Traffic Noise Technical Report

SL 288

From IH 35W to IH 35
Denton County, Texas

CSJs: 2250-02-013, 2250-02-014

April 2020

The environmental review, consultation, and other actions required by applicable Federal environmental laws for this project are being, or have been, carried-out by TxDOT pursuant to 23 U.S.C. 327 and a Memorandum of Understanding dated December 9, 2019, and executed by FHWA and TxDOT.

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1.0 INTRODUCTION

The Texas Department of Transportation (TxDOT), in conjunction with Denton County, is proposing the construction of a four-lane new location frontage road system for State Loop (SL) 288 from Interstate Highway (IH) 35W south of Denton to IH 35 north of Denton, in Denton County, Texas. The distance of the proposed project is approximately 9.0 miles. The proposed project right-of-way (ROW) would include a median that would accommodate the future construction of an ultimate mainlane facility. Construction of the ultimate mainlane facility would be based on projected traffic and funding and would require additional environmental analysis prior to construction.

The new location SL 288 frontage road system would include a northbound and southbound frontage road facility. For rural areas, the facility would consist of two travel lanes (one 12-foot wide lane and one 14-foot wide lane for bicycle accommodation) and 8-foot wide inside and outside shoulders in each direction, with open ditch drainage. For urbanized areas, the facility would consist of two travel lanes (one 12-foot wide lane and one 14-foot wide lane for bicycle accommodation) in each direction, with curb and gutter drainage. The facility would also include 6-foot wide sidewalks along both sides of the road throughout the project limits. The proposed project ROW would include a median (variable width) that would accommodate the future construction of an ultimate mainlane facility.

The proposed project would also construct intersections at six (6) major cross-roads as follow: John Paine, Farm-to-Market Road (FM) 2449, Tom Cole/FM 1515, Jim Christal Road, U.S. Highway (US) 380, and Masch Branch Road. In addition, the proposed project would construct a grade separation at the KCS Railroad and would tie into the grade separations at IH 35 and IH 35W.

The proposed SL 288 project (frontage road system) would likely be constructed in two phases based on traffic needs and project funding. A logical sequence for staging the various elements for construction of the new location frontage road system could be as follows:

- Phase 1 would construct a single two-lane, two-way frontage road, and would also acquire the proposed ROW to accommodate the frontage roads and the future ultimate mainlane facility.

- As traffic warrants and funding becomes available, Phase 2 would involve the construction of the two-lane frontage road, which would include the conversion of the two-way frontage road built in Phase 1 to a one-way operation, and the construction of grade separations at specific high-volume intersections.

- Phase 3 (a separate project) would involve the construction of the ultimate mainlane facility in both directions. Construction of the ultimate mainlane facility would be based on projected traffic and funding and would require additional environmental analysis prior to construction.

The project area includes approximately 26.6 acres of existing roadway ROW, 401.5 acres of proposed ROW, 1.2 acres of proposed permanent drainage easements, and 13.2 acres of proposed ROW by others.

2.0 TRAFFIC NOISE ANALYSIS

This analysis was accomplished in accordance with TxDOT's (Federal Highway Administration [FHWA] approved) Guidelines for Analysis and Abatement of Roadway Traffic Noise (2011).

Sound from highway traffic is generated primarily from a vehicle's tires, engine and exhaust. It is commonly measured in decibels and is expressed as "dB."

Sound occurs over a wide range of frequencies. However, not all frequencies are detectable by the human ear; therefore, an adjustment is made to the high and low frequencies to approximate the way an average person hears traffic sounds. This adjustment is called A-weighting and is expressed as "dB(A)."

Also, because traffic sound levels are never constant due to the changing number, type and speed of vehicles, a single value is used to represent the average or equivalent sound level and is expressed as "Leq."

The traffic noise analysis process includes the following elements:

- Identification of land use activity areas that might be impacted by traffic noise.
- Determination of existing noise levels.
- Prediction of future noise levels.
- Identification of possible noise impacts.
- Consideration and evaluation of measures to reduce noise impacts.

The FHWA has established the following Noise Abatement Criteria (NAC), shown in **Table 1**, for various land use activity areas that are used as one of two means to determine when a traffic noise impact would occur.

Table 1: FHWA Noise Abatement Criteria (NAC)

Activity Category	FHWA dB(A) Leq	Activity Description
A	57 (exterior)	Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose.
B	67 (exterior)	Residential
C	67 (exterior)	Active sports areas, amphitheaters, auditoriums, campgrounds, cemeteries, day care centers, hospitals, libraries, medical facilities, parks, picnic areas, places of worship, playgrounds, public meeting rooms, public or non-profit institutional structures, radio studios, recording studios, recreation areas, Section 4(f) sites, schools, television studios, trails, and trail crossings.
D	52 (interior)	Auditoriums, day care centers, hospitals, libraries, medical facilities, places of worship, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, schools, and television studios.
E	72 (exterior)	Hotels, motels, offices, restaurants/bars, and other developed lands, properties or activities not included in A-D or F.
F	--	Agriculture, airports, bus yards, emergency services, industrial, logging, maintenance facilities, manufacturing, mining, rail yards, retail facilities, shipyards, utilities (water resources, water treatment, electrical), and warehousing.
G	--	Undeveloped lands that are not permitted.
Source: *Guidelines for Analysis and Abatement of Roadway Traffic Noise* (TxDOT 2011)		

A noise impact occurs when either the absolute or relative criterion is met:

Absolute criterion - the predicted noise level at the receiver approaches, equals, or exceeds the NAC. "Approach" is defined as one dB(A) below the NAC. For example, a noise impact would occur at a Category B residence if the noise level is predicted to be 66 dB(A) or above.

Relative criterion - the predicted noise level substantially exceeds the existing noise level at a receiver even though the predicted noise level does not approach, equal, or exceed the NAC. "Substantially exceeds" is defined as more than 10 dB(A). For example: a noise impact would occur at a Category B residence if the existing level is 54 dB(A) and the predicted level is 65 dB(A).

When a traffic noise impact occurs, noise abatement measures must be considered. A noise abatement measure is any positive action taken to reduce the impact of traffic noise on an activity area.

The FHWA traffic noise modeling software was used to calculate existing and predicted traffic noise levels. The model primarily considers the number, type, and speed of vehicles; highway alignment and

grade; cuts, fills, and natural berms; surrounding terrain features; and the locations of activity areas likely to be impacted by the associated traffic noise. See **Appendix B** for the traffic data utilized in the SL 288 traffic noise models. Traffic data used for the SL 288 facility was provided by TxDOT's Transportation Planning and Programming Division (TPP). Traffic data used for cross streets in the project area was provided by a Traffic Memorandum upon which the TPP memo was based.

Receiver locations were foremost based on the NAC land use activity areas, described in **Table 1**, adjacent to the roadway right-of-way (ROW). Receiver locations are generally identified as outdoor areas that experience frequent human activity and might be impacted by traffic noise. Receivers were placed closest to the ROW for locations having more than one area of frequent human activity. For the proposed project, existing and predicted traffic noise levels were modeled at eight representative noise receivers exhibiting similar noise levels, NAC activity categories, and geographic location for mapping and reporting purposes (see **Table 2** and **Figure 4** in **Appendix A**).

Ambient noise measurements were taken in the field during the peak AM traffic hours (7:00 a.m. to 9:00 a.m.) on April 10, 2019 using a Larson Davis LxT2 noise meter (see **Appendix C**). The purpose of the noise measurements was to determine ambient (existing) noise levels due to the Denton Enterprise Airport that is located in the vicinity of the proposed SL 288 roadway in order to determine the dominant noise source in the area. The ambient traffic measurement was taken in the vicinity of R1 along Tom Cole Road/FM 1515 (see **Figure 4** in **Appendix A**). The ambient reading was 59.6 dB(A) and the corresponding noise level at the same location, as modeled in TNM, was 65.9 dB(A). Therefore, it can be concluded that the ambient noise from Denton Enterprise Airport operations is not the dominant noise source in the project area.

Table 2: Traffic Noise Levels [dB(A) Leq]

Receiver ID	Land Use	NAC Category	NAC Level	Predicted Traffic Noise Level [dB(A) Leq]			Noise Impact
				Existing (2020)	Predicted (2040)	Change (+/-)	
R1	Observatory	C	67	52	67	+15	**Yes**
R2	Residential	B	67	49	61	+12	**Yes**
R3	Residential	B	67	56	60	+4	No
R4	Residential	B	67	55	65	+10	No
R5	Residential	B	67	41	57	+16	**Yes**
R6	Residential	B	67	41	56	+15	**Yes**
R7	Residential	B	67	42	58	+16	**Yes**
R8	Residential	B	67	53	59	+6	No

3.0 NOISE ABATEMENT MEASURES

The proposed project would result in a traffic noise impact; therefore, the following noise abatement measures were considered: traffic management, alteration of horizontal and/or vertical alignments, acquisition of undeveloped property to act as a buffer zone, and the construction of noise barriers.

Before any abatement measure can be proposed for incorporation into the proposed project, it must be both feasible and reasonable. In order to be "feasible," the abatement measure must be able to reduce the noise level at greater than 50% of impacted, first-row receivers by at least five dB(A); and to be "reasonable," it must not exceed the cost-effectiveness criterion of $25,000 for each receiver that would benefit by a reduction of at least five dB(A) and the abatement measure must be able to reduce the noise level for at least one impacted, first-row receiver by at least seven dB(A).

Traffic management - Control devices could be used to reduce the speed of the traffic; however, the minor benefit of one dB(A) per five mph reduction in speed does not outweigh the associated increase in congestion and air pollution. Other measures such as time or use restrictions for certain vehicles are prohibited on state highways.

Alteration of horizontal and/or vertical alignments - Any alteration of the existing alignment would displace existing businesses and residences, require additional ROW and not be cost effective/reasonable.

Buffer zone - The acquisition of undeveloped property to act as a buffer zone is designed to avoid rather than abate traffic noise impacts and, therefore, is not feasible.

Noise barriers - This is the most commonly used noise abatement measure. Noise barriers were evaluated for each of the impacted receiver locations.

A noise barrier would not be feasible or reasonable for the following impacted receivers and, therefore, is not proposed for incorporation into the proposed project:

R1: This receiver represents a school observatory (UNT Rafes Urban Astronomy Center) on the west side of proposed SL 288, north of Tom Cole Road/FM 1515. The representative receiver was modeled at an outdoor seating area. Because this is a Category C receiver, the impacted land use area was determined for this parcel, and this area was used to determine the equivalent number of residences to assess cost effectiveness. Based on the average residential lot size in the area of approximately 5 acres, estimated from Amyx Ranch Estates subdivision off FM 2449, the approximately 0.90 acre of impacted area on the observatory parcel is equivalent to one residential receiver. A noise barrier

modeled on the ROW line at 20 feet in height would achieve the minimum feasible reduction of five dB(A) at greater than 50% of impacted, first-row receivers and would reduce the noise level at one or more receivers by at least seven dB(A). However, the resulting noise barrier would exceed the cost effectiveness criterion of $25,000 per benefitted receiver; therefore, a barrier at this location is not proposed for incorporation into the project.

R2: This receiver represents a single-family residence on the east side of proposed SL 288, north of Jim Christal Road. The representative receiver was modeled in the backyard of the single-family residence. A noise barrier modeled on the ROW line at 20 feet in height would achieve the minimum feasible reduction of five dB(A) at greater than 50% of impacted, first-row receivers but would not reduce the noise level at one or more first-row receivers by at least seven dB(A). Therefore, a barrier at this location is not proposed for incorporation into the project.

R5: This receiver represents a single-family residence on the west side of proposed SL 288, west of Lovers Lane. The representative receiver was modeled in the backyard of the single-family residence. A noise barrier modeled on the ROW line at 20 feet in height would not achieve the minimum feasible reduction of five dB(A) at greater than 50% of impacted, first-row receivers and would not reduce the noise level at one or more first-row receivers by at least seven dB(A). Therefore, a barrier at this location is not proposed for incorporation into the project.

R6: This receiver represents a single-family residence on the west side of proposed SL 288, west of Lovers Lane. The representative receiver was modeled in the backyard of the single-family residence. A non-contiguous noise barrier, with a break for driveway access, modeled on the ROW line at 20 feet in height would not achieve the minimum feasible reduction of five dB(A) at greater than 50% of impacted, first-row receivers and would not reduce the noise level at one or more first-row receivers by at least seven dB(A). Therefore, a barrier at this location is not proposed for incorporation into the project.

R7: This receiver represents a single-family residence on the west side of proposed SL 288, west of Lovers Lane. The representative receiver was modeled in the backyard of the single-family residence. A noise barrier modeled on the ROW line at 20 feet in height would not achieve the minimum feasible reduction of five dB(A) at greater than 50% of impacted, first-row receivers and would not reduce the noise level at one or more first-row receivers by at least seven dB(A). Therefore, a barrier at this location is not proposed for incorporation into the project.

4.0 NOISE PLANNING

To avoid noise impacts that may result from future development of properties adjacent to the proposed project, local officials responsible for land use control programs must ensure, to the maximum extent possible, no new activities are planned or constructed along or within the following predicted (2040) noise impact contours (see **Table 3**).

Table 3: Traffic Noise Contours [dB(A) Leq]

Location	Distance from ROW	
	NAC Category B & C 66 dB(A)	NAC Category E 71 dB(A)
Between Lovers Rd and IH 35 – East side of SL 288	60 feet	Within ROW
Between US 380 and Masch Branch Rd – East side of SL 288	60 feet	10 feet
Between Lumley Rd and East Fork Trinity River – East side of SL 288	140 feet	60 feet

Note: Impact contours are one dB(A) lower than the NAC per category to reflect impacts that would occur as a result of approaching the NAC for the respective contours.

