Jurisdiction	TxDOT San Antonio District	Time Period Analyzed	2022 Build Saturday Peak Hour
Project Description	I-35 SB Off Ramp to S Interstate 35 Frontage Road	Unit	United States Customary

Geometric Data

Number of Lanes (N), ln	2	Segment Type	Highway/CD Roadway
Segment Length (L_S), ft	1935	Number of Maneuver Lanes (N_{WL}), ln	0
Weaving Configuration	Two-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Rolling	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	1
Interchange Density (ID), int/mi	2.00	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	1701	151	159	181
Peak Hour Factor (PHF)	0.94	0.94	0.94	0.94
Total Trucks, %	4.00	2.00	27.00	22.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.926	0.980	0.787	0.694
Flow Rate (v_i), pc/h	1954	164	215	277

Weaving Flow Rate (v_w), pc/h	215	Freeway Max Capacity (c_{IFL}), pc/h/ln	2250
Non-Weaving Flow Rate (v_{NW}), pc/h	2395	Density-Based Capacity (c_{IWL}), pc/h/ln	1901
Total Flow Rate (v), pc/h	2610	Demand Flow-Based Capacity (c_{IW}), pc/h	-
Volume Ratio (VR)	0.082	Weaving Segment Capacity (c_W), veh/h	3396
Minimum Lane Change Rate (LC_{MIN}), lc/h	215	Adjusted Weaving Area Capacity, pc/h	3802
Maximum Weaving Length (L_{MAX}), ft	6498	Volume-to-Capacity Ratio (v/c)	0.69

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	927	Average Weaving Speed (S_W), mi/h	48.7
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	1157	Average Non-Weaving Speed (S_{NW}), mi/h	47.2
Weaving Lane Change Rate (LC_W), lc/h	367	Average Speed (S), mi/h	47.3
Weaving Lane Change Rate (LC_{All}), lc/h	1524	Density (D), pc/mi/ln	27.6
Weaving Intensity Factor (W)	0.187	Level of Service (LOS)	C

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Feasibility Study

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On behalf of:

Love's

Love's Travel Stops
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New Braunfels, Texas 78130

Contact

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APPENDICES

A. Texas Statewide Truck Parking Study

I. Narrative

Love's Travel Stops & Country Stores, Inc. (Love's) is seeking to developed the properties at 4001 / 4023 / 4165 IH-35 Frontage Road in the City of New Braunfels. The Love's Travel Plaza will consist of the following features:

- Country Store with one (1) attached restaurant with drive-thru and one (1) attached restaurant without a drive-thru, as pictured below
- Speedco Truck Care Center that performs preventative maintenance and Department of Transportation (DOT) inspections, as pictured below
- Caterpillar Truck Scale
- Passenger car fueling and parking areas
- Diesel truck fueling and parking areas for professional drivers
- Recreational vehicle parking areas and holding tank unloading facilities
- Dog Park
- Propane tank

II. Demand for Truck Fueling & Overnight Parking

Easily accessible and adequate truck parking is one of the leading concerns for the trucking industry per the Texas Statewide Truck Parking Study completed by the Texas Department of Transportation (TxDOT) in April of 2020. Below are some pertinent statements from that study indicating a lack of truck parking within the State of Texas.

> *"Interstate-35 is a major United States-Mexico-Canada trade corridor from Mexico to Canada. This corridor has the third lowest number of spaces per truck-miles traveled. More importantly, there is a shortage of public and private truck parking facilities in and around the Austin area."*

> *"The safe and efficient movement of freight depends on adequate and strategically located truck parking. Federal hours-of-service regulations require drivers to rest at defined intervals, causing them to search for parking before their allowable drive time expires or while staging for their pick-up and delivery slots, resulting in lost productivity, higher shipping costs and increased congestion. Parking shortages can also lead to parking in unauthorized locations and result in a safety hazard for both the driver and the motoring public."*

The study also identified five main reasons why trucks need to park; pertinent reason are summarized below:

- Long haul – drivers are on the road days and weeks at a time.
- 30-minute break – federal mandates require a 30-minute break, meaning the professional driver is off duty and the truck cannot move for any reason.
- Emergency – drivers may be impacted by an incident that has either closed or severely congested the roadway, and they need a place to park.

III. Existing Nearby Love's Sites & Rest Areas

The closest Love's Travel Plaza in relation to New Braunfels is located appropriately 15-miles southeast in Seguin, Texas. This site is located off of Interstate-10 and is not easily accessible via interstate highways when traveling the Interstate-35 corridor between San Antonio and Austin.

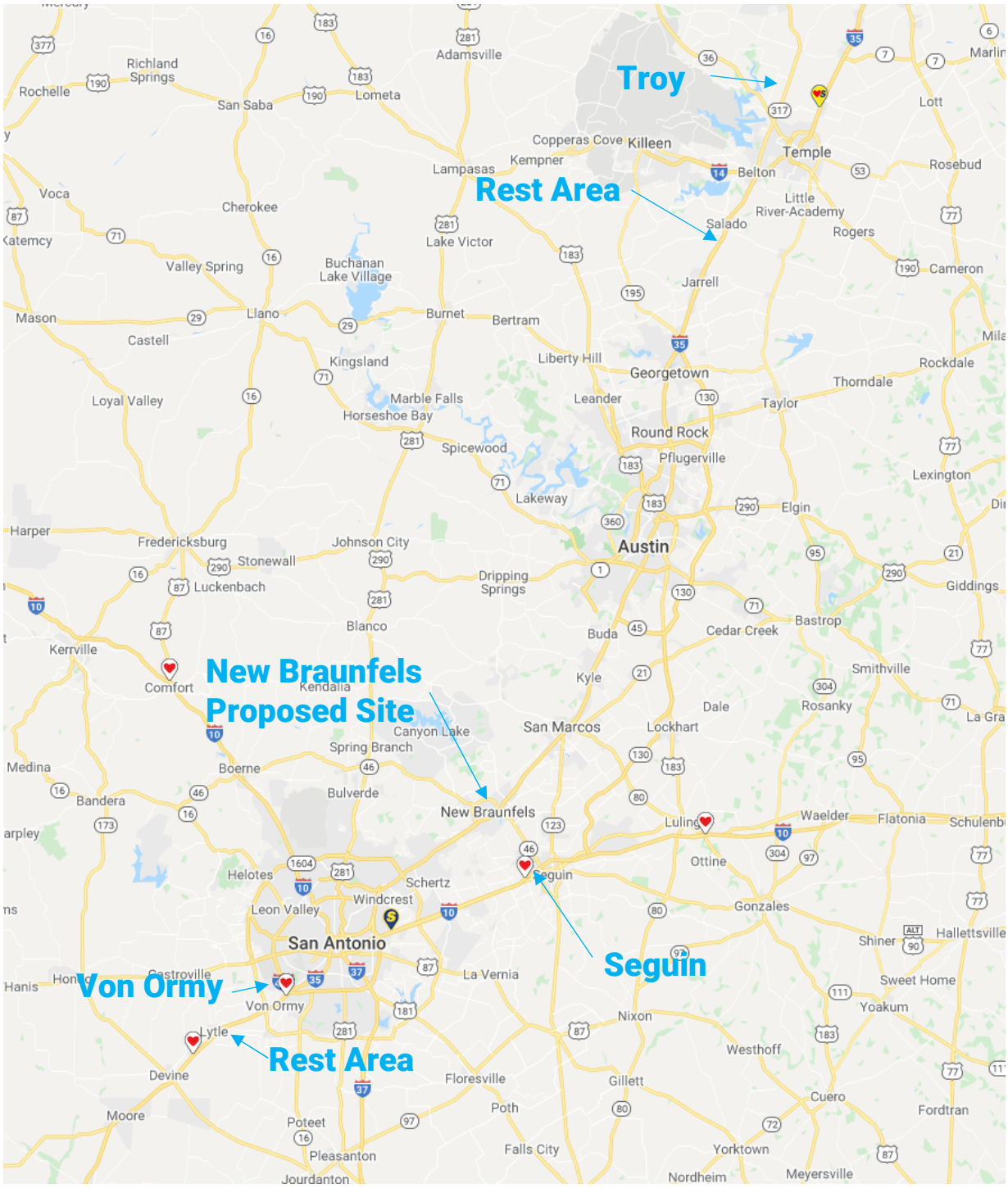
Along Interstate-35, the closest Love's sites are located in Troy and Von Ormy, which are approximately 165-miles apart. The site in Troy is approximately 118-miles to the north of New Braunfels, on average serves 471 diesel trucks per day, and sells approximately 1.5-million gallons of diesel fuel per month. The truck parking area is 100-percent full on a nightly basis.

The Von Ormy site is located approximately 48-miles to the south, serves 283 diesel trucks per day on average, and sells approximately 900,000-gallons of diesel fuel per month. The truck parking area is 100-percent full on a nightly basis.

The peak hour sales for both sites occur between the hours of 5am – 9am and 2pm – 10pm.

Rest areas are located along Interstate-35 about 67-miles to the south and 95-miles to the north of the proposed Love's. These rest areas have limited truck parking available, limited food and beverage options, do not offer fueling or vehicle maintenance, and do not offer Wi-Fi, showers, or laundry.

These locations are depicted in the figure on the next page.


Troy
Rest Area
New Braunfels
Proposed Site
Seguin
Von Ormy
Rest Area
Austin
San Antonio
New Braunfels
Seguin
Von Ormy
Lytle
Temple
Killeen
Belton
Georgetown
Round Rock
Pflugerville
Leander
Cedar Park
Kyle
Buda
San Marcos
Lockhart
Luling
Gonzales
Schertz
Converse
Universal City
Windcrest
Leon Valley
Helotes
Boerne
Bulverde
Spring Branch
Canyon Lake
Kendalia
Comfort
Kerrville
Fredericksburg
Stonewall
Luckenbach
Johnson City
Blanco
Dripping Springs
Marble Falls
Horseshoe Bay
Spicewood
Lakeway
Liberty Hill
Burnet
Bertram
Llano
Mason
Castell
Kingsland
Lake Victor
Buchanan Lake Village
Valley Spring
Cherokee
Lampasas
Kempner
Copperas Cove
Salado
Jarrell
Taylor
Thorndale
Rockdale
Elgin
Giddings
Lexington
Bastrop
Smithville
Rosanky
Dale
Ottine
Waelder
Flatonia
Schulenburg
Shiner
Hallettsville
Sweet Home
Yoakum
Nixon
Westhoff
Cuero
Fordtran
Yorktown
Meyersville
Nordheim
Gillett
Floresville
Poth
Falls City
Pleasanton
Poteet
Moore
Devine
La Vernia
Castroville
Hondo
Hanis
Bandera
Medina
Harper
Voca
Katemcy
Richland Springs
Rochelle
San Saba
Lometa
Adamsville
Rosebud
Little River-Academy
Rogers
Cameron
Mila
Rockdale
Thorndale
Giddings
La Grange
Lott
Marlin

IV. Site Selection & Proposed Demand

As identified above, there is a lack of available locations for professional drivers between San Antonio and Austin. To help fill this void Love's is looking to development in the City of New Braunfels. Prior to selecting this site, Love's investigated sites in Kyle, San Marcos, and Schertz along the Interstate-35 corridor; however, the site in New Braunfels best fit the existing Love's network and provided access with minimal impact to the surrounding traffic pattern. Being positioned between the exit and entrance ramps, motorist traveling southbound will have a minimal impact to the existing traffic network. Access for motorist traveling northbound on Interstate-35 will be able to utilize the frontage road.

To assist with selection of the proposed site, on February 11, 2020 a Love's representative counted 168 diesel trucks, over a fifteen-minute interval, traveling in both directions on Intersate-35. This number of trucks exceeds Love's preferred amount of 100 trucks over a fifteen-minute interval. **Based on the amount of diesel trucks traveling on Interstate-35, and the sales at the existing sites mentioned above, Love's anticipates the proposed development in New Braunfels to generate similar demand, or possibly greater.**

V. Job Creation & Tax Revenue

The Love's development will create over 60 new jobs for the area including salaried and hourly manager positions. It is estimated that appropriately 70-percent of the positions will be full time. All employees, regardless of salary or hourly, will have the opportunity for paid vacation, health / dental / vision insurance, and bonus opportunities.

Based on sales from Love's developments of similar size and scale it is estimated that the Love's development will generate appropriately 10-million dollars in revenue each year.

APPENDIX A:
TEXAS STATEWIDE TRUCK PARKING STUDY

TEXAS STATEWIDE TRUCK PARKING STUDY

APRIL 2020

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Acronyms

AADT	Annual Average Daily Traffic
AADTT	Annual Average Daily Truck Traffic
AAR	Association of American Railroads
AS/RS	Automated Storage and Retrieval System
ATA	American Trucking Associations
ATCMTD	Advanced Transportation and Congestion Management Technologies Deployment
ATRI	American Transportation Research Institute
AV	Automated Vehicle
BAT	Border Adjustment Tax
BCA	Benefit-cost Analysis
Bcf/d	Billion Cubic Feet per Day
BLS	Bureau of Labor Statistics
BSIF	Border Safety Inspection Facility
BTAC	Border Trade Advisory Committee
BTU	British Thermal Units
CAA	U.S. Clean Air Act
CMV	Commercial Motor Vehicles
CRIS	Crash Record Information System
DE	District Engineer
DFW	Dallas-Fort Worth
DMS	Dynamic Message Sign
DOT	Department of Transportation
DPS	Department of Public Safety
ELD	Electronic Logging Device
FAST Act	Fixing America's Surface Transportation Act
FHWA	Federal Highway Administration
FMCSA	Federal Motor Carrier Safety Administration
FSD	Freight System Designation
GPS	Global Positioning System
H-GAC	Houston-Galveston Area Council
HOS	Hours-of-Service
IRI	International Roughness Index
ITS	Intelligent Transportation Systems
LOS	Level of Service
MAASTO	Mid America Association of State Transportation Officials
MAP-21	Moving Ahead for Progress in the 21st Century
MPO	Metropolitan Planning Organization
NATSO	National Association of Truck Stop Operators
NHS	National Highway System
OOIDA	Owner-Operator Independent Drivers Association
OS/OW	Over-Size/Over-Weight
PAAC	Port Authority Advisory Committee
POE	Port of Entry

RFI	Request for Information
ROW	Right of Way
RV	Recreational Vehicle
SAM	Statewide Analysis Model
SHSP	Strategic Highway Safety Plan
SRA	Safety Rest Area
TCEQ	Texas Commission on Environmental Quality
TFMP	Texas Freight Mobility Plan
THFN	Texas Highway Freight Network
TIA	Traffic Impact Analysis
TIC	Travel Information Centers
TPAS	Truck Parking Availability Systems
TSPS	Truck Specialized Parking Services
TTP	Texas Transportation Plan
TxDOT	Texas Department of Transportation
TxDMV	Texas Department of Motor Vehicles
TxFAC	Texas Freight Advisory Committee
TxTA	Texas Trucking Association
U.S.	United States
USMCA	United States-Mexico-Canada Agreement
USDOT	United States Department of Transportation
UTP	Unified Transportation Program

SECTION 1:

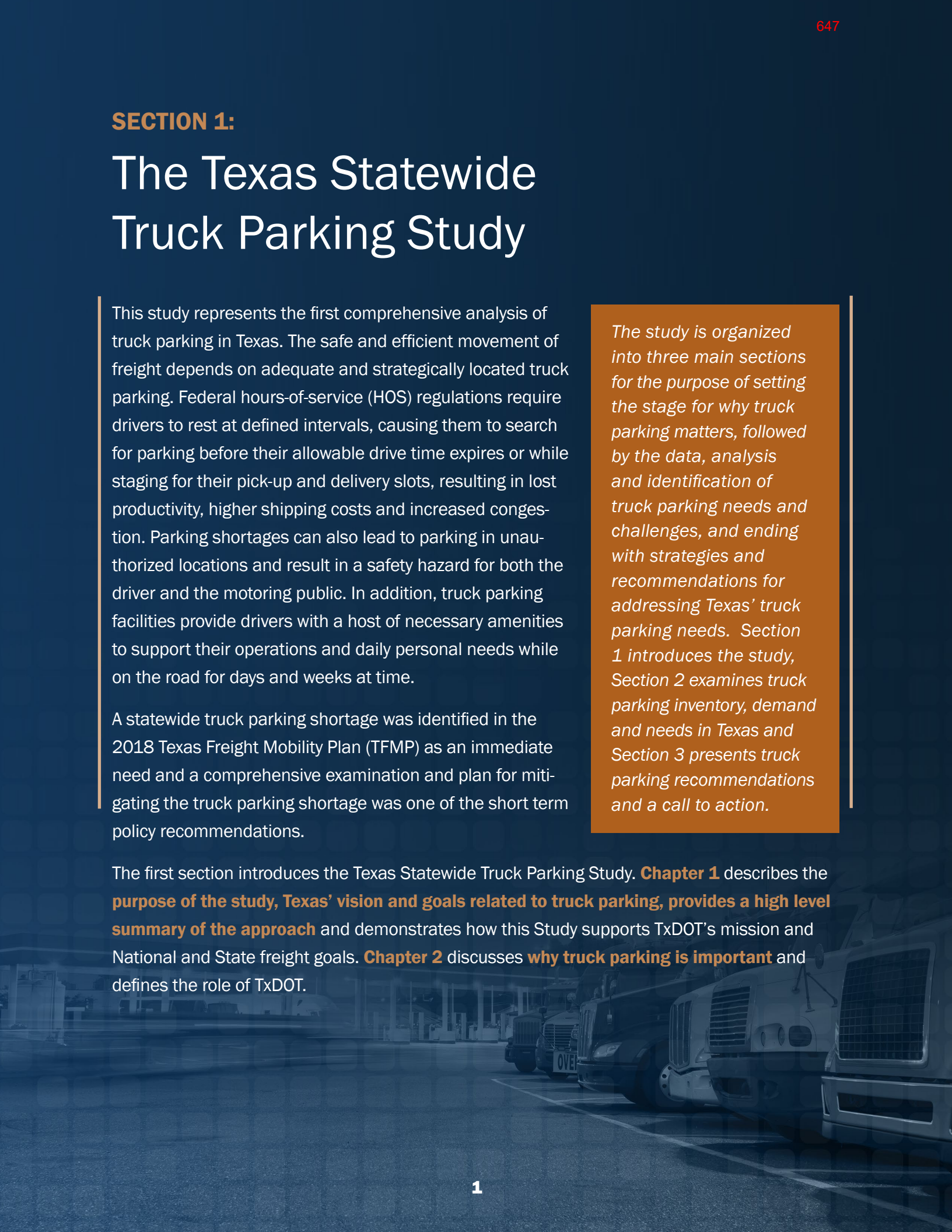
The Texas Statewide Truck Parking Study

This study represents the first comprehensive analysis of truck parking in Texas. The safe and efficient movement of freight depends on adequate and strategically located truck parking. Federal hours-of-service (HOS) regulations require drivers to rest at defined intervals, causing them to search for parking before their allowable drive time expires or while staging for their pick-up and delivery slots, resulting in lost productivity, higher shipping costs and increased congestion. Parking shortages can also lead to parking in unauthorized locations and result in a safety hazard for both the driver and the motoring public. In addition, truck parking facilities provide drivers with a host of necessary amenities to support their operations and daily personal needs while on the road for days and weeks at time.

A statewide truck parking shortage was identified in the 2018 Texas Freight Mobility Plan (TFMP) as an immediate need and a comprehensive examination and plan for mitigating the truck parking shortage was one of the short term policy recommendations.

The study is organized into three main sections for the purpose of setting the stage for why truck parking matters, followed by the data, analysis and identification of truck parking needs and challenges, and ending with strategies and recommendations for addressing Texas' truck parking needs. Section 1 introduces the study, Section 2 examines truck parking inventory, demand and needs in Texas and Section 3 presents truck parking recommendations and a call to action.

The first section introduces the Texas Statewide Truck Parking Study. **Chapter 1** describes the **purpose of the study, Texas' vision and goals related to truck parking, provides a high level summary of the approach** and demonstrates how this Study supports TxDOT's mission and National and State freight goals. **Chapter 2** discusses **why truck parking is important** and defines the role of TxDOT.



1 Overview of the Texas Statewide Truck Parking Study

The shortage of safe, authorized truck parking was identified in the 2018 Texas Freight Mobility Plan (TFMP) as a high priority need. This Study represents the advancement of the 2018 TFMP recommendation to conduct a statewide truck parking study and develop comprehensive strategies to address truck parking needs. This study assesses the current supply and demand of truck parking in Texas and provides recommendations and strategies to address existing and future parking gaps and needs.

The Texas Statewide Truck Parking Study supports national and state freight mobility goals and missions. This chapter provides an overview of the study including the study purpose, goals and objectives, the approach, stakeholder outreach and data collection.

PURPOSE, GOALS AND OBJECTIVES

TxDOT, in coordination with public and private sector stakeholders, developed a study purpose, and goals and objectives to achieve the purpose. The purpose, goals and objectives are informed by:

- Texas Freight Advisory Committee (TxFAC);
- Federal Highway Administration (FHWA);
- Trucking companies and drivers across the state;
- Community leaders and planning partners;
- TxDOT districts and divisions;
- TxDOT's 2019-2023 Strategic Plan;
- Texas Transportation Plan 2050;
- 2018 Texas Freight Mobility Plan; and
- National freight policy goals defined in the 2012 Moving Ahead for Progress in the 21st Century (MAP-21) and 2015 Fixing America's Surface Transportation (FAST) Act.

KEY FINDINGS

- The purpose of the study is to assess and address existing and future truck parking needs with practical, innovative and cost-effective strategies
- A data-driven, stakeholder-informed approach was used to complete the study

19 stakeholder workshops were held **throughout the state**
November 2018 → February 2019

4 updates to the Texas Freight Advisory Committee, including **two panels comprised of truckers** that operate throughout Texas

Two on-line surveys resulted in over **1,600 responses**, **75% from truck drivers**

20 stakeholder interviews and **focus groups** were held with **drivers**, **managers**, **trucking associations**, **planning partners**, **shippers and receivers**, **private truck stop facility operators** and **solution providers**.

Three industry forums were conducted in coordination with the **Texas Trucking Association** to gain input from drivers on strategies for **addressing truck parking needs**.

TxDOT **staffed a booth** at the **Great American Truck Show** in Dallas in August 2019.

Webinars and **meetings** conducted with District Engineers and planning staff.

STUDY PURPOSE

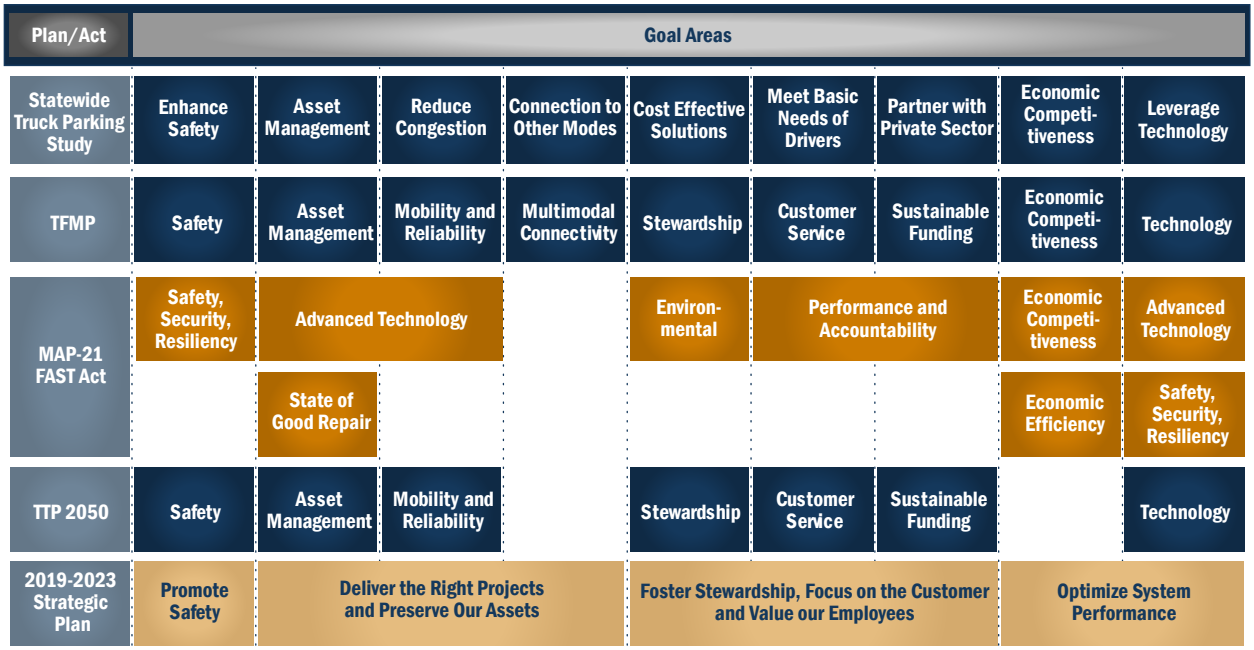
Assess and address existing and future truck parking needs with practical, innovative and cost-effective strategies

Exhibit 1 displays the relationship between the goals of the Statewide Truck Parking Study and the plans noted above. As demonstrated, there is overlap between all of the goal areas of the TFMP and the Statewide Truck Parking Study.

The goals and objectives were defined in a way to support accomplishing the purpose of the Study. The goals primarily focused on enhancing safety for all motorists and reducing unauthorized truck parking on the Texas Highway Freight Network (THFN) while ensuring that Texas remains a competitive state for trucking. The goals also addressed the need for technology and partnering with the private sector to ensure cost effective solutions for meeting truck parking needs. Finally, the goals focused on actionable strategies so that the study would result in implementable recommendations and become a catalyst for investment.

These goals are intended to guide the current and future truck parking planning efforts and to serve as the touchstone by which to measure the success of these efforts. Accomplishment of these objectives will make concrete, measurable progress toward the success of the Statewide Truck Parking Study and the TFMP purpose and ultimate realization of TxDOT's mission.

Exhibit 1: Relationship Between the Statewide Truck Parking Study Goals and Previous Planning Efforts

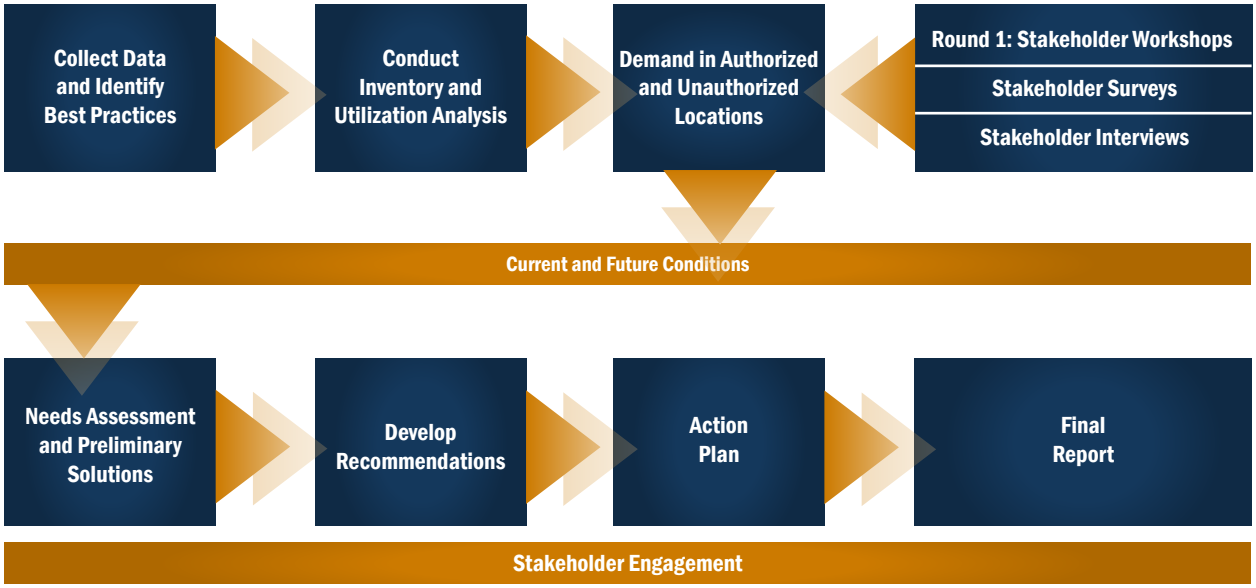


Source: Cambridge Systematics.

STUDY APPROACH

The Statewide Truck Parking Study builds upon the 2018 TFMP which incorporated multimodal strategic planning at the statewide, regional and local levels. Developing the Statewide Truck Parking Study involved a number of steps, including obtaining and analyzing a statewide truck location based dataset, inventorying all public and private sector truck parking facilities, conducting meetings and engaging with drivers and other stakeholders, identifying truck parking needs and shortages and developing recommendations. Key outcomes of the Statewide Truck Parking Study are specific actions to guide short- and long-term investments, policies and programs. Exhibit 2 displays the Statewide Truck Parking Study's development process.

Exhibit 2: Overview of the Approach for Developing the Texas Statewide Truck Parking Study



Source: Cambridge Systematics.

This final report draws upon the technical assessments and reports compiled throughout this effort including:

- **State of the Practice, Laws and Regulation Report—**An assessment on the state of the practice regarding truck parking across the U.S. was conducted. Topics include a review of applicable federal, state, local and neighboring state laws. In addition, more than 50 truck parking studies and reports at the federal, state, and local level were reviewed and an inventory of existing truck parking technology deployments was completed.
- **Truck Parking Inventory and Utilization Report—**An inventory of truck parking facilities, spaces and attributes of all known and authorized truck parking locations across the state was developed from a variety of sources including FHWA's Jason's Law survey and online truck parking applications. The utilization of authorized sites by time of day, day of week, and for what purpose is analyzed and documented.
- **Truck Parking Demand in Dedicated and Unauthorized Locations Report—**Building on the utilization analysis in the prior step, a more in-depth assessment was conducted to identify: 1) the demand for truck parking in key corridors and regions in Texas, 2) areas or locations where parking is not sufficient to meet current demand, and 3) common areas, patterns, and reasons for unauthorized parking.
- **Truck Parking Crash Analysis Report—**Truck-involved crash statistics for 2013-2017 were analyzed to document and map the highest crash incident locations and compare those crash statistics with the truck parking inventory and demand analysis.

- **Current and Forecasted Truck Parking Needs Assessment Report**—Utilizing the information gathered in previous reports, truck parking shortages and issues were summarized by category, and truck parking needs were identified. Future freight volumes were also forecasted to estimate future truck parking needs.
- **Truck Parking Recommendations and Action Plan Report**—A range of policies, programs, and projects to address Texas' current and future truck parking needs was presented, along with an assessment of estimated costs and potential funding sources.
- **Truck Parking Stakeholder Outreach and Engagement Summary Report**—Extensive stakeholder outreach was conducted to identify truck parking challenges, required amenities, and potential strategies.

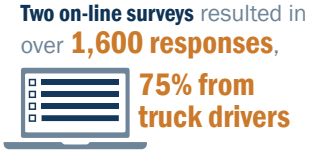
Stakeholder Outreach

Stakeholder input was critical throughout the development of the truck parking study, but perhaps the most critical input was provided by stakeholders in identifying truck parking challenges and needs and providing input on strategies to address the needs. The **Truck Parking Stakeholder Outreach and Engagement Summary Report** details the outreach activities and findings. Below is a summary of key stakeholder events held throughout the study highlighting the input received throughout the stakeholder engagement process.

- 19 stakeholder workshops were held throughout the state in a period spanning November 2018 to February 2019. At these workshops, stakeholders provided input on key needs and issues. The needs identified ranged from general truck parking challenges they observed in their regions and the state, to needs at specific locations. In addition, stakeholders provided input on key truck parking amenities and driver needs. This input was used to inform the needs assessment from identifying truck parking shortages to needed improvements at existing public Safety Rest Areas (SRA).

- Updates were given to the TxFAC including two panels comprised of truckers that operate throughout Texas. The drivers discussed their experiences in finding truck parking in Texas including top challenges and implications arising from the truck parking shortage as well as identified potential solutions. TxFAC input was used to refine the needs and challenges and inform the recommendations.

- Two on-line surveys resulted in over 1,600 responses, 75% from truck drivers. The first survey focused on gaining input on why, where, and when trucks need parking and truck parking



challenges. The second survey focused on obtaining input on recommendations and strategies. The survey revealed that 53% of the respondents parked in unauthorized locations once a week or more with 50% of the driver respondents citing HOS as the reason for unauthorized parking.

- 20 stakeholder interviews and focus groups were held with drivers, fleet managers, trucking associations, planning partners, shippers and receivers, private truck stop facility operators and solution providers. The stakeholders provided input on challenges, solutions, implications and trends impacting truck parking demand.

20 stakeholder interviews and **focus groups** were held with **drivers**, **managers**, **trucking associations**, **planning partners**, **shippers and receivers**, **private truck stop facility operators** and **solution providers**.

- Three industry forums were conducted in coordination with the Texas Trucking Association to gain input from drivers on strategies for addressing truck parking needs.

Three industry forums were conducted in coordination with the **Texas Trucking Association** to gain input from drivers on strategies for **addressing truck parking needs**.

- TxDOT also staffed a booth at the Great American Truck Show in Dallas in August 2019 to provide information on the study and market the driver survey.

TxDOT **staffed a booth** at the **Great American Truck Show** in Dallas in August 2019.

- Webinars and meetings were held with TxDOT district engineers and planning staff to discuss the findings and solicit input on recommendations and strategies.

Webinars and **meetings** conducted with District Engineers and planning staff.

Data and Previous Studies Used in the Development of the Plan – The Statewide Truck Parking Study draws from a variety of proprietary and publicly available data sources and sixty different reports to compile the inventory of truck parking spaces, analyze utilization of existing truck parking, identify unauthorized parking, forecast truck parking demand and analyze crashes and congestion arising from truck parking challenges. FHWA's Jason's Law Truck Parking Survey Results and Comparative analysis from 2015 was a key starting point for the inventory. It should be noted that FHWA is in the process of updating the survey and Texas has submitted updated data. Details on the literature review are available in the **State of Practice, Laws and Regulations Report.**

PREVIOUS STUDIES AND RESEARCH USED TO INFORM THE STATEWIDE TRUCK PARKING STUDY

5 FHWA publications:

- 2017: National Coalition on Truck Parking – Activity Report 2015-2016
- 2015: Jason's Law Truck Parking Survey Results and Comparative Analysis
- 2012: Commercial Motor Vehicle Parking Shortage
- 2002: Study of Adequacy of Commercial Truck Parking Facilities
- 1996: Commercial Driver Rest & Parking Requirements: Making Space for Safety

5 ATRI publications:

- 2018: Understanding the Impacts of Truck Parking Shortages
- 2017: Managing Critical Truck Parking Tech Memo #2: Minnesota Case Study
- 2016: Identifying Autonomous Vehicle Impacts on the Transportation Industry
- 2016: Managing Critical Truck Parking Case Study – Real World Insights from Truck Parking Diaries
- 2015: Kansas Truck Parking Survey Analysis

4 additional ATRI studies

20 publications from 15 state DOTs: AZ, CA, CO, CT, FL, IA, KS, MI, MN, NM, NC, OR, VA, WA, WI

34 other plans, studies, or publications

Exhibit 3 summarizes the primary data sources used in the Study. While the list is not exhaustive of all the data types, it represents the most critical and unique data. The table is organized by data use and provides the source and type of data. The single most critical data source utilized was truck GPS data obtained from the American Transportation Research Institute (ATRI), which consisted of nearly 1.6 billion records of truck movements over 8 weeks in 2018 (see Exhibit 4). From these 1.6 billion records, nearly 11 million recorded stops of 15 minutes or more were identified which formed the basis for the truck parking demand analysis. This is discussed in more detail in Chapter 4.

Exhibit 3: Summary of Key Data Sources Used in Developing the Statewide Truck Parking Study

DATA USE	DATA SOURCE	DATA TYPE
Truck Parking Inventory	TxDOT	Safety Rest Area Inventory
	American Truck Parking	Truck parking facility data
	TruckerPath	Truck parking facility data
	Google Imagery	Truck parking facility data
	District Input	TxDOT truck parking facilities
Truck Parking Demand	ATRI	Truck GPS data
Freight Network Data	TxDOT Roadway Inventory	Annual Average Daily Traffic (AADT)
	TFMP	Freight system designation score
Safety Analysis	TxDOT Crash Record Inventory System (CRIS)	Crash data

Exhibit 4: Summary of Raw Truck GPS Data from American Transportation Research Institute

	FEBRUARY	MAY	JULY	OCTOBER
Start Date	02/01/2018	05/01/2018	07/16/2018	10/16/2018
End Date	02/15/2018	05/15/2018	07/30/2018	10/31/2018
Number of Trucks (Thousands)	168	161	229	165
Number of Points (Millions)	385	407	415	380

Key Terms and Definitions – There are a number of key terms used throughout the study and it is important that they are clearly defined and used consistently throughout.

- **Authorized Location—**Specific site that explicitly allows truck parking.
- **Inventory—**Number of truck parking spaces at a location.
- **Capacity—**Number of truck parking spaces in a given geographic area.
- **Demand—**Number of trucks that would park at a location or geographic area if there was sufficient space.
- **Utilization—**Number of trucks that are parked at a location or in a geographic area at a given time.
- **Raw Utilization—**Number of trucks in ATRI's database parked at a location or within a defined geographic area.
- **Expanded Utilization—**An estimate of the full number of trucks within a defined geographic area, derived by "expanding" the number of trucks in ATRI's database.
- **Truck Parking Shortage—**The demand of truck parking that exceeds the inventory or capacity of truck parking at a location or in a geographic area at a given time.

This chapter provided an overview of how the study was conducted including key data and resources and key stakeholder outreach activities. The next chapter discusses why truck parking is important to TxDOT, truck drivers, the motoring public, businesses and consumers. Section 2, which consists of Chapters 3-6, summarizes key data and findings to determine prioritized truck parking needs. Section 3, which consists of Chapters 7-10, presents the recommendations and action plan.

2 Why Truck Parking Matters in Texas

Texas' multimodal freight network plays a critical role every day for every resident and business. Delivering goods to Texas' businesses and directly to residents' homes keeps food on the table, shelves at stores stocked, manufacturing plants operating, oil pumping and medical supplies at area medical facilities flowing. Trucks are necessary to meet these demands as they provide critical first and last mile connections for the freight in Texas.

Trucks carry over 1.2 billion tons of freight valued at more than $1.7 trillion annually in Texas. The volume of freight moved by truck is projected to grow by 80% to 2.3 billion tons by 2040.[1] Trucks often function as "warehouses on wheels" as they make their way to destinations across Texas. Long-haul trucks traveling from border crossings, maritime ports, and other points of entry make multi-day trips across Texas and the country and need to make stops for required breaks and overnight stops. Local or regional drivers are making local pickups and deliveries and often need to park while they wait for their designated loading/unloading time.

Ensuring that Texas can meet the trucking demands of a growing population and economy while maintaining the safety of the state's roadways means ensuring the state provides sufficient truck parking across the THFN. The inability of trucks to find safe, authorized parking when and where needed results in tired drivers and less safe driving conditions, lost productivity and income for drivers, increased congestion, higher shipping costs for businesses and consumer goods and unsafe parking along highway shoulders and ramps.

The remainder of this chapter examines why trucks need to park, the factors driving the demand for truck parking, the implications of inadequate truck parking and why truck parking is of public interest.

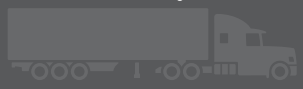
[1] IHS TRANSEARCH data, 2018.

Key Findings

- Trucks are vital to the Texas economy and quality of life

Trucks carry over **1.2 billion tons** of **freight** valued at more than **$1.7 trillion annually in Texas**

140,000 trucks need parking for some period of time each day in Texas



- Regulations and business practices are the biggest drivers of parking demand

50% of drivers surveyed said **Hours-of-Service** was the reason for **unauthorized parking** while **16%** said the reason was **no parking at pickup/delivery** locations

- Truck parking is a public concern because it impacts the safety of everyone on the roadways.

During the 2013-2017 period, there were **2,315 crashes** in Texas involving parked trucks resulting in **138 fatalities** and **997 injuries**

WHY DO TRUCKS NEED TO PARK?

Overall, the demand for truck parking is driven by the number of trucks on the roadways. Where truck parking is needed is based on a number of factors including driver preferences and shipper/receiver demands. In addition, federal legislation, state and local laws can impact the location and availability of truck parking.

Trucks typically need to park for one of five reasons, each of which comes with a challenge:

Types of Truck Parking

Long-haul

Challenge:
Long-haul drivers are on the road days and sometimes weeks at a time traveling across the country.

Staging

Challenge:
Truck drivers picking up and delivering freight at manufacturing plants, warehouses and distributions centers or trucks near international border crossings awaiting paperwork need a place to park to await the window of time to pick up, deliver, or cross the border.

30-minute break

Challenge:
As part of the federally mandated 30-minute break, the driver must be off-duty meaning they are no longer working and will not have to move the truck for any reason.

Emergency

Challenge:
Drivers may be impacted by an incident that has either closed or severely congested the roadway, and they need a place to park.

Time off

Challenge:
Independent drivers don't have a company facility to provide parking during time off. They are done with their work week and need a place to park their truck while off-duty.

Drivers on a long-distance stretch of their trip need to find a safe parking location which maximizes their driving distance for the day, will not be full when they arrive, and provides a variety of amenities. Drivers arriving at a shipper or receiver prior to the allotted pick up or delivery time must wait for access to the facility, and the facilities often do not provide a truck staging area. Also, drivers often need to wait near international border crossings until they receive the proper paperwork and clearance to cross the border. For their required 30 minute breaks, drivers need a safe, authorized place to park where they will not be required to move during these breaks. All time spent at pick up, delivery and waiting at international borders to cross is included in the driver's allowable drive time. Emergency parking may be needed for either a short period if the road reopens quickly, or longer if they need to reset their HOS status or there is a longer term closure such as during a hurricane. The need for parking during time-off primarily impacts independents or owner-operators to a larger degree because they have no company provided parking and many cities prohibit truck parking of any type in neighborhoods.

While there is a myriad of reasons why trucks park where they do, there are four main factors influencing that decision. Each of these and their implication on truck parking demand is discussed below.

4 Main Factors Influencing Where Trucks Park

- **HOS regulations**
- **Shipper and receiver delivery windows**
- **Electronic logging device (ELD) mandates for enforcing the HOS**
- **Driver (company) preferences for fuel and amenities**

Hours of Service: The single most important factor driving where trucks need to park is the Federal Motor Carrier Safety Administration's (FMCSA) Hours of Service regulation. HOS regulations include strict provisions on driving limits, rest breaks, sleeper berths and "restart" timing. A summary of key provisions is shown in Exhibit 5. It should be noted that there are a variety of exemptions that are significant for Texas including those for agricultural products and oil fields. HOS regulations are enforced by state highway patrol on interstate highways as well as local law enforcement in local jurisdictions. Penalties can be high for drivers and trucking companies and may include putting the truck out of service.

Exhibit 5: Summary of Federal Hours of Service Regulations

HOS PROVISION	DESCRIPTION
11-Hour Driving Limit	Drivers may drive a maximum of 11 hours after 10 consecutive hours off duty. All time spent at the driving controls of a CMV in operation is considered driving time.
14-Hour Driving Limit	Property-carrying drivers may not drive beyond the 14th consecutive hour after coming on duty, following 10 consecutive hours off duty.
Rest Breaks	Drivers cannot drive more than 8 hours before taking an off-duty or sleeper berth rest period of at least 30 minutes.
60/70-Hour Limit	Drivers may not drive after 60/70 hours on duty in 7/8 consecutive dates. A driver may restate a 7/8 consecutive day period after taking 34 or more consecutive hours off duty.
Sleeper Berth Provision	Drivers using the sleeper berth provision must take at least 8 consecutive hours in the sleeper berth, plus a separate 2 consecutive hours either in the sleeper berth or off duty.
34-Hour Restart	A driver of a property-carrying vehicle may "restart" a 7/8-consecutive-day period after taking 34 or more consecutive hours off duty.

Source: Federal Motor Carrier Safety Administration.

Two key variables impact a truck driver's ability to find parking—travel time to the parking location and parking availability. Travel time to parking is directly related to the amount of time the driver has left on their HOS, distance to the parking facility, and congestion levels. Together, the remaining drive time, distance, and congestion levels define whether or not a driver can make it to their desired truck parking location before they are in violation of HOS rules.

The focus on travel time reflects the desire of drivers to maximize the miles driven. If a driver stops early because they are unsure if they can reach a parking location within the HOS, they are giving up income, or they run the risk of not getting to the parking location within their HOS, thus risking a costly HOS violation or parking in an unauthorized and less safe location. Even when a driver is confident they can reach a truck parking location within their HOS, they may be uncertain about the availability of parking spaces when they reach the location. If parking availability is uncertain and a driver wants to find a legal parking spot, they have to spend driving time searching for parking and possibly stop driving earlier in the day to increase the certainty that they will find parking before their HOS expire. Both of these decisions reduce a driver's productivity because they reduce the overall distance a driver can cover in a day. Alternately, drivers may risk trying to find parking when they reach the end of their HOS. If they fail to find legal parking they must either park in an undesignated or unauthorized location as shown in Exhibit 6, or drive beyond their legal HOS.

AGRICULTURAL AND OIL FIELD HOS EXEMPTIONS

Agricultural

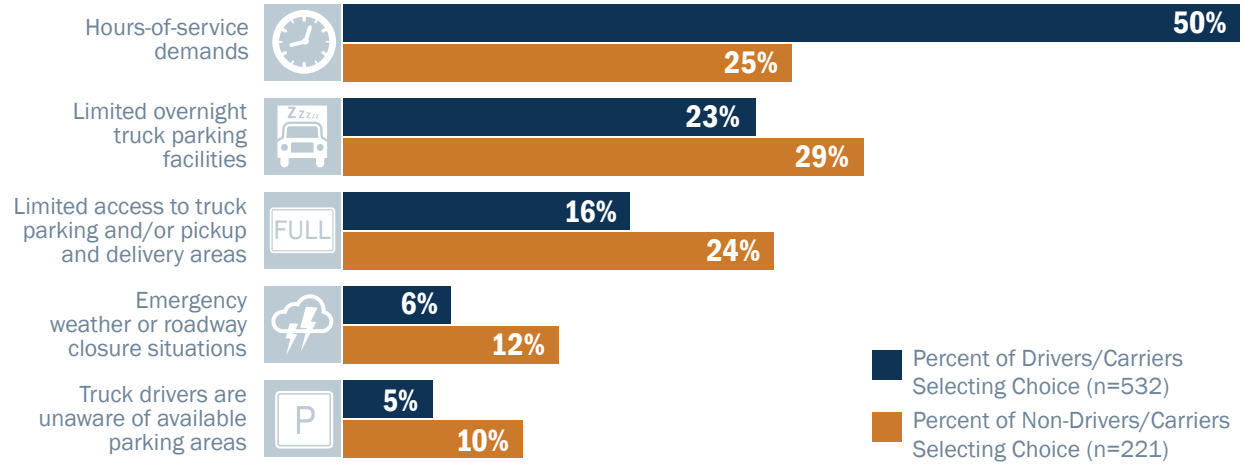
Exceptions from the HOS rules exist during planting and harvesting periods as determined by the State, for the transportation of agricultural commodities (including livestock, bees, horses, fish used for food) within a 150 air-mile radius from the source of the commodities. The exception also applies to the transport of farm supplies for agricultural purposes shipped from either a wholesale or retail distribution point to the location the supplies will be used or from a wholesale distribution point to a retailer. The HOS regulations do not apply to the transportation of agricultural commodities that stay within the 150 air-mile radius by for hire or private carriers.

Oil Field Operations

For drivers of commercial motor vehicles (CMV) used exclusively in the transportation of oilfield equipment, including the stringing and picking up of pipe used in pipelines, and servicing of the field operations of the natural gas and oil industry, any period of eight consecutive days may end with the beginning of any off-duty period of 24 or more consecutive hours. In the case of specially trained drivers of specialized trucks designed to service oil wells, “on-duty time shall not include waiting time at a natural gas or oil well site.” It was further clarified that oilfield HOS exceptions do not apply to truck drivers making routine deliveries of sand, water, and other products to oilfield sites.

Source: Federal Motor Carrier Safety Administration.

Exhibit 6: Texas Survey Responses on Why Drivers Park in Unauthorized Locations



Electronic Logging Device Mandate (ELD): ELDs are a replacement for the paper logbooks used to track a driver's HOS. These devices are intended to improve highway safety and reduce paperwork for truck drivers by automatically recording information about truck operations, and saving data in a tamper-proof system.

An ELD interfaces directly with a truck's existing computers and systems, and captures a range of data about the operations of a truck, including whether the engine is on, whether the truck is moving, mileage, and number of hours the engine runs. ELDs are also required to automatically record a truck's location when a truck engine is turned on or off, when a driver comes on or off duty, and when the truck is moving. For example, even if a driver is in a driver's lounge waiting to unload, the driver is still considered on duty and the time is still ticking on allowable drive time through the ELD. Previously, paper logbooks gave drivers some flexibility in reporting driving times since drive times were recorded in 15 minute increments and it was based in large part on the honor system. However, the ELD mandate requires onboard computers to automatically record HOS changes to the minute, and thus have eliminated the small amount of flexibility provided by paper logs that drivers could use to find parking. ELDs also have greater limits on editing the log compared to paper logs. A driver could operate a few minutes beyond their HOS limits to find parking or reach their destination, and the 15 minute time increment could be used to cover this overage time. However, ELDs automatically record when a truck is in motion and do not allow an edit to that record. Other changes in status, such as changing from off duty to on duty not driving, are allowed but ELDs do not allow drivers to erase data. The accurate recording, combined with tamper-proof requirements, has eliminated the flexibility of the paper logbooks.

The most likely implication of ELDs is to force drivers to stop driving to find parking earlier, leading to loss in productive drive time leading to lower income for truckers and/or higher trucking costs for shippers. Another implication of ELDs is an increase in trucks parked in unauthorized, unsafe locations such as road shoulders and highway ramps.

However, ELDs are mandated due to the safety impacts and there are also numerous potential benefits for drivers including:

1. ELDs can expedite inspections
2. ELDs reduce burdensome paperwork and can result in more driving time
3. ELDs eliminate easy form and manner errors that can be troublesome and expensive
4. ELDs issue warnings when time is tight
5. ELDs build a commercial truck driver's roadside resume
6. ELDs document driver safety in the event of an accident

More than **half of respondents** in a **survey of truck drivers** reported **parking in unauthorized locations at least once per week.**

(54%)

HOS demands were identified as the **primary reason.**

(50%)

The **next most common responses** were **limited overnight facilities**

(23%) and **limited access to parking at pickup/delivery**

(16%)

Imagine leaving work at 5 p.m. on a Friday for your normal commute home. You need to stop at the grocery store to pick up a couple of things for dinner, and get your child from daycare by 5:30.
No Problem.

A minor accident ahead of you creates a small delay, but you aren't worried. Then you pull into the grocery store and don't see any place to park. Circling once, still nothing. You wait a couple minutes, but nobody leaves. Now time is getting tight. What do you do? Drive to another grocery store. What if traffic is bad? What if the next store is 10 minutes out of your way? Wait for a space. What if someone beats you to it? What if you have to wait a long time and that will make you late to pick up your child? Skip the grocery store. Do you have anything else at home? Can you afford takeout on a tight budget?

Imagine the stress, the anxiety. You planned the best you could, but things just aren't working out.
Now imagine facing this every day.

Shipper and Receiver Needs: Trucking is the primary mode of transportation for freight associated with warehouses, distribution centers and commercial facilities such as retailers and service providers. As a result, these facilities generate large amounts of truck traffic, and demand for truck parking, but frequently have prohibitions on trucks outside of their own fleets parking on-site. A common complaint heard from truck drivers during stakeholder engagement was a lack of parking at or near their delivery locations. Since trucks need to stage for access at specific times, parking demand for truck activity related to warehouses and distribution centers is highest close to clusters of these businesses, typically within

metropolitan areas. Limited parking for staging leads to unauthorized parking on many local streets and commercial businesses and can lead to trucks driving around contributing to congestion and air pollutants.

The demand for staging parking is expected to increase for two primary reasons. First, continued new development of warehouses and distribution centers to meet the expanding Texas population and growing economy will create new demand. Exacerbating this is the fact that truck parking can consume significant space and it does not generate revenue directly. Therefore, there is no incentive for shippers and receivers to include truck parking on their property. Second, as congestion increases in urban areas, travel times will become less reliable and drivers who have fixed appointment windows will need to get closer to their final destination when searching for parking. The fact that on-time delivery is the most widely used metric in trucking contracts creates even higher demand for staging parking.

The growing population and economy has led to unprecedented warehousing and distribution development in Texas. In the Dallas-Fort Worth area alone, more than 100 million square feet of space has been added since 2000,[2] sending the total warehousing space to approximately 760 million square feet. Houston is home to more than 520 million square feet of warehousing and distribution space.[3] Because the majority of shippers are located near large population centers and international gateways, the need for staging parking is in metropolitan areas where land is more scarce and more expensive. In addition, staging parking is typically for a shorter time, therefore drivers may be more prone to pull off on shoulders and ramps if no immediate authorized parking is available.

Driver Preference for Fuel and Amenities: Drivers' responses to an online survey conducted as part of this effort demonstrated definite preferences and priorities when it comes to choosing where they will park. When drivers park their trucks, most expect to satisfy only their basic needs. In Texas, state-maintained picnic areas and pull-offs do not provide toilets or often trash cans. Drivers prefer parking facilities that provide food, fuel, restrooms, phones, and showers. They also consider safety and convenience important when they park their trucks. As one driver stated, "I just want to find a place to park that is safe and available." Because truck stops typically provide showers, restaurants, and repair facilities, it is not surprising that most drivers generally prefer private truck stops to public SRAs. For more lengthy activities such as eating a meal, resting for the night, or repairing a truck, most drivers would choose truck stops whenever possible.

Top 3 truck parking amenities

Safety features such as lighted areas

Availability of restaurant or fast food

Shower facilities

[2] https://www.dallasnews.com/business/real-estate/2018/01/03/warehouse-construction-hits-new-high-in-d-fw-with-more-on-the-way/.

[3] https://www.joc.com/international-logistics/industrial-real-estate/industrial-real-estate-demand-keeps-building-us-gulf_20190215.html.

In addition, fleet operators often have fuel contracts with specific truck stop companies, meaning that drivers are required to fuel up a specific locations. SRAs are often preferred for quick breaks and naps as they have easy access off the highway.

Meeting these basic needs combined with federal restrictions on commercialization of public SRAs can lead to overcrowding at private truck stops while nearby public SRAs or TICs are underutilized. It is not uncommon to see trucks spilling out of private truck stops onto the shoulders and ramps while a mile down the road, a public SRA has numerous open truck parking spaces. Exhibit 7 provides an example of this along I-10 west of El Paso.

Exhibit 7: Parking at a Private Truck Stop and a TIC Area One-Mile apart on I-10

Source: Cambridge Systematics analysis of ATRI data.

WHY IS THE LACK OF SAFE AUTHORIZED TRUCK PARKING A PUBLIC CONCERN?

Safety – The lack of safe, convenient, and easy-to-find parking along corridors forces truck drivers to make difficult choices, with dangerous consequences. When truck drivers are tired or reach the limit of how long they can legally drive without having found an appropriate parking location, they must choose whether to park illegally or drive illegally. Truck drivers

face these decisions on a regular basis. A lack of available safe parking or information about available parking at public and private parking areas forces some truckers to drive longer while they search for a place to stop for the night or to park illegally, endangering themselves and potentially the motoring public. During the 2013-2017 period, there were 190,240 crashes involving trucks in Texas of which 2,315 crashes in involved parked trucks resulting in 138 fatalities and 997 injuries.[4] Truck parking is a problem that spans both the public and private sector requiring collaboration amongst both sectors.

During the 2013-2017 period, there were 190,240 commercial motor vehicle related crashes in Texas resulting in 2,953 fatalities. 2,315 of those crashes involved parked trucks resulting in 138 fatalities and 997 injuries.

Jason's Law – As a result of the public safety concerns, MAP-21, signed into law in 2012, addressed the shortage of truck parking nationally through Jason's Law. Jason's Law was established to provide a national priority on addressing the shortage of long-term parking for commercial motor vehicles on the National Highway System (NHS) to improve the safety of motorized and non-motorized users and for commercial motor vehicle operators. Specifically, Jason's Law requires the U.S. Department of Transportation (DOT) to conduct a survey and comparative assessment in consultation with relevant state motor carrier representatives to:

"Jason's Law is named in honor of Jason Rivenburg. On March 4, 2009, Jason stopped for a delivery in Virginia and then headed toward a delivery destination in South Carolina. While only 12 miles from the delivery location, he needed to find parking to rest through the night as his arrival location was not yet open to receive deliveries. Jason did not have a safe place to park. Jason had learned from truckers familiar with the area that a nearby abandoned gas station was a safe location to park and proceeded to park there for the night. Tragically, he was attacked and murdered at this location while he slept with his killer taking both his life and just $7.00 that he had in his wallet."

Source: https://ops.fhwa.dot.gov/freight/infrastructure/truck_parking/jasons_law/truckparkingsurvey/ch1.htm

- Evaluate the capability of each state to provide adequate parking and rest facilities for commercial motor vehicles engaged in interstate transportation;
- Assess the volume of commercial motor vehicle traffic in [each] State; and
- Develop a system of metrics to measure the adequacy of commercial motor vehicle parking facilities in each state.

[4] TxDOT Crash Record Information System (CRIS).

Law Enforcement Dilemma – Trucks that park along limited-access highways present a difficult problem for law enforcement. Parking on the shoulder or ramps of a limited-access highway is prohibited by law in Texas. Vehicles parked on the shoulders of these roadways are a serious potential hazard to other motorists because they are fixed objects within the roadway right of way that are unprotected by a barrier or horizontal buffer area.

However, law enforcement officials presented with clear violations of these laws may be reluctant to enforce them because of the dilemma presented by a situation involving a truck driver who must observe federal HOS regulations but may not be able to find a safe place to park off the highway. A driver sleeping in a truck parked on the side of a highway may be more of a danger to other motorists if he or she is awakened and ordered to vacate the premises. Police officers presented with this scenario often find themselves in the uncomfortable position of weighing the competing hazards of an illegally parked truck and a fatigued driver violating HOS regulations.

Preservation of TxDOT's Assets – When trucks cannot find authorized parking and they reach the end of their HOS, they most often park on the shoulders of the roadways and ramps. This leads to damage to the infrastructure. Trucks parking on shoulders cause the pavement to deteriorate and can lead to ruts along the road. In turn, the damage can lead to unsafe operating conditions for the motoring public. Some districts reported the need to do shoulder reinforcements and repairs on a regular basis, costing in the hundreds of thousands of dollars annually. Given the funding challenges facing TxDOT, money spent on these repairs is taking away from needs in other areas.

Impacts to Shipping Costs and the Growing Texas Economy – A survey conducted by ATRI documented the amount of lost revenue time that drivers experience by parking earlier than they otherwise needed to, just to find parking. With an average of 56 minutes of revenue drive time sacrificed by drivers per day, the parking shortage effectively reduces an individual driver's productivity by 9,300 revenue-earning miles a year, which equates to lost wages of $4,600 annually.[5]

These costs are either passed onto shippers and thus ultimately consumers or absorbed by drivers. Either way, they increase the cost of doing business in Texas and the cost of consumer goods. With the shortage of truck drivers being a top concern in the industry, the difficulty and costs associated with safe, reliable truck parking makes a tight labor market worse. Without enough drivers, manufacturers and retailers have to increase inventories to avoid stock outs, thus increasing inventory carrying costs. In addition, to get the just-in-time service required to meet today's supply chain demands, shippers often have to pay premiums for guaranteed on-time deliveries. All of these factors add to overall freight transportation and supply chain costs and the overall competitiveness of Texas' business climate. Additionally, given Texas' role as the nation's largest gateway for trade with Mexico and a global energy producer, the impacts

[5] https://truckingresearch.org/2016/12/13/atri-truck-parking-case-study/.

span far beyond Texas. Ensuring there is adequate truck parking will help ensure the trucking industry can continue to meet the needs of the growing Texas and national economies.

Challenges to Providing Public Truck Parking – Publicly owned truck parking includes SRAs, TICs, picnic areas and other locations owned and maintained by public agencies. There are numerous challenges to providing adequate public truck parking but the most common include:

Perception of truck parking as a private sector issue – The general public and many decision makers see truck parking as part of private industry cost of doing business and therefore resist spending public funds to provide truck parking. In addition, they see the numerous private sector truck stops and assume that the private sector is already meeting the truck parking needs.

Public opposition to truck parking facilities – Regardless of whether it is to be a public or private sector provided truck parking facility, there is often public resistance due to the negative perceptions of the trucking industry and truck drivers. This resistance may be due to littering, noise, or worry that these locations might attract illegal activity.

Public truck parking facilities can be cost prohibitive – Because truck parking generates little to no revenue for the private sector yet requires lots of land, the return on investment often does not support expanding or building new parking. In addition, truck parking is often needed near or in urban areas where the cost of land is higher and more scarce than in rural areas.

Lack of public funding – Funding for transportation falls far short of the transportation needs and the truck parking must compete with other priorities for funding. Because the benefits of truck parking are harder to quantify and less understood, it is difficult for investments in public truck parking facilities to compete for limited transportation funding.

This chapter provided an overview of why truck parking is important and lays the foundation for why TxDOT undertook the study. The next section summarizes the key findings from the technical analysis conducted as part of the study including examining the supply and demand of truck parking in Texas and identifying needs and challenges.

SECTION 2:

The State of Truck Parking in Texas

The second section of the Texas Statewide Truck Parking Study describes the inventory, utilization, and needs assessment of truck parking facilities. This analysis represents the compilation of truck parking location data from public and private owners of truck parking facilities in Texas, truck GPS data from ATRI, crash data from TxDOT's CRIS, and the freight network analysis conducted during development of the 2018 Texas Freight Mobility Plan.

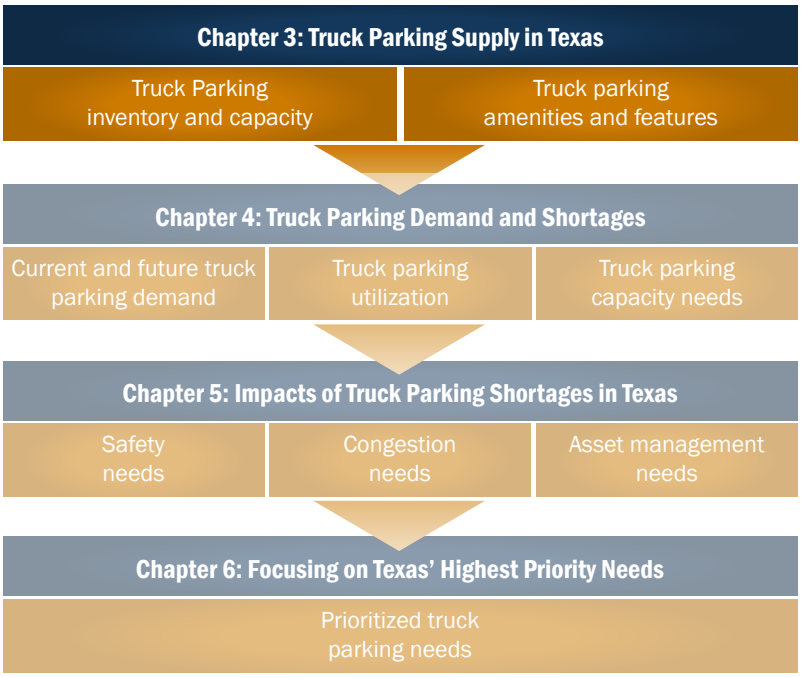
The truck parking needs analysis combines several facets of truck parking to identify and prioritize truck parking needs. While investment in truck parking is needed throughout the state, the prioritization process ensures that TxDOT directs funding to the locations most likely to improve highway safety and mobility.

Chapter 3 provides the **inventory of current supply** of truck parking in Texas. **Chapter 4** presents **current and future truck parking demand** and compares it with the supply data from Chapter 3 to assess **utilization and truck parking capacity needs**. **Chapter 5** examines **safety, congestion and asset management needs** related to truck parking. **Chapter 6** examines the combined truck parking needs on the Texas Highway Freight Network to identify **priority truck parking needs**.

3 Truck Parking Supply in Texas

Publicly- and privately-owned truck parking locations both play a role in meeting the demand for truck parking in Texas. The private sector attempts to meet the truck parking demand in high traffic areas and provides more amenities for drivers, charging for some. TxDOT and its public sector partners provide parking throughout the state, particularly when and where private investment is not economically viable such as in rural areas.

This chapter focuses on the supply of truck parking in Texas and is the first in a series of chapters that lay the foundation of the truck parking needs assessment. The findings from the inventory of truck parking will be combined with the demand in Chapter 4 to identify capacity needs and unauthorized parking.



Key Findings

TxDOT provides less than 10% of all authorized truck parking in the state

TxDOT maintains **177 locations** with approximately **2,300 truck parking spaces**.

The **private sector** provides more than **90%** of **Texas truck parking capacity** with nearly **25,000 truck parking spaces**

TxDOT maintained truck parking is usually in rural areas or small metro areas

- Houston District has the most spaces at over 3,000 but no TxDOT maintained truck parking spaces
- Amarillo and Odessa Districts have the most TxDOT maintained spaces with more than 200 public spaces each

Basic amenities are needed at truck parking facilities to meet basic safety and sanitary needs of drivers

Lighting

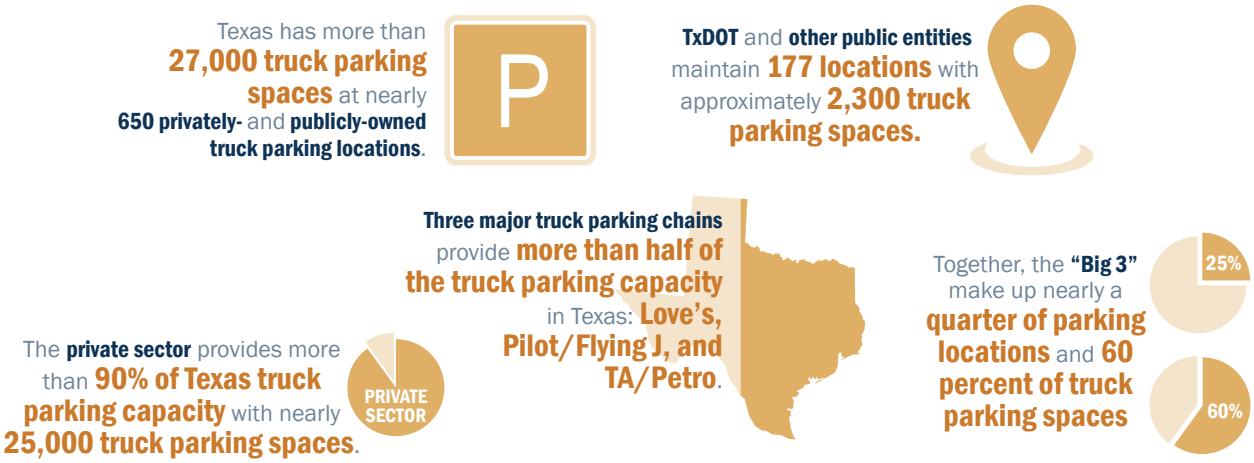
Trash receptacles

Flush toilets

Texas' 92 picnic areas and pull-offs do not have toilets

TRUCK PARKING INVENTORY AND CAPACITY

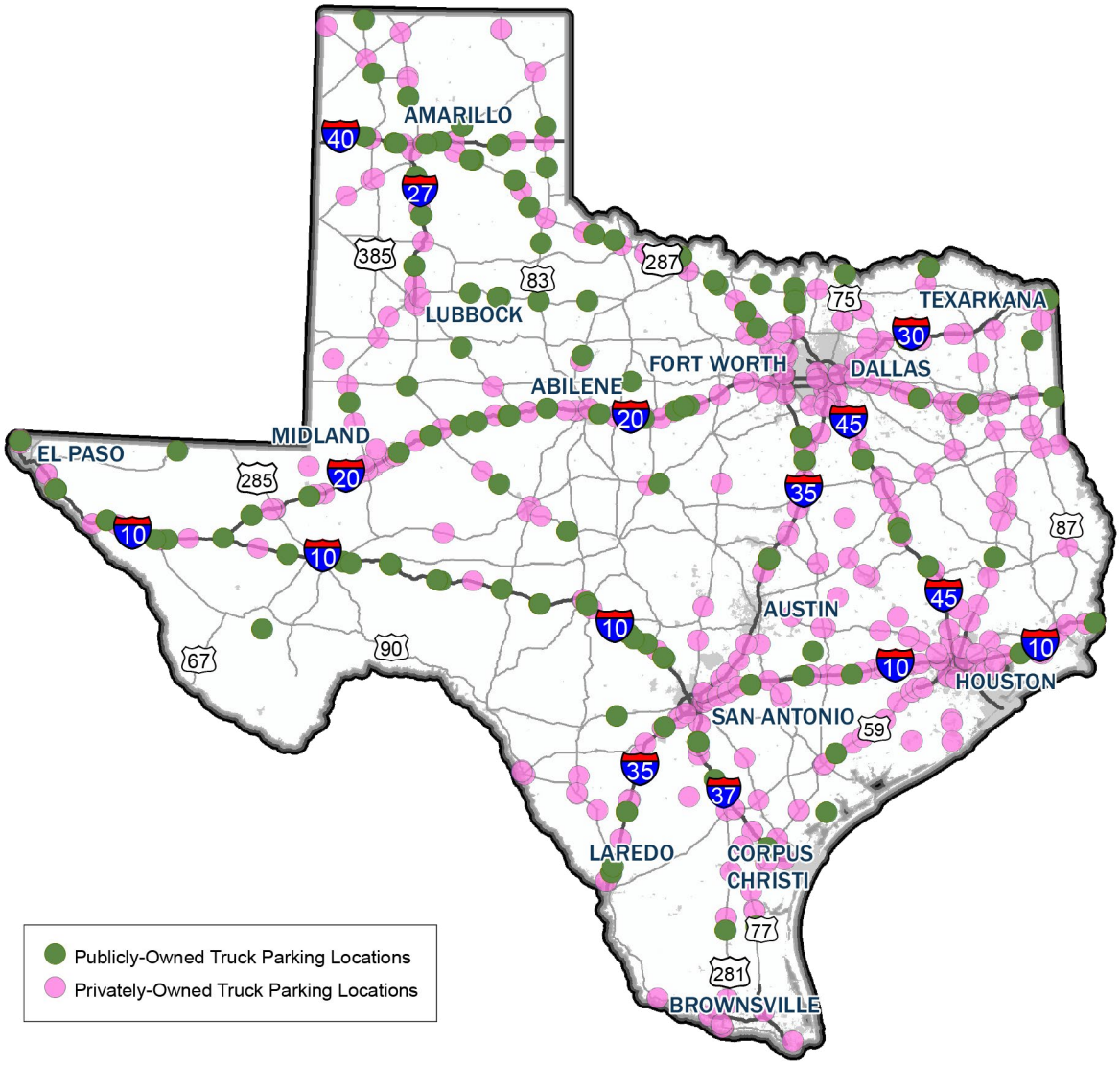
An inventory of truck parking spaces by locations was conducted between November 2018 and June 2019. The summation of the inventory across all locations within a defined geographic area is a measure of truck parking capacity.



While the private sector provides a significant amount of Texas' truck parking capacity, the public sector has an important role in providing safe and secure truck parking facilities. For example, a private truck stop may not be profitable because of high land costs in dense areas or relatively low usage in remote areas. The public sector can provide truck drivers with options in these areas where the private sector cannot make a business case to operate. While the technical analysis focuses on both public and private sector truck parking, the strategies focus on TxDOT maintained facilities and policies and programs that TxDOT can lead or support. Details on the inventory process and results are available in the **Truck Parking Inventory and Utilization Report**.

More than half of all truck parking locations are located within a mile of an interstate. Major U.S. highways such as US 59 or US 287 also have a large truck parking supply. The locations in dense, urbanized areas tend to be privately owned, with publicly-owned facilities often positioned outside of major cities or along rural stretches of corridors. Exhibit 8 shows the locations of publicly-owned and privately-owned truck parking facilities in Texas.

Exhibit 8: Truck Parking Supply in Texas



Source: Cambridge Systematics analysis of TxDOT and private sector truck parking data sources.

Exhibit 9 summarizes truck parking capacity within one mile of major interstates in Texas. More than three-quarters of truck parking spaces are located within one mile of an interstate (77 percent). Exhibit 9 summarizes the capacity within one mile of Interstate corridors in Texas over 100 mies in length. One measure of the amount of truck parking relative to the truck traffic is truck parking density, or the number of spaces per 100,000 truck-miles traveled. This metric does not necessarily indicate a shortage or surplus of truck parking. Utilization of parking locations by corridor is discussed in Chapter 4. However, by comparing the inventory relative to the length of each corridor and the number of trucks on each corridor, each interstate's capacity can be compared more directly. The average truck parking density for all of these corridors combined is 64 spaces per 100,000 truck-miles traveled.

I-27 has the highest truck parking density of any of the state's major interstates, and nearby I-40 follows with the second highest truck parking density. I-30, I-45, I-35, and I-37 have truck parking densities lower than the statewide average for major interstates. I-30, I-45, and I-35 handle more trucks per day than others, and all 3 pass through dense cities where constructing truck parking is often most cost-prohibitive. I-10 and I-20, the longest interstates in Texas, rank in the middle. These two corridors traverse most or all of the state from east to west and include a wide range of environments from urbanized locations to remote, rural areas. The following chapters examine how this capacity is used along interstates, including how demand and shortages vary throughout corridors.

Exhibit 9: Truck Parking Supply by Interstate Corridor

INTERSTATE CORRIDOR	PUBLICLY-OWNED TRUCK PARKING SPACES	PRIVATELY-OWNED TRUCK PARKING SPACES	TOTAL TRUCK PARKING SPACES	TRUCK PARKING DENSITY	TRUCK PARKING DENSITY RANKING
I-10	559	5,213	5,772	69	4
I-20	306	4,293	4,599	82	3
I-27	70	556	626	161	1
I-30	98	728	826	32	8
I-35	318	4,255	4,573	53	6
I-37	44	448	492	57	5
I-40	195	1,114	1,309	114	2
I-45	122	1,416	1,538	48	7
Combined Corridors	**1,712**	**18,023**	**19,735**	**64**	**N/A**

Source: Cambridge Systematics analysis of TxDOT data (2018).

Another 19 percent of Texas' truck parking capacity is within a mile of a U.S. highway, and 96 percent of truck parking in Texas is within a mile of an interstate or U.S. highway. US 59 and US 77 are the only two U.S. highway corridors with more than 1,000 spaces.

A description and more detailed discussion of capacity by interstate corridor is shown on the following page.

TOP U.S. HIGHWAYS BY CAPACITY WITHIN 1 MILE

- US 59: 1,432 spaces
- US 77: 1,348 spaces
- US 90: 861 spaces
- US 287: 792 spaces
- US 281: 770 spaces

I-10 is a major freight corridor from the Ports of Los Angeles and Long Beach to Florida. It passes through Texas connecting three major urban areas (Houston, San Antonio, and El Paso) and makes up the south leg of the Texas Triangle. These regions have maritime port access, an interchange with I-35, and an international border crossing, respectively. Because it traverses so many rural miles, it has the largest inventory of publicly-owned spaces. The greatest concentration of privately-owned spaces is concentrated in the dense urban regions from San Antonio to Beaumont. Overall, there are 69 total truck parking spaces per 100,000 truck-miles traveled.

I-20 spans Texas from the energy sector and natural resources of West Texas to Dallas-Fort Worth and beyond to Louisiana and the rest of the Southeast. The total truck parking spaces per 100,000 truck-miles traveled at 82 is above average for the State. Most privately-owned spaces are concentrated in the urban areas, and publicly-owned spaces are in the rural areas.

I-27 connects the agricultural regions in the Texas Panhandle, and is part of the ports-to-plains corridor. It has 161 truck parking spaces per 100,000 truck-miles traveled, the highest in the State, in part because it is a short corridor at 124 miles in total length—otherwise, the concentration of truck parking inventory is on par with the other corridors.

I-30 connects the Dallas-Fort Worth metropolitan area to Texarkana and continues northeast towards Memphis. The corridor has three publicly-owned truck parking locations and the lowest amount of truck parking spaces at 32 spaces per 100,000 truck-miles traveled in the state.

I-35 is a major United States-Mexico-Canada (USMCA) trade corridor from Mexico to Canada, a critical north-south trucking corridor through the central United States that passes through several large metro areas in Texas (Laredo, San Antonio, Austin, and DFW). While there is a relatively large inventory of publicly-owned spaces, they are concentrated at only six locations along the statewide corridor. Additionally, there is a shortage of public or private truck parking locations in and around Austin. This corridor has the third lowest number of spaces at 53 per 100,000 truck-miles traveled.

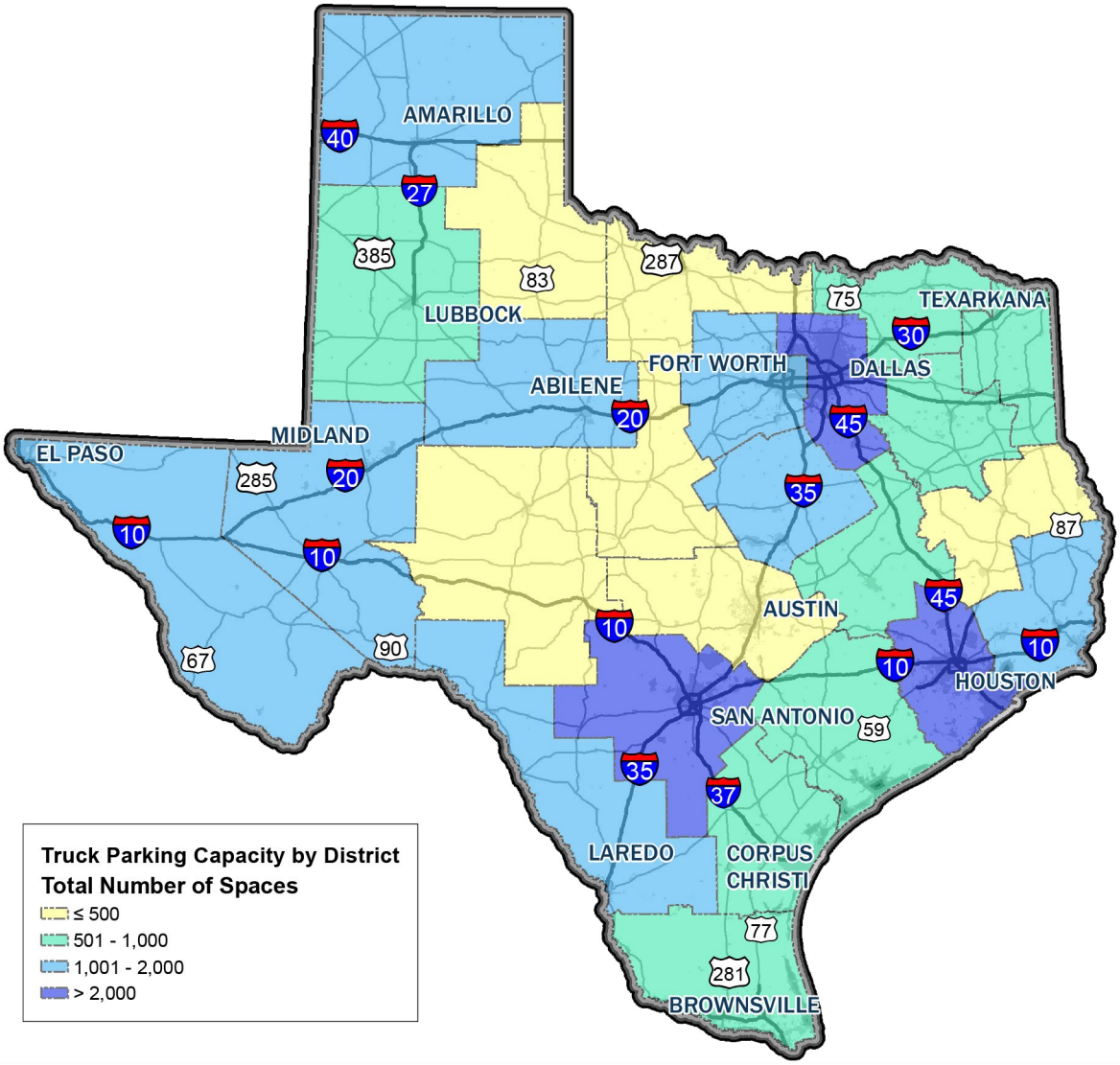
I-37 is a relatively short corridor at 143 miles, connecting San Antonio and Corpus Christi with lower than average truck volumes and truck parking inventory, and only one small publicly-owned lot. I-37 has 57 truck parking spaces per 100,000 truck-miles traveled, which is below the state average.

I-40, like I-10 to the south, is a major east to west coast trucking route, passing through Amarillo and the Texas Panhandle. Two large SRAs, well-designed for truck parking, are located east of Amarillo and just west of McLean. I-40 has the second highest number of truck parking spaces at 114 per 100,000 truck-miles traveled.

I-45 makes up the eastern leg of the Texas Triangle, connecting the Port of Houston to the DFW metropolitan area, and has only one publicly-owned truck parking location. I-45 has the second lowest number of truck parking spaces at 48 per 100,000 truck-miles traveled.

Truck parking capacity, or the sum of the inventory of truck parking within a defined geographic area, by TxDOT district is shown in Exhibit 10. The Houston district has more capacity than any other district with more than 3,000 spaces, despite having no publicly-owned capacity. The Dallas and San Antonio districts follow with more than 2,000 spaces. The Amarillo district has more publicly-owned capacity than any other district, and the Odessa district is the only other district with at least 200 publicly-owned spaces. Exhibit 10 displays the truck parking capacity for each TxDOT district. District profiles summarizing truck parking inventory, demand, and needs are available in **Appendix A of the Truck Parking Demand in Dedicated and Unauthorized Locations Report**.

Exhibit 10: Truck Parking Capacity by District



Source: TxDOT. Analysis by Cambridge Systematics, 2018.

AMENITIES AT TRUCK PARKING LOCATIONS

Drivers' needs at truck parking locations vary based on the individual driver's schedule, reason for stopping, and preferences. Some drivers spend days or weeks at a time on the road, while others are home every night. Long-haul drivers traverse the state, while drayage operators move freight within a relatively small region. Drivers may stop for 30 minutes, a few hours, or overnight. No matter the duration or reason for their stop, drivers need safe and secure places to park their trucks and take breaks.

Basic amenities such as lighting, trash cans, and toilets are needed at every truck parking facility for a safe and sanitary environment. In urban areas or locations with concentrated freight activity, security cameras and fencing around a parking location can provide additional safeguards against theft or other crime. Security staff or periodic law-enforcement patrol further increase feelings of safety and security for drivers in both densely populated and isolated locations. Wi-Fi is also viewed by drivers as a safety feature in rural areas with limited cell phone service.

Drivers, particularly long-haul drivers, also fulfill their basic needs while on the road. They eat, sleep, shower, exercise, and do laundry from truck stops and SRAs. Toilets and real-time parking availability information were the top-ranked amenities, followed by shower facilities, in surveys completed by more than 1,200 drivers. Finding nutritious food choices was also identified by drivers as a challenge. Some drivers expressed a desire for healthier food options than the fast food and packaged snacks typically available at truck stops or in vending machines. Drivers also commented on the need to stretch and move after being in a seated position for the day. Additional detail on the survey results and ranking of amenities can be found in Exhibit 44 in Chapter 7 and in the **Stakeholder Outreach and Engagement Summary Report**.

Truck parking facilities maintained by TxDOT and other public entities tend to have minimal amenities. Exhibit 11 lists the amenities available at publicly owned truck parking locations. Of the 92 picnic areas and pull-offs maintained by TxDOT, none have restrooms, vending, staff, or Wi-Fi. Only one-fifth of these sites have angled parking, a safer design than parallel parking. SRAs and travel information centers have more amenities, including restrooms and staff at all locations. Newer facilities, such as the Bell County SRAs between Austin and Temple, are designed with more amenities for drivers and the traveling public such as nicer restrooms, walking paths and basic exercise or stretching equipment, and indoor and outdoor spaces. **Appendix B of the Truck Parking**

Demand in Dedicated and Unauthorized Locations Report provides more detail on the public facilities along with a summary profile that includes information on capacity, amenities, and utilization data. An example profile is provided in Exhibit 12.

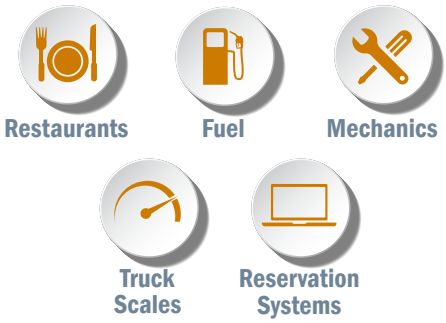
Exhibit 11: Amenities at Public TxDOT Facilities with Truck Parking

TYPE	PERCENT OF FACILITIES WITH... RESTROOM	VENDING	STAFFED	WI-FI	ANGLED PARKING
SRA/Travel Information Center (85 sites)	100%	42%	100%	39%	72%
Picnic Area/Pull-off (92 sites)	0%	0%	0%	0%	18%

Source: Cambridge Systematics analysis of TxDOT data.

Exhibit 12: Example Profile of TxDOT Maintained SRAs and Travel Information Centers

Many premium amenities available at private truck stops:



Privately-owned truck parking facilities range from simple lots with minimal amenities to major chains with fuel, showers, laundry, restaurants, mechanics, truck scales, and reservation systems. In general, privately-owned truck stops in the state's most traveled areas tend to have more amenities and more truck spaces than publicly-owned locations. Privately-owned facilities can provide these amenities due to their ability to charge for goods and services. The availability of fuel, partnerships between large fleets and truck stop chains, and loyalty programs also make these locations more attractive for drivers.

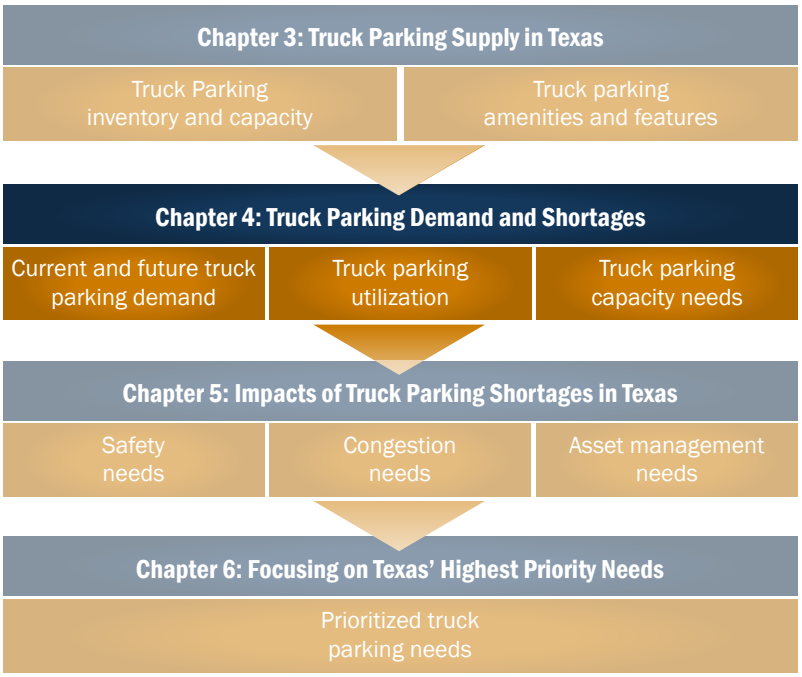
Unlike privately-owned truck stops, federal law prohibits all states from commercializing SRAs, and other truck parking facilities on interstates, which are the highways with the greatest need for truck parking. Limited commercial activity such as vending machines is allowed. In general, this constraint makes funding construction and maintenance of improved amenities at public SRAs, picnic areas, and travel information centers more challenging.

This chapter provided an inventory of the total supply of truck parking in Texas including an assessment of amenities provided. Chapter 4 presents the current and future demand for truck parking which, when combined with the supply from this chapter, allows for the examination of utilization and truck parking shortages and capacity needs.

4 Truck Parking Demand and Shortages

Truck parking shortages impact drivers and the traveling public throughout Texas. Every TxDOT district has truck parking facilities near or over capacity at peak hour, even if they have other facilities that are underutilized. The statewide peak hour is defined as when the most trucks are trying to park which is 1:00 a.m. to 2:00 a.m. The lack of truck parking availability where truck drivers need it results in unauthorized parking on highway shoulders, ramps, and frontage roads. While the state is operating near capacity now, the demand for spaces will be 170 percent of capacity by 2050 without investment in additional truck parking.

This chapter builds off the inventory and truck parking data from Chapter 3 by incorporating analysis of truck GPS data. This chapter presents truck parking demand and utilization to identify truck parking capacity needs and unauthorized truck parking.



Key Findings

Demand for truck parking exceeds capacity in all major metro areas and Permian Basin during peak hour (1:00 a.m. to 2:00 a.m.)

Average total utilization at peak hour at:

- **105%** Major national truck stops
- **+ 67%** All other privately owned truck stops
- **=92%** Total of all privately owned truck stops

- **86%** Publicly owned safety rest areas/ travel information centers
- **+ 60%** Publicly owned picnic areas/ pull-offs

Lack of capacity is forcing drivers to park in unauthorized locations

63% of drivers report parking in unauthorized locations at least weekly, including **10% of drivers** who said they do daily.

By **2050**, truck parking demand is projected to be **170%** current capacity

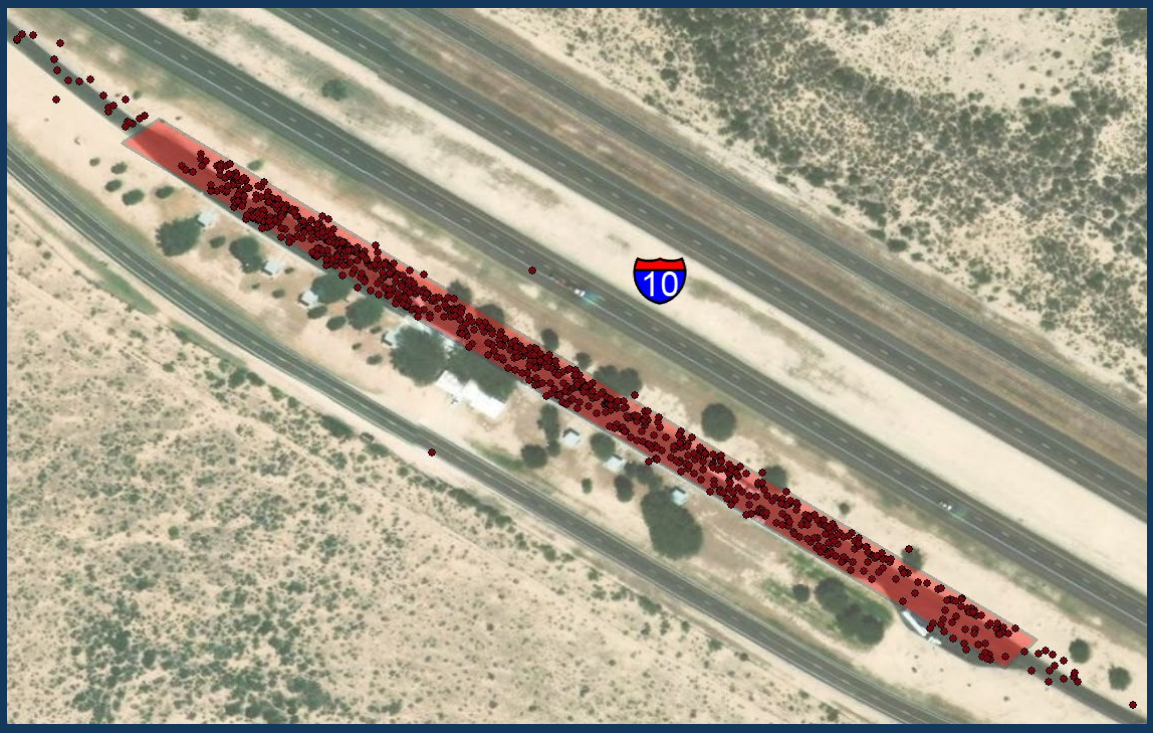
USING TRUCK GPS TO ANALYZE TRUCK PARKING DEMAND

Anonymous truck GPS data were obtained from ATRI and spanned 4 two-week periods for a total of eight weeks of data from 2018. The data points were processed to identify trucks stopped for at least 15 minutes. These stops were then analyzed to identify where trucks are parking at authorized locations, in the TxDOT right of way, or outside of either of those locations. Trucks parked at shippers and receivers, retail or commercial industries, and private homes are not included in this assessment of truck parking utilization and capacity needs. No private information about shippers, receivers, or carriers was received or used during the creation of this study.

The GPS data collected by ATRI represents a sample of trucks on Texas roadways. Long-haul drivers and large carriers are more likely to be included than independent owner-operators or regional drivers. TxDOT truck data from throughout the state was compared against the volume of trucks in the ATRI data for the same period to estimate the percentage of trucks captured by the sample in various parts of the state. The resulting percentages were used to develop expansion factors. For example, if the TxDOT truck count was 10,000 trucks and ATRI sample reported 5,000 trucks at the same location, the expansion factor to be applied to the ATRI data is 2. Expansion factors were then applied to the raw data to estimate total truck parking demand. On average, the ATRI sample captures about one-third of trucks statewide. In the Permian Basin, where there is significant regional traffic from oil and gas production, the data captured half as many trucks, and a larger expansion factor was used.

An example of the raw ATRI data is shown below. Additional detail on the data processing is available in the *Truck Parking Inventory and Utilization Report*.

Example of Raw Data Points (Red Dots) at East Pecos SRA on I-10 in West Texas

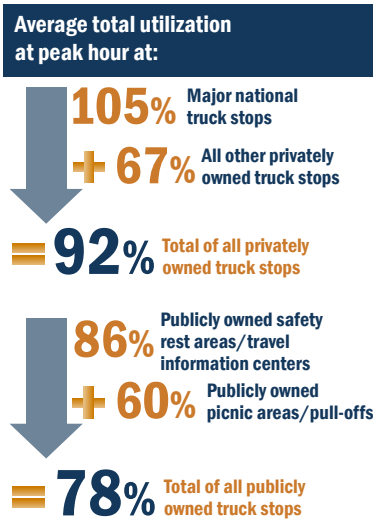


Source: Cambridge Systematics analysis using ATRI truck GPS data, 2018.

Truck parking demand is typically highest overnight, and facilities often are at or over capacity during these hours. The time period with the greatest demand for truck parking, also known as the peak hour, was determined using truck GPS data. The statewide average peak hour for truck parking is from 1:00 a.m. to 2:00 a.m., although individual locations may have a different peak hour. Input from drivers, cities, economic development corporations, ports, businesses and other stakeholders indicated truck parking shortages are a problem in nearly every part of Texas at some time of day or another. In some locations, there is a persistent problem throughout the day. Other locations only fill up once drivers stop for a long break, typically overnight.

UTILIZATION AT AUTHORIZED TRUCK PARKING LOCATIONS

Estimated utilization of SRAs and truck stops – or the number of trucks parked in a place relative to its capacity – is a primary measure of strain on the state's truck parking infrastructure. Privately-owned truck stops tend to have higher utilization than publicly-owned facilities. During the peak hour, privately-owned locations have an average utilization rate of 92 percent while publicly-owned locations have an average utilization rate of 78 percent. This is found by summing the total demand for truck parking at each type of location (public/private) at the peak hour and dividing by the total capacity at those locations. While the average utilization rate across all facilities is less than 100 percent, it should be noted that the majority of facilities are over-capacity during the peak hour.



The "Big 3" national truck stops (Love's, Pilot/Flying J, and TravelCenters of America/Petro) tend to have many amenities, fuel, and rewards programs and are the most utilized truck parking locations in the state. These sites are often over capacity at peak hour with an estimated utilization rate of 105 percent. Overcapacity truck stops have trucks parked along nearby side streets, shoulders, or in unmarked places within the lot. Other privately-owned truck stops tend to have a lower utilization rate with an average of 67 percent during peak hour. These truck stops are often smaller than the Big 3, and the amenities offered vary widely depending on size, location, proximity to other amenity providers, or other outside factors. These utilization estimates do not include spaces that may be reserved but empty, spaces that are inaccessible due to blockage by other trucks, or other situations where an empty space is unusable to drivers.

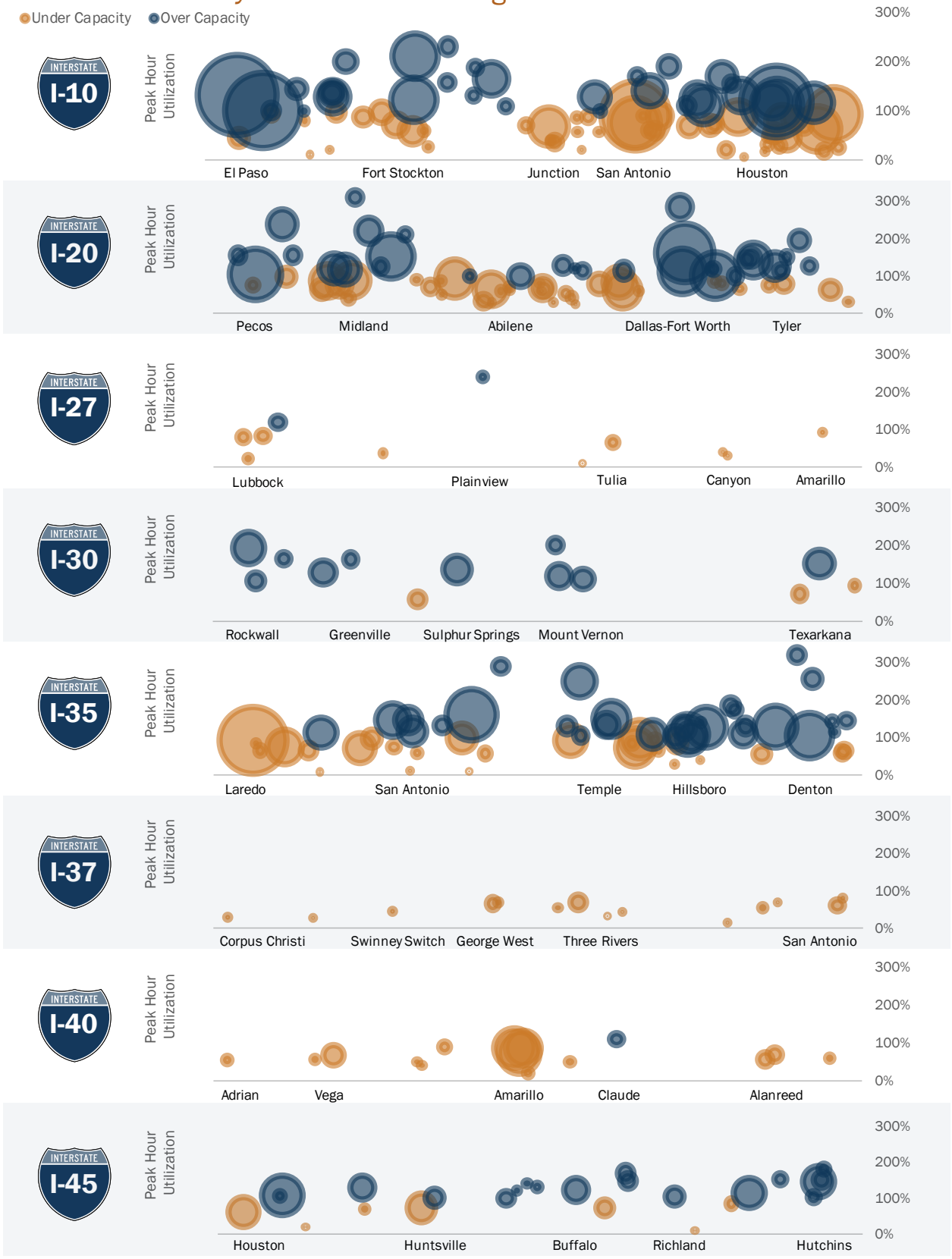
Publicly-owned SRAs and TICs – the public facilities with the most amenities – are 86 percent utilized at peak hour statewide, including 21 sites in 12 districts that are over capacity with trucks spilling out onto entrance and exit ramps or frontage roads. Ward, Bell, Howard and Van Zandt County SRAs and the Pecos East SRA are among the highest utilized locations. Each has a peak utilization over 150 percent in at least one direction.

Picnic areas and highway pull-offs are the least-utilized truck parking infrastructure type with a 60% utilization rate during the peak hour. These locations may not have even basic amenities such as toilets, and they are not attractive for drivers during long breaks. However, 19 picnic areas and pull-offs are over capacity during the peak hour, such as Midland, Reeve, Smith, and Crockett County Picnic Areas. Small, low-amenity locations with lower peak hour utilization still serve a purpose throughout the day in the state's overall truck parking infrastructure for short breaks, cargo safety checks, or other brief stopping needs. With improved amenities and enhanced design, these facilities may attract more drivers and relieve the spillover from nearby over-capacity facilities. Detailed inventory and utilization information on TxDOT maintained facilities is provided in the **Truck Parking Inventory and Utilization of Authorized Locations Report**.

Exhibit 13 displays truck parking demand and utilization on major interstates in Texas grouped by mile marker. The circle size represents the number of trucks at parking facilities on a given mile, and the peak hour utilization shown indicates how full these locations are. Individual locations within a certain mile may still be overcapacity, even if the mile as a whole is not.

I-10, I-20, and I-35 are the most heavily used truck parking corridors in the state with high demand and high utilization facilities in many segments of the corridor. Others such as I-30 and I-45 are overcapacity throughout the corridors, despite having lower demand at individual miles. Truck parking demand and utilization are generally lower on I-27, I-37, and I-40 compared to other interstates.

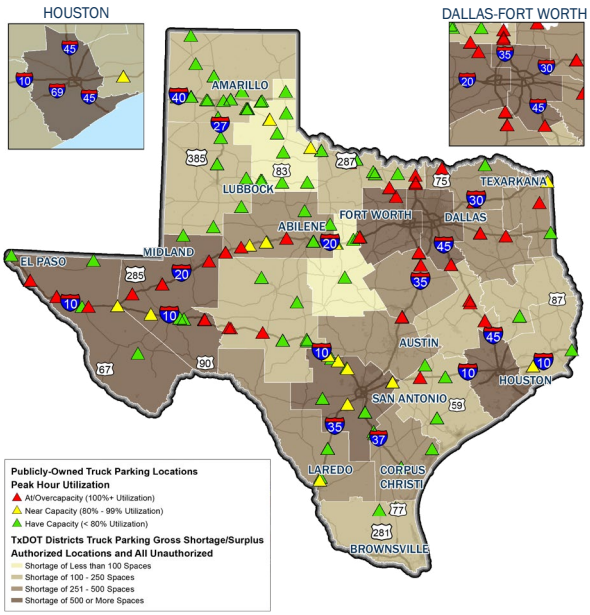
Exhibit 13: Truck Parking Demand and Utilization at Publicly Owned and Privately Owned Truck Parking Locations



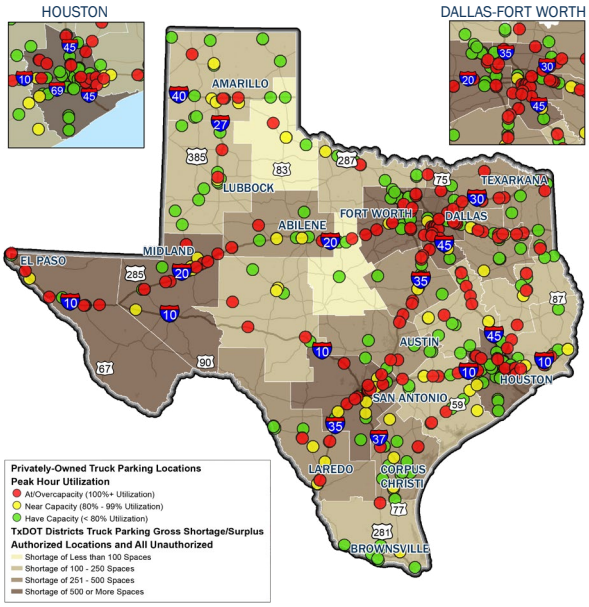
Source: Cambridge Systematics analysis using ATRI truck GPS data, 2019

Exhibit 14 displays the peak hour utilization for publicly-owned and privately-owned truck parking locations. The publicly-owned facilities that are over capacity are located on interstates and some U.S. highways, while locations with available capacity tend to be located away from major highways. Reasons for this high demand for truck parking varies throughout the state. Urban areas have population centers that require goods and deliveries as well as industrial and warehousing clusters with significant truck activity. Near border ports and maritime ports also have concentrations of shippers, receivers, and intermodal facilities that generate significant truck traffic. Drivers near these facilities also need parking while waiting for appointments to pick up or drop off a load. At the international border, drivers waiting for customs clearance also generate parking demand at ports of entry.

Exhibit 14: District Shortage/Surplus



Publicly-Owned Truck Parking Utilization



Privately-Owned Truck Parking Utilization

Source: Cambridge Systematics analysis using ATRI truck GPS data, 2019.

UNAUTHORIZED TRUCK PARKING

63% of drivers report parking in unauthorized location at least weekly, including **10% of drivers** who said they do daily.

Truck drivers prefer to park in safe, authorized spaces if available. However, as demonstrated above, there are times when authorized parking is completely full. In this case, if the driver is approaching the end of their HOS, they may be forced to park in an unauthorized location. Unauthorized parking, or truck parking outside of a dedicated truck parking facility, introduces safety and security risks for drivers as well as the traveling public. Trucks parked on shoulders and ramps can reduce visibility, damage pavement, and result in crashes. Crashes

involving a parked truck will be discussed in the following chapter. Additionally, some unauthorized parking occurs on private land, vacant lots, or other non-roadway locations. Parking on TxDOT right of way was the central focus of the analysis in this Study. Additional maps, data, images and details on unauthorized parking can be found in the **Truck Parking Demand in Dedicated and Unauthorized Locations Report**.

Unauthorized Truck Parking – Fabens, TX

Source: Cambridge Systematics, 2019.

Parking in unauthorized locations occurs because of inadequate or poorly located truck parking capacity or due to interruptions to a driver's travel plans. For example, severe congestion could result in a driver running out of hours of service before reaching their intended parking destination. As discussed in Chapter 1, the ELD mandate has exacerbated this problem for drivers. TxDOT's truck driver survey found that while drivers want to park in safe, authorized locations, more than 60% of drivers park in an unauthorized location at least once a week, including 10% of drivers who said they do so daily. Statewide, the majority of trucks (64 percent) stopped in authorized truck parking locations are there for less than 1 hour. Parking for 8 to 14 hours is the second highest category in every district except Laredo where there is a higher number of stops between 1 and 4 hours.

50% of drivers say they park in unauthorized places due to **hours-of-service constraints**

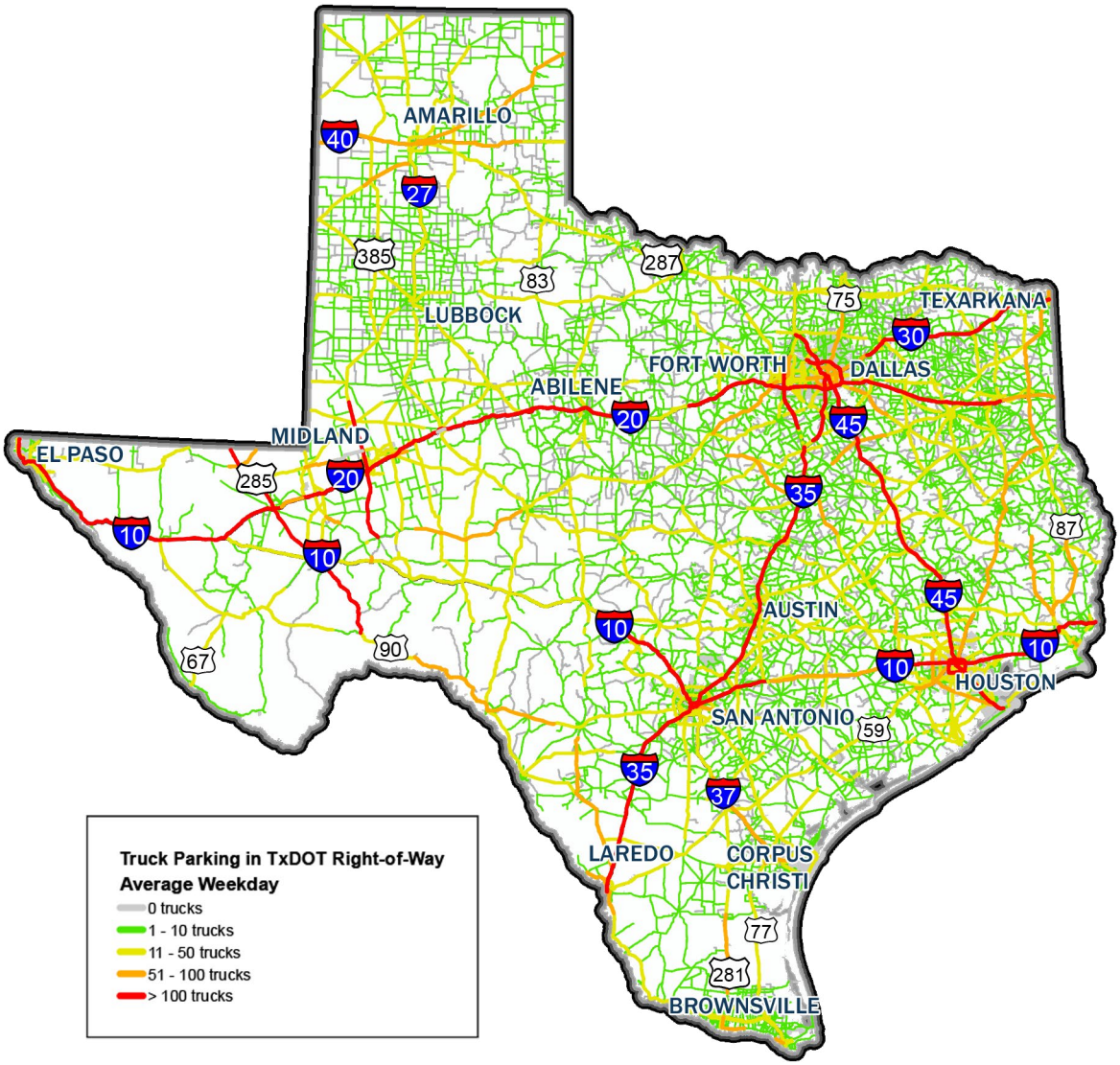
23% point to lack of **overnight parking**

Unauthorized Truck Parking – Near DFW International Airport

Source: Cambridge Systematics, 2019.

As shown in Exhibit 15, the majority of parking along TxDOT roadways occurred along interstates, in urban areas, and on US 285 and US 385 in the Permian Basin. Unauthorized parking is compared to truck parking shortages later in this chapter and compared to crash statistics in Chapter 5.

Exhibit 15: Unauthorized Truck Parking in TxDOT Right of Way

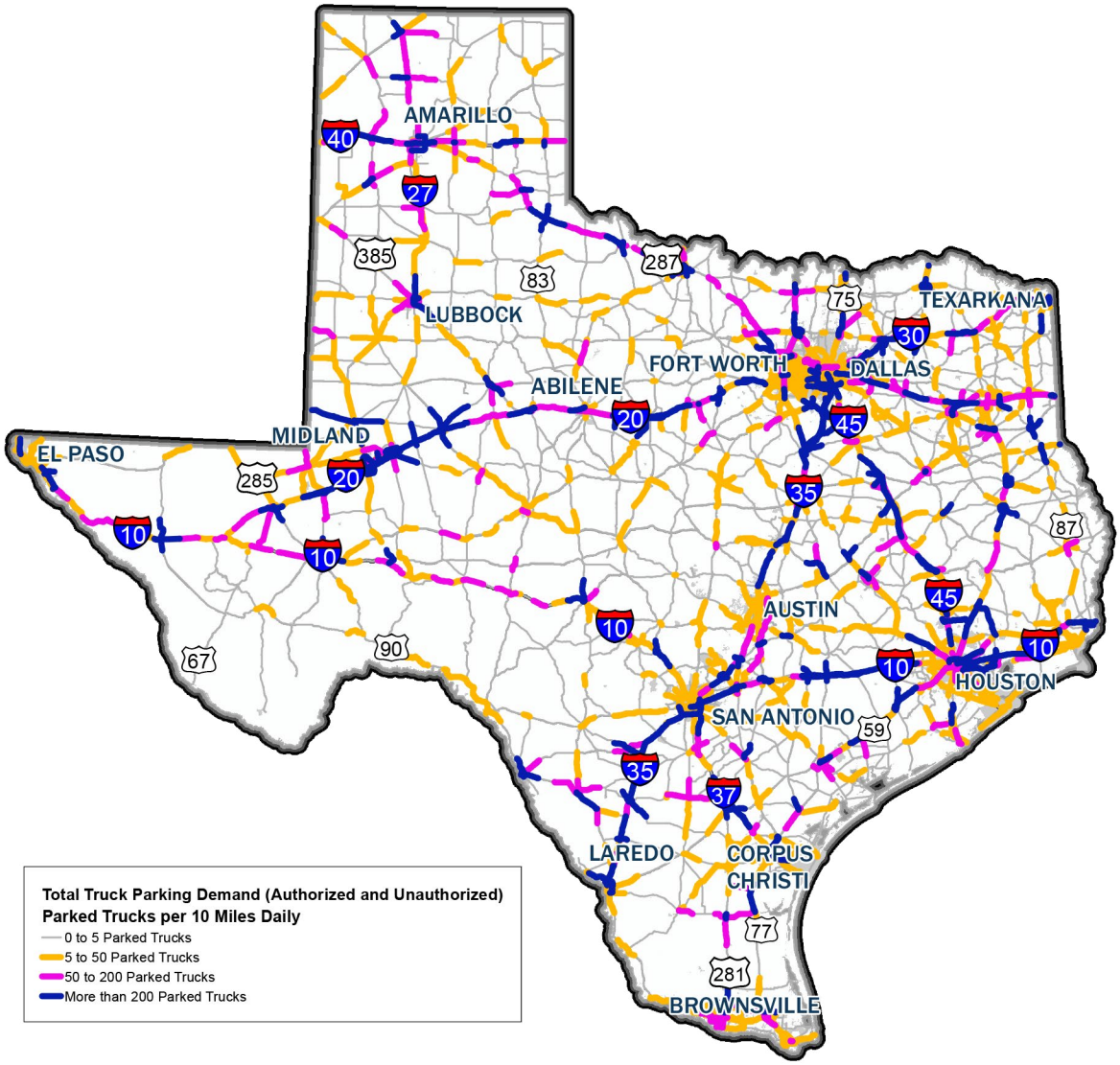


Source: Cambridge Systematics analysis using ATRI truck GPS data, 2018.

TOTAL PARKING DEMAND AND NEED

Parking in authorized and unauthorized locations makes up the total parking demand for truck parking in Texas, shown on Exhibit 16. Additionally, some parking occurs at private businesses owned by carriers, shippers, or receivers. These stops are also difficult to distinguish from pickups and deliveries at businesses. Throughout this study, parking at private businesses was not quantified, and is not included in the total parking demand for each district or corridor due to proprietary data concerns.

Exhibit 16: Truck Parking Demand During Statewide Peak Hour per 10 Miles



Source: Cambridge Systematics analysis using ATRI truck GPS data, 2018.

Note: Peak-hour is 1:00 a.m. to 2:00 a.m.

The majority of Texas' truck parking demand, in and out of authorized locations, is located within a mile of an interstate. Several U.S. and state highways also absorb a significant amount of truck parking. I-10, I-35, and I-20 have the greatest peak hour demand of any corridors. When comparing the amount of parking per mile, I-35 is the densest interstate corridor. U.S. highways tend to have less dense parking. SH 225 (near Port Houston) and SH 342 (in South Dallas) have the greatest density of truck parking per mile, and are both located in industrial areas of Texas' largest cities. Exhibit 17 lists the total truck parking demand during peak hour for major interstates and for the top U.S. and state highways.

Exhibit 17: Peak Hour Demand on Major Interstates and Top U.S. and State Highways

CORRIDOR	TOTAL PEAK DEMAND	TOTAL PEAK DEMAND PER MILE	FACILITIES NEAR/ OVER CAPACITY
Major Interstates			
I-10	5,663	6	64
I-20	4,904	8	59
I-27	265	2	4
I-30	1,187	5	15
I-35	4,891	8	48
I-37	319	2	3
I-40	997	6	5
I-45	1,606	6	22
Top U.S. Highways by Total Parking Demand			
US 77	1,269	3	11
US 59	1,080	2	15
US 90	879	1	11
US 87	617	1	7
US 285	615	4	4
Top State Highways by Total Parking Demand			
SH 225	343	22	3
SH 158	310	2	4
SH 34	288	2	6
SH 342	286	19	1
SH 350	275	6	2

Source: Cambridge Systematics analysis using ATRI truck GPS data, 2018.

Note: Peak-hour is 1:00 a.m. to 2:00 a.m.

Today, at least one authorized truck parking location is over capacity during peak hour in each TxDOT district, and several are near capacity. Even if limited spaces are available, drivers may park on a shoulder or ramp outside of a site if they believe it to be full or worry about being blocked into a space when they are ready to leave. In nine districts, the shortage is so severe that the number of trucks parking in the district exceeds the number of spaces

available in the entire district. In other places, the available supply is not located where drivers need it most, amenities could be improved to encourage use, or information is needed to direct drivers to available spaces.

Exhibit 18: Peak Hour Utilization by District

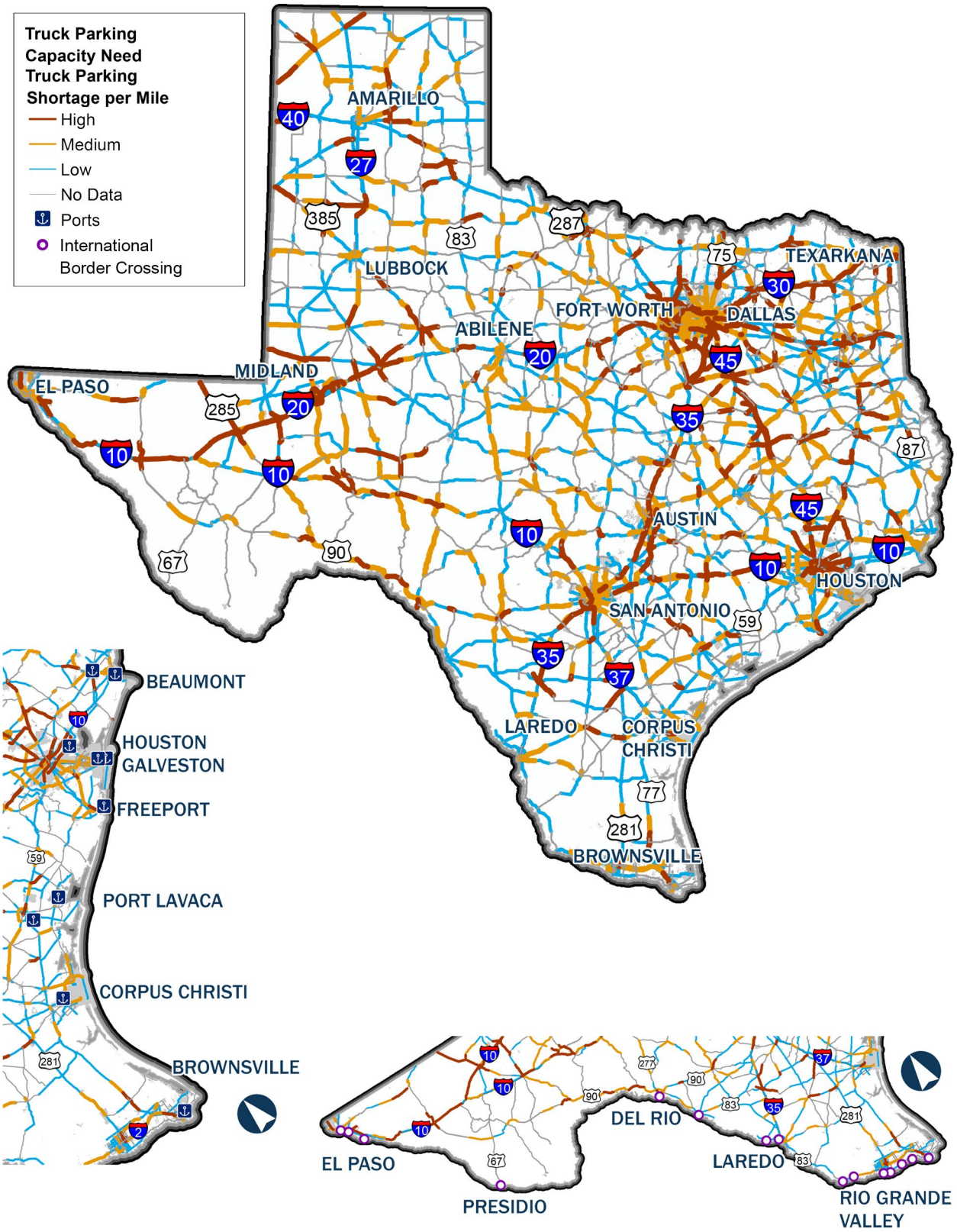
ABILENE	AMARILLO	ATLANTA	AUSTIN	BEAUMONT
14 facilities near/over capacity	9 facilities near/over capacity	6 facilities near/over capacity	6 facilities near/over capacity	10 facilities near/over capacity
BROWNWOOD	**BRYAN**	**CHILDRESS**	**CORPUS CHRISTI**	**DALLAS**
3 facilities near/over capacity	12 facilities near/over capacity	5 facilities near/over capacity	5 facilities near/over capacity	34 facilities near/over capacity
EL PASO	**FORT WORTH**	**HOUSTON**	**LAREDO**	**LUBBOCK**
18 facilities near/over capacity	11 facilities near/over capacity	18 facilities near/over capacity	11 facilities near/over capacity	3 facilities near/over capacity
LUFKIN	**ODESSA**	**PARIS**	**PHARR**	**SAN ANGELO**
5 facilities near/over capacity	27 facilities near/over capacity	12 facilities near/over capacity	3 facilities near/over capacity	9 facilities near/over capacity
SAN ANTONIO	**TYLER**	**WACO**	**WICHITA FALLS**	**YOAKUM**
21 facilities near/over capacity	16 facilities near/over capacity	15 facilities near/over capacity	8 facilities near/over capacity	11 facilities near/over capacity

Source: Cambridge Systematics analysis using ATRI truck GPS data, 2018.
Note: Peak-hour is 1:00 a.m. to 2:00 a.m.

Truck parking shortages were also associated with highway segments to identify the locations with the greatest truck parking need. It is important to note that even if a specific facility has a surplus of truck parking, it does not mean that there is no problem. It could be that the facility lacks a basic amenity, is poorly designed causing operational safety concerns or has other attributes that impact the willingness of driver to use the facility.

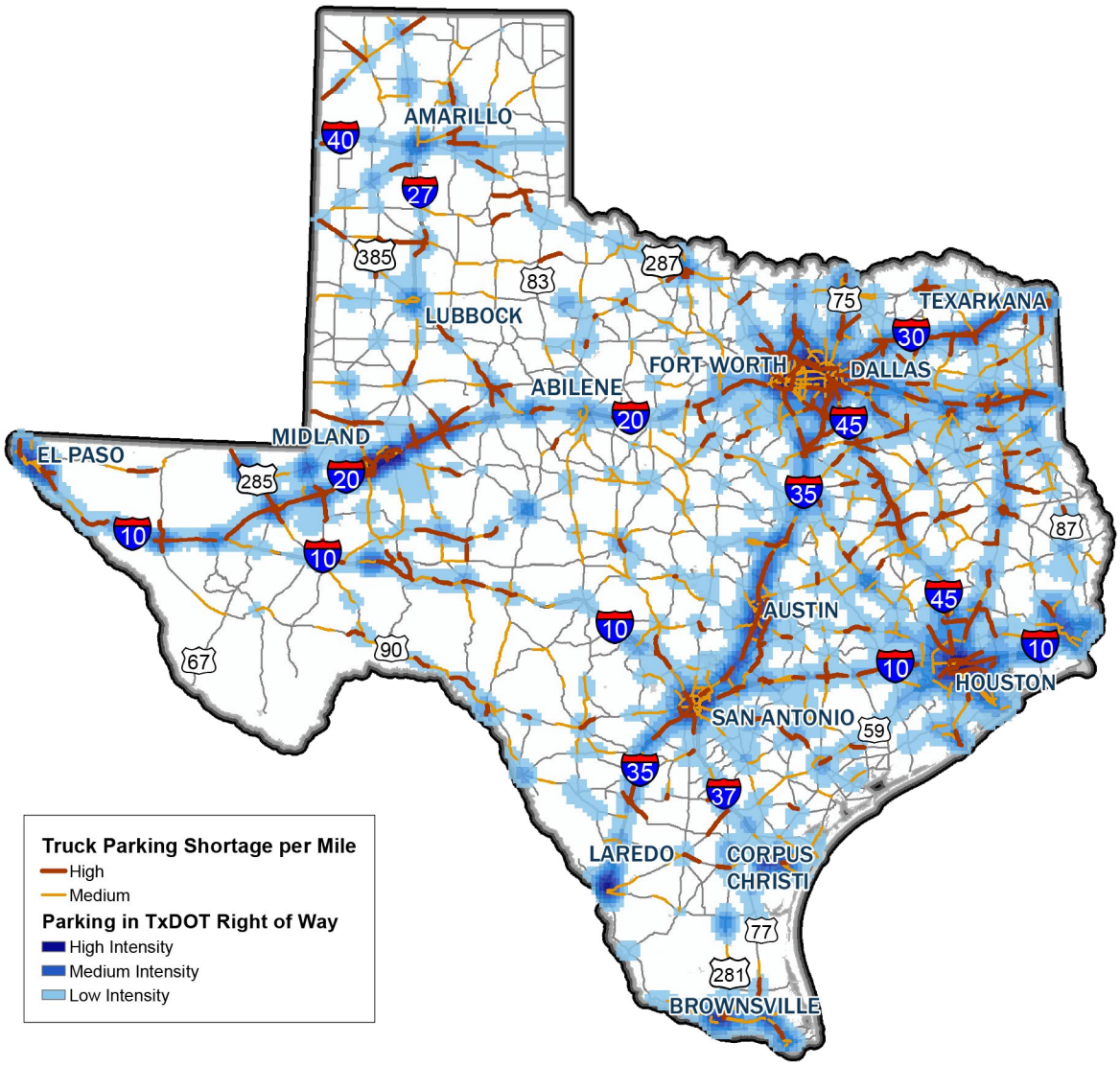
Exhibit 19 displays truck parking capacity need, measured by peak hour truck parking shortage per mile. Dallas-Fort Worth, Houston, the Permian Basin, and interstates have the greatest parking need when compared to other locations. However, even locations with a less urgent need from a statewide perspective may be significant locally. High-need locations often coincide with the unauthorized parking, shown in Exhibit 20. There are no concentrations of unauthorized parking that do not coincide with a medium or high capacity need. A few locations have a lower density of unauthorized parking spread out over a corridor or region, such as US 287 or parts of the Permian Basin and Eagle Ford Shale. In these locations, added capacity in one location may alleviate parking issues in the surrounding area.

Exhibit 19: Current Truck Parking Capacity Need



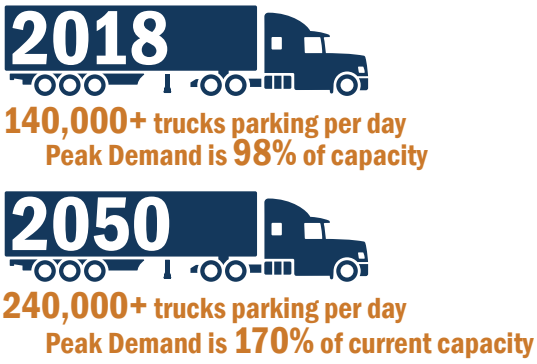
Source: Cambridge Systematics analysis using ATRI truck GPS data, 2018.

Exhibit 20: High and Medium Priority Shortages and Parking in TxDOT Right of Way



Source: Cambridge Systematics analysis using ATRI truck GPS data, 2019.

FORECASTED TRUCK PARKING DEMAND

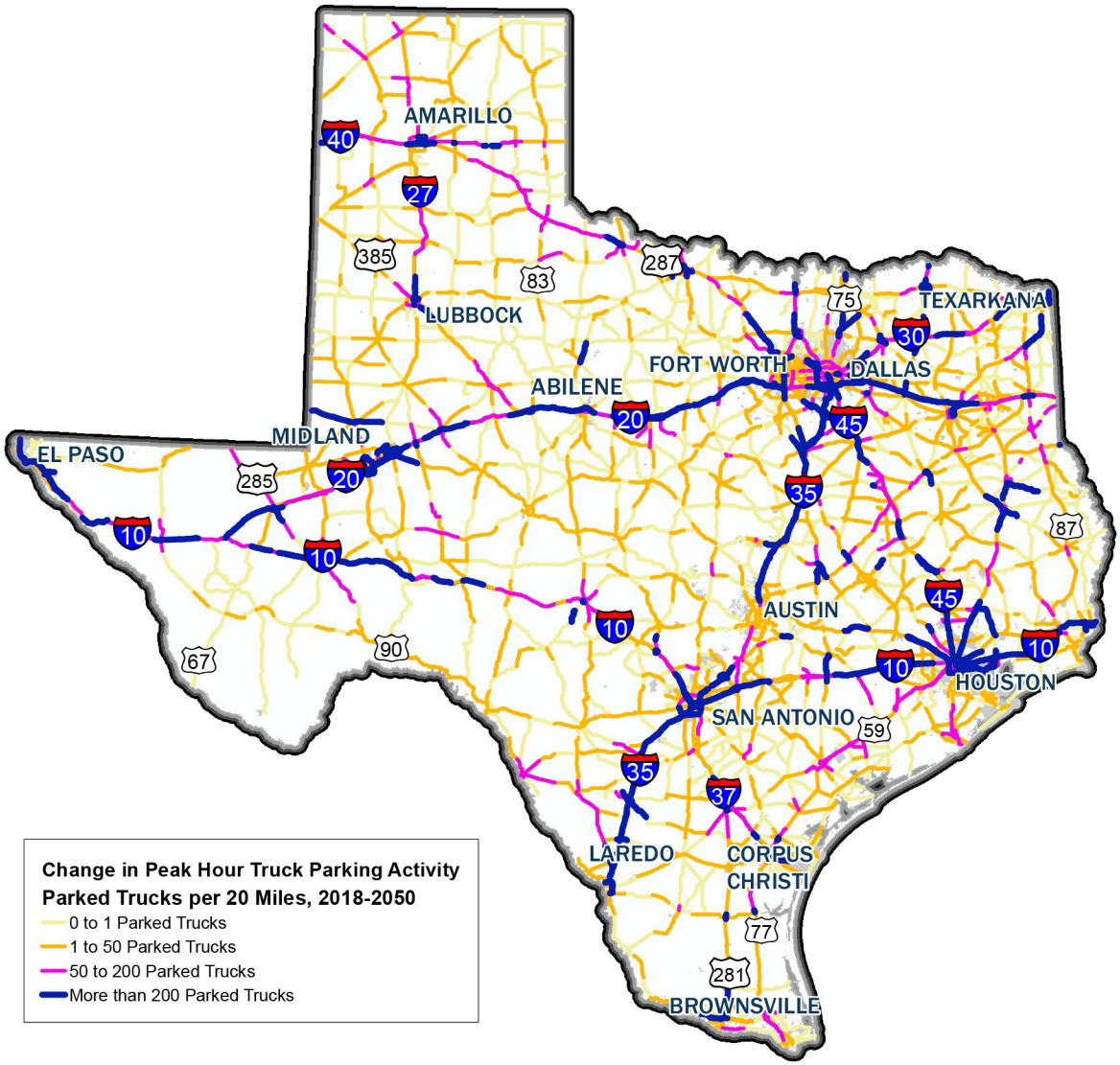


Forecasted truck parking demand was developed using the Statewide Analysis Model (SAM), TRANSEARCH commodity flow forecasts for 2018 and 2050, and 2018 ATRI GPS data. These data sources were combined by dividing the state into zones and analyzing where trucks park during trips between zones. These patterns were then scaled to the future commodity forecast. Finally, the stops within each zone were distributed across highways based on current parking patterns and forecasted truck traffic growth. More information about this process is available in the **Current and Forecasted Truck Parking Needs Assessment Report**.

Demand for truck parking stops of 15 minutes or more is forecasted to increase from more than 140,000 stops per day to more than 240,000 stops per day by 2050. This expected increase will further strain the current system, resulting in peak demand that is 170% of current capacity. Autonomous vehicles may change the locations where parking is needed in some circumstances. However, autonomous trucks are not expected to significantly reduce demand for truck parking in the areas that already have the highest demand: in complex environments (urban or rural), near ports and international border crossings, and near warehousing.

Exhibit 21 displays the forecasted change in peak hour truck parking activity on Texas highways by 2050. Truck stops or SRAs near intersections are assigned to both the major and minor roadways. Interstates throughout Texas are forecasted to experience the largest growth in truck parking demand, particularly on I-20, I-30, and I-35. Urban truck parking demand in Dallas-Fort Worth and Houston is forecasted to grow quickly as well. I-27, US 287, segments of the future I-69 corridor (currently US 281 and US 59), parts of the Permian Basin, and highways near the US-Mexico border are also expected to experience significant growth in truck parking demand.

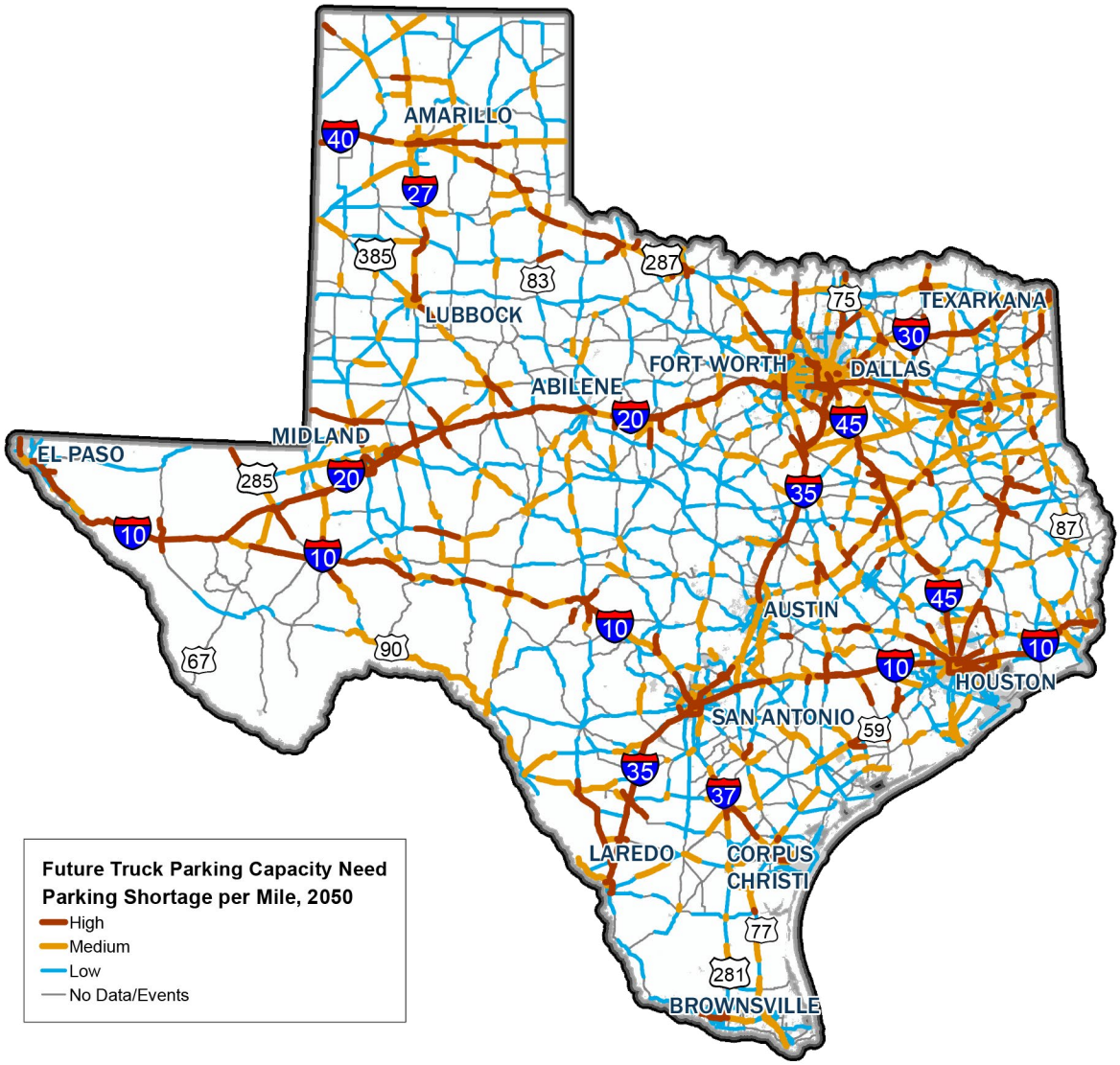
Exhibit 21: Change in Peak Truck Parking Activity per 20 Miles, 2018-2050



Source: Cambridge Systematics analysis using ATRI truck GPS data, 2018.

Exhibit 19 displays current high priority capacity needs on interstates and in urbanized areas. The forecasted demand shown in Exhibit 22 shows the prioritized capacity needs by 2050. Many current high priority locations are forecasted to continue to have the highest truck parking shortages in the state in the future. However, forecasted growth at some locations is expected to increase the priority on several highways in the future, including I-10 near Beaumont, I-20 between Abilene and Fort Worth, and I-35 and US 83 near Laredo. Exhibit 23 shows the top 5 interstates, US, and State highways by forecasted demand in 2050. These corridors are located throughout the State and include key freight corridors, especially those connecting to border crossings and maritime ports such as US 77 and SH 146.

Exhibit 22: Change in Peak Hour Truck Activity per 20 Miles, 2018-2050



Source: Cambridge Systematics analysis using ATRI truck GPS data, 2018.

Exhibit 23: Top 5 Interstates, U.S. or State Highways with Greatest Future Demand

INTERSTATES	U.S. HIGHWAYS	STATE HIGHWAYS
• I-10: 418% growth	• US 77: 137% growth	• SH 34: 161% growth
• I-20: 252% growth	• US 59: 198% growth	• SH 6: 168% growth
• I-27: 165% growth	• US 287: 240% growth	• SH 11: 154% growth
• I-30: 238% growth	• US 90: 137% growth	• SH 146: 380% growth
• I-35: 300% growth	• US 281: 174% growth	• SH 19: 130% growth

Exhibit 24 highlights peak truck parking demand by district. Districts with the greatest truck parking demand today are forecasted to continue to have the greatest truck parking demand in the future; the Dallas, Houston, San Antonio, Odessa, and Waco districts make up the top five in terms of peak hour truck parking demand for both 2018 and 2050. The Bryan district is forecasted to have the largest percent growth in truck parking demand with a near doubling between 2018 and 2050. Houston, Yoakum, San Antonio, and Beaumont are the next highest districts in terms of forecasted growth, and all are expected to have at least 85% more demand for truck parking by 2050.

Exhibit 24: Peak Truck Parking Demand by District, 2018-2050

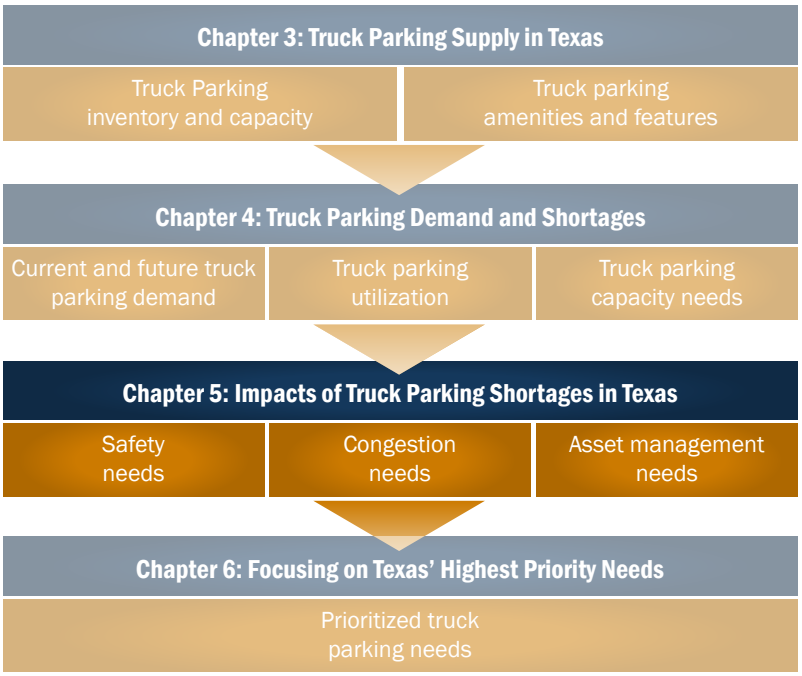
ABILENE	AMARILLO	ATLANTA	AUSTIN	BEAUMONT
2018: 997	**2018:** 1,244	**2018:** 731	**2018:** 414	**2018:** 1,045
2050: 1,730	**2050:** 2,007	**2050:** 1,239	**2050:** 744	**2050:** 1,938
Change: 73%	**Change:** 61%	**Change:** 69%	**Change:** 80%	**Change:** 85%
BROWNWOOD	**BRYAN**	**CHILDRESS**	**CORPUS CHRISTI**	**DALLAS**
2018: 231	**2018**: 716	**2018:** 294	**2018:** 671	**2018:** 3,201
2050: 416	**2050:** 1,391	**2050:** 511	**2050:** 1,151	**2050:** 5,509
Change: 80%	**Change:** 94%	**Change:** 74%	**Change:** 72%	**Change:** 72%
EL PASO	**FORT WORTH**	**HOUSTON**	**LAREDO**	**LUBBOCK**
2018: 1,490	**2018:** 1,169	**2018:** 2,872	**2018:** 1266	**2018:** 358
2050: 2,690	**2050:** 2,006	**2050:** 5,415	**2050:** 2,226	**2050:** 498
Change: 81%	**Change:** 72%	**Change:** 89%	**Change:** 76%	**Change:** 39%
LUFKIN	**ODESSA**	**PARIS**	**PHARR**	**SAN ANGELO**
2018: 291	**2018:** 2,354	**2018:** 743	**2018:** 328	**2018:** 454
2050: 495	**2050:** 3,634	**2050:** 1,222	**2050:** 587	**2050:** 772
Change: 70%	**Change:** 54%	**Change:** 64%	**Change:** 79%	**Change:** 70%
SAN ANTONIO	**TYLER**	**WACO**	**WICHITA FALLS**	**YOAKUM**
2018: 2,213	**2018:** 785	**2018:** 1,580	**2018:** 398	**2018:** 852
2050: 4,112	**2050:** 1,275	**2050:** 2,786	**2050:** 648	**2050:** 1,593
Change: 86%	**Change:** 62%	**Change:** 76%	**Change:** 63%	**Change:** 87%

This chapter summarized truck parking demand, utilization and capacity needs at the state, district and corridor levels. Chapter 5 identifies the impacts of inadequate truck parking on truck parking safety, congestion and asset management. These will be combined with the capacity needs identified in this chapter to identify the highest priority truck parking needs in Chapter 6.

5 Impacts of Truck Parking Shortages in Texas

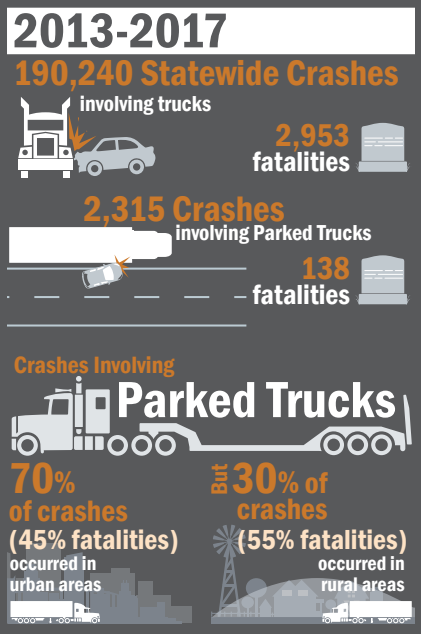
The availability of authorized truck parking impacts the safety and security of drivers and their cargo; the safety of everyone on the roadways; the congestion on our roadways especially in and around urban areas; and the condition of our roadways especially highway shoulders and ramps and local roads connecting to businesses and facilities that attract significant truck traffic such as international border crossings and maritime ports. In turn, these impacts affect driver productivity and income, travel times for the motoring public, shipping costs, public cost to repair infrastructure, cost of consumer products and the cost of doing business in Texas.

This chapter uses the inventory data from Chapter 3 and the truck parking demand and utilization in Chapter 4 to identify impacts of inadequate truck parking including safety, congestion and asset management impacts. The findings from this chapter are used to prioritize truck parking needs in Chapter 6.



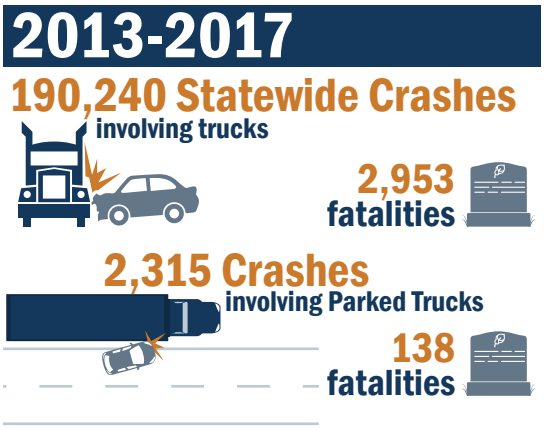
Key Findings

Although truck drivers seek safe, authorized parking, sometimes they have to park in unauthorized locations as a last resort. This leads to significant impacts on the safety of drivers and the motoring public.



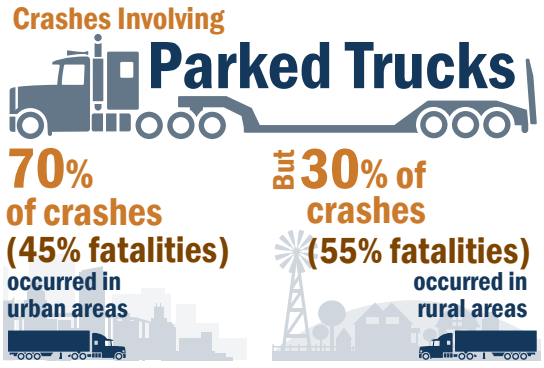
- Segments with nearby closed rest areas and both high priority truck parking safety needs and relatively high rates of unauthorized parking include:
  - » I-35 north of San Antonio,
  - » I-35 north of Austin, and
  - » I-30 near Mount Vernon.
- TxDOT Districts report safety and maintenance as significant truck parking challenges facing TxDOT.

SAFETY IMPACTS OF INADEQUATE TRUCK PARKING



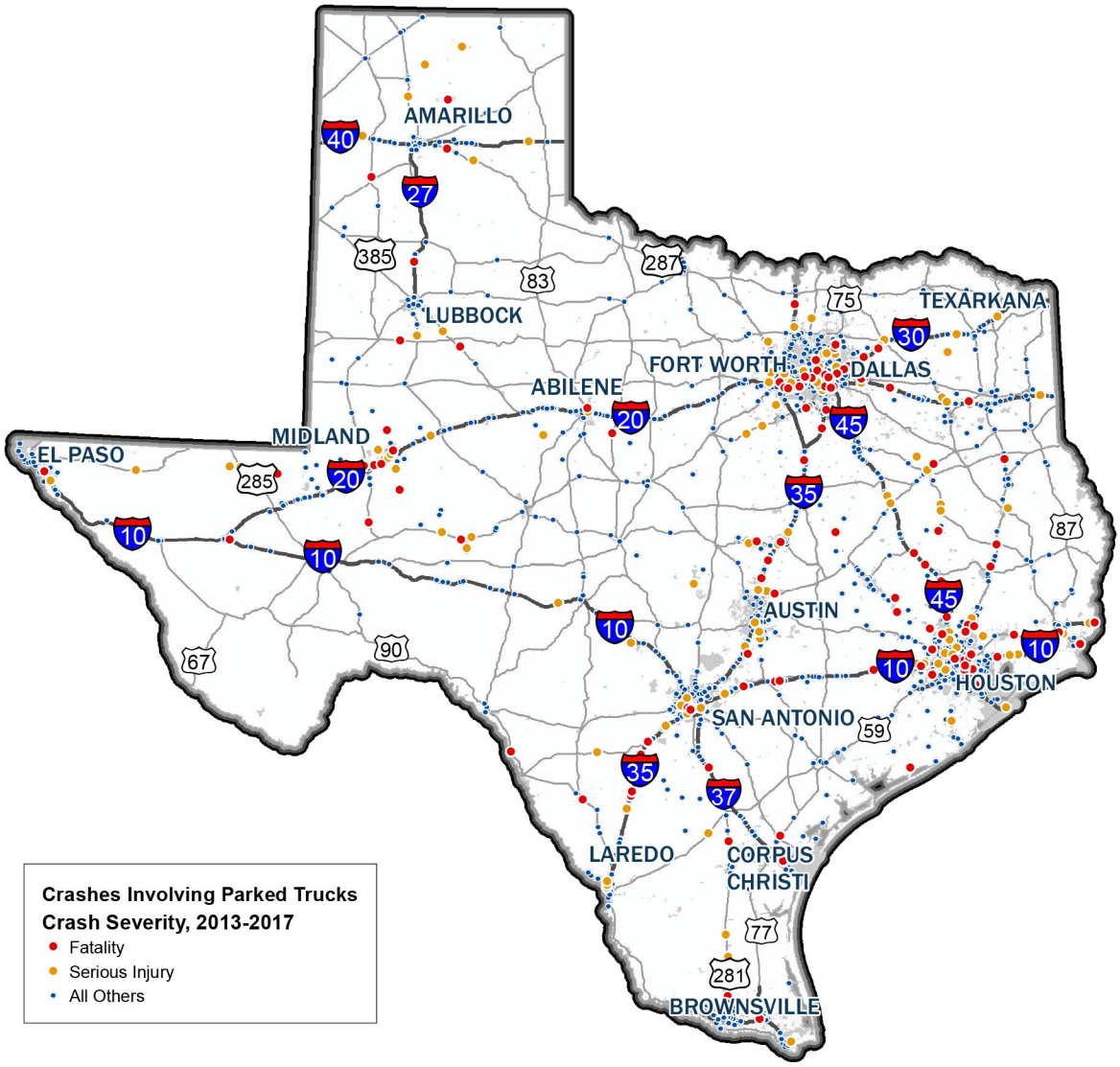
Trucks parked along highway shoulders and ramps and tired and fatigued truck drivers are examples of how the lack of truck parking can result in negative safety impacts for the traveling public. This section examines the impacts of inadequate truck parking and unauthorized truck parking on crashes and highway performance.

Crashes Involving Parked Trucks: Safety is the most important performance metric for commercial truck drivers and their safety record follows them from job to job, impacting their employability and pay. Therefore, truck drivers prefer safe, designated parking and nearly always only park on shoulders and ramps as a last resort. Between 2013 and 2017, there were 190,240 crashes involving trucks in Texas. 2,525 of these crashes were fatal, resulting in 2,953 deaths. Over the same period, there were more than 2,300 crashes involving parked trucks. 117 of these were fatal, resulting in 138 deaths. Crashes involving parked trucks make up a small but preventable percentage of roadway fatalities in Texas. While the exact location of each parked truck is difficult to determine at the statewide level, parked trucks that were struck were in a vulnerable position and likely outside of a designated truck parking area.



More than 70% of crashes involving a parked truck occurred in urban areas, and a concentration of crashes in Dallas-Fort Worth, Houston, and elsewhere in the Texas Triangle can be seen on Exhibit 25. Despite having a smaller number of crashes involving a parked truck, rural areas accounted for more than half of fatal crashes. Many factors may contribute to this disparity in crash severity, including speed, lighting, shoulder width, driver anticipation of trucks, or behavioral factors. In addition, crashes in rural areas are more likely to have slower emergency response times and more limited access to medical facilities. Exhibit 26 displays the top interstate, U.S., and state highways by number of crashes involving a parked truck per mile between 2013-2017. Sections of the longest corridors have a greater concentration of crashes than the corridor average, and Exhibit 26 shows a more detailed corridor analysis.

Exhibit 25: Crashes Involving Parked Trucks



Source: TxDOT, Crash Record Information System, 2013-2017, Accessed December 2018.

Exhibit 26: Top 5 Interstates, U.S. or State Highways: Crashes Involving Parked Trucks per Mile, 2013-2017

INTERSTATES	U.S. HIGHWAYS	STATE HIGHWAYS
• I-35: 0.45 crashes/mile	• US 75: 0.27 crashes/mile	• SH 225: 1.33 crashes/mile
• I-45: 0.37 crashes/mile	• US 59: 0.21 crashes/mile	• SH 183: 0.73 crashes/mile
• I-30: 0.37 crashes/mile	• US 290: 0.15 crashes/mile	• SH 249: 0.60 crashes/mile
• I-20: 0.24 crashes/mile	• US 281: 0.08 crashes/mile	• SH 180: 0.54 crashes/mile
• I-10: 0.23 crashes/mile	• US 60: 0.07 crashes/mile	• SH 360: 0.50 crashes/mile

Exhibit 27: Crashes Involving Parked Trucks, 2013-2017 by District

ABILENE	AMARILLO	ATLANTA	AUSTIN	BEAUMONT
Crashes: 53	**Crashes:** 78	**Crashes:** 39	**Crashes:** 80	**Crashes:** 67
Fatal: 6%	**Fatal:** 4%	**Fatal:** 0%	**Fatal:** 4%	**Fatal:** 10%
BROWNWOOD	**BRYAN**	**CHILDRESS**	**CORPUS CHRISTI**	**DALLAS**
Crashes: 16	**Crashes:** 42	**Crashes:** 6	**Crashes:** 48	**Crashes:** 367
Fatal: 0%	**Fatal:** 12%	**Fatal:** 0%	**Fatal:** 6%	**Fatal:** 6%
EL PASO	**FORT WORTH**	**HOUSTON**	**LAREDO**	**LUBBOCK**
Crashes: 67	**Crashes:** 189	**Crashes:** 422	**Crashes:** 148	**Crashes:** 36
Fatal: 3%	**Fatal:** 3%	**Fatal:** 5%	**Fatal:** 3%	**Fatal:** 8%
LUFKIN	**ODESSA**	**PARIS**	**PHARR**	**SAN ANGELO**
Crashes: 31	**Crashes:** 99	**Crashes:** 32	**Crashes:** 67	**Crashes:** 44
Fatal: 10%	**Fatal:** 9%	**Fatal:** 3%	**Fatal:** 4%	**Fatal:** 2%
SAN ANTONIO	**TYLER**	**WACO**	**WICHITA FALLS**	**YOAKUM**
Crashes: 201	**Crashes:** 55	**Crashes:** 68	**Crashes:** 24	**Crashes:** 36
Fatal: 3%	**Fatal:** 9%	**Fatal:** 7%	**Fatal:** 4%	**Fatal:** 11%

Crashes Involving Fatigued Drivers:

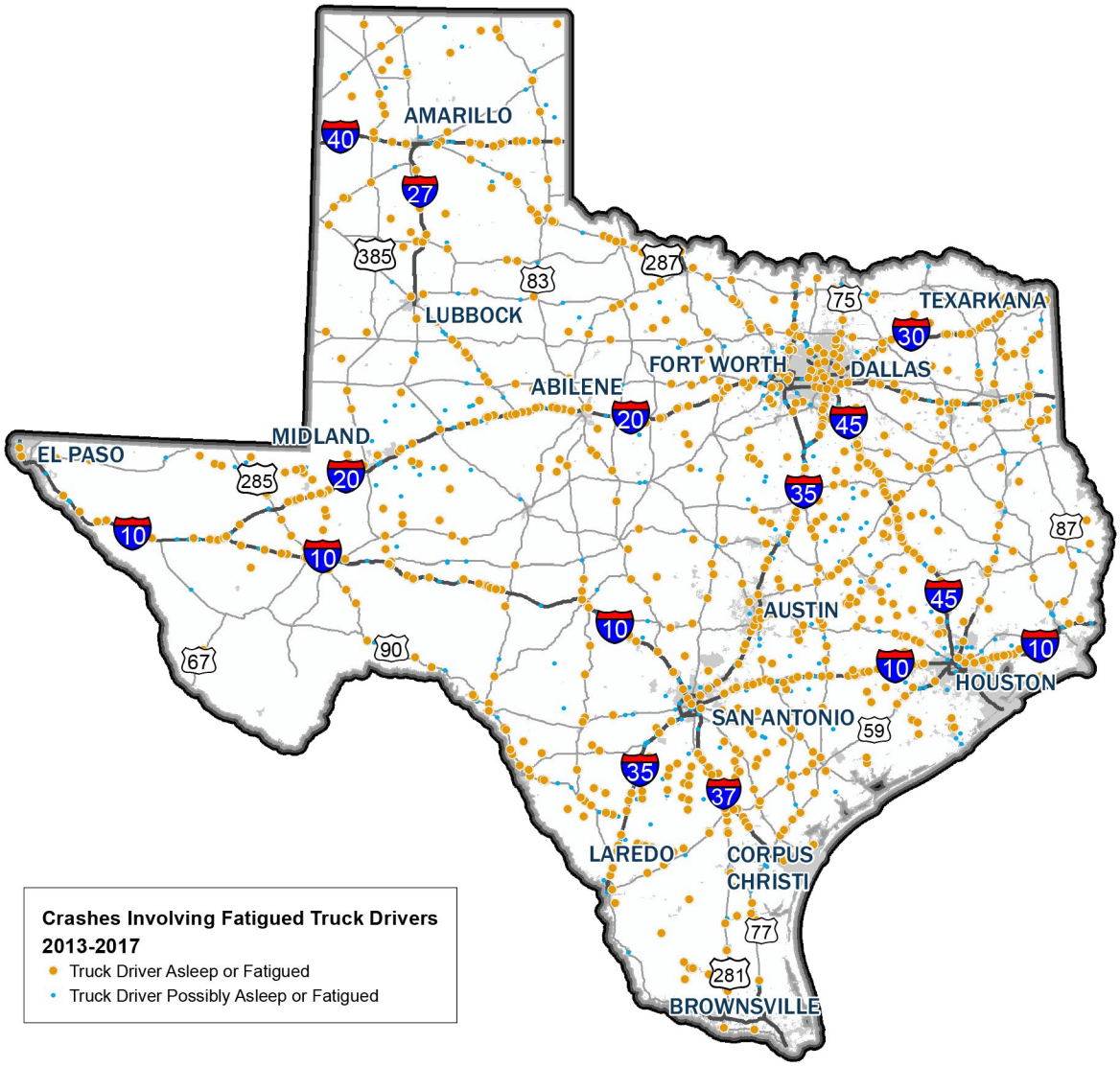
Fatigued driving is another type of crash potentially influenced by inadequate truck parking. Drivers are constrained to 14 hours on-duty (11 hours of driving) per day by federal HOS regulations, and they are required to take a 10 hour break once this limit is reached. However, a driver may decide to stop sooner to rest, take advantage of an available or preferred parking location, or any number of reasons specific to the individual. If there are not safe truck parking locations available, a driver may have to continue driving in search of parking despite recognizing the need to stop and rest.