5.0 CONCLUSION

Based on this modeled noise analysis, there are five projected noise impacts within the corridor. Barrier analysis was conducted, and results indicated that a barrier would be feasible but not reasonable for two of the impacted representative receivers and would not be feasible for three of the impacted representative receivers.

Noise associated with the construction of the proposed project is difficult to predict. Heavy machinery, the major source of noise in construction, is constantly moving in unpredictable patterns. However, construction normally occurs during daylight hours when occasional loud noises are more tolerable. None of the receivers are expected to be exposed to construction noise for a long duration; therefore, any extended disruption of normal activities is expected. Provisions would be included in the plans and specifications that require the contractor to make every reasonable effort to minimize construction noise through abatement measures such as work-hour controls and proper maintenance of muffler systems.

A copy of this traffic noise analysis would be made available to local officials. On the date of approval of this document (Date of Public Knowledge), FHWA and TxDOT are no longer responsible for providing noise abatement for new development adjacent to the proposed project.

APPENDIX A

EXHIBITS

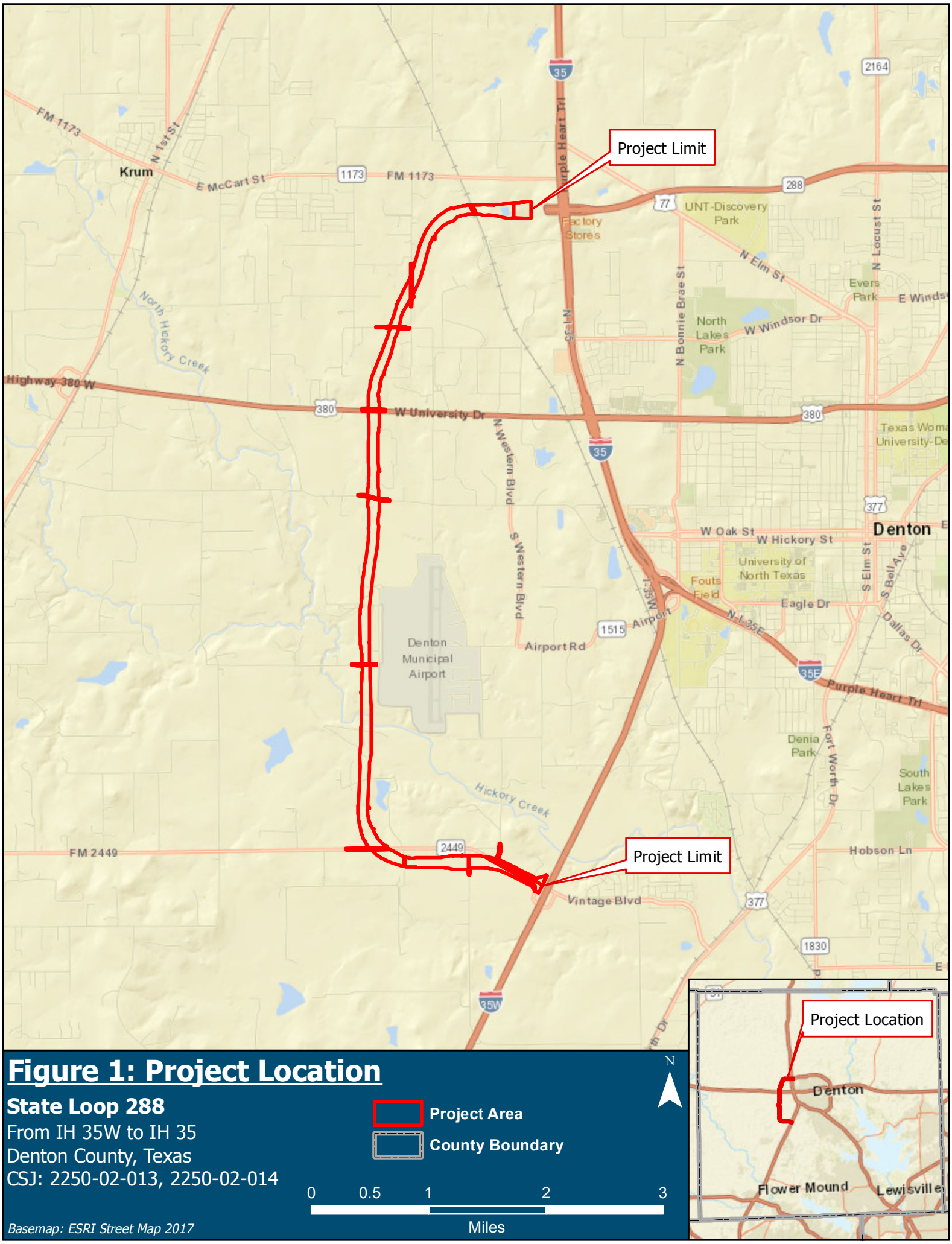


Figure 1: Project Location

State Loop 288
From IH 35W to IH 35
Denton County, Texas
CSJ: 2250-02-013, 2250-02-014

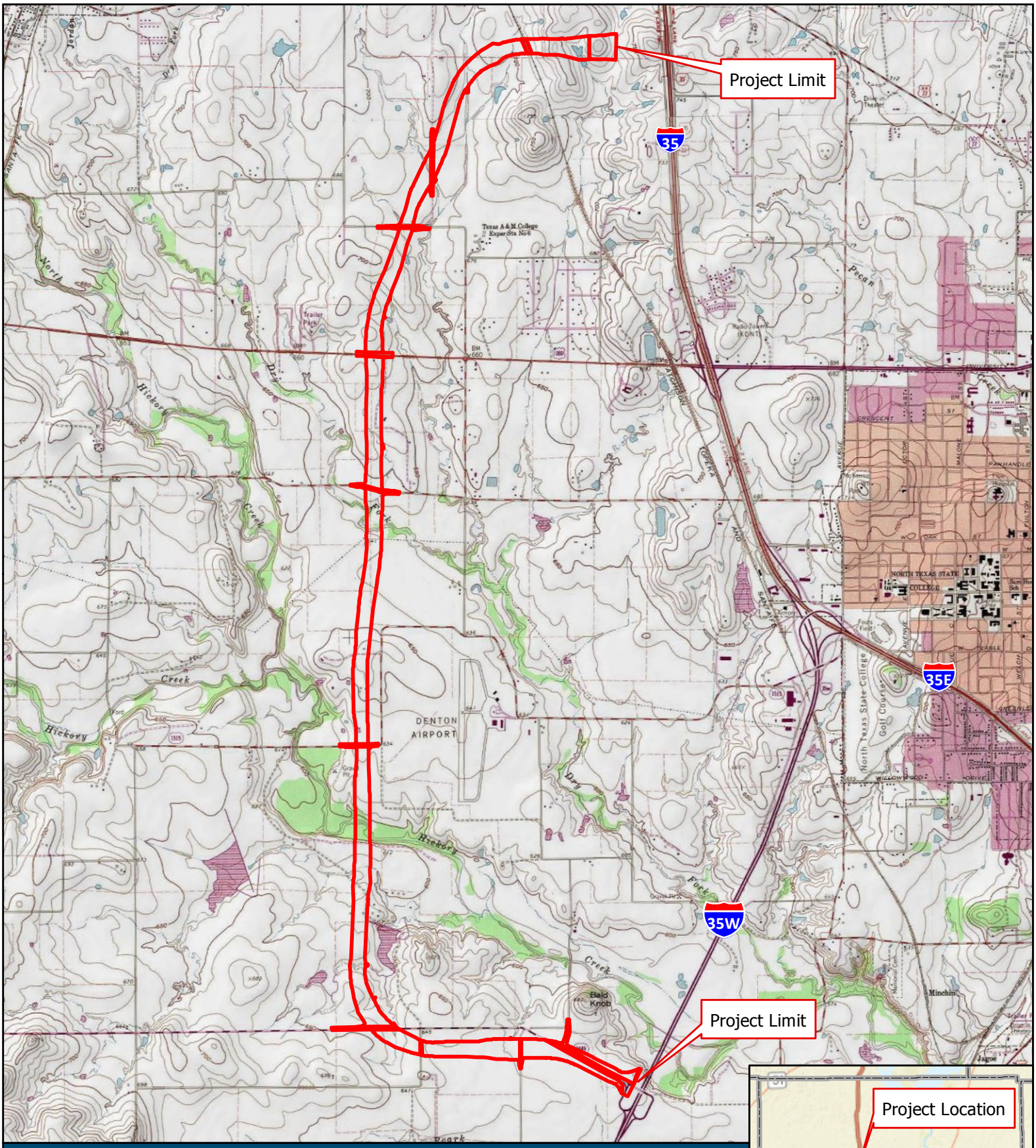


Figure 2: USGS Topographic Map

State Loop 288

From IH 35W to IH 35

Denton County, Texas

CSJ: 2250-02-013, 2250-02-014

Basemap: ESRI Street Map 2017; USGS Topo Sanger & Denton West Quads

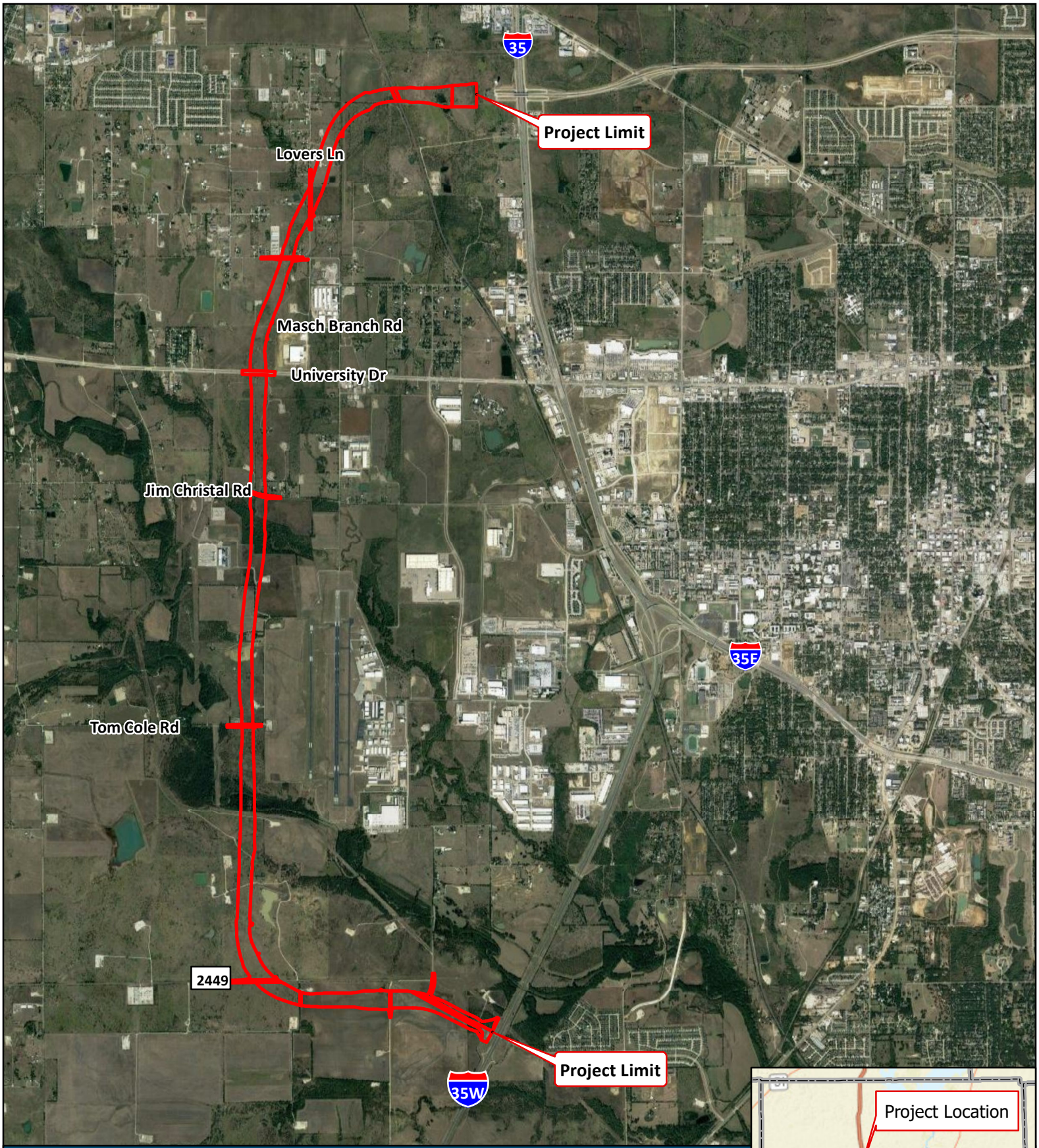


Figure 3: Aerial Map

State Loop 288

From IH 35W to IH 35
Denton County, Texas
CSJ: 2250-02-013, 2250-02-014

Basemap: Google Imagery 2018; ESRI Street Map 2017

Figure 4: Representative Receivers

State Loop 288
From IH 35W to IH 35
Denton County, Texas
CSJ: 2250-02-013, 2250-02-014

Ambient Receiver
Proposed ROW
66 dBA Contours
Denton City Limits
Parcel Boundary

Receiver
Impacted
Non-Impacted

Basemap: Google Imagery 2019

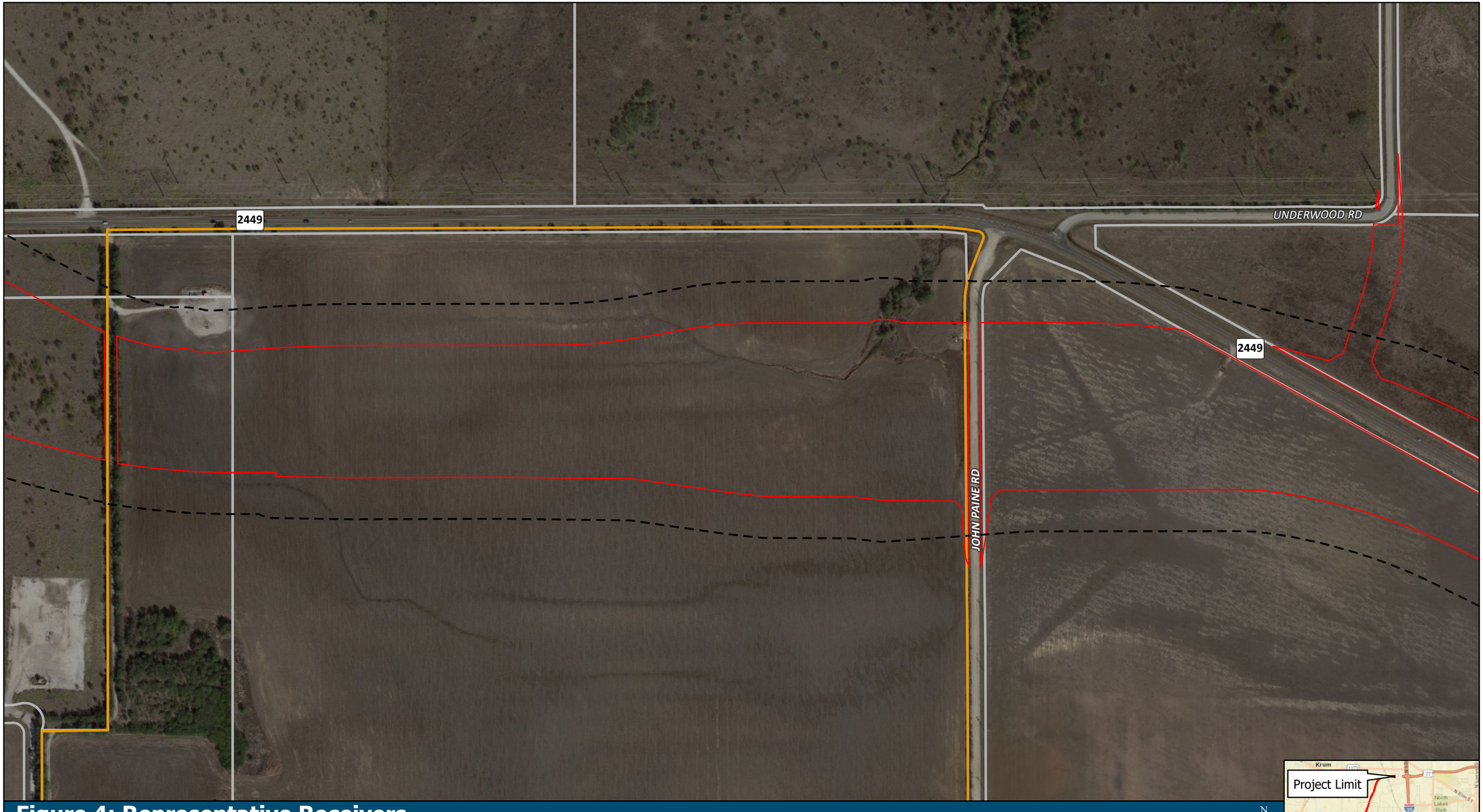


Figure 4: Representative Receivers

State Loop 288
From IH 35W to IH 35
Denton County, Texas
CSJ: 2250-02-013, 2250-02-014

Ambient Receiver
Proposed ROW
66 dBA Contours
Denton City Limits
Parcel Boundary

Receiver
Impacted
Non-Impacted

0 150 300
Feet

Basemap: Google Imagery 2019

Figure 4: Representative Receivers

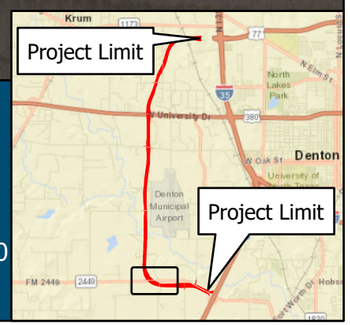
State Loop 288
From IH 35W to IH 35
Denton County, Texas
CSJ: 2250-02-013, 2250-02-014

Ambient Receiver
Proposed ROW
66 dBA Contours
Denton City Limits
Parcel Boundary

Receiver
Impacted
Non-Impacted

N

0 150 300
Feet



Basemap: Google Imagery 2019

Figure 4: Representative Receivers

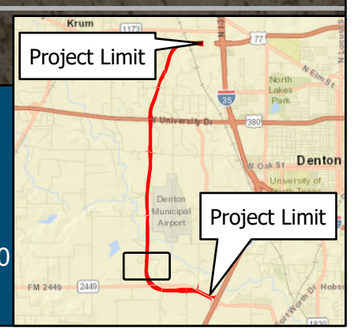
State Loop 288
From IH 35W to IH 35
Denton County, Texas
CSJ: 2250-02-013, 2250-02-014

Ambient Receiver
Proposed ROW
66 dBA Contours
Denton City Limits
Parcel Boundary

Receiver
Impacted
Non-Impacted

N

0 150 300
Feet



Basemap: Google Imagery 2019

Figure 4: Representative Receivers

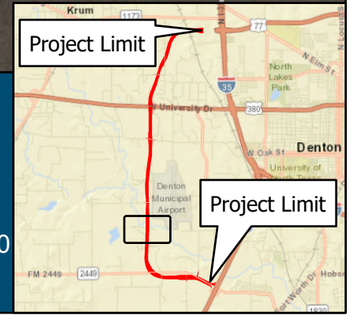
State Loop 288
From IH 35W to IH 35
Denton County, Texas
CSJ: 2250-02-013, 2250-02-014

Ambient Receiver
Proposed ROW
66 dBA Contours
Denton City Limits
Parcel Boundary

Receiver
Impacted
Non-Impacted

N

0 150 300
Feet



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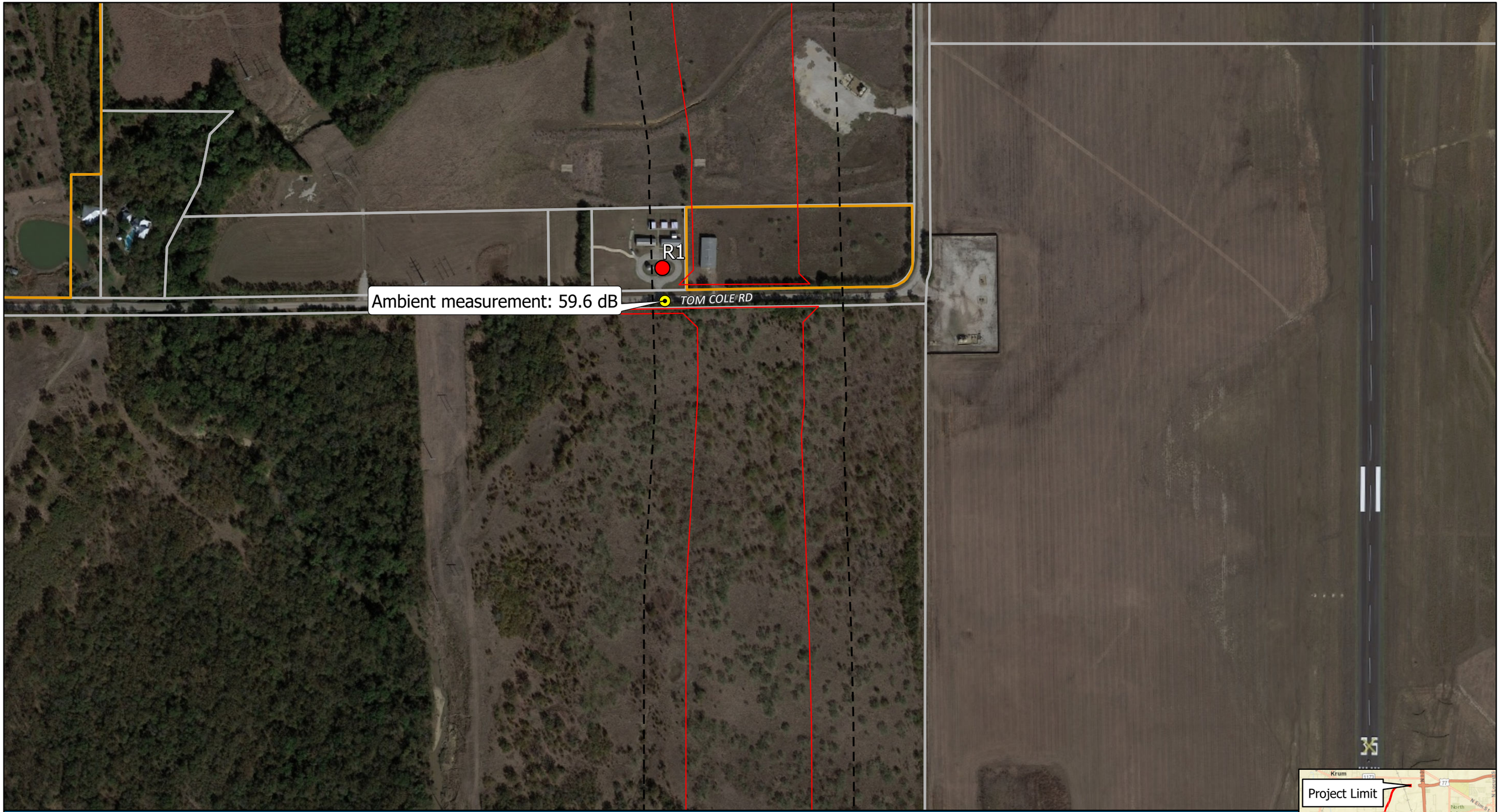


Figure 4: Representative Receivers

State Loop 288
From IH 35W to IH 35
Denton County, Texas
CSJ: 2250-02-013, 2250-02-014

Ambient Receiver
Proposed ROW
66 dBA Contours
Denton City Limits
Parcel Boundary

Receiver
Impacted
Non-Impacted

Basemap: Google Imagery 2019

Figure 4: Representative Receivers

State Loop 288
From IH 35W to IH 35
Denton County, Texas
CSJ: 2250-02-013, 2250-02-014

Ambient Receiver
Proposed ROW
66 dBA Contours
Denton City Limits
Parcel Boundary

Receiver
Impacted
Non-Impacted

Basemap: Google Imagery 2019

Figure 4: Representative Receivers

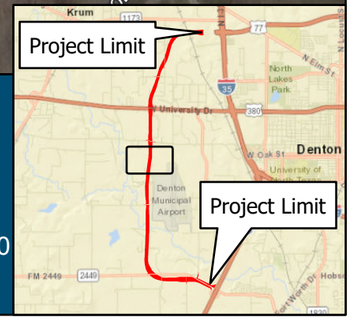
State Loop 288
From IH 35W to IH 35
Denton County, Texas
CSJ: 2250-02-013, 2250-02-014

Ambient Receiver
Proposed ROW
66 dBA Contours
Denton City Limits
Parcel Boundary

Receiver
Impacted
Non-Impacted

N

0 150 300
Feet



Basemap: Google Imagery 2019

R2

JIM CHRISTAL RD

Figure 4: Representative Receivers

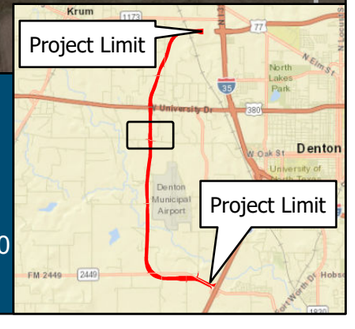
State Loop 288
From IH 35W to IH 35
Denton County, Texas
CSJ: 2250-02-013, 2250-02-014

Ambient Receiver
Proposed ROW
66 dBA Contours
Denton City Limits
Parcel Boundary

Receiver
Impacted
Non-Impacted

N

0 150 300
Feet



Basemap: Google Imagery 2019

Figure 4: Representative Receivers

State Loop 288
From IH 35W to IH 35
Denton County, Texas
CSJ: 2250-02-013, 2250-02-014

Ambient Receiver
Proposed ROW
66 dBA Contours
Denton City Limits
Parcel Boundary

Receiver
Impacted
Non-Impacted

Basemap: Google Imagery 2019

HAMPTON RD

MASCH BRANCH

Figure 4: Representative Receivers

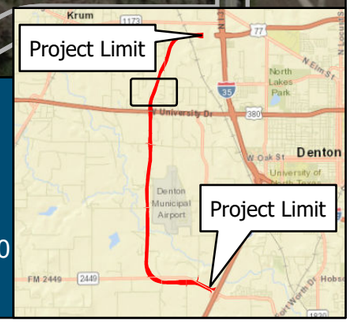
State Loop 288
From IH 35W to IH 35
Denton County, Texas
CSJ: 2250-02-013, 2250-02-014