ABOUT THE DATA:

Law enforcement officers can assign up to three contributing factors and two potential contributing factors to each vehicle in a crash, but these factors should be interpreted with caution. Factors are at times subjective, and they may not be documented uniformly for minor collisions.

Between 2013 and 2017 there were 1,511 crashes involving fatigued or possibly fatigued truck drivers, shown on Exhibit 28. While crashes involving parked trucks (Exhibit 25) often occurred on interstates or in urbanized areas, fatigued driver crashes also occur on U.S. or state highways in addition to interstates. Crash locations are compared to truck parking shortages and unauthorized parking later in this chapter.

Exhibit 28: Crashes Involving Fatigued Truck Drivers (2013-2017)



Source: TxDOT, Crash Record Information System, 2013-2017, Accessed December 2018.

Exhibit 29: Crashes Involving Fatigued Drivers, 2013-2017 by District

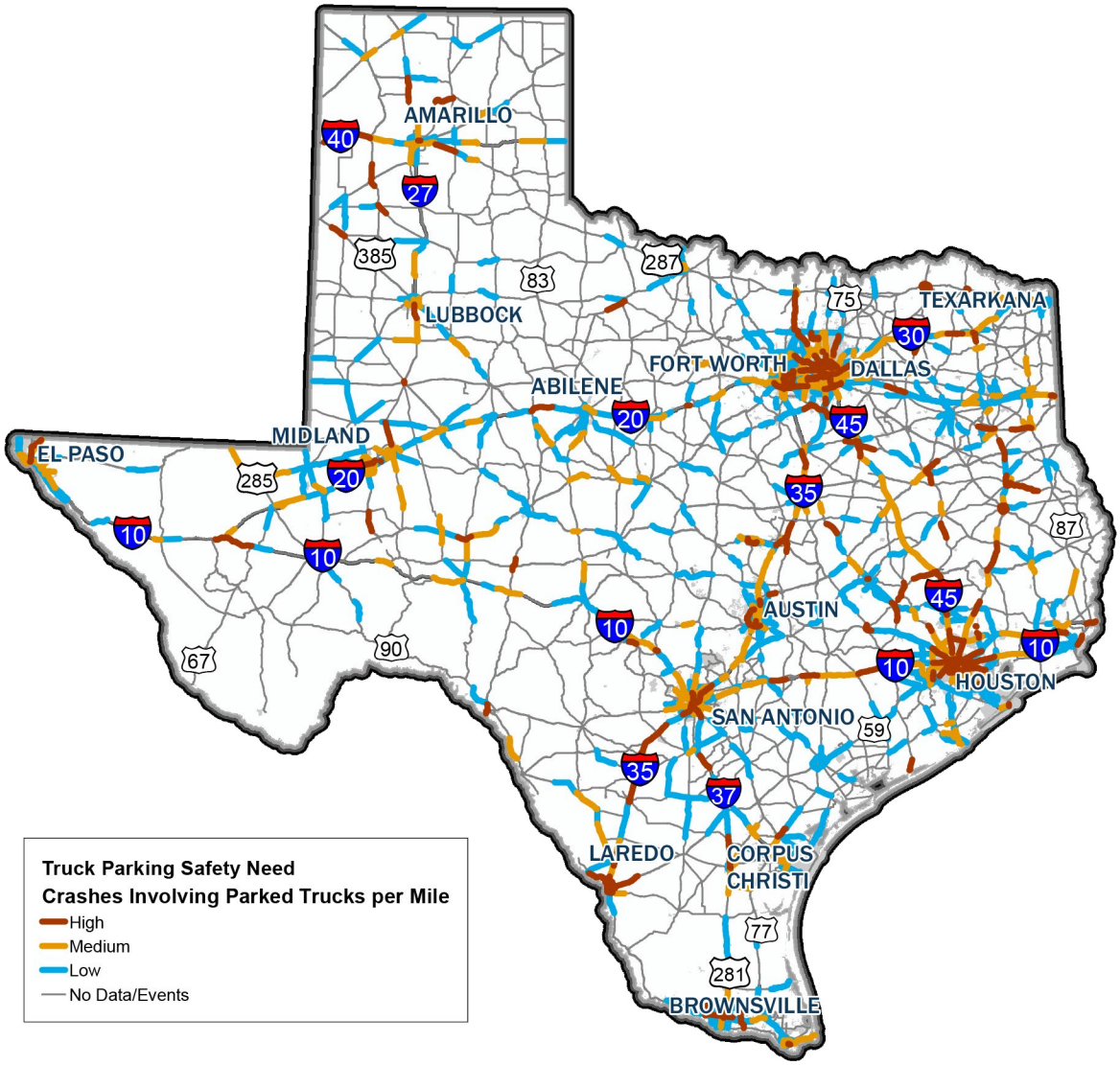
ABILENE	AMARILLO	ATLANTA	AUSTIN	BEAUMONT
Crashes: 61	**Crashes:** 67	**Crashes:** 65	**Crashes:** 58	**Crashes:** 41
Fatal: 3%	**Fatal:** 7%	**Fatal:** 5%	**Fatal:** 10%	**Fatal:** 7%
BROWNWOOD	**BRYAN**	**CHILDRESS**	**CORPUS CHRISTI**	**DALLAS**
Crashes: 30	**Crashes:** 87	**Crashes:** 42	**Crashes:** 72	**Crashes:** 111
Fatal: 7%	**Fatal:** 3%	**Fatal:** 2%	**Fatal:** 10%	**Fatal:** 3%
EL PASO	**FORT WORTH**	**HOUSTON**	**LAREDO**	**LUBBOCK**
Crashes: 45	**Crashes:** 59	**Crashes:** 75	**Crashes:** 86	**Crashes:** 42
Fatal: 7%	**Fatal:** 2%	**Fatal:** 0%	**Fatal:** 7%	**Fatal:** 7%
LUFKIN	**ODESSA**	**PARIS**	**PHARR**	**SAN ANGELO**
Crashes: 19	**Crashes:** 89	**Crashes:** 37	**Crashes:** 28	**Crashes:** 59
Fatal: 5%	**Fatal:** 13%	**Fatal:** 11%	**Fatal:** 4%	**Fatal:** 5%
SAN ANTONIO	**TYLER**	**WACO**	**WICHITA FALLS**	**YOAKUM**
Crashes: 110	**Crashes:** 46	**Crashes:** 70	**Crashes:** 42	**Crashes:** 70
Fatal: 5%	**Fatal:** 2%	**Fatal:** 6%	**Fatal:** 5%	**Fatal:** 4%

PRIORITIZING TRUCK PARKING SAFETY NEEDS

The prioritization of safety needs related to truck parking was based on the number of crashes from 2013-2017 involving a parked truck as well as the number of fatal crashes involving a parked truck. Fatigued driver crashes were not included in this assessment because of the number of factors, including driver behavior, that are beyond TxDOT's ability to address through this study. Fatal crashes were weighted five times higher than non-fatal crashes to ensure areas with less frequent but more severe crashes were included. As with capacity need, this need category was then normalized by segment length. Additional detail on the prioritization can be found in the **Current and Forecasted Truck Parking Needs Assessment Report**.

The resulting prioritized truck parking safety needs are shown on Exhibit 30. Dallas-Fort Worth, Houston, and I-35 south of San Antonio, segments of the future I-69 corridor (currently US 281 and US 59), and I-40 west of Amarillo had the most consistently high priority safety needs. However, truck parking safety hotspots are present throughout the state and in each district.

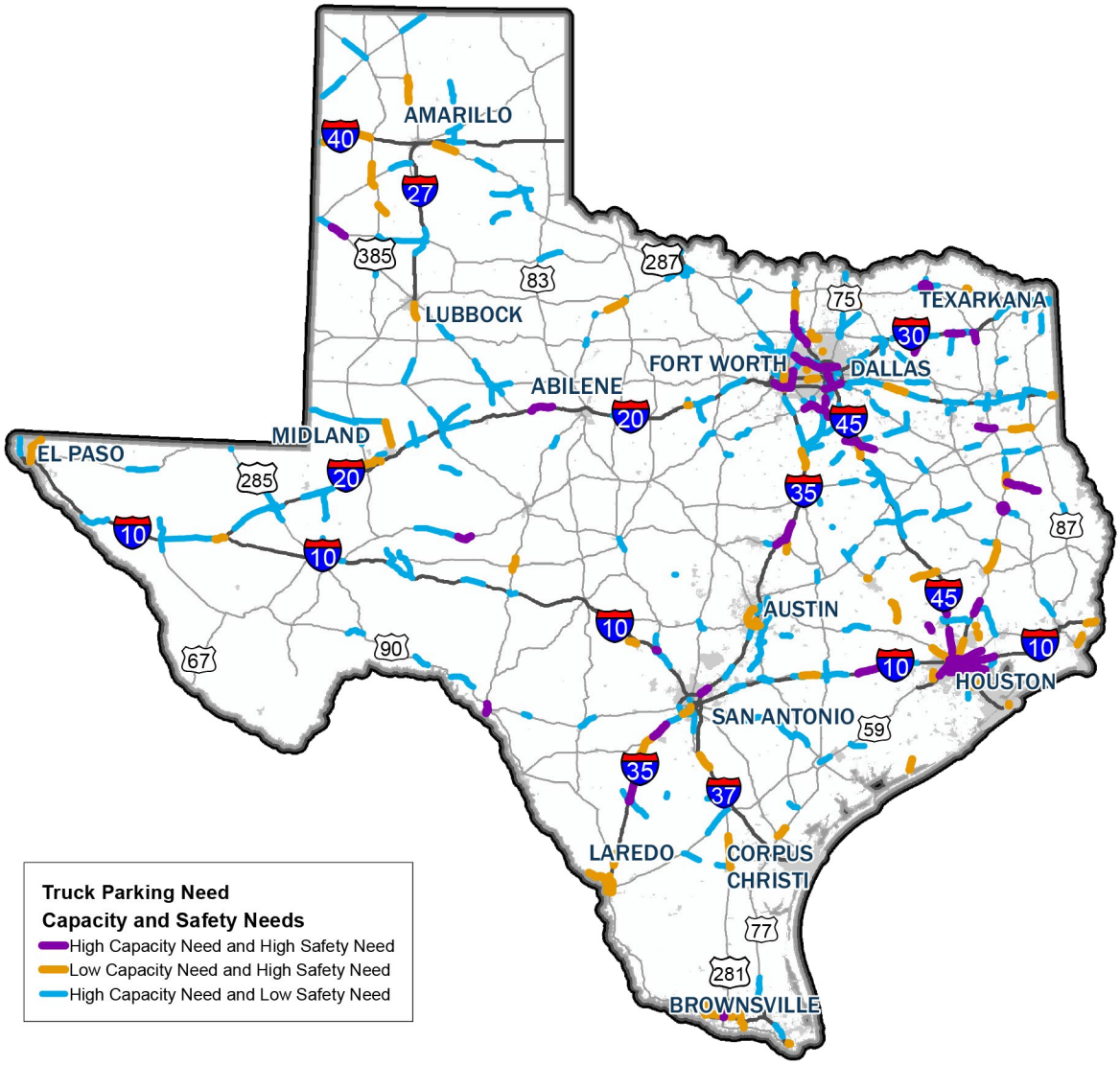
Exhibit 30: Truck Parking Safety Need



Source: TxDOT, Crash Record Information System, 2013-2017, Accessed December 2018.

Prioritized truck parking safety needs can be compared to the prioritized capacity needs to identify locations where capacity investments could have the greatest impact on safety and crash rates. As shown on Exhibit 31, locations with high truck parking capacity and safety needs indicate a need to increase the number of authorized truck parking spaces. Locations with low capacity needs and high safety needs may be opportunities for increased enforcement or signage directing truck drivers to available parking locations. The best strategy for each location should be determined on a case-by-case basis in cooperation with local officials and law enforcement.

Exhibit 31: Truck Parking Capacity and Safety Needs

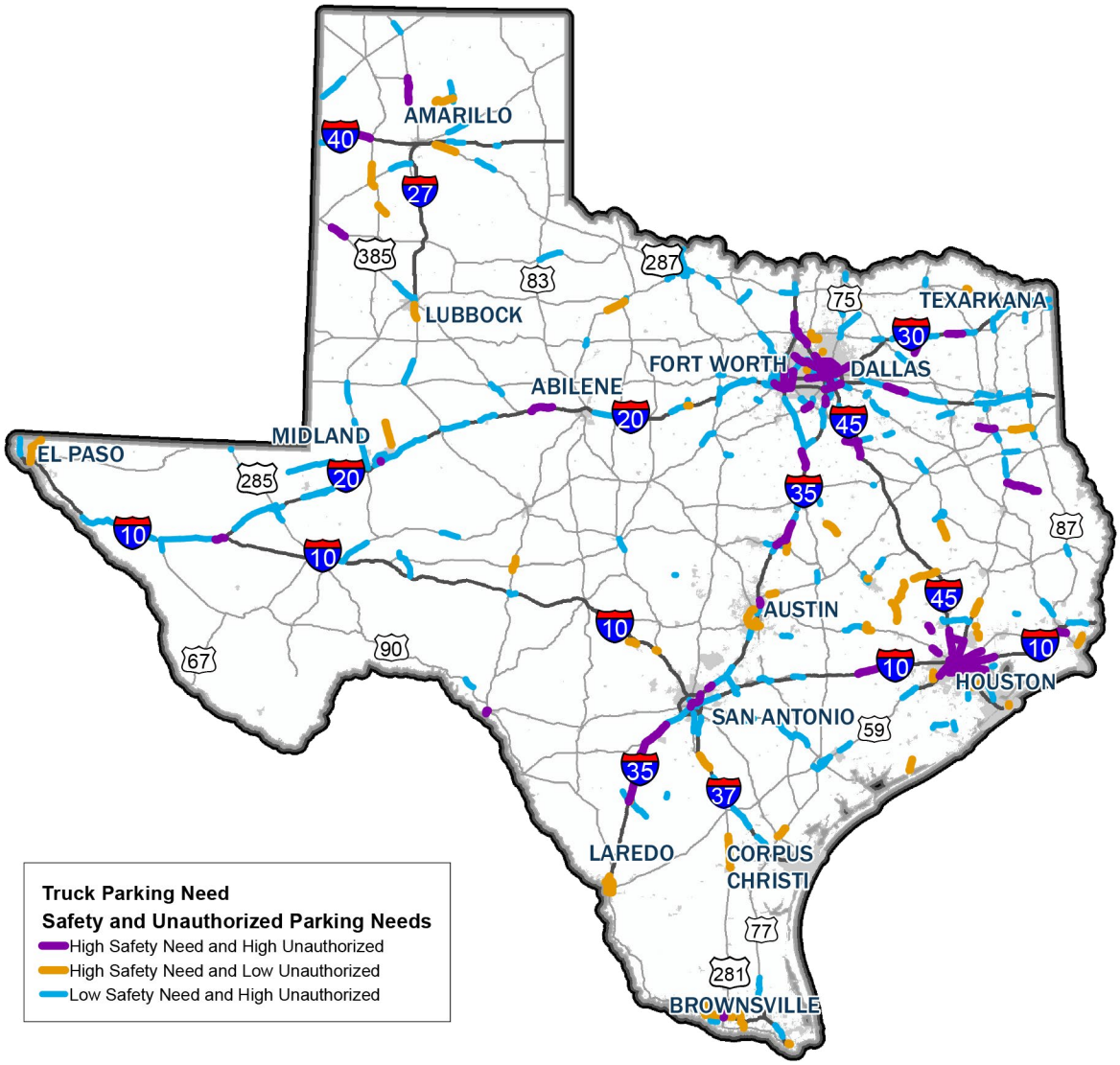


Source: Cambridge Systematics analysis using ATRI truck GPS data, 2019.

Prioritized truck parking safety needs were similarly compared to the number of trucks parked within TxDOT right of way, as shown in Exhibit 32. The rate of unauthorized parking per mile was prioritized in the same manner as truck parking capacity and safety needs. The locations with high safety needs and high levels of unauthorized parking have an immediate need for improvements ranging from added capacity, increased enforcement, additional lighting/visibility, and additional signage depending on the local context.

Locations with high truck parking capacity and safety needs indicate a need to increase the number of authorized truck parking spaces. Locations with low capacity needs and high safety needs may be opportunities for increased enforcement or signage directing truck drivers to available parking locations.

Exhibit 32: Truck Parking Safety and Unauthorized Parking Needs



Source: Cambridge Systematics analysis using ATRI truck GPS data, 2019.

Prioritized truck parking safety needs were compared to the number of trucks parked within TxDOT right of way and in proximity to closed TxDOT parking facilities. Again, this stratification of need is not intended to indicate that issues in a certain region are not important. However, prioritizing can illuminate the greatest opportunities for TxDOT. Exhibit 33 combines prioritized safety needs and unauthorized parking rates for three categories:

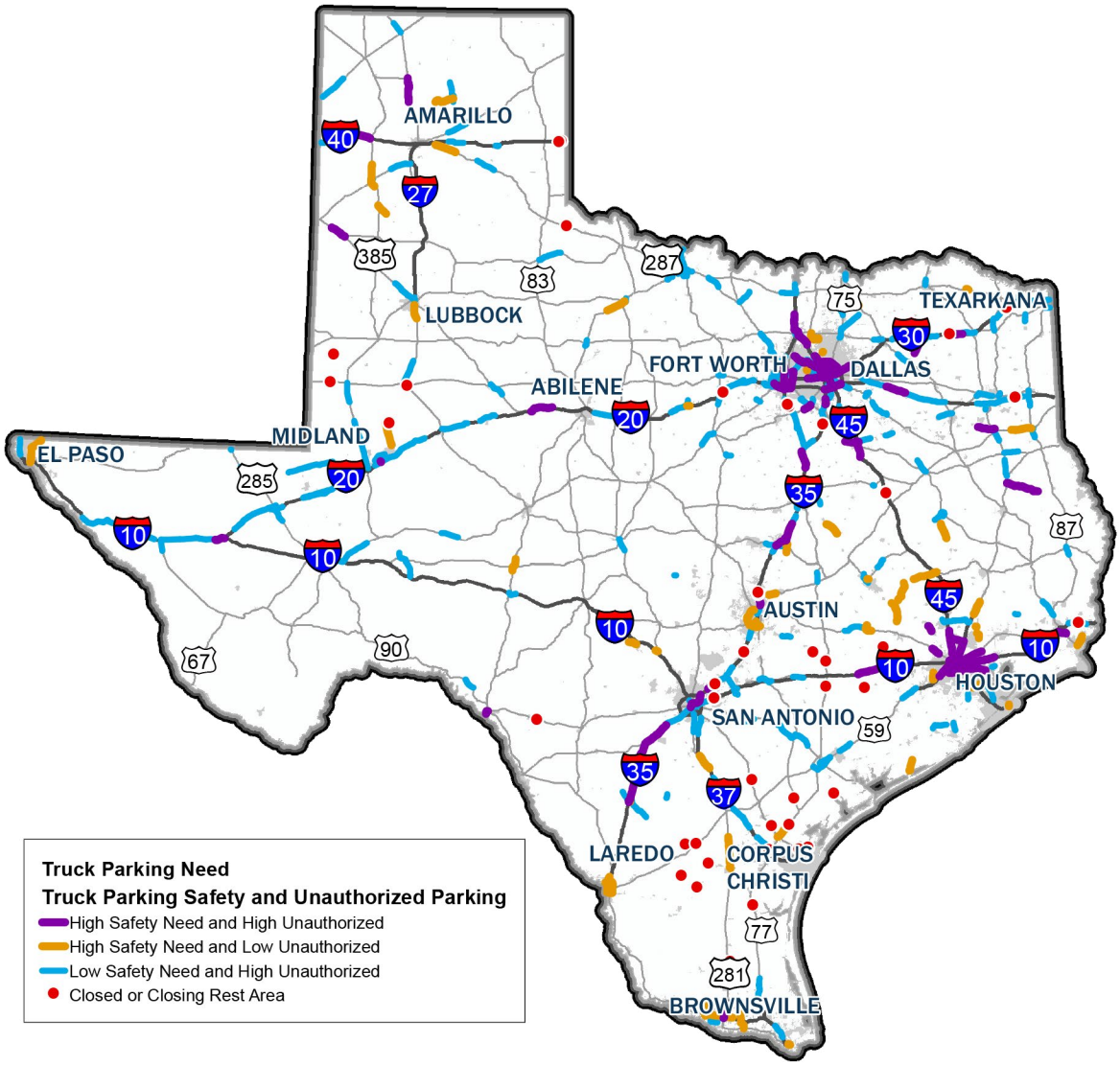
- High safety need and high unauthorized parking: immediate need for increased enforcement and additional capacity;
- High safety need and low unauthorized parking: immediate need for increased enforcement and hazard mitigation; and
- Low safety need and high unauthorized parking: less urgent capacity need, but need for increased enforcement.

Corridor segments with nearby (not necessarily adjacent) closed SRAs and both high priority truck parking safety needs and relatively high rates of unauthorized parking include:

- I-35 north of San Antonio;
- I-35 north of Austin; and
- I-30 near Mount Vernon.

Additional corridor segments on the THFN that were found to have a relatively high number of crashes despite a relatively low number of unauthorized trucks in the TxDOT right of way include US 77 north of Corpus Christi and SH 349 north of Midland. The closed SRAs near these locations, if re-opened, could improve safety as well. Other locations with high amounts of unauthorized parking and a relatively low safety need represent a third tier that experiences negative impacts of unauthorized truck parking, such as reduced visibility for other drivers and trash or disturbances for land owners. However, these locations may not be the highest priority for direct investment in additional truck parking capacity.

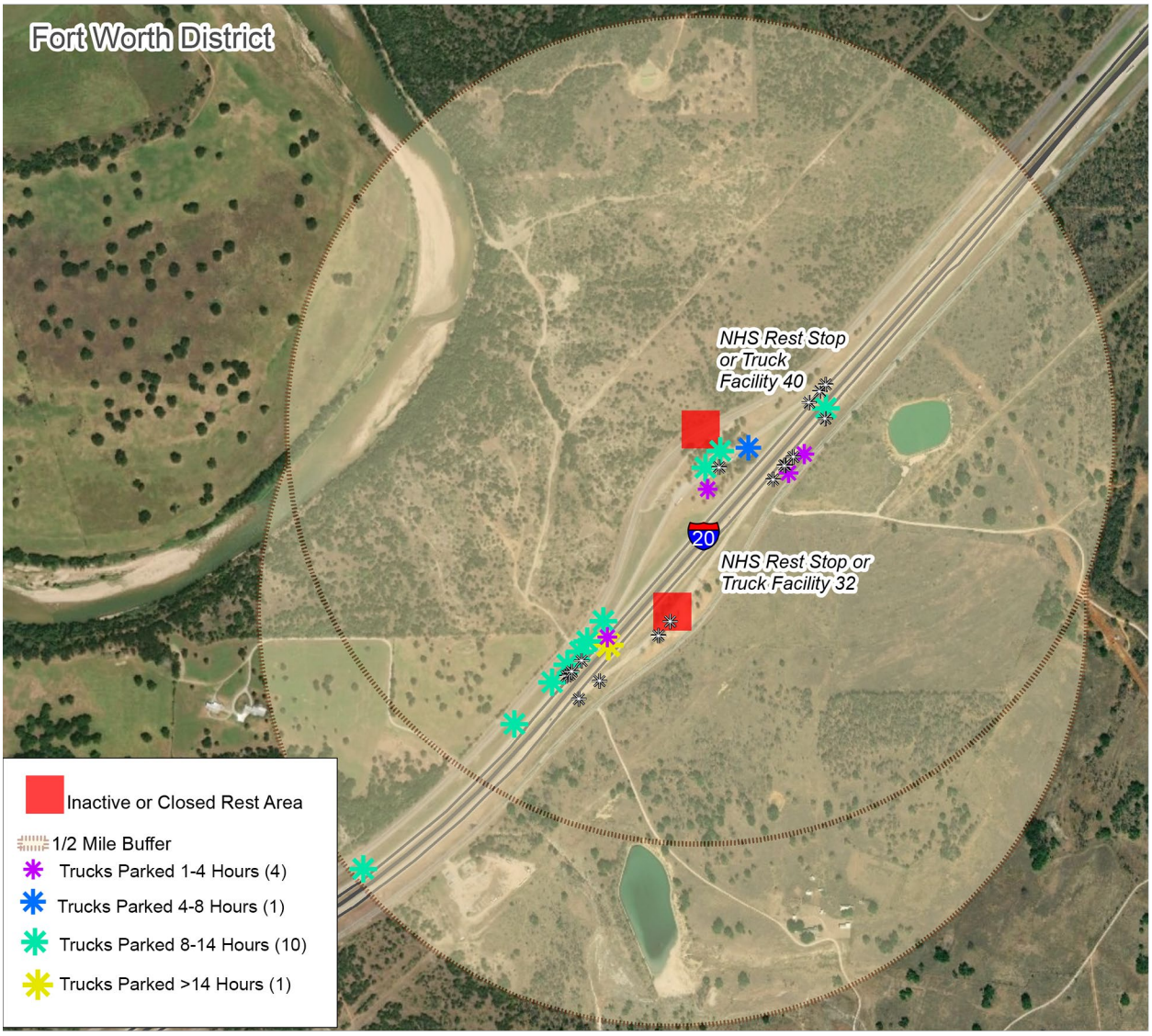
Exhibit 33: Truck Parking Safety Needs, Unauthorized Parking and Closed or Closing TxDOT Parking Facilities



Source: ATRI; TxDOT "NHS Rest Stop or Truck Facility #" references Jason's Law submittal provided by TxDOT; Analysis by Cambridge Systematics, 2019.

Exhibit 34 displays an example of documented unauthorized parking at a closed TxDOT facility in Fort Worth. As can be seen, trucks were parked there from less than one hour to more than fourteen hours.

Exhibit 34: Truck Parking Safety Needs, Unauthorized Parking and Closed TxDOT Parking Facilities



Source: Cambridge Systematics Analysis of ATRI truck GPS data, 2018. TxDOT "NHS Rest Stop or Truck Facility #" references Jason's Law submittal provided by TxDOT, 2019.

IMPACTS OF INADEQUATE TRUCK PARKING ON CONGESTION

The ability to find safe, authorized truck parking can both be affected by congestion and contribute to congestion. Congestion and truck parking needs are intertwined, as delayed or less reliable travel times can cause drivers to make an additional parking stop or park in an unplanned location. Many truck drivers report parking hours before they would run out of HOS, particularly near large urban areas, to avoid being caught in peak traffic and congestion far away from truck parking facilities. Stopping early results in lost productivity, greater shipping costs and increased prices for goods and possibly additional demand for truck parking.

Drivers lose an average of 56 minutes of available drive time per day due to having to park early to avoid the risk of limited parking closer to their destination.

ATRI estimated this unused time effectively reduced an individual driver's productivity by 9,300 revenue-earning miles a year, or $4,600 annually.

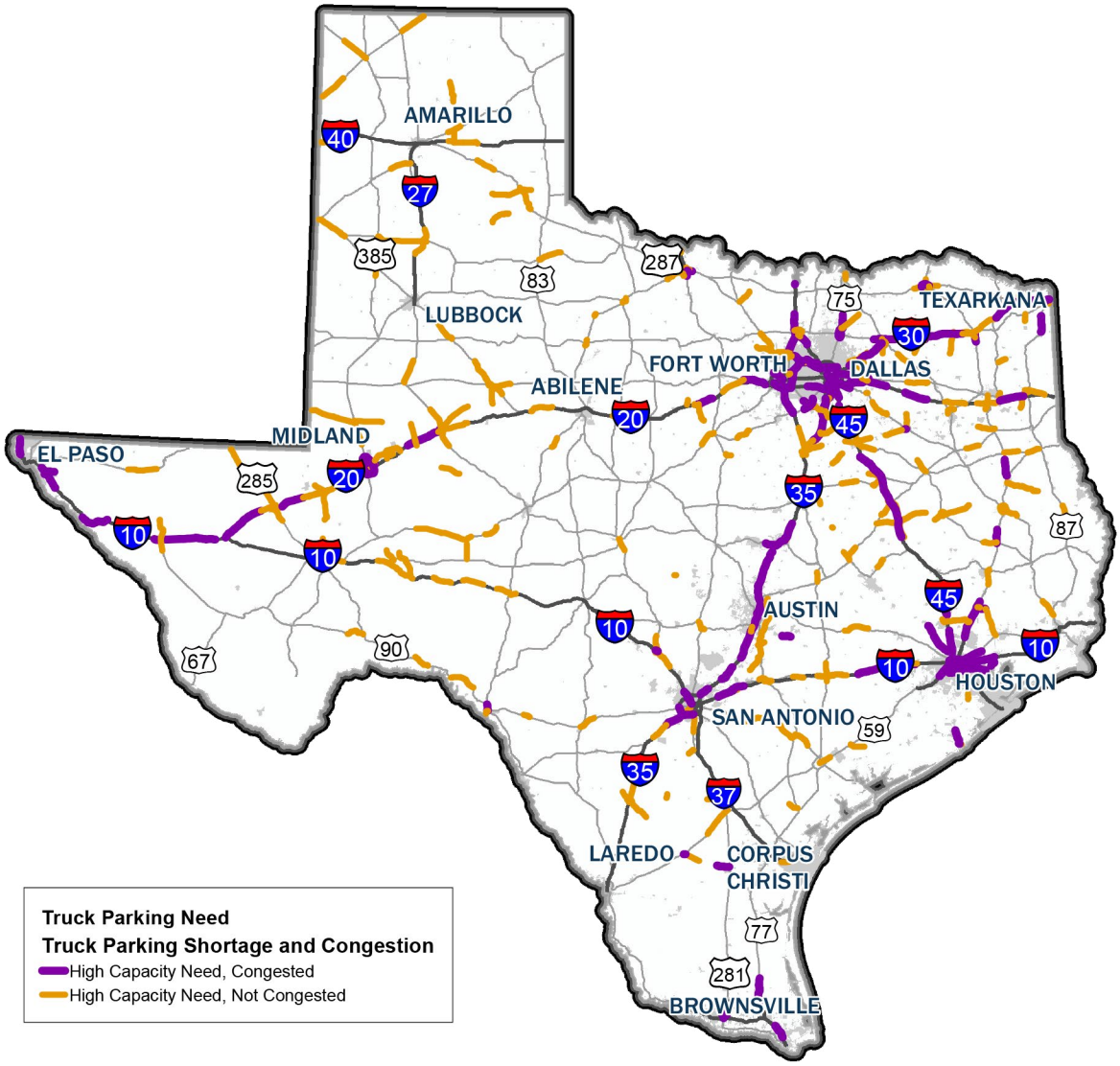
Source: ATRI, Managing Critical Truck Parking Case Study, Real World Insights from Truck Parking Diaries, 2016

In addition, lack of truck parking can negatively contribute to congestion. Truck drivers searching for parking are driving more miles and at times on more roadways than otherwise needed to complete the delivery. If adverse traffic conditions result in truck drivers parking on shoulders, traffic may further slow as all drivers exercise caution around the truck parked adjacent to the roadway. Unauthorized parking is typically a result of lack of authorized parking and is a last resort.

Exhibit 35 compares prioritized truck parking needs with congestion. Congestion is measured by level of service which is calculated based on the volume of traffic on a roadway relative to its designed capacity.

High-priority needs coincide with congested conditions in and around Dallas-Fort Worth, Houston, and San Antonio, as well as on portions of I-20, I-30, I-35, and I-45. US 75, US 77/I-69E north of Brownsville, and US 281/I-2 through the Rio Grande Valley also include sections where congestion and high truck parking capacity need overlap. Extended sections of congestion and capacity need are less common away from major interstates and U.S. highways, though they may still present issues locally.

Exhibit 35: Truck Parking Capacity Need and Congestion



Source: Cambridge Systematics analysis using ATRI truck GPS data, 2019. TxDOT Statewide Analysis Model, 2019.

In urban areas and on interstates in the Texas Triangle, congestion and high priority truck parking needs coincide. These findings highlight the challenges drivers face in planning trips around anticipated congestion as well as reacting to unexpected delays. The exact location of the parking impact is difficult to determine, as a delay in one city may influence a driver's parking over one hundred miles away. However, systematic capacity increases and information about congestion and travel times can help drivers make informed decisions to avoid unauthorized truck parking.

IMPACTS OF INADEQUATE TRUCK PARKING ON ASSET MANAGEMENT

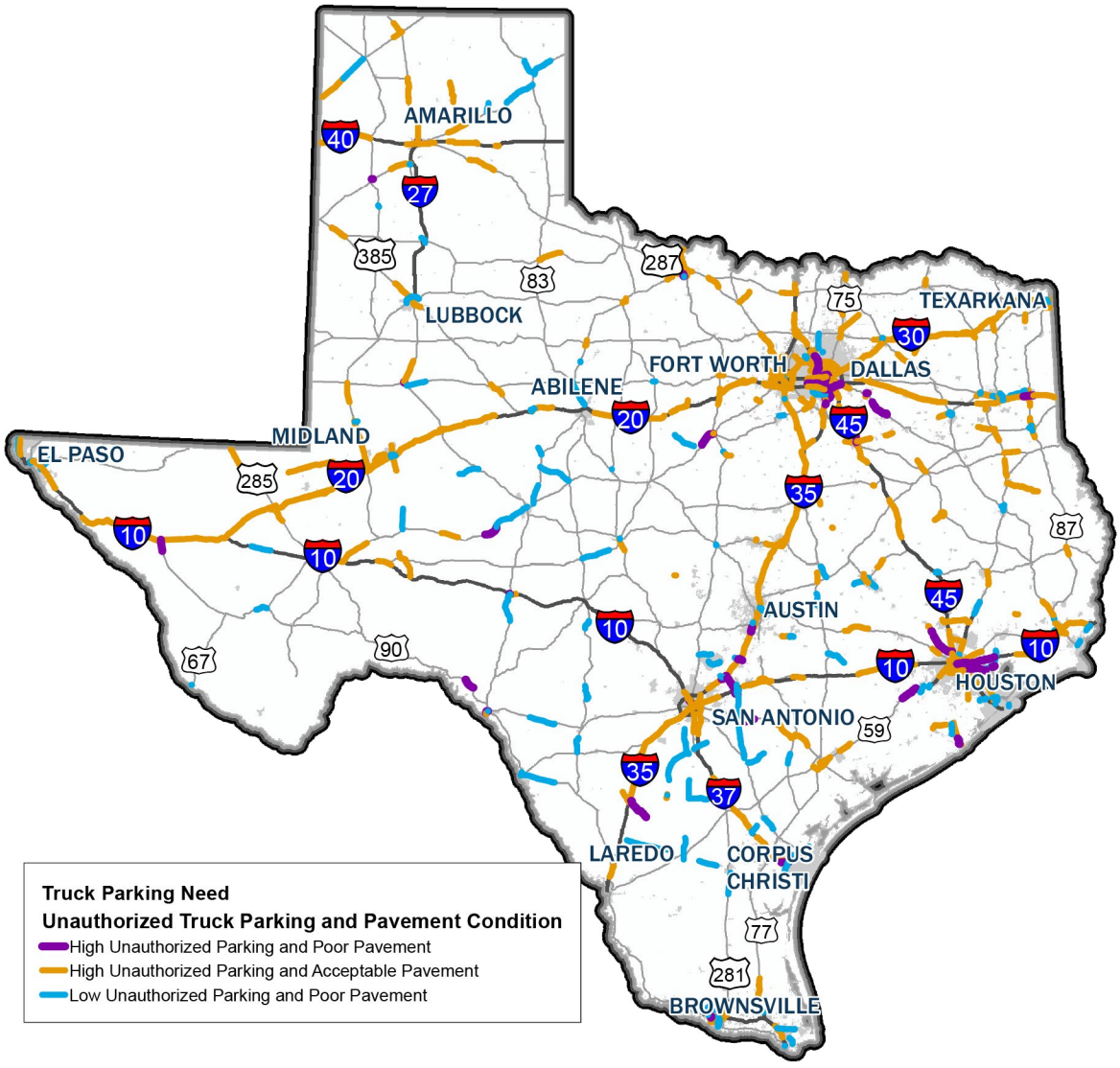
Highway maintenance costs may also increase as a result of inadequate truck parking infrastructure. When trucks park on ramps, shoulders, or land directly adjacent to the paved right of way, the weight of the truck damages the pavement or ground. If truck parking repeatedly occurs in a location not designed to handle this weight, the pavement quality will deteriorate and compromise the overall integrity of the pavement.

Pavement condition of the roadway is impacted by many factors unrelated to truck parking such as initial design, traffic volume and weight, soil conditions, and weather conditions. However, unauthorized truck parking on shoulders can also negatively impact pavement quality by causing deterioration of shoulders. Shoulder quality data were not available at the time of this study, and overall pavement quality measured by International Roughness Index (IRI) was used instead. The data for the pavement analysis was taken directly from the 2018 TFMP.

Exhibit 36 displays the overlap between unauthorized truck parking and pavement conditions. While there are some locations, especially in urban areas, where high levels of unauthorized truck parking coincide with poor pavement, most other locations do not. Better data on asset condition is needed in order to better understand the relationship between unauthorized parking and pavement quality.

Trucks Parked on an Unpaved Surface Next to the Roadway Near Midland, Texas

Exhibit 36: Unauthorized Truck Parking and Pavement Condition

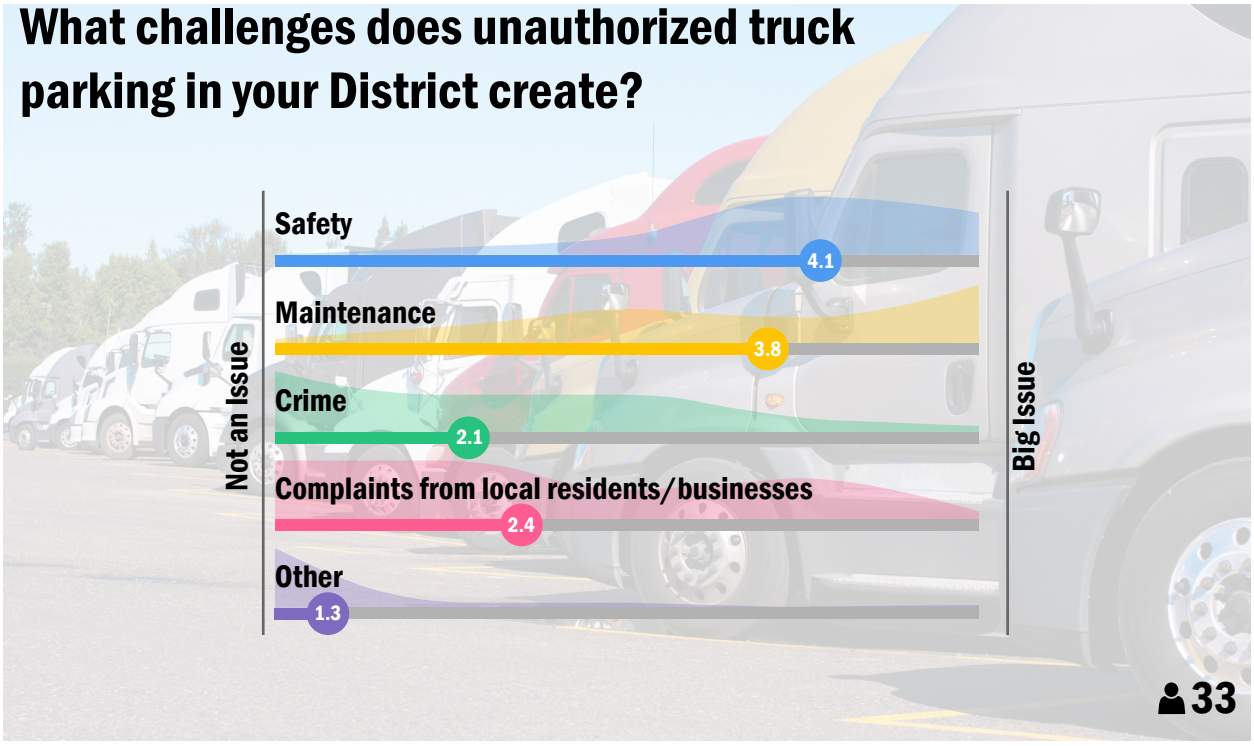


Source: Cambridge Systematics analysis using ATRI truck GPS data, 2018. TFMP, 2018.

Districts reported that they have to repeatedly repair shoulders along routes due to unauthorized truck parking. In addition, some districts have invested in fencing and signage to discourage unauthorized parking which is frequently damaged by a truck pulling over to park.

SUMMARY OF TRUCK PARKING NEEDS AND CHALLENGES

Chapter 4 presented the truck parking capacity needs and this chapter discussed truck parking safety, congestion and asset management needs. From a truck driver's perspective, capacity or availability and safety are the primary challenges. For the motoring public, safety is of the utmost importance. For TxDOT, safety and maintenance are the top challenges as conveyed by the districts when asked to rate identified truck parking challenges. The needs and challenges discussed in Chapters 4 and 5 are compared and prioritized to identify the highest priority truck parking needs.



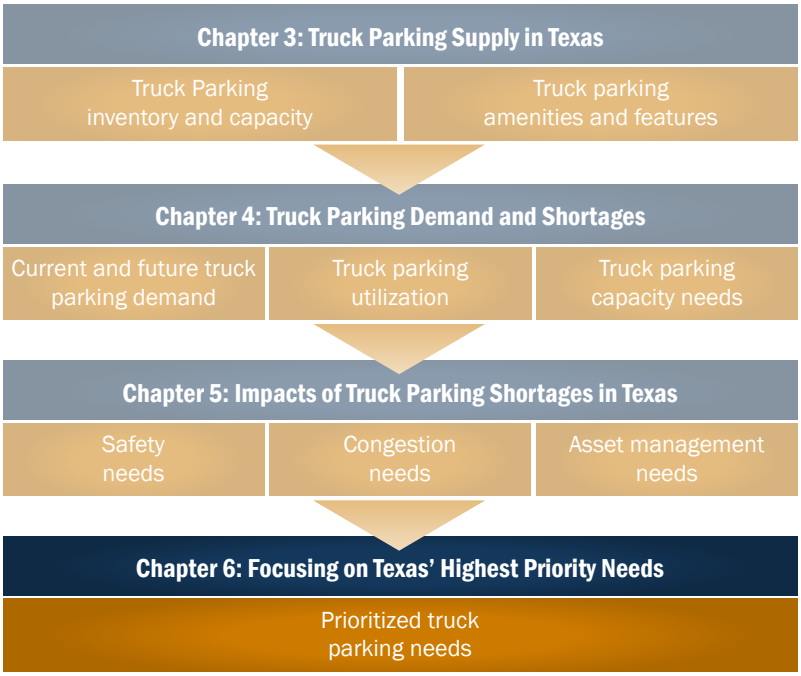
Source: Statewide Truck Parking Study TxDOT district webinar, February 14, 2020.

This chapter identified the impacts of inadequate truck parking on truck parking safety, congestion and maintenance on the Texas Highway Freight Network. Chapter 6 presents the prioritized total truck parking needs using the capacity needs from Chapter 4 and the safety needs from this chapter.

6 Focusing on Texas' Highest Priority Truck Parking Needs

Texas' strained truck parking infrastructure impacts drivers, communities, and businesses throughout the state. TxDOT has prioritized its truck parking needs in order to invest in projects, policies, and programs that will have the greatest impact on the safety and mobility of truck drivers and the traveling public. Medium or low priority truck parking needs may still be important to address and could become higher priorities for TxDOT as improvements are made.

This chapter takes the needs identified in Chapters 4 and 5 and identifies total high, medium and low needs.



The total truck parking need for any highway segment in Texas is a function of its parking shortage, truck parking safety and crash history, and level of importance of that roadway to freight movement in Texas. Truck parking capacity and safety needs were displayed in

Key Findings

Three factors contributed to the prioritization of truck parking needs.

1. **Capacity need, or shortage of spaces**
2. **Safety need, measured by crashes involving parked trucks**
3. **Freight priority, as determined in the 2018 Texas Freight Mobility Plan**

The highest priority locations are often on interstates, particularly :

- I-45
- The future I-69 corridor
- Segments of I-35 through-out the state
- I-40 west of Amarillo
- A mixture of high and medium corridor segments on I-20 and I-10 in the Permian Basin

Currently, on the Texas Highway Freight Network, there are:

1,887 miles with **high priority truck parking needs**

7,905 miles of **medium priority truck parking needs**

Future forecasted truck parking needs on the Texas Highway Freight Network include:

2,337 miles with **high priority needs**

7,353 miles of **medium priority needs**

Chapters 4 and 5, and this chapter introduces the third factor to differentiate corridors of greatest freight importance. For example, if two roadways have a similar parking shortage and crash history but different levels of truck traffic, the roadway with more trucks (and higher likelihood that a truck would need to stop) is a higher priority.

PRIORITIZED CURRENT TRUCK PARKING NEEDS

Because the need for truck parking across the state is significant, a data-driven prioritization process was employed to identify highway segments with the greatest need for truck parking. The prioritized truck parking needs will be a direct input into the recommendations presented later in this study. The prioritization process was based on three factors:

- **Capacity Need:** measured by peak hour truck parking shortage, or how many additional spaces are needed during the statewide peak hour of demand for truck parking (1:00 a.m. – 2:00 a.m.) under current conditions, per mile.
- **Safety Need:** measured by the number and severity of crashes involving parked trucks from 2013-2017, per mile.
- **Freight Network Significance:** measured by the Freight System Designation (FSD) score developed during the 2018 TFMP.[6] The FSD component was included to account for potential shortcomings in the ATRI data such as underreporting of truck parking in regions with a significant level of regional traffic. These locations are also often near major freight generators such as maritime ports, international border crossings, or energy sector activity.

The prioritized needs analysis was conducted on the THFN as well as state or U.S. highways not on the THFN. The prioritized truck parking capacity need, truck parking safety need, and priority freight segments were given a value of high, medium or low for each category. Exhibit 37 shows the prioritization process used to combine these three factors and identify the locations with the greatest truck parking need. This weighting is intended to focus on the top priority of TxDOT (safety) while also considering where capacity issues may cause safety or mobility issues currently or in the future.

Exhibit 37: Truck Parking Needs Prioritization Approach

[6] FSD scoring ranked all segments of the THFN based on goods movement criteria (such as AADTT), market access criteria (such as proximity to markets or ports), supply chain criteria (such as tonnage moved in target industries), and economic competitiveness criteria (such as workforce readiness).

FREIGHT NETWORK SIGNIFICANCE

TxDOT developed its Freight System Designation process during the 2018 TFMP. This process combined many attributes about freight movement, land use, and demographics to identify highway corridors that are most critical for moving freight in Texas. All roadways on the TxDOT system were scored, and this score was used as the basis for determining the highest priority freight segments during the truck parking need prioritization (Exhibit 38).

Interstates, connections to maritime ports and international border crossings, connections to intermodal facilities, and highways near concentrations of freight activity such as manufacturing, or energy production were scored as the highest significance roadways. Since this scoring process, TxDOT has improved its freight data in the Permian Basin and designated a regional network that reflects the significant freight activity in the region.

Exhibit 38: Freight Network Significance

Source: 2018 Texas Freight Mobility Plan.

Exhibit 39 shows the final prioritized truck parking needs throughout Texas, as a combination of the safety need, capacity need, and Freight Network Significance. The highest priority locations are often on interstates, particularly segments of I-45, segments of the future I-69 corridor (currently US 281 and US 59), I-35, I-40 west of Amarillo, and a mixture of high and medium segments on I-20 and I-10. The Permian Basin region contains a concentration of medium priority needs, which together reveal the persistence of truck parking issues spread throughout the region. Roadways accessing maritime ports on the Gulf Coast also exhibit consistent need. It should be noted that segments identified as a medium priority still have pressing truck parking issues that need to be addressed, and all prioritization shown is relative. In total, 30% or nearly 10,000 miles of the THFN has high or medium truck parking needs and the entire network has some level of need.

CURRENT PRIORITIZED NEED

The entire THFN, including all Interstate, U.S., and State Highways were analyzed. The results found that on the THFN, there are:

- 1,887 miles of high priority
- 7,905 miles of medium priority
- Over 30% of the network has high or medium truck parking needs

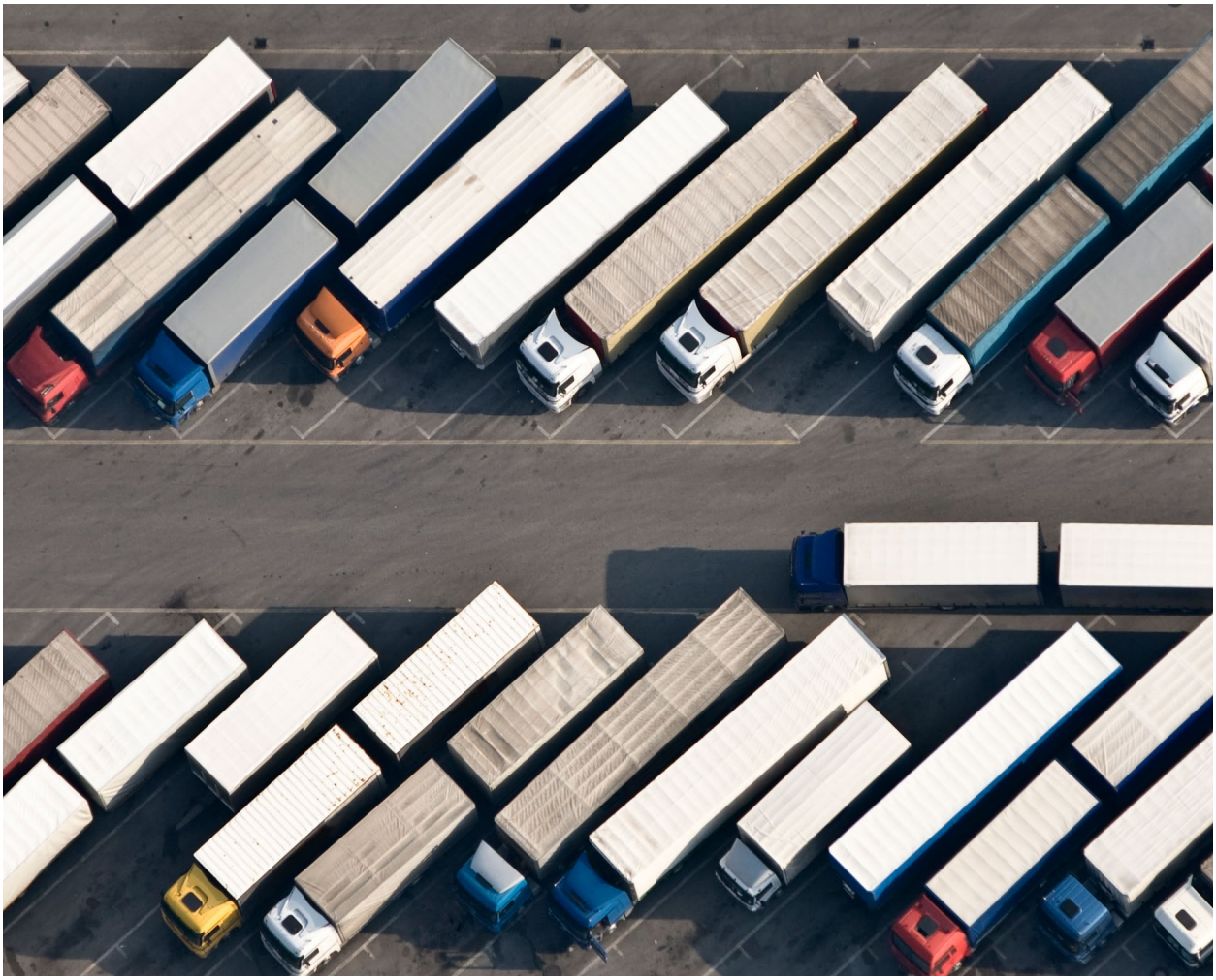
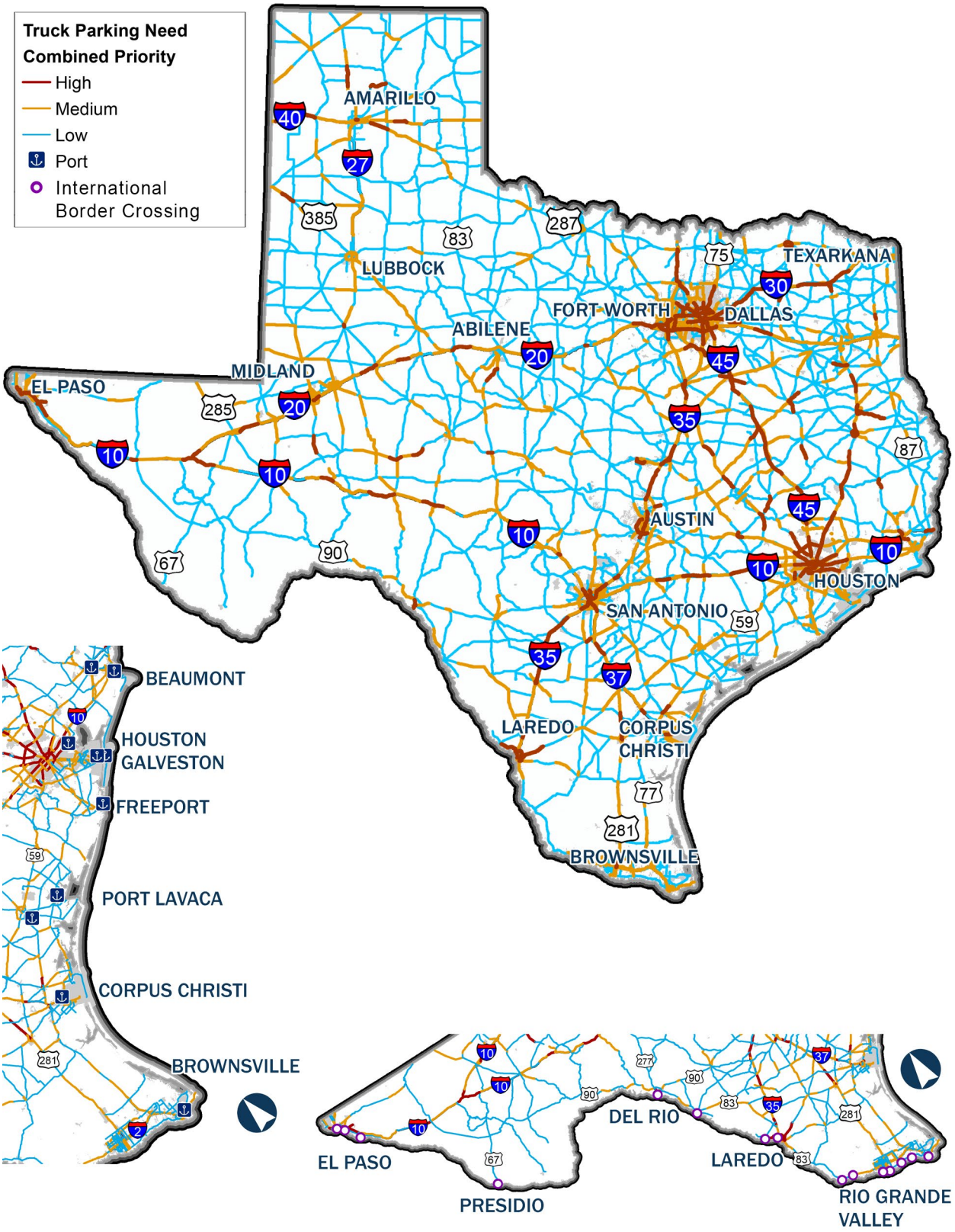


Exhibit 39: Combined Medium and High Priority Truck Parking Needs



Source: Cambridge Systematics analysis using ATRI truck GPS data, 2019.

Ninety percent of mileage on major interstates (longer than 100 miles) was identified as a high or medium priority need. More than half of the mileage on I-30 and I-45 was identified as high priority truck parking needs, and nearly all of the mileage on these two corridors was ranked as high or medium priority. I-30 also has a large amount of unauthorized parking and two closed SRAs. Unauthorized parking is less of an issue on I-45, but the publicly-owned truck parking sites on this corridor are all at or over capacity. I-27 is the only major interstate without any high priority needs. However, 40 percent of its mileage was identified as a medium priority location. Exhibit 40 shows the mileage of high and medium priority truck parking needs for the top eight interstates and the top five U.S. and state highways. The top highways were determined by ranking corridors by the percentage of total mileage ranked as a high truck parking need area.

Exhibit 40: Prioritized Truck Parking Needs by Corridor, 2050

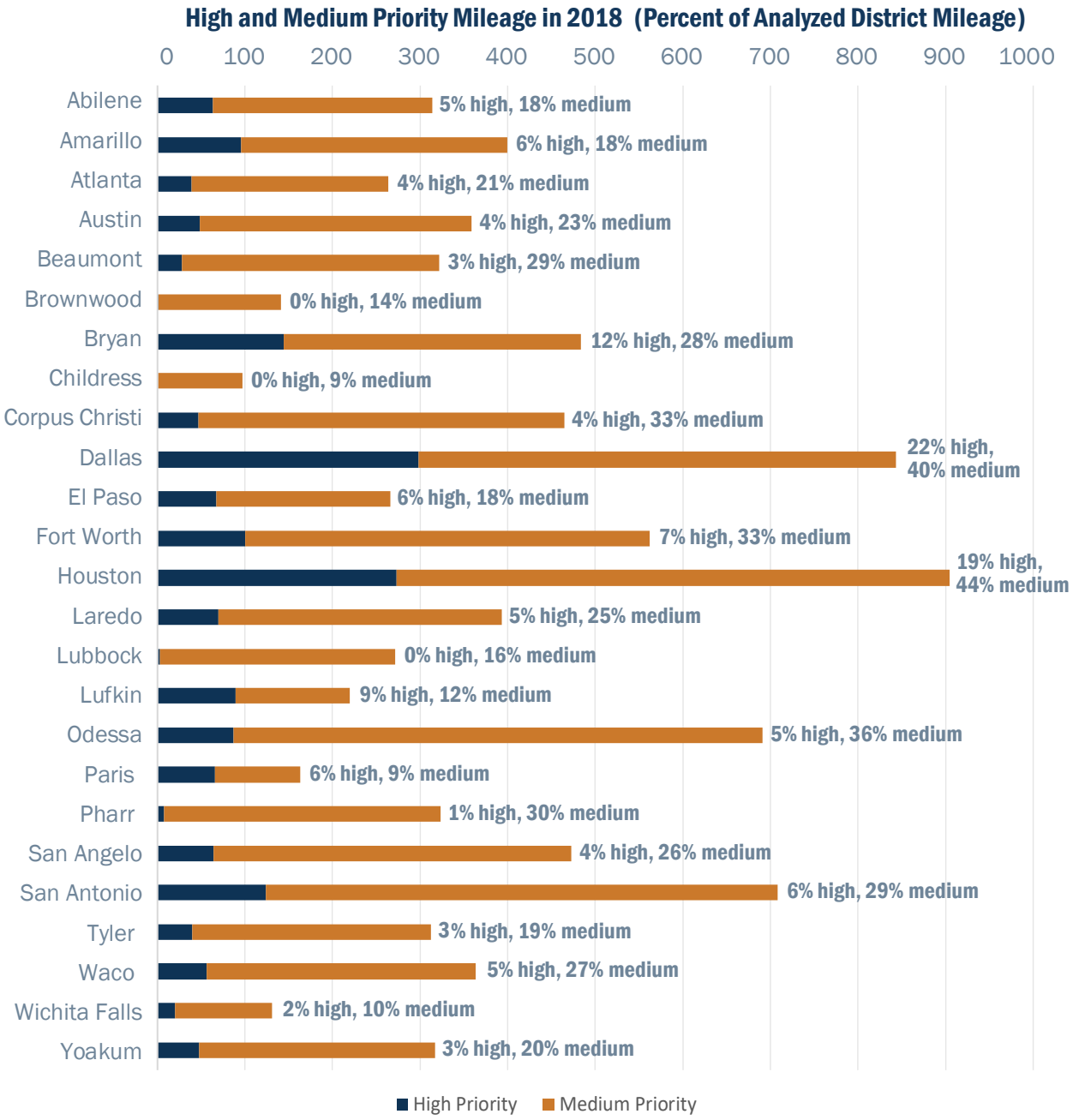
CORRIDOR	TOTAL CORRIDOR MILES	HIGH NEED		MEDIUM NEED		HIGH AND MEDIUM NEED COMBINED	
		MILES	PERCENT OF TOTAL MILES	MILES	PERCENT OF TOTAL MILES	MILES	PERCENT OF TOTAL MILES
Interstates							
I-10	877	263	30%	504	58%	768	88%
I-20	634	160	25%	445	70%	605	95%
I-27	124	0	0%	51	41%	51	41%
I-30	223	137	61%	86	39%	223	100%
I-35	588	261	44%	296	50%	556	95%
I-37	143	27	19%	87	61%	114	80%
I-40	177	45	25%	113	64%	157	89%
I-45	284	148	52%	130	46%	278	98%
U.S. Highways							
US 75	75	29	39%	25	33%	21	28%
US 59	549	85	15%	258	47%	207	38%
US 80	155	17	11%	36	23%	103	66%
US 79	271	28	10%	131	48%	112	41%
US 259	146	14	10%	36	24%	96	66%
State Highways							
SH 225	16	16	100%	0	0%	0	0%
SH 249	27	24	89%	0	0%	3	11%
SH 183	36	17	48%	9	25%	10	27%
SH 90	42	14	33%	0	0%	28	67%
SH 121	60	15	25%	7	12%	38	63%

Note: Due to rounding, numbers presented in this table may not add up precisely to the totals indicated and percentages may not precisely reflect the absolute figures for the same reason.

High priority truck parking needs were found on 6 percent of all mileage analyzed statewide. Nine districts had a higher percentage of their mileage ranked as a high priority, led by the Dallas, Houston, and Bryan districts. Lufkin, Fort Worth, San Antonio, Paris, El Paso, and Amarillo

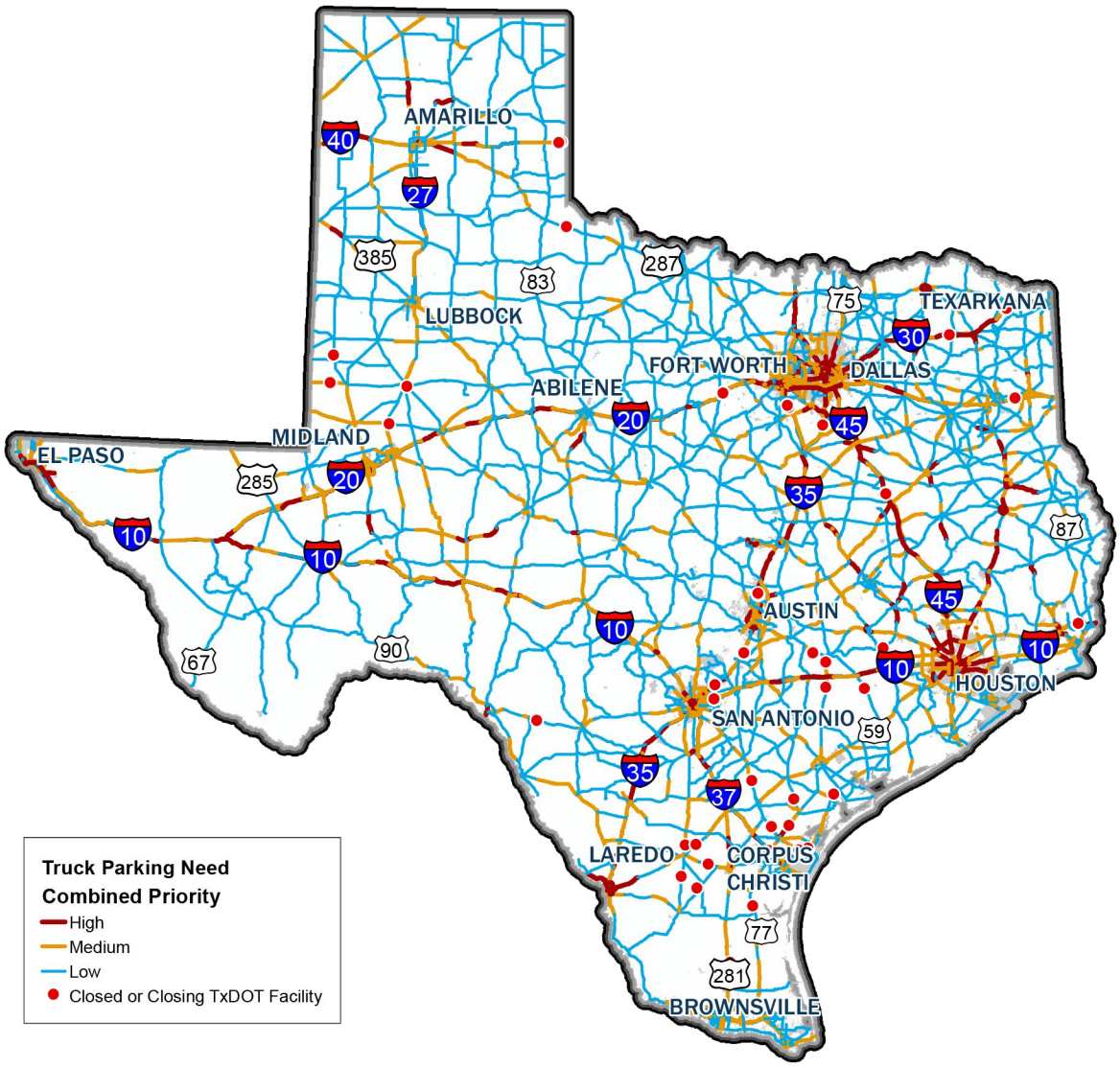
districts also have above-average high priority truck parking needs (6 percent). Seven more districts had a higher share of medium priority needs than the statewide average (24 percent). Exhibit 41 displays the high priority mileage and medium priority mileage by district as well as the percentage of the district's total mileage falling in those categories. Truck parking needs are located throughout the state, in urban and rural districts and in every region of the state.

Exhibit 41: High and Medium Priority Truck Parking Needs by District



Closed or closing TxDOT facilities can present an opportunity for increased truck parking capacity at a lower cost than new construction. Exhibit 42 compares closed TxDOT facilities with prioritized truck parking needs. Facilities near areas with medium and high priority truck parking needs are located along several interstates as well as on US 77, US 87, US 180, and US 281.

Exhibit 42: Medium and High Priority Truck Parking Needs and Closed TxDOT Facilities



Source: Cambridge Systematics analysis using ATRI truck GPS data, 2019.

PRIORITIZED FUTURE TRUCK PARKING NEEDS

Chapter 4 described the process for estimating future truck parking demand in Texas by the year 2050. Prioritized future truck parking needs were determined using the same approach as current needs. While the location, number, and severity of crashes involving parked trucks is expected to change over time, this change is subject to too many factors to reasonably incorporate into this report. The freight significance score includes components of future freight forecasts and proximity to major generators, and it remains relevant to the future needs prioritization. The prioritized future needs were scored using the following factors:

FUTURE PRIORITIZED NEED

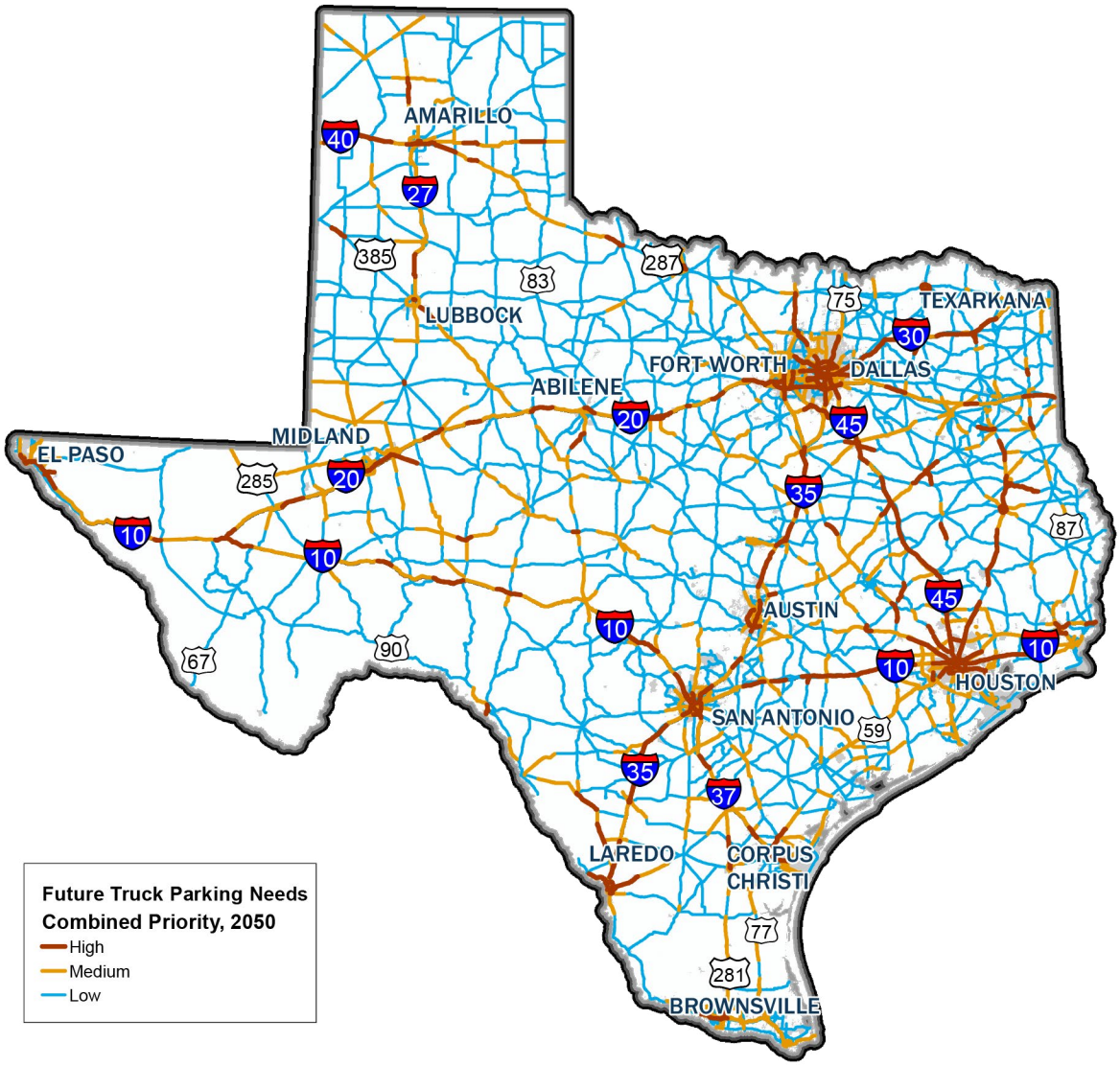
The entire THFN including all Interstate, U.S., and State Highways were analyzed. The findings indicate that by 2050 there would be a 24% increase in the number of high priority truck parking needs from 1,887 miles to 2,337 miles.

- **Future Capacity Need:** 25 percent of the score
- **Current Safety Need:** 50 percent of the score
- **Freight Network Significance:** 25 percent of the score

As with current needs, corridor segments were ranked against each other. Through this process, the highest priority corridor segments both today and in the future can be identified. Exhibit 43 displays the prioritized future truck parking needs in 2050. Much of the consistently high priority truck parking need is located on corridors in the eastern half of the state where there are more population centers. There are also several rural corridors in West Texas and the Pan Handle with a high priority truck parking need. Rural corridors are most likely where autonomous trucks will operate in the future, and that should be considered when assessing future demand and during design of site improvements.

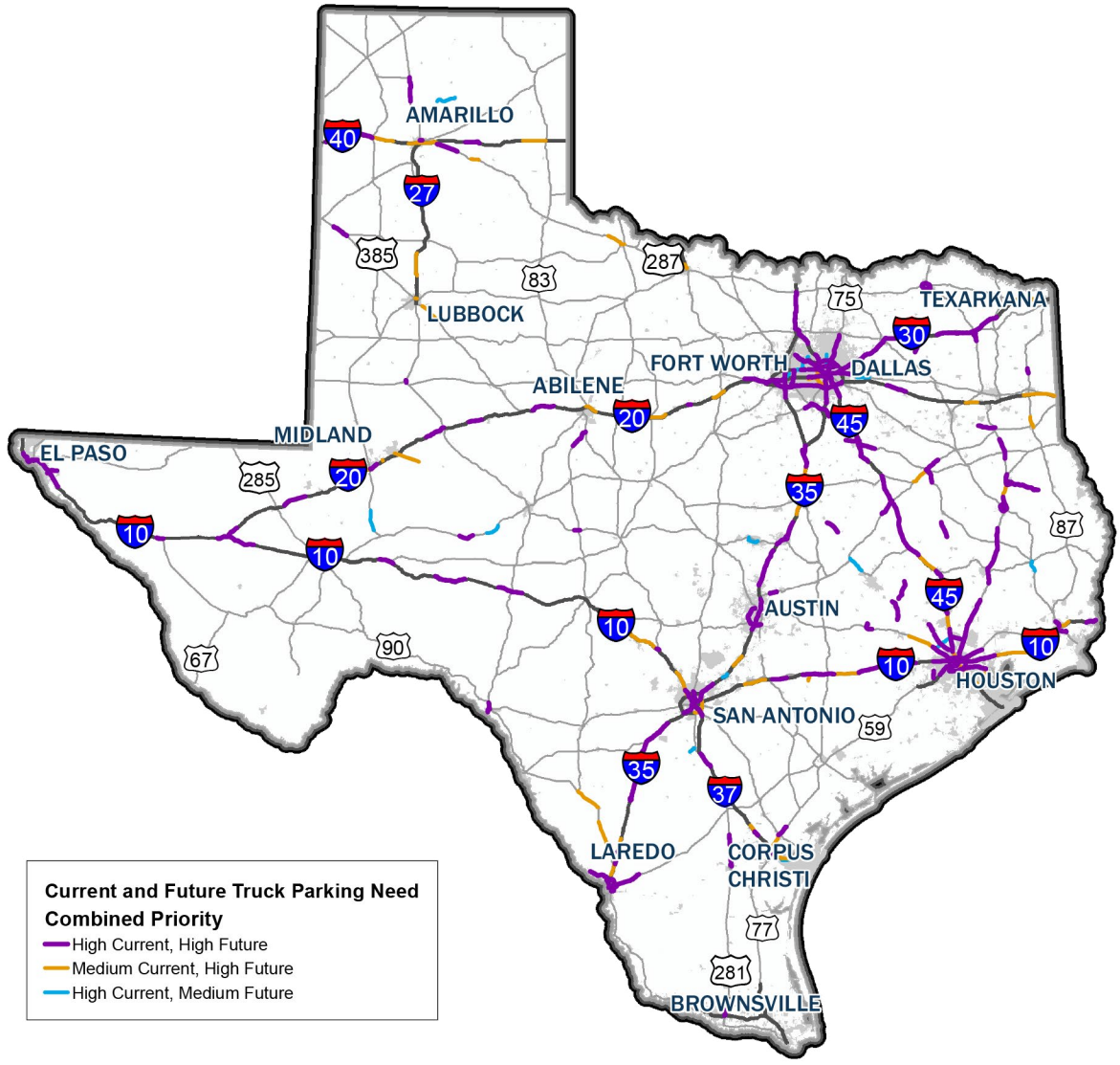
There are 1,752 miles of Texas highways that are forecasted to have high priority truck parking needs both today and in the future, and more than 8,500 miles of highway that are forecasted to be at least medium or high priority needs during both periods. Exhibit 44 displays the change in high priority truck parking needs between 2018 and 2050. These corridor segments are the most effective places to improve safety and mobility on Texas roadways through investment in truck parking infrastructure, policies, and programs due to their consistent need over time.

Exhibit 43: Statewide Prioritized Future Truck Parking Needs by Corridor, 2050



Source: Cambridge Systematics analysis using ATRI truck GPS data, 2019.

Exhibit 44: Statewide High Priority Truck Parking Needs by Corridor, 2018 to 2050



Source: Cambridge Systematics analysis using ATRI truck GPS data, 2019.

Truck parking needs are expected to continue to be concentrated on interstates in the future. As more and more freight is moved in Texas, the state's most used highways and nearby truck parking facilities are expected to become even more strained. The highlighted interstates in Texas are forecasted to be almost entirely high priority locations in the future. All of I-20, I-30, I-37, and I-40 are all forecasted to be medium or high priority locations. I-10, I-45 and I-30 are expected to continue to be largely high need locations, with up to three-quarters of the I-45 corridor categorized as high priority in 2050. I-35 and I-40 are also expected to have high priority needs on more than half of their mileage. Exhibit 45 shows the mileage of high and medium priority truck parking needs for major interstates and the top five U.S. and state highways. The top highways were determined by ranking corridors by the percentage of total mileage ranked as a high truck parking need area in 2050.

Exhibit 45: Forecasted Prioritized Truck Parking Needs by Corridor, 2050

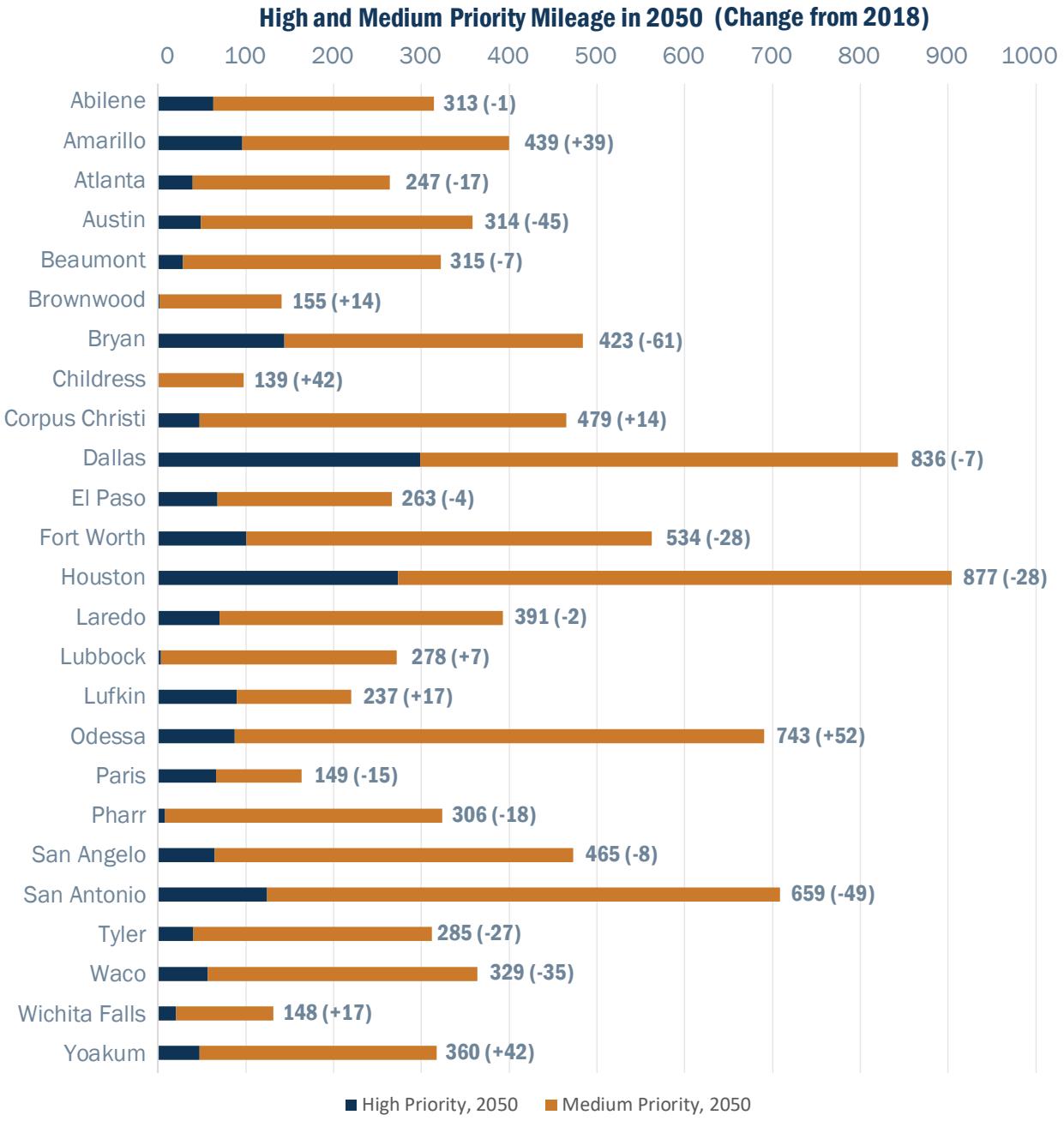
CORRIDOR	TOTAL CORRIDOR MILES	HIGH NEED		MEDIUM NEED		HIGH AND MEDIUM NEED COMBINED	
		MILES	PERCENT OF TOTAL MILES	MILES	PERCENT OF TOTAL MILES	MILES	PERCENT OF TOTAL MILES
Interstates							
I-10	877	389	44%	477	54%	865	99%
I-20	634	246	39%	388	61%	634	100%
I-27	124	16	13%	87	70%	103	83%
I-30	223	151	68%	72	32%	223	100%
I-35	588	321	55%	261	44%	582	99%
I-37	143	49	34%	94	66%	143	100%
I-40	177	96	54%	80	45%	176	100%
I-45	284	209	74%	69	24%	278	98%
U.S. Highways							
US 75	75	29	39%	25	33%	21	28%
US 59	549	87	16%	261	47%	201	37%
US 79	271	41	15%	123	45%	107	39%
US 259	146	14	10%	36	24%	96	66%
US 290	259	19	7%	84	32%	157	60%
State Highways							
SH 225	16	16	100%	0	0%	0	0%
SH 249	27	24	89%	0	0%	3	11%
SH 183	36	17	48%	9	25%	10	27%
SH 90	42	14	33%	0	0%	28	67%
SH 180	24	7	29%	6	24%	11	47%

Source: Analysis by Cambridge Systematics, 2019.

Although some segments will move between high and medium priority needs between 2018 and 2050, in many districts the total amount of high or medium priority mileage is expected to be similar in both years. Exhibit 46 shows the total mileage of high and medium priority need segments by district and the change in these two categories between 2018 and 2050. The largest increases in high and medium need mileage are forecasted to be in the Odessa, Yoakum, Childress, and Amarillo districts. The largest reductions in high and medium priority mileage are expected to be in Bryan, Austin, San Antonio, and Waco districts.

Because this prioritization approach ranks highways against each other, a reduction in high or medium need segments does not necessarily mean a reduction in truck parking demand or need. In fact, all districts are forecasted to have a significant increase in truck parking demand by 2050 (Exhibit 22 in Chapter 4). By identifying the highest priority locations now and in the future, TxDOT is able to prioritize investments that will best serve Texans.

Exhibit 46: High and Medium Priority Truck Parking Needs by District, 2050



This Section which consists of Chapters 3, 4, 5, and 6 has provided a summary of the State's inventory of truck parking, current and future demand for truck parking, truck parking utilization and unauthorized parking, and capacity, safety, congestion, and asset management needs. The prioritized needs presented in this chapter form the basis for the identification of strategies and recommendations and a resulting action plan to address truck parking challenges in Texas. Section 3, which consists of Chapters 7, 8, 9, and 10 lays out these recommendations and short, medium and long-term actions for addressing truck parking.

SECTION 3:

Addressing Texas' Truck Parking Challenges

TxDOT has an important role in meeting the truck parking needs and challenges through the identification, prioritization and implementation of truck parking investments, programs and policies. These three types of strategies combine to create a comprehensive approach to truck parking based on the goals of the Statewide Truck Parking Study, stakeholder identified needs and solutions and a detailed analysis of truck parking shortages and deficiencies on the Texas Highway Freight Network. By moving forward with these three types of strategies, TxDOT can support their goals of a safer, more reliable and competitive highway network throughout the State.

The final section of the Study presents the strategies, recommendations and actionable steps for addressing the State's truck parking challenges. **Chapter 7** provides a summary of **policy, outreach and coordination strategies**, **Chapter 8** presents **program and technology strategies** and **Chapter 9** summarizes **infrastructure strategies** identified for expanding existing truck parking facilities and building new ones. Based on the strategies, **Chapter 10** presents **short, medium and long-term recommendations** and a call to action for TxDOT.

7 Addressing Truck Parking Through Policy, Outreach and Coordination

TxDOT takes a transparent, data-driven and stakeholder-informed approach to decision-making for freight transportation improvements. The process used in the current Study leverages a variety of stakeholder outreach activities to gain varied perspectives. This input was combined with an assessment of needs, project identification and gap analysis, and project prioritization process to develop a strategic and cost-effective approach to truck parking investments in Texas.

The Statewide Truck Parking Study led to development of a robust and comprehensive set of strategies addressing the truck parking needs and challenges presented in the previous chapters. The strategies include three broad-based improvement categories for addressing truck parking challenges in Texas:

- **Policies.** Broad policy recommendations to help change the way Texas approaches truck parking.
- **Infrastructure.** Specific infrastructure strategies that provide safe, efficient and desirable truck parking in an effort to make an impact on safety, maintenance and efficiency.
- **Technology and Programs.** A collection of technology and programs that can be undertaken to improve the effectiveness of existing truck parking and facilitate the development of new truck parking.

The policy, infrastructure and technology program recommendations are not exclusive. Instead, the success of one strategy may significantly depend on the success of another, thus underscoring the need for a well-coordinated and simultaneous advancement of the recommendations.

Summary of Policy, Outreach and Coordination Truck Parking Strategies

TxDOT Led Strategies

1. Develop guidelines for integrating truck parking into the TxDOT project development process
2. Integrate consideration of truck parking needs into right of way acquisition guidelines
3. Reassess public facility closures in high demand areas
4. Allow truck parking in auto-designated areas at TxDOT facilities during off-hours
5. Prepare corridor truck parking plans
6. Integrate truck parking into the Strategic Highway Safety Plan (SHSP)

TxDOT Supported Strategies

1. Collaborate with planning partners to examine feasibility of truck parking at non-TxDOT public facilities
2. Coordinate with public or private property owners to allow truck parking at large parking facilities when not in use
3. Create guidance to help municipalities include truck parking demand as part of Traffic Impact Analyses for new developments
4. Develop guidelines for integrating truck parking into local and regional transportation and land use plans
5. Encourage commercial and industrial property owners to provide truck parking on unused portions of property
6. Create guidance for next generation logistics parks that includes integrated and full-service truck parking facilities

Additionally, a continuous and sustained advancement of these strategies is necessary for Texas to remain economically competitive.

IDENTIFYING POTENTIAL STRATEGIES

Exhibit 47 summarizes the approach for identifying strategies to meet the priority needs discussed in Chapter 6. After identifying and prioritizing the needs, the next step was to develop a comprehensive list of potential strategies.

Exhibit 47: Process for Identifying Truck Parking Strategies

Strategies were identified from several sources including a review of notable practices from across the U.S. as documented in the **State of the Practice Report**, stakeholder input from 40 workshops and industry meetings held across the state, on-line surveys, and meetings with TxDOT districts (see the **Stakeholder Outreach and Engagement Summary Report**).

This chapter presents the policy approaches to addressing the truck parking needs in Texas, drawing on examples from other states, best practices, and stakeholder suggestions. Specific recommended actions are presented in Chapter 10.

Over ninety percent of truck parking in Texas is provided by the private sector and the general public often views truck parking as a private sector issue. As a result, addressing truck parking needs and challenges in Texas will require significant outreach and coordination as well as policies aimed at mitigating barriers to expanding both public and private sector truck parking in the State.

Based upon stakeholder and industry engagement, several policies, coordination efforts, and education and outreach opportunities were developed to help meet truck parking needs in Texas. Many of these TxDOT can lead while others require TxDOT to play a supporting role. This chapter provides a summary of the program strategies. More detail can be found in the **Truck Parking Recommendations and Action Plan Report**.

TXDOT LED POLICY STRATEGIES

Six policy strategies for which TxDOT would lead were developed. These policies focus on areas under the control of TxDOT and include planning, operations, project development and right of way acquisition. The TxDOT led policy strategies are summarized below.

TxDOT Led Policy Strategy 1: The State Should Develop Guidelines for Integrating Truck Parking into the TxDOT Project Development Process

Coordination and communication between the large and varied departments within TxDOT is critical to ensure that truck parking needs along with all other highway needs are identified and considered.

Providing information about the critical role that trucks play in Texas' economy and the need to recognize and incorporate truck parking issues, facilities, and needs in the planning process, particularly during the development of a project, could help TxDOT plan for truck parking needs more effectively.

TxDOT Led Policy Strategy 2: The State Should Consider Truck Parking Needs Prior to Purchase or Sale of TxDOT Right of Way

Similar to the above, as TxDOT continues to purchase new right of way, truck parking needs should be considered for future use of the property, just as highway expansion or rail right of way is accounted for in the state's long-range planning process. In addition, prior to the sale of any TxDOT right of way, the location should be checked against truck parking high-needs areas to ensure that potential expansion or new development opportunities are not missed. TxDOT should revise guidelines governing right of way transactions to include truck parking in the process.

TxDOT Led Policy Strategy 3: The State Should Reassess Public Facility Closures in High Demand Areas

Public facilities such as SRAs, picnic areas, and maintenance yards may be closed due to underuse, aging facilities, criminal activity, or limited funding. All these properties could be valuable options for increasing the truck parking inventory through conversion to lower cost, truck-only parking facilities. Weigh stations that are planned to be decommissioned may provide another opportunity.

Prior to closing any publicly-owned facility, the site should be evaluated by TxDOT to determine if it is in a high truck parking demand area. If so, the site should be targeted for conversion to truck-only parking. This policy is meant to avoid the need to completely rebuild a closed facility by identifying and converting these locations prior to closure.

TxDOT Led Policy Strategy 4: The State Should Allow Truck Parking in Auto-designated Areas at Existing TxDOT Facilities During Off-Hours Where Feasible

At certain times, especially during overnight hours when automobile traffic is typically lighter at SRAs, TICs, and picnic areas, TxDOT should consider allowing trucks to utilize some of the space typically reserved for cars. Aerial imagery of many rest stops and picnic areas (see

Appendix B in the Truck Parking Demand in Dedicated and Unauthorized Locations Report) shows that trucks are informally using this space, indicating a demand for additional inventory at many locations. Alternatively, a more in-depth study of automobile use at SRAs may identify some locations where additional parking could be turned over to truck parking on a more permanent basis. Site geometry and pavement may need to be examined to confirm the car parking areas are able to accommodate trucks.

TxDOT Led Policy Strategy 5: The State Should Prepare Corridor Truck Parking Plans

Detailed assessments of corridor level truck parking demand and utilization is needed to fully advance the infrastructure strategies. This information is key to determining specific needs, locations and most applicable strategies. Specific recommendations on where to construct new facilities, expand and enhance existing facilities, repurpose closed or underutilized facilities and what amenities to provide will require corridor and location level data, feasibility assessments and local input and coordination. Corridor Truck Parking Plans should be undertaken and include direct data collection and vehicle counts to provide additional truck parking utilization at existing SRAs and picnic and pull off areas along the corridor. Truck Parking Plans should first be developed for corridors with the greatest truck parking needs.

TxDOT Led Policy Strategy 6: The State Should Integrate Truck Parking into the Strategic Highway Safety Plan (SHSP)

Texas should consider truck related crashes as a potential area of focus for the SHSP to identify and develop additional mitigation strategies to address truck parking needs. In addition to improving safety, this may also open safety funding streams for investing in truck parking.

TXDOT SUPPORTED POLICY STRATEGIES

Because TxDOT maintains less than 10 percent of all authorized truck parking the state, it is necessary that other stakeholders take the lead on some policies aimed at meeting the truck parking challenges. TxDOT can serve a supporting role and sometimes be the catalyst for initiating action. Following are six policy strategies that TxDOT should support.

TxDOT Supported Policy Strategy 1: The State Should Collaborate with Planning Partners to Examine Feasibility of Truck Parking at non-TxDOT Public Facilities

Similar to allowing trucks to park in auto-oriented sections of an SRA or TIC during off-hours, TxDOT could work with partner agencies and local agencies to identify commuter parking lots, bus depots, or other facilities that, while not owned by TxDOT, could support truck parking during off-hours. These facilities are usually located in urban areas where the demand

for truck parking is high and have patterns of use that are regular and opposite of the peak demand hours for truck parking. These locations would likely have minimal amenities on-site but in some areas might be adjacent to commercial or retail establishments that could provide food and restrooms for (paid) use. Additional study would be needed to identify areas with a surplus of overnight parking spaces and that are properly built to carry heavier commercial vehicles for longer periods of time. A park and ride lot in Fallbrook, California north of San Diego, at I-15 and SR 76 (Exhibit 48) includes an area for dedicated truck parking. Caltrans is exploring the feasibility of allowing trucks to park in the car parking area during the overnight hours when not in use. The State of Maryland allows trucks to park in specific park and ride lots during inclement winter weather.[7]

TxDOT Supported Policy Strategy 2: The State Should Coordinate with Private Property Owners to Allow Truck Parking at Large Parking Facilities When Not in Use

Fairgrounds, stadiums, racetracks, and other event venues with large amounts of parking close to the highway in areas with high truck parking needs should be identified and owners contacted to investigate the potential of providing truck parking. These types of locations have schedules that are known far in advance, often have significant downtime, and are used to accommodating large numbers of vehicles and people in a condensed period. Two examples of the application of this policy can be found on I-80 in Eastern California, Caltrans has an arrangement with the Gold Country Fairgrounds in Auburn, near the base of Donner Pass, and with the Boreal Ski Resort closer to the summit, to allow truck parking during winter closures of I-80.

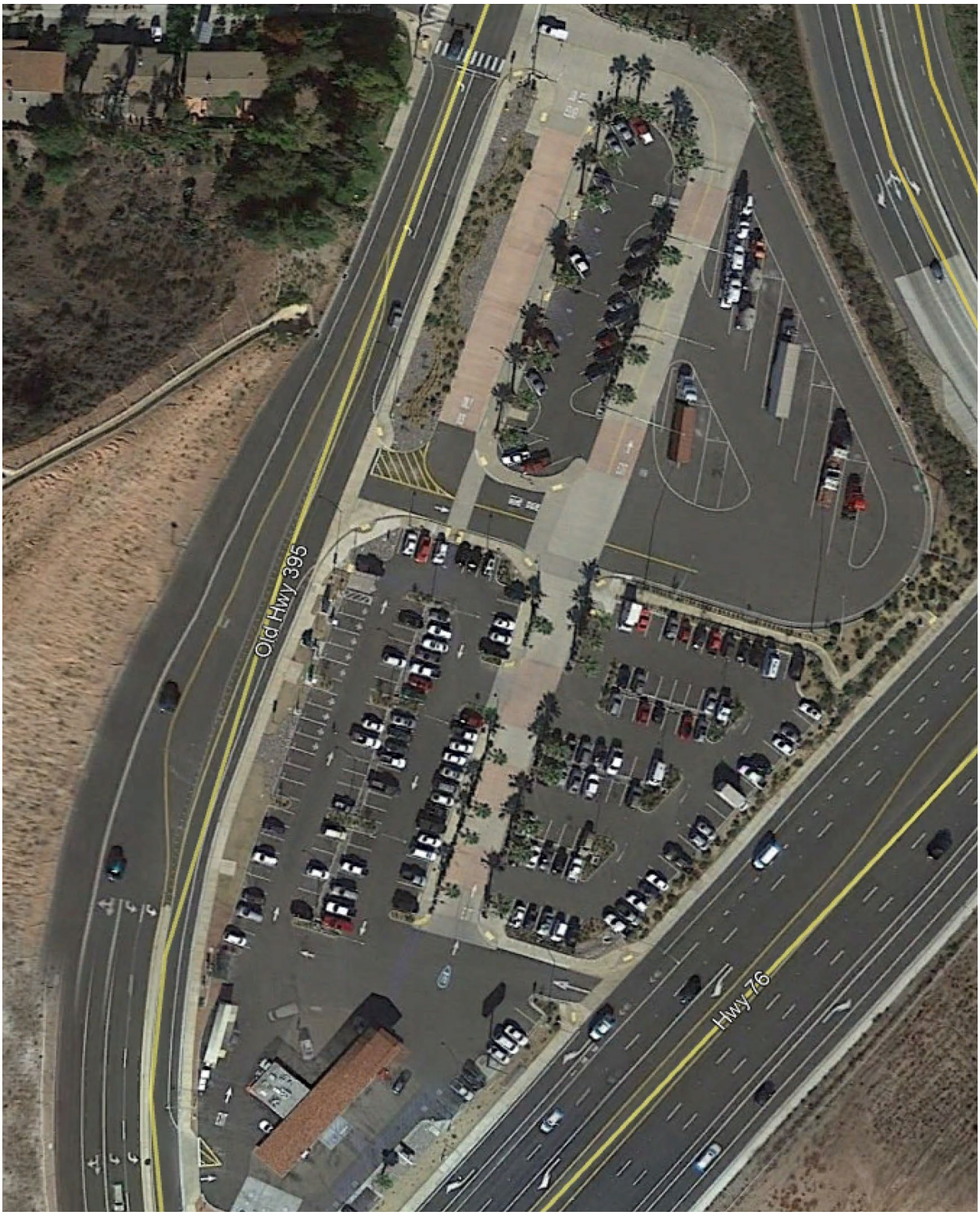
Additional research would be necessary to identify areas of opportunity in Texas, examine utilization patterns, and confirm that the pavement and geometry of the lot can accommodate large trucks for longer periods of time.

TxDOT Supported Policy Strategy 3: The State Should Create Guidance to Help Local Agencies Include Truck Parking Demand as Part of Traffic Impact Analyses for New Developments

Many local jurisdictions have policies or guidelines in place to evaluate the potential traffic impacts of a proposed development project. State and local agencies should ensure that their policies and guidelines also require that a proposed project that will generate truck trips evaluate the potential impact on local road safety and conditions if increased truck parking demand is not met. By identifying the truck parking needs before a project is built, projects can incorporate design changes or mitigation measures to address the potential impacts and help meet truck parking needs. TxDOT could play a lead role in developing guidance or sharing best practices with local communities.

[7] https://www.roads.maryland.gov/mdotsha/pages/Index.aspx?PageId=856.

Exhibit 48: Park and Ride Lot, I-15 at SR 76, Fallbrook, California



Source: Google Maps. North is to the top of the image.

TxDOT Supported Policy Strategy 4: The State Should Develop Guidelines for Integrating Truck Parking into Local and Regional Transportation and Land Use Plans

When local jurisdictions allow for new development, but do not also account for the increased level of truck parking needs, the costs for mitigating these needs are often passed on to the local jurisdiction—such as the cost of providing truck parking, and costs associated with safety, congestion, and community disruption. The State should develop guidelines for integrating truck parking needs into the planning process such as requiring shippers and receivers to provide on-site parking or contribute their fair share to the cost of a common parking area to help meet the parking demand while also helping to spread the costs of providing truck parking.

FHWA in their Freight and Land Use Handbook, in the Context-Sensitive Solutions (CSS) section states: "Establish staging areas for freight delivery. Many stores and other facilities receiving shipments do not have staging areas or freight loading docks. Trucks making deliveries must park along the curb or in a parking lot, which can impede traffic flow and cause congestion on the streets around the store. One solution calls for municipalities and other zoning authorities to require onsite, and, preferably, off-street staging areas for facilities and businesses that regularly receive freight shipments. In some cases, there may not be sufficient space for onsite loading docks or parking areas. The establishment of common loading areas in multiple-tenant facilities, and/or regulations to effectively manage curbside truck parking may be more suitable solutions."[8]

Some areas within the U.S. have taken this step. In 2017, the Township of Upper Macungie in the Lehigh Valley passed a new zoning requirement which requires one off-street truck parking space for every loading dock at a new warehouse or distribution facility.[9] The new zoning regulations also mandated one truck staging space (with 10-feet x 80-feet dimensions) for every two loading spaces at a distribution or warehouse facility.[10] The new zoning requirements specify that "*the applicant shall present credible evidence that the number of "oversized" off-street parking spaces provided for trucks will be adequate to accommodate the expected demand generated by the warehouse activities.*"

This approach helps alleviate the issue before it becomes an issue, especially in freight generating areas including border-crossings, ports, warehousing, and industrial developments. In addition, businesses that have truck parking and associated amenities available to drivers—whether on property or in a shared staging lot nearby—become "shippers of first choice" and may receive better rates or preference when trucking capacity becomes tight. TxDOT should parter with industrial development agencies, economic development agencies, and local agencies in stressing the need for and potential benefits from including truck parking in new construction.

8 https://ops.fhwa.dot.gov/publications/fhwahop12006/.

9 Township of Upper Macungie Municipal Code § 27-605. https://ecode360.com/14517379.

10 Township of Upper Macungie Municipal Code § 27-601. https://ecode360.com/14517379.

TxDOT Supported Policy Strategy 5: The State Should Encourage Commercial and Industrial Property Owners to Provide Truck Parking on Unused Portions of Property

In industrially zoned areas it is common to find vacant lots, and developed sites with excess space that could be used for truck parking. TxDOT should promote or encourage this type of activity by engaging property owners, local agencies, economic development agencies, industrial development agencies, and chambers of commerce in high need areas. As noted in the technology strategies in the next chapter, mobile applications that connect drivers looking for parking to property owners with excess capacity can facilitate deployment of this policy.

TxDOT Supported Policy Strategy 6: The State Should Create Guidance for Next Generation Logistics Parks that Includes Integrated and Full-Service Truck Parking Facilities

Truck parking and staging facilities near their customers helps truck drivers maximize their HOS, thereby improving efficiency and profitability. TxDOT should work with industrial developers, shippers and drivers to develop guidance on state of the art logistics parks that accommodate the need for truck staging. The guidelines should be made available to local governments, economic development agencies and developers.

Twelve policy and coordination strategies were presented in this chapter including both those that will be led by TxDOT and those that will be led by others but supported by TxDOT. Many of these strategies can be undertaken simultaneously in the short-term as presented in Chapter 10, which presents Actions for Addressing Truck Parking Challenges in Texas to guide the advancement of the highest priority recommendations.

8 Addressing Truck Parking Through Infrastructure Investments

The truck parking needs assessment identified truck parking shortages throughout Texas. The shortages, combined with the lack of basic amenities at many TxDOT maintained truck parking facilities lead to unauthorized parking and associated negative impacts. Infrastructure investments play a critical role in addressing the truck parking needs across the state and include adding additional truck parking spaces and facilities and upgrading the amenities and design at existing public facilities.

EXISTING INFRASTRUCTURE STRATEGY: EXPAND AND UPGRADE EXISTING TRUCK PARKING FACILITIES

This chapter includes four recommended strategies for adding capacity and increasing utilization at TxDOT maintained truck parking facilities. The recommendations focus on expanding and upgrading existing TxDOT truck parking facilities and building new facilities.

Infrastructure Strategy 1: The State Should Improve/ Enhance Amenities at Existing TxDOT Maintained Truck Parking Facilities

Perhaps the simplest strategy for increasing the utilization of publicly-owned facilities is to improve the amenities provided at the facilities. The State should provide common amenities at truck parking locations that make them more attractive to drivers, help ensure compliance with HOS requirements, prevent pavement degradation,

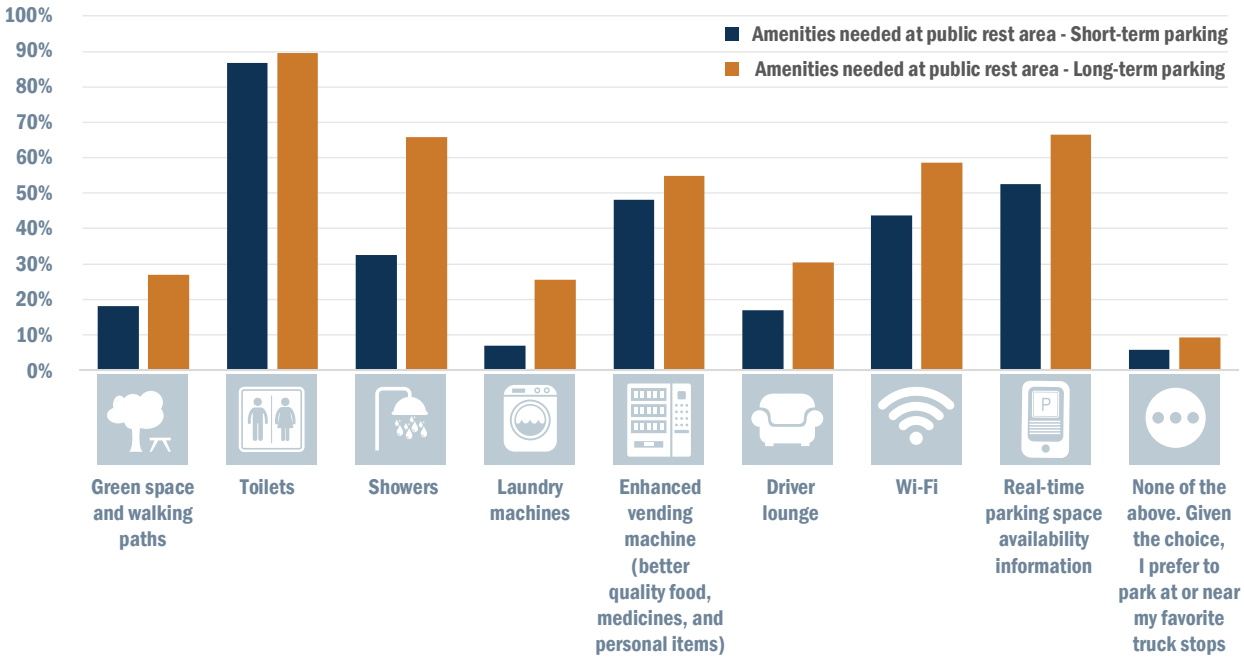
Summary of Infrastructure Strategies

Expand and upgrade existing truck parking facilities

1. Improve/enhance amenities to include these minimum features:
   - Paved lots
   - Angled parking
   - Lighting
   - Curb space for OS/OW trucks
   - Flush toilets
   - Enhanced vending machines
   - Trash receptacles
2. Expand and upgrade truck parking at existing TxDOT maintained facilities including at SRAs and TICs and at pull-offs and picnic areas
3. Repurpose underutilized or closed/closing TxDOT maintained parking facilities
4. Develop new publicly-owned truck parking

and make them consistent with Jason's Law.[11] When asked about their desired amenities at a public truck parking facility, stakeholders identified toilets, enhanced vending machine options, Wi-Fi, real-time parking availability and shower facilities as their top desired amenities for long-term or overnight parking with showers being less important for short term parking (see Exhibit 49).

Exhibit 49: Stakeholder Identified Amenities Desired at Public Truck Parking Facilities



Source: On-line survey of Texas truck drivers conducted in January 2020.

At a minimum, all TxDOT maintained SRAs, TICs and picnic or pullout areas with dedicated truck parking should include the basic amenities shown in Exhibit 50. These locations should be paved with angled parking and curb space for oversize/overweight (OS/OW) vehicles, and should include lighting, flush toilets, enhanced vending machines, and trash cans. Currently, none of the 92 TxDOT maintained picnic and pull off areas have restrooms or vending. However, all of the 85 SRAs and TICs have both restrooms and vending. Enhanced vending machines can take different forms but could include more nutritious food and drink options, toiletries, small electronics, or medical needs (bandages, aspirin, etc.) beyond the typical drinks and snack items. In addition, depending on the specific location, level of demand, and resources available, TxDOT should consider including some or all of the enhanced amenities. These amenities are more likely to draw drivers who might otherwise choose to park in an unauthorized location.

[11] Jason's Law requires states to evaluate their capability to provide adequate truck parking and rest facilities for safe parking of commercial motor vehicles. See: https://ops.fhwa.dot.gov/freight/infrastructure/truck_parking/jasons_law/truckparkingsurvey/index.htm.

Exhibit 50: Amenities for Consideration at TxDOT Facilities

During interviews, drivers identified the service plazas on the Ohio Turnpike as examples of "best practice" in terms of amenities provided. Each plaza is located approximately every 30-50 miles and includes a truckers' lounge, separate restrooms, shower facilities (at no charge), and coin-operated washers and dryers.

State Departments of Transportation, including TxDOT can only provide basic amenities consistent with a federal regulation on commercial activities within the Interstate right of way under 23 U.S.C. § 111(b), which prevents commercialization or the provision of goods and services with commercial value at no charge or for sale at SRAs and other DOT facilities. 23 U.S.C. § 111(c) does allow for the use of vending machines in SRAs as an exception to the above rule.

Infrastructure Strategy 2: The State Should Expand and Upgrade Truck Parking at Existing TxDOT Maintained Facilities

TxDOT should undertake the following strategies to develop additional truck parking spaces by expanding existing public facilities and are intended to utilize existing infrastructure and minimize the need to purchase additional right of way, reducing costs for TxDOT.

- **The State Should Expand and Upgrade Truck Parking at Existing Safety SRAs/Travel Information Centers –** Most older SRAs in Texas provide only parallel parking for trucks or a mix of both angled and parallel parking and are usually smaller ranging from about 5 to 18 truck parking spaces. Some locations with truck parking could be reconfigured to increase the number of spaces and improve traffic flow. To achieve this TxDOT should examine the striping to make better use of space to allow more trucks to park within existing site limits. Striping and site flow patterns at these facilities should be analyzed to determine if there are ways to improve truck movement and add space without

expanding beyond the existing site footprint. For example, drivers often indicate that locations with striped spaces can fit more trucks than those without as the striping provides direction to drivers on where to park safely. Angled parking, where trucks pull into a space at an angle and then leave by pulling ahead, also tend to provide better capacity where space is available and reduce safety concerns by eliminating the need to reverse or pull out of a tight parallel parking space.

The Study identified 78 SRAs and TICs for potential upgrades and expansions. The improvements include converting to angled parking and increasing the number of spaces, adding enhanced vending, configuring angled parking so that trucks can pull in and exit a spot without backing up, and developing curb parking for OS/OW vehicles. Maps depicting the location of recommended sites to be improved and illustrative examples of how facilities could be expanded and enhanced are provided in Chapter 10. In locations where data indicate high utilization rates, expanding the pavement within the existing right of way should be considered as a means for increasing the number of truck parking spaces. In addition, the basic amenities noted above should be installed at all SRAs and TICs. To determine the type and extent of possible upgrades and expansions a detailed feasibility assessment should be conducted at each of the candidate SRAs and TICs.

- **The State Should Expand and Upgrade Truck Parking at Existing Pull-offs or Picnic Areas –** There may be pull-offs or picnic areas in locations where the need for truck parking is high but conversion to a full SRA and TIC is not possible or cost-effective. For these facilities, the State should:

  1. Provide basic amenities (as described above);
  2. Examine the current truck parking spaces to determine if a new striping and site flow pattern could allow more trucks to park within the same area; and
  3. Expand sites where the utilization data supports the need for additional truck parking and there is room for expansion within the existing right of way.

  For pull off areas, utilization data should be collected to see if it is feasible to make the facility a dedicated truck-only parking facility, freeing up additional space to accommodate more trucks. A total of 62 picnic and pull off areas are identified as potential candidates for expansion. A map depicting the locations of these sites and illustrative examples are provided in Chapter 10.

- **Potentially Add Truck Parking at Weigh Stations –** Weigh stations are a tool used in several states to help identify, inspect, and stop commercial vehicles that are traveling in violation of state or federal weight and safety regulations. There are approximately 100 inspection stations operated by the Texas Department of Public Safety (DPS). The design and approach used for this enforcement activity varies widely. Weigh stations that are permanently (or nearly permanently) staffed and located near a state border are a common approach in many southern and western states including Texas.

Several states have built truck parking at these locations and allow trucks to park. For example, Exhibit 51 shows the Post 9 Walton Weigh Station on I-71 in Boone County, Kentucky which allows trucks to park overnight.

Weigh stations are operated and maintained by the TxDPS and they do not currently allow trucks to park at weigh stations. Many of the existing weigh stations do not have space for trucks to park. However, some newer facilities do have space (such as the New Waverly Weigh Station on I-45 north of Houston shown in the **Truck Parking Demand in Dedicated and Unauthorized Locations Report**) but parking is still not allowed unless trucks are required to stop due to enforcement action (placed out of service due to violation of regulations).

The State should coordinate with DPS and the driver community to assess this potential. Many of Texas' older weigh stations may not have sufficient space at the existing site to allow parking or have adjacent right of way to expand. At locations where truck parking is available or could be built, communication to the driver community is key as use of these truck parking areas varies widely between states. Because of these challenges, this strategy is not a high priority at this time.

Exhibit 51: Walton Weigh Station, KY

Source: Google Maps. North is to the top of the image.

NEW INFRASTRUCTURE STRATEGY: BUILD TRUCK-ONLY PARKING FACILITIES

In areas with an identified need and no existing facilities to expand, the State should assess the feasibility of building new truck parking facilities. Options include repurposing recently closed or closing public facilities or building brand new facilities.

Infrastructure Strategy 3: The State Should Repurpose Underutilized or Closed/Closing TxDOT Maintained Facilities Where Feasible in High Need Corridors

One option under this strategy is to repurpose closed or closing TxDOT facilities such as SRAs, pull off areas, picnic areas, and maintenance facilities. Weigh stations could also be considered in coordination with TxDPS. Land at these locations may still be publicly owned and prior investments (grading, entrance/exit ramps, electricity, pavement, etc.) can reduce up-front costs for TxDOT. These sites are referred to as opportunity sites and 32 such sites are identified for further investigation. Exhibit 55 in Chapter 10 depicts the location of these opportunity sites and additional detail is available in the **Truck Parking Demand in Dedicated and Unauthorized Location Report**. The State should conduct feasibility studies for these 32 sites.

Missouri DOT has converted 23 obsolete SRAs and weigh stations to parking spaces for trucks, typically with no or minimal amenities (lighting, graded/paved, sometimes a vault toilet). An example location on I-70 is shown in Exhibit 52. These conversions supplement private parking facilities in locations with high truck parking demand and insufficient capacity. The State should identify potential properties for repurposing and ensure that truck parking needs are considered before the property is offered for sale or considered for other use. In addition, coordination is recommended to ensure any areas that may be considered for closing are reviewed for use as truck parking prior to closure.

Exhibit 52: Missouri Converted SRA I-70

Source: Missouri DOT Presentation to the I-95 Corridor Coalition, May 1, 2018.

Infrastructure Strategy 4: The State Should Develop New Publicly Owned Truck Parking

Based on the needs analysis, there are areas where additional truck parking is needed, but there are no existing or recently closed or closing facilities that can be expanded or converted to fulfill the need. In these cases, the State should develop new truck parking facilities. The State should conduct a feasibility study to determine the exact size, design, and level of amenities based on need, ranging from a small truck pull-off area with minimal amenities to a new state-of-the-art dedicated truck parking facility, SRA, or TIC. A map depicting the locations where new facilities may be needed and illustrative examples of how the facilities may be designed are provided in Chapter 10.

One area of concern based on the needs analysis is a lack of capacity in or near urban areas where truck parking demand is highest. More intense and complicated land ownership issues (and more constrained right of way), zoning challenges, community opposition, and higher land prices all make construction of truck parking facilities more difficult in urban areas. However, as urban areas continue to attract and develop manufacturing, distribution, and warehousing services, and affordable available land decreases, the need for truck parking to serve all truck parking needs will increase.

If located on the outskirts of major urban areas, a new publicly-owned, dedicated truck parking facility with a large number of truck parking spaces and a full suite of enhanced amenities could help fill the demand for urban parking, but at a lower initial investment than if placed inside urban areas.

Alternatively, two potential approaches to developing truck parking to serve these urban-specific needs are described below. Both could be built by the public sector and operated as publicly-owned truck parking locations. However, private entities may also develop this type of truck parking, independently or in collaboration with TxDOT or a local agency.

- **The State Should Facilitate the Development of Dedicated Truck Parking Near Shippers/Receivers, Ports, Border Crossings, or Other Areas of High Demand –** The need for truck parking and freight staging near freight generators and in urban areas, especially through a collective or multi-facility parking area was identified in the 2018 TFMP as well as current regional freight planning efforts throughout the state. Truck parking in these areas should be open at all times so that they can address multiple needs including short-term, staging, long-term, storage, and emergency truck parking. Perhaps most critically, if properly developed they can address the need for short-term and staging parking near areas that require large numbers of truck deliveries whether this is an industrial area or a dense commercial district, or as is prevalent in Texas, near maritime ports and international border crossings. TxDOT should conduct a feasibility study for developing dedicated truck parking in these high need areas and facilitate partnerships necessary for implementation. This type of parking has historically been difficult to develop for reasons discussed above. However, there are a few examples of local jurisdictions taking the initiative to develop parking in more urban areas, as well as private companies providing parking for a fee.

NOTABLE EXAMPLES OF URBAN AREA TRUCK PARKING FACILITIES

The **City of Weed, CA**, is located near Mount Shasta on Interstate 5. The area is home to large lumber mills and a Crystal Geyser Alpine Spring water bottling plant. To alleviate trucks parking in residential areas, the City used local tax dollars to pave an area near an existing Pilot Travel Center.[12] The space has been designated for truck-only parking with personal vehicles and RVs prohibited. To ensure the availability of parking spaces, trucks are given a 72-hour maximum period for free parking.

The Oasis Trucking Center in Detroit, Michigan is an example of a privately-owned and operated secure truck parking facility[13] that allows for long- and short-term parking near Detroit International Intermodal Terminals and the large auto manufacturing plants such as Ford Motor Company.[14] The facility also works with local freight centers to assist with the dispatch of trucks to their final delivery points. This facility, developed through private-land acquisition and no public sector involvement, has security personnel, guarded entry and exit points, high fences, and is connected to the Truck Specialized Parking Services (TSPS) – a private for profit firm focused on providing commercial parking solutions for trucks across the U.S. – for proprietary truck parking notification system and mobile reservation system. Their approach to short-term parking is based on generating revenue through user fees, which is different from most long-term parking facilities (TA/Petro, Flying J, etc.) that typically generate revenue by selling food, fuel, and other commodities on site.

Truck Depot LLC is another company that operates secure truck parking facilities near urban areas and distribution centers.[15] The company provides storage parking (rented for 30 days at a time) which can provide space for owner-operators, short-term parking for a set fee, and provides space for trucks to cross dock (shift loads within a vehicle or between vehicles).

Truck Parking Facilities in Weed, CA (Left), Signage At Facility (Right)

Source: Google Maps and OOIDA.

12 Kahaner, Larry. "Truckers love Weed; Weed loves truckers" FleetOwner.com. 17 June 2016. https://www.fleetowner.com/driver-management-resource-center/truckers-love-weed-weed-loves-truckers.

13 http://www.tsps.io/.

14 In-person interview with TSPS on 11 October 2018.

15 https://www.truckdepotllc.com/about/.

- **The State Should Develop Dedicated Truck Parking Near Areas of High Demand to Accommodate Short-Term Truck Parking and Staging Needs –** TxDOT should develop smaller lots with basic amenities and restricted hours to counter local resistance to, or the cost of building large, full-service urban lots. These would consist of smaller lots close to a concentration of shippers and receivers and be used for staging only. The hours of operation could be restricted to match those of the shippers and receivers, thereby restricting its use during the overnight hours when nearby residents might object to idling trucks. It should be open early enough for drivers to gain access to it prior to the morning commute.

  These types of staging lots could also be advantageous near ports and border crossings where there is a greater need for short-term and staging parking. A large lot may be required if demand is high in these areas, however, operational and maintenance costs would still be lower with few amenities and restricted hours.

Addressing the truck parking challenges in Texas will require a holistic and comprehensive approach that includes a myriad of approaches. This chapter focused on four infrastructure strategies that expand, enhance and add new truck parking facilities in Texas. Not all of these can be undertaken at once but there are short, medium and long term steps that can be taken on all of the recommendations. Chapter 10 presents Actions for Addressing Truck Parking Challenges in Texas to guide the advancement of the highest priority recommendations.

9 Addressing Truck Parking Challenges Through Technology and Programs

This chapter describes several technology solutions and programs that TxDOT could deploy to help address truck parking needs in the State. Although these approaches will not increase capacity, they can make finding parking easier, reduce truck parking in unauthorized areas by providing drivers with information about nearby options, and increase public awareness about the importance of trucks and truck parking.

TECHNOLOGY STRATEGIES

Technology Strategy 1: The State Should Invest in Truck Parking Availability Systems

Throughout this Study, truck drivers indicated that one of their top needs is for accurate, real-time information about the availability of truck parking spaces (see Exhibit 49). Truck Parking Availability Systems (TPAS) are one way to obtain and disseminate this information. TPAS are a type of Intelligent Transportation Systems (ITS). TPAS makes finding a truck parking space easier and less stressful for drivers by accurately counting and disseminating real-time information of the number of available spaces at connected facilities. This increases the efficient use of existing capacity, and more advanced analysis, such as predictive analytics, can help predict the future supply of truck parking, providing drivers and dispatchers with even more information. Truck drivers overwhelming indicated their desire for TPAS in the survey conducted for this study (see Exhibit 49 in the previous chapter).

SUMMARY OF TECHNOLOGY AND PROGRAM TRUCK PARKING STRATEGIES

Technology Strategies

1. Deploy **Truck Parking Availability System Statewide**
2. Provide **truck parking information** for **integration** into **mobile applications**

Programs

1. Collect truck and car utilization data at publicly-owned truck parking facilities
2. Install static signs and use existing ITS signs indicating upcoming locations for truck parking
3. Collaborate with privately-owned truck stop operators to develop new or expand existing truck parking
4. Include driver outreach in "Don't Mess with Texas" campaign to encourage them to not litter
5. Develop a public education campaign to inform the public on the importance of truck parking

A TPAS relies on accurate and timely collection of truck parking availability and the ability to disseminate that information to users real-time. TPAS uses two common approaches to collect parking availability information: 1) a site volume approach to measure truck volume entering and leaving a site; and 2) a vehicle occupancy approach which detects if a vehicle is in a particular parking space to determine availability. As noted below, as a part of the I-10 Corridor Coalition and through federal grant funding, TxDOT has partnered with Arizona, California and New Mexico Departments of Transportation on the development of a truck parking information system program along the I-10 corridor.

Information on where to find available truck parking is typically communicated to drivers via roadside signs and mobile applications. A popular option for roadside TPAS signing is a static blue services sign with fixed destination options that each have a dynamic matrix panel for reporting available parking spaces. This option is widely used by the Mid America Association of State Transportation Officials (MAASTO) states.

Data availability on a website or mobile application usually compliments the information on the sign and can provide a lot of detail at a fairly low cost. In lieu of developing a new app to communicate truck parking availability, TxDOT should consider integrating the TPAS data into their DriveTexas.org highway conditions and Lonestar websites and application.

Technology solutions may be more effective when deployed at a regional or multi-State level, especially applicable for TPAS. Truck drivers benefit from a single, national source for locating available parking, and TxDOT has an opportunity to be at the forefront of implementing one by promoting and supporting a system that can be connected to other regional systems.

I-10 CORRIDOR COALITION TRUCK PARKING AVAILABILITY SYSTEM

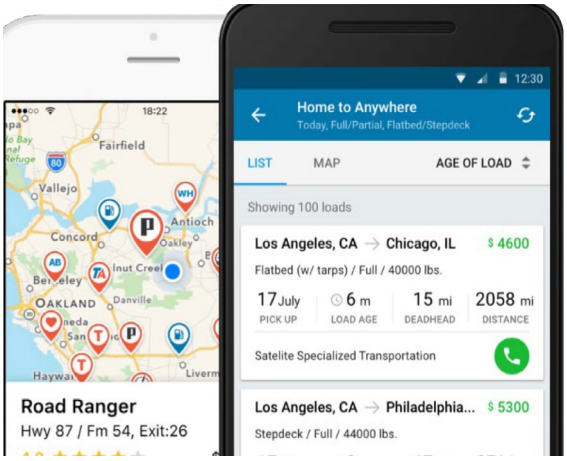
In June of 2018, TxDOT submitted to USDOT, on behalf of the four states of the I-10 Corridor Coalition (Arizona, California, New Mexico and Texas), an Advanced Transportation and Congestion Management Technologies Deployment grant request for $6.8 million, with an equal amount of state match. The purpose of the grant was to deploy the I-10 Corridor Coalition TPAS. The grant was awarded to the I-10 Corridor Coalition, and TxDOT is the lead state on the project.

The project began in late 2019 and will implement a truck parking availability detection and information system at 37 public truck parking locations along the I-10 Corridor from California to Texas. The objective of this system is to make real-time truck parking information available to truck drivers and dispatchers to assist them in making informed parking decisions.

The initial deployment of the I-10 Corridor Coalition TPAS will focus on collecting and publishing truck parking information for public facilities. This will be accomplished with Dynamic Parking Capacity Signs, existing state 511 and road information system platforms, and the potential development of an I-10 Corridor truck parking smartphone application. This application would serve as the basis for anticipated future technology deployments in the I-10 Corridor and ensure that information is available to drivers regardless of private sector involvement. However, as requested, data will also be made available to third-party applications and websites to promote widespread use of truck parking availability information. In the future, the Coalition will explore incorporating the private sector operated truck plazas into the system and wider options for truck parking dissemination may be developed.

Deploying TPAS statewide would increase the number of locations where information would be available to drivers, helping them make better parking choices, ultimately reducing the number of trucks parking in unauthorized locations, reducing the number of trucks searching for parking (and associated environmental and pavement degradation), and reducing the chance that drivers might drive over the HOS limits and contribute to a fatigue-related crash. In other states where implemented, smaller independent truck stops have reported a dramatic increase in trucks parking at their facility, indicating that information on availability helps to distribute truck parking more evenly among authorized sites. It would also provide TxDOT with valuable data about parking patterns that can inform investment decisions and eventually help predict future parking demand patterns (predictive analytics).

Technology Strategy 2: The State Should Provide Truck Parking Information for Integration into Mobile Applications



Source: https://truckerpath.com/.

TxDOT should also make the TPAS data available to interested third-party truck parking application developers, such as Park My Truck run by National Association of Truck Stop Operators (NATSO), and possibly to mapping and traveler information platforms like Waze and Google maps, to integrate into their own services. There are other truck parking apps that may not be able to disseminate the TPAS data, nevertheless they provide unique solutions for notifying drivers of truck parking opportunities. A few are noted below. TruckerPath is a crowdsourcing application which relies on drivers to report the number of spaces available at a parking location using a scale ranging from "Lots of Spots" to "Some Spots" to "Lot is Full." This system, while low cost, relies on each driver's interpretation of capacity and the updates can be infrequent. As shown in the screenshot, the app also provides information to assist in load matching for drivers which helps increase the number of drivers using the application.

SecūrSpace is an example of a private application for utilizing public and private spaces more efficiently. It is an online marketplace that connects truck drivers and companies needing parking and storage options to those with dedicated or excess capacity. For example, there are several commercial business and strip malls with ample parking that have closed. The land owner may choose to allow truck parking for a fee as a way to earn some revenue from otherwise dormant property. The challenge would be getting information about the parking availability to those who need parking. The app would be the mechanism for connecting the land owner with truckers in need of parking.

PARKUNLOAD® is another example of a mobile application used throughout Europe that directs city delivery truck drivers to available curb space and indicates any restrictions such as time of day or duration of parking. Law enforcement, with a different interface, can quickly identify those trucks registered and allowed to park at a particular curb, and cite those who are not.

While none of these offers the ultimate solution, they all have interesting components and applications for providing truck parking information that assists in addressing truck parking and staging needs without adding capacity. For instance, in many areas curbside truck parking is allowed in commercial and industrial areas at certain locations and specified times. An application could indicate to drivers where curbside parking is allowed, at what times of the day, and for what duration—and allow the city to change those restrictions at any time and easily enforce non-compliance. Likewise, private property owners with excess space could

also make their space available at the dates, times and durations they desire, and use a private application to communicate those details and availability and facilitate payment. This would enable them to generate revenue from unused space while helping drivers find available parking. TxDOT could help to facilitate the development of applications that would help to serve truck parking needs in Texas.

TRUCK PARKING PROGRAMS

Several actions that TxDOT can take to encourage truck parking at authorized locations, improve efficiencies, better utilize available space, educate the public on the importance of truck parking, and educate truck drivers on the importance of being good stewards of public infrastructure are summarized below.

Program Strategy 1: The State Should Collect Truck and Car Utilization Data at Publicly Owned Truck Parking Facilities

Truck utilization data at SRAs and TICs can be used for performance reporting, evaluating the effectiveness of public investments in truck parking, and providing data to FHWA for its periodic Jason's Law survey. In addition, by also collecting data on cars and RVs, TxDOT will know how each public facility is being used by vehicle type, time of day, day of week, and services used. Collecting this data using technology such as cameras could be low cost and require little lead time and the data could inform future renovation plans for more efficient configuration and utilization of parking areas. For instance, if few cars utilize the parking area, TxDOT may be able to convert some of that space to truck parking. Or if cars are not parking during certain hours, trucks could be allowed to park in those spaces during those hours.

Program Strategy 2: The State Should Install Static Signs and Use Existing ITS Signs Indicating Upcoming Locations for Truck Parking

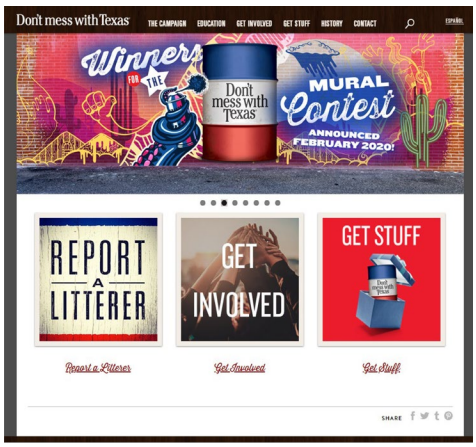
In advance of the development of a statewide TPAS, TxDOT should install low cost, static signs indicating the exit numbers for upcoming SRAs with truck parking and other truck parking areas. These could be placed on major highways at the entrance points to the state, or on the outbound side of major metropolitan areas. Existing ITS signs could also be used to notify drivers of locations of truck parking. These will help truck drivers understand their upcoming parking options and therefore plan their stops to avoid unauthorized parking.

Program Strategy 3: The State Should Collaborate with Privately-Owned Truck Stop Operators to Develop New or Expand Existing Truck Parking

TxDOT should meet with the NATSO and other private sector stakeholders to discuss a program and process for supporting development of new or expanded truck parking that would provide tangible benefits to the truck stop operators, without significant costs or complicated

programs for TxDOT. An example of a collaborative program is working on guidelines to help the private sector navigate permitting and public comment processes. Several truck stop operators have indicated that permitting requirements can increase the cost of construction and make development at a site infeasible, or that public opposition can kill a project. More important to them than financial support, is assistance with the permitting process and gaining public support for the project.

Program Strategy 4: The State Should Include Truck Driver Outreach in "Don't Mess with Texas" Campaign to Encourage Them to Not Litter



Truck drivers who litter contribute to a negative public perception of drivers and an opposition to facilities that attract truckers, such as truck parking lots. Outreach and partnership with the trucking industry specifically may help raise awareness about the importance of litter prevention to the industry and the communities they service. TxDOT launched the "Don't Mess with Texas" anti-litter campaign over thirty years ago, reaching thousands of Texans through advertising, consumer outreach, and media relations. In addition, TxDOT's Adopt-a-Highway and the Don't Mess with Texas Trash-off campaigns have helped reduce roadside trash along state-maintained roadways. These programs could be expanded to target the trucking industry.

At a drivers forum in the Permian Basin held in February, 2020, the topic of trash and litter from parked trucks was discussed. The drivers confirmed that this is a big issue and even in their company parking lot where only company trucks parked, daily litter pickup was necessary. The drivers agreed that a campaign that targets holding one another accountable along with increased number of trash containers could be helpful.

Program Strategy 5: The State Should Develop a Public Education Campaign to Inform the Public on the Importance of Truck Parking

Everyone relies on trucks to deliver our food, medicine, clothing and all personal and household goods, often directly to our door. Employers also depend on trucks to deliver materials and supplies to keep factories, offices and places of employment open. However, few people think about how those purchases drive a demand for truck trips and thus the need for trucks to park. Trucks, like much of the freight system that supports Texas' economy, are often considered a problem rather than a necessity.

Changing this public perception is a critical piece of outreach for TxDOT in partnership with other agencies and the private sector. One of the largest challenges private truck parking operators face when trying to expand or build new inventory is opposition from residents who do not want trucks parking near them. In tandem with the above message that encourages drivers to stop littering, TxDOT and its partners need to do more to explain the need for truck parking and examine how the negative impacts (noise, light pollution, traffic, etc.) can be ameliorated.

Addressing the truck parking challenges in Texas will require a holistic and comprehensive approach that includes a myriad of approaches. This chapter presented eight strategies including two technology strategies that would increase the effectiveness of existing truck parking capacity and five program strategies that support on-going truck parking assessment and provide justification for future investments. Steps that can be taken to advance these strategies are presented in Chapter 10.

10 Taking Action to Address Truck Parking Challenges in Texas

The recommendations presented in Chapters 7, 8 and 9 were developed to ensure the availability of safe and efficient truck parking by addressing the needs identified in Chapters 4, 5 and 6. To be effective, the Statewide Truck Parking Study must offer specific steps that can be taken to advance the recommendations. It must also be recognized that the Study cannot be static especially with uncertainty around advances in truck technologies and changes in federal regulations. The recommendations should be re-evaluated on a regular basis to adapt to changing truck parking needs and changes in priorities, funding sources and resources. This chapter provides a summary of the steps that can be taken in the short, medium and long term to advance the strategies in Chapters 7, 8 and 9.

This chapter breaks down the action plan for infrastructure/capacity projects, programs and technology solutions and truck parking policies into short and long-term actions; summarizes potential funding options and puts forth a call to action for TxDOT and its planning partners to address truck parking needs across the state. Additional details are provided in the **Truck Parking Recommendations and Action Plan Report**.

A Call to Action

Lack of authorized truck parking makes Texas highways less safe.

There are an average of **460 crashes** and **28 fatalities** per year **involving parked trucks**.*

There is a shortage of safe truck parking throughout the state.

10% of drivers say they **park in unauthorized locations daily**

Key recommendations include:

- Provide minimum required amenities at all TxDOT truck parking facilities
- Expand/Upgrade Truck Parking at existing TxDOT facilities
- Repurpose underutilized or closed/closing TxDOT facilities
- Expand TPAS (as being developed by the I-10 Corridor Coalition)
- Coordinate with private sector and local governments to mitigate barriers to expanding private truck parking

Key Short-term Actions

- Conduct feasibility studies for expanding/enhancing/reopening high priority TxDOT facilities
- Install truck parking signage while advancing planning for deployment of TPAS
- Develop corridor truck parking plans

* Data based on analysis of crashes in the CRIS database spanning 2013-2017

TECHNOLOGY PROGRAMS

Technology programs provide ways for the existing truck parking to be used more effectively and provide drivers with necessary information related to truck parking. The upfront capital costs and on-going maintenance costs are often lower than traditional infrastructure and the time needed for planning and implementation a fraction of what is needed for construction. For these reasons, technology solutions are often more cost effective and timely in meeting immediate needs. Steps for advancing two technology program recommendations are presented below including a summary matrix that presents the actions, roles and responsibilities of various agencies, regulatory implications and order of magnitude costs. Additional detail can be found in the **Truck Parking Recommendation and Action Plan Report**.

Technology Action 1: The State Should Develop a Statewide Truck Parking Availability System Plan

Truck parking availability systems (TPAS) make finding a truck parking space easier and less stressful for drivers by accurately counting and disseminating the number of available spaces at connected facilities. Implementing TPAS statewide would help drivers make better parking choices, reduce unauthorized truck parking, reduce the time drivers spend searching for parking, and reduce the chance that drivers might drive over the HOS limits and could contribute to a fatigue-related crash.

In the short-term, the State should:

- **Prioritize locations for TPAS across the state –** Deployment locations for a statewide TPAS will need to be prioritized. Work completed to date has identified truck parking shortages by major Interstate corridors, as shown in Exhibit 53. Using this approach, I-30, I-35, I-20, and I-45 are all potential candidates for deployment based on percent utilization and the fact that there are some locations in each corridor that are underutilized.

Exhibit 53: Truck Parking Utilization by Interstate Corridor

INTERSTATE CORRIDOR	NUMBER OF TRUCK PARKING LOCATIONS	TOTAL TRUCK PARKING SPACES	AVERAGE WEEKDAY PEAK HOUR DEMAND	TOTAL CORRIDOR UTILIZATION	NUMBER OF LOCATIONS AT/ OVER CAPACITY AT PEAK HOUR (1–2 A.M.)	AVERAGE WEEKDAY TRUCKS PARKED IN HIGHWAY RIGHT OF WAY AT PEAK HOUR
I-10	112	5,772	5,521	96%	40	117
I-20	91	4,599	4,718	103%	43	165
I-27	15	636	490	77%	2	8
I-30	19	826	1,059	128%	14	126
I-35	67	4,573	4,892	107%	35	185
I-37	18	492	289	59%	0	30
I-40	23	1,309	976	75%	3	21
I-45	30	1,538	1,555	101%	19	50
Total	375	19,745	19,500	99%	142	702

Source: Cambridge Systematics analysis using ATRI truck GPS data, 2019.

Note: Detail available in the Truck Parking Inventory and Utilization Report.

In the medium to long-term, the State should:

- **Deploy TPAS in areas or corridors with high priority truck parking needs.** Planning level cost estimates for the truck detection portion of a TPAS range from $50,000 – $100,000 for most SRAs but can go much higher depending on the inventory at the location and the specific detection technology deployed. Dynamic message signs cost approximately $55,000 per sign.
- **Deploy TPAS statewide.** The cost will vary depending on the number of locations where it is deployed as well as the number of spaces and type of sensors.

Technology Action 2: The State Should Install Static Signs or Use Existing ITS Signs Indicating Upcoming Locations for Truck Parking Where Needed

TxDOT should install low cost, static signs or use existing ITS signs indicating the exit numbers for upcoming SRAs, picnic areas and other parking areas with truck parking. The signs should also note the distance to the next public truck parking. The signs will help truck drivers understand their upcoming parking options and therefore plan their stops to avoid unauthorized parking.

In the short-term, the State should:

- **Identify truck parking facilities in need of signage –** Candidate locations include those that are not regularly reaching capacity but are in proximity of other facilities that are routinely over capacity, those facilities with limited visibility from the road and those where drivers may not be aware truck parking is permitted such as picnic areas.
- **Install pilot static signs and conduct pilot ITS messaging –** Static signs and ITS messaging should be deployed at select locations as a pilot project to evaluate their effectiveness and determine whether additional signs for other sites should be deployed.

Example Static Truck Parking Sign in Texas

Source: https://ftp.dot.state.tx.us/pub/txdot-info/trf/shsd/2012/complete_060512.pdf.

In the medium to long-term, the State should:

Install additional signs and messaging where needed, focusing on truck parking areas that are less visible from the road or there is less certainty about the presence of truck parking. Implementing this recommendation could be an interim step to increase knowledge of truck parking locations in the state until TPAS can be deployed.

Installing signage can be undertaken by TxDOT and does not require participation from other agencies. The cost to install a sign is approximately $300[16] and funding should be included as part of TxDOT's larger sign deployment and maintenance efforts. As TxDOT already has a sign available to indicate truck parking, there should be no regulatory issues involved in this deployment.

[16] Based on 2015 estimate to update speed signs in Wisconsin. See: https://www.postcrescent.com/story/news/local/2015/06/27/watchdog-qa-mph-speed-limit-signs-cost/29341217/.

SUMMARY OF ACTIONABLE STEPS FOR DEPLOYING TRUCK PARKING TECHNOLOGIES

	TIMING	SUPPORTING AGENCIES	RESOURCES	REGULATORY NEEDS
Action 1) Develop a Statewide Truck Parking Availability System Plan				
Steps				
1. Prioritize locations for TPAS across the state	Short	FHWA	TxDOT staff/ consultant time	None
2. Construct priority TPAS projects (assume 50 sites)	Medium	FHWA	Cost of approximately $2.5 million – $7.5 million	None
3. Construct balance of projects (assume 50 sites)	Long	FHWA	TBD	None
Action 2) In advance of a statewide TPAS deployment, where needed, install static signs or use existing ITS signs indicating upcoming locations for truck parking				
Steps				
1. Conduct site feasibility assessment and recommendations	Short	FHWA	No additional costs (included with site assessments)	None
2. Prioritize recommended locations for static signs across the state	Short	FHWA	TxDOT staff/ consultant time	None
3. Install pilot static signs (assume 5 sites)	Short	FHWA	$1,500 (Small signs – $1,100 per sign[17]; Large signs that could be converted to DMS – $50,000 per sign)	None
4. Install static signs at medium- and long-term TPAS sites (assume 100 sites)	Medium-Long	FHWA	$30,000 (Small signs - $300 per sign; Large signs that could be converted to DMS – $50,000 per sign)	None

[17] Sign D9-16T from: https://ftp.dot.state.tx.us/pub/txdot-info/trf/shsd/2012/complete_060512.pdf. Cost estimate from TxDOT: https://www.postcrescent.com/story/news/local/2015/06/27/watchdog-qa-mph-speed-limit-signs-cost/29341217/.

ADVANCING PROGRAMS TO ADDRESS TRUCK PARKING CHALLENGES

Chapter 9 presented five programmatic recommendations and all these programs should be initiated within the short-term (next 3 years) and most need to be ongoing efforts. The programs are described below and a matrix summarizing actions to advance the strategies, roles and responsibilities, order of magnitude costs and regulatory implications is provided following the descriptions. Additional detail is available in the **Truck Parking Recommendations and Action Plan Report**.

Program Action 1: The State Should Develop an On-going Utilization Data Collection Program for TxDOT SRAs and TICs

Truck utilization data at SRAs and TICs can be used for performance reporting, evaluating the effectiveness of public investments in truck parking, and providing data to FHWA for its periodic Jason's Law survey. The data can inform future renovation plans for more efficient configuration and utilization of parking areas.

In the short-term, the State should:

- **Collect car and truck counts as part of feasibility studies statewide –** Technology to collect this data may vary and may include traffic counting tubes or more permanent technology such as a closed-circuit television camera. TxDOT should begin by collecting data as part of the site feasibility studies at the priority locations identified in the infrastructure/capacity section above.
- **Develop program for ongoing data collection –** This program should become more formal and be designed to collect ongoing car and truck utilization data. TPAS data could be useful for collecting truck utilization data at those facilities outfitted with TPAS, however car parking data will also be needed to understand the appropriate balance between car and truck parking spaces as described above.

  TxDOT will lead the data collection program and should not require partners outside of the agency. As this work will occur within existing TxDOT right of way, there are no anticipated regulatory concerns.

Program Action 2: The State Should Prepare Corridor Truck Parking Plans

Corridor Truck Parking Plans can support other infrastructure, technology and program recommendations by providing utilization data collection, right of way inventories and unauthorized parking locations. The State should undertake the corridor truck parking plans for the highest need corridors in the near future. The plans can be conducted as stand-alone efforts or as part of a larger corridor planning effort. Findings from the corridor plans should be used to update the statewide study every five years.

In the short-term, the State should:

- **Develop work plan templates for conducting Corridor Truck Parking Plans.** A workplan template for how to conduct a corridor truck parking plan is needed to ensure consistency and appropriate use of the data.
- **Conduct a pilot Corridor Truck Parking Plan.** TxDOT should undertake a pilot effort to develop a truck parking plan on a high need corridor.
- **Develop Corridor Truck Parking Plans for all the interstates in the State.** TxDOT can lead this task with coordination with local municipalities and MPOs. This project can be completed using TxDOT staff and/or consultant resources and there are no regulatory concerns.

In the medium to long-term, the State should:

- **Develop Corridor Truck Parking Plans for high truck volume, non-interstate corridors in the State.** After developing plans for the interstates, TxDOT should undertake the development of truck parking plans for non-interstate corridors on the THFN starting with the corridors with the highest truck volumes.

Program Action 3: The State Should Include Truck Driver Outreach in "Don't Mess with Texas" Campaign

Incorporating outreach with the trucking industry through the "Don't Mess with Texas" anti-litter campaign may encourage drivers to stop littering and mitigate some of the public resistance to truck parking and reduce the cost of operating truck parking facilities.

In the short-term, the State should:

- **Develop partnership with trucking industry associations.** The State should establish a working group to develop a plan for tackling this issue with the Texas Motor Carrier Associations, Owner-Operator Independent Drivers Association, Women in Trucking and other relevant stakeholder groups.
- **Update the campaign website with a section devoted to truck drivers**. A section should be added to the "Don't Mess with Texas" website that includes specific messaging to truck drivers. That section could also include a way to report when trash receptacles at truck parking locations are full or if more are needed.
- **Develop targeted outreach materials.** The State should develop targeted promotional goods including in-cab garbage collection bags and branded trash receptacles at truck parking facilities. TxDOT should also emphasize the fines for littering in public right of way.
- **Increase number of trash containers at truck parking facilities.** Drivers across the state stated a need for more trash cans at existing facilities. It was also commonly suggested that trash containers that can be reached from inside the cab be placed at the approach to the exit of parking areas.

TxDOT can lead this recommendation but partnering with the Texas Department of Motor Vehicles and the private sector industry associations are necessary to ensure success. The resources needed to accomplish this recommendation are limited to TxDOT staff time and additional resources for “Don’t Mess with Texas” campaign.

Program Action 4: The State Should Create a Public Education Campaign to Inform the Public on the Importance of Truck Parking

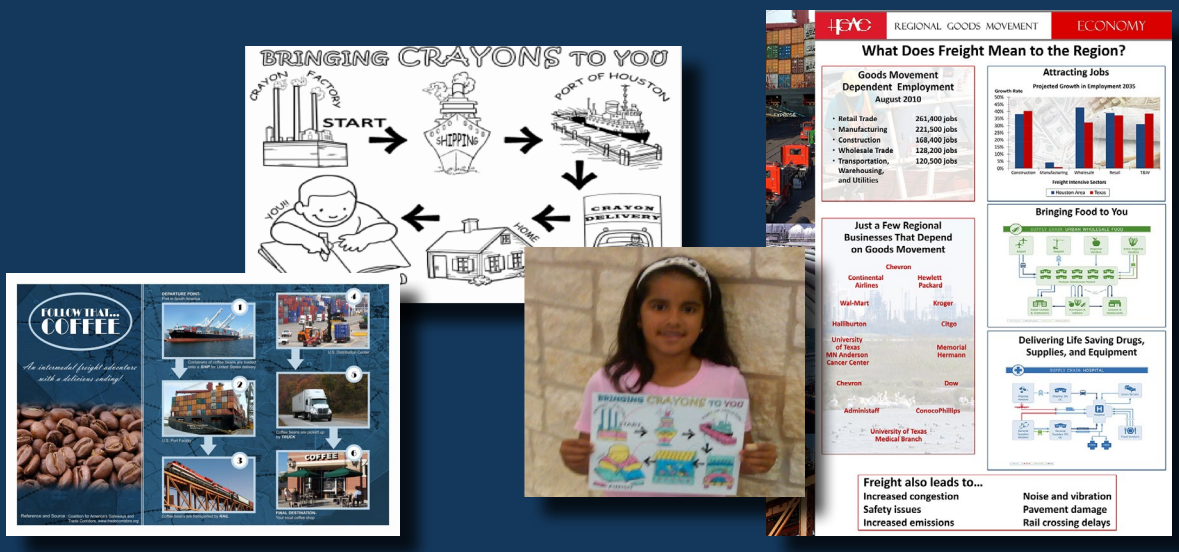
TxDOT and its partners need to inform the public of the important role truck parking plays in our everyday life and present strategies for mitigating any negative community impacts. TxDOT can develop a public information campaign and provide resources to local communities.

In the short-term, the State should:

- **Develop outreach materials.** The first action needed is to develop key topics and themes for outreach, and public education materials that convey the appropriate messages. The State should develop specific target markets and distribution channels and materials.

EXAMPLE PUBLIC CAMPAIGN MATERIALS: HOUSTON-GALVESTON AREA COUNCIL

During the development of their Regional Freight Plan, the Houston-Galveston Area Council (H-GAC) developed public education materials to educate the general public and local community leaders on the critical role freight plays in the livelihood of every citizen and visitor in the region.



Ongoing Steps

- Once the plan is in place the marketing materials can be developed and distributed. TxDOT should implement this recommendation using TxDOT staff time and/or consultant support. This approach will require significant media development and direct outreach so TxDOT media policy regulations will need to be followed.

Program Action 5: The State Should Facilitate Discussions for Private Truck Stop Development or Expansion

Publicly-owned truck parking spaces account for less than 10% of the total capacity in the state. Adding additional publicly-owned truck parking is necessary, but not sufficient, to solve the truck parking problem. The private sector is and will need to continue to build more truck parking capacity in the state, and TxDOT should play a role by better understanding what support they can offer the private sector—whether outreach to communities to help reduce opposition to truck stops, working with truck stop operators to include community-friendly components such as public meeting space or other community assets, or help with permitting needs.

Ongoing Steps

- The outreach conducted as part of this statewide study is a solid foundation to build upon relationships with private sector stakeholders. TxDOT should continue to build those relationships through roundtables with the NATSO, private truck stop operators, and public sector officials to identify ways TxDOT can support development of new or expanded privately-owned truck parking.

  The corridor truck parking plans are a logical way to begin these additional conversations and can include city, county, MPO, and federal partners for support during plan development.

SUMMARY OF ACTIONABLE STEPS FOR ADVANCING TRUCK PARKING PROGRAM STRATEGIES

	TIMING	SUPPORTING AGENCIES	RESOURCES	REGULATORY NEEDS
Action 1) Develop program for on-going parking utilization data collection at TxDOT SRAs and TICs				
Steps				
1. Collect car and truck counts as part of feasibility studies	Short	None	No additional costs (included with site assessments)	None
2. Develop program for ongoing data collection statewide	Short	None	TxDOT staff/ consultant time	None
Action 2) Prepare Corridor Truck Parking Plans				
Steps				
1. Develop work plan templates for conducting corridor truck parking plans	Short	None	TxDOT staff/ consultant time	None
2. Conduct a pilot corridor truck parking plan	Short	Relevant MPOs, municipalities, corridor organizations	TxDOT staff/ consultant time	None
3. Develop Corridor Truck Parking Plans for all the interstates in the State	Short	Relevant MPOs, municipalities, corridor organizations	TxDOT staff/ consultant time	None
4. Develop Corridor Truck Parking Plans for high truck volume, non-interstate corridors in the State	Medium	Relevant MPOs, municipalities, corridor organizations	TxDOT staff/ consultant time	None
Action 3) Include driver outreach in "Don't Mess with Texas" campaign				
Steps				
1. Develop partnership with trucking industry associations	Short	None	TxDOT staff/ consultant time	None
2. Update website with section devoted to truck drivers	Short	None	TxDOT staff/ consultant time	None
3. Develop targeted outreach materials	Short	None	TxDOT staff/ consultant time	None
4. Increase number of trash receptacles at truck parking facilities	Short	None	TxDOT staff/ consultant time	None
5. Provide information and outreach to truck drivers	Ongoing	Texas Dept. of Motor Vehicles	TxDOT staff/ consultant time	None

	TIMING	SUPPORTING AGENCIES	RESOURCES	REGULATORY NEEDS
Action 4) Create a public education campaign on importance of truck parking				
Steps				
1. Develop key topics/themes for outreach, identify markets and distribution channels	Short	None	TxDOT staff/ consultant time	None
2. Produce and distribute outreach material for campaign	Ongoing	None	To be determined	TxDOT media policy
Action 5) Facilitate discussions on developing additional private sector truck parking				
Steps				
1. Discussion/outreach could include roundtables and interviews with the NATSO and other private truck stop operators and continued outreach during *Corridor Truck Parking Plan development*	Ongoing	City, County, MPO, FHWA	TxDOT staff/ consultant time	None

TXDOT LED POLICY/COORDINATION/SUPPORT

Chapter 7 identified six TxDOT led Policy/Coordination/Support strategies. For these strategies, TxDOT should be the lead agency. A description of actionable steps that TxDOT can take to advance these strategies is provided below, followed by a matrix summarizing actions, roles and responsibilities, order of magnitude costs and regulatory implications. Additional detail is available in the **Truck Parking Recommendations and Action Plan Report**.

TxDOT Led Policy Action 1: The State Should Develop Guidelines for Integrating Truck Parking into TxDOT Project Development Guidelines

Coordination and communication between TxDOT departments is critical to ensuring that truck parking needs specifically, and freight needs generally, are identified, considered and funded as part of the project cost if warranted.

In the short-term, the State should:

- **Document a process for how truck parking gets integrated in the project development process.** The TxDOT *Project Development Process Manual* provides guidance to districts,

divisions, and consultants on the process for planning, developing, and designing a project. TxDOT should evaluate each of the major steps in the process for opportunities to incorporate truck parking and freight considerations in general.

TxDOT Led Policy Action 2: The State Should Consider Truck Parking Needs Prior to Purchase or Sale of Right of Way

As TxDOT continues to purchase new right of way, truck parking needs should be considered when expanding existing highways on the THFN or developing new corridors. In addition, prior to the sale of any TxDOT right of way, the location should be checked against truck parking needs to ensure that potential expansion or new development opportunities are not missed.

In the short-term, the State should:

- **Integrate truck parking into the guidelines for acquiring or disposing of right of way.** The TxDOT Right of Way Division is responsible for the acquisition and disposition of right of way within the agency and also provides guidance for local governments in its *Real Estate Acquisition Guide for Local Public Agencies* and its *Local Government Projects Policy Manual*. The State should evaluate procedures within the Division and common practices of local partners to identify steps that could incorporate truck parking considerations.
- **Develop the characteristics of desirable parcels (size, location, truck parking demand, proximity to other parking locations, etc.).** TxDOT should establish characteristics of parcels with potential to alleviate truck parking needs. Defining these attributes is the first step towards implementing a process for ongoing review of parcels for truck parking suitability prior to acquisition or disposal of right of way. Parcel size, nearby truck parking demand or need, highway access, and other factors could be considered.

TxDOT Led Policy Action 3: The State Should Develop Guidelines for Funding Truck Parking Solutions

There are several potential funding sources available for truck parking projects, though many have location requirements or only fund specific types of deployment (such as technology features). TxDOT should develop guidelines on federal, state and local funding sources that can be used to fund truck parking.