Ambient Receiver
Proposed ROW
66 dBA Contours
Denton City Limits
Parcel Boundary

Receiver
Impacted
Non-Impacted

N

0 150 300
Feet



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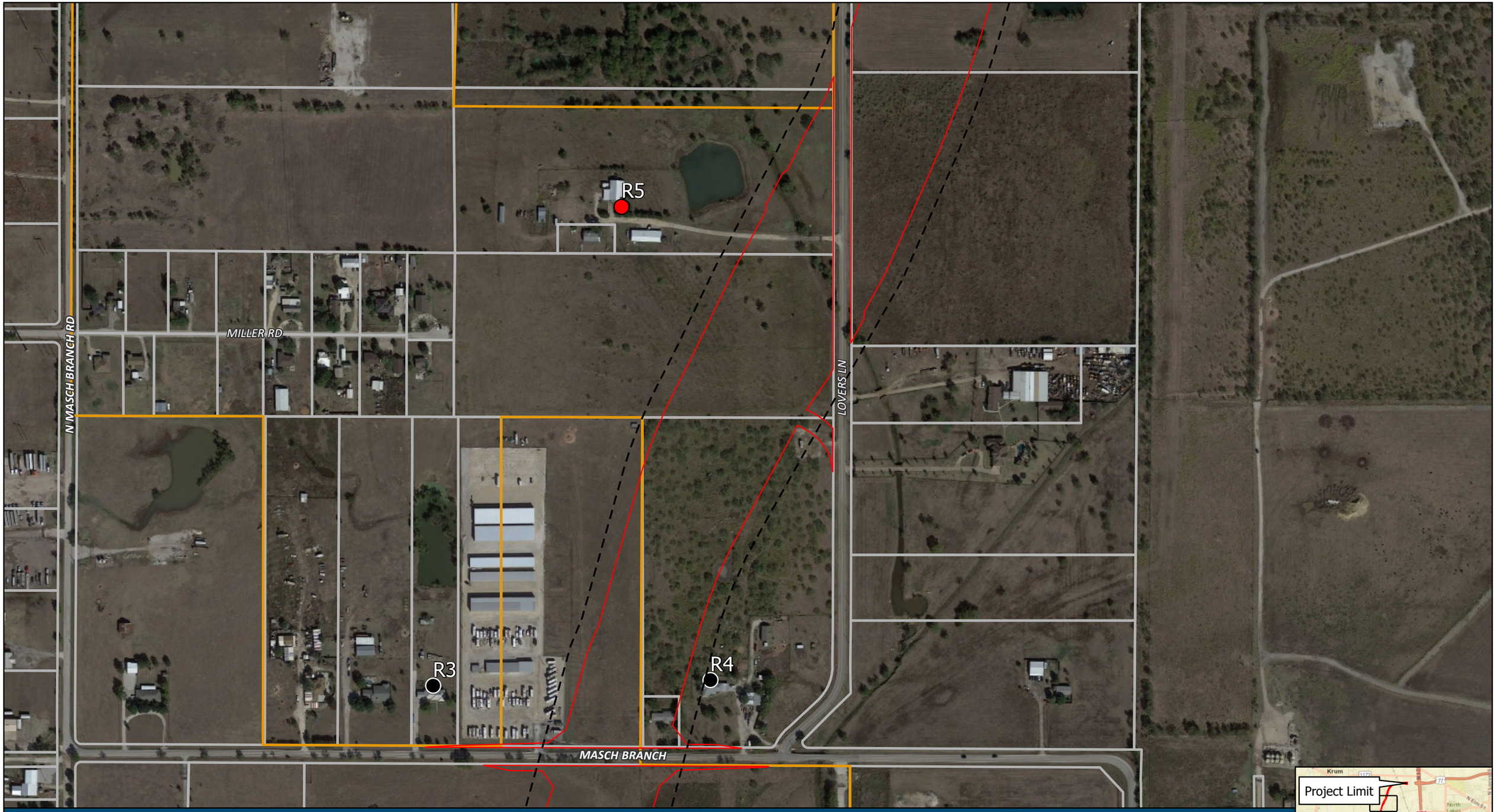

Figure 4: Representative Receivers

State Loop 288
From IH 35W to IH 35
Denton County, Texas
CSJ: 2250-02-013, 2250-02-014

Ambient Receiver
Proposed ROW
66 dBA Contours
Denton City Limits
Parcel Boundary

Receiver
Impacted
Non-Impacted

0 150 300
Feet

Basemap: Google Imagery 2019

FRUTH RD
PINA TRL
MORGAN LN
HARRISON CT
ROBMAR LN
LITTLE BROOK RD
HOOK LN
LOVERS LN
R8
R7
R6

Figure 4: Representative Receivers

State Loop 288
From IH 35W to IH 35
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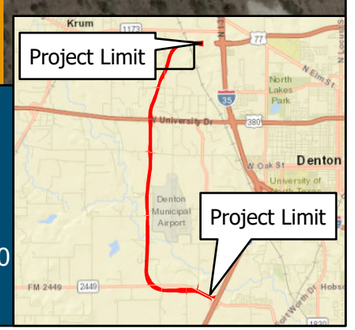
Ambient Receiver
Proposed ROW
66 dBA Contours
Denton City Limits
Parcel Boundary

Receiver
Impacted
Non-Impacted

N

0 150 300
Feet



Basemap: Google Imagery 2019

Project Limits

Figure 4: Representative Receivers

State Loop 288
From IH 35W to IH 35
Denton County, Texas
CSJ: 2250-02-013, 2250-02-014

Ambient Receiver
Proposed ROW
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Parcel Boundary

Receiver
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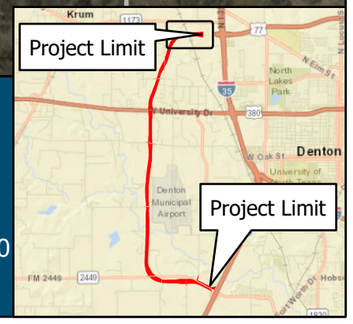
Non-Impacted

N

0 150 300
Feet



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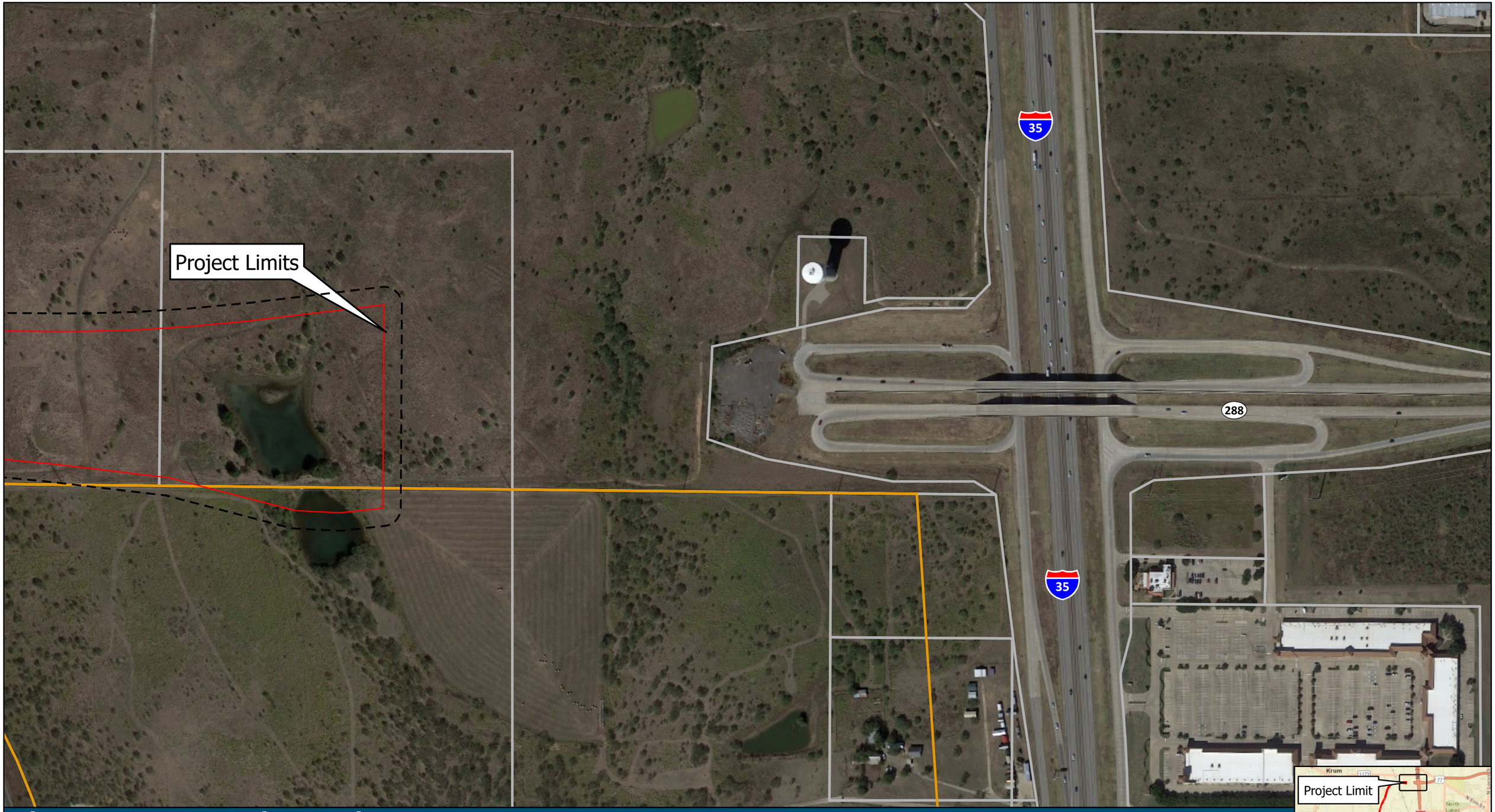

Figure 4: Representative Receivers

State Loop 288
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Ambient Receiver
Proposed ROW
66 dBA Contours
Denton City Limits
Parcel Boundary

Receiver
Impacted
Non-Impacted

0 150 300
Feet

Basemap: Google Imagery 2019

APPENDIX B

TRAFFIC DATA

Texas Department of Transportation

MEMO

January 24, 2020

To: Transportation Planning & Programming Division
William E. Knowles, P.E.

Through: Lacey Rodgers, P.E.
Dallas Director of Transportation Planning and Development, TP&D

Through: Dan Perge, P.E.
Dallas environmental Director, APD

From: Lani Marshall, P.E., LEED AP.
Transportation Engineer Supervisor, PDO

Nelson L. Underwood, P.E.
Project Manager, PDO

Subject: Traffic Request for ESALs (Option – C)

CSJ:2250-02-013, 02-014
Loop 288
From: IH 35W
To: IH 35
Denton County

The attached Traffic Projections and Traffic Methodology were prepared by Kimley-Horn Associates through CP&Y and reviewed by TTI for QA/QC. Kimley -Horn Associates, through CP&Y, and the District approved the Traffic Methodology and Line diagrams. The line diagrams depict 2020, 2040 and 2050 anticipated average daily traffic and turning movements for the proposed corridor improvements.

We request TPP develop the noise, air and pavement data for this project.

If any additional information is required, please contact Nelson L. Underwood at (214) 320-6628 or Tim Wright at (214) 319-6477.

Attachments

TRAFFIC ANALYSIS FOR HIGHWAY DESIGN (OPTION C)

Dallas District **February 28, 2020**

Description of Location	Average Daily Traffic 2020	Average Daily Traffic 2040	Base Year Dir Dist %	Base Year K Factor	Base Year Percent Trucks ADT	Base Year Percent Trucks DHV	ATHWLD	Percent Tandem Axles in ATHWLD	Total Number of Equivalent 18k Single Axle Load Applications One Direction Expected for a 20 Year Period (2020 to 2040) Flexible Pavement	S N	Rigid Pavement	SLAB
LP 288 Proposed - Section 1 From I-35W To US 380 (University Dr.) Denton County	16,280	24,540	53 - 47	10.6	17.4	11.5	12,100	50	13,833,000	3	20,036,000	8"

Data for Use in Air & Noise Analysis

Vehicle Class	Base Year % of ADT	Base Year % of DHV
Light Duty	82.6	88.5
Medium Duty	2.3	1.5
Heavy Duty	15.1	10.0

Description of Location	Average Daily Traffic 2020	Average Daily Traffic 2050	Base Year Dir Dist %	Base Year K Factor	Base Year Percent Trucks ADT	Base Year Percent Trucks DHV	ATHWLD	Percent Tandem Axles in ATHWLD	Total Number of Equivalent 18k Single Axle Load Applications One Direction Expected for a 30 Year Period (2020 to 2050) Flexible Pavement	S N	Rigid Pavement	SLAB
LP 288 Proposed - Section 1 From I-35W To US 380 (University Dr.) Denton County	16,280	29,910	53 - 47	10.6	17.4	11.5	12,200	50	23,480,000	3	34,008,000	8"

TRAFFIC ANALYSIS FOR HIGHWAY DESIGN (OPTION C)

Dallas District **February 28, 2020**

Description of Location	Average Daily Traffic 2020	Average Daily Traffic 2040	Base Year Dir Dist %	Base Year K Factor	Base Year Percent Trucks ADT	Base Year Percent Trucks DHV	ATHWLD	Percent Tandem Axles in ATHWLD	Total Number of Equivalent 18k Single Axle Load Applications One Direction Expected for a 20 Year Period (2020 to 2040) Flexible Pavement	S N	Rigid Pavement	SLAB
LP 288 Proposed - Section 2 From US 380 (University Dr.) To Masch Branch Rd. Denton County	3,990	6,010	53 - 47	10.6	26.3	17.4	11,500	60	5,116,000	3	7,415,000	8"

Data for Use in Air & Noise Analysis

Vehicle Class	Base Year % of ADT	Base Year % of DHV
Light Duty	73.7	82.6
Medium Duty	3.5	2.3
Heavy Duty	22.8	15.1