In the short-term, the State should:

- **Develop a guidebook for financing truck parking solutions in Texas.** TxDOT can accomplish this recommendation using staff or consultant resources and there are no regulatory concerns noted other than ensuring that identified funding sources can be used for truck parking purposes following established criteria and guidelines for those funds.

TxDOT Led Policy Action 4: The State Should Allow Truck Parking in Auto-Designated Areas in Existing TxDOT Facilities During Off-Hours

The State should conduct feasibility studies on allowing trucks to utilize some of the space reserved for cars during overnight hours. Driver input indicated that some drivers already informally using this space when there is no available truck parking and they are out of HOS, indicating a demand for additional inventory at many locations.

In the short-term, the State should:

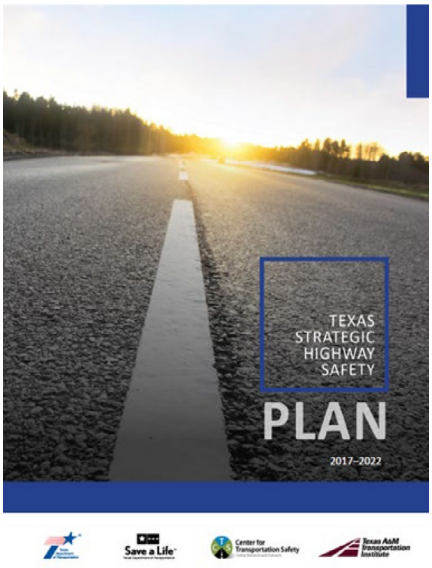
- **Collect car and truck utilization data –** The State should complete truck and car utilization counts at all SRAs and TICs.
- **Conduct site reviews –** The State should conduct site reviews at locations with low car utilization to confirm there are no infrastructure challenges that would restrict truck parking in car areas.
- **Install signage noting allowance of truck parking along with restricted timeframes –** If no impediments are discovered, new signs should be deployed, or existing signs could be modified.

In the medium to long-term, the State should:

The main regulatory concern, raised during outreach to TxDOT's district engineers, was related to a reluctance in asking drivers to move if they are parking outside of the time limits shown for an auto-oriented area.

TxDOT Led Policy Action 5: The State Should Integrate Truck Parking into the Strategic Highway Safety Plan

The State should consider commercial motor vehicles related crashes as a potential area of focus for the SHSP to identify and develop additional mitigation strategies. In addition to improving safety, this may also open safety funding streams for these strategies.



Ongoing Steps

- Texas' current Strategic Highway Safety Plan was completed in 2017 and does not specifically identify truck related crashes as an emphasis area. Future updates, required at minimum every five years, should seek to include trucks as an emphasis area.

TxDOT Led Policy Action 6: The State Should Establish Minimum Required Amenities at Publicly Owned Truck Parking Facilities

The State should include the following basic amenities in all new or renovated truck parking: paved, angled parking and curb space for oversize/overweight vehicles; lighting; flush toilets; trash containers; and enhanced vending machines which could include more nutritious food and drink options, toiletries, small electronics, or medical needs. Wi-Fi should be considered at all rural locations where cellular phone coverage may not be reliable. In some locations additional amenities should be considered, such as a driver lounge, emergency phone/notification system, green space, and security fencing.

In the short-term, the State should:

- The State should consider this policy during the site feasibility studies conducted at high priority truck parking locations and opportunity sites and be implemented to the fullest extent possible as part of future projects.

SUMMARY OF ACTIONABLE STEPS FOR ADVANCING THE TXDOT LED TRUCK PARKING POLICY/COORDINATION AND SUPPORT STRATEGIES

	TIMING	SUPPORTING AGENCIES	RESOURCES	REGULATORY NEEDS
Action 1) Develop guidelines for integrating truck parking into the TxDOT project development process				
Steps				
1. Research and document the steps for TxDOT project development process	Short	None	TxDOT staff/ consultant time	None
2. Work with TxDOT Districts and Divisions, as well as the TxFAC to develop guidelines for integrating truck parking into the project development process	Short	None	TxDOT staff/ consultant time	None
Action 2) Consider truck parking needs prior to purchase or sale of right of way				
Steps				
1. Integrate truck parking into the guidelines for acquiring or disposing of right of way	Short	None	TxDOT staff/ consultant time	None
2. Develop the characteristics of desirable parcels (size, location, truck parking demand, proximity to other parking locations, etc.)	Short	None	TxDOT staff/ consultant time	None

	TIMING	SUPPORTING AGENCIES	RESOURCES	REGULATORY NEEDS
Action 3) Develop guidelines for funding truck parking solutions				
Steps				
1. Develop a guidebook for financing truck parking solutions in Texas	Short	None	TxDOT staff/ consultant time	None
Action 4) Allow truck parking in auto-designated areas in existing TxDOT facilities during off-hours				
Steps				
1. Collect car and truck utilization data (see Program Action 1 above)	Short	None	No additional costs (included with site assessments)	None
2. Conduct site reviews at locations with low car utilization to confirm there are no infrastructure challenges that would restrict truck parking in car areas	Short	None	No additional costs (included with site assessments)	None
3. Deploy any necessary signage	Short	None	TxDOT staff/ consultant time	None
Action 5) Integrate truck parking into the Strategic Highway Safety Plan (SHSP)				
Steps				
1. Consider including trucks as an emphasis area in future SHSP updates	Short	None	TxDOT staff/ consultant time	None
Action 6) Establish minimum required amenities at publicly-owned truck parking facilities				
Steps				
1. Evaluate basic amenities during the site feasibility studies	Short			See above

POLICY/COORDINATION/OUTREACH – TXDOT SUPPORT

Chapter 7 identified five Policy/Coordination/Outreach actions that TxDOT should participate in and support but will not directly lead. Descriptions of the strategies and actions needed to advance these activities are provided below, followed by a matrix summarizing actions necessary for advancing, roles and responsibilities, order of magnitude costs and regulatory implications. Additional detail is available in the **Truck Parking Recommendations and Action Plan Report**.

TxDOT Support Action 1: The State Should Advocate for Truck Parking at Non-TxDOT Public Facilities (Commuter Lots, Bus Depots, Maintenance Lots) During Off-Hours

TxDOT should work with partner agencies and municipalities to identify commuter parking lots, bus depots, or other facilities that could support truck parking during off-hours in high demand areas.

In the short-term, the State should:

- Share results of the truck parking study with MPOs and local agencies
- Include an inventory of key facilities that could be utilized for truck parking during off-hours in corridor truck parking plans

In the medium to long-term, the State should:

In the medium term, studies on potential locations identified during the corridor studies. The feasibility studies would be similar to those that need to be conducted at SRAs with low car utilization prior to allowing trucks to park during off-hours.

TxDOT Support Action 2: The State Should Encourage Shippers/Receivers to Provide On-Site Truck Parking or Contribute to a Common Staging Lot

The private sector should play a role in providing truck parking, particularly shippers/receivers who generate a significant truck parking demand. Requiring shippers/receivers to provide on-site parking or contribute their fair share to the cost of a common parking area will help meet the parking demand and spread the costs.

In the short-term, the State should:

- **Create guidance for next generation logistics parks that include integrated and full-service truck parking facilities –** Truck parking and staging facilities near their customers helps truck drivers maximize their HOS, thereby improving efficiency and profitability and reduces unauthorized parking, enhancing the safety of the roadways for the motoring public.
- **Develop benefit-cost analysis and case studies** to highlight competitive reasons to include truck parking in industrial/commercial development.
- **Develop outreach material** for local agencies, economic development agencies and permitting agencies.

Ultimately local government, supported by MPOs, industrial or economic development agencies and chambers of commerce will need to lead full implementation of this recommendation. TxDOT can provide support through research and knowledge sharing.

TxDOT Support Action 3: The State Should Create Guidance to Help Agencies Include Truck Parking Demand as Part of Traffic Impact Analyses for New Developments

Many local agencies have policies or guidelines in place to evaluate the potential traffic impacts of a proposed development project. State and local agencies that require traffic impact analyses should ensure that their policies and guidelines also require that a proposed project evaluate the potential increase in truck parking demand, and possible impacts on road safety and condition if the parking demand is not met.

In the short-term, the State should:

- Conduct a research project to identify methodologies to estimate the need for truck parking generated by new development.
- Develop guidance to local agencies on how that information can be used as part of a Traffic Impact Analysis for new construction.

TxDOT Support Action 4: The State Should Encourage Commercial/Industrial Property Owners to Provide Truck Parking on Unused Portions of Property

TxDOT could promote or encourage this type of activity throughout the state by bringing together and engaging with property owners, municipalities, economic development agencies, industrial development agencies, and chambers of commerce to highlight the need for and potential economic benefit of this type of truck parking.

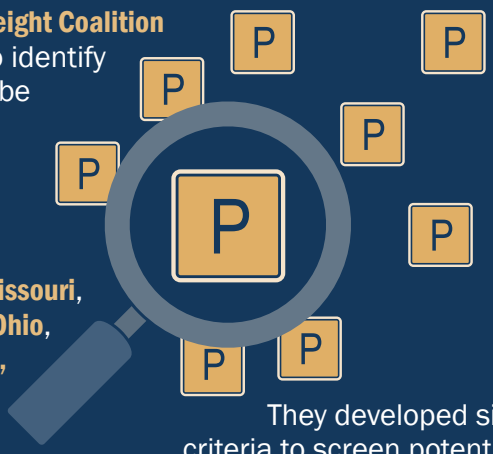
In the short-term, the State should:

- Meet with local agencies and industrial property owners to evaluate the opportunities and constraints of this policy.
- Develop guidelines to assist interested local agencies implement this policy.
- Develop an outreach campaign to industrial property owners that local agencies could use, or that could be integrated into TxDOT's public education campaign.

TxDOT can complete this recommendation using staff time and/or consultant support with no regulatory hurdles. Future development of identified properties for truck parking use may require permitting and regulatory clearances at the local level.

The Mid-America Freight Coalition conducted a study to identify parcels that could be candidates for truck parking development. They developed site criteria to screen potential parcels and identified nearly 40 acres of candidate parcels across three midwestern metropolitan areas.

The **Mid-America Freight Coalition conducted a study** to identify parcels that could be **candidates** for **truck parking development**.



St. Louis, Missouri, Columbus, Ohio, and **Detroit, Michigan**

They developed site criteria to screen potential parcels and **identified** nearly **40 acres** of **candidate parcels** across three midwestern metropolitan areas.

Exhibit 54: Mid-America Freight Coalition Urban Parking Criteria, Comparison of Studied Parcels

CRITERIA	COLUMBUS	DETROIT	ST. LOUIS
Size	21.0 acres	12.15 acres	5.25 acres
Cost per acre	$8,065	$26,532	$6,495
Distance to interstate (straight line)	1.2 miles	0.1 miles	1.0 miles
Distance to city (straight line)	2.6 miles	4.0 miles	5.0 miles
Surface material	Gravel	Concrete, Pavement	Gravel, Vegetation
Electric service	Yes	Yes	Yes
Water/sewer service	No	Yes	Unknown
Fencing	Complete	Partial	Partial
Soil contamination	Not likely	Possible	Likely
Safety	Safer	Safer	Safer
Social impacts	Low	Medium	Low

Source: http://midamericafreight.org/wp-content/uploads/2017/03/MAFC-White-Paper_Truck-Parking-1.pdf.

TxDOT Support Action 5: The State Should Support Development of a Mobile Application (App)

TxDOT should encourage and support private development of a mobile application (app) that will show drivers where public and private urban parking is allowed and any applicable time restrictions. The private app could also show availability and/or include a reservation system.

In the short-term, the State should:

- Research and share related industry best practices and other state DOT activities and integrate into the above policy to encourage commercial/industrial property owners to provide truck parking on unused portions of property.

SUMMARY OF ACTIONAL STEPS FOR ADVANCING TXDOT SUPPORTED POLICY, COORDINATION AND OUTREACH TRUCK PARKING STRATEGIES

	TIMING	SUPPORTING AGENCIES	RESOURCES	REGULATORY NEEDS
Action 1) Advocate for truck parking at non-TxDOT public facilities (commuter lots, bus depots, maintenance lots) during off-peak hours				
Steps				
1. Share results of the truck parking study with MPOs and local municipalities	Short		TxDOT staff	None
2. As part of the Corridor Truck Parking plans, include an inventory of key facilities that could be utilized for truck parking during off-hours	Short	Relevant MPOs, municipalities, transit agencies	TxDOT staff/ consultant time	None
3. Conduct site feasibility studies on high potential locations	Medium	Relevant MPOs, municipalities, transit agencies	TxDOT staff/ consultant time	None
Action 2) Encourage shippers/receivers to provide on-site truck parking or contribute to in a common staging lot				
Steps				
1. Create guidance for next generation logistics park that include integrated and full-service truck parking facilities	Short	Industrial and economic development agencies	TxDOT staff/ consultant time	None
2. Develop benefit-cost analysis and case studies to highlight competitive reasons to include truck parking in industrial/commercial development	Short	Industrial and economic development agencies	TxDOT staff/ consultant time	None
3. Develop outreach material for local municipalities and permitting agencies	Short	Industrial developers, local municipalities	TxDOT staff/ consultant time	None
Action 3) Create guidance to help municipalities include truck parking demand as part of Traffic Impact Analyses for new developments				
Steps				
1. Conduct a research project to develop methodologies for estimating demand for truck parking, staging, and queuing at shippers and receivers.	Short	Industrial developers, local municipalities	TxDOT staff/ consultant time	None
2. Develop guidance to local municipalities on how that information can be used as part of a Traffic Impact Analysis for new construction	Short	Industrial developers, local municipalities	TxDOT staff/ consultant time	None

	TIMING	SUPPORTING AGENCIES	RESOURCES	REGULATORY NEEDS
Action 4) Encourage commercial/industrial property owners to provide truck parking on unused portions of property				
Steps				
1. Meet with local municipalities and industrial property owners to evaluate the opportunities and constraints of this policy	Short	Local municipalities, industrial property owners	TxDOT staff/ consultant time	None
2. Develop guidelines to assist interested local municipalities deploy this policy	Short	Local municipalities, industrial property owners	TxDOT staff/ consultant time	None
3. Develop an outreach campaign to industrial property owners that local municipalities could use, or that could be integrated into TxDOT's public education campaign	Short	Local municipalities	TxDOT staff/ consultant time	None
Action 5) Support development of a mobile application (app) that connects property owners desiring to rent unused space, to truck drivers needing parking				
Steps				
1. Research and share related industry best practices and other state DOT activities	Short	Technology companies	TxDOT staff/ consultant time	None
2. Integrate into the policy: Encourage commercial/industrial property owners to provide truck parking on unused portions of property	Short	Local municipalities	TxDOT staff/ consultant time	None

ACTIONS FOR ADVANCING INFRASTRUCTURE STRATEGIES TO ENHANCE, EXPAND AND ADD TRUCK PARKING CAPACITY

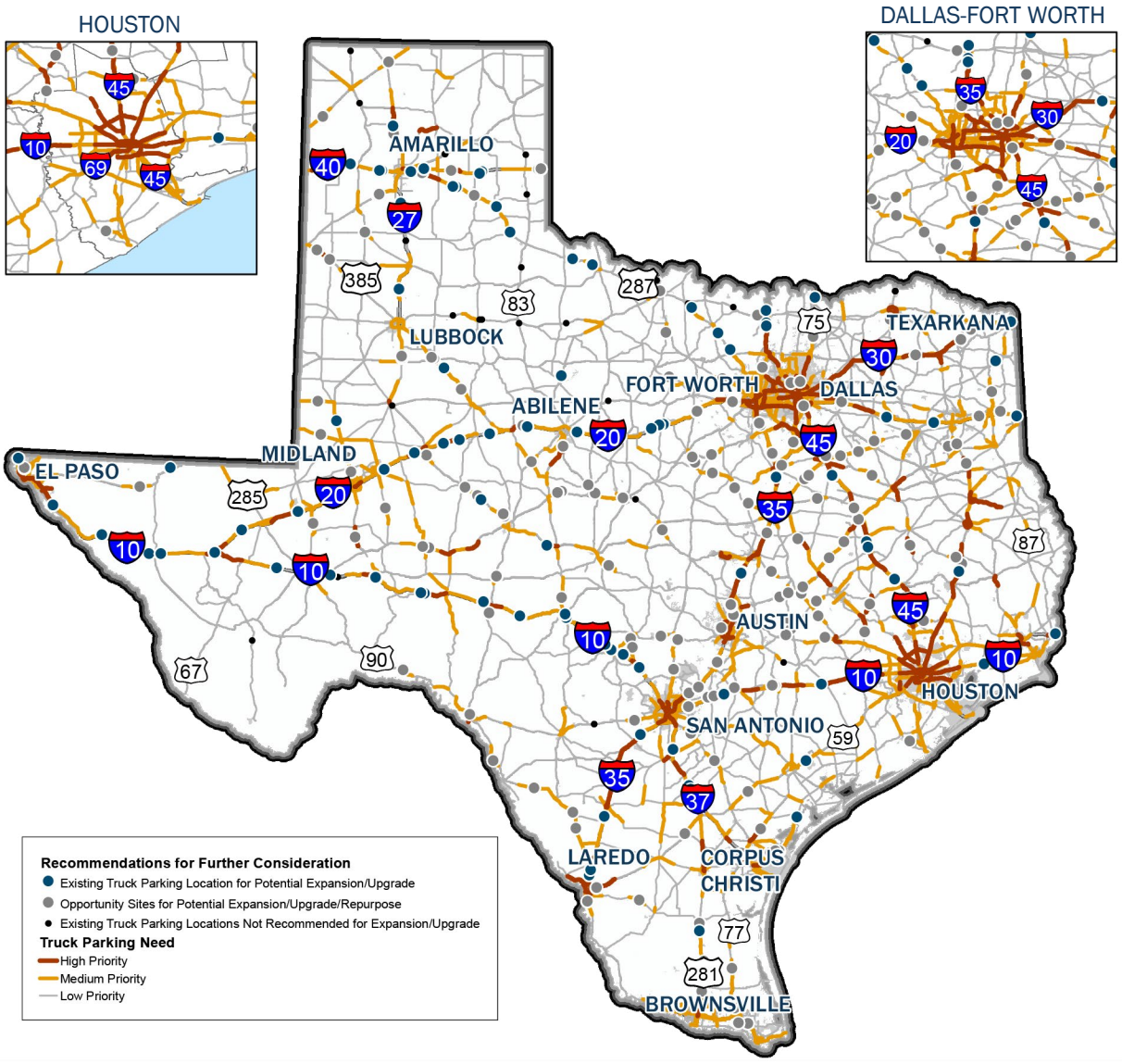
Actions for advancing the strategies for improving and adding truck parking spaces to Texas' inventory are summarized below. A matrix that identifies timing, roles and order of magnitude costs follows the descriptions. Additional detail can be found in the **Truck Parking Recommendations and Action Plan Report.**

Infrastructure Action 1: The State Should Add Capacity on TxDOT Right of Way by Expanding and Upgrading Truck Parking at Existing Public Facilities; and Build Dedicated Truck Parking Facilities

These strategies utilize existing TxDOT right of way, and in many cases have existing built environment such as ramps, access roads, paved parking, structures, utilities, and landscaping available to expand and/or upgrade truck parking capacity in Texas. Descriptions of actionable steps for each strategy, including location specific recommendations and illustrative examples, are provided below.

Exhibit 55 highlights 140 existing TxDOT maintained facilities and 32 opportunity sites that have been identified for consideration for expansion and/or upgrade or converted to dedicated truck parking. Some of these sites are existing facilities, while other are "opportunity" sites such as closed facilities or weigh stations. The process and criteria used to identify these sites is described in the **Truck Parking Recommendations and Action Plan Report**, and a table listing these sites can be found in **Appendix A** of the same report. Examples of specific sites are profiled as illustrative examples as part of the discussion on short-term strategies. The State should conduct feasibility studies to examine the possibility of expanding these 32 sites. Analyses of these sites must be conducted to identify specific opportunities and challenges at each location that would help determine priorities and appropriate phasing of projects.

Exhibit 55: Locations for Expanding or Upgrading TxDOT Truck Parking Facilities



Source: Analysis by Cambridge Systematics, 2019.

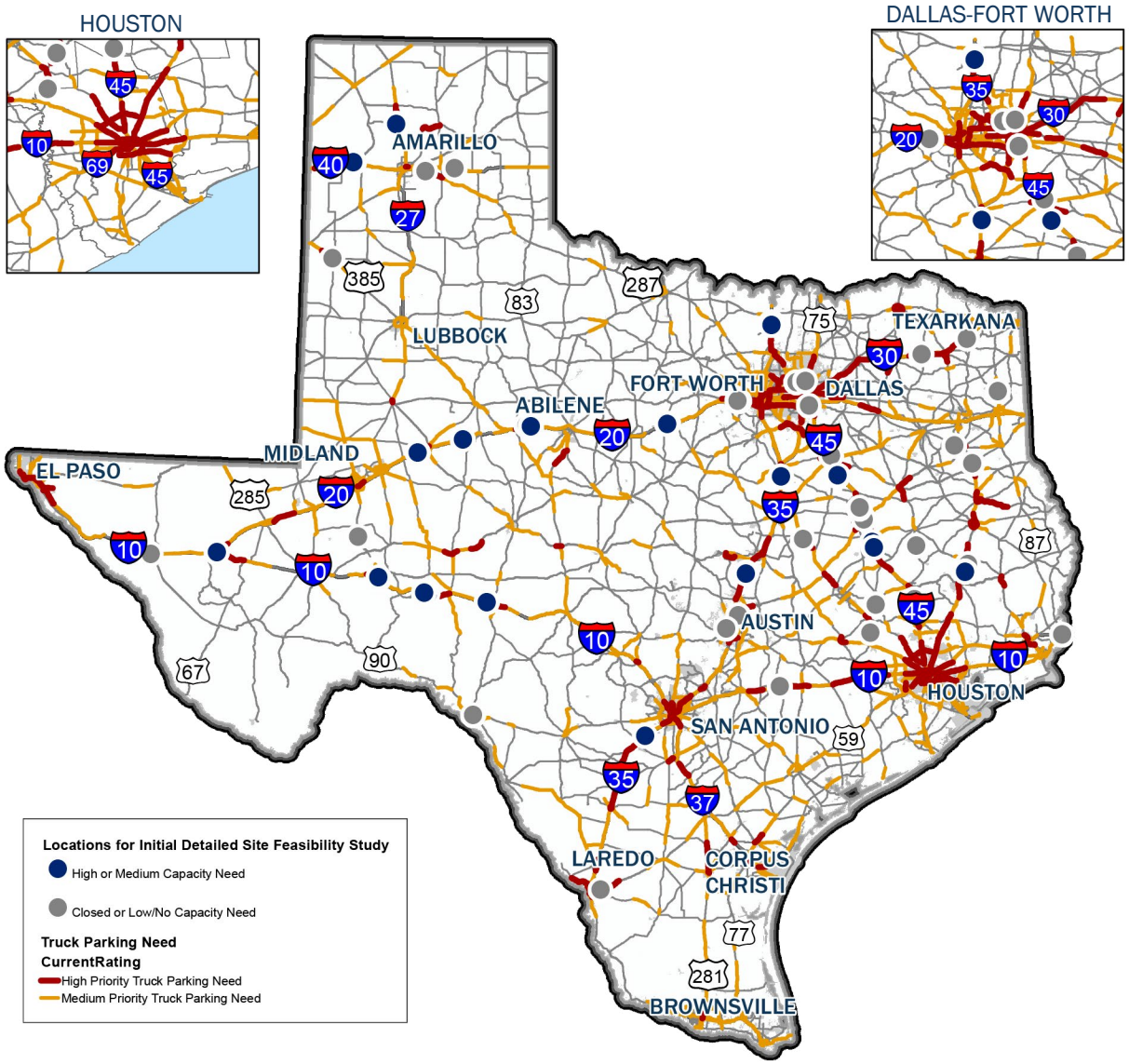
In the short-term, the State should:

- **Conduct detailed feasibility assessment at the highest priority sites –** The State should conduct more detailed site feasibility analysis to determine if an upgrade and/or expansion of truck parking is feasible. Twenty locations are rated as having "high" or "medium" capacity needs[18] and are located on a high need segment. A second set of 56 "medium" priority locations are those that are rated as having a "low" current capacity need or are an opportunity site, but they are located on segments with a high future need. Exhibit 56 displays the highest priority locations along with medium priorities. A listing of these sites can be found in **Appendix A of the Truck Parking Recommendations and Action Plan Report**.

  The site feasibility analysis is required to better understand local conditions such as presence of or lack of utilities, surrounding land use regulations and property ownership, exact right of way constraints, actual utilization, and other issues that may make a recommendation unfeasible. Recommendations, conceptual plans, and cost estimates are needed for each site that is deemed feasible for improvements. Supporting agencies that may need to be involved in the feasibility assessments would be the local city, county and MPO. No regulatory needs are anticipated for this action.

[18] Based on truck parking utilization analysis at peak hour (1-2 A.M.). High capacity need locations have an utilization rate over 80 percent, medium capacity need locations have a utilization rate between 30 and 80 percent.

Exhibit 56: Priority Locations for Detailed Feasibility Analysis



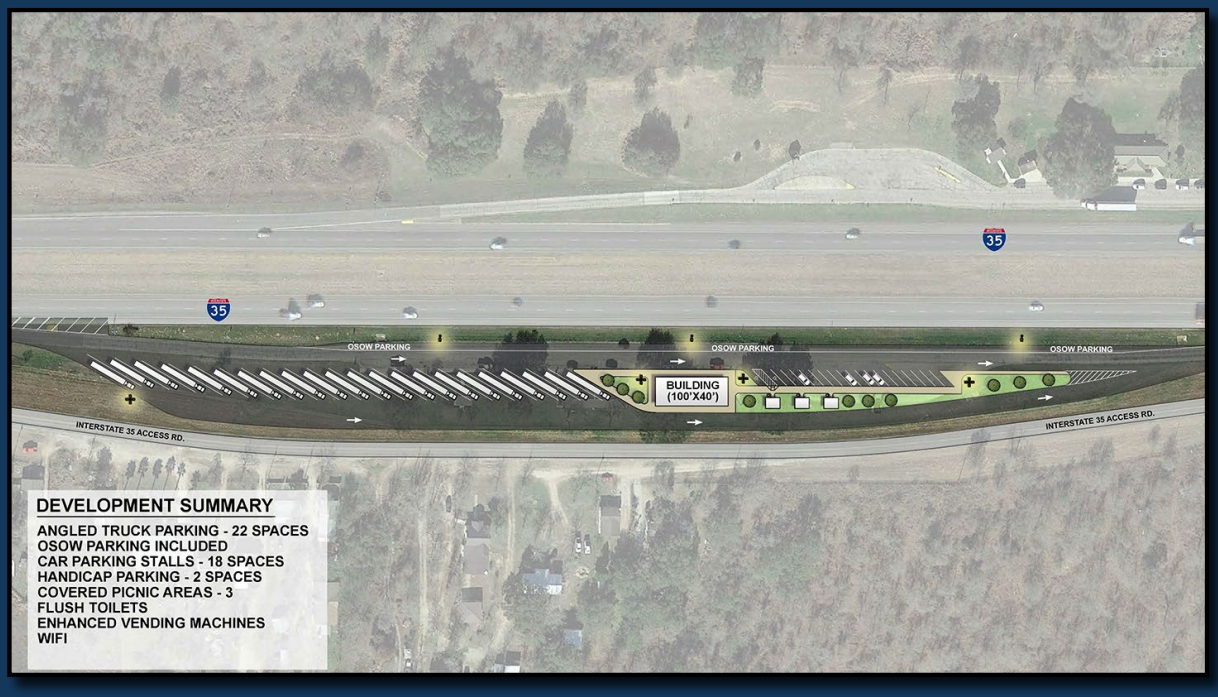
Source: Analysis by Cambridge Systematics, 2019.

- **Design a pilot project for each of the 3 facility types –** The State should advance pilot projects to refine the costs and actions, identify the risks, and demonstrate dedication to implementing the following types of projects: upgrade an existing TxDOT truck parking facility, repurpose a TxDOT facility to a dedicated truck parking facility, and repurpose a closed SRA to a dedicated truck parking facility.

ILLUSTRATIVE EXAMPLES OF EXPANDING AND UPGRADING EXISTING TXDOT TRUCK PARKING FACILITIES

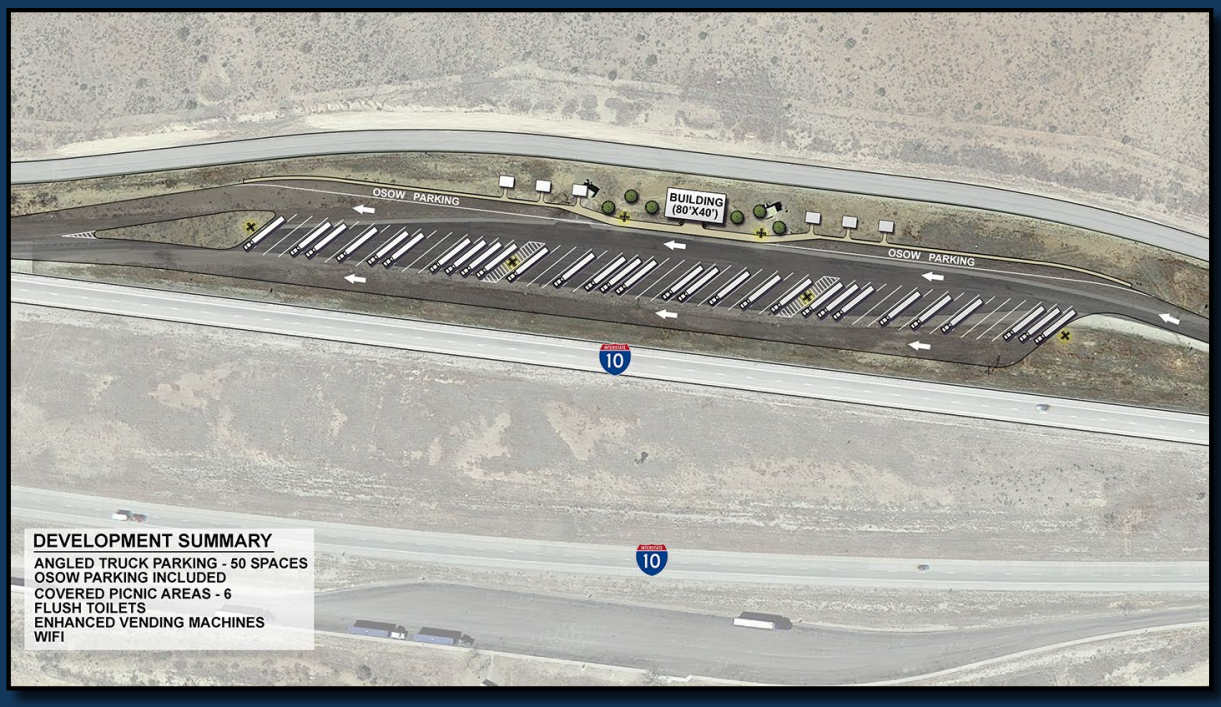
(All timeframes and cost represent planning level estimates to be refined during site feasibility studies)

1. Medina County Safety Rest Area: Example of Expanding and Upgrading an Existing SRA – Est. $2,420,000
    a. Site survey: 2-3 months
    b. Detailed site design: 8-10 months
    c. Environmental clearance (if necessary): 6-12 months, TCEQ coordination: 3 months
    d. Right of way review: 1-2 months
    e. Right of way purchase (if necessary): 8-12 months
    f. Utilities examination: 4-6 months
    g. Permitting: 8-12 months depending on location
    h. Construction: 8-14 months



Source: Schematics developed by Atkins in consultation with Cambridge Systematics.

2. Fort Davis Picnic Area: Example of Repurposing an Existing Picnic Area to a Dedicated Truck Parking Facility – Est. $3,260,000
   a. Site survey: 2-3 months
   b. Detailed site design: 10-12 months
   c. Environmental clearance (if necessary): 6-12 months, Texas Commission on Environmental Quality (TCEQ) coordination: 3 months
   d. Right of way review: 1-2 months
   e. Right of way purchase (if necessary): 8-12 months
   f. Utilities examination: 4-6 months
   g. Permitting: 8-12 months depending on location
   h. Construction: 10-16 months



Source: Schematics developed by Atkins in consultation with Cambridge Systematics.

3. Hopkins County Safety Rest Area: Example of Repurposing a Closed SRA to a Dedicated Truck Parking Facility – Est. $2,008,000
    a. Site survey: 2-3 months
    b. Detailed site design: 8-10 months
    c. Environmental clearance (if necessary): 6-12 months, TCEQ coordination: 3 months
    d. Right of way review: 1-2 months
    e. Right of way purchase (if necessary): 8-12 months
    f. Utilities examination: 4-6 months
    g. Permitting: 8-12 months depending on location
    h. Construction: 6-12 months

Source: Schematics developed by Atkins in consultation with Cambridge Systematics.

In the medium to long-term, the State should:

Address all of the high priority areas by completing a detailed feasibility assessment, design and construction of the balance of the priority projects. Assuming an average of $4 million per site, the cost of addressing the low to medium priority locations identified for upgrading and expanding would be $480 million.

Infrastructure Action 2: The State Should Build Dedicated Truck Parking Facilities (Acquire New TxDOT Right of Way)

Ideally, TxDOT's ability to expand and upgrade existing truck parking locations to both provide more inventory and make the location more appealing to drivers will limit the need for new greenfield development which is likely to be more expensive and face more regulatory hurdles. However, there are 21 areas throughout the state where new, dedicated truck parking is needed but there are no existing or recently closed (or closing) facilities that can be expanded or converted, as shown in Exhibit 57. A list of these areas can be found in **Appendix C of the Truck Parking Recommendations and Action Plan Report**. In this case, the State should develop a new truck parking facility. The exact size, design, and level of amenities could vary greatly depending on need, ranging from a small truck parking facility with minimal amenities to a large state-of-the-art truck-only parking facility with a full suite of enhanced amenities.

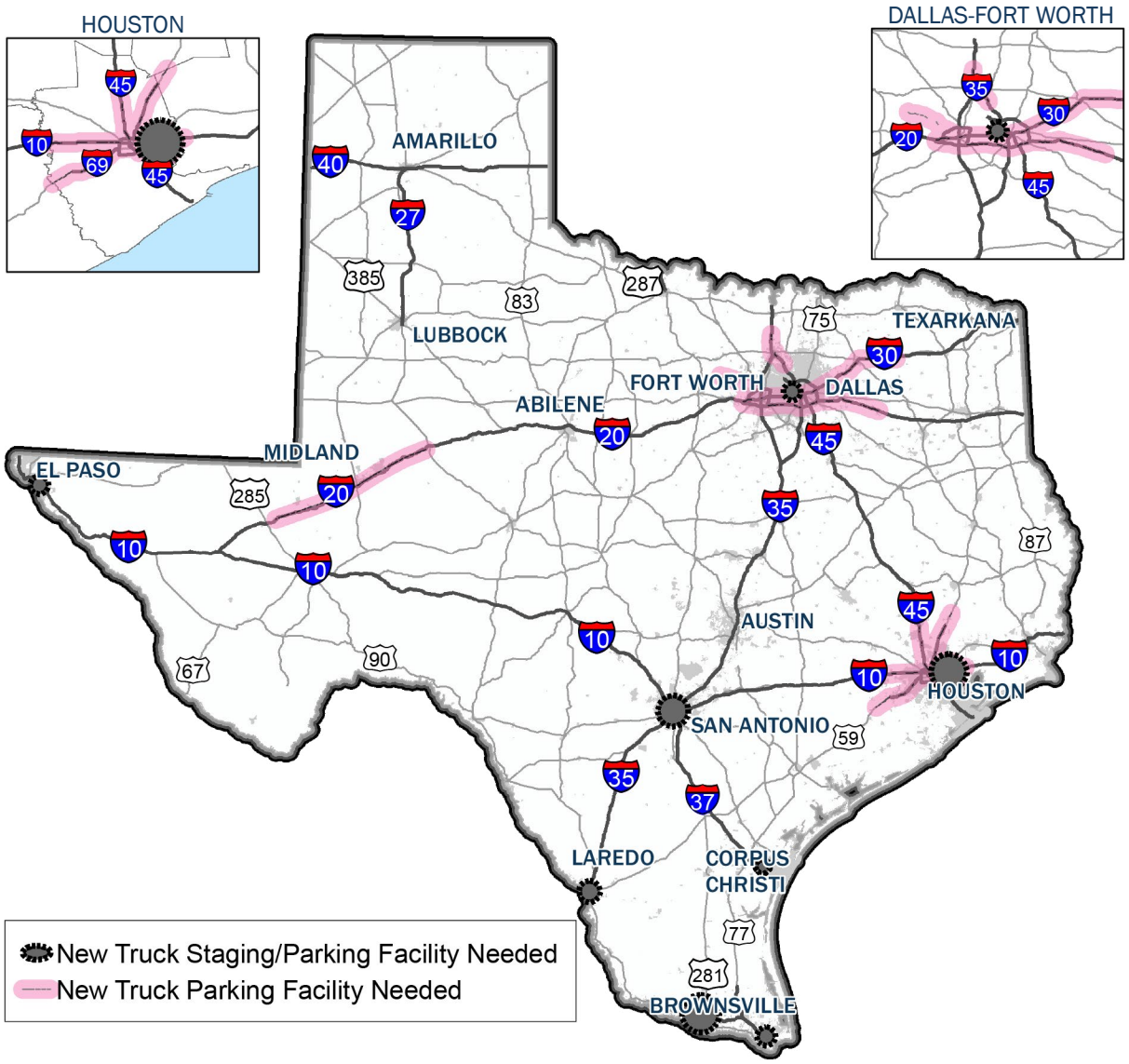
In the short-term, the State should:

- **Identify potential sites and conduct site feasibility assessments and make recommendations**

  The State should conduct feasibility assessments for the pink shaded areas in Exhibit 57 which represent corridor segments where new truck parking facilities are needed, and the gray shaded circles which indicate approximate areas in those corridors where new truck staging/parking facilities are needed near shippers and receivers, ports, and border crossings. These areas do not have proximate existing open or closed (or closing) facilities that could be expanded to fulfill truck parking needs and are located primarily in high priority segments, and medium priority segments that are surrounded by high priority segments.

  The State should conduct a detailed analysis to identify potential sites for a dedicated truck parking facility adjacent to a highway and sized according to the demand in the area. After selecting a preferred site, recommendations, conceptual plans, and cost estimates can be developed. Supporting agencies that may need to be involved in the site identification and feasibility assessments would be the local city, county and MPO, as well as FHWA. No regulatory needs are anticipated for this action.

Exhibit 57: Areas in Need of New Truck Parking Facilities



Source: Analysis by Cambridge Systematics, 2019.

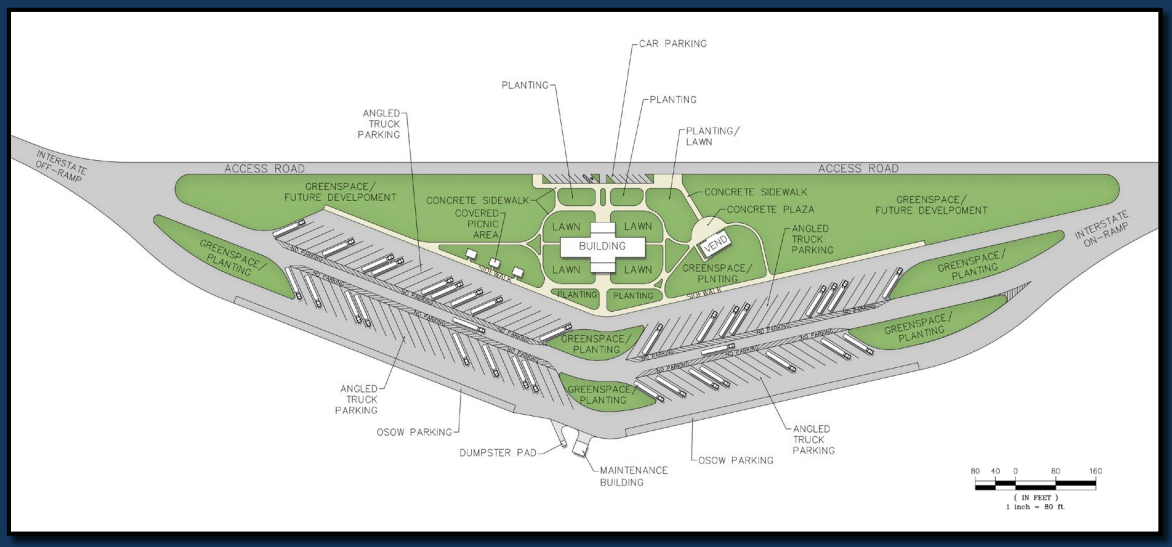
In the medium to long-term, the State should:

- **Design and construct a pilot project for a large facility adjacent to an Interstate** – There are two general types of facilities: new dedicated truck parking facility (adjacent to a highway), and new urban staging lot. Given that a new facility will require additional planning and environmental work, these strategies are medium and long term.

  The State should consider priority projects for design and construction in the medium term. Assuming 4 sites, the cost could be approximately $60 million. Beyond the next 10 years, construction of the remaining 15 sites could cost approximately $225 million.

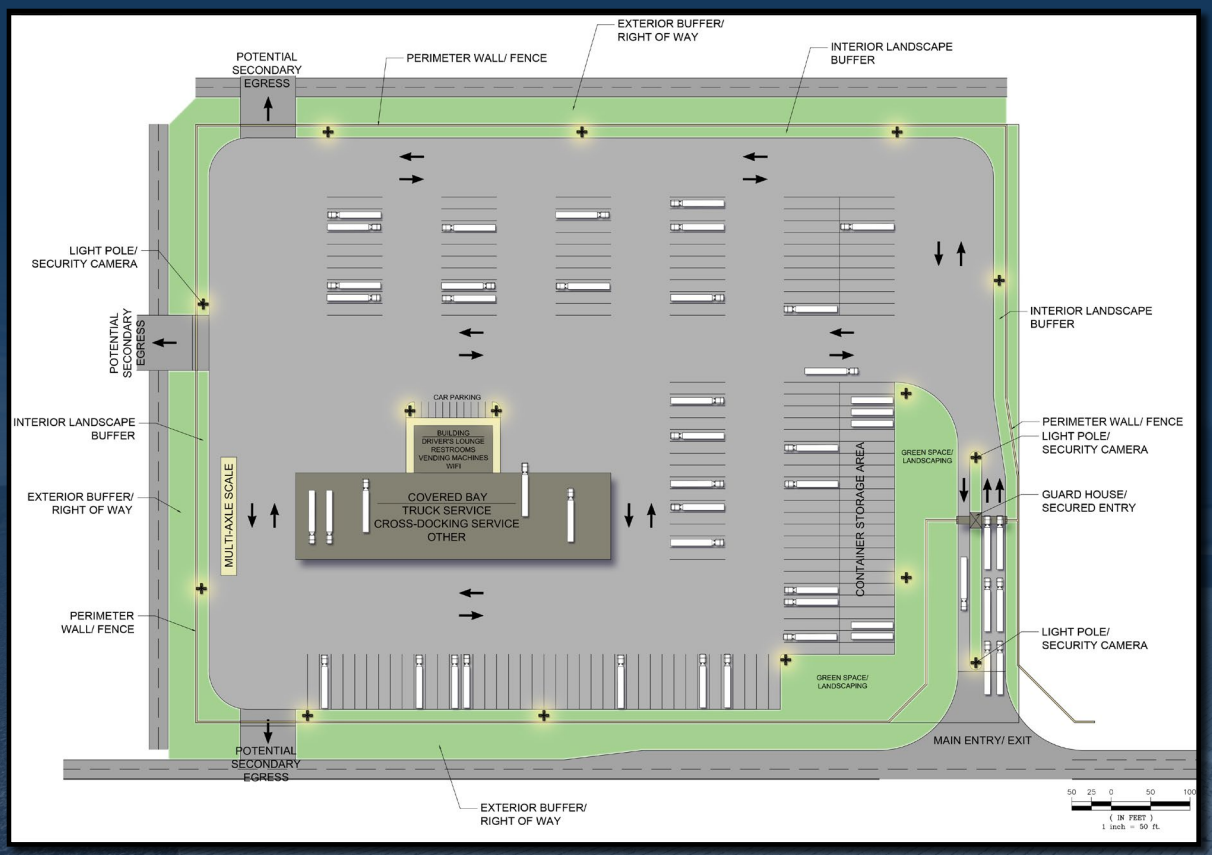
ILLUSTRATIVE CONCEPTS FOR NEW TRUCK PARKING FACILITIES

1. New Dedicated Truck Parking Facility (Adjacent to a Highway) – Est. $9,370,000.00
   a. Site survey: 2-3 months
   b. Detailed site design: 12-18 months
   c. Environmental clearance: 6-12 months, TCEQ coordination: 3 months
   d. Right of way review: 1-2 months
   e. Right of way purchase (if necessary): 8-12 month
   f. Utilities examination: 4-6 months
   g. Permitting: 8-12 months depending on location
   h. Construction: 12-18 months



Source: Schematics developed by Atkins in consultation with Cambridge Systematics.

2. New Urban Staging Lot – Est. $20, 508,000.00
    a. Site survey: 3-4 months
    b. Detailed site design: 12-16 months
    c. Environmental clearance: 6-12 months, TCEQ coordination: 3 months
    d. Right of way review: 1-2 month
    e. Right of way purchase (if necessary): 12-16 months
    f. Utilities examination: 6-10 months
    g. Permitting: 10-12 months depending on location
    h. Construction: 12-18 months



Source: Schematics developed by Atkins in consultation with Cambridge Systematics.

SUMMARY OF ACTIONABLE STEPS FOR ADDING TRUCK PARKING CAPACITY ON TXDOT RIGHT OF WAY

	TIMING	SUPPORTING AGENCIES	RESOURCES	REGULATORY NEEDS
Action 1) Expand and upgrade truck parking at existing TxDOT maintained facilities or within existing TxDOT right of way				
Steps				
1. Identify and prioritize range of potential sites for feasibility assessment	Complete	None	None	None
2. Conduct site feasibility assessment and recommendations at priority sites	Short	City, County, MPO	TxDOT staff/ consultant time	None
3. Conduct site feasibility assessment and recommendations at the remaining proposed sites	Short or Medium	City, County, MPO	TxDOT staff/ consultant time	None
4. Prioritize recommended sites for improvement	Short	City, County, MPO	TxDOT staff/ consultant time	None
5. Design pilot project for each of the 3 facility types (SRA, Picnic Area and New Facility)	Short	City, County, MPO, FHWA	$10 million	Environmental reviews, permitting
6. Design and construct priority projects (assume 20 sites)	Medium	City, County, MPO, FHWA	$80 million	Environmental reviews, permitting
7. Design and construct balance of projects (assume 120 sites)	Long	City, County, MPO, FHWA	$480 million	Environmental reviews, permitting
Action 2) Build dedicated TxDOT maintained truck parking facilities				
Steps				
1. Identify potential sites and conduct site feasibility assessment and recommendations	Short	City, County, MPO	TxDOT staff/ consultant time	Right of way
2. Prioritize recommended sites for improvement	Short	City, County, MPO	TxDOT staff/ consultant time	None
3. Design and construct a pilot project for large facility adjacent to an Interstate	Medium	City, County, MPO, FHWA	$10 million	Environmental reviews
4. Construct priority projects (assume 4 sites)	Medium	City, County, MPO, FHWA	$60 million	Environmental reviews, right of way, permitting
5. Construct balance of projects (assume 15 sites)	Long	City, County, MPO, FHWA	$225 million	Environmental reviews, right of way, permitting

SUMMARY AND NEXT STEPS

The development of the Statewide Truck Parking Study is a first-of-its-kind for Texas and represents a significant implementation milestone for the 2018 TFMP. This Study builds on the strong foundation of the 2018 TFMP by updating and supplementing the data, tools, processes and approaches to lay the groundwork for the challenging job ahead. The Study also had an unprecedented level of stakeholder engagement and was guided by the trucking industry and the TxFAC. The study reaffirms Texas' truck parking challenges and puts forth investment strategies and policies needed to address them.

Continued Collaboration

Advancing the recommendations from the Statewide Truck Parking Study will only be successful with the participation and collaboration of all public and private sector users and owners of the transportation system. TxDOT has an important role to play in maintaining and expanding the state's truck parking infrastructure but ninety percent of the existing truck parking capacity is owned and operated by the private sector. Therefore, TxDOT cannot be solely responsible for moving all the policy, program and project recommendations forward. These recommendations can only become actionable with strong coordination and cooperation with industry stakeholders, as well as with other public agencies, such as federal, other state agencies, Metropolitan Planning Organizations, cities and counties and other entities. TxDOT will continue to convene the TxFAC, the Border Trade Advisory Committee, the Port Authority Advisory Committee and engage other stakeholders in advancing the recommendations from this effort.

Balanced Approach

The state must be prepared to address the increase in freight and truck traffic that accompany population, economic and international trade growth. The Statewide Truck Parking Study identifies a balanced, comprehensive approach that the state can follow in order to meet the needs of the trucking and freight industry and maintain its position as a global trade hub.

The Statewide Truck Parking Study highlights the importance of safe, reliable truck parking to the economy, highway safety and quality of life in Texas. Truck parking considerations need to be taken into account during the project development process to ensure the future safe and efficient movement of freight. Furthermore, the truck parking needs of Texas are dynamic, and the programs and priorities outlined in the Statewide Truck Parking Study will need to be amended or updated regularly to adapt to changes and adjust priorities as may be appropriate.

Key to Meeting Texas' Truck Parking Challenges

Addressing truck parking needs must be a coordinated public-private effort and include improvements discussed in the study as well as the initiation of new statewide programs and policies. Current and future efforts should focus on:

1. **Policy and Program Recommendations:** The State should take short- and medium-term actions to fully advance truck parking policy and program recommendations outlined in the Statewide Truck Parking Study.

2. **High priority Truck Parking Capacity Investments:** The State should undertake near-term expansion and upgrading of truck parking facilities in the highest need areas.

3. **Low and Medium Truck Parking Capacity Investments:** The State should undertake:

    - Advancement of feasibility studies for the medium and low need truck parking facilities located on high need highway segments.
    - Monitoring the remaining facilities to ensure changing truck parking needs are met without the need for a complete update of the Statewide Truck Parking Study.
    - Ensuring that the Unified Transportation Program (UTP) project prioritization incorporates truck parking safety and congestion considerations.
    - Outlining how to advance the truck parking projects through project development and implementation.
    - Identifying potential funding sources to pay for needed investments in truck parking infrastructure.
    - Focusing efforts at the corridor, border, energy production regions, district and MPO levels on identifying and addressing truck parking needs.

These steps are crucial to addressing truck parking needs and impacts in Texas and advancing TxDOT's commitment to support a safer highway system, continued economic growth and development, and quality of life of all Texans.

Texas
Department
of Transportation

PLANNING COMMISSION – JUNE 1, 2021 – 6:00PM

Zoom Meeting

Applicant/Owner: Brad Peck, Love's Travel Stops & Country Stores, Inc.

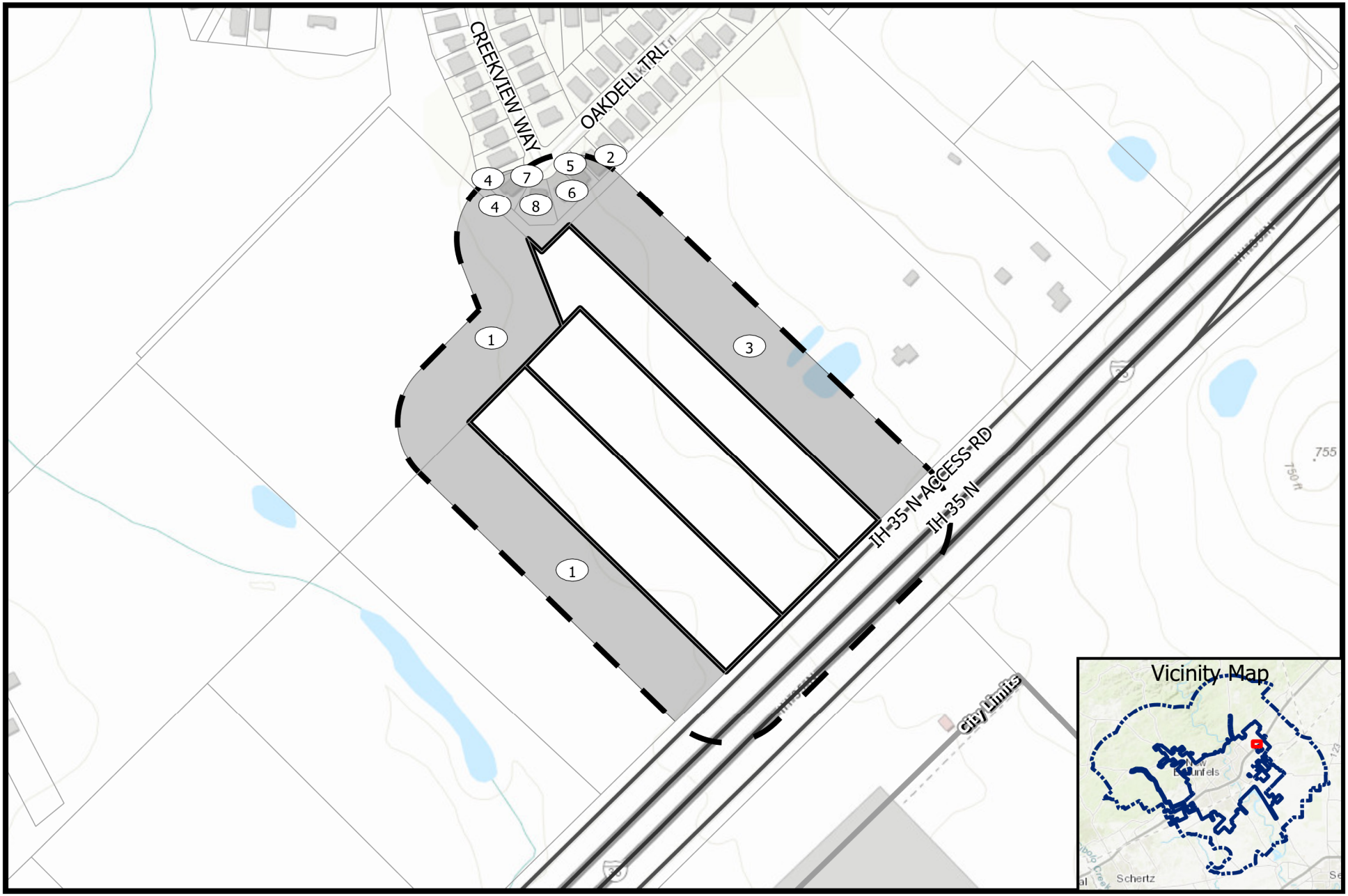
Address/Location: 4001, 4023, & 4165 IH 35 N Access Road

PROPOSED SPECIAL USE PERMIT – CASE #SUP21-123

The circled numbers on the map correspond to the property owners listed below. All information is from the Appraisal District Records. The property under consideration is marked as "Subject Property".

1. TURNER MICHAEL SCOTT
2. HALUZAN JANICE S & RON
3. HOOVER RONALD C
4. OAK CREEK ESTATES MASTER COMMUNITY INC
5. MCCLEARY DAVID M TRUST & LORENA L MCCLEARY TRUST
6. WASIM ANTON & KYRA
7. NICHOLS BRYAN S & ANNA M TAPIA
8. WIGINTON JAMES D & BEATRICE

SEE MAP



SUP21-123

Special Use Permit to allow for Truck Stop

0 210 420 Feet

N

DISCLAIMER: This map and information contained in it were developed exclusively for use by the City of New Braunfels. Any use or reliance on this map by anyone else is at that party's risk and without liability to the City of New Braunfels, its officials or employees for any discrepancies, errors, or variances which may exist.

Path:
\\chfs-1\Departments\Planning\ZBA\2021 Cases\Z-18-004 Tolbert\2021\NPH\Z18-004.aprx

Source: City of New Braunfels Planning
Date: 5/11/2021

City of New Braunfels

Planning Commission Agenda Item Report

550 Landa Street
New Braunfels, TX

6/1/2021

Agenda Item No. F)

PRESENTER:
Applicant: James Ingalls, INK Civil
Owner: Gary Henry

SUBJECT:
SUP21-126 Public hearing and recommendation to City Council regarding a proposed rezoning to apply a Type 2 Special Use Permit to adopt a site plan and establish development standards for an RV Resort on approximately 29 acres consisting of Lot 1D-R Walnut Heights Subdivision and approximately 25 acres out of the J. M. Veramendi A-2 Survey, located in the 700 block of N. Walnut Avenue.

DEPARTMENT: Planning and Development Services

COUNCIL DISTRICTS IMPACTED: Council District 1

BACKGROUND INFORMATION:

Applicant: James Ingalls, P.E.
INK Civil
2021 Highway 46 West
New Braunfels, TX 78132
(830) 358-7127 jamesingalls@ink-civil.com

Owner: Gary Henry
Liberty Partnership
604 N. Hickory Avenue
New Braunfels, TX 78130

Developer: Stuart Blythin
431 N. Hickory
New Braunfels, TX 78130
blythinstuart@gmail.com

Staff Contact: Holly Mullins
(830) 221-4054 hmullins@nbtexas.org

The subject property is located west of North Walnut Avenue, between the two sets of Union Pacific railroad tracks and adjacent to Dry Comal Creek. It consists of approximately 29 acres, zoned as follows:

- 18.5 acres zoned M-1 Light Industrial (unplatted);
- 5 acres zoned R-2 Single and Two-family (unplatted); and
- 5 acres of C-1 Local Business District (Lot 1D-R Walnut Heights plus 0.384 acres unplatted)

Most of the property sits over 750 feet from Walnut Avenue, and over 50% of it (approximately 16 acres) is

located within the floodway and/or 1% annual chance floodplain. These conditions limit development options for retail uses where high visibility is important, and for permanent residential or commercial structures in the flood prone areas.

In February 2021, City Council approved a Type 1 Special Use Permit (SUP) to allow the proposed use of the property as an RV resort/park with the stipulation that the applicant return with a detailed site plan and flood study for consideration of a Type 2 SUP.

This Type 2 SUP request includes a site plan, flood study and development standards proposed to address concerns from the Type 1 SUP. The applicant's proposed development standards include:

- A maximum of 180 RV pad sites with no long-term stays exceeding 6 months.
- All ingress/egress is from Walnut Avenue. The Bavarian Drive access will be gated for emergency use only.
- Proposed quiet hours are 10 pm to 6 am. The developer states no noise may leave the campsite during quiet hours. Music and TV must be inaudible to other campers. He will also enforce a reasonable level for music and TV during non-quiet hours.
- A portion of the Dry Comal Creek hike and bike trail is being constructed with the development, and once a connection is built extending it beyond this property the trail will be open for public use.
- A minimum 6-foot tall masonry wall will be constructed adjacent to residential and multifamily use where outside the floodplain. Within the floodplain, a vegetative buffer is proposed (see waiver request). No buffer is required in the floodway where permanent obstructions, including fences and landscaping, are not permitted.

Waiver Request:
The Zoning Ordinance requires a residential buffer, consisting of a 6 to 8-foot masonry fence and the planting of trees, where non-residential development is adjacent to single or two-family use or zoning. The applicant is requesting a waiver to allow a vegetative buffer in lieu of a solid fence/wall for the portion of the property boundary within the floodplain.

The current site plan shows the vegetative buffer along five properties on Creek Drive south of Bavarian Drive; however, only one of the five appears to be within the 1% annual chance (100-year) floodplain.

The residential buffer requirement in the Zoning Ordinance includes a process whereby adjacent property owners may decline the masonry wall or accept other fence types (Masonry Wall Objection). The applicant has not indicated this process was discussed with the adjacent owners, nor provided specific details on the proposed landscape buffer (plant type, size, etc.).

If this waiver is approved, conditions may be included for height, density and speed of growth of the vegetative buffer to ensure an adequate noise and visual barrier at the time of planting. Any conditions will be reviewed for compliance during the plan review and building permitting process. For lots outside the floodplain/floodway, staff recommends meeting the ordinance requirement by providing the solid fence/wall and tree plantings or Masonry Wall Objection form from adjacent property owners.

The residential buffer is the only deviation being requested with this SUP. All other aspects of the development will meet code standards, including but not limited to zoning, building, drainage, and floodplain, as well as supplemental standards for RV parks (tourist courts) in Appendix B of the code of ordinances.

The City's Public Works Department performed a preliminary review of the flood study submitted by the

applicant. A full compliance review will be made with the floodplain development/commercial building permit for the RV resort if this SUP is approved. Note that minor revisions to the site plan could be required with the floodplain development permit once grading and detailed engineering plans are submitted.

Due to the location in a flood prone area, staff recommends the developer make flash flood information and an evacuation map available to guests.

Surrounding Zoning and Land Use:
North - Across railroad, M-1, R-3/ Commercial, Multifamily
South - R-2, R-3, C-1/ Multifamily, Single-family residences
East - Across Walnut, M-1/ Commercial
West - M-1/ Undeveloped

ISSUE:
The subject property is currently zoned:
C-1 Local Business District, intended for professional offices, retail and light commercial uses which are suitable in close proximity to residential neighborhoods.
M-1 Light Industrial District, intended for light manufacturing, warehousing, research and development and other operations that do not depend on frequent customer visits, but may involve medium to heavy truck traffic for equipment deliveries and product shipping. It is generally located on major thoroughfares or railroad lines.
R-2 Single and Two-family District, intended for residential development.

Given the irregular shape of the property, its limited access and floodplain constraints, the applicant chose a Special Use Permit rather than rezoning the entire 29 acres to a district that allows RV parks by right (C-1B or MU-B). With the SUP, City Council can add conditions to the use to achieve compatibility with surrounding land uses and neighboring properties. The use of the property as an RV park/resort was approved by City Council in February, with this Type 2 SUP as an added requirement to ensure compatibility with surrounding land uses and flood-related issues.

This site takes access from Walnut Avenue, a principal arterial. The proposed RV resort provides a use where the few permanent structures can be located outside the floodway/floodplain while allowing use and enjoyment of the majority of the property. The proposed SUP is consistent with the following actions from Envision New Braunfels:

- Action 1.3: Encourage balanced and fiscally responsible land use patterns.

- Action 1.6: Incentivize infill development and redevelopment to take advantage of existing infrastructure.
- Action 1.14: Ensure regulations do not unintentionally inhibit the provision of a variety of flexible and innovative lodging options and attractions.

Future Land Use Plan: The subject property is located in the New Braunfels Sub-Area and along a Transitional Mixed-Use Corridor and a Scenic River Corridor.

FISCAL IMPACT:
N/A

RECOMMENDATION:

Approval of the proposed Type 2 SUP with site plan, with a waiver to allow a vegetative buffer along residential properties within the floodplain and no buffer within the floodway, subject to the following conditions:

1. Revise the site plan to include the masonry wall/fence buffer for all adjacent single or two-family properties that are outside the floodplain, or provide a formal Masonry Wall Objection from the property owners.
2. The RV resort will comply with the approved site plan. Minor changes resulting from the floodplain development permit may be reviewed and approved administratively. Substantial revisions to the site plan will require approval of an amended SUP.
3. Add an explanation of the 10 pm to 6 am "quiet hours" to the list of development standards.
4. Prepare an informational handout regarding flash flooding risks with an evacuation map to be provided to guests.

Notification:
Public hearing notices were sent to owners of 44 properties within 200 feet of the request. To date the City has received 3 responses in favor (#1, 3, 29) and none in objection.

Resource Links:

- Chapter 144, Sec. 3.3-7 (C-1) and 3.3-11 (M-1)

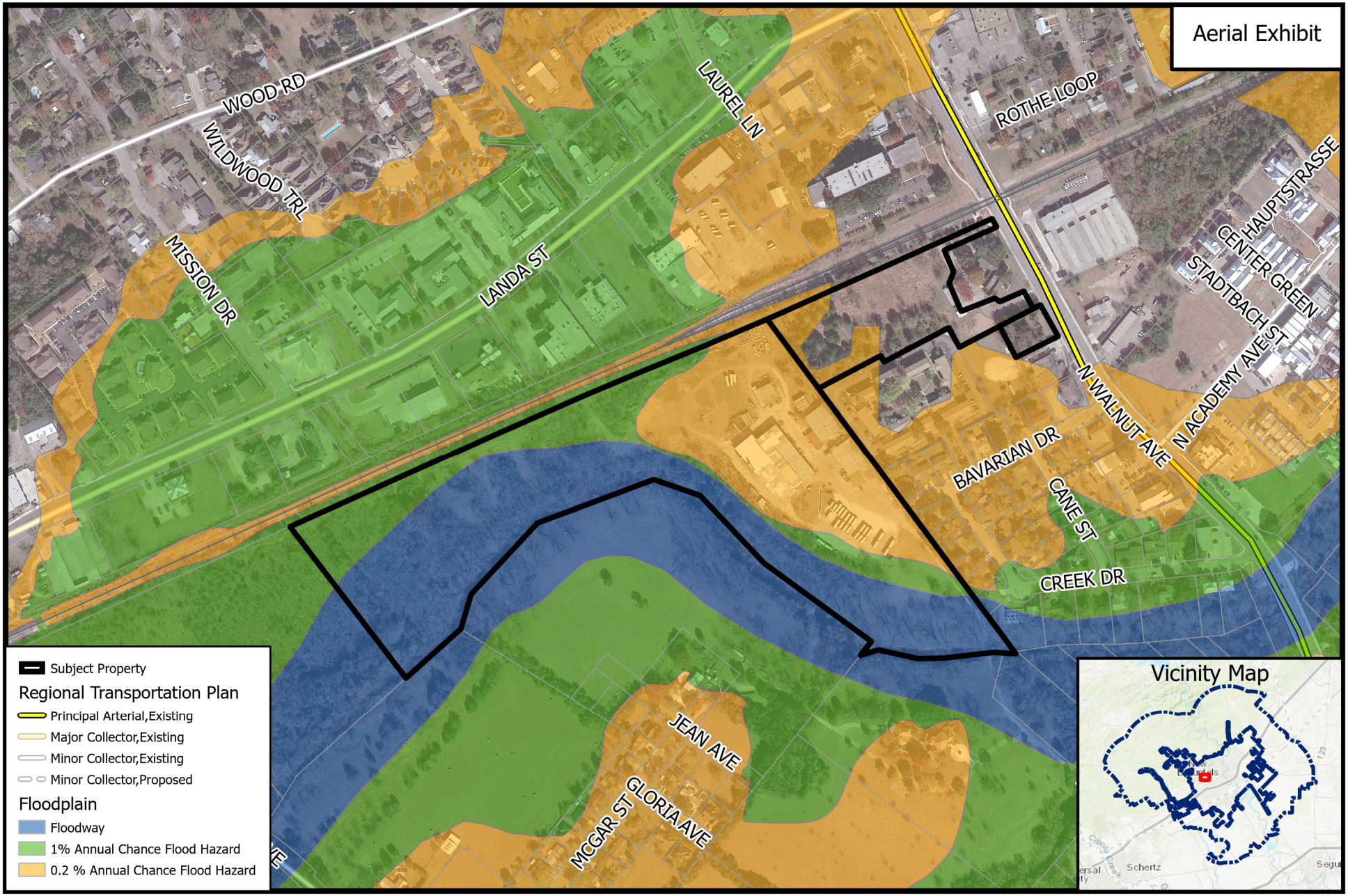
Sec. 144-3.3. - Zoning districts and regulations for property zoned prior to June 22, 1987. | Code of Ordinances | New Braunfels, TX | Municode Library
<https://library.municode.com/tx/new_braunfels/codes/code_of_ordinances?nodeId=PTIICOOR_CH144ZO_ARTIIIZODI_S144-3.3ZODIREPRZOPRJU221987>

- Chapter 144, Sec. 3.6 (SUP) of the City's Code of Ordinances:

<https://library.municode.com/tx/new_braunfels/codes/code_of_ordinances?nodeId=PTIICOOR_CH144ZO_ARTIIIZODI_S144-3.6SPUSPE>

Attachments:

1. Aerial Map
2. Land Use Maps (Zoning, Existing and Future Land Use)
3. Site Plan
4. Waiver Request
5. Notification Map



SUP21-126

Special Use Permit to allow for RV Park

0 250 500 Feet

N

Path:
\\chfs-1\Departments\Planning\ZoneChange-SUP-Replats\2021\SUP21-126 - RV Park -

Source: City of New Braunfels Planning
Date: 5/13/2021

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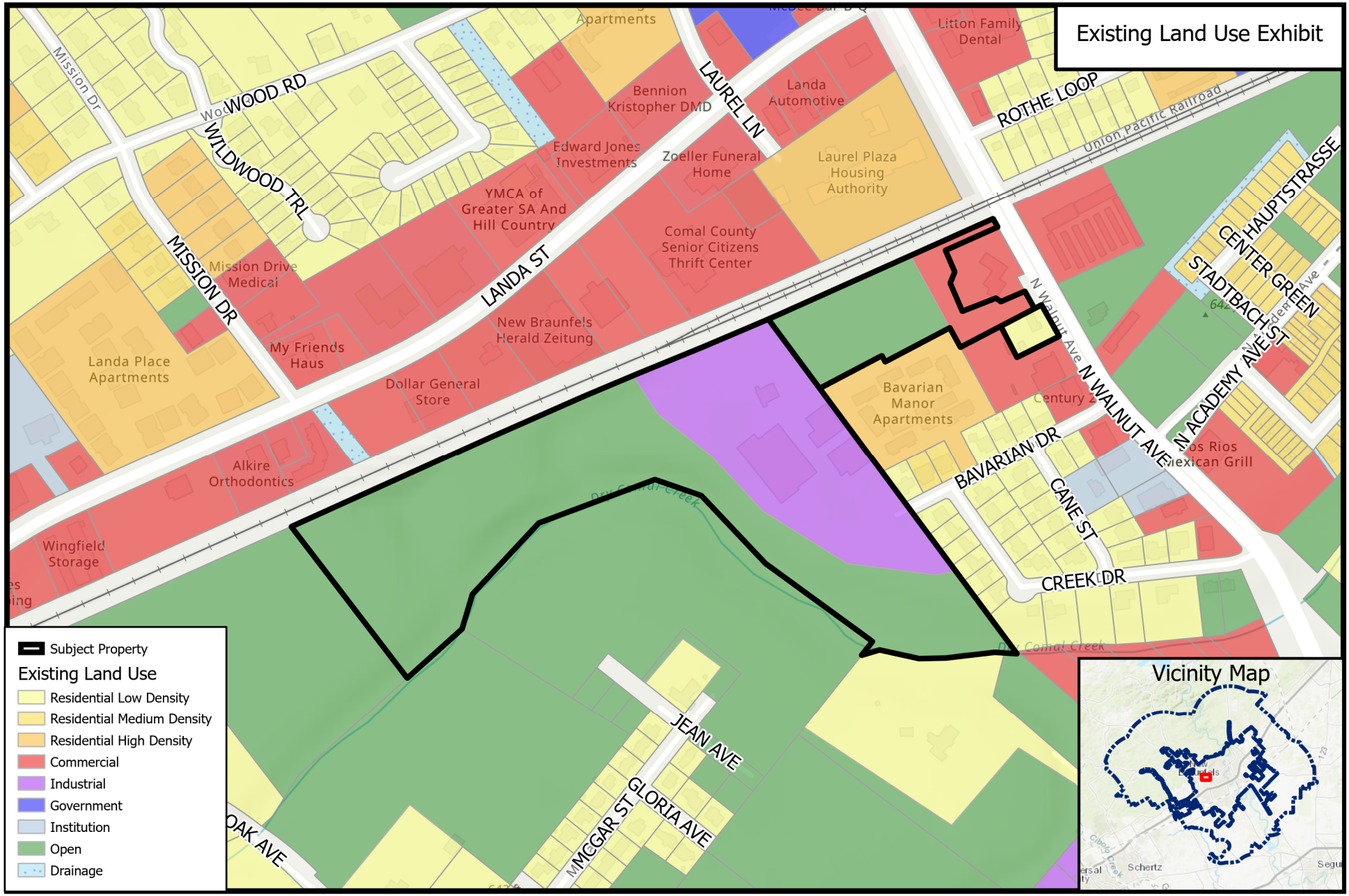

SUP21-126

Special Use Permit to allow for RV Park

0 250 500 Feet

N

Path:
\\chfs-1\Departments\Planning\ZoneChange-SUP-Replats\2021\SUP21-126 - RV Park -

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EXISTING CENTERS

Centers are the middle, core or heart of an area. It is a point of activity and vitality. Centers come in many sizes and have different purposes or activities within. They may have endangered species habitat or aquifer recharge areas that require additional standards and consideration relating to future growth. It is envisioned that all centers be walkable, connected, and have a mix of uses. These centers must provide adequate infrastructure to support the commercial development present especially mobility and access for pedestrians, bicycles, vehicles and transit. Given the mixed-use nature of these centers, parking should be shared and not detract from the aesthetic of the area.

EMPLOYMENT CENTER

Employment Centers are mixed-use areas centered around office or industrial uses that can support significant employment.

MARKET CENTER

Market Centers are mixed-use areas anchored by a retail destination where surrounding residents go to get daily goods and services.

MEDICAL CENTER

Medical Centers are mixed-use areas centered around a medical destination such as a hospital or clinic.

CIVIC CENTER

Civic Centers are mixed-use areas centered around a civic destination such as City Hall, a library or a recreation center.

OUTDOOR RECREATION CENTER

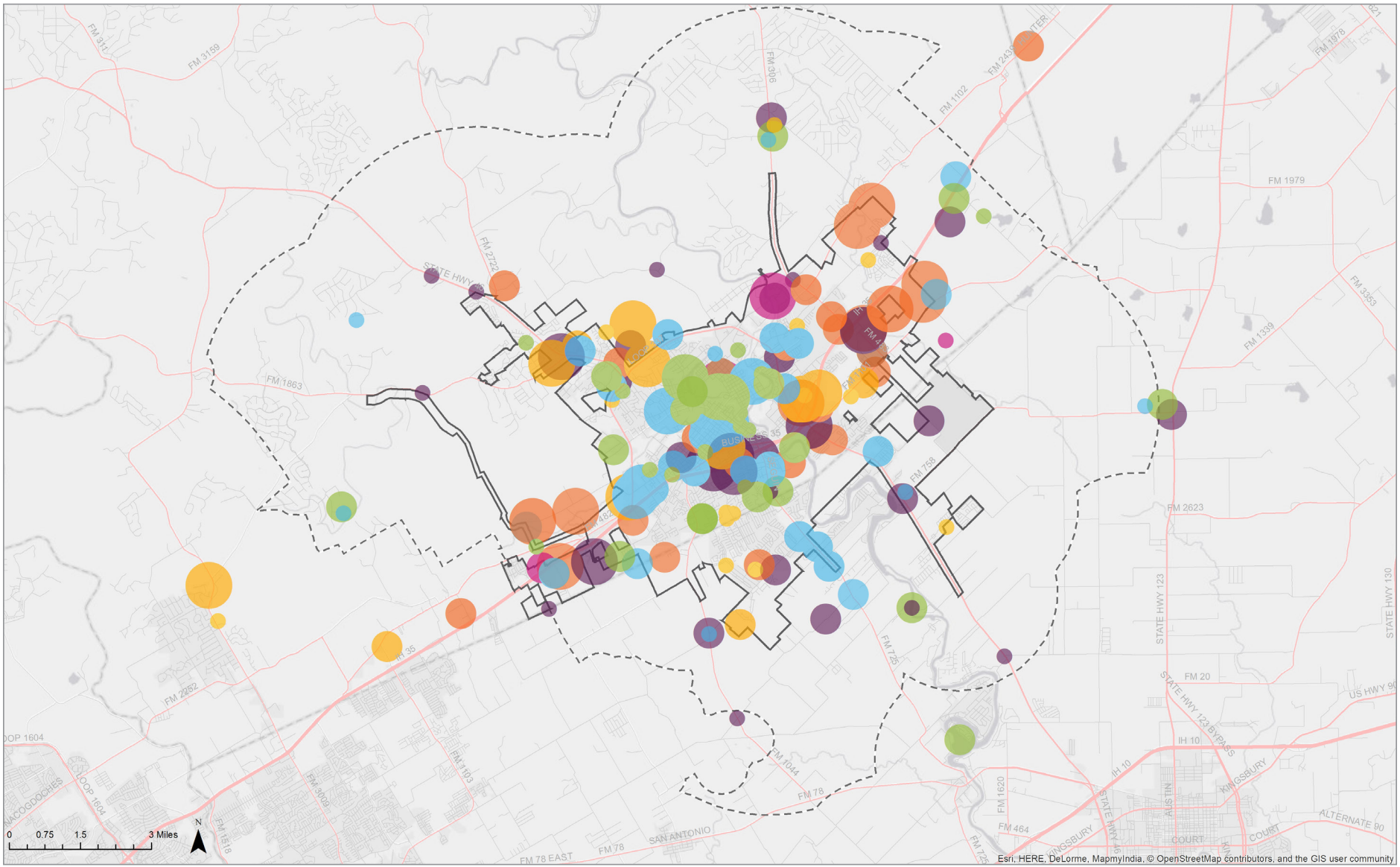
Outdoor Recreation Centers center around a public or private outdoor destination such as Landa Lake.

EDUCATION CENTER

Education Centers are mixed-use areas centered around an educational destination such as a K-12 school or university/college.

TOURIST/ENTERTAINMENT CENTER

Tourist/Entertainment Centers are mixed-use areas around an entertainment venue such as Gruene Hall or a tourist destination such as the Tube Chute.



The location of existing centers was determined through the analysis of previous studies and background documents, windshield surveys, and reviewed by City staff, Steering Committee members, and Plan Element Advisory Group members during a public workshop.

FUTURE LAND USE PLAN

A future land use plan is how land is envisioned to be. It establishes priorities for more detailed plans (sub area plans) and for detailed topical plans (such as parks and open spaces, trails and roads). It cannot be interpreted without the goals and actions of Envision New Braunfels.

TRANSITIONAL MIXED-USE CORRIDOR
Transitional Mixed-Use Corridors express an aspiration to retrofit existing auto-dominated retail corridors with a mix of uses and a variety of travel modes over time.

OUTDOOR RECREATION CENTER
Outdoor Recreation Centers are centered around a public or private outdoor destination like Fischer Park.

EMPLOYMENT CENTER
Employment Centers are mixed-use areas centered around office or industrial uses that can support significant employment.

MARKET CENTER
Market Centers are mixed-use areas anchored by a retail destination where surrounding residents go to get daily goods and services.