Description of Location	Average Daily Traffic 2020	Average Daily Traffic 2050	Base Year Dir Dist %	Base Year K Factor	Base Year Percent Trucks ADT	Base Year Percent Trucks DHV	ATHWLD	Percent Tandem Axles in ATHWLD	Total Number of Equivalent 18k Single Axle Load Applications One Direction Expected for a 30 Year Period (2020 to 2050) Flexible Pavement	S N	Rigid Pavement	SLAB
LP 288 Proposed - Section 2 From US 380 (University Dr.) To Masch Branch Rd. Denton County	3,990	7,320	53 - 47	10.6	26.3	17.4	11,700	60	8,680,000	3	12,580,000	8"

TRAFFIC ANALYSIS FOR HIGHWAY DESIGN (OPTION C)

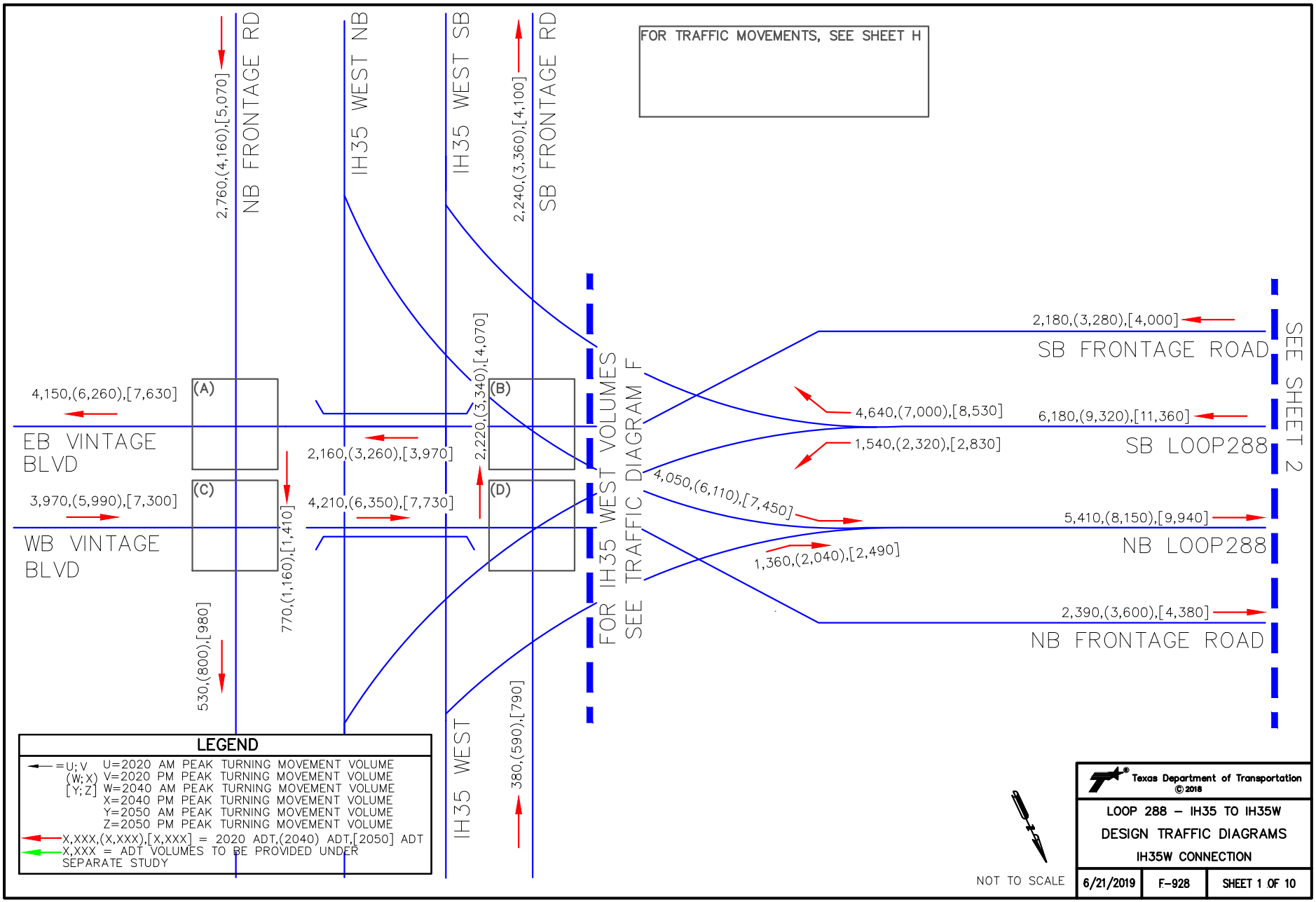
Dallas District **February 28, 2020**

Description of Location	Base Year Average Daily Traffic 2020	Base Year Average Daily Traffic 2040	Dir Dist %	K Factor	Percent Trucks ADT	Percent Trucks DHV	ATHWLD	Percent Tandem Axles in ATHWLD	Total Number of Equivalent 18k Single Axle Load Applications One Direction Expected for a 20 Year Period (2020 to 2040) Flexible Pavement	S N	Rigid Pavement	SLAB
LP 288 Proposed - Section 3 From Masch Branch Rd. To I-35 Denton County	9,250	13,950	53 - 47	10.6	23.0	15.2	12,000	60	10,384,000	3	15,047,000	8"

Data for Use in Air & Noise Analysis

Vehicle Class	Base Year % of ADT	Base Year % of DHV
Light Duty	77.0	84.8
Medium Duty	3.0	2.0
Heavy Duty	20.0	13.2

Description of Location	Base Year Average Daily Traffic 2020	Base Year Average Daily Traffic 2050	Dir Dist %	K Factor	Percent Trucks ADT	Percent Trucks DHV	ATHWLD	Percent Tandem Axles in ATHWLD	Total Number of Equivalent 18k Single Axle Load Applications One Direction Expected for a 30 Year Period (2020 to 2050) Flexible Pavement	S N	Rigid Pavement	SLAB
LP 288 Proposed - Section 3 From Masch Branch Rd. To I-35 Denton County	9,250	16,990	53 - 47	10.6	23.0	15.2	12,100	50	17,617,000	3	25,527,000	8"


FOR TRAFFIC MOVEMENTS, SEE SHEET H
2,760,(4,160),[5,070]
NB FRONTAGE RD
IH35 WEST NB
IH35 WEST SB
2,240,(3,360),[4,100]
SB FRONTAGE RD
SEE SHEET 2
FOR IH35 WEST VOLUMES
SEE TRAFFIC DIAGRAM F
2,180,(3,280),[4,000]
SB FRONTAGE ROAD
4,640,(7,000),[8,530]
6,180,(9,320),[11,360]
SB LOOP288
1,540,(2,320),[2,830]
4,050,(6,110),[7,450]
5,410,(8,150),[9,940]
NB LOOP288
1,360,(2,040),[2,490]
2,390,(3,600),[4,380]
NB FRONTAGE ROAD
4,150,(6,260),[7,630]
(A)
(B)
EB VINTAGE BLVD
2,160,(3,260),[3,970]
2,220,(3,340),[4,070]
3,970,(5,990),[7,300]
(C)
(D)
WB VINTAGE BLVD
4,210,(6,350),[7,730]
770,(1,160),[1,410]
530,(800),[980]
380,(590),[790]
IH35 WEST
LEGEND
=U;V (W;X) [Y;Z] U=2020 AM PEAK TURNING MOVEMENT VOLUME
V=2020 PM PEAK TURNING MOVEMENT VOLUME
W=2040 AM PEAK TURNING MOVEMENT VOLUME
X=2040 PM PEAK TURNING MOVEMENT VOLUME
Y=2050 AM PEAK TURNING MOVEMENT VOLUME
Z=2050 PM PEAK TURNING MOVEMENT VOLUME
X,XXX,(X,XXX),[X,XXX] = 2020 ADT,(2040) ADT,[2050] ADT
X,XXX = ADT VOLUMES TO BE PROVIDED UNDER SEPARATE STUDY
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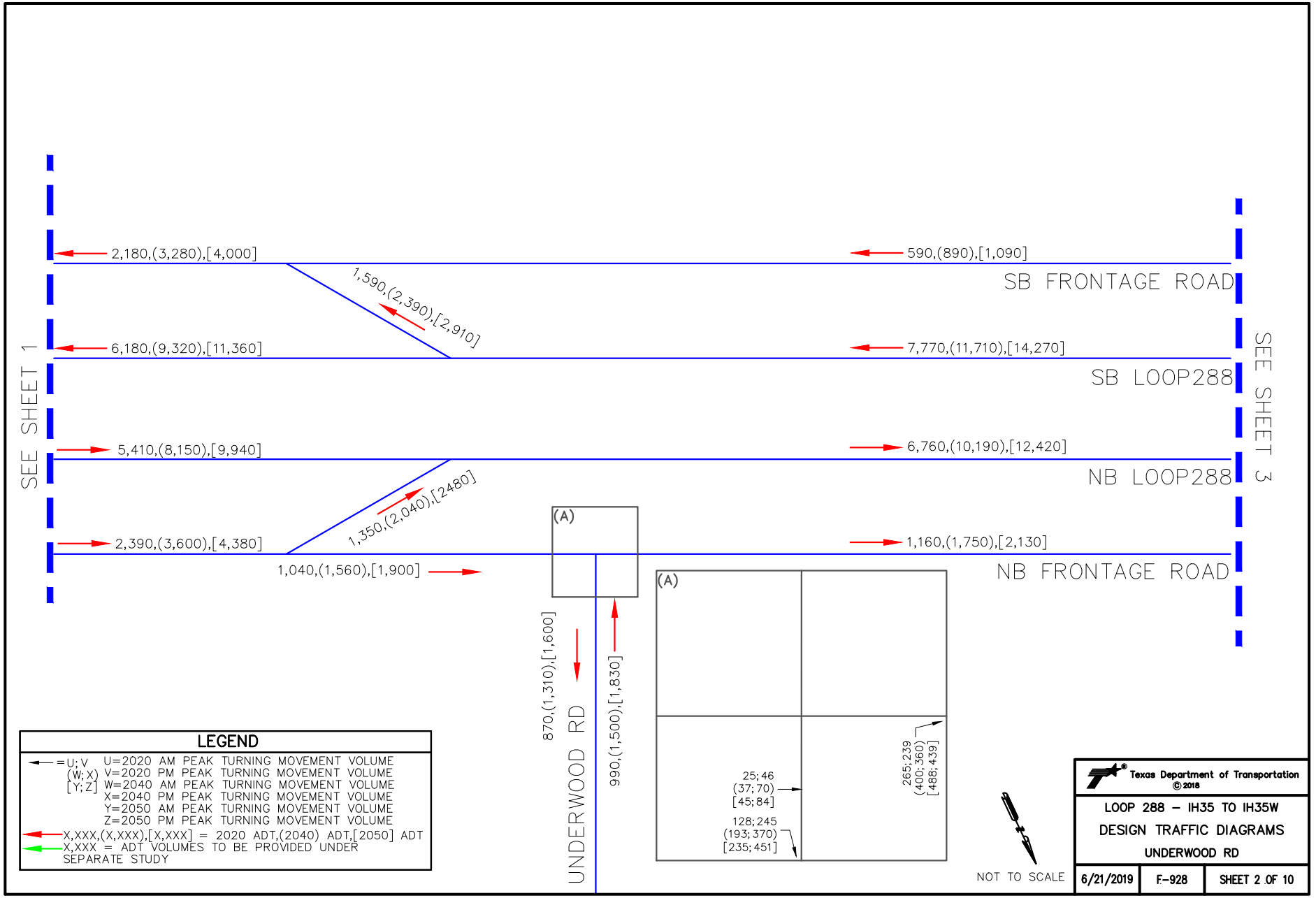
LOOP 288 – IH35 TO IH35W
DESIGN TRAFFIC DIAGRAMS
IH35W CONNECTION
6/21/2019
F-928
SHEET 1 OF 10