CIVIC CENTER
Civic Centers are mixed-use areas centered around a civic destination such as City Hall, a library or a recreation center.

SUB AREA 1
Sub Area 1 includes the Downtown, Gruene and the Mid-Century or older neighborhoods that surround them. It is home to the natural springs and headwaters of flowing rivers that have attracted New Braunfelsers to the town for centuries.

SUB AREA 2
Sub Area 2 refers to the neighborhoods and residential enclaves that have grown alongside the Hill Country landscape.

SUB AREA 3
Sub Area 3 includes a planned community offering a diversity of housing, distinct community centers and preserved Hill Country landscape features.

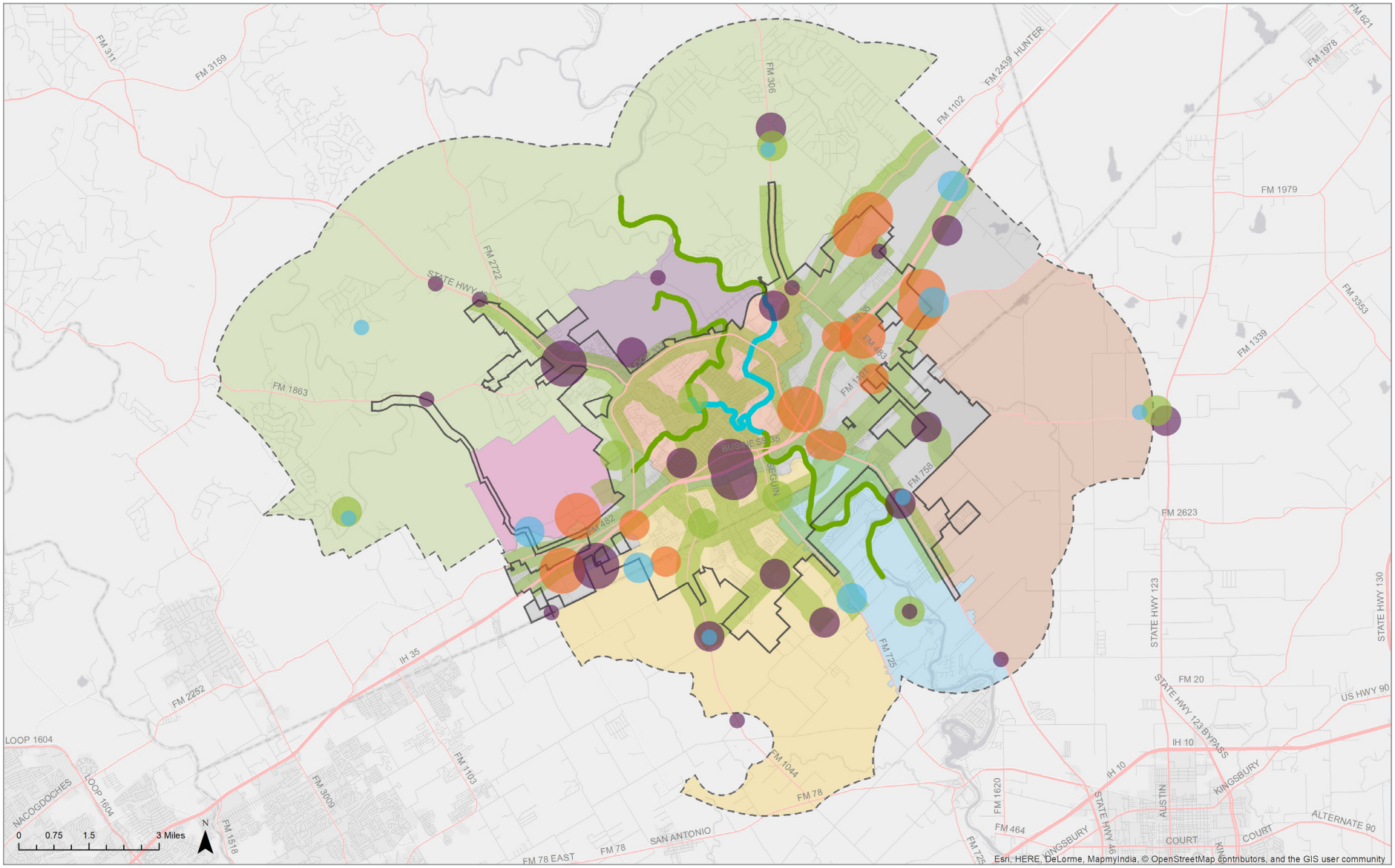
SUB AREA 4
At the heart of Sub Area 4 is Fischer Park. Proximity to IH-35, downtown and neighboring communities like McQueeney makes this area highly desirable and accessible.

SUB AREA 5
Sub Area 5 bridges together many communities east of IH-35. It includes the scenic landscape along both banks of the Guadalupe River between Highway 46 and FM 725.

SUB AREA 6
Sub Area 6 expresses an aspiration for conservation communities focused around maintaining and enhancing ecological integrity while allowing some level of development to occur.

SUB AREA 7
Sub Area 7 includes parts of the city currently being mined for natural resources. These sites may become parks and open space, mixed-use communities or new commercial or entertainment areas in the future.

SUB AREA 8
This fast-growing Sub Area includes many neighborhoods offering affordable places for young families to live.



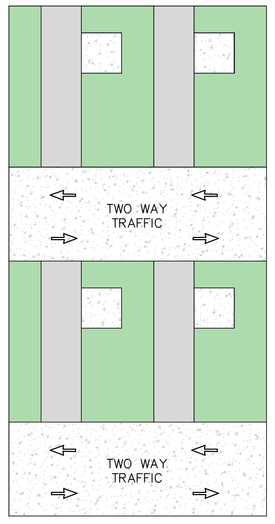
A Comprehensive Plan shall not constitute zoning regulations or establish zoning district boundaries. Preferred future growth scenario combines Scenarios A and C per recommendations of the Envision New Braunfels Steering Committee (February 2018). Exact boundaries of sub areas, centers, and corridors may be zoomed and viewed online.

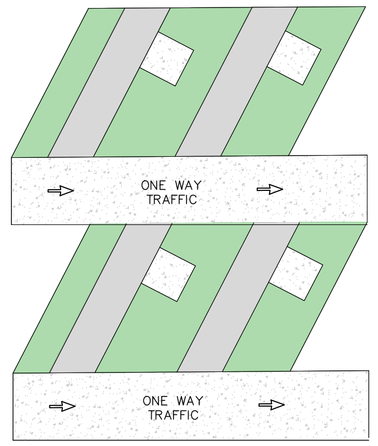
DEVELOPMENT STANDARDS

1. MAXIMUM OF 180 RV PAD SITES.
2. THE PROJECT SITE IS LOCATED WITHIN THE FEMA FLOODPLAIN ACCORDING TO FIRMETTE 48091C0435F.
3. INTERNAL DRIVES ARE PRIVATE AND MAINTAINED BY DEVELOPMENT. AMENITY CENTER AND CLUBHOUSE TO BE CONSTRUCTED IN FIRST DEVELOPMENT PHASE.
4. DESIGNATED PARKING AREA IS FOR RV AND PASSENGER VEHICLES ONLY. NO BOAT STORAGE IS ALLOWED.
5. NO ON-STREET PARKING ALLOWED.
6. ALL INTERNAL DRIVES, UTILITIES AND DRAINAGE IMPROVEMENTS WILL BE CONSTRUCTED IN THE FIRST PHASE.
7. HIKE AND BIKE TRAIL WILL BE COMPLETED IN PHASE 1. HOWEVER, IT WILL NOT BE UTILIZED FOR PUBLIC ACCESS UNTIL THERE IS A CONNECTION FROM THE RESORT PROPERTY TO DOWNTOWN. ONCE THE CONNECTION IS COMPLETE, THE TRAIL WILL BE OPEN FOR PUBLIC USE.
8. MASONRY RESIDENTIAL BUFFER WALL – OUTSIDE FLOODPLAIN
9. VEGETATIVE RESIDENTIAL BUFFER WALL – INSIDE FLOODPLAIN
10. BAVARIAN DR – WILL BE GATED OFF FOR CITY/EMERGENCY VEHICLES ONLY
11. EXISTING DRIVE ON WALNUT AVE WILL BE USED
12. NO LONG TERM STAY TENANTS (OVER 6 MONTHS)
13. NO WASTE WATER DUMP STATIONS WILL BE PROVIDED. THE ONLY CONNECTIONS WILL BE AT THE RV SITES.
14. NO BOAT STORAGE
15. ALL DRIVES WILL BE TWO – WAY UNLESS OTHERWISE NOTED

ACREAGE SUMMARY (APPROX.)

RV SPOTS AND STREETS	12.73 ACRES
AMENITY SPACE	1.35 ACRES
OPEN SPACE/DRAINAGE AREA	15.10 ACRES
TOTAL ACREAGE:	29.18 ACRES





LEGEND

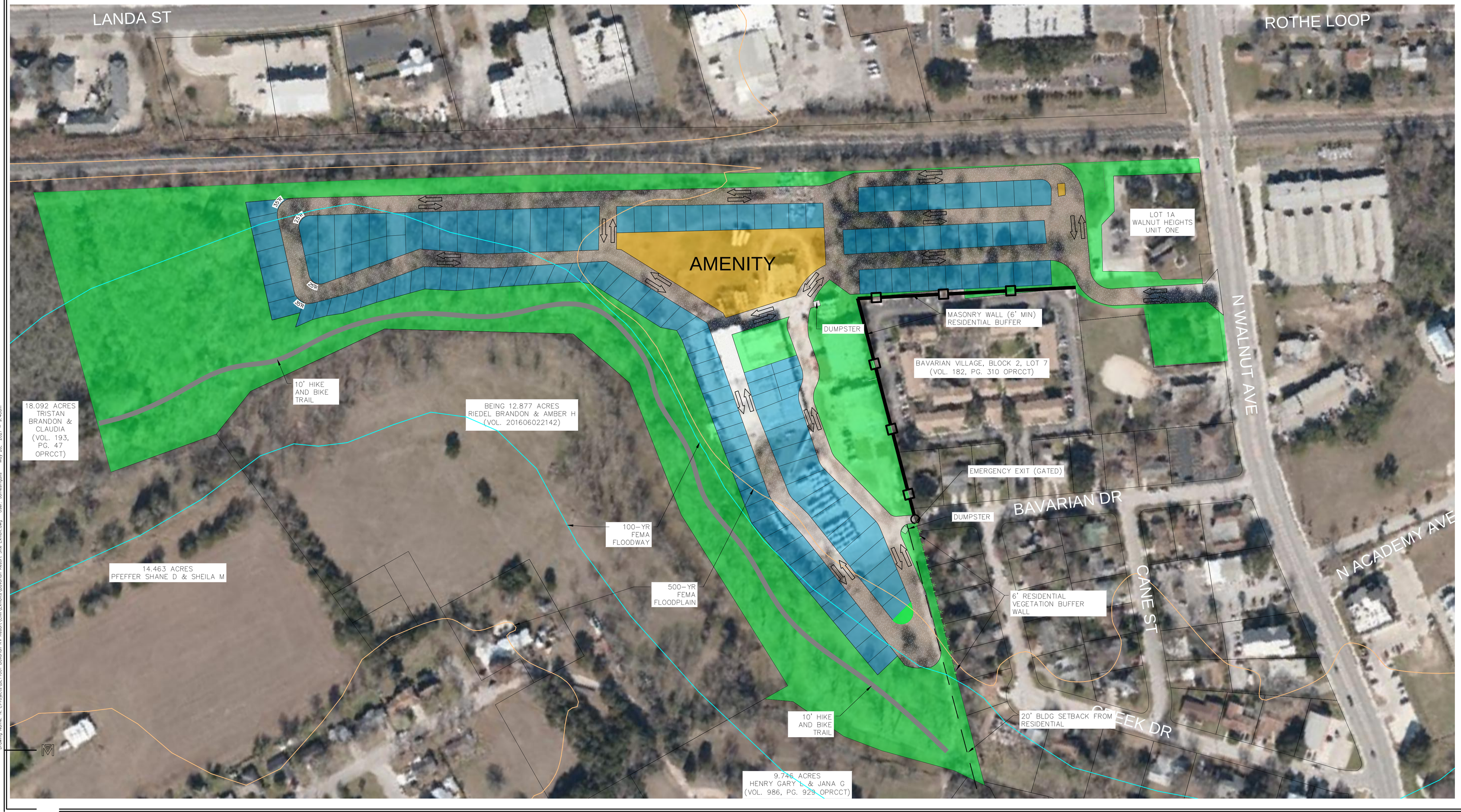
- AMENITY AREA
- PARKING / IMP COVER
- GREENSPACE
- DRIVES AND PATIO PADS
- RV SPACES
- TRAFFIC ARROW
- 100-YR FEMA FLOODWAY
- 500-YR FEMA FLOODPLAIN

N

0 100' 200'

SCALE: 1" = 100'

RV SPACE TYPICAL LAYOUT



Drawing Name: N:\Projects\BLT001 Bavarian RV Resort\Civil\Exhibits\Bavarian Resort Site Exhibit.dwg User: Jamesingalls May 26, 2021 - 9:40am

Know what's below. Call before you dig.

STATE OF TEXAS
JAMES INGALLS
107416
LICENSED
PROFESSIONAL ENGINEER
5-11-21

NO	DATE	ISSUES AND REVISIONS

MOELLER & ASSOCIATES Engineering Solutions
2021 W. SH46, STE. 105, NEW BRAUNFELS, TX. 78132
PH: 830-358-7127 www.mo-tx.com
TBPE FIRM F-13351

SITE PLAN

DATE: 5-11-2021

BAVARIAN RV RESORT

NEW BRAUNFELS, TX

SHEET 1 OF 1

COPYRIGHT 2020

May 13, 2021

Planning Department
City of New Braunfels
550 Landa Street
New Braunfels, TX 78130

Special Use Permit Type 2 (Bavarian RV) – Waiver Request

The intent of this letter is to request a waiver for the required Residential Buffer Wall between the planned non-residential project and the neighboring residential subdivision.

For background, it is the client's intent to develop these tracts of land into a luxury RV resort that will serve the City of New Braunfel's community and respect the neighboring residents. The client has applied for a Type 2 Special Use District zoning change application on March 29, 2021 to rezone from C-1, M-1 and R-2 to SUP.

As part of this rezoning process and due to the requested use for this development, it is required by section 144.-3.8 (Sub 5.3-2.H) of the New Braunfels Code of Ordinances that a 6' to 8' residential buffer wall be installed. This section of the code describes several impervious materials for this requirement.

However, the property in question is within both the 100-year FEMA floodplain (Panel No. 48091C0435F) and the 500-year floodway. It is our opinion that a large vegetative buffer wall would offer less impact to the floodplain and still meet the intent of the requirement. The vegetative buffer will be a minimum of 6 feet in height and will offer screening of the non-residential use parking areas on this site.

With this project summary, please accept our waiver request. If you need additional information or have any questions, please do not hesitate to contact myself or Shane Klar, P.E.

Sincerely,

James Ingalls, P.E.

PLANNING COMMISSION – JUNE 1, 2021 – 6:00PM

Council Chambers & Zoom

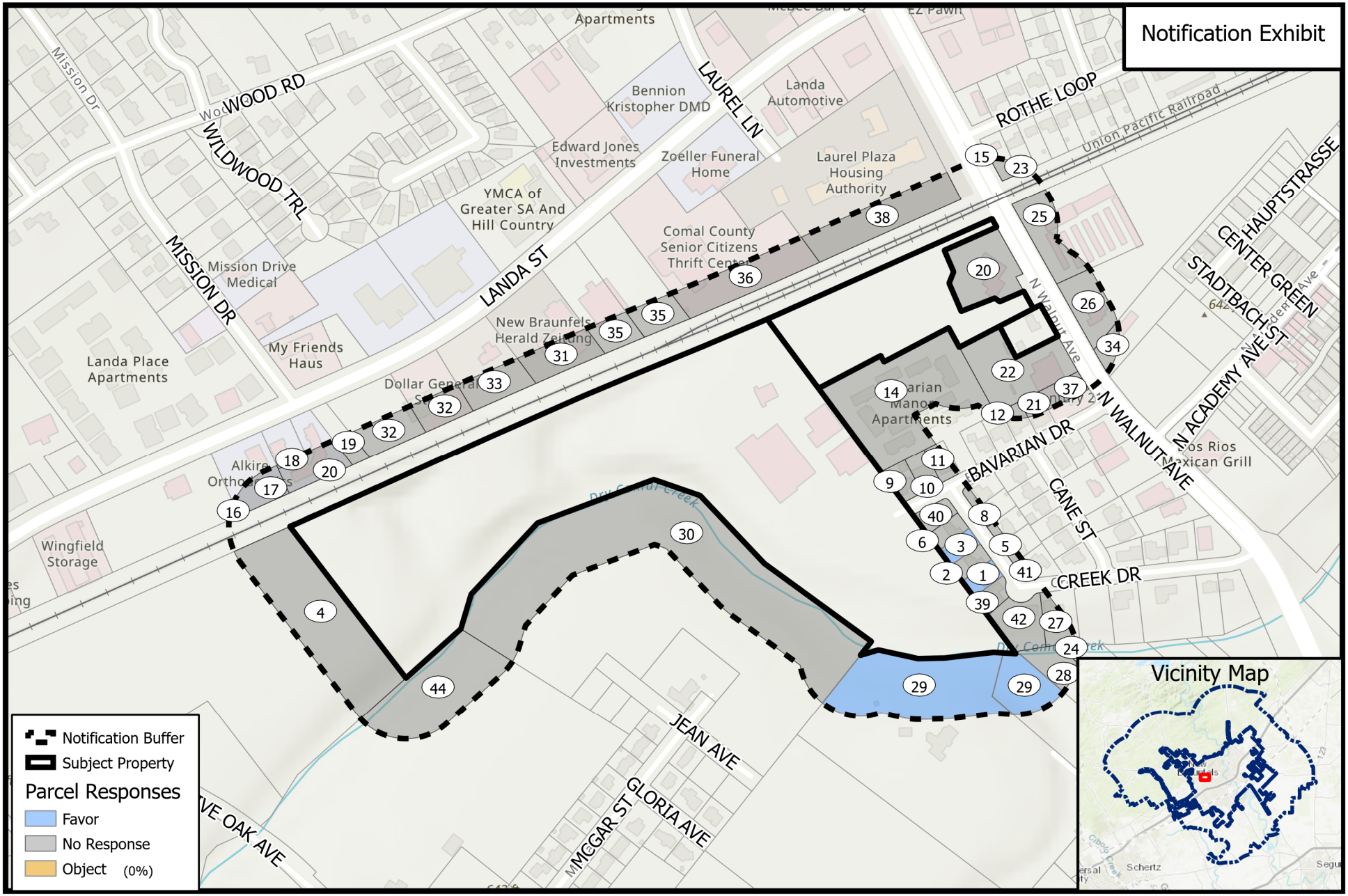
Applicant/Owner: James Ingalls, P.E., Moeller
Address/Location: Bavarian Dr & Walnut Ave

PROPOSED SPECIAL USE PERMIT – CASE #SUP21-126

The circled numbers on the map correspond to the property owners listed below. All information is from the Appraisal District Records. The property under consideration is marked as "Subject Property".

1. ARREDONDO GLORIA & ROBERTO
2. ELIAS JESUS
3. SODDERS PROPERTIES LLC
4. TRISTAN BRANDON & CLAUDIA
5. DEAN BARBARA H
6. THOMAS MARILYN
7. PITTMAN JORDAN T
8. WOOLSEY ASHLEY N
9. DUNLAP RUTH K
10. RENEAU SHAWN M
11. RENEAU NATHAN
12. FRITSCH JENS & KATIE M
13. DELAVAN SYLVIA A
14. T G 104 INC
15. NEWMAN JOEL
16. AGARITA PROPERTIES LTD
17. GATHANY FAMILY LTD PARTNERSHIP
18. KNEUPER S J & R R LIVING TRUST
19. NEW BRAUNFELS CITY OF
20. PROPERTY OWNER
21. WIEGEL BRANDEN CHUCK
22. HANSMANN ROY L ET AL
23. CLASSEN WAYNE
24. TALCOTT THOMAS L & CATHY C
25. SCHRIEWER PROPERTIES LLC
26. WALNUT CENTRE LLC
27. WILLEFORD DWAYNE S
28. NB 24 HOUR CLUB
29. HENRY GARY L & JANA G
30. RIEDEL BRANDON & AMBER H
31. 7075PLS LP
32. ARC DGNBFTX001 LLC
33. SOGGY PESO INVESTMENTS LLC
34. VANSTORY RANDY & ROXI
35. JLFH INVESTMENTS LLC
36. COMAL COUNTY SENIOR CITIZENS FOUNDATION
37. KMNB LLC
38. HOUSING AUTHORITY OF CITY OF N B
39. WORD WILLIAM
40. JENNY COX III LP
41. CINOTTO DAVID J & CHRISTINA M
42. CRUZ J REFUGIO
43. WOOLSEY JULIE R
44. PFEFFER SHANE D & SHEILA M

SEE MAP



SUP21-126

Special Use Permit to allow for RV Park

0 250 500 Feet

N

800

Path:
Y:\ZoneChange-SUP-Replats\2021\SUP21-126 - RV Park - Moeller\NPH\SUP21-126.aprx

Source: City of New Braunfels Planning
Date: 5/25/2021

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YOUR OPINION MATTERS - DETACH AND RETURN

Case: #SUP21-126 hm

Name: Roberto & Gloria Arredondo I favor: ✓

Address: 627 Creek Dr., NB, TX 78130 I object: _____(State reason for objection)

Property number on map: 1 Comments: (Use additional sheets if necessary)

RECEIVED
MAY 25 2021
BY: .....

Signature: Roberto Arredondo Gloria Arredondo

YOUR OPINION MATTERS - DETACH AND RETURN

Case: #SUP21-126 hm

Name: Wanda J. Soldan I favor: ✓

Address: _____ I object: _____(State reason for objection)

Property number on map: 3 Comments: (Use additional sheets if necessary)

RECEIVED
MAY 25 2021
BY: .....

Signature: Wanda J. Soldan

YOUR OPINION MATTERS - DETACH AND RETURN

Case: #SUP21-126 hm

Name: GARY HENRY, G.P. LIBERTY PARTNERSHIP, LTD I favor: ✓

Address: 600 N HICKORY AVE. NB, TX I object: _____(State reason for objection)

Property number on map: ~~15~~ 29 Comments: (Use additional sheets if necessary)

RECEIVED
MAY 25 2021
BY: .....

Signature: _____

City of New Braunfels

Planning Commission Agenda Item Report

550 Landa Street
New Braunfels, TX

6/1/2021

Agenda Item No. G)

PRESENTER:
Applicant/Owner: Senaido Rodriguez, Jr.

SUBJECT:
SUP21-156 Public hearing and recommendation to City Council regarding a proposed rezoning to apply a Special Use Permit to allow short term rental of a single-family dwelling in the "C-3" Commercial District, addressed at 218 South Peach Avenue.

DEPARTMENT: Planning and Development Services

COUNCIL DISTRICTS IMPACTED: Council District 1

BACKGROUND INFORMATION:

Applicant/Owner: Senaido Rodriguez, Jr.
1886 W. Mill Street
New Braunfels, TX 78130

Staff Contact: Matt Greene
(830) 221-4053 mgreene@nbtexas.org

The subject property is located on the west side of Peach Avenue between Spur Street and S. Business IH 35, is zoned “C-3” Commercial District, and contains a 1,152 square-foot single-family residence constructed in 1949 with an addition constructed in 1993. There are 9 lots out of the 20 lots on the neighborhood block zoned the cumulative/pyramidal C-3 District, with one R-3 Lot and the remaining 10 lots zoned R-1A-6.6, therefore the area is developed with a mix of commercial and residential uses. However, the subject block is mostly residential with the exception of the City cemetery, which encompasses approximately half of the block.

The applicant is requesting a Special Use Permit (SUP) to allow short term rental (STR) of the property. The house has 2 bedrooms and 2 bathrooms. Per the Zoning Ordinance, maximum occupancy of an STR with 2 bedrooms and 2 bathrooms is limited to 6 occupants.

The minimum off-street parking requirement for this proposed STR is 2 spaces, or one per sleeping room. The existing paved driveway can accommodate two tandem parked vehicles.

Short-term rental standards in the Zoning Ordinance help to ensure proper measures are in place to protect public health, safety and neighboring properties. If the SUP is approved, short-term rental registration and online payment of hotel occupancy taxes are also required.

Surrounding Zoning and Land Use:
North - C-3 / Single-family dwellings

File #: 21-428, **Version:** 1

South - C-3 and R-1A-6.6 / Single-family dwellings and a cemetery
East - Across S. Peach Ave., R-1A-6.6 / Single-family residences
West - C-3 / A restaurant and single-family residences

ISSUE:
Short term rental would be consistent with the following actions in the Comprehensive Plan:
Action 1.3: Encourage balanced and fiscally responsible land use patterns.
Action 1.14: Ensure regulations do not unintentionally inhibit the provision of a variety of flexible and innovative lodging options and attractions.
The property lies within the New Braunfels Sub Area near existing Civic, Education and Employment Centers and is in close proximity to future Market Centers and Recreational and Transitional Mixed-Use Corridors.

FISCAL IMPACT:
If approved, short term rental of the property will be subject to local and state hotel occupancy tax.

RECOMMENDATION:
While this would be the first introduction of lodging facilities in the block, a short-term rental on this property, following all the standards of the Zoning Ordinance, would complement the overall mix of uses in this area. The location would allow easy access to main thoroughfares and visitor destinations without extensive vehicular traffic through the interior of the neighborhood. Staff recommends approval in accordance with the Zoning Ordinance requirements for short term rentals that protect the surrounding residential neighborhood, plus the following conditions:

1. The residential character of the property must be maintained.

2. The property will remain in compliance with the approved site plan. Any significant changes to the site plan will require a revision to the SUP.

3. Occupancy is limited to a maximum of 6 guests.

4. The applicant will register the short-term rental and create an account for online payment of hotel occupancy taxes.

5. All other standards of the Zoning Ordinance will also be met.

Notification:
Public hearing notices were sent to 19 owners of property within 200 feet of the request. To date, staff has received no responses.

Resource Links:

- Chapter 144, Sec. 3.3-9 “C-3” Commercial District of the City’s Code of Ordinances: <https://library.municode.com/tx/new_braunfels/codes/code_of_ordinances?

- Chapter 144, Sec. 3.6 Special Use Permits of the City’s Code of Ordinances: <https://library.municode.com/tx/new_braunfels/codes/code_of_ordinances?

- Chapter 144, Sec. 5.17 Short-Term Rental of the City’s Code of Ordinances: <https://library.municode.com/tx/new_braunfels/codes/code_of_ordinances?

Attachments:

- Aerial Map
- Site Plan
- Floor Plan
- Land Use Maps (Zoning, Existing, Future Land Use, Short Term Rental)
- Notification List and Map
- Photographs

City of New Braunfels

SUP21-156

Special Use Permit for Short Term Rental

0 60 120 Feet

N

Path:
\\chfs-1\Departments\Planning\ZoneChange-SUP-Replats\2021\SUP21-156 - 218 S. Peach

Source: City of New Braunfels Planning
Date: 5/11/2021

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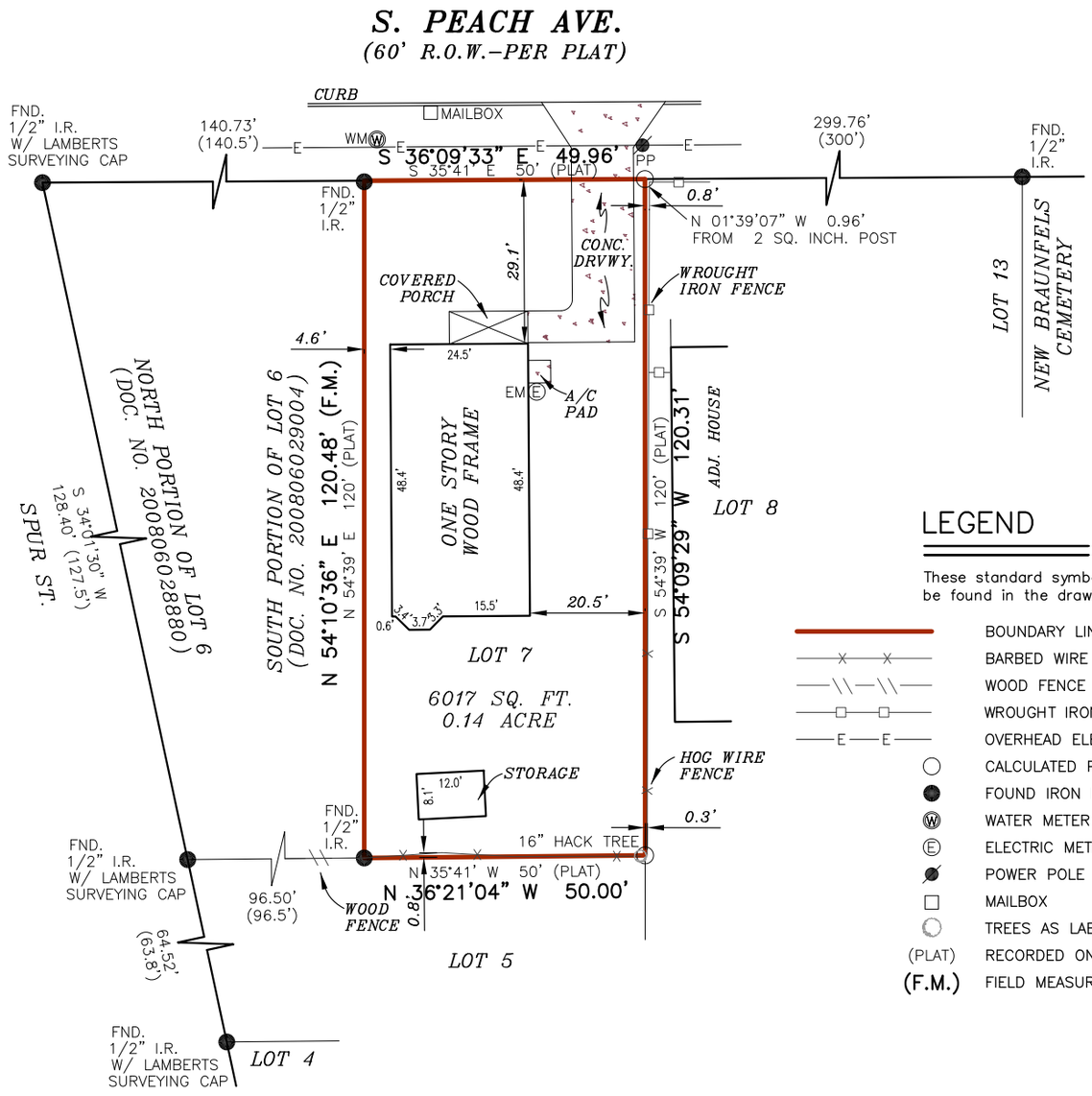

LEGEND

These standard symbols will be found in the drawing.

	BOUNDARY LINE
X X	BARBED WIRE FENCE
\\ \\	WOOD FENCE
□ □	WROUGHT IRON FENCE
E E	OVERHEAD ELECTRIC
○	CALCULATED POINT
●	FOUND IRON ROD
Ⓦ	WATER METER
Ⓔ	ELECTRIC METER
⌀	POWER POLE
□	MAILBOX
○	TREES AS LABELED
(PLAT)	RECORDED ON PLAT
(F.M.)	FIELD MEASURED

SITE PLAN

SURVEYOR'S NOTE(S):
BASIS OF BEARING, TEXAS SOUTH CENTRAL ZONE, NAD 83.

At date of this survey, the property is in FEMA designated ZONE X as verified by FEMA map Panel No: 48091C 0445 F effective date of SEPTEMBER 2, 2009 Exact designations can only be determined by a Elevation Certificate. This information is subject to change as a result of future FEMA map revisions and/or amendments.

The survey is hereby accepted with the discrepancies, conflicts, or shortages in area or boundary lines, encroachments, protrusions, or overlapping of Improvements shown.

X _____.

X _____.

GRAPHIC SCALE

0' 30' 60'

1 Inch = 30 Feet

I, ROY JOHN RONNFELDT, a Registered Professional Land Surveyor in the State of Texas, do hereby certify to FIRST WESTERN TITLE and --

that the above map is true and correct according to an actual field survey, made by me on the ground or under my supervision, of the property shown hereon or described by field notes accompanying this drawing. I further certify that all easements and rights-of-way of which I have been advised are shown hereon and that, except as shown, there are no visible encroachments, no visible overlapping of improvements and no apparent discrepancies or conflicts in the boundary lines, and no visible physical evidence of easements or rights-of-way as of the date of the field survey. I further certify that this survey meets or exceeds the minimum standards established by the Texas Board of Professional Land Surveying (Section 663.18).

Borrower/Owner: CARLOR MUGICA & SENAIDO RODRIGUEZ

Address: 218 S. PEACH AVE. GF No. 19-10861-300

Legal Description of the Land:

LOT SEVEN (7) IN "SUBDIVISION OF WELSCH 4.29 ACRE BLOCK", CITY OF NEWBRAUNFELS, COMAL COUNTY, TEXAS, ACCORDING TO MAP OR PLAT THEREOF RECORDED IN VOLUME 91, PAGE 589, DEED RECORDS, COMAL COUNTY, TEXAS.

SUBJECT TO RESTRICTIVE COVENANTS AND/OR EASEMENTS RECORDED IN: VOLUME 91, PAGE 589, DEED RECORDS, COMAL COUNTY, TEXAS

PROPERTY PHOTOGRAPH:

FINAL "AS-BUILT" SURVEY

JOB NO.:	1905062373	NO.	REVISION	DATE
DATE:	05/16/19			
DRAWN BY:	MN/DT			
APPROVED BY:	RJR			

STATE OF TEXAS REGISTERED ROY JOHN RONNFELDT 3520 PROFESSIONAL LAND SURVEYOR

ROY JOHN RONNFELDT, R.P.L.S.
Registered Professional Land Surveyor
Registration No. 3520

AMERISURVEYORS LLC
1100 NW Loop 410, Suite 546 San Antonio, Texas 78213
Phone: (210) 572-1995 Fax: (210) 572-1993

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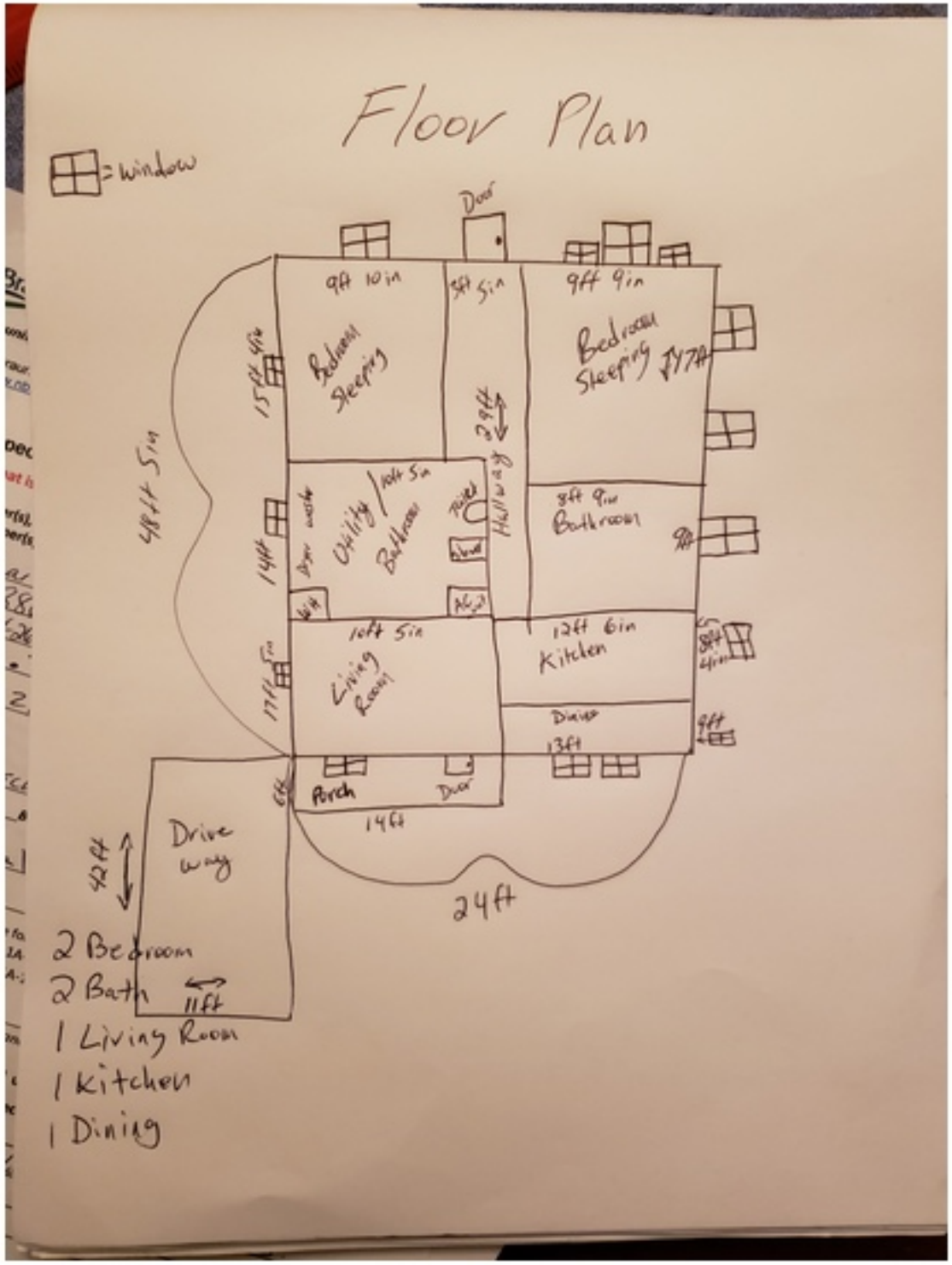
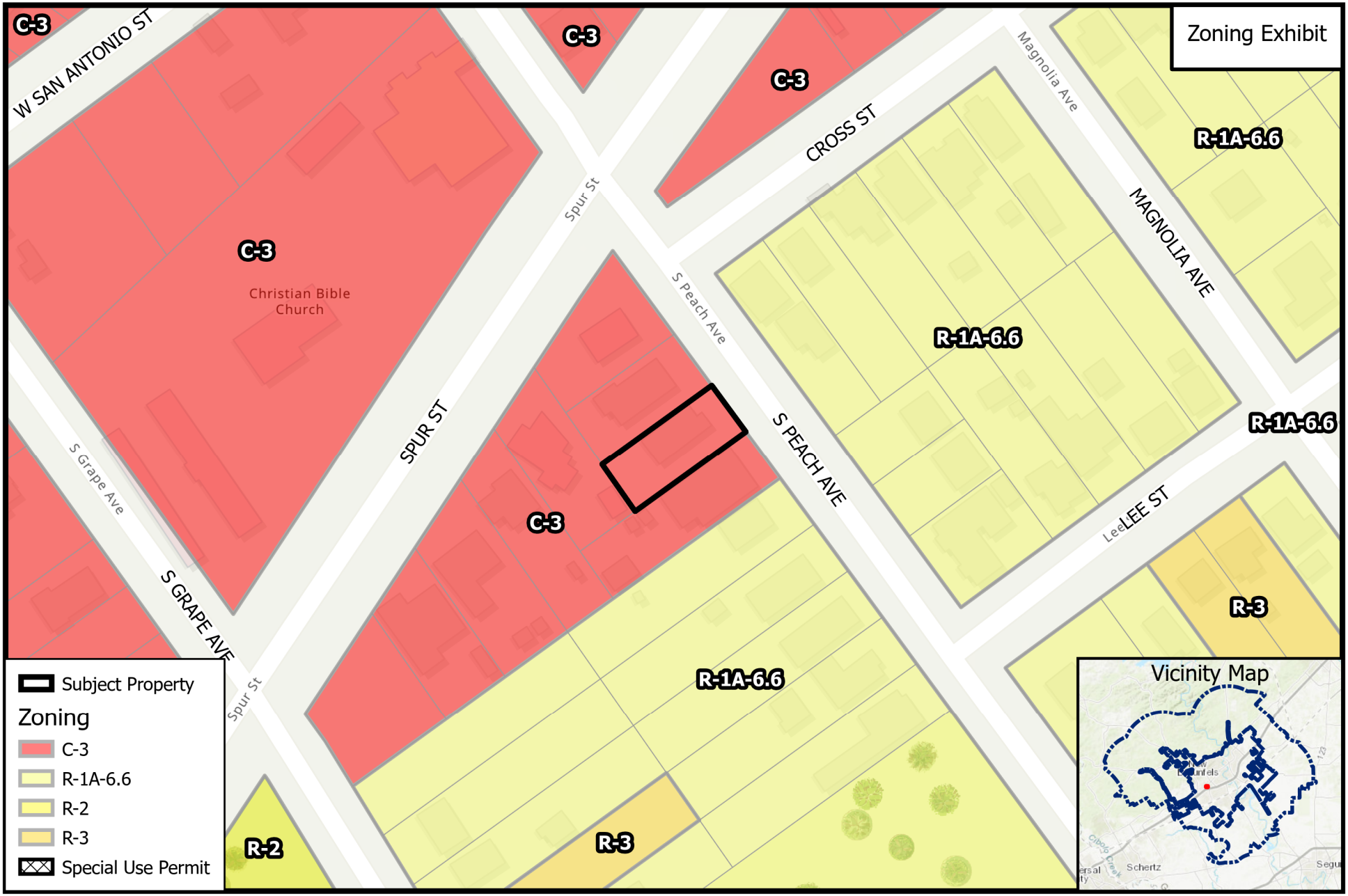

Floor Plan
= window
Door
9ft 10in
Bedroom Sleeping
3ft 5in
9ft 9in
Bedroom Sleeping
15ft 4in
48ft 5in
2 9ft
Hallway
Utility / 10ft 5in Bathroom
9ft 9in Bathroom
14ft
10ft 5in
Living Room
12ft 6in
Kitchen
17ft 5in
Dining
13ft
9ft
Porch
Door
14ft
24ft
42ft
Drive way
11ft
2 Bedroom
2 Bath
1 Living Room
1 Kitchen
1 Dining



SUP21-156

Special Use Permit for Short Term Rental

0 60 120 Feet

N

Path:
\\chfs-1\Departments\Planning\ZoneChange-SUP-Replats\2021\SUP21-156 - 218 S. Peach

Source: City of New Braunfels Planning
Date: 5/11/2021

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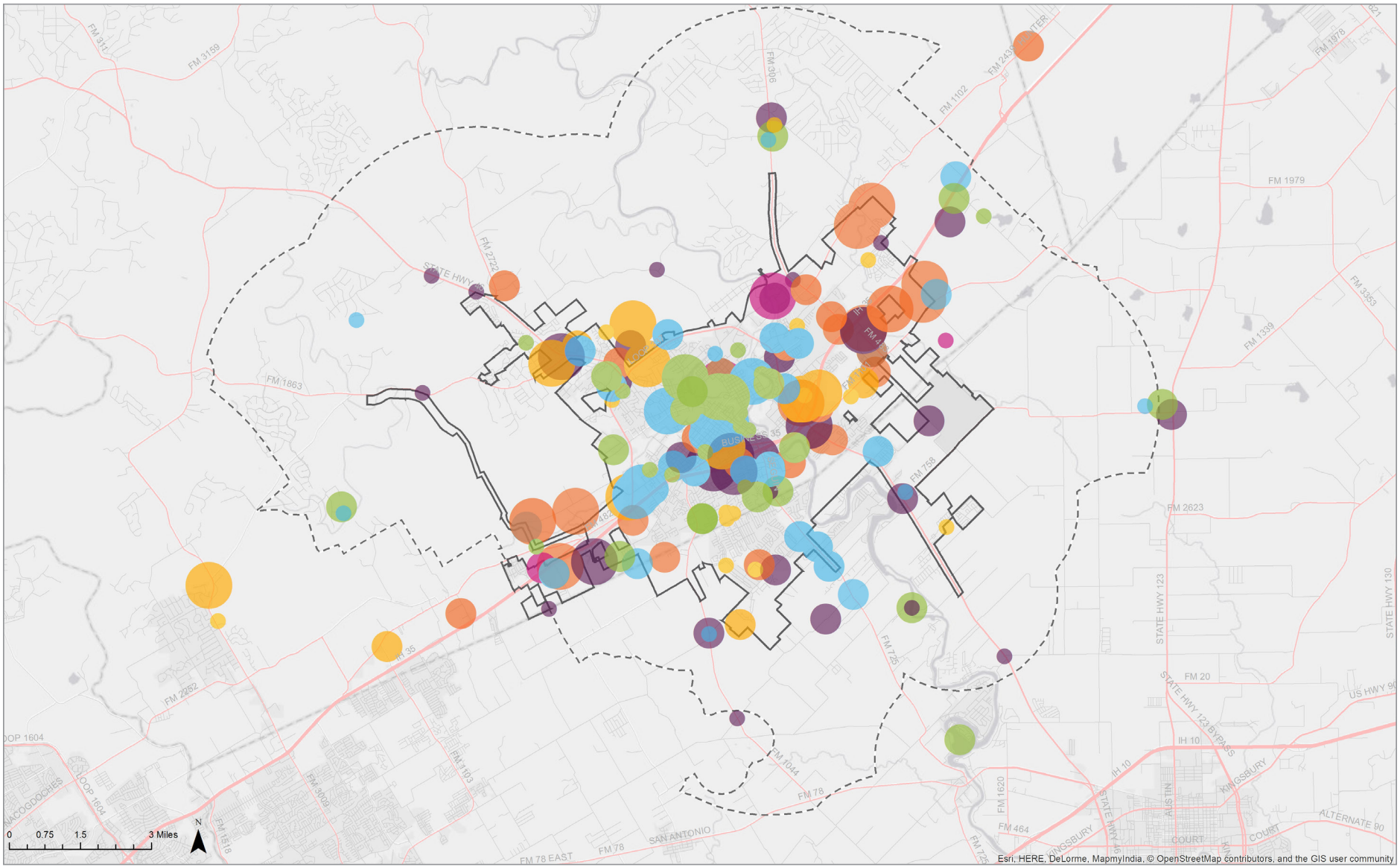

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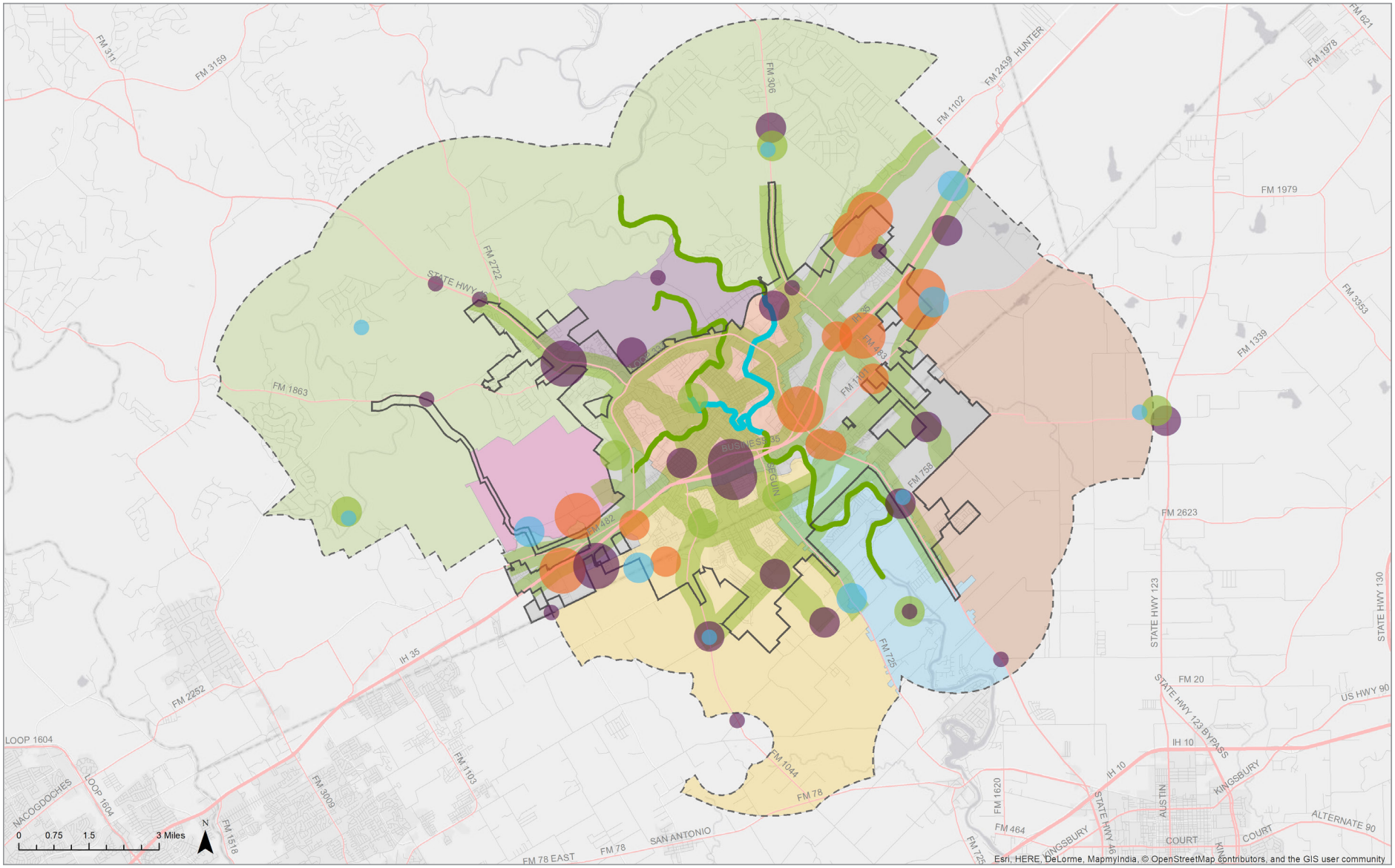

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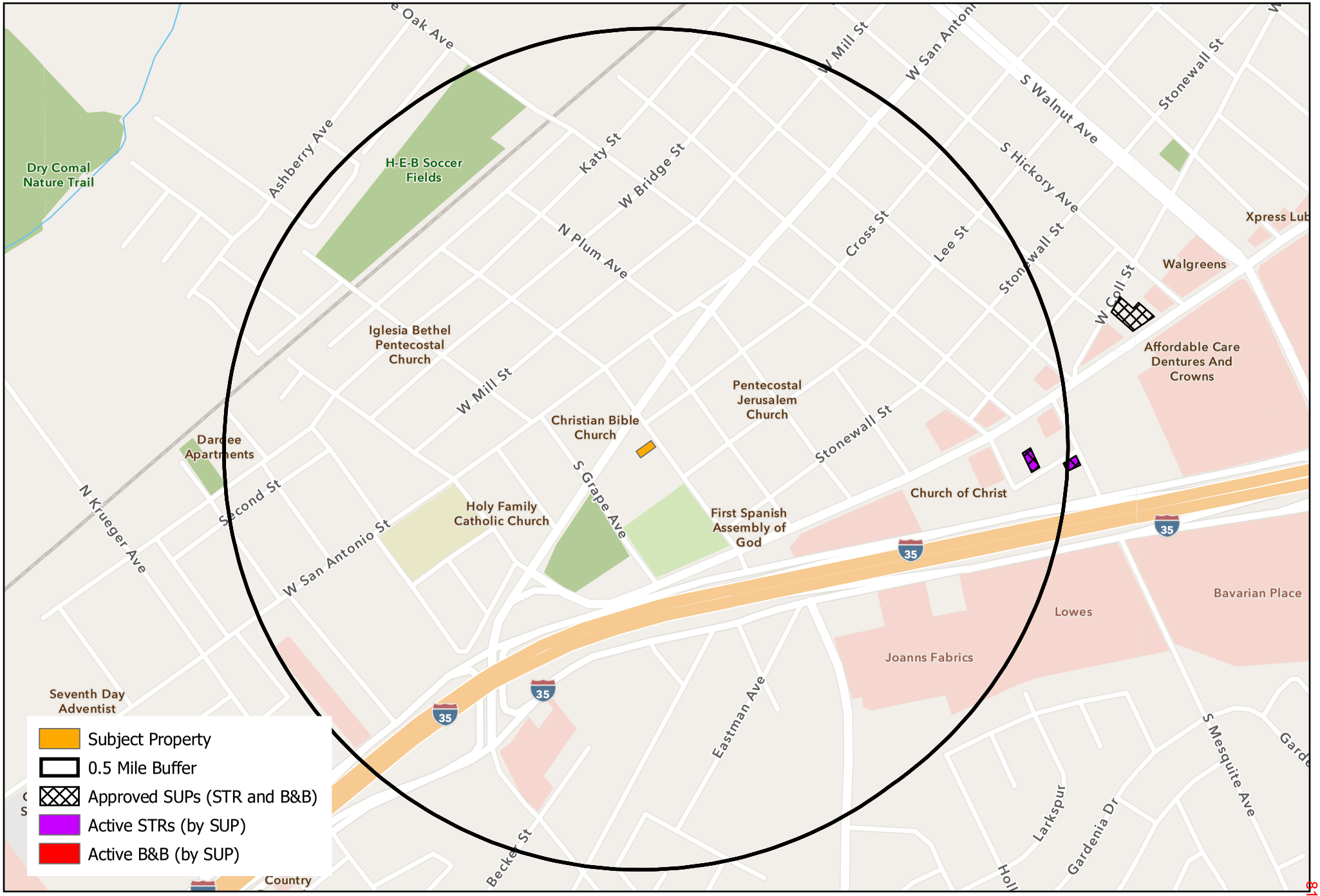

SUP21-156

SUP for STR - 218 S. Peach Avenue

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Document Path:
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Source: City of New Braunfels GIS
Date: 5/20/2021

PLANNING COMMISSION – JUNE 1, 2021 – 6:00PM

Zoom Meeting

Applicant/Owner: Senaido Rodriguez

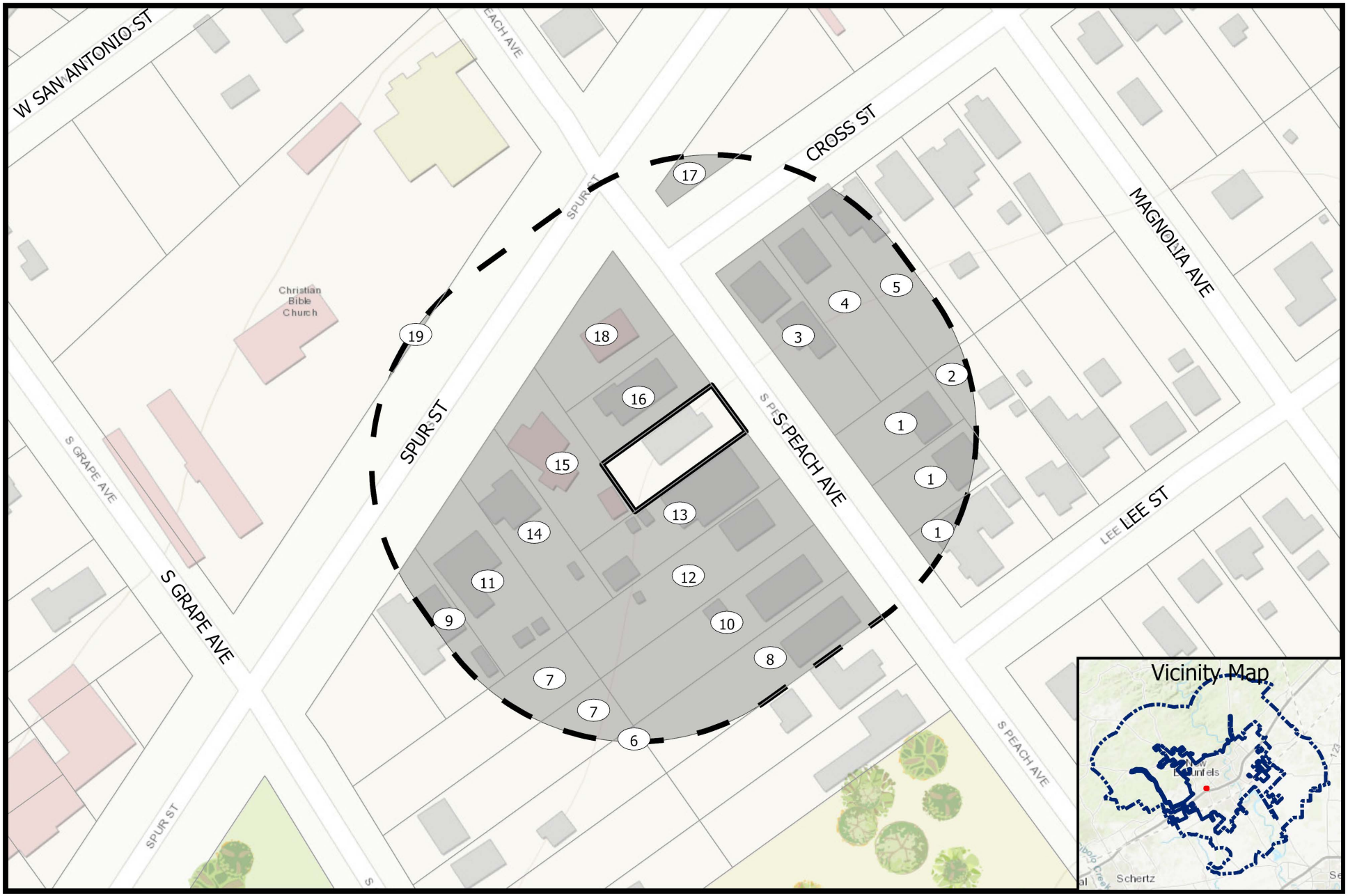
Address/Location: 218 S Peach Ave

PROPOSED SPECIAL USE PERMIT – CASE #SUP21-156

The circled numbers on the map correspond to the property owners listed below. All information is from the Appraisal District Records. The property under consideration is marked as "Subject Property".

1. MARTINEZ GILBERTO L & MARIA S
2. MORENO LUIS
3. ROJAS RUBEN
4. RAMIREZ MICHAEL & ELISABETE
5. GALLEGOS IRENE CABALLERO
6. ROSALES PETRA D
7. MUNOZ-GILL SONIA
8. MARTINEZ REGINA H
9. MUNOZ SONIA C
10. CANO JOSE S & NORMA
11. ORNES DANIEL E & CANDICE D
12. GONZALES JUANITA V
13. MIRANDA ANGEL & LOIS M
14. CHAPA FRANCISCO R & RUTH
15. HARRISON LAURA A
16. MORALES ROBERTO
17. GALVAN DANIEL & RUTH
18. ESTRADA DORA A ET AL
19. KERNER RANDAL S & CYNTHIA

SEE MAP



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0 60 120 Feet

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Path:
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Source: City of New Braunfels Planning
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SUBJECT

SUBJECT

SUBJECT

City of New Braunfels

Planning Commission Agenda Item Report

550 Landa Street
New Braunfels, TX

6/1/2021

Agenda Item No. H)

PRESENTER:
Applicant/Owner: IAKOBO Four LP (Monique Weston)
SUBJECT:
PZ-20-001 Discuss and consider a recommendation to City Council regarding the proposed abandonment of a 0.366-acre portion of Tolle Street Right-of-Way, located between South Gilbert Avenue and the terminus of Tolle Street.

DEPARTMENT: Planning and Development Services

COUNCIL DISTRICTS IMPACTED: City Council District 5

BACKGROUND INFORMATION:

Owner/Applicant: IAKOBO Four LP (Monique Weston)
690 Laurel Lane
New Braunfels, TX 78130
(830) 237-3220 moniquetweston@gmail.com

Agent: NBS Real Estate Consulting (Todd Olson)
4949 Meadows Road, Suite 490
Lake Oswego, OR 97035
(210) 913-0860 tolson@nbsreconsulting.com

Staff Contact: Matt Greene
(830) 221-4053 mgreened@nbtexas.org

The subject right-of-way is located east of the intersection of Tolle street and South Gilbert Avenue, consists of 0.366 acres with improved street pavement and curbs and is abutting property zoned "C-4" Resort Commercial District. All adjacent properties, with the exception of 515 Napoleon Street (the condominiums), are owned by the applicant. The applicant is requesting to purchase the right-of-way to construct additional parking for the businesses on her adjacent properties. She intends to provide a 24-foot wide vehicular access easement and fire lane and a 10-foot wide pedestrian access easement to the condominium property. Most of the pedestrian access easement will be located on the applicant's adjacent property to the southeast. The greater part of the subject right-of-way is currently encumbered with several easements including sanitary sewer, water, electric, gas and communication easements.

The City's Comprehensive Plan, Envision New Braunfels, includes goals/strategies requiring environmentally sound development utilizing tools such as but not limited to low impact development (LID). Due to the subject property's proximity to the Comal River, staff is recommending any development of the property include LID techniques to address water quality and stormwater runoff. Effective LID designs attempt to make use of

natural landscape features to best manage runoff and maximize onsite storage and infiltration and can reduce the need for downstream structural practices that concentrate stormwater flows and contaminants into the river at the end of a pipe or ditch.

An appraisal was conducted at the City's request and the appraiser valued the property at $115,000, which accounted for the multiple easements and encumbrances within the right-of-way. The applicant did not concur with the City's appraisal and hired their own appraiser. The applicant's appraiser valued the land at $60,955. Staff agreed to use the value indicated by the applicant's appraiser, however, did not agree with the appraiser's adjustments. After modifying the adjustments, staff proposed a counteroffer of $102,000, which the applicant has agreed to pay if the abandonment is approved by City Council.

Surrounding Zoning and Land Use:
North - C-4 / Condominiums
South - Across S. Gilbert Ave., C-4 and C-2 / Offices and single-family residences
East - C-4 / Parking lot and single-family residence
West - C-4 / 44Tubing Company, a vacant commercial building and parking lot

ISSUE:
The proposed abandonment is consistent with the following actions from the Envision New Braunfels Comprehensive Plan:

Action 7.38: Identify possible additional parking areas for Downtown, Gruene, tourist areas and high demand events such as Wurstfest.
Action 7.43: Consider locating parking on underutilized parcels city-wide and within core attraction corridors through collaboration with private property owners, including but not limited to areas along Mill Street as well as areas behind buildings on Seguin Avenue.
Action 7.47: Increase parking to improve access to the Comal River and Guadalupe River.

FISCAL IMPACT:
The addition of $102,000 from the sale of improved right-of-way, addition of 0.366 of an acre to the tax rolls, and less asphalt and curb for the taxpayers to maintain.

RECOMMENDATION:
Multiple City departments reviewed the request and have no objections with the dedication of the identified easements to continue to provide necessary utilities and access. Staff recommends approval with the following conditions:

1. The subject property must be included within a plat with at least one of the adjacent properties owned by the applicant in compliance with the City's Subdivision Platting standards.

2. The plat shall include the following easements:

   a. Provide a minimum 15-foot wide Utility Easement along the southeast side of Tolle Street from Gilbert Avenue to the condominiums for electric infrastructure;

   b. A 20-foot wide Utility Easement for the existing water infrastructure;

   c. A 20-foot wide Utility Easement for the existing wastewater infrastructure;

d. A minimum 24-foot wide vehicular access easement from South Gilbert Avenue to the condominium project (Lot 1R, Summer Home Subdivision) and 454 Tolle Street (North 62 feet of Lots 4 and 5, City Block 1044); and

e. A minimum 10-foot wide pedestrian access easement from Gilbert Avenue to the condominium property. To be included on the plat or by separate instrument if located outside the plat boundary.

3. Ownership transfer will occur after the final plat has been approved by a Deed Without Warranty, which must be executed within 120 days of the second and final reading of this ordinance.

4. Recordation of the final plat will occur subsequent to the transfer of ownership of the property.

5. Amend the Parking by Permit Ordinance to delete this street section once abandoned.

6. Provide signage at the new terminus of Tolle Street stating "City maintenance ends here" unless otherwise authorized by staff through the permitting process for the reconstruction of the abandoned roadway into a parking lot.

7. The applicant shall utilize low impact development (LID) techniques in the water quality control treatment to minimize stormwater runoff as part of the redevelopment of the right-of-way into a parking lot.

8. New development, including a parking lot, shall be developed in compliance with development standards in place at the time of permit issuance.

Resource Links:
Chapter 118-56 Closure, abandonment, and sale of public right-of-way of the City's Code of Ordinances:
<https://library.municode.com/tx/new_braunfels/codes/code_of_ordinances?nodeId=PTIICOOR_CH118SUPL_ARTIVDEST_S118-56CLABSAPURI-W>

Attachments:
Aerial Map
Land Use Maps (Zoning, Existing and Future Land Use)
Survey of Subject Property
Photographs of Subject Property
Preliminary Site Plan
Appraisal Summary Sheet
Staff's Counteroffer Adjustments Exhibit

822

PZ-20-0001

ROW Abandonment - Tolle St

0 40 80 Feet

N

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Source: City of New Braunfels Planning
Date: 6/16/2020

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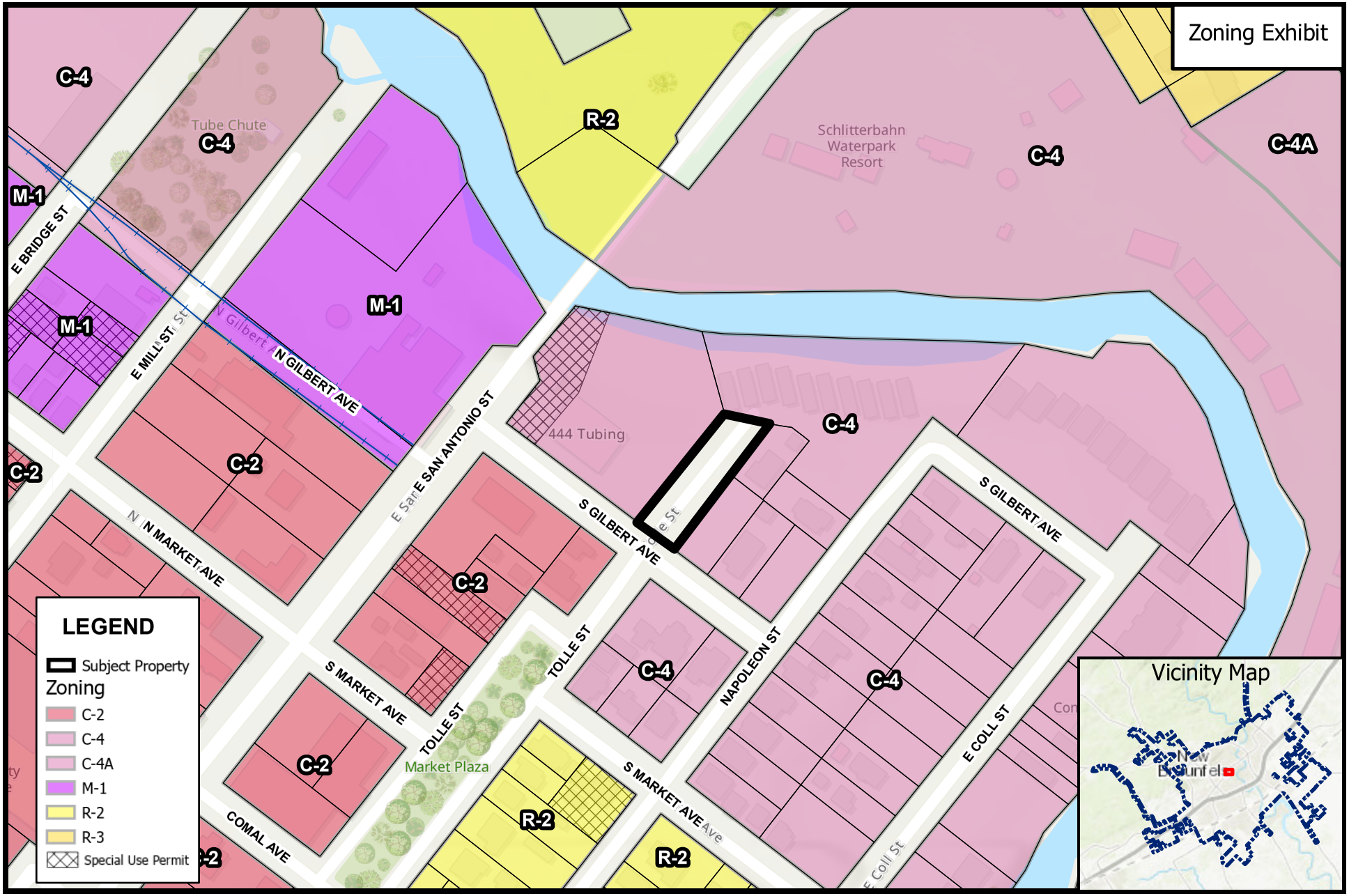

PZ-20-0001

ROW Abandonment - Tolle St

0 120 240 Feet

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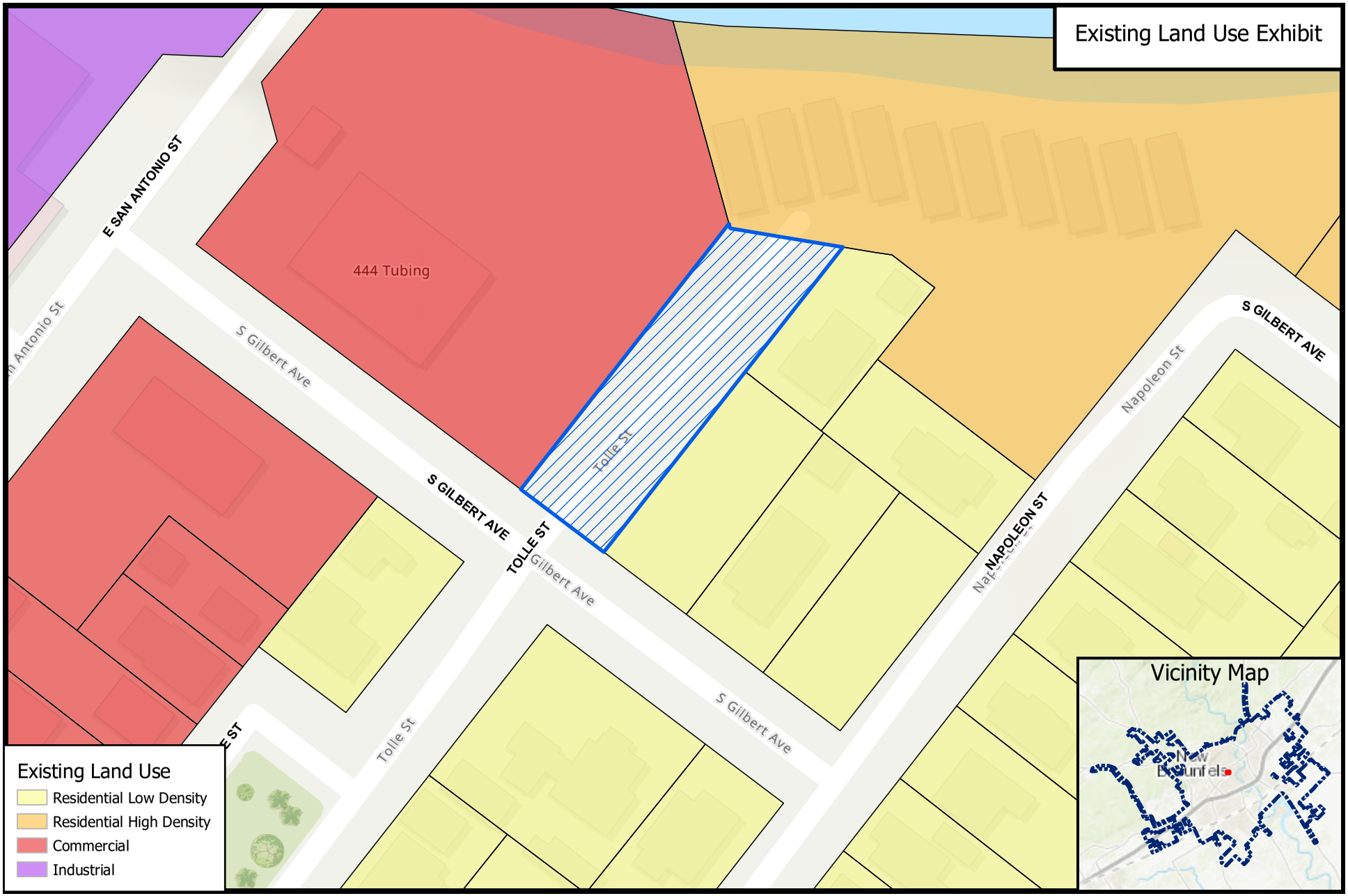

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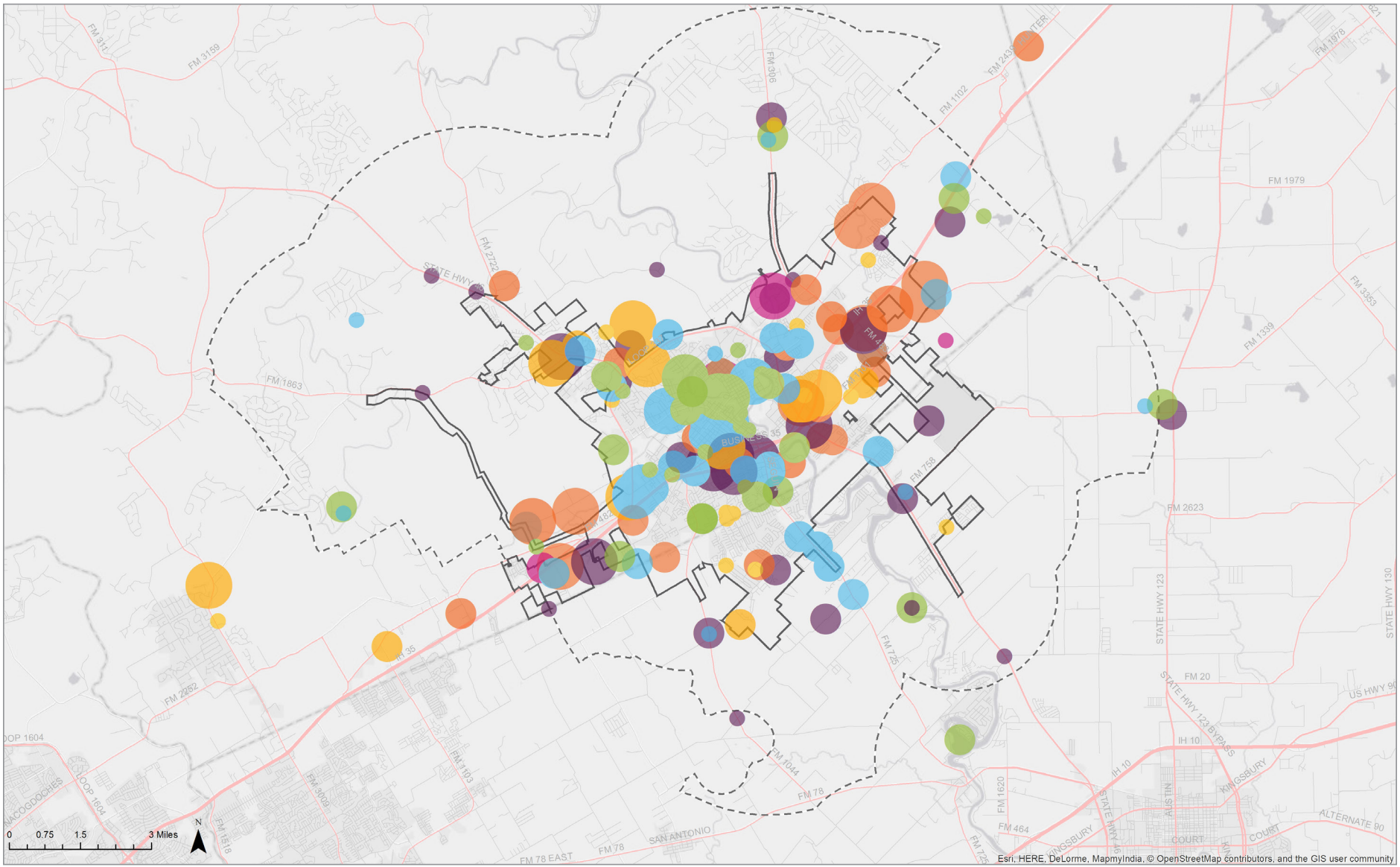

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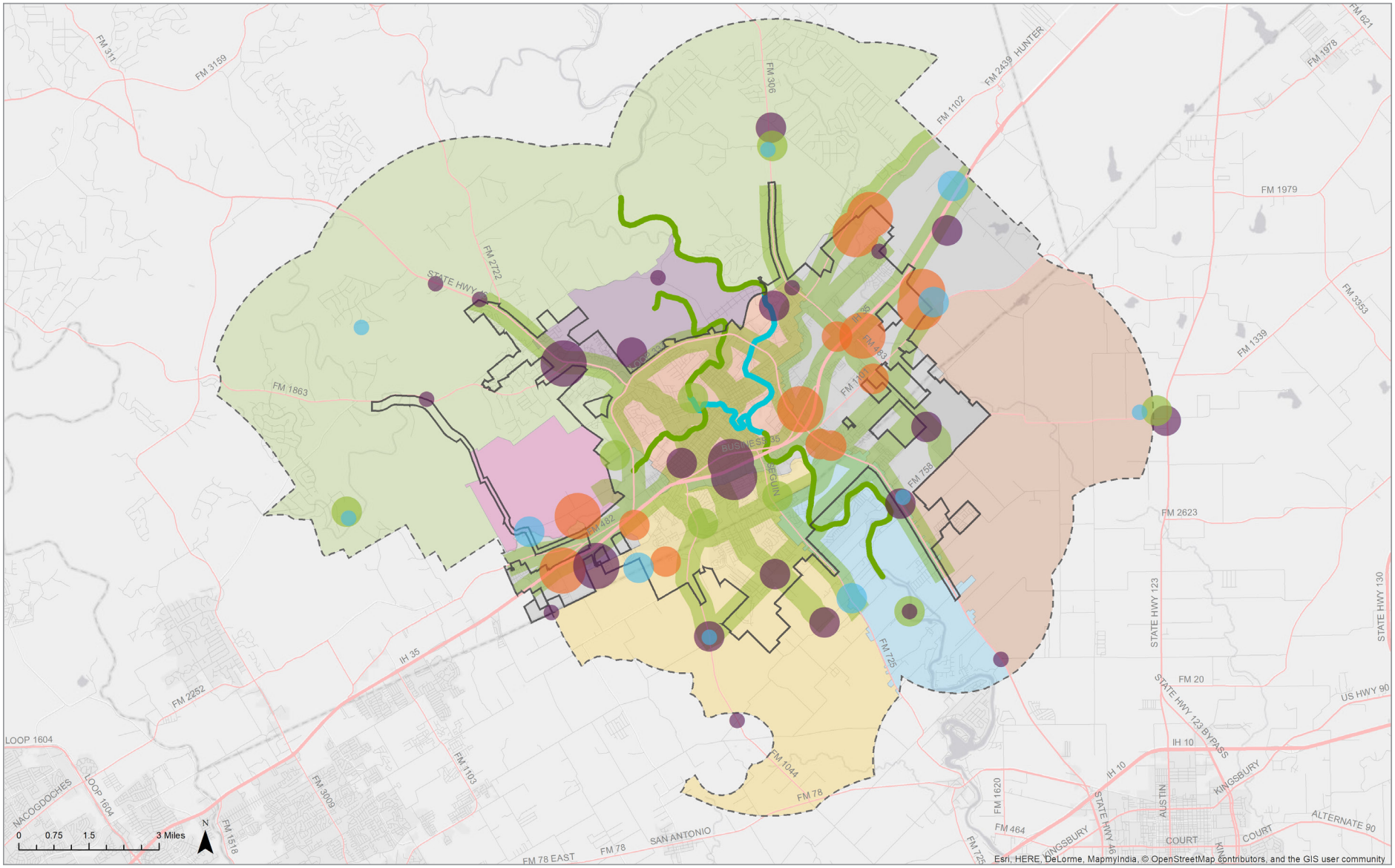

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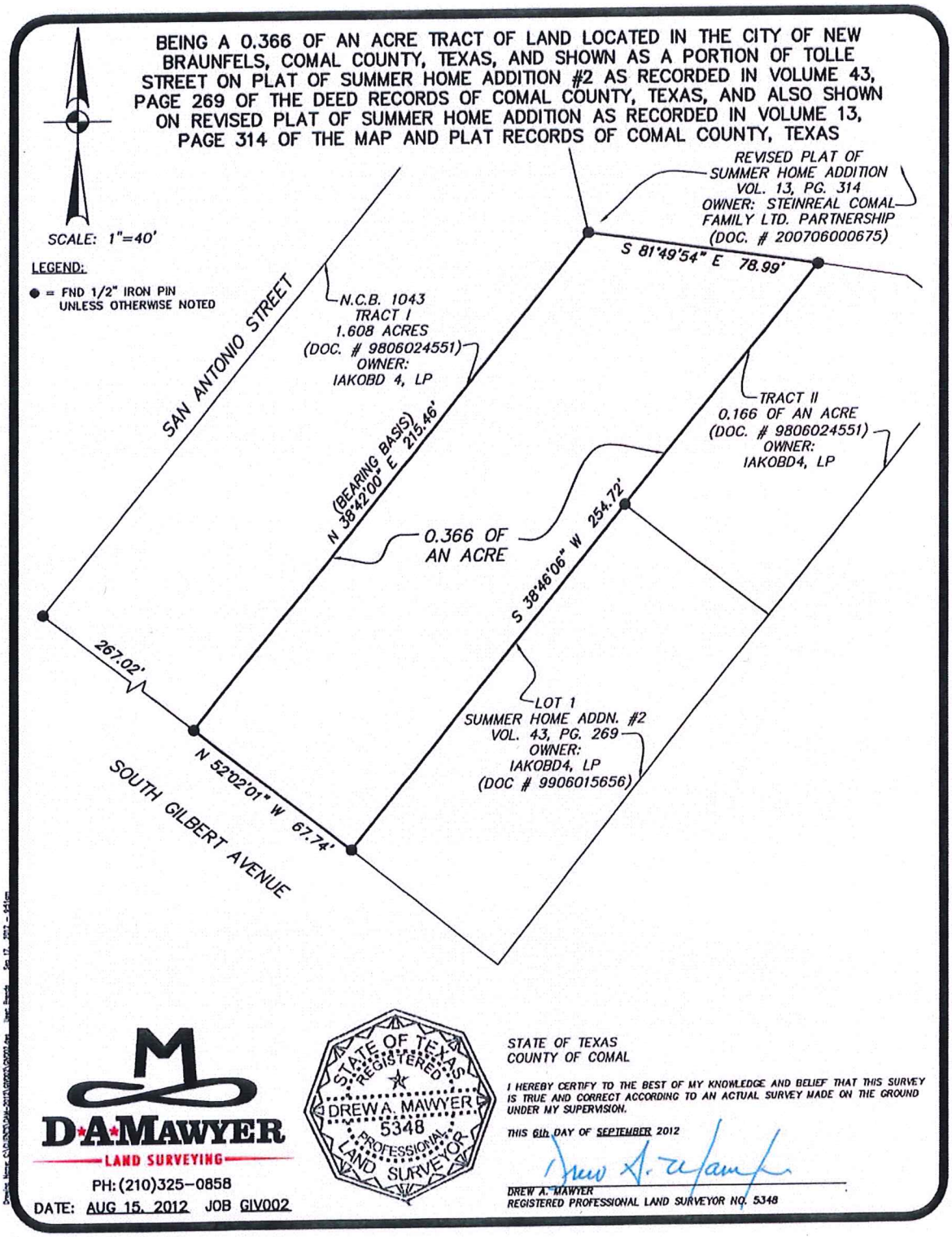
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SCALE: 1"=40'
LEGEND:
● = FND 1/2" IRON PIN UNLESS OTHERWISE NOTED
REVISED PLAT OF SUMMER HOME ADDITION VOL. 13, PG. 314 OWNER: STEINREAL COMAL FAMILY LTD. PARTNERSHIP (DOC. # 200706000675)
S 81°49'54" E 78.99'
SAN ANTONIO STREET
N.C.B. 1043 TRACT I 1.608 ACRES (DOC. # 9806024551) OWNER: IAKOBD 4, LP
(BEARING BASIS) N 38°42'00" E 215.46'
TRACT II 0.166 OF AN ACRE (DOC. # 9806024551) OWNER: IAKOBD4, LP
0.366 OF AN ACRE
S 38°46'06" W 254.72'
267.02'
LOT 1 SUMMER HOME ADDN. #2 VOL. 43, PG. 269 OWNER: IAKOBD4, LP (DOC # 9906015656)
N 52°02'01" W 67.74'
SOUTH GILBERT AVENUE
D·A·MAWYER
LAND SURVEYING
PH: (210)325-0858
DATE: AUG 15, 2012 JOB GIV002
STATE OF TEXAS REGISTERED DREW A. MAWYER 5348 PROFESSIONAL LAND SURVEYOR
STATE OF TEXAS
COUNTY OF COMAL
I HEREBY CERTIFY TO THE BEST OF MY KNOWLEDGE AND BELIEF THAT THIS SURVEY IS TRUE AND CORRECT ACCORDING TO AN ACTUAL SURVEY MADE ON THE GROUND UNDER MY SUPERVISION.
THIS 6th DAY OF SEPTEMBER 2012
DREW A. MAWYER
REGISTERED PROFESSIONAL LAND SURVEYOR NO. 5348

STOP
Subject
(Tolle St.)
S. Gilbert Ave.