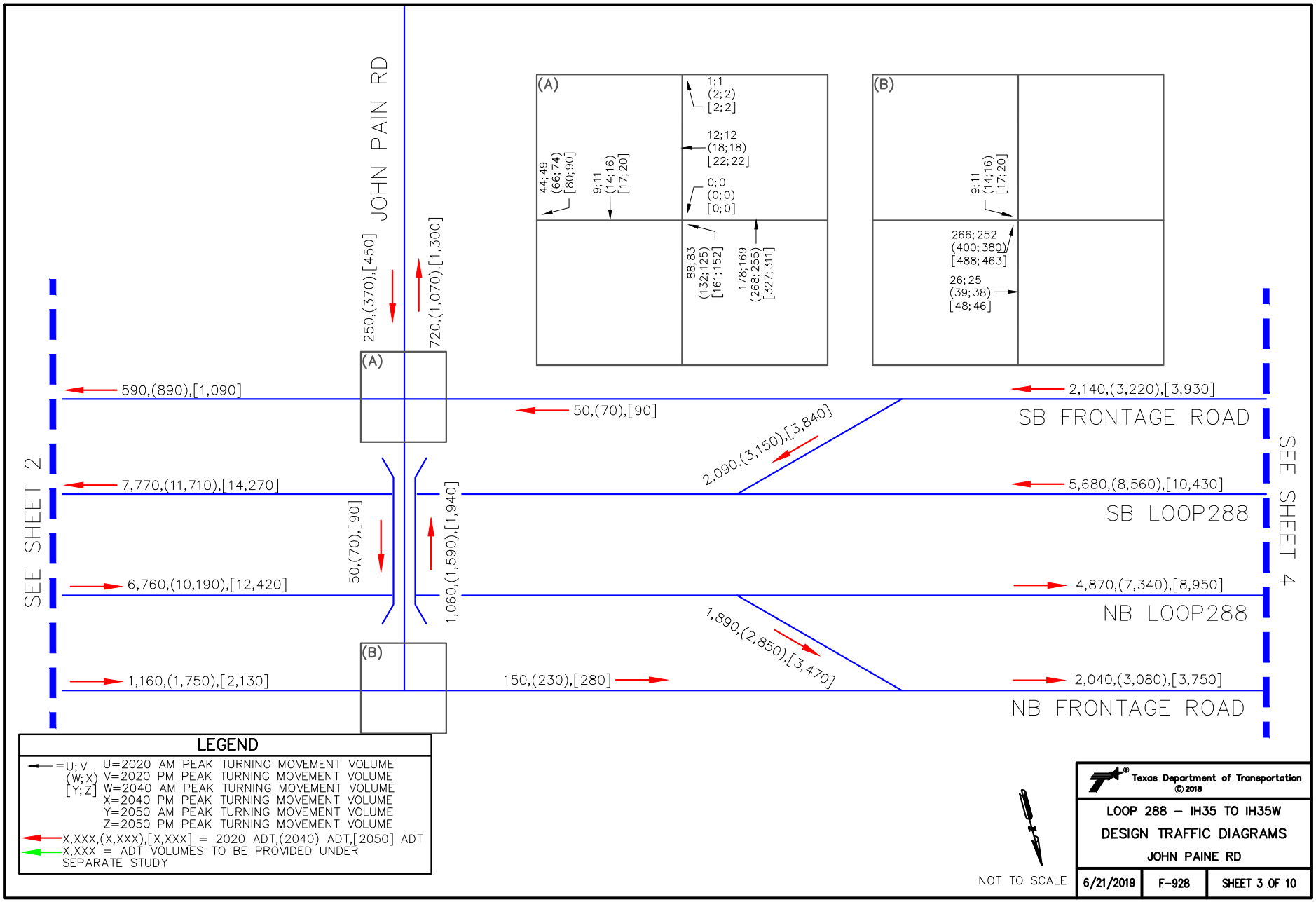
LEGEND

← =U; V (W; X) [Y; Z]	U=2020 AM PEAK TURNING MOVEMENT VOLUME V=2020 PM PEAK TURNING MOVEMENT VOLUME W=2040 AM PEAK TURNING MOVEMENT VOLUME X=2040 PM PEAK TURNING MOVEMENT VOLUME Y=2050 AM PEAK TURNING MOVEMENT VOLUME Z=2050 PM PEAK TURNING MOVEMENT VOLUME
←	X,XXX,(X,XXX),[X,XXX] = 2020 ADT,(2040) ADT,[2050] ADT
←	X,XXX = ADT VOLUMES TO BE PROVIDED UNDER SEPARATE STUDY

Texas Department of Transportation

LOOP 288 – IH35 TO IH35W
DESIGN TRAFFIC DIAGRAMS
UNDERWOOD RD

6/21/2019	F-928	SHEET 2 OF 10


JOHN PAIN RD
(A)
1;1
(2;2)
[2;2]
12;12
(18;18)
[22;22]
0;0
(0;0)
[0;0]
44;49
(66;74)
[80;90]
9;11
(14;16)
[17;20]
88;83
(132;125)
[161;152]
178;169
(268;255)
[327;311]
(B)
9;11
(14;16)
[17;20]
266;252
(400;380)
[488;463]
26;25
(39;38)
[48;46]
250,(370),[450]
720,(1,070),[1,300]
590,(890),[1,090]
50,(70),[90]
2,140,(3,220),[3,930]
SB FRONTAGE ROAD
2,090,(3,150),[3,840]
7,770,(11,710),[14,270]
5,680,(8,560),[10,430]
SB LOOP288
50,(70),[90]
1,060,(1,590),[1,940]
6,760,(10,190),[12,420]
4,870,(7,340),[8,950]
NB LOOP288
1,890,(2,850),[3,470]
1,160,(1,750),[2,130]
150,(230),[280]
2,040,(3,080),[3,750]
NB FRONTAGE ROAD
SEE SHEET 2
SEE SHEET 4
LEGEND
=U;V (W;X) [Y;Z] U=2020 AM PEAK TURNING MOVEMENT VOLUME
V=2020 PM PEAK TURNING MOVEMENT VOLUME
W=2040 AM PEAK TURNING MOVEMENT VOLUME
X=2040 PM PEAK TURNING MOVEMENT VOLUME
Y=2050 AM PEAK TURNING MOVEMENT VOLUME
Z=2050 PM PEAK TURNING MOVEMENT VOLUME
X,XXX,(X,XXX),[X,XXX] = 2020 ADT,(2040) ADT,[2050] ADT
X,XXX = ADT VOLUMES TO BE PROVIDED UNDER SEPARATE STUDY
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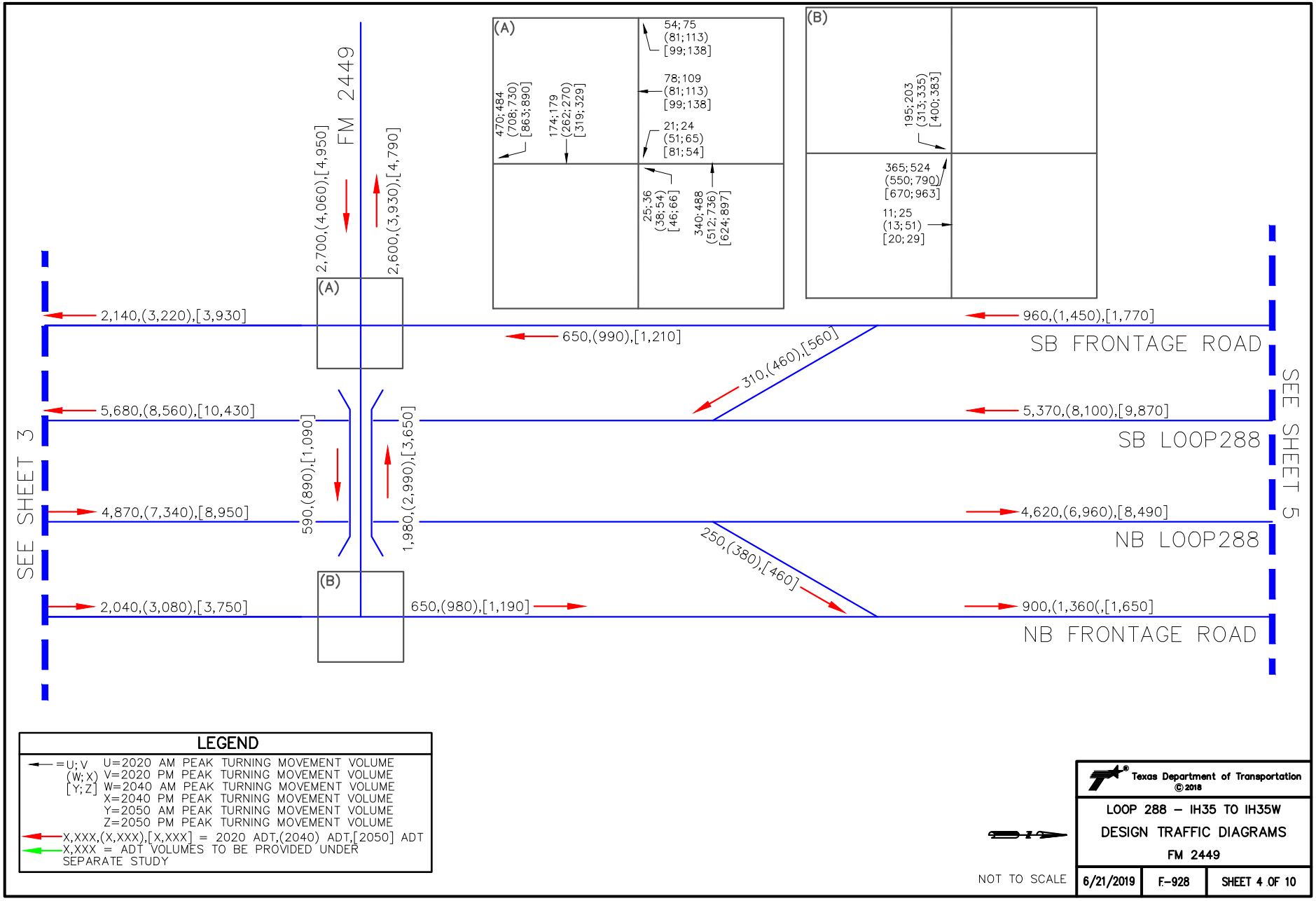
DESIGN TRAFFIC DIAGRAMS
JOHN PAINE RD
6/21/2019
F-928
SHEET 3 OF 10



LEGEND

← = U;V (W;X) [Y;Z]	U=2020 AM PEAK TURNING MOVEMENT VOLUME V=2020 PM PEAK TURNING MOVEMENT VOLUME W=2040 AM PEAK TURNING MOVEMENT VOLUME X=2040 PM PEAK TURNING MOVEMENT VOLUME Y=2050 AM PEAK TURNING MOVEMENT VOLUME Z=2050 PM PEAK TURNING MOVEMENT VOLUME
← X,XXX,(X,XXX),[X,XXX]	= 2020 ADT,(2040) ADT,[2050] ADT
← X,XXX	= ADT VOLUMES TO BE PROVIDED UNDER SEPARATE STUDY

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Texas Department of Transportation

LOOP 288 – IH35 TO IH35W

DESIGN TRAFFIC DIAGRAMS

FM 2449

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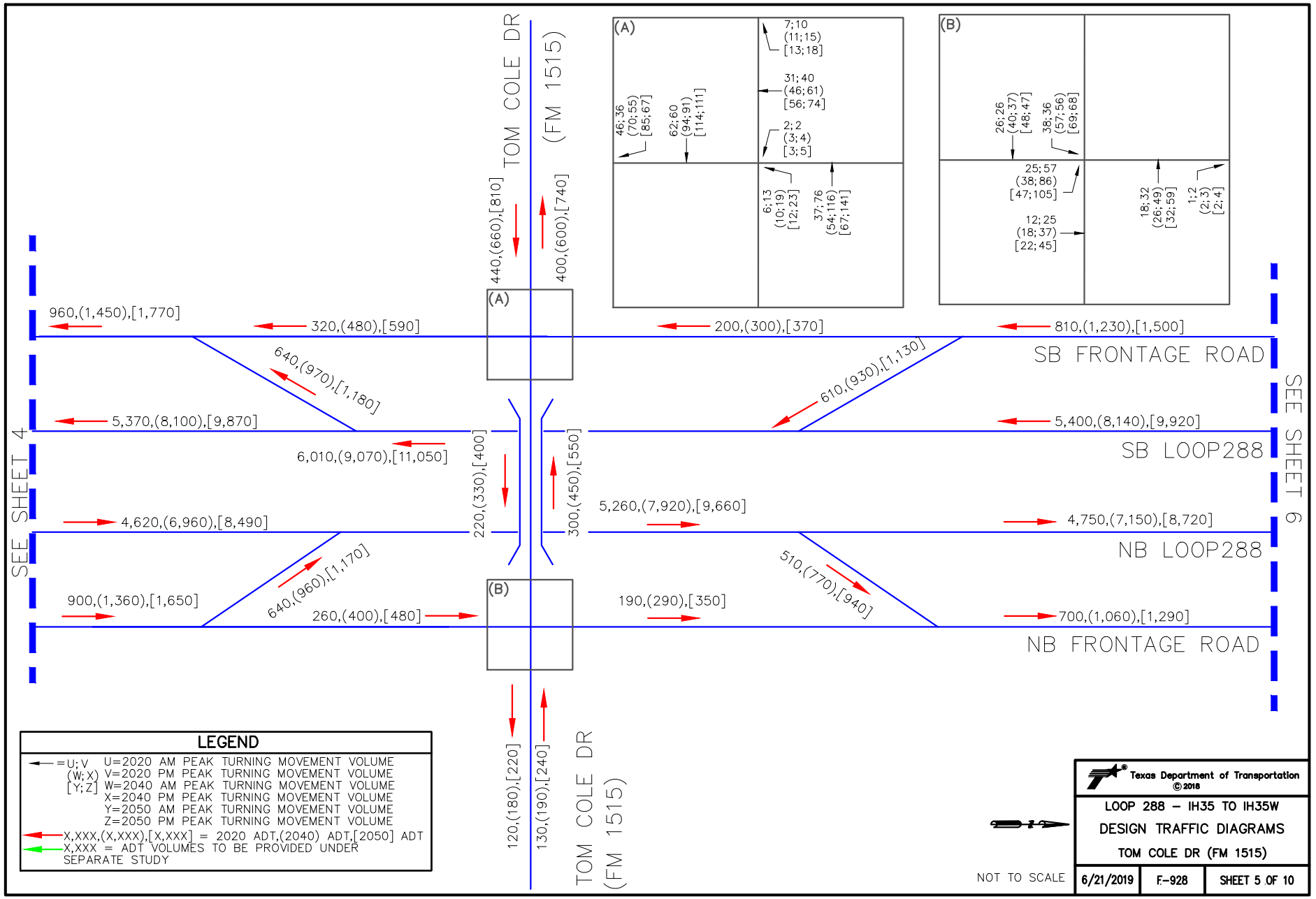

LEGEND

- ← = U; V (W; X) [Y; Z]
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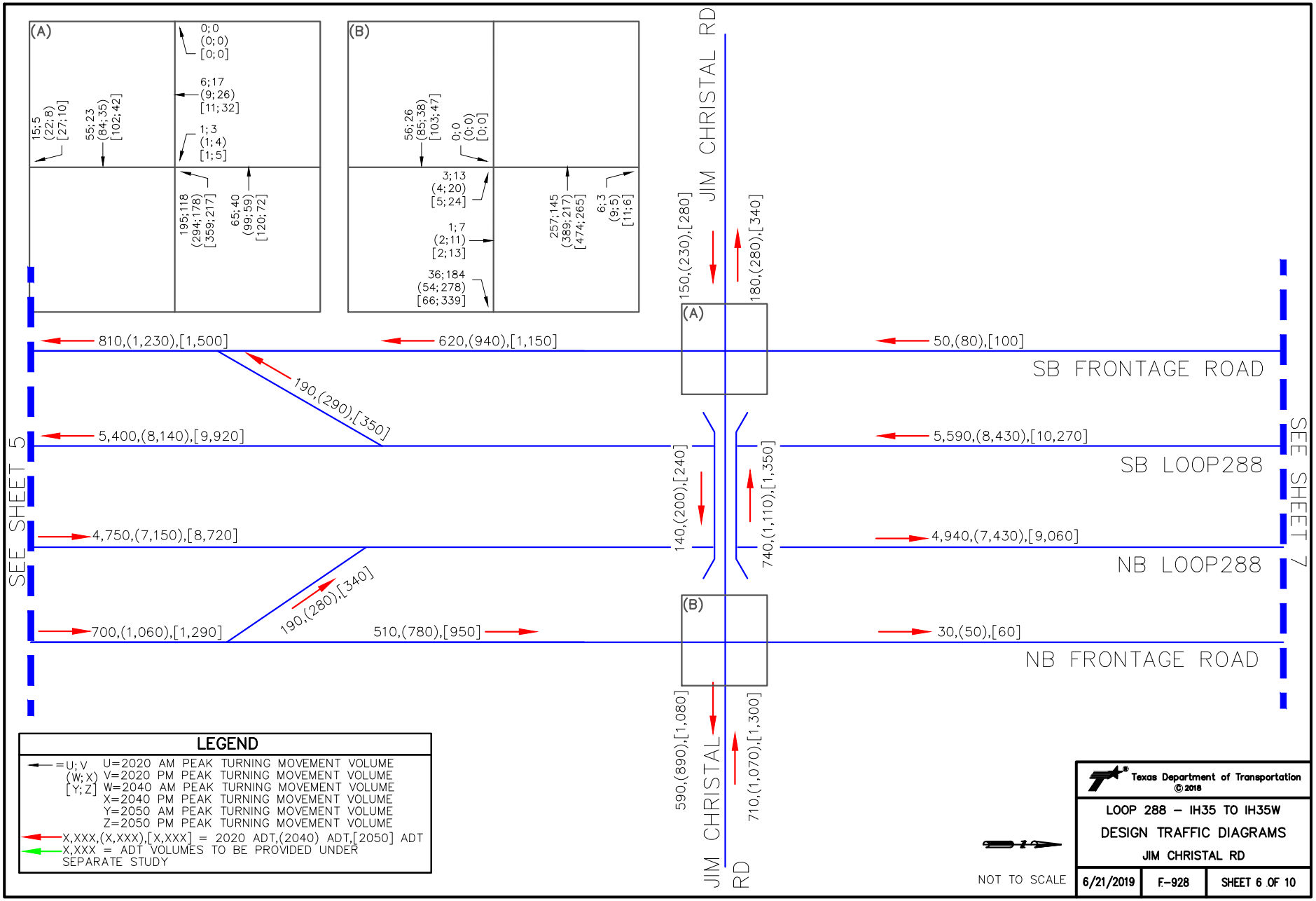
  - V=2020 PM PEAK TURNING MOVEMENT VOLUME
  - W=2040 AM PEAK TURNING MOVEMENT VOLUME
  - X=2040 PM PEAK TURNING MOVEMENT VOLUME
  - Y=2050 AM PEAK TURNING MOVEMENT VOLUME
  - Z=2050 PM PEAK TURNING MOVEMENT VOLUME
- ← X,XXX,(X,XXX),[X,XXX] = 2020 ADT,(2040) ADT,[2050] ADT
- ← X,XXX = ADT VOLUMES TO BE PROVIDED UNDER SEPARATE STUDY

NOT TO SCALE

LOOP 288 – IH35 TO IH35W
DESIGN TRAFFIC DIAGRAMS
TOM COLE DR (FM 1515)

6/21/2019	F-928	SHEET 5 OF 10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(9;26)
[11;32]
1;3
(1;4)
[1;5]
15;5
(22;8)
[27;10]
55;23
(84;35)
[102;42]
195;118
(294;178)
[359;217]
65;40
(99;59)
[120;72]
(B)
56;26
(85;38)
[103;47]
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(0;0)
[0;0]
3;13
(4;20)
[5;24]
1;7
(2;11)
[2;13]
36;184
(54;278)
[66;339]
257;145
(389;217)
[474;265]
6;3
(9;5)
[11;6]
JIM CHRISTAL RD
150,(230),[280]
180,(280),[340]
(A)
810,(1,230),[1,500]
620,(940),[1,150]
50,(80),[100]
SB FRONTAGE ROAD
190,(290),[350]
5,400,(8,140),[9,920]
5,590,(8,430),[10,270]
SB LOOP288
140,(200),[240]
740,(1,110),[1,350]
4,750,(7,150),[8,720]
4,940,(7,430),[9,060]
NB LOOP288
190,(280),[340]
(B)
700,(1,060),[1,290]
510,(780),[950]
30,(50),[60]
NB FRONTAGE ROAD
590,(890),[1,080]
710,(1,070),[1,300]
JIM CHRISTAL RD
SEE SHEET 5
SEE SHEET 7
LEGEND
=U;V (W;X) [Y;Z]
U=2020 AM PEAK TURNING MOVEMENT VOLUME
V=2020 PM PEAK TURNING MOVEMENT VOLUME
W=2040 AM PEAK TURNING MOVEMENT VOLUME
X=2040 PM PEAK TURNING MOVEMENT VOLUME
Y=2050 AM PEAK TURNING MOVEMENT VOLUME
Z=2050 PM PEAK TURNING MOVEMENT VOLUME
X,XXX,(X,XXX),[X,XXX] = 2020 ADT,(2040) ADT,[2050] ADT
X,XXX = ADT VOLUMES TO BE PROVIDED UNDER SEPARATE STUDY
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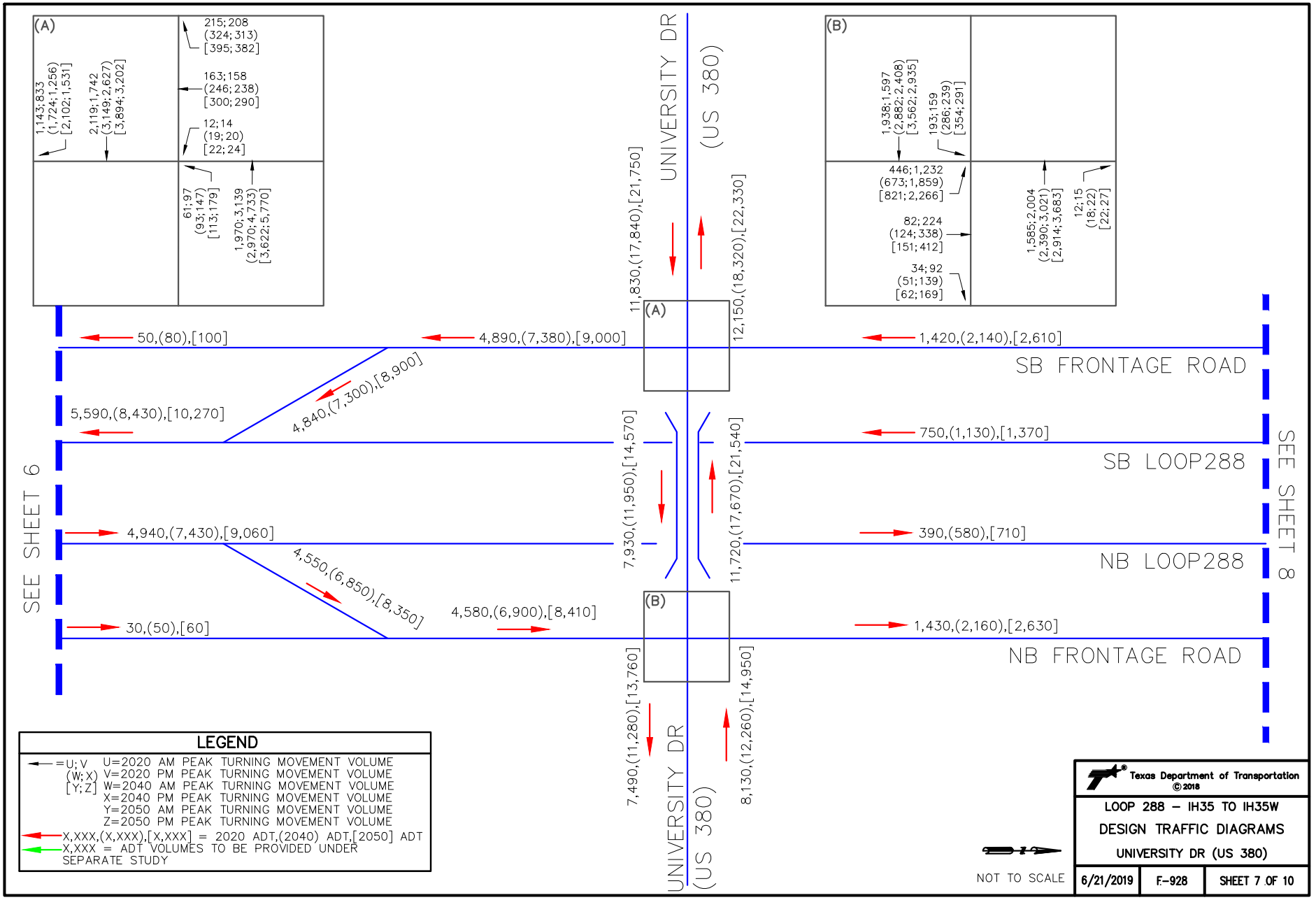
LOOP 288 – IH35 TO IH35W
DESIGN TRAFFIC DIAGRAMS
JIM CHRISTAL RD
6/21/2019
F-928
SHEET 6 OF 10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2,119;1,742
(3,149;2,627)
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215;208
(324;313)
[395;382]
163;158
(246;238)
[300;290]
12;14
(19;20)
[22;24]
61;97
(93;147)
[113;179]
1,970;3,139
(2,970;4,733)
[3,622;5,770]
(B)
1,938;1,597
(2,882;2,408)
[3,562;2,935]
193;159
(286;239)
[354;291]
446;1,232
(673;1,859)
[821;2,266]
82;224
(124;338)
[151;412]
34;92
(51;139)
[62;169]
1,585;2,004
(2,390;3,021)
[2,914;3,683]
12;15
(18;22)
[22;27]
UNIVERSITY DR
(US 380)
11,830,(17,840),[21,750]
12,150,(18,320),[22,330]
50,(80),[100]
4,890,(7,380),[9,000]
1,420,(2,140),[2,610]
SB FRONTAGE ROAD
4,840,(7,300),[8,900]
5,590,(8,430),[10,270]
750,(1,130),[1,370]
SB LOOP288
7,930,(11,950),[14,570]
11,720,(17,670),[21,540]
4,940,(7,430),[9,060]
390,(580),[710]
NB LOOP288
4,550,(6,850),[8,350]
4,580,(6,900),[8,410]
30,(50),[60]
1,430,(2,160),[2,630]
NB FRONTAGE ROAD
7,490,(11,280),[13,760]
8,130,(12,260),[14,950]
SEE SHEET 6
SEE SHEET 8
LEGEND
=U;V (W;X) [Y;Z]
U=2020 AM PEAK TURNING MOVEMENT VOLUME
V=2020 PM PEAK TURNING MOVEMENT VOLUME
W=2040 AM PEAK TURNING MOVEMENT VOLUME
X=2040 PM PEAK TURNING MOVEMENT VOLUME
Y=2050 AM PEAK TURNING MOVEMENT VOLUME
Z=2050 PM PEAK TURNING MOVEMENT VOLUME
X,XXX,(X,XXX),[X,XXX] = 2020 ADT,(2040) ADT,[2050] ADT
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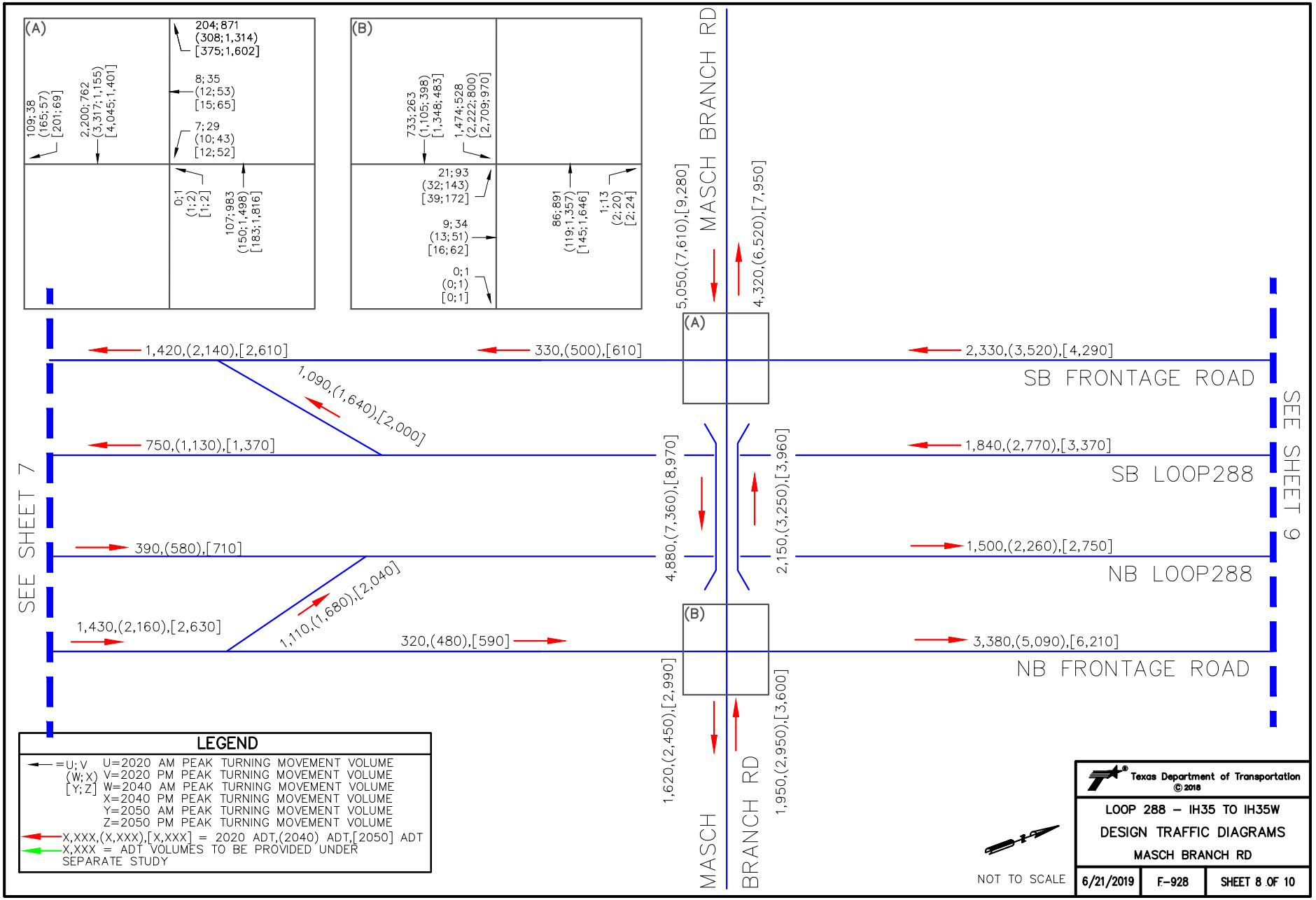
LOOP 288 – IH35 TO IH35W
DESIGN TRAFFIC DIAGRAMS
UNIVERSITY DR (US 380)
6/21/2019
F-928
SHEET 7 OF 10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(12; 53)
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(10; 43)
[12; 52]
109; 38
(165; 57)
[201; 69]
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0; 1
(1; 2)
[1; 2]
107; 983
(150; 1,498)
[183; 1,816]
(B)
733; 263
(1,105; 398)
[1,348; 483]
1,474; 528
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[2,709; 970]
21; 93
(32; 143)
[39; 172]
9; 34
(13; 51)
[16; 62]
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(0; 1)
[0; 1]
86; 891
(119; 1,357)
[145; 1,646]
1; 13
(2; 20)
[2; 24]
MASCH BRANCH RD
5,050,(7,610),[9,280]
4,320,(6,520),[7,950]
(A)
1,420,(2,140),[2,610]
330,(500),[610]
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SB FRONTAGE ROAD
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750,(1,130),[1,370]
1,840,(2,770),[3,370]
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2,150,(3,250),[3,960]
390,(580),[710]
1,500,(2,260),[2,750]
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1,110,(1,680),[2,040]
1,430,(2,160),[2,630]
320,(480),[590]
3,380,(5,090),[6,210]
NB FRONTAGE ROAD
(B)
1,620,(2,450),[2,990]
1,950,(2,950),[3,600]
MASCH BRANCH RD
SEE SHEET 7
SEE SHEET 9
LEGEND
=U; V (W; X) [Y; Z]
U=2020 AM PEAK TURNING MOVEMENT VOLUME
V=2020 PM PEAK TURNING MOVEMENT VOLUME
W=2040 AM PEAK TURNING MOVEMENT VOLUME
X=2040 PM PEAK TURNING MOVEMENT VOLUME
Y=2050 AM PEAK TURNING MOVEMENT VOLUME
Z=2050 PM PEAK TURNING MOVEMENT VOLUME
X,XXX,(X,XXX),[X,XXX] = 2020 ADT,(2040) ADT,[2050] ADT
X,XXX = ADT VOLUMES TO BE PROVIDED UNDER SEPARATE STUDY
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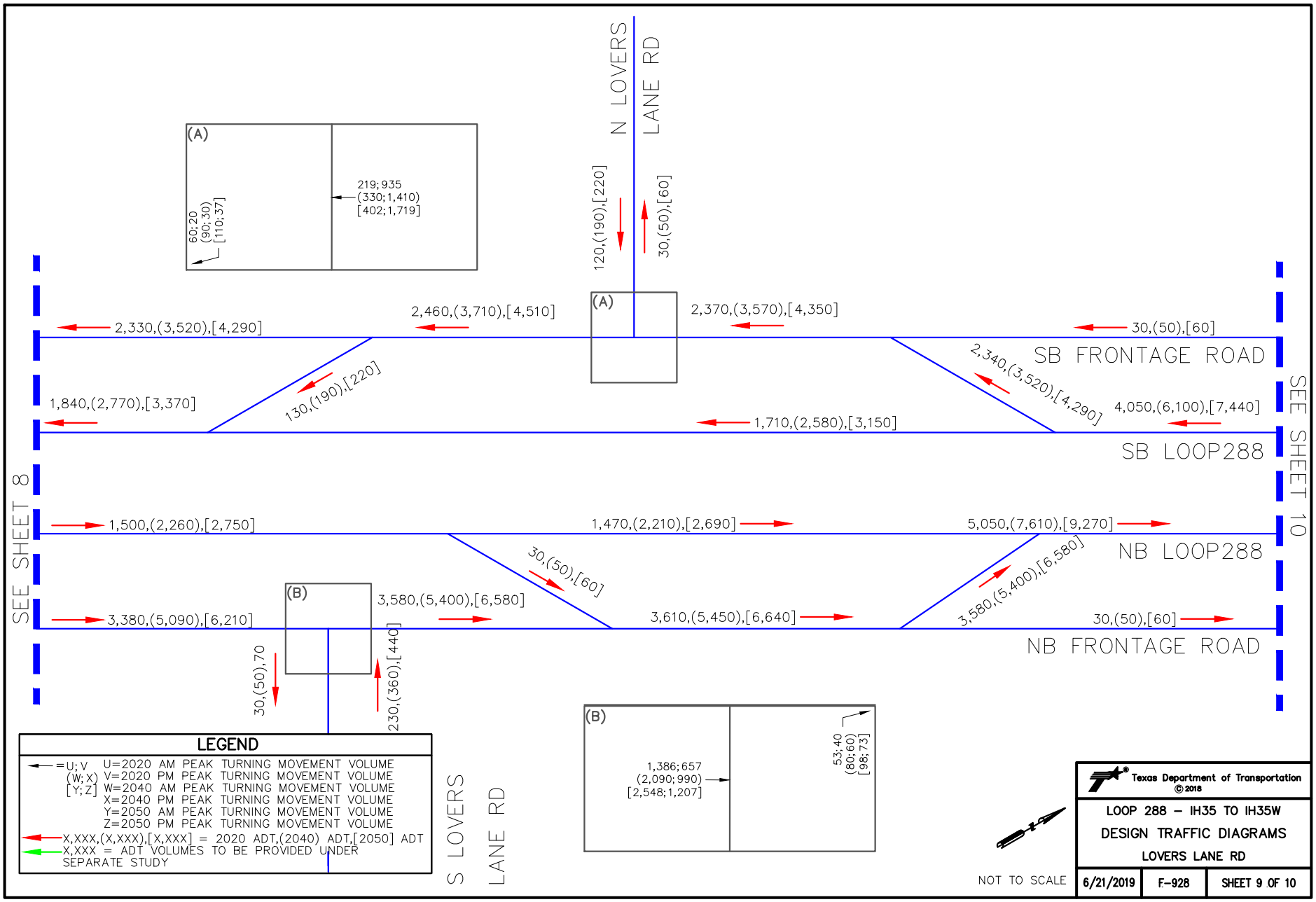
LOOP 288 – IH35 TO IH35W
DESIGN TRAFFIC DIAGRAMS
MASCH BRANCH RD
6/21/2019
F-928
SHEET 8 OF 10