S. Gilbert Ave.
Subject
(Tolle St.)

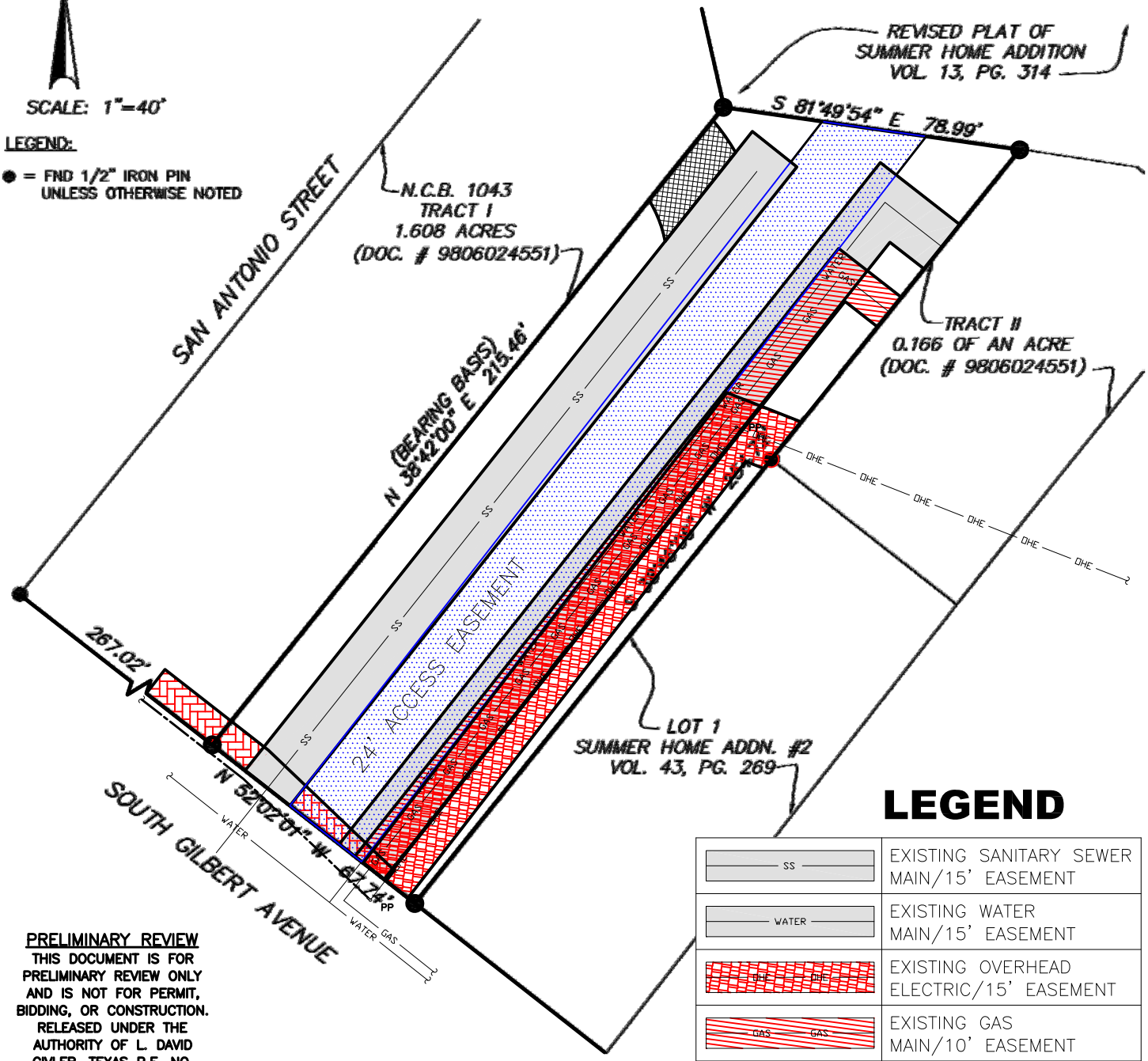
444 E. San Antonio St.
S. Gilbert Ave.
Subject
(Tolle St.)

S. Gilbert Ave.
444 E. San Antonio St.
Subject
(Tolle St.)

DEAD END
217 S. Gilbert Ave.
Subject
(Tolle St.)
S. Gilbert Ave.

454 Tolle St.
Subject
(Tolle St.)

BEING A 0.366 OF AN ACRE TRACT OF LAND LOCATED IN THE CITY OF NEW BRAUNFELS, COMAL COUNTY, TEXAS, AND SHOWN AS A PORTION OF TOLLE STREET ON PLAT OF SUMMER HOME ADDITION #2 AS RECORDED IN VOLUME 43, PAGE 269 OF THE DEED RECORDS OF COMAL COUNTY, TEXAS, AND ALSO SHOWN ON REVISED PLAT OF SUMMER HOME ADDITION AS RECORDED IN VOLUME 13, PAGE 314 OF THE MAP AND PLAT RECORDS OF COMAL COUNTY, TEXAS



LEGEND

SS	EXISTING SANITARY SEWER MAIN/15' EASEMENT
WATER	EXISTING WATER MAIN/15' EASEMENT
OHE OHE	EXISTING OVERHEAD ELECTRIC/15' EASEMENT
GAS GAS	EXISTING GAS MAIN/10' EASEMENT
	EXISTING AT&T COMM. LINE/10' EASEMENT
	24' ACCESS EASEMENT
	26' FIRE LANE ACCESS

PRELIMINARY REVIEW
THIS DOCUMENT IS FOR PRELIMINARY REVIEW ONLY AND IS NOT FOR PERMIT, BIDDING, OR CONSTRUCTION. RELEASED UNDER THE AUTHORITY OF L. DAVID GIVLER, TEXAS P.E. NO. 73842

THE BASE MAP DATED SEPTEMBER 6, 2012 WAS PROVIDED BY D.A. MAWYER LAND SURVEYING.

EASEMENT ENCUMBRANCE	0.2857 ACRES
FIRE LANE ENCUMBRANCE	0.0065 ACRES
UNENCUMBERED	0.0738 ACRES
TOTAL ABANDONMENT	0.3660 ACRES

GEI GIVLER ENGINEERING, INC.
Texas Registration #F-002573
1901 NW Military Hwy, Suite 201
San Antonio, Texas 78213
Phone: (210) 342-3991
Fax: (210) 342-6065

Tolle Street Abandonment

444 East San Antonio Street
New Braunfels, Texas 78130

PROJECT NO.	WESTON-001
CHECKED BY	LDG
DRAWN BY	TJN
DATE	NOVEMBER 2, 2012
SHEET	1 OF 1
	UTILITY EASEMENTS

P:\WESTON_001\Drawings\FESTUB 2\2012 11 05 Tolle St. Utility Easements Rev2.dwg, 11/6/2012 10:08:37 AM

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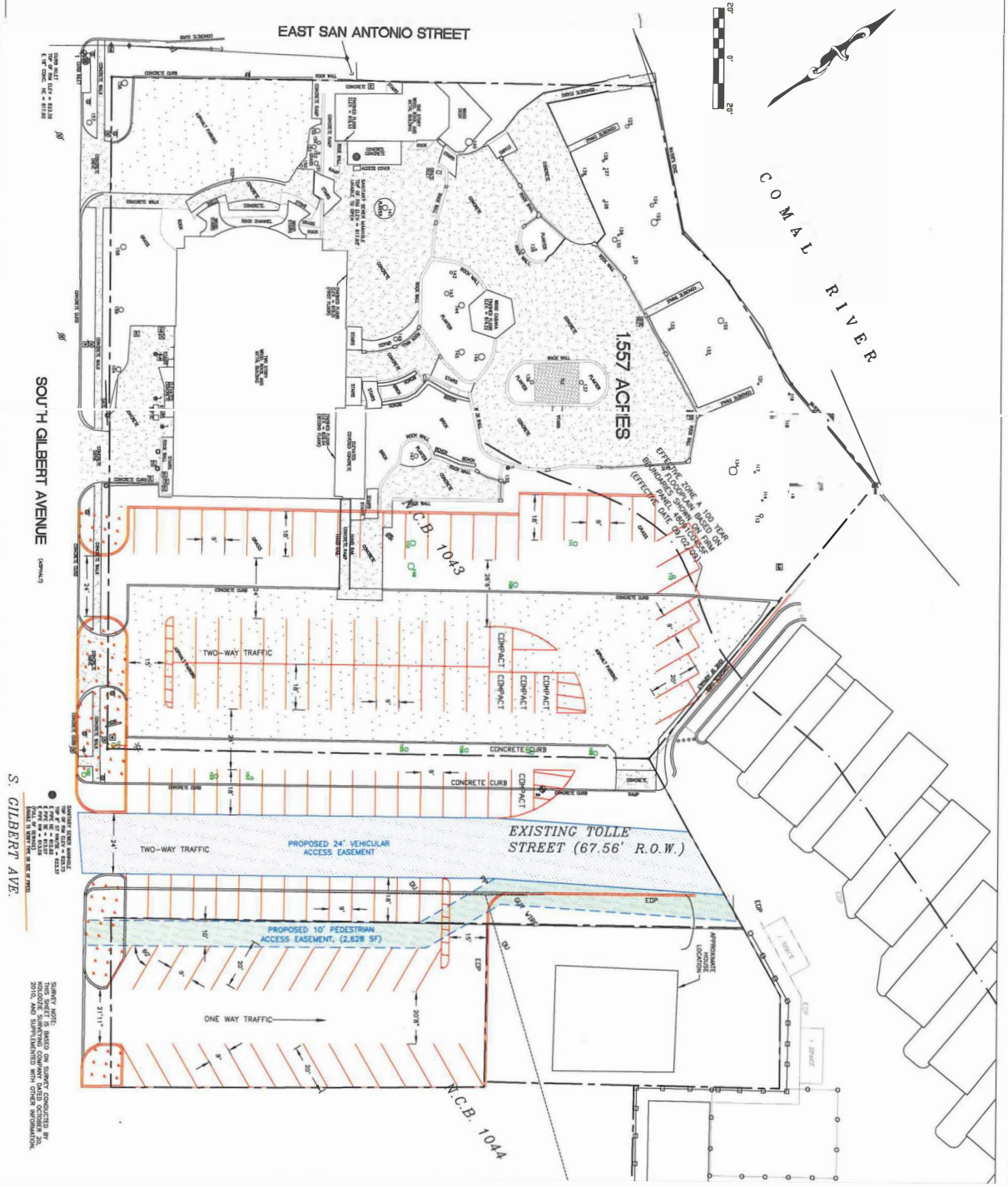


444 Project
444 East San Antonio Street
New Braunfels, Texas

GEI GIVLER ENGINEERING, INC.

SHEET NO.	1 OF 1
PARKING LOT CONCEPT NO.	1
DATE	FEBRUARY 2013
DRAWN BY	LDG
CHECKED BY	LDG
DESIGNED BY	WESTON-001
JOB NO.	
REVISIONS	

WESTON-001 PRELIMINARY DESIGN

The appraisal, subject to the assumptions and limiting conditions as expressed herein and conducted according to the Uniform Standards of Professional Appraisal Practice, led us to develop the following opinion of market value:

VALUE CONCLUSION		
Interest	Date	Value
Fee Simple	June 14, 2020	$115,000

Support and explanation for our value conclusion is explained in detail in the contents of the attached report. It has been a pleasure to assist you, and if we can be of service to you in the future, please let us know.

Lowery Property Advisors, LLC

MARIO CARO, MAI, AI-GRS, SR/WA
Texas State Certified General Real Estate Appraiser
Certificate No. TX1334889-G
mario@lowerypa.com

PHILLIP COURCHESNE
Texas Appraiser Trainee
Certification No. TX1341511 Trainee
phillip@lowerypa.com

STAFF'S COUNTEROFFER ADJUSTMENTS EXHIBIT

			Landowner Appraisal		City Counteroffer	
Encumbrance	Size (SF)	Land Value	% of Fee	Adjustment	% of Fee	Adjustment
15' Electric Easement	2,467	$11.00	95%	$25,780	50%	$13,569
24' Access Easement	5,709	$11.00	95%	$59,659	50%	$31,400
26' Fire Lane Access	266	$11.00	90%	$2,633	50%	$1,463
10' Gas Easement	970	$11.00	55%	$5,869	55%	$5,869
15' Sewer Easement	3,236	$11.00	50%	$17,798	50%	$17,798
15' Water Easement	406	$11.00	50%	$2,233	50%	$2,233
10' AT&T Easement	81	$11.00	50%	$446	50%	$446
		Total Land Value:		$175,373		$175,373
		Less Adjustment:		$114,418		$72,776
		Reconciled Value:		**$60,955**		**$102,597**

City of New Braunfels

Planning Commission Agenda Item Report

550 Landa Street
New Braunfels, TX

6/1/2021

Agenda Item No. I)

PRESENTER:
Applicant: Pape-Dawson Engineers (Matt Geistweidt, P.E.)
Owner: Charles Grimm

SUBJECT:
MP21-0174, WVR21-177 and WVR21-178 Discuss and consider approval of the master plan for Creekside Terrace Subdivision with waivers to Sections 118-44(b) and 118-46(d) of the Subdivision Platting Ordinance to allow block length to exceed 1,200 feet and to not require projection of streets into adjacent unplatted property.

DEPARTMENT: Planning and Development Services

COUNCIL DISTRICTS IMPACTED: N/A (Outside City Limits)

BACKGROUND INFORMATION:

Applicant: Pape-Dawson Engineers (Matt Geistweidt, P.E.)
2000 NW Loop 410
San Antonio, TX 78232
(210) 375-9000 mgeistweidt@pape-dawson.com

Owner: Charles Grimm
2912 FM 1101
New Braunfels, TX 78130

Staff Contact: Matt Greene
(830) 221-4053 mgreene@nbtexas.org

Description: Master Plan of 98.94 acres for 500 single-family residential lots and 6 open space lots

ISSUE:
The subject property is located in the ETJ in Comal County on the east side of FM 1101 between Holcan Drive and Kroesche Lane. The proposed subdivision will consist of 500 single-family residential lots and 6 open space lots. The subdivision is surrounded by the Heatherfield Subdivision to the north, FM 1101 to the west and undeveloped land to the east and south.

Drainage:
The Public Works Department reviewed preliminary drainage with the Letter of Certification process as required by Section 118-51e. of the Subdivision Platting Ordinance and in accordance with the requirements of Chapter 143 Municipal Drainage Utility Systems, and the Drainage and Erosion Control and Design Manual.

A portion of the subject property is located within the 1% annual chance floodplain and floodway.

Utilities:
Electric, water and wastewater services will be provided by New Braunfels Utilities (NBU). Utility Easements will be established with he platting of each phase of development.

Transportation:
Regional Transportation Plan
FM 1101 is indicated as a Principal Arterial up to 150 feet in width. The current right-of-way width is 80 feet and a 35-foot right-of-way dedication will be provided on the final plat for Phase 1.

Block Length
The applicant is requesting a waiver from the maximum block length requirement for the block on the southwest side of Bellflower Dr.

A block is "a unit of land bounded by streets, other transportation or utility rights-of-way, parks, streams, waterways, or any other barrier to the continuity of development." The length of a block is measured along the axis of the block.

To meet the 1,200-foot block length requirement along the block to the southwest of Bellflower Dr., an additional street would need to be provided from Bellflower Dr. to the southwest. The applicant claims the orientation of the floodplain would result in a proposed street that would terminate in the middle of the floodplain and floodway in a wide section of Alligator Creek. Bellflower Dr. right-of-way will not exceed 1,200 linear feet in length.

Staff does not oppose the request for maximum block length waiver as compliance with the Subdivision Platting Ordinance would result in a street projection with a temporary turnaround terminating within the floodplain and floodway of Alligator Creek and the length of the actual street right-of-way would not exceed 1,200 linear feet.

Street Projection
The applicant is requesting a waiver to not require street projections into three adjacent unplatted properties to the south.

Per Section 118-46(d) of the Subdivision Platting Ordinance, where adjoining areas are not subdivided, the arrangement of streets in the subdivision shall make provision for the proper projection of streets into such unsubdivided area to facilitate connectivity with future development.

The applicant claims one of the adjacent parcels is a small 1.3 acre tract adjacent to Phase 1 and fronting FM 1101 that will require dedication of approximately 40 feet of right-of-way at the time of development, making it impractical for a street to be incorporated into the development of such a small property. The applicant claims the physical orientation of the floodplain restricts the ability to provide practical street projections to the other two parcels to the south, adjacent to Phase 3 (an 80-acre tract and a 9.5-acre tract), and if the code requirement were followed, the street stubs would terminate in the middle of the floodplain.

Staff does not oppose the request for street projection waivers as compliance with the Subdivision Platting Ordinance would result in a street projection to a property too small to accommodate a street extension and two

street projections and temporary turnarounds terminating within the floodplain and floodway of Alligator Creek.

Hike and Bike:
The City's Hike and Bike Trails Plan includes a 10-foot wide off-street trail along the west side of FM 1101 across the street from this development. Therefore, no hike and bike trail right-of-way dedication is required with this subdivision.

Sidewalks
The developer will construct 4-foot wide sidewalks interior to the subdivision adjacent to all non-buildable lots and a 6-foot wide sidewalk adjacent to FM 1101 at the time of subdivision construction. Four-foot wide sidewalks will be constructed adjacent to all residential lots by the builder/owner at the time of home construction.

Airport Hazard Overlay Zoning District:
This subdivision is located within the Airport Hazard Overlay Zoning District, containing portions of the Inner Precision Approach, Transition Zone, Horizontal Zone and Inner Turning Zone.

Roadway Impact Fees:
This subdivision is outside city limits and the Roadway Impact Fee Study Area and Roadway Impact Fees do not apply.

Parkland Dedication and Development:
This subdivision is subject to the 2018 Parkland Dedication and Development Ordinance. According to the applicant's park letter, this subdivision intends to pay fee-in-leu of parkland dedication and development. The fees will be required to be paid to the City prior to plat recordation.

Commission Findings:
The adopted Subdivision Platting Ordinance indicates the Planning Commission shall not approve/recommend approval of a waiver unless it makes findings based upon the evidence presented to it in each specific case that:

1. Granting the waiver will not be detrimental to the public safety, health or welfare, and will not be injurious to other property or to the owners of other property, and the waiver will not prevent the orderly subdivision of other property in the vicinity.

2. Because of the particular physical surroundings, shape and/or topographical conditions of the specific property involved, a particular hardship to the property owner would result, as distinguished from a mere inconvenience, if the strict letter of these regulations is carried out; or an alternate design will generally achieve the same result or intent as the standards and regulations prescribed herein; and

3. The waiver will not in any manner vary the provisions of the Zoning Ordinance or other ordinance(s) of the City.

FISCAL IMPACT:
N/A
RECOMMENDATION:
To meet the requirements of the City's Subdivision Platting Ordinance and other adopted codes, the applicant's

proposed final plat must comply with the conditions noted below. Staff recommends approval of the applicant's proposed master plan and requested waivers to block length and street projection with the following Conditions of Approval:

1. Show and label the City Limits boundary adjacent to the subject property *(NBCO 118-22a.(3))*

2. Label the City Limits on the location map. *(NBCO 118-22a.(3))*

3. Add a note to the Master Plan stating: "A portion of this subdivision is located within indicated Special Flood Hazard Zone AE according to the adopted flood maps of the City of New Braunfels, as defined by the Comal County, Texas, Flood Insurance Rate Map Number 48091C046F, effective date September 2, 2009 as prepared by the Federal Emergency Management Agency". *(NBCO 118-22a.(10))*

4. Show and label the location of the floodway. *(NBCO 118-22a.(10))*

5. Add a note to the Master Plan stating: 'This subdivision is located within the Airport Hazard Zoning District and is subject to the Airport Hazard Zoning District regulations of the City of New Braunfels Zoning Ordinance". *(NBCO 118-22a.(4))*

6. Add "2018" after "subject to the" in Note #9. *(NBCO 118-22a.)*

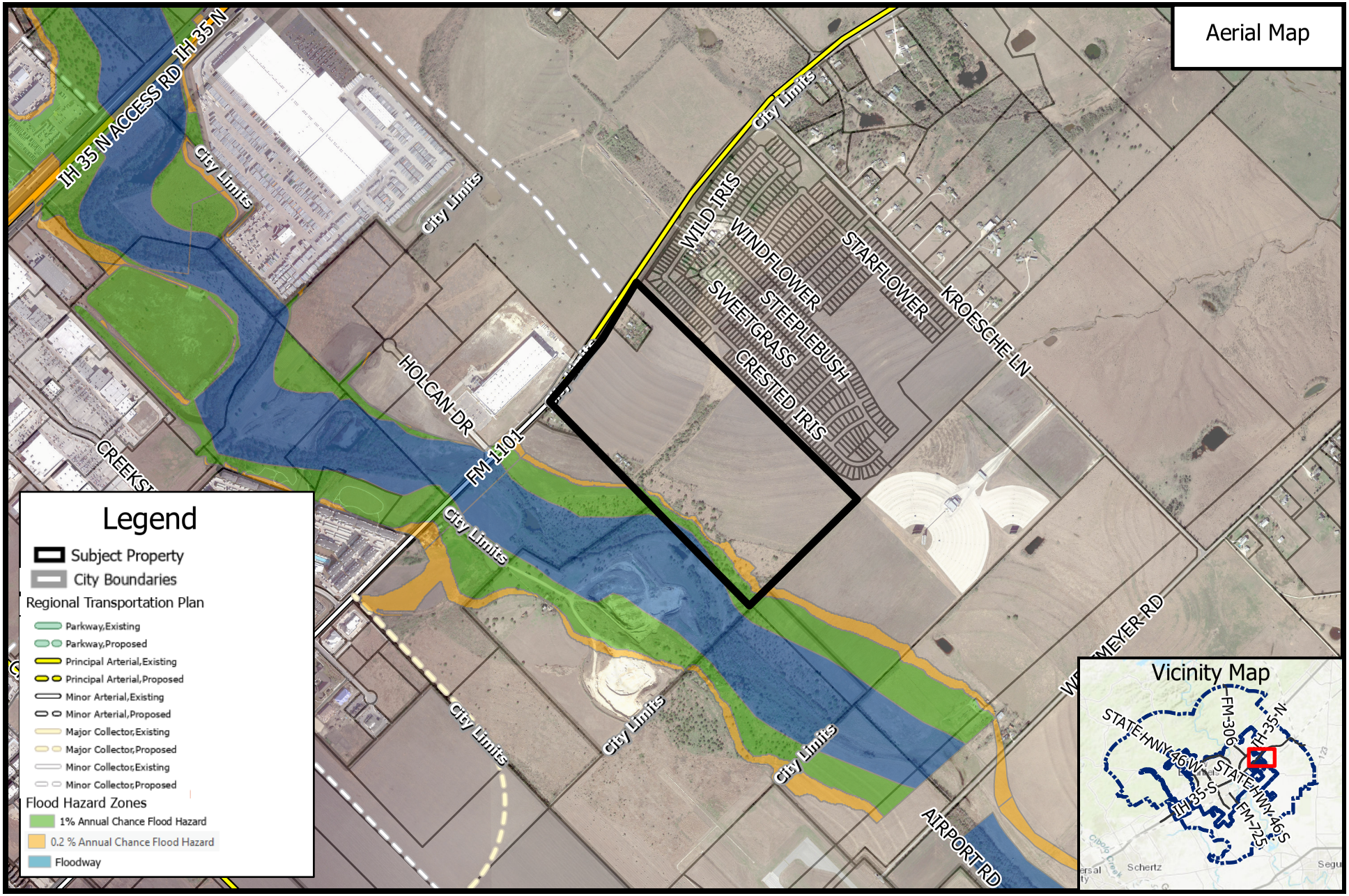
7. Remove the "Typical Lot" and "Street Section" exhibits from the Master Plan. *(NBCO 118-22a.)*

8. Show and label the recorded lots and include the recordation document numbers for Heatherfield, Units 3 and 5. *(NBCO 118-22a.(4))*

9. Add bearings to the outer boundary of the Master Plan. *(NBCO 118-21c.)*

Approval Compliance:
Pursuant to State Law, if the Planning Commission approves with conditions, to obtain final approval of the master plan, the applicant must submit to the City a written response that satisfies each condition of approval prior to expiration of the master plan and prior to submittal of the first application for a preliminary or final plat (Section 118-32(b)). In accordance with Chapter 212, Texas Local Government Code, the City will determine the master plan approved if the response adequately addresses each Condition of Approval.

Attachments:
Aerial Map
Master Plan
Block Length and Street Projection Waiver Exhibit
Applicant's Letters of Waiver Justification



MP21-0174, WVR21-177 & WVR21-178

Creekside Terrace Master Plan - with Waivers to Block Length and Street Projection

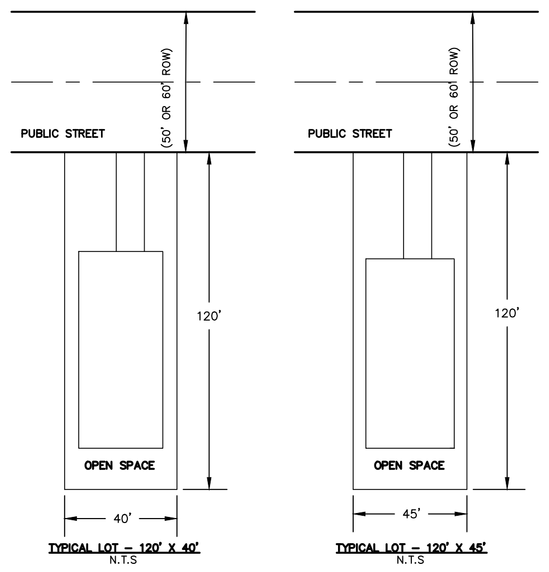
0 750 1,500 Feet

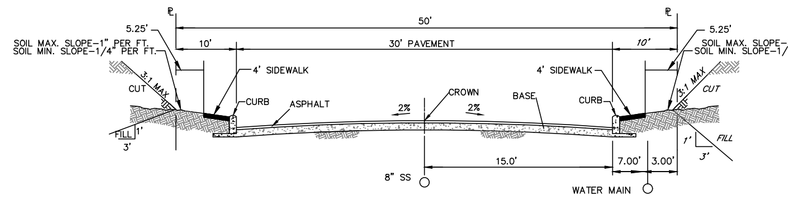
N

Source: City of New Braunfels Planning
Date: 5/24/2021

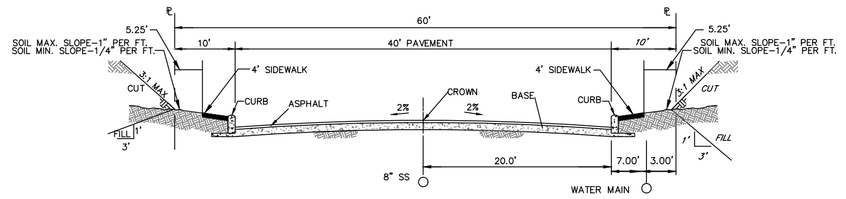
Path:
\\chfs-1\Departments\Planning\Plats\2021\MP21-0174 - Creekside Terrace Subdivision -

DISCLAIMER: This map and information contained in it were developed exclusively for use by the City of New Braunfels. Any use or reliance on this map by anyone else is at that party's risk and without liability to the City of New Braunfels, its officials or employees for any discrepancies, errors, or variances which may exist.





50' STREET SECTION
NOT-TO-SCALE



60' STREET SECTION
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CURVE TABLE					
CURVE	RADIUS	DELTA	CHORD BEARING	CHORD	LENGTH
C1	1949.86'	5°46'45"	N37°02'52"E	196.59'	196.67'

NOTES:

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LOT SUMMARY	
TOTAL SITE ACREAGE	98.94 AC
UNIT	NUMBER OF LOTS
PHASE I (29.03 AC)	150
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PHASE III (33.05 AC)	150
TOTAL RESIDENTIAL LOTS	500
OPEN SPACE LOTS (17.99 AC)	6
TOTAL LOTS	506
LOT DENSITY = 5.05 LOTS PER ACRE (RESIDENTIAL)	

OWNER:
CHARLES GRIMM
2912 FM 1101
NEW BRAUNFELS, TX 78130-2619

ENGINEER/DESIGNER:
PAPE-DAWSON ENGINEERS, INC.
2000 NW LOOP 410
SAN ANTONIO, TEXAS 78213
PHONE: (210) 375-9000
FAX: (210) 375-9010

DEVELOPER:
PULTE HOMES OF TEXAS, L.P.
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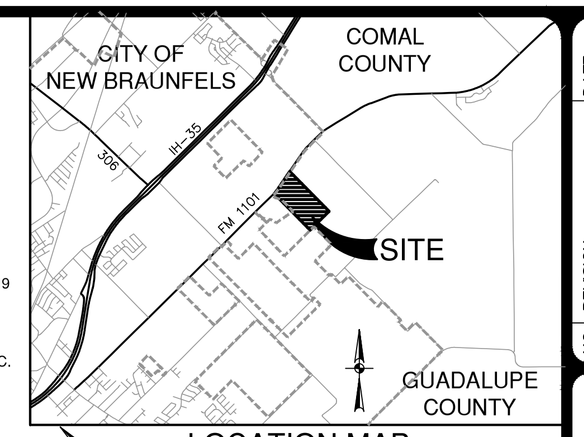
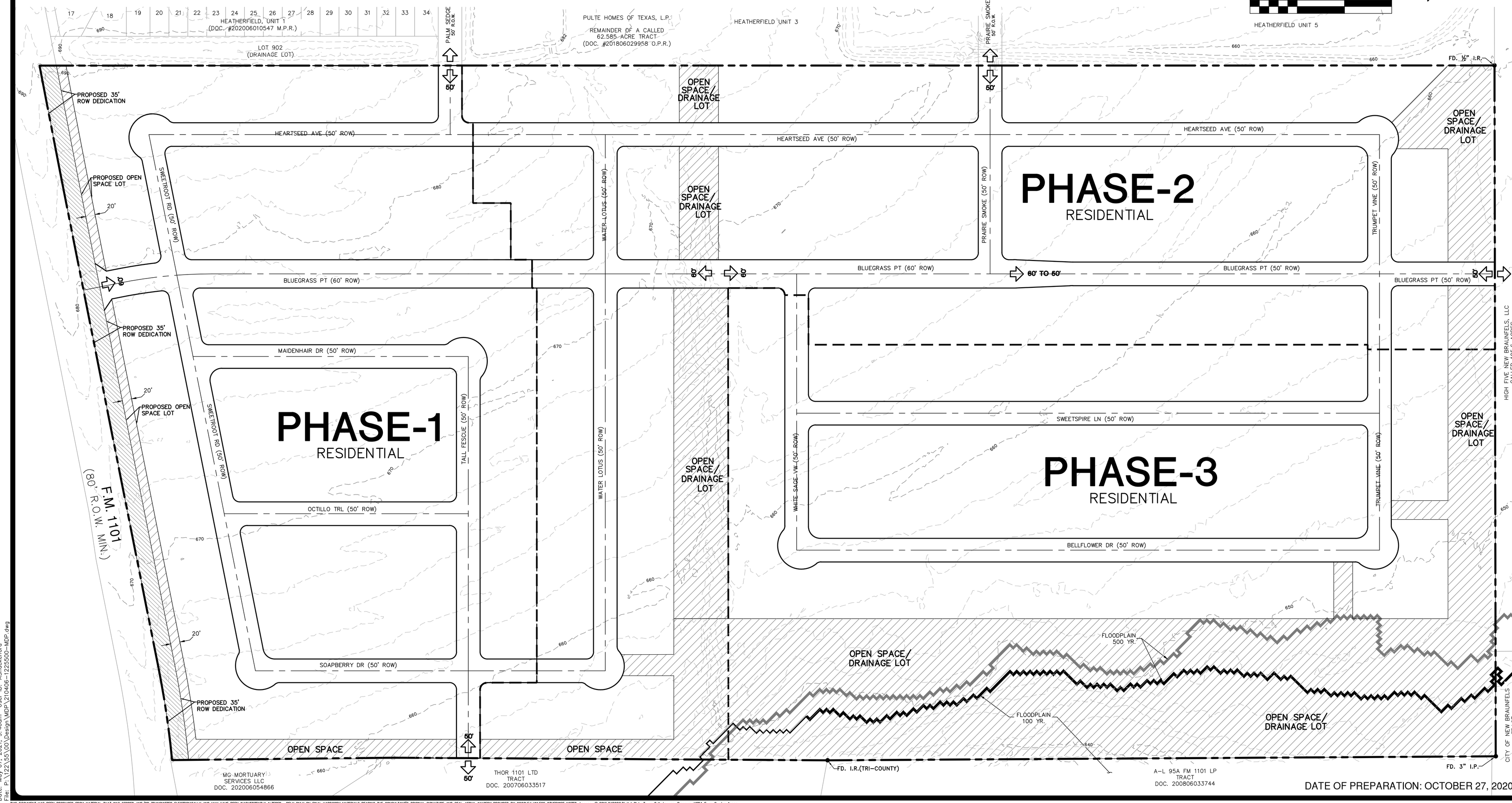
PHONE: (210) 581-8812



LOCATION MAP
NOT-TO-SCALE

LEGEND
PROPERTY LINE
UNIT BOUNDARY
ACCESS POINTS

SCALE: 1"= 100'
0' 100' 200' 300'



DATE OF PREPARATION: OCTOBER 27, 2020

NO.	REVISION	DATE

PAPE-DAWSON ENGINEERS
SAN ANTONIO | AUSTIN | HOUSTON | FORT WORTH | DALLAS
2000 NW LOOP 410 | SAN ANTONIO, TX 78213 | 210.375.9000
TBPE FIRM REGISTRATION #470 | TBPLS FIRM REGISTRATION #10028800

CREEKSIDE TERRACE
NEW BRAUNFELS, TEXAS
MASTER PLAN

JOB NO. 12255-00
DATE OCTOBER 2020
DESIGNER MG
CHECKED SSC DRAWN JZD
SHEET 1 OF 1

Date: May 07, 2021, 9:46am User ID: AShackelford
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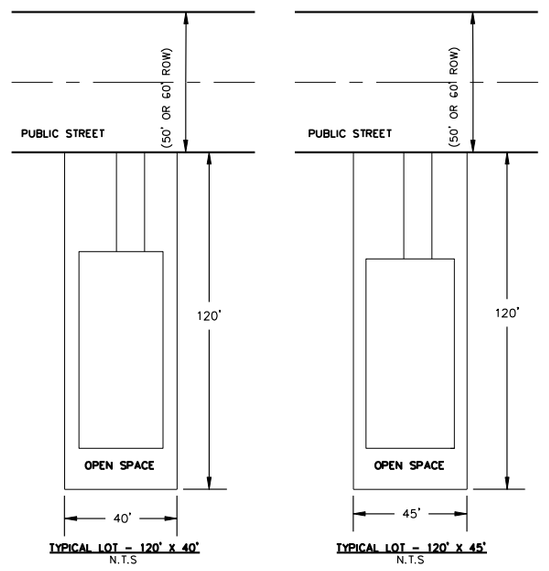
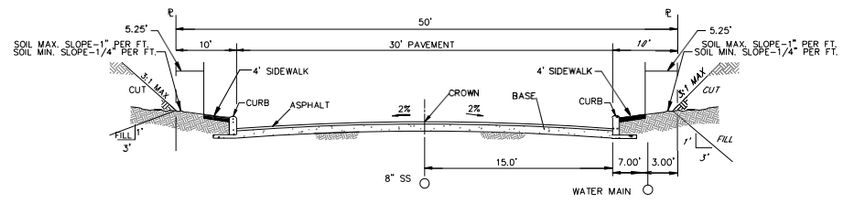
THIS DOCUMENT HAS BEEN PRODUCED FROM MATERIAL THAT WAS STORED AND/OR TRANSMITTED ELECTRONICALLY AND MAY HAVE BEEN INADVERTENTLY ALTERED. RELY ONLY ON FINAL HARDCOPY MATERIALS BEARING THE CONSULTANT'S ORIGINAL SIGNATURE AND SEAL. AERIAL IMAGERY PROVIDED BY GOOGLE© UNLESS OTHERWISE NOTED. Imagery © 2016,CAPCOG,Digital Globe,Texas OrthoImagery Program, USDA Farm Service Agency.

BLOCK LENGTH AND STREET PROJECTION WAIVER EXHIBIT





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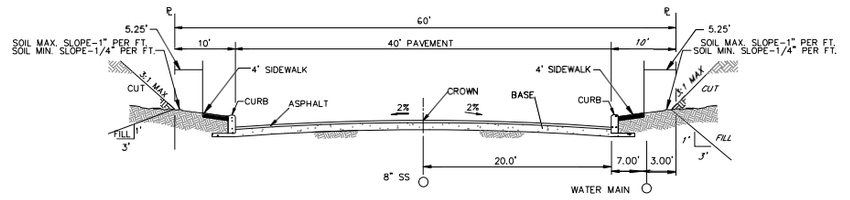

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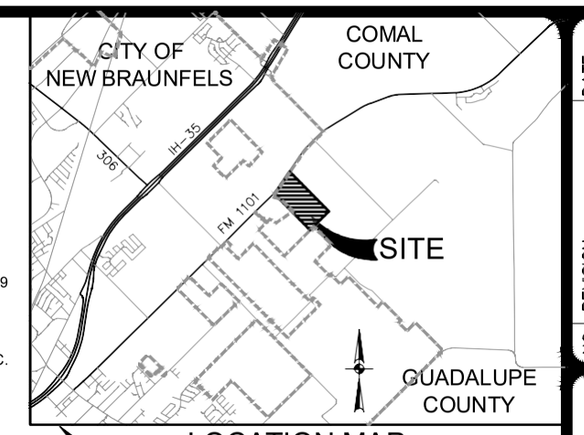

LOCATION MAP
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PROPERTY LINE
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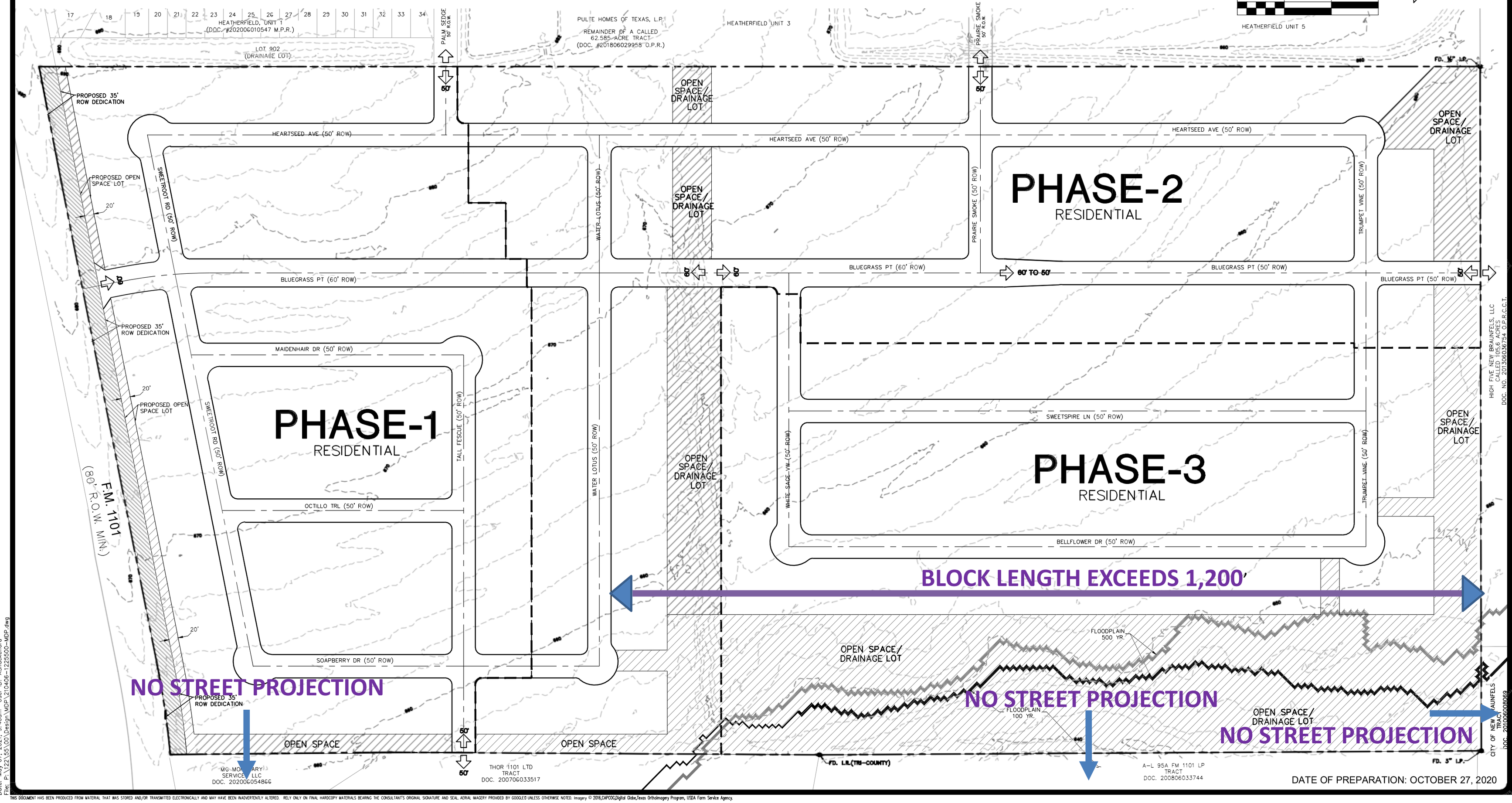
0' 100' 200' 300'



DATE OF PREPARATION: OCTOBER 27, 2020

NO.	REVISION	DATE

PAPE-DAWSON ENGINEERS
SAN ANTONIO | AUSTIN | HOUSTON | FORT WORTH | DALLAS
2000 NW LOOP 410 | SAN ANTONIO, TX 78213 | 210.375.9000
TBPE FIRM REGISTRATION #470 | TBPLS FIRM REGISTRATION #10028800

CREEKSIDE TERRACE
NEW BRAUNFELS, TEXAS
MASTER PLAN

JOB NO. 12255-00
DATE OCTOBER 2020
DESIGNER MG
CHECKED SSC DRAWN JZD
SHEET 1 OF 1

Date: May 07, 2021, 9:46am User ID: ASpickelford
File: P:\122\55\00\Design\MDP\210406-122500-MDP.dwg

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PAPE-DAWSON ENGINEERS

April 30, 2021

City of New Braunfels
Planning & Development Services Department
550 Landa Street
New Braunfels, TX 78130

Re: Creekside Terrace Subdivision
Waiver Request
Platting Code §118-46(d)

To whom it may concern:

Please accept this letter for the Creekside Terrace Subdivision located south of the FM1101 & Kroesche Lane intersection as a request for a waiver from the City of New Braunfels platting code section 118-46(d). Per this section "Where adjoining areas are not subdivided, the arrangement of streets in the subdivision shall make provision for the proper projection of streets into such unsubdivided area". On behalf of the developer, our office is requesting a waiver to not provide a stub to three tracts to the south, owned by MG Mortuary Services LLC (Tract 1), A-L 95A FM 1101LP (Tract 2), and the City of New Braunfels (Tract 3).

We respectfully ask that a waiver be granted to allow the plat for this project to proceed for the following reasons:

Granting the waiver will not be detrimental to the public safety, health, or welfare, and will not be injurious to other property or to the owners of other property, and the waiver will not prevent the orderly subdivision of other property in the vicinity.

- *The safety, health, and welfare of the public will not be detrimentally affected by not providing a street stub to the three tracts mentioned. Tract 1, owned by MG Mortuary services, is a small +/-1.3-acre tract adjacent to FM 1101 and the future 150' parkway on the major thoroughfare plan. The other two tracts are located in the floodplain. The Creekside Terrace Subdivision provides a total of 5 street connection points along its property boundary to allow for access to the adjacent platted and unplatted property. The connections proposed with the development provide cross access to all other adjoining properties yielding adequate local cross access in harmony with the intent of the code for orderly subdivision.*

Because of the particular physical surroundings, shape and/or topographical conditions of the specific property involved, a particular hardship to the property owner would result, as distinguished from a mere inconvenience, if the strict letter of these regulations is carried out; or an alternate design will generally achieve the same result or intent as the standards and regulations prescribed herein;

- The proposed Creekside Terrace subdivision provides a street stub-out to the larger tract adjacent to the Tract 1. Tract 1 also has access to the adjacent FM 1101 and future major thoroughfare. The physical orientation of the floodplain restricts the ability to provide a street stub-out to any portion of the Tract 2 or Tract 3 owned by A-L 95A FM 1101LP and the City of New Braunfels, respectively. Any attempt to provide a street stub-out to either of these tracts from the Creekside Terrace Subdivision would render a proposed street that terminates in the middle of floodplain. As a general standard practice, crossings are permitted and constructed to completely span a flood plain. In the case of this subdivision, this would not be possible since the other side of the flood plain is on adjacent property. Additionally, the floodplain and floodway are significantly wide at this point of Alligator Creek and any crossing would require substantial financial investment in order to construct it in compliance with the City of New Braunfels Code Chapter 58 regarding floods.

The waiver will not in any manner vary the provisions of the zoning ordinance or other ordinance(s) of the city.

- By not constructing the street stub the project will not be in violation of any other City code nor will it interfere with the orderly development of this tract or the adjacent tracts. Notably, both tracts 1 and 2 already have access to a public ROW at FM 1101 to the west.

In my professional opinion, the proposed waiver request remains in harmony with the spirit and intent of the City of New Braunfels Platting Ordinance and will not adversely affect health, safety, or welfare of the public.

If you have any questions, please do not hesitate to contact me.

Sincerely,
Pape-Dawson Engineers, Inc.

Trey Dawson, P.E.
Sr. Vice President

4/30/21

P:\122\55\00\WORD\LETTERS\210426_WAIVER.DOCX

STATE OF TEXAS
EUGENE H. DAWSON, III
112792
LICENSED
PROFESSIONAL ENGINEER

May 7, 2021

City of New Braunfels
Planning & Development Services Department
550 Landa Street
New Braunfels, TX 78130

Re: Creekside Terrace Subdivision
Waiver Request
Platting Code §118-44(b)

To whom it may concern:

Please accept this letter for the Creekside Terrace Subdivision located south of the FM1101 & Kroesche Lane intersection as a request for a waiver from the City of New Braunfels platting code section 118-44(b). Per this section "Block lengths shall not exceed 1,200 feet except along arterial streets". On behalf of the developer, our office is requesting a waiver to exceed the maximum requirement along the proposed Bellflower Dr street.

We respectfully ask that a waiver be granted to allow the plat for this project to proceed for the following reasons:

Granting the waiver will not be detrimental to the public safety, health, or welfare, and will not be injurious to other property or to the owners of other property, and the waiver will not prevent the orderly subdivision of other property in the vicinity.

- *The safety, health, and welfare of the public will not be detrimentally affected by exceeding the maximum block length within Phase III of the Creekside Terrace Development. Due to the presence of the 100-year floodplain, a stub street cannot be provided to decrease the block length along Bellflower Drive.*

Because of the particular physical surroundings, shape and/or topographical conditions of the specific property involved, a particular hardship to the property owner would result, as distinguished from a mere inconvenience, if the strict letter of these regulations is carried out; or an alternate design will generally achieve the same result or intent as the standards and regulations prescribed herein;

- To meet the 1,200-foot block length requirement along Bellflower Drive, an additional street would need to be provided to the south. Due to the physical orientation of the floodplain, any attempt to provide an additional street to the south of the Creekside Terrace Subdivision would result in a proposed street that terminates in the middle of floodplain. As a general standard practice, crossings are permitted and constructed to completely span a flood plain. In the case of this subdivision, this would not be possible since the other side of the flood plain is on adjacent property. Additionally, the

floodplain and floodway are significantly wide at this point of Alligator Creek and any crossing would require substantial financial investment in order to construct it in compliance with the City of New Braunfels Code Chapter 58 regarding floods.

The waiver will not in any manner vary the provisions of the zoning ordinance or other ordinance(s) of the city.

- Exceeding the block length requirement will not be in violation of any other City code nor will it interfere with the orderly development of this tract or the adjacent tracts.

In my professional opinion, the proposed waiver request remains in harmony with the spirit and intent of the City of New Braunfels Platting Ordinance and will not adversely affect health, safety, or welfare of the public.

If you have any questions, please do not hesitate to contact me.

Sincerely,
Pape-Dawson Engineers, Inc.

5/7/2021

STATE OF TEXAS
MATTHEW GEISTWEIDT
118861
LICENSED
PROFESSIONAL ENGINEER

Matthew Geistweidt, P.E.
Sr. Project Manager

P:\122\55\00\WORD\LETTERS\210507_WAIVER_BLOCK LENGTH.DOCX

City of New Braunfels

Planning Commission Agenda Item Report

550 Landa Street
New Braunfels, TX

6/1/2021

Agenda Item No. J)

PRESENTER:
Applicant: Ink Civil (James Ingalls, P.E.)
Owner: EB Industries (Richard Byrd)
SUBJECT:
WVR21-153 Discuss and consider a waiver request from Section 118-44(b) to allow block length to exceed 1,200 feet in the proposed Goodwin Tract Subdivision.
DEPARTMENT: Planning and Development Services
COUNCIL DISTRICTS IMPACTED: 4

BACKGROUND INFORMATION:

Applicant: Ink Civil (James Ingalls, P.E.)
2021 SH 46W, Ste. 105
New Braunfels, TX, 78132
(830) 358-7127 jamesingalls@ink-civil.com

Owner: EB Industries (Richard Byrd)
(251) 510-1118 rbyrd@aspengroverealty.com

Staff Contact: Matthew Simmont
(830) 221-4058 msimmont@nbtexas.org

The subject property consists of approximately 68 acres located north of the intersection of Goodwin Lane and Orion Drive. The applicant is intending to subdivide the property into approximately 340 residential lots.

Block Length:
The applicant is requesting a waiver from the maximum block length required for a northeastern portion of the tract within the proposed subdivision.

A block is "a unit of land bounded by streets, other transportation or utility rights-of-way, parks, streams, waterways, or any other barrier to the continuity of development." The length of a block is measured along the axis of the block. The proposed layout of blocks for this subdivision resulted in one block exceeding the maximum block length of 1,200 feet.

The subject proposed block length is approximately 3,300 feet, exceeding the maximum block length by 2,100 feet. The applicant states the property is adjacent to the existing Wasser Ranch Subdivision that does not provide any street stubs to allow for connection. In addition, the northeastern portion of the property is partially bound by floodplain.

ISSUE:
Waiver criteria are provided below in Commission Findings.

Commission Findings:
The adopted Subdivision Platting Ordinance indicates the Planning Commission shall not approve/recommend approval of a waiver unless it makes findings based upon the evidence presented to it in each specific case that:

1. Granting the waiver will not be detrimental to the public safety, health or welfare, and will not be injurious to other property or to the owners of other property, and the waiver will not prevent the orderly subdivision of other property in the vicinity.

2. Because of the particular physical surroundings, shape and/or topographical conditions of the specific property involved, a particular hardship to the property owner would result, as distinguished from a mere inconvenience, if the strict letter of these regulations is carried out; or an alternate design will generally achieve the same result or intent as the standards and regulations prescribed herein; and

3. The waiver will not in any manner vary the provisions of the Zoning Ordinance or other ordinance(s) of the City.

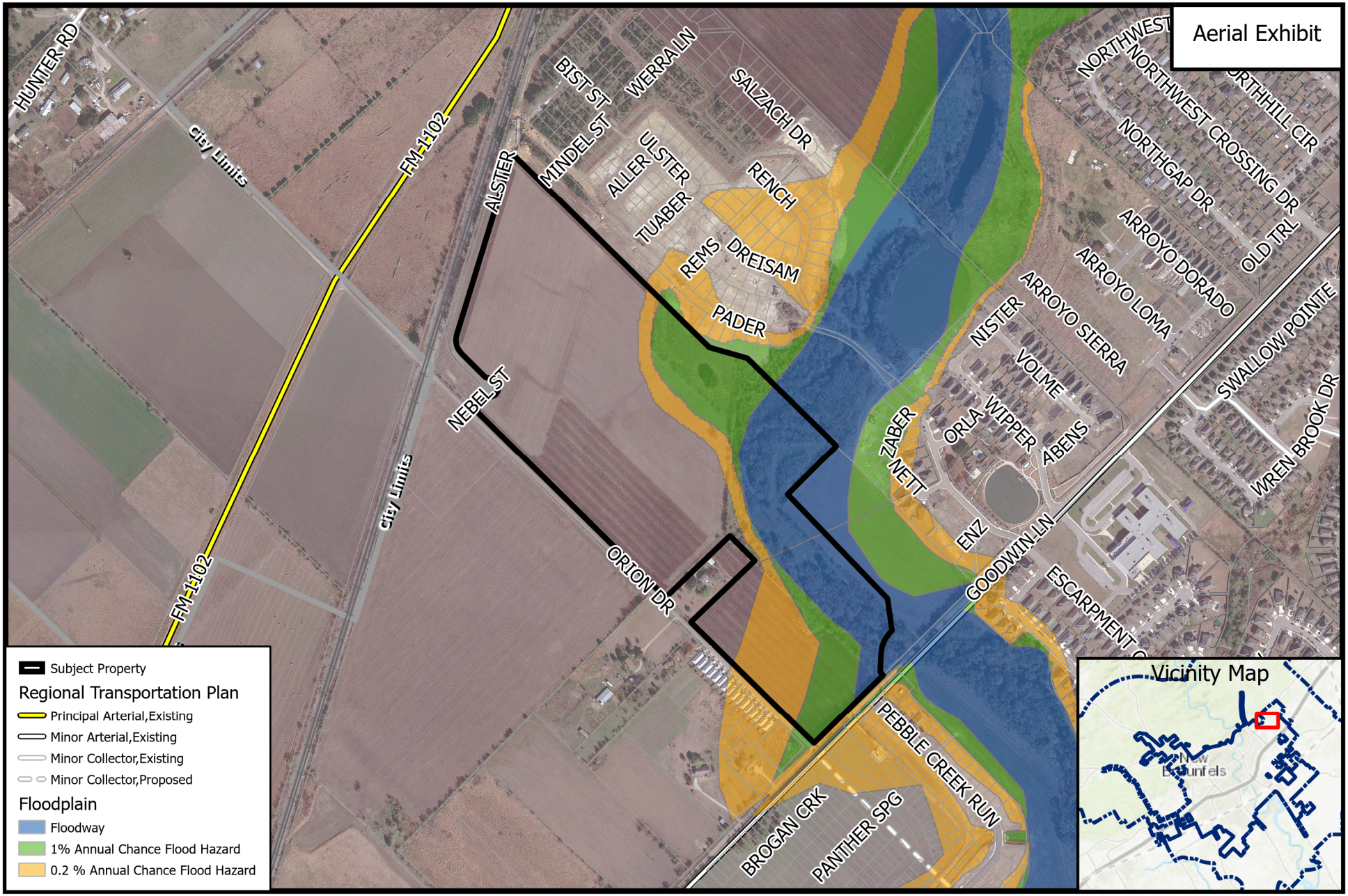
FISCAL IMPACT:
N/A
RECOMMENDATION:
Staff acknowledges the limitations of the property to provide breaks in block length with additional street stubs as much of the adjacent property is already platted and the floodway is considered a barrier to the continuity of development. While it appears the subdivision could be designed with cul-de-sacs to break up the blocks, that development style has drawbacks of its own, including hindering walkability. Therefore, staff does not oppose the waiver request for the proposed block length for this single-family residential subdivision.

Resource Links:
Chapter 118-44(b) Blocks, of the City's Code of Ordinances:
<https://library.municode.com/tx/new_braunfels/codes/code_of_ordinances?nodeId=PTIICOOR_CH118SUPL_ARTIVDEST_S118-44BL>

Attachments:
1. Aerial Map

2. Applicant's Plat Waiver Justification Letter

3. Proposed Master Plan and Waiver Exhibit



PLAT21-WVR21-153

Goodwin Tract - Block Length Waiver

0 400 800 Feet

N

DISCLAIMER: This map and information contained in it were developed exclusively for use by the City of New Braunfels. Any use or reliance on this map by anyone else is at that party's risk and without liability to the City of New Braunfels, its officials or employees for any discrepancies, errors, or variances which may exist.

Path:
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Source: City of New Braunfels Planning
Date: 5/21/2021

April 28, 2021

Planning Department
City of New Braunfels
550 Landa Street
New Braunfels, TX 78130

Goodwin Tract Subdivision Master Plan – Waiver Request Letter

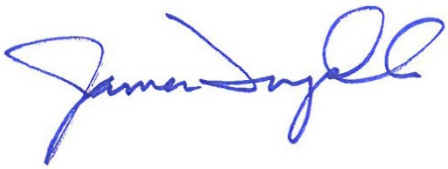
The intent of this letter is to request an exemption from plat code section 118-44.

This subdivision is located at the intersection of Orion Dr and Goodwin Ln. We are submitting a master plan for single family residential lots.

We are requesting a waiver for the New Braunfels Code of Ordinances Sec. 118-44 for the requirement that block lengths shall not exceed 1,200 feet except along arterial streets. The street along the northeast side of the property is adjacent to the existing Wasser Ranch Subdivision and partially separated by floodplain. Wasser Ranch does not provide any street stubs to the Goodwin Tract Subdivision property, so any street stubs that would be added on the Goodwin Tract Subdivision would have no connection.

If you need additional information or have any questions, please do not hesitate to contact myself or Melanie Norris P.E.

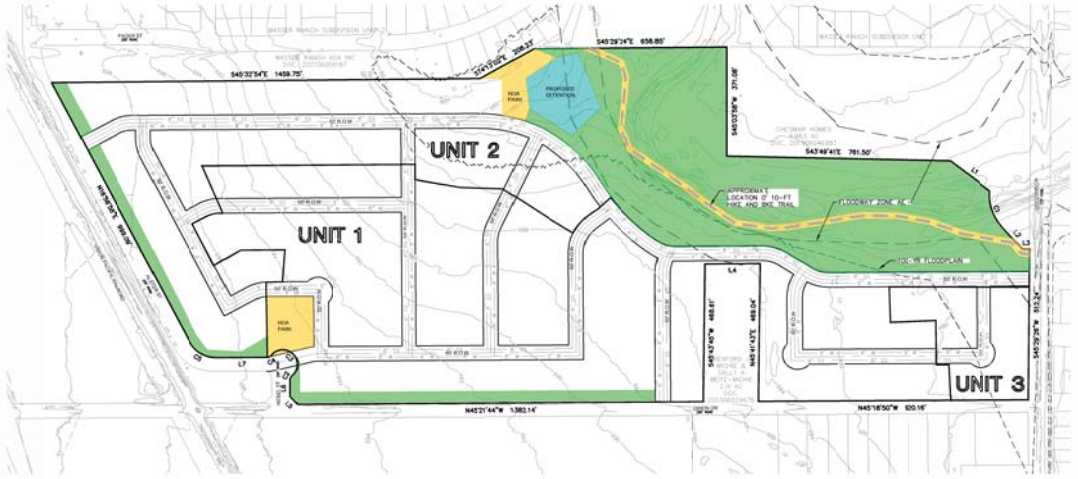
Sincerely,



James Ingalls, P.E.

NOTES:
1. THE PROPOSED USE OF THE SUBDIVISION IS FOR SINGLE FAMILY RESIDENTIAL.
2. THE PROPERTY IS INSIDE THE CITY LIMITS OF NEW BRAUNFELS.
3. THE UNIT NUMBERS SHOWN REPRESENT THE ORDER IN WHICH THE UNITS WILL BE DEVELOPED AND PLATTED. THE ACTUAL AREA OF EACH UNIT AND THE LENGTH OF STREETS MAY VARY. UNITS MAY BE PLATTED AND DEVELOPED OUT OF THE NUMBERED SEQUENCE.
4. 4' SIDEWALKS WILL BE CONSTRUCTED FOR THIS DEVELOPMENT AT THE BACK OF CURB. SIDEWALKS WILL BE CONSTRUCTED ALONG GOODWIN LANE WITH THE GOODWIN LANE CAPITAL IMPROVEMENTS PROJECT. SIDEWALKS WILL BE CONSTRUCTED ALONG ORION DR AS PART OF THE DWELLING AT BRAUNFELS PUBLIC IMPROVEMENTS.
5. ALL STREETS WILL BE DEDICATED AS PUBLIC RIGHT OF WAYS.
6. THE LOTS DESIGNATED AS H.O.A., O.S. OR D.L. LOTS WILL NOT BE AVAILABLE FOR RESIDENTIAL DEVELOPMENT. THESE LOTS WILL BE MAINTAINED BY THE PROPERTY OWNER'S ASSOCIATION.
7. NO PORTION OF THE SUBDIVISION IS LOCATED WITHIN THE EXISTING SPECIAL FLOOD HAZARD ZONE A, 100-YEAR FLOOD BOUNDARY, AS DEFINED BY THE COMAL COUNTY COUNTY, TEXAS COMMUNITY PANEL NUMBER 48091C290F AND NUMBER 48091C0455', AS PREPARED BY THE FEDERAL EMERGENCY MANAGEMENT AGENCY, EFFECTIVE DATE SEPTEMBER 2, 2009.
8. THIS PROPERTY IS NOT LOCATED OVER THE EDWARDS AQUIFER RECHARGE ZONE.
9. ALL LOTS WITHIN THE SUBDIVISION WILL BE SERVED BY NEW BRAUNFELS UTILITIES (NBU) FOR WATER, SEWER, AND ELECTRIC SERVICE.
10. ALL DRAINAGE LOTS CAN BE USED FOR DRAINAGE CONVEYANCE.
11. ALL STANDARD CURB AND GUTTER STREET SECTIONS WILL PROVDE STORM WATER CAPACITY PER CITY OF NEW BRAUNFELS DRAINAGE REQUIREMENTS.
12. THE ENTIRE SUBDIVISION FALLS WITHIN COMAL INDEPENDENT SCHOOL DISTRICT.
13. THIS SUBDIVISION IS SUBJECT TO THE 2018 CITY OF NEW BRAUNFELS PARK LAND DEDICATION AND DEVELOPMENT ORDINANCE. THIS PLAT IS APPROVED FOR 1 DWELLING UNIT PER BUILDABLE LOT WITH A MAXIMUM OF 284 BUILDABLE LOTS. AT SUCH TIME THAT ADDITIONAL DWELLING UNITS ARE CONSTRUCTED; THE OWNER OF THE LOT SHALL CONTACT THE CITY AND COMPLY WITH THE ORDINANCE FOR EACH DWELLING UNIT.
14. ELECTRIC AND UTILITY EASEMENT LOCATIONS WILL BE DETERMINED DURING THE ENGINEERING DESIGN PHASE OF THE PROJECT. EASEMENTS WILL BE RECORDED WITH THE FINAL PLAT FOR EACH LOT.
15. EXACT DIMENSIONS AND LOCATION OF DRAINAGE EASEMENTS AND DETENTION POND LOCATIONS WILL BE DETERMINED DURING THE ENGINEERING DESIGN PHASE OF THE PROJECT.
16. CONTOURS SHOWN ARE BASED ON THE CITY OF NEW BRAUNFELS LIDAR GIS DATABASE.
17. ALL BEARINGS AND COORDINATES SHOWN HEREON ARE IN GRID BASED ON THE TEXAS STATE PLANE COORDINATE SYSTEM, TEXAS SOUTH CENTRAL ZONE (4204), NORTH AMERICAN DATUM 1983. DISTANCES SHOWN HEREON ARE SURFACE USING COMBINED SCALE FACTOR OF 1.00015.
18. THIS SUBDIVISION IS SUBJECT TO SECTION 18-50, SPECIFICALLY THE REQUIREMENTS FOR EASEMENT AND CONSTRUCTION OF A 10-FOOT WIDE HIKE AND BIKE TRAIL BY THE DEVELOPER. EXACT LOCATION AND ALIGNMENT OF THE HIKE AND BIKE TRAIL WILL BE COORDINATED WITH CITY STAFF DURING DESIGN STAGE

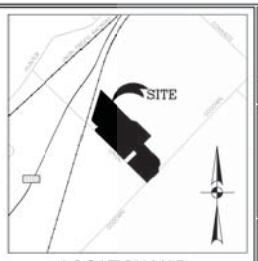
LOT SUMMARY	
UNIT	RESIDENTIAL
UNIT 1	200 LOTS
UNIT 2	120 LOTS
UNIT 3	20 LOTS
TOTAL	340 LOTS



OWNER/DEVELOPER:
EB INDUSTRIES
111 BLUE BONNET CIR
JUSTIN, TX 76247

ENGINEER/SURVEYOR:
MOELLER & ASSOCIATES
JAMES INGALLS, P.E. - ENGINEER
2021 SH 46W, STE 105
NEW BRAUNFELS, TX. 78132
(830) 358-7127

D.A. MAWYER LAND SURVEYING, INC.
DREW MAWYER, R.P.L.S. - SURVEYOR
5151 SH 46W
NEW BRAUNFELS, TEXAS 78132
(210) 325-0858



LOCATION MAP
SCALE: 1"=4,000'

LEGEND

- UNIT BOUNDARY
- DRAINAGE LOT
- OPEN SPACE (O.S.)
- HOME OWNER'S ASSOCIATION PARK (HOA)
- APPROXIMATE LOCATION OF 10-FT HIKE AND BIKE TRAIL
- PROPOSED 8" WATER MAIN
- PROPOSED 8" SANITARY SEWER
- EXISTING 8" WATER MAIN
- EXISTING 8" SANITARY SEWER

LINE TABLE		
LINE	LENGTH	BEARING
L1	17.03'	S08°53'19"E
L2	101.05'	S02°55'49"W
L3	22.63'	S44°38'10"E
L4	185.80'	N45°30'57"W
L5	36.82'	N00°05'09"W
L6	57.57'	N44°55'14"E
L7	176.47'	N45°15'25"W

CURVE TABLE						
CURVE	LENGTH	RADIUS	DELTA	TANGENT	CHORD LENGTH	CHORD BEARING
C1	134.30'	167.95'	45°49'03"	70.97'	130.75'	S26°04'29"W
C2	13.95'	15.00'	53°11'07"	7.51'	13.43'	N70°39'15"E
C3	170.89'	50.01'	195°47'49"	360.45'	99.07'	N00°11'32"W
C4	13.85'	15.02'	52°48'23"	7.45'	13.34'	N71°42'44"W
C5	109.69'	100.89'	62°17'23"	60.97'	104.36'	N14°06'44"W

811 Know what's below. Call before you dig.

THIS DOCUMENT IS RELEASED FOR THE PURPOSE OF INTERIM REVIEW UNDER THE AUTHORITY OF JAMES INGALLS, P.E. #117120 ON April 28, 2021. IT IS NOT TO BE USED FOR BIDDING AND PERMITTING PURPOSES ONLY. NOT TO BE USED FOR CONSTRUCTION.

NO	DATE	ISSUES AND REVISIONS

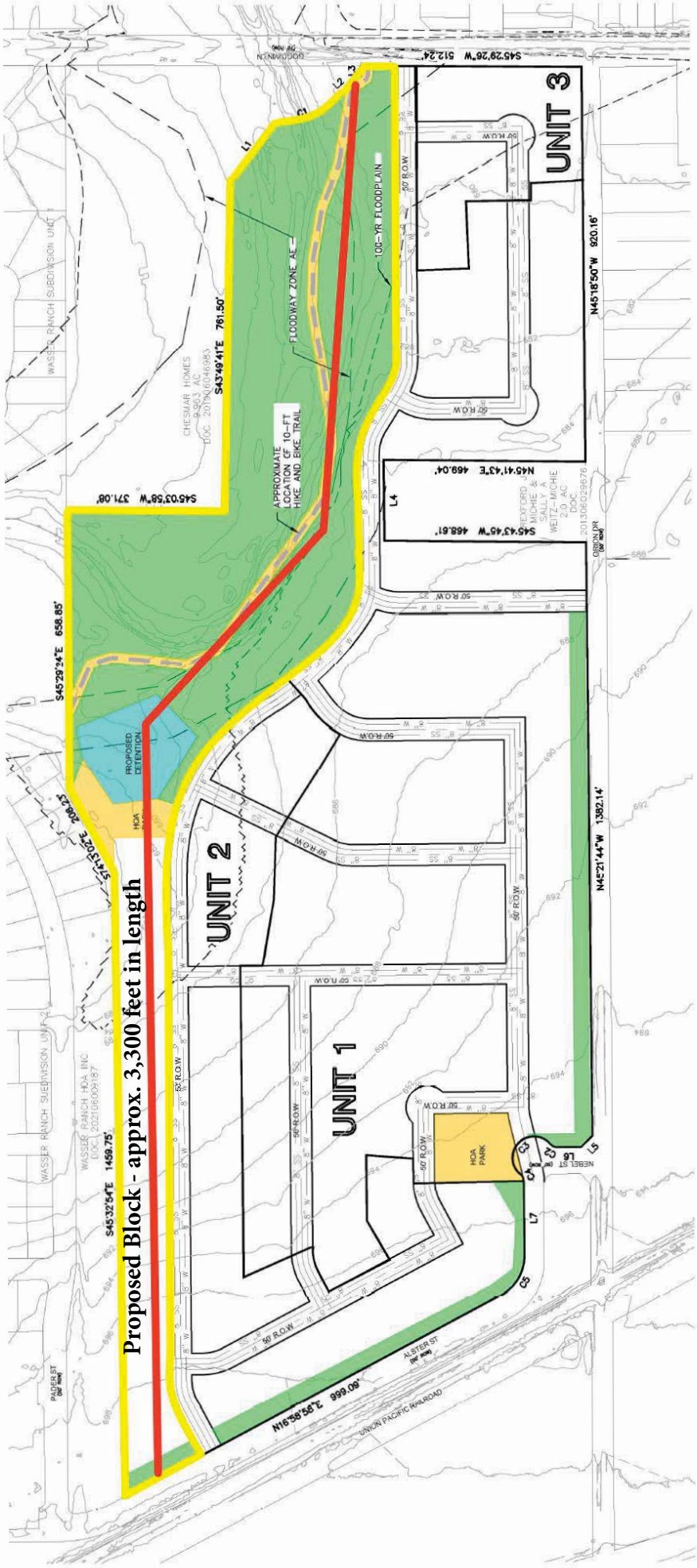
MOELLER & ASSOCIATES Engineering Solutions
2021 W. SH46, STE. 105, NEW BRAUNFELS, TX. 78132
PH: 830-358-7127 www.mo-tx.com
TBPE FIRM F-13351

MASTER PLAN

GOODWIN TRACT SUBDIVISION
EB INDUSTRIES
111 BLUE BONNET CIR
JUSTIN, TX 76247

SHEET
MP-1
OF 1

Block Length Exhibit



City of New Braunfels

Planning Commission Agenda Item Report

550 Landa Street
New Braunfels, TX

6/1/2021

Agenda Item No. K)

PRESENTER:
Applicant: HMT Engineering & Surveying (Chris Van Heerde, P.E.)
Owner: Darrell & Maureen Jonas
SUBJECT:
WVR21-161 Discuss and consider a waiver request from Section 118-51(f)(3)(b) to not require the floodway be designated a drainage easement on the replat of Misty Acres, Unit 2, Block 3, Lot 6.
DEPARTMENT: Planning and Development Services
COUNCIL DISTRICTS IMPACTED: 5

BACKGROUND INFORMATION:

Applicant: HMT Engineering & Surveying (Chris Van Heerde, P.E.)
290 S. Castell Ave., Suite 100
New Braunfels, TX, 78130
(830) 625-8555 plats@hmtnb.com

Owner: Darrell & Maureen Jonas
4661 Spring Fork Drive
Corpus Christi, TX 78413
(361) 549-1925

Staff Contact: Matthew Simmont
(830) 221-4058 msimmont@nbtexas.org

The subject property consists of approximately 2.87 acres located at the cul-de-sac terminus of Misty Acres Drive. A replat was approved in February 2017 for the creation of 3 residential lots.