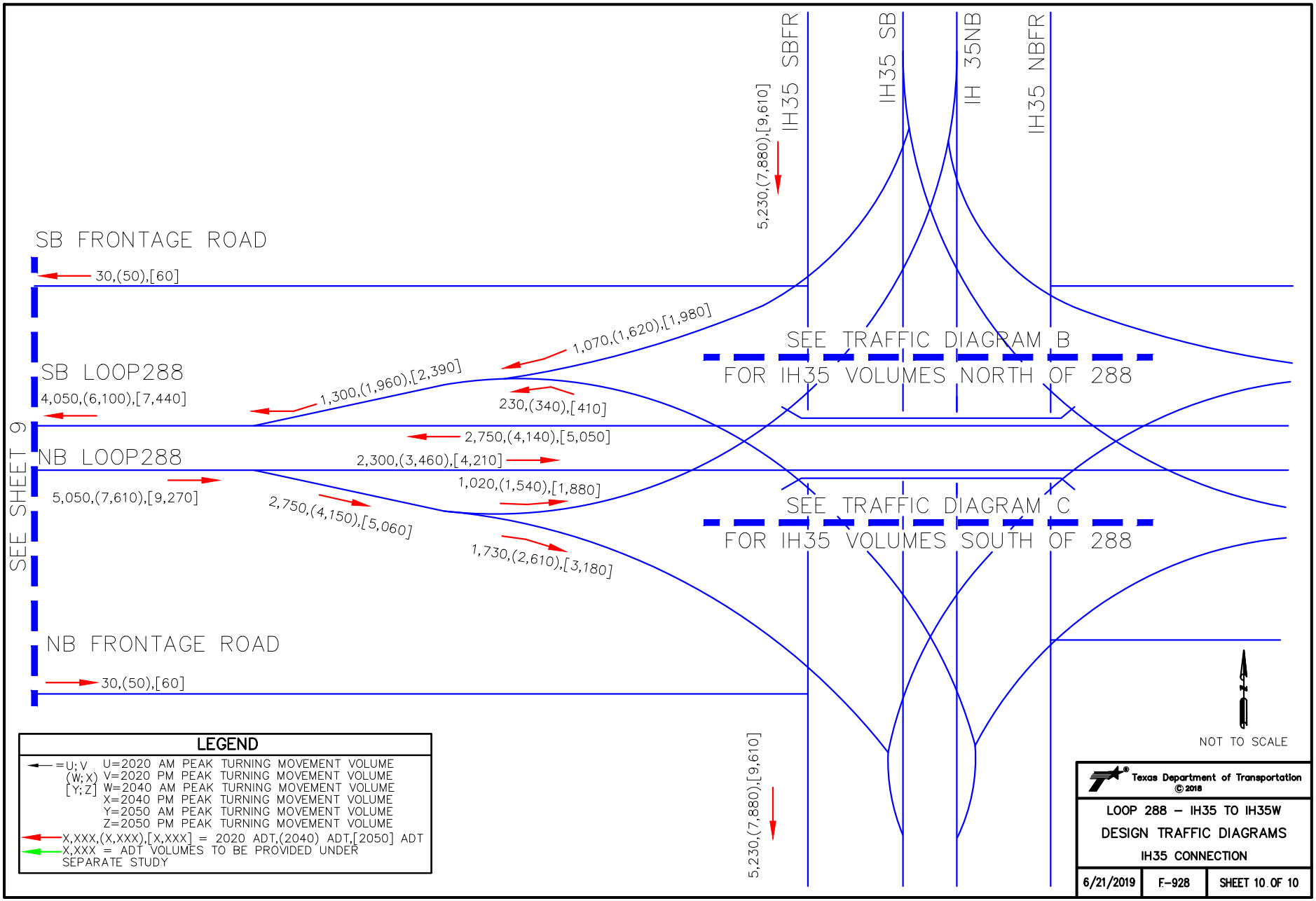


LOOP 288 – IH35 TO IH35W

DESIGN TRAFFIC DIAGRAMS

LOVERS LANE RD

6/21/2019	F-928	SHEET 9 OF 10


IH35 SBFR
IH35 SB
IH 35NB
IH35 NBFR
5,230,(7,880),[9,610]
SB FRONTAGE ROAD
30,(50),[60]
1,070,(1,620),[1,980]
SEE TRAFFIC DIAGRAM B
FOR IH35 VOLUMES NORTH OF 288
SB LOOP288
4,050,(6,100),[7,440]
1,300,(1,960),[2,390]
230,(340),[410]
2,750,(4,140),[5,050]
NB LOOP288
2,300,(3,460),[4,210]
1,020,(1,540),[1,880]
5,050,(7,610),[9,270]
2,750,(4,150),[5,060]
SEE TRAFFIC