Drainage:
Section 118-51 of the Subdivision Platting Ordinance requires the floodway to be designated on a plat as a drainage easement. Structures, fences and other obstructions are not allowed within a drainage easement.

The applicant is requesting a waiver to not require the floodway to be designated as a drainage easement within this subdivision.

The applicant states the waiver request is to be able to fully enjoy the benefits of living on the river's edge.

ISSUE:
Waiver criteria are provided below in Commission Findings.

Commission Findings:
The adopted Subdivision Platting Ordinance indicates the Planning Commission shall not approve/recommend approval of a waiver unless it makes findings based upon the evidence presented to it in each specific case that:

1. Granting the waiver will not be detrimental to the public safety, health or welfare, and will not be injurious to other property or to the owners of other property, and the waiver will not prevent the orderly subdivision of other property in the vicinity.

2. Because of the particular physical surroundings, shape and/or topographical conditions of the specific property involved, a particular hardship to the property owner would result, as distinguished from a mere inconvenience, if the strict letter of these regulations is carried out; or an alternate design will generally achieve the same result or intent as the standards and regulations prescribed herein; and

3. The waiver will not in any manner vary the provisions of the Zoning Ordinance or other ordinance(s) of the City.

FISCAL IMPACT:
N/A
RECOMMENDATION:
Staff is opposed to the waiver request to not designate the mapped floodway as a drainage easement. The waiver request references the desire to construct improvements to include boat houses and docks in the floodway to the benefit of the property owners. The addition of such structures into the floodway would introduce additional flood risk for the subject and downstream properties. For example, during a flood, such structures can wash downstream and damage others' property, or break apart as debris and hurt people.

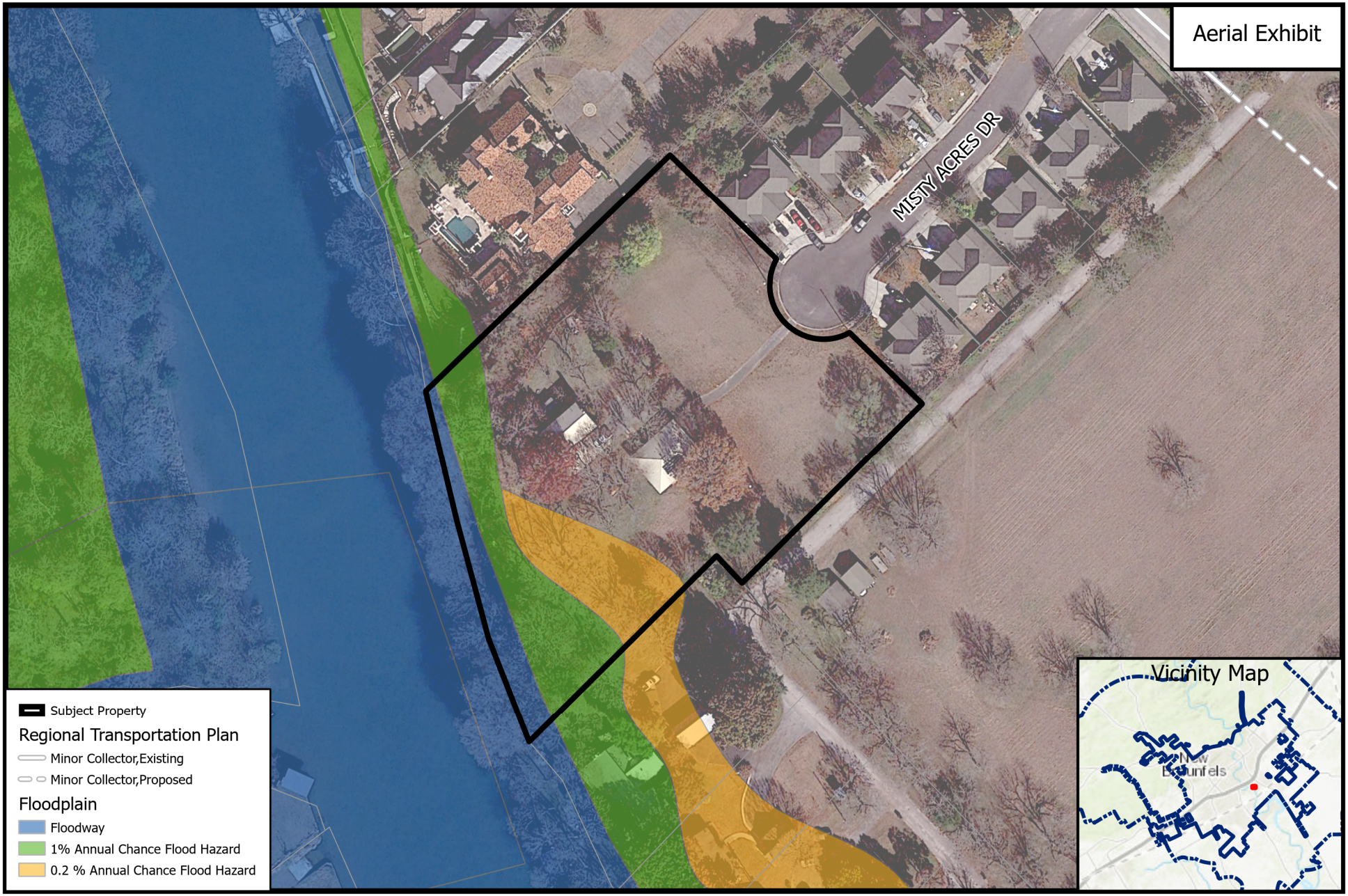
Taxpayer dollars have gone toward the purchase of properties in the floodway to lower/remove the risk to the public health, safety and welfare that results from construction within the floodway. It is also important to note that certain improvements are allowed in the floodway that would enhance the river frontage to include boat ramps, patio space, walkways and stairways.

Resource Links:
Chapter 118-51(e) Drainage, of the City's Code of Ordinances:
<https://library.municode.com/tx/new_braunfels/codes/code_of_ordinances?nodeId=PTIICOOR_CH118SUPL_ARTIVDEST_S118-51WASEDRFAFLHA>

Attachments:
1. Aerial Map

2. Applicant's Plat Waiver Justification Letter

3. Replat



PLAT21-WVR21-162
Misty Acres DE waiver

0 70 140 Feet

N

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Source: City of New Braunfels Planning
Date: 5/21/2021

DISCLAIMER: This map and information contained in it were developed exclusively for use by the City of New Braunfels. Any use or reliance on this map by anyone else is at that party's risk and without liability to the City of New Braunfels, its officials or employees for any discrepancies, errors, or variances which may exist.

HMT
ENGINEERING & SURVEYING
290 S. Castell Avenue, Ste 100
New Braunfels, TX 78130
TBPE-FIRM F-10961
TBPLS FIRM 10153600

April 27, 2021

Mr. Matthew Simmont
City of New Braunfels
550 Landa Street
New Braunfels TX 78130

RE: Waiver Request – Misty Acres, Unit Two, Block 3, Lot 6R-1, Lot 6R-2 and Lot 6R-3 Replat
Section 118-11 – Waiver Request for Drainage Easement around Floodway

Mr. Simmont,

The approved Misty Acres, Unit Two, Block 3, Lot 6R-1, Lot 6R-2 and Lot 6R-3 Replat abuts up against the Guadalupe River where a small portion of the Floodway encroaches on the rear of the property. The developer of the properties would like to build boat houses/docks along the water edge for homeowners to enjoy the benefits of living along the river.

According to code Sec. 118-51(f)(3)(b) – In areas where there is an approved and mapped floodway, the subdivider or developer shall designate a drainage easement(s) for the floodway.

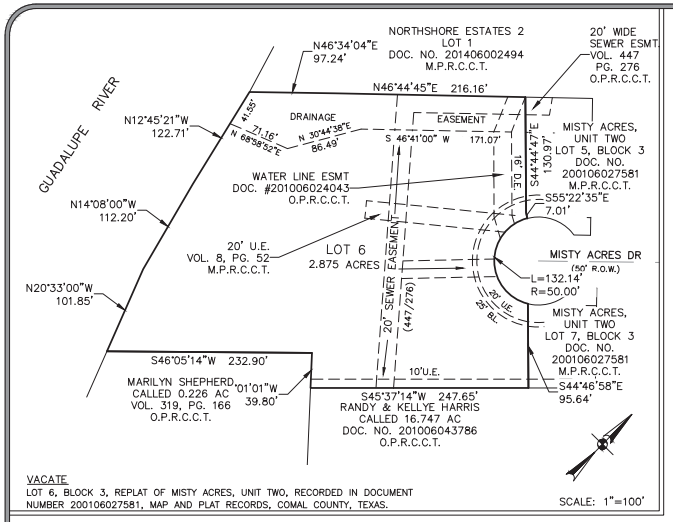
We would like to request the drainage easement requirement be waived for these properties. The subdivider of the property would like to build boat houses/docks, walkways to the river edge, etc, so that home owners can utilize their entire property with the benefits of living on the river edge. Our client plans to complete drainage studies required by the City to build said structures.

We respectfully request an approval to waive this requirement. Please contact me if you have any questions or concerns.

Thank you,

Chris Van Heerde, PE

Chris Van Heerde, PE
Managing Partner



VACATE

LOT 6, BLOCK 3, REPLAT OF MISTY ACRES, UNIT TWO, RECORDED IN DOCUMENT NUMBER 200106027581, MAP AND PLAT RECORDS, COMAL COUNTY, TEXAS.

SCALE: 1"=100'

REPLAT ESTABLISHING

MISTY ACRES, UNIT 2, BLOCK 3, LOT 6R-1, LOT 6R-2 AND LOT 6R-3

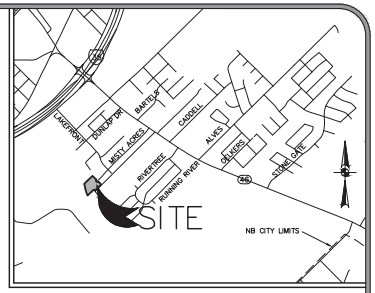
BEING LOT 6, BLOCK 3, REPLAT OF MISTY ACRES, UNIT TWO, RECORDED IN DOCUMENT NUMBER 200106027581, MAP AND PLAT RECORDS, COMAL COUNTY, TEXAS

0 30 60 120

HORIZONTAL SCALE: 1:60

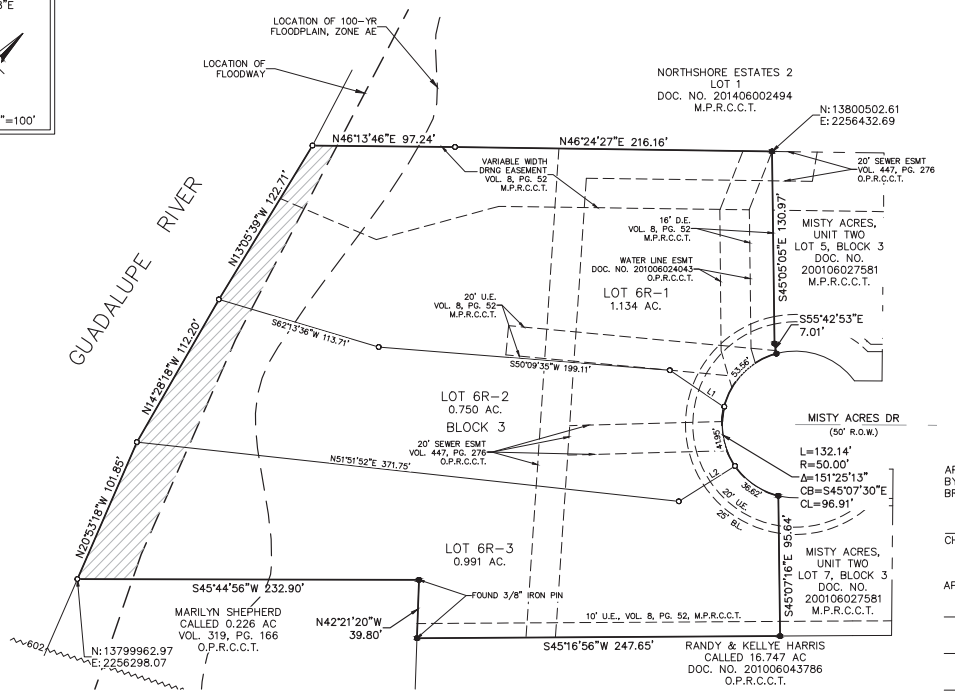
LEGEND:

- ● = FND 1/2" IRON PIN
- o = SET 1/2" IRON PIN W/ PLASTIC CAP STAMPED "HMT"
- B.L. = BUILDING SETBACK LINE
- U.E. = UTILITY EASEMENT
- D.E. = DRAINAGE EASEMENT
- R.O.W. = RIGHT-OF-WAY
- M.P.R.C.C.T. = MAP AND PLAT RECORDS, COMAL COUNTY, TEXAS
- O.P.R.C.C.T. = OFFICIAL PUBLIC RECORDS, COMAL COUNTY, TEXAS
- ~~602~~ = BASE FLOOD ELEVATION (B.F.E.)



LOCATION MAP

NOT TO SCALE



NEW BRAUNFELS UTILITIES NOTES:

1. MAINTENANCE OF DEDICATED UTILITY EASEMENTS IS THE RESPONSIBILITY OF THE PROPERTY OWNER. ANY USE OF AN EASEMENT, OR ANY PORTION OF IT, INCLUDING LANDSCAPING OR DRAINAGE FEATURES, IS SUBJECT TO AND SHALL NOT CONFLICT WITH THE TERMS AND CONDITIONS IN THE EASEMENT, MUST NOT ENDANGER OR INTERFERE WITH THE RIGHTS GRANTED BY THE EASEMENT TO NEW BRAUNFELS UTILITIES, ITS SUCCESSORS AND ASSIGNS, AND SHALL BE SUBJECT TO APPLICABLE PERMIT REQUIREMENTS OF THE CITY OF NEW BRAUNFELS OR ANY OTHER GOVERNING BODY. THE PROPERTY OWNER MUST OBTAIN, IN ADVANCE, WRITTEN AGREEMENT WITH THE UTILITIES TO UTILIZE THE EASEMENT, OR ANY PART OF IT.
2. UTILITIES WILL POSSESS A 5' WIDE SERVICE EASEMENT TO THE DWELLING ALONG THE SERVICE LINE TO THE SERVICE ENTRANCE. THIS EASEMENT WILL VARY DEPENDING UPON LOCATION OF DWELLING AND SERVICE.
3. UTILITIES SHALL HAVE ACCESS TO THE METER LOCATIONS FROM THE FRONT YARD AND METER LOCATIONS SHALL NOT BE LOCATED WITHIN A FENCED AREA.
4. EACH LOT MUST HAVE ITS OWN WATER AND SEWER SERVICE AT THE OWNER'S/DEVELOPER'S EXPENSE.
5. DO NOT COMBINE ANY NEW UTILITY EASEMENTS (U.E.) WITH DRAINAGE EASEMENTS (D.E.) OR MAKE CHANGES IN GRADE WITHIN THE UTILITY EASEMENTS (U.E.) WITHOUT WRITTEN APPROVAL FROM NEW BRAUNFELS UTILITIES.

PLAT NOTES:

1. ALL LOTS WITHIN THE SUBDIVISION WILL BE PROVIDED WATER, SEWER AND ELECTRIC SERVICES BY NEW BRAUNFELS UTILITIES. TELEPHONE AND CABLE SERVICES FOR THE SUBDIVISION WILL BE PROVIDED BY AT&T COMMUNICATIONS AND/OR SPECTRUM.
2. ALL BEARINGS AND COORDINATES SHOWN HEREON ARE BASED UPON THE TEXAS COORDINATE SYSTEM, SOUTH CENTRAL ZONE (4204), NORTH AMERICAN DATUM 1983, GRID. DISTANCES SHOWN HEREON ARE BASED UPON SURFACE MEASUREMENTS. TO CONVERT SURFACE DISTANCES TO GRID, APPLY A COMBINED SCALE FACTOR OF 1.00015.
3. MONUMENTS WERE FOUND OR SET AT EACH CORNER OF THE SURVEY BOUNDARY OF THE SUBDIVISION. MONUMENTS AND LOT MARKERS WILL BE SET WITH 1/2" IRON PINS WITH PLASTIC CAP STAMPED "HMT" IMMEDIATELY AFTER COMPLETION OF UTILITY INSTALLATION AND STREET CONSTRUCTION UNLESS NOTED OTHERWISE.
4. THIS SUBDIVISION IS NOT WITHIN THE EDWARDS AQUIFER RECHARGE ZONE.
5. THIS SUBDIVISION IS WITHIN THE CITY LIMITS OF NEW BRAUNFELS, TEXAS.
6. THE SUBDIVISION IS WITHIN THE COMAL INDEPENDENT SCHOOL DISTRICT.
7. A PORTION OF THE SUBDIVISION IS LOCATED WITHIN AN INDICATED SPECIAL FLOOD HAZARD ZONE ACCORDING TO THE ADOPTED FLOOD MAPS OF THE CITY OF NEW BRAUNFELS, AS DEFINED BY THE COMAL COUNTY, TEXAS, FLOOD INSURANCE RATE MAP NUMBER 48091C0455F, EFFECTIVE DATE SEPTEMBER 2, 2009 AS PREPARED BY THE FEDERAL EMERGENCY MANAGEMENT AGENCY.
8. NO STRUCTURES, WALLS OR OTHER OBSTRUCTIONS OF ANY KIND SHALL BE PLACED WITHIN THE LIMITS OF THE DRAINAGE EASEMENTS SHOWN ON THIS PLAT. NO LANDSCAPING, FENCES, OR OTHER TYPE OF MODIFICATIONS WHICH ALTER THE CROSS SECTIONS OF THE DRAINAGE EASEMENTS OR DECREASE THE HYDRAULIC CAPACITY OF THE EASEMENT, AS APPROVED, SHALL BE ALLOWED WITHOUT THE APPROVAL OF THE CITY ENGINEER. THE CITY OF NEW BRAUNFELS SHALL HAVE THE RIGHT OF INGRESS AND EGRESS OVER GRANTORS ADJACENT PROPERTY TO REMOVE ANY OBSTRUCTIONS PLACED WITHIN THE LIMITS OF SAID DRAINAGE EASEMENTS AND TO MAKE ANY MODIFICATIONS OR IMPROVEMENTS WITHIN SAID DRAINAGE EASEMENTS.
9. FUTURE DEVELOPMENT IS SUBJECT TO CHAPTER 114 (STREETS, SIDEWALKS AND OTHER PUBLIC SPACES) OF THE NEW BRAUNFELS CODE OF ORDINANCES.
10. FOUR (4) FOOT WIDE SIDEWALKS WILL BE CONSTRUCTED PER CITY STANDARDS BY THE BUILDER AT THE TIME OF BUILDING CONSTRUCTION ALONG:
    A. MISTY ACRES
11. THE ELEVATION OF THE LOWEST FLOOR OF A STRUCTURE SHALL BE AT LEAST 10 INCHES ABOVE THE FINISHED GRADE OF THE SURROUNDING GROUND, WHICH SHALL BE SLOPED IN A FASHION SO AS TO DIRECT STORMWATER AWAY FROM THE STRUCTURE. PROPERTIES ADJACENT TO STORMWATER CONVEYANCE STRUCTURES MUST HAVE A FLOOR SLAB ELEVATION OR BOTTOM OF FLOOR JOISTS A MINIMUM OF ONE FOOT ABOVE THE 100-YEAR WATER FLOW ELEVATION IN THE STRUCTURE. DRIVEWAYS SERVING HOUSES ON THE DOWNHILL SIDE OF THE STREET SHALL HAVE A PROPERLY SIZED CROSS SWALE PREVENTING RUNOFF FROM ENTERING THE GARAGE AND SHALL PREVENT WATER FROM LEAVING THE STREET.
12. THIS SUBDIVISION IS SUBJECT TO THE 2006 CITY OF NEW BRAUNFELS PARK LAND DEDICATION AND DEVELOPMENT ORDINANCE. THIS PLAT IS APPROVED FOR ONE DWELLING UNIT(S) PER BUILDABLE LOT WITH A MAXIMUM OF 3 BUILDABLE LOTS. AT SUCH TIME THAT ADDITIONAL DWELLING UNITS ARE CONSTRUCTED, THE OWNER OF THE LOT(S) SHALL NOTIFY THE CITY AND COMPLY WITH THE ORDINANCE FOR EACH DWELLING UNIT.
13. THIS UNIT CONTAINS 3 BUILDABLE RESIDENTIAL LOTS. ALL LOTS MEET THE MINIMUM SQUARE FOOTAGE REQUIREMENT ACCORDING TO THE ZONING ORDINANCE.
14. ALL DRAINAGE EASEMENTS DESIGNATED WITHIN THE LOTS SHALL BE OWNED AND MAINTAINED BY THE PROPERTY OWNER.
15. NO CUTTING OR GRADING ALLOWED IN 20' SEWER EASEMENT. ONLY LEVELING OR ADDING OF GRADE ALLOWED OVER 20' SEWER EASEMENT.
16. BASE FLOOD ELEVATION FOR THIS TRACT IS CALCULATED TO BE 602.2'. BASE FLOOD ELEVATION WAS DETERMINED BY INTERPOLATING BETWEEN BASE FLOOD ELEVATION LINES SHOWN ON COMMUNITY PANEL NUMBER 48091C0455F EFFECTIVE DATE SEPTEMBER 2, 2009, AS PREPARED BY FEDERAL EMERGENCY MANAGEMENT AGENCY.

KNOW ALL MEN BY THESE PRESENTS:

I, THE UNDERSIGNED DOROTHY J. TAYLOR, A REGISTERED PROFESSIONAL LAND SURVEYOR IN THE STATE OF TEXAS, HEREBY CERTIFY THAT THIS PLAT IS TRUE AND CORRECTLY MADE UNDER MY SUPERVISION AND IN COMPLIANCE WITH CITY AND STATE SURVEY REGULATIONS AND LAWS AND MADE ON THE GROUND AND THAT THE CORNER MONUMENTS WERE PROPERLY PLACED UNDER MY SUPERVISION.

PRELIMINARY, THIS DOCUMENT SHALL NOT BE RECORDED FOR ANY PURPOSE.

DOROTHY J. TAYLOR
REGISTERED PROFESSIONAL LAND SURVEYOR NO. 6295
290 S. CASTELL AVE., SUITE 100, NEW BRAUNFELS, TEXAS 78130

PLAT REVISED MARCH 22, 2021
PLAT PREPARED NOVEMBER 22, 2016

HMT ENGINEERING & SURVEYING
290 S. CASTELL AVE., STE. 100
NEW BRAUNFELS, TX 78130
TBPE FIRM F-10961
TBPLS FIRM 10153600

STATE OF TEXAS
COUNTY OF COMAL

I (WE) THE UNDERSIGNED OWNER(S) OF THE LAND SHOWN ON THIS PLAT, AND DESIGNATED HEREIN AS THE MISTY ACRES, UNIT TWO, BLOCK 3, LOT 6R-1, LOT 6R-2 AND LOT 6R-3 A SUBDIVISION TO THE CITY OF NEW BRAUNFELS, COUNTY OF COMAL, TEXAS, AND WHOSE NAME IS SUBSCRIBED HERETO, DO HEREBY SUBDIVIDE SUCH PROPERTY AND DEDICATE TO THE USE OF THE PUBLIC ALL STREETS, ALLEYS, PARKS, DRAINS, EASEMENTS, AND PUBLIC PLACES THEREON SHOWN FOR THE PURPOSES AND CONSIDERATION THEREIN EXPRESSED.

DARRELL JONAS
4661 SPRING FORK DRIVE
CORPUS CHRISTI, TEXAS 78413

STATE OF TEXAS
COUNTY OF _____.

THIS INSTRUMENT WAS ACKNOWLEDGED BEFORE ME ON THIS _____ DAY OF _____, 20__,
BY _____

NOTARY PUBLIC, STATE OF TEXAS
MY COMMISSION EXPIRES: _____

STATE OF TEXAS
COUNTY OF COMAL

I (WE) THE UNDERSIGNED OWNER(S) OF THE LAND SHOWN ON THIS PLAT, AND DESIGNATED HEREIN AS THE MISTY ACRES, UNIT TWO, BLOCK 3, LOT 6R-1, LOT 6R-2 AND LOT 6R-3 A SUBDIVISION TO THE CITY OF NEW BRAUNFELS, COUNTY OF COMAL, TEXAS, AND WHOSE NAME IS SUBSCRIBED HERETO, DO HEREBY SUBDIVIDE SUCH PROPERTY AND DEDICATE TO THE USE OF THE PUBLIC ALL STREETS, ALLEYS, PARKS, DRAINS, EASEMENTS, AND PUBLIC PLACES THEREON SHOWN FOR THE PURPOSES AND CONSIDERATION THEREIN EXPRESSED.

MAUREEN JONAS
4661 SPRING FORK DRIVE
CORPUS CHRISTI, TEXAS 78413

STATE OF TEXAS
COUNTY OF _____.

THIS INSTRUMENT WAS ACKNOWLEDGED BEFORE ME ON THIS _____ DAY OF _____, 20__,
BY _____

NOTARY PUBLIC, STATE OF TEXAS
MY COMMISSION EXPIRES: _____

APPROVED THIS THE _____ DAY OF _____, 20__, BY THE PLANNING COMMISSION OF THE CITY OF NEW BRAUNFELS, TEXAS.

_____
CHAIRMAN

APPROVED FOR ACCEPTANCE

_____ _____
DATE PLANNING DIRECTOR

_____ _____
DATE CITY ENGINEER

_____ _____
DATE NEW BRAUNFELS UTILITIES

STATE OF TEXAS
COUNTY OF COMAL

I, _____ DO HEREBY CERTIFY THAT THE FOREGOING INSTRUMENT WAS FILED FOR RECORD IN THE MAP AND PLAT RECORDS, DOC# _____ OF COMAL COUNTY ON THE _____ DAY OF _____, 20__, AT _____ __ M.

WITNESS MY HAND AND OFFICIAL SEAL, THIS THE _____ DAY OF _____, 20__.

COUNTY CLERK, COMAL COUNTY, TEXAS

_____
DEPUTY

Drawing Name: N:_Projects\Subdivision Plotting\PLT094 - Misty Acres Lot 6 Replat\102 - Plat\PLT094-20210309.dwg User: kellyk Apr 22, 2021 - 10:37am

859

City of New Braunfels

Planning Commission Agenda Item Report

550 Landa Street
New Braunfels, TX

6/1/2021

Agenda Item No. L)

PRESENTER:
Applicant: HMT Engineering & Surveying (Chris Van Heerde, P.E.)
Owner: NB Corridor Investments, LLC (Fred Heimer)

SUBJECT:
WVR21-162 Discuss and consider a waiver from Section 118-49(a) of the Subdivision Platting Ordinance to allow an alternative pedestrian access plan adjacent to existing Zipp Road for the Highland Ridge Subdivision.

DEPARTMENT: Planning and Development Services

COUNCIL DISTRICTS IMPACTED: City Council District 2

BACKGROUND INFORMATION:

Applicant: HMT Engineering & Surveying (Chris Van Heerde, P.E.)
290 S. Castell Avenue, Suite 100
New Braunfels, TX 78130
(830) 625-8555 plats@hmtnb.com

Owner: NB Corridor Investments, LLC (Fred Heimer)
130 S. Seguin Ave., Suite 100
New Braunfels, TX 78130
(830) 625-8410 fred.heimer@sv-re.com

Staff Contact: Matt Greene
(830) 221-4053 mgreene@nbtexas.org

Description: Proposed subdivision consisting of 338 single-family residential lots, 3 drainage lots, 1 park lot, 1 open space lot and 1 utility lot on 58.62 acres.

ISSUE:
The proposed Highland Ridge Subdivision is located on West Zipp Road, south of the Legend Pond Neighborhood, is comprised of 58.62 acres proposed for the development of 338 single-family residential lots and is zoned “ZH-A” Zero Lot Line Home District. The subdivision master plan was approved in July of 2019 with a Master Plan Minor Revision approved in March of this year.

Section 118-46 of the Subdivision Platting Ordinance requires four-foot wide public sidewalks to be constructed by the developer adjacent to all internal subdivision streets and perimeter streets. However, an exception may be granted by the Planning Commission and City Council to allow an alternative pedestrian access plan or complete exemption from the requirement for sidewalks.

The applicant is requesting a waiver to allow an alternative pedestrian access plan for the section of sidewalk required to be constructed adjacent to existing Zipp Road, a local perimeter street. The majority of the proposed sidewalk will be constructed within the right-of-way adjacent to existing Zipp Road as required, however, the applicant claims roadside ditches, a culvert crossing and non-centered pavement present drainage, grading and pedestrian safety concerns for the installation of the sidewalk in the right-of-way near the 90 degree angle of Zipp Road and proposed detention basin for the subdivision. Therefore, the applicant is requesting approval of the alternate pedestrian path around the west side of the proposed detention basin in the southeastern corner of Unit 1.

Per the Subdivision Platting Ordinance, all sidewalk waiver requests recommended for approval, or approval with conditions, by the Planning Commission will be forwarded to City Council for final consideration. If the Planning Commission denies the waiver request, that denial stands.

The ordinance authorizes waivers to be granted when:

1. An undue hardship will result from strict compliance with the ordinance, or

2. When the purpose of the regulation may be served to a greater extent by an alternative proposal, so that substantial justice may be done, and the public interest is secured.

The ordinance also states a waiver may not be approved unless it is found that:

1. Granting the waiver will not be detrimental to the public safety, health or welfare, and will not be injurious to other property or to the owners of other property, and the waiver will not prevent the orderly subdivision of other property in the vicinity;

2. Because of the particular physical surroundings, shape and/or topographical conditions of the specific property involved, a particular hardship to the property owner would result, as distinguished from a mere inconvenience, if the strict letter of these regulations is carried out; or an alternate design will generally achieve the same result or intent as the standards and regulations prescribed herein; and

3. The waiver will not in any manner vary the provisions of the Zoning Ordinance or other ordinance(s) of the City.

In considering this waiver request, the Planning Commission has three options:

1. Approve the waiver request for the alternative pedestrian access plan as presented;

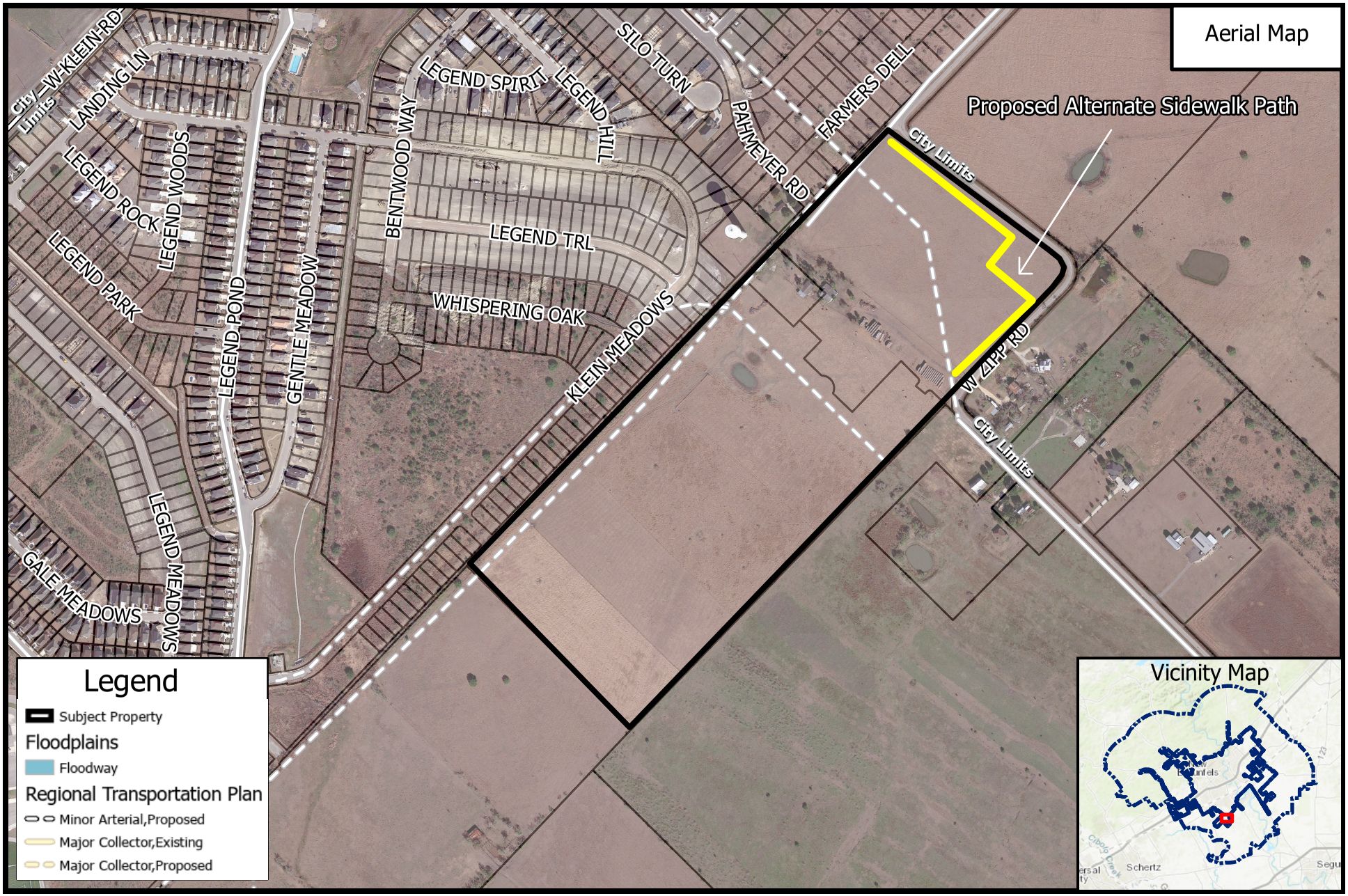
2. Deny the waiver request and require sidewalk construction in the right-of-way adjacent to existing Zipp Road for the entire length of the sidewalk;

3. Recommend approval with modifications to the proposed alternative pedestrian access plan.

FISCAL IMPACT:
N/A
RECOMMENDATION:
Staff recommends approval of the alternative pedestrian access plan as presented as the purpose of the regulation is better served by the alternative pedestrian access plan and will provide a safer route for

pedestrians. In addition, the linear distance of the travel path of the sidewalk as proposed in the alternative pedestrian access plan is no greater than the linear distance of the travel path of the sidewalk if it were constructed adjacent to existing Zipp Road for the entire distance of the sidewalk.

Attachments:
Aerial Map
Applicant's Letter of Waiver Justification
Highland Ridge, Unit 1 Proposed Plat Exhibit
Alternative Pedestrian Access Plan Exhibit



WVR21-162

Waiver Request for Alternative Pedestrian Access Plan

0 310 620 Feet

N

Path:
\\file-04\Users$\Planning\mgreene\Desktop\WVR21-162 Aerial map.aprx

Source: City of New Braunfels Planning
Date: 5/21/2021

DISCLAIMER: This map and information contained in it were developed exclusively for use by the City of New Braunfels. Any use or reliance on this map by anyone else is at that party's risk and without liability to the City of New Braunfels, its officials or employees for any discrepancies, errors, or variances which may exist.

HMT
ENGINEERING & SURVEYING
290 S. Castell Avenue, Ste 100
New Braunfels, TX 78130
TBPE-FIRM F-10961
TBPLS FIRM 10153600

April 30, 2021

Mr. Garry Ford, P.E.
City of New Braunfels
550 Landa Street
New Braunfels TX 78130

RE: Waiver Request - Highland Ridge Subdivision
Section 118-11 – Alternate Access Path Request for Zipp Rd Sidewalk

Dear Garry,

The approved Highland Ridge Master Plan requires the developer to construct 4' sidewalks along Zipp Rd at the eastern boundary of the property. We respectfully request that an alternate access path be supported for this case.

Sidewalks are proposed within Right-of-way dedications for the main lengths of the road up the 90-degree turn. At this turn, the roadside ditches, culvert crossing, and non-centered pavement present both drainage, grading, and pedestrian safety concerns for the installation of a sidewalk.

Therefore, we are requesting that the alternate pedestrian path around the west side of detention basin in the southeastern corner of Unit 1 be approved. A sidewalk exhibit is also attached along with the associated civil plans to provide further clarification.

We respectfully request an approval for this alternate access path. Please contact me if you have any questions or concerns.

Thank you,

Chris Van Heerde, PE

Chris Van Heerde, PE
Managing Partner
HMT Engineering & Surveying

4/30/21

FINAL PLAT ESTABLISHING

HIGHLAND RIDGE, UNIT 1

BEING AN 13.40 ACRE TRACT OF LAND SITUATED IN THE SARAH DEWITT SURVEY NO. 48, ABSTRACT NO. 103, GUADALUPE COUNTY, TEXAS. BEING A PORTION OF A CALLED 18.186 ACRE TRACT DESCRIBED IN DOCUMENT NO. 202099024053, OFFICIAL PUBLIC RECORDS, GUADALUPE COUNTY, TEXAS.

Highland Ridge, Unit 1
Proposed Plat Exhibit

0 50 100 200
HORIZONTAL SCALE: 1:100

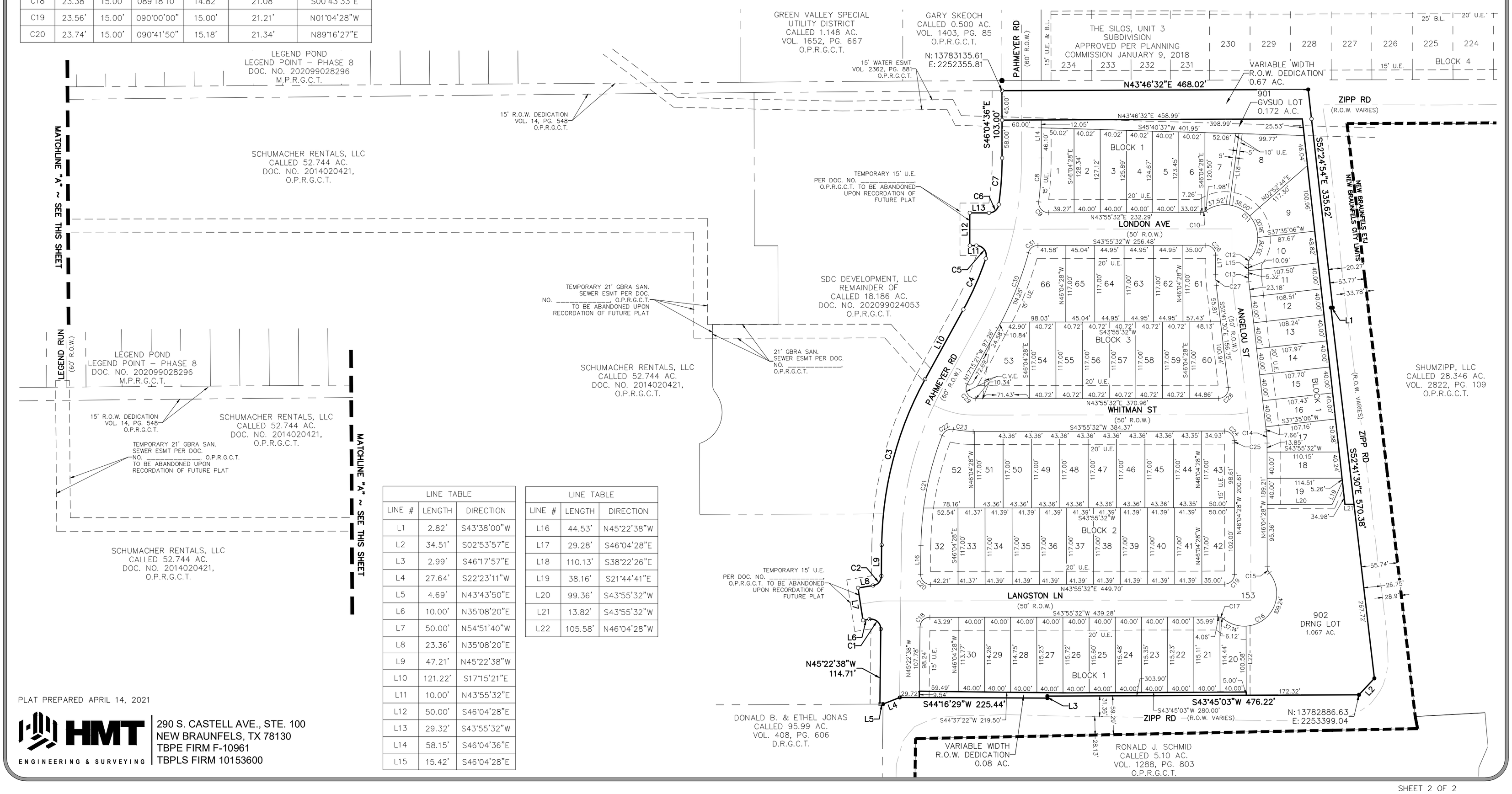
LEGEND:
- ● = FND 1/2" IRON PIN W/ PLASTIC CAP STAMPED "HMT" (UNLESS NOTED OTHERWISE)
- ○ = SET 1/2" IRON PIN W/ PLASTIC CAP STAMPED "HMT"
- U.E. = UTILITY EASEMENT
- C.V.E. = CLEAR VISION EASEMENT
- DRNG = DRAINAGE
- R.O.W. = RIGHT-OF-WAY
- M.P.R.G.C.T. = MAP AND PLAT RECORDS, GUADALUPE COUNTY, TEXAS
- O.P.R.G.C.T. = OFFICIAL PUBLIC RECORDS, GUADALUPE COUNTY, TEXAS

CURVE TABLE						
CURVE	LENGTH	RADIUS	DELTA	TANGENT	CHORD LENGTH	CHORD BEARING
C1	26.04'	15.00'	099°29'01"	17.71'	22.89'	S84°52'51"W
C2	21.08'	15.00'	080°30'59"	12.70'	19.39'	N05°07'09"W
C3	265.04'	540.00'	028°07'17"	135.24'	262.39'	S31°19'00"E
C4	85.13'	480.00'	010°09'44"	42.68'	85.02'	N22°20'13"W
C5	28.45'	15.00'	108°39'23"	20.90'	24.37'	N81°44'47"W
C6	21.34'	15.00'	081°29'52"	12.92'	19.58'	N03°10'36"E
C7	71.25'	480.00'	008°30'15"	35.69'	71.18'	N41°49'28"W
C8	67.08'	540.00'	007°07'04"	33.58'	67.04'	N42°31'04"W
C9	25.42'	15.00'	097°06'56"	16.99'	22.49'	S87°31'00"E
C10	9.24'	15.00'	035°17'54"	4.77'	9.10'	N26°16'35"E
C11	143.28'	50.00'	164°11'17"	360.06'	99.05'	N89°16'43"W
C12	10.18'	15.00'	038°53'24"	5.30'	9.99'	S26°37'46"E
C13	11.55'	100.00'	006°37'02"	5.78'	11.54'	S49°22'59"E
C14	17.32'	150.00'	006°37'02"	8.67'	17.31'	N49°22'59"W
C15	10.18'	15.00'	038°52'15"	5.29'	9.98'	S65°30'36"E
C16	146.38'	50.00'	167°44'30"	465.62'	99.43'	N01°04'28"W
C17	10.18'	15.00'	038°52'15"	5.29'	9.98'	S63°21'39"W
C18	23.38'	15.00'	089°18'10"	14.82'	21.08'	S00°43'33"E
C19	23.56'	15.00'	090°00'00"	15.00'	21.21'	N01°04'28"W
C20	23.74'	15.00'	090°41'50"	15.18'	21.34'	N89°16'27"E

CURVE TABLE						
CURVE	LENGTH	RADIUS	DELTA	TANGENT	CHORD LENGTH	CHORD BEARING
C21	172.20'	480.00'	020°33'15"	87.03'	171.27'	S35°06'01"E
C22	21.05'	15.00'	080°25'11"	12.68'	19.37'	S15°23'13"W
C23	30.56'	150.00'	011°40'16"	15.33'	30.50'	N49°45'40"E
C24	22.96'	15.00'	087°42'44"	14.41'	20.79'	S87°46'57"W
C25	3.99'	100.00'	002°17'14"	2.00'	3.99'	N47°13'05"W
C26	23.56'	15.00'	090°00'00"	15.00'	21.21'	S88°55'32"W
C27	17.32'	150.00'	006°37'02"	8.67'	17.31'	S49°22'59"E
C28	25.29'	15.00'	096°37'02"	16.84'	22.40'	N04°22'59"W
C29	31.11'	15.00'	118°49'07"	25.37'	25.82'	S76°39'55"E
C30	125.09'	540.00'	013°16'20"	62.83'	124.81'	N23°53'31"W
C31	19.49'	15.00'	074°27'13"	11.40'	18.15'	S06°41'55"W

LINE TABLE		
LINE #	LENGTH	DIRECTION
L1	2.82'	S43°38'00"W
L2	34.51'	S02°53'57"E
L3	2.99'	S46°17'57"E
L4	27.64'	S22°23'11"W
L5	4.69'	N43°43'50"E
L6	10.00'	N35°08'20"E
L7	50.00'	N54°51'40"W
L8	23.36'	N35°08'20"E
L9	47.21'	N45°22'38"W
L10	121.22'	S17°15'21"E
L11	10.00'	N43°55'32"E
L12	50.00'	S46°04'28"E
L13	29.32'	S43°55'32"W
L14	58.15'	S46°04'36"E
L15	15.42'	S46°04'28"E

LINE TABLE		
LINE #	LENGTH	DIRECTION
L16	44.53'	N45°22'38"W
L17	29.28'	S46°04'28"E
L18	110.13'	S38°22'26"E
L19	38.16'	S21°44'41"E
L20	99.36'	S43°55'32"W
L21	13.82'	S43°55'32"W
L22	105.58'	N46°04'28"W

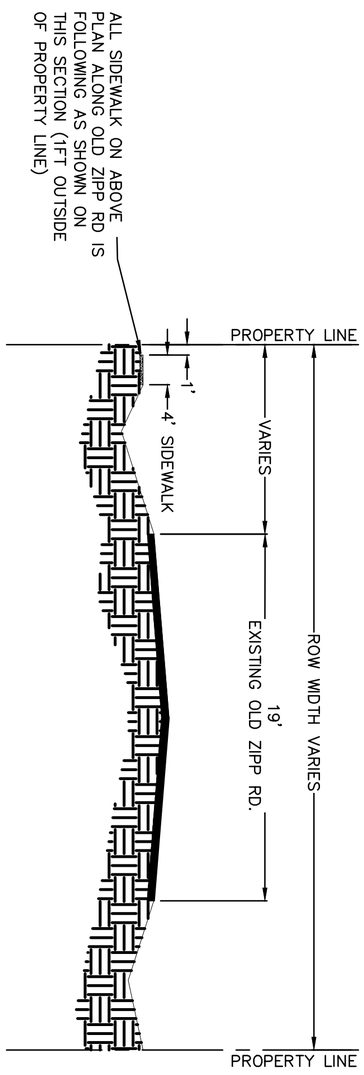


PLAT PREPARED APRIL 14, 2021

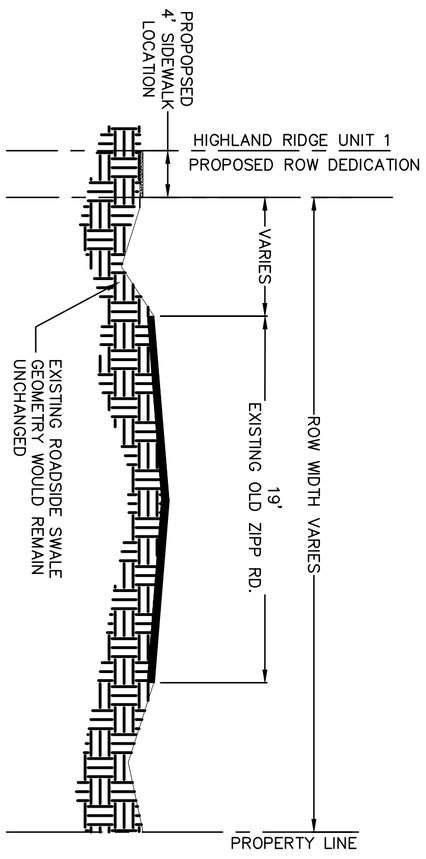
HMT ENGINEERING & SURVEYING
290 S. CASTELL AVE., STE. 100
NEW BRAUNFELS, TX 78130
TBPE FIRM F-10961
TBPLS FIRM 10153600

Drawing Name: T:\080 - Armadillo Homes\080.007 - Highland Ridge\Unit 1\Highland Ridge Unit 1 Plat.dwg User: kellyk Apr 14, 2021 - 12:50pm

ALTERNATIVE PEDESTRIAN ACCESS PLAN EXHIBIT



TYPICAL SECTION A-A
NOT TO SCALE



ROW DEDICATION SIDEWALK SECTION B-B
NOT TO SCALE

THE LOCATION OF ALL EXISTING UNDERGROUND UTILITIES ARE SHOWN IN APPROXIMATE LOCATIONS ONLY. THE CONTRACTOR SHALL DETERMINE THE EXACT LOCATION OF ALL EXISTING UTILITIES BEFORE COMMENCING WORK. THE CONTRACTOR WILL AGREE TO BE FULLY RESPONSIBLE FOR ANY AND ALL DAMAGES WHICH MIGHT BE INCURRED BY THEIR FAILURE TO EXACTLY LOCATE AND PRESERVE ANY AND ALL UNDERGROUND UTILITIES, STRUCTURES OR FACILITIES. CONTRACTOR SHALL NOTIFY ENGINEER OF ANY DISCREPANCIES 24- HOURS PRIOR TO COMMENCING CONSTRUCTION.

NO.	REVISION DESCRIPTION	REVISION DATE

DATE: MAY 2021
DRAWN BY: LB
DESIGNED BY: HLC
REVIEWED BY:
HMT PROJECT NO.: 080.008

SHEET
EXH

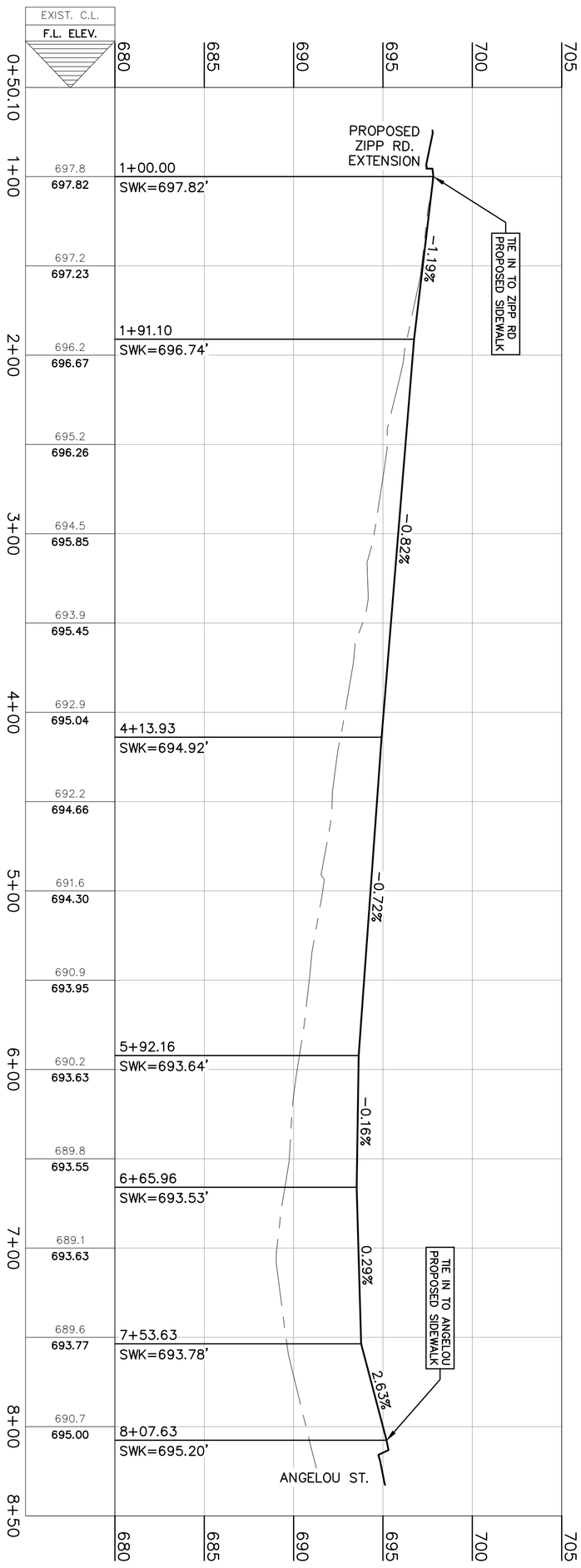
OLD ZIPP RD SIDEWALK EXHIBIT

HIGHLAND RIDGE
UNIT 1

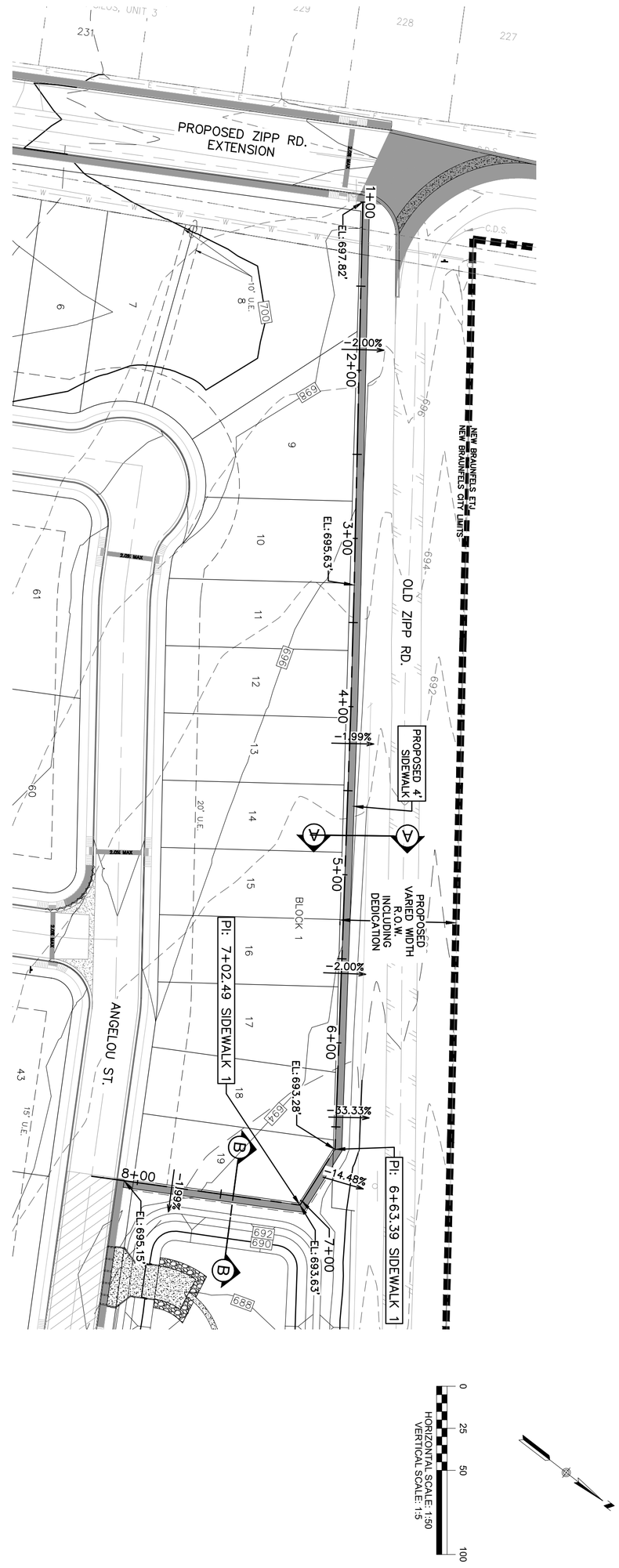
05/03/2021

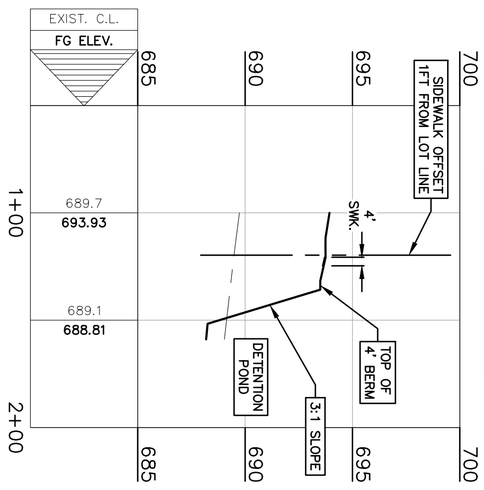
CHRISTOPHER P. VAN HEERDE
93047
LICENSED PROFESSIONAL ENGINEER
STATE OF TEXAS

HMT ENGINEERING & SURVEYING
290 S. CASTELL AVE., STE. 100
NEW BRAUNFELS, TX 78130
TBPE FIRM F-10961
TBPLS FIRM 1053600

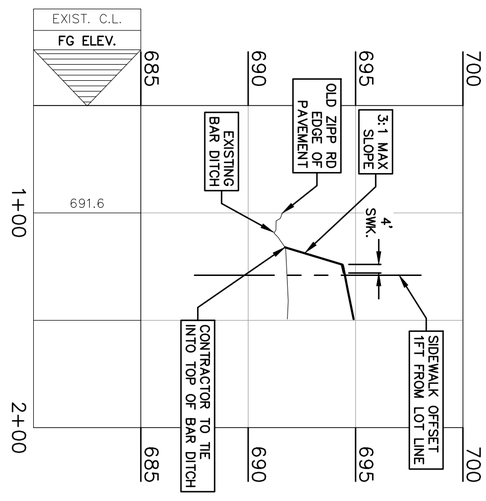


SIDEWALK 1
0+50.10 – 8+50





SECTION B
0+50 – 2+00.01



SECTION A
0+50 – 2+00.01

THE LOCATION OF ALL EXISTING UNDERGROUND UTILITIES ARE SHOWN IN APPROXIMATE LOCATIONS ONLY. THE CONTRACTOR SHALL DETERMINE THE EXACT LOCATION OF ALL EXISTING UTILITIES BEFORE COMMENCING WORK. THE CONTRACTOR WILL AGREE TO BE FULLY RESPONSIBLE FOR ANY AND ALL DAMAGES WHICH MIGHT BE INCURRED BY THEIR FAILURE TO EXACTLY LOCATE AND PRESERVE ANY AND ALL UNDERGROUND UTILITIES, STRUCTURES OR FACILITIES. CONTRACTOR SHALL NOTIFY ENGINEER OF ANY DISCREPANCIES 24-HOURS PRIOR TO COMMENCING CONSTRUCTION.

NO.	REVISION DESCRIPTION	REVISION DATE

DATE: APRIL 2021
DRAWN BY: LB
DESIGNED BY: HLC
REVIEWED BY: CVH/SWH
HMT PROJECT NO.: 080.008

SHEET C6.13

SIDEWALK FROM LOTS 8-19 PLAN AND PROFILE

HIGHLAND RIDGE
UNIT 1

04/29/2021

STATE OF TEXAS
CHRISTOPHER P. VAN HEERDE
93047
LICENSED PROFESSIONAL ENGINEER

HMT ENGINEERING & SURVEYING
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NEW BRAUNFELS, TX 78130
TBPE FIRM F-10961
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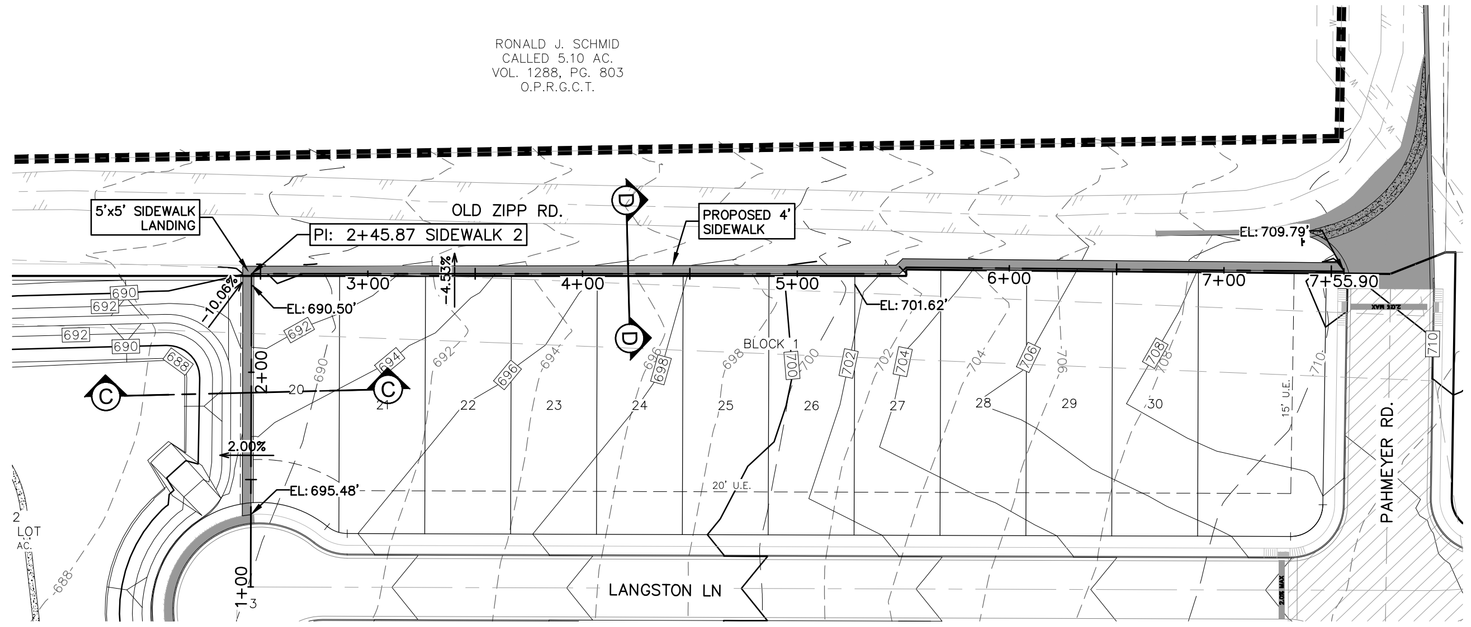

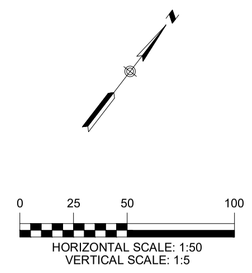

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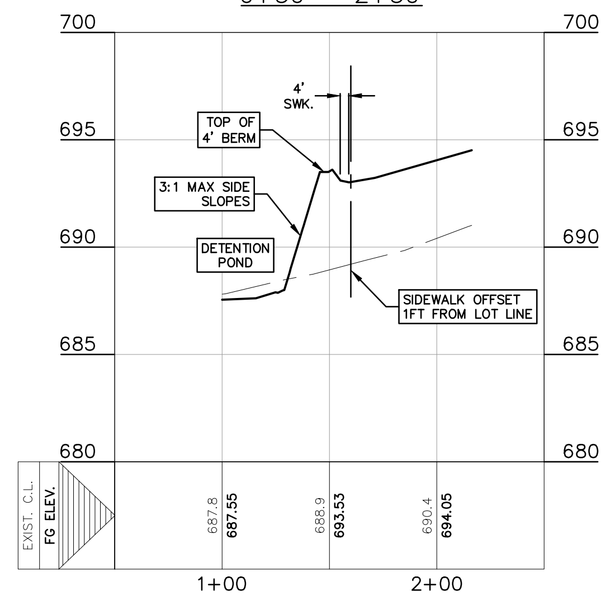
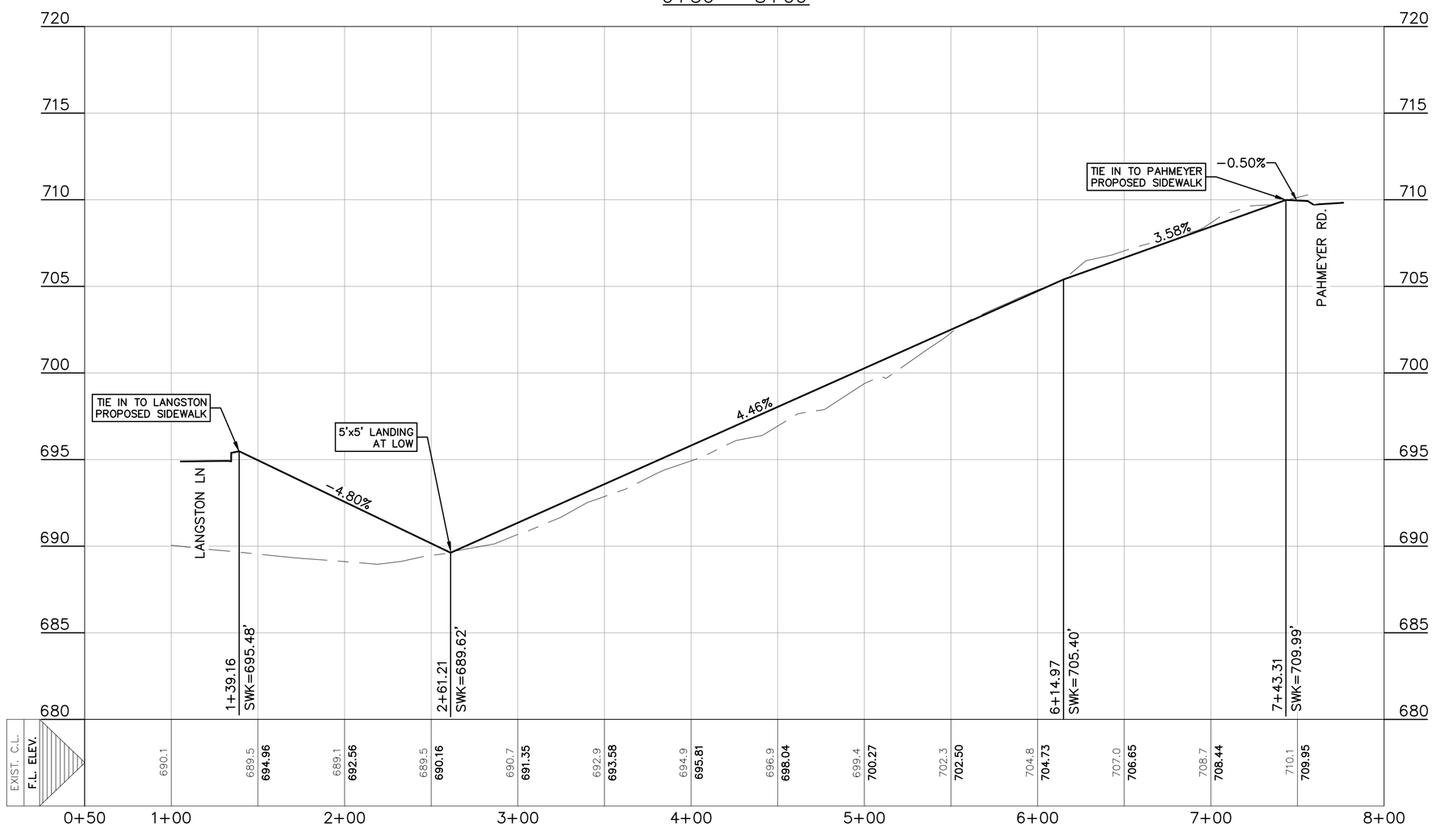
HORIZONTAL SCALE: 1:50
VERTICAL SCALE: 1:5

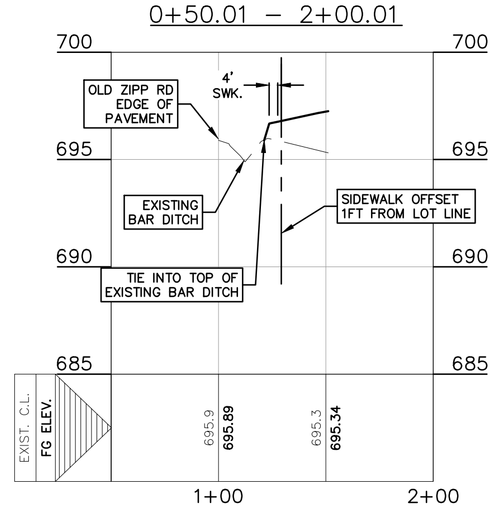
SECTION C
0+50 – 2+50



SIDEWALK 2
0+50 – 8+00



SECTION D
0+50.01 – 2+00.01



THE LOCATION OF ALL EXISTING UNDERGROUND UTILITIES ARE SHOWN IN APPROXIMATE LOCATIONS ONLY. THE CONTRACTOR SHALL DETERMINE THE EXACT LOCATION OF ALL EXISTING UTILITIES BEFORE COMMENCING WORK. THE CONTRACTOR WILL AGREE TO BE FULLY RESPONSIBLE FOR ANY AND ALL DAMAGES WHICH MIGHT BE INCURRED BY THEIR FAILURE TO EXACTLY LOCATE AND PRESERVE ANY AND ALL UNDERGROUND UTILITIES, STRUCTURES OR FACILITIES. CONTRACTOR SHALL NOTIFY ENGINEER OF ANY DISCREPANCIES 24-HOURS PRIOR TO COMMENCING CONSTRUCTION.

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TBPLS FIRM 1053600

STATE OF TEXAS
CHRISTOPHER P. VAN HEERDE
93047
LICENSED
PROFESSIONAL ENGINEER
04/29/2021

SIDEWALK FROM LOTS 20-31 PLAN AND PROFILE

HIGHLAND RIDGE
UNIT 1

NO.	REVISION DESCRIPTION	REVISION DATE

DATE: APRIL 2021
DRAWN BY: LB
DESIGNED BY: HLC
REVIEWED BY: CVH/SWH
HMT PROJECT NO.: 080.008

SHEET
C6.14

Drawing Name: N:_Projects\080 - Armadillo Homes\080.008 - Highland Ridge Unit 1\Cds\080.008_STREET SIDEWALK.dwg User: josephs Apr 29, 2021 - 11:53am

City of New Braunfels

Planning Commission Agenda Item Report

550 Landa Street
New Braunfels, TX

6/1/2021

Agenda Item No. M)

Presenter**:** Jean Drew, Senior Planner

ORD21-129 Public Hearing and recommendation to City Council of an ordinance to revise sections *144 -1.3, Definitions*, to define efficiency/studio apartments, and to *144-5.1-3 Schedule of Required Spaces* to identify parking standards for efficiency/studio apartments.

DEPARTMENT: Planning and Development Services Department

COUNCIL DISTRICTS IMPACTED: This would be a city-wide revision, thus potentially impacting all City Council Districts.

BACKGROUND INFORMATION:
A need has been identified to determine the appropriate parking standard for efficiency/studio apartments. These units consist of one common room for living, with a separate room allowed only for the bathroom. These limitations are restrictive and are significantly different from a one-bedroom apartment, warranting revisiting their parking needs.

Interest has been identified by owners of several existing hotels regarding the potential to convert their use from hotel to efficiency apartments. Redevelopment of property is highly desirable from many perspectives. Adaptive re-use to meet current market needs prior to the existing use going into disrepair is desirable; it is a luxury for a community to have such opportunities as not many communities have an economic climate that supports adaptive reuse. Utilizing existing infrastructure lowers the cost of service, providing economic and environmental benefits for the community.

The proposed use of efficiency apartments would help address New Braunfels' need for workforce housing, while both maintaining an active use for properties and addressing the housing needs of a growing city. Discussions of the potential for redevelopment identified that our zoning ordinance does not currently have a standard for efficiency/studio apartments, only for a one-bedroom apartment (1.5 per unit). Benchmarking was performed with other Texas cities to understand their parking requirements for efficiency/studio apartments as opposed to one-bedroom apartments, and to aid in identifying the appropriate parking standard for this use.

This initiative addresses the following action items from **Envision New Braunfels:**

- **Action 1.6:** Incentivize infill development and redevelopment to take advantage of existing infrastructure.
- **Action 3.1:** Change zoning/land use and plating rules and create tax and permit fee incentives in under-utilized neighborhoods, nodes and corridors to encourage redevelopment.
- **Action 3.16:** Review and revise regulations that inadvertently inhibit creative housing options or

workforce housing alternatives.

- **Action 3.18:** Encourage Multifamily to disperse throughout the community rather than to congregate en masse.
- **Action 3.30:** Encourage and incentivize workforce/affordable housing to attract new workforce entrants and young families.
- **Action 3.31:** Adopt policies and ordinances supportive of workforce housing, creating opportunities that make investment in workforce housing more feasible for private and nonprofit developers.

ISSUE:
To identify the number of parking spaces appropriate for efficiency/studio apartments. No parking standards currently exist for an efficiency apartment, and the requirement of 1.5 spaces used for a one-bedroom apartment is excessive when comparing the rate to that used by other Texas cities for efficiency units. Both Seguin and Schertz, two comparable Texas cities, require only 1 space per unit for efficiency/studio apartments.

FISCAL IMPACT:
N/A

RECOMMENDATION:
Based on research conducted, staff recommends to define efficiency/studio apartments so no ambiguity arises as to the use, and to define a parking standard of 1.1 spaces per unit be established, to provide adequate parking for both residents and visitors, as included in the draft ordinance sections provided for your review.

Sec. 144-1.4. Definitions.

For the purpose of this chapter, certain words and terms as used herein are defined as follows:

Words used in the present tense include the future; words in the singular number include the plural, and vice versa; the word "building" includes the word "structure;" the word "shall" is mandatory and not directory; the term "used for" includes the meaning "designed for" or "intended for."

Accessory dwelling means a separate, complete housekeeping unit with a separate entrance, kitchen, sleeping area, and full bathroom facilities, which is an attached or detached extension to an existing single-family structure.

Accessory structure or use means a subordinate building having a use customarily incident to and located on the lot occupied by the main building; or a use customarily incident to the main use of the property.

.....

Dwelling means a building or structure or portion thereof designed for occupancy by one family for residential purposes as a single housekeeping unit. In no case shall a motor home, trailer coach, automobile chassis, tent, or portable building be considered a dwelling.

Efficiency apartment or unit means a dwelling unit consisting of a single room for cooking, eating, sleeping and living, and a separate room for bath and toilet facilities, also referred to as a studio apartment or unit.

.....

(Ord. No. 2012-49, § 1(Exh. A), 9-10-12; Ord. No. 2016-75, § 1, 12-12-16; Ord No. 2017-06, § 1, 1-9-17; Ord. No. 2017-77, § 1, 10-23-17; Ord. No. 2017-78, § 1, 10-23-17; Ord. No. 2018-21, § 2, 3-26-18; Ord. No. 2018-76, § 1, 11-12-18; Ord. No. 2019-78, § 1, 11-11-19; Ord. No. 2020-20, § 1, 3-9-20; Ord. No. 2020-78, § 1, 12-14-20)

Editor's note(s)—Ord. No. 2018-21, § 2, adopted March 26, 2018, redesignated the former section 144-1.3Editor's note(s)— as section 144-1.4Editor's note(s)—. The historical notation has been preserved for reference purposes.

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Sec. 144-5.1. Parking, loading, stacking and vehicular circulation.

5.1-1. *General provisions.*

.....

(c) For each structure designed for any of the following uses, or for any like use, no less than the number of parking spaces required shall be provided according to the following schedule:

PERMITTED USE	MINIMUM VEHICLE SPACES
Adult care facility	One for each two employees or staff members, PLUS One space for each five adults for which the facility is licensed by the state
Ambulance service	One for each 400 sq. ft. of gross floor area
Amphitheaters	One for each four persons based on maximum occupancy capacity
Amusement parks	One for each 600 sq. ft. of outdoor recreation area, and 1 for each 400 sq. ft. of indoor recreation area
Amusement services	One for each 200 sq. ft. of gross floor area
Animal grooming shops	One for each 400 sq. ft. of gross floor area
Antique shops	One for each 400 sq. ft. of gross floor area
Apartments	Two-bedroom apartment or unit Two
	One-bedroom apartment or unit One and one-half
	Efficiency/ Studio Apartment or unit One and one-tenth
	Each additional bedroom One-half
	Each dwelling unit provided exclusively for low income elderly occupancy Three-fourths
	("Low income elderly" is defined as any person 55 years of age or older with low or moderate income, according to HUD standards)
Archery ranges	One for each 600 sq. ft. of outdoor recreation area, and One for each 400 sq. ft. of indoor recreation area
Arenas	One for each four persons based on maximum occupancy capacity
Art dealer/gallery	One for each 400 sq. ft. of gross floor area
Artist or artisans studio	One for each 400 sq. ft. of gross floor area
Assisted living/retirement homes	One for each four employees, and One for each four patient beds, and One for each staff doctor
Asylums	One for each four employees, and One for each four patient beds, and One for each staff doctor
Assembly halls	One for each four seats for patron use, or one for each 100 sq. ft. of gross floor area, whichever is greater
Auditoriums	One for each 200 sq. ft. of gross floor area, or One for each four seats, or One for each three persons of total building occupancy, whichever is greater
Auto leasing	One for each 400 sq. ft. of gross floor area
Auto glass repair/tinting	One for each 400 sq. ft. of gross floor area
Automobile driving school	One for each 200 sq. ft. of gross floor area
Auto muffler shops	One for each 300 sq. ft. of gross floor area

.....

5.1-4. *Parking and storage of certain vehicles.*

(a) *Parking, standing or storing of vehicles as described below in residential districts.*

(1) It shall be unlawful for any person or owner to allow to park, stand or store any Oversized Vehicle upon any private premises, private street, private alley, private parkway, vacant or undeveloped lot/land, or public place within a residential district of the city.

(2) This section shall not prevent the parking or standing of the above described vehicles in such areas for the purpose of expeditiously loading and unloading of passengers, freight, merchandise or property; nor prevent the parking of any such vehicles owned and operated for the normal course of business operations in any permitted non-residential use, such as farms, churches, daycare centers and school district facilities.

(3) Provided further, that this subsection shall not apply to street construction, maintenance and repair equipment trucks, rollers and implements, or to trucks, equipment, trailers and vehicles used by any public service utility companies, the city or its contractors engaged in repairing or extending public service utilities, providing city services or as engaged in an active permitted construction project.

(Ord. No. 2012-49, § 1(Exh. A), 9-10-12; Ord. No. 2016-75, § 2, 12-12-16; Ord. No. 2017-80, § 2, 10-23-17; Ord. No. 2018-21, § 2, 3-26-18; Ord. No. 2019-78, § 3, 11-11-19)

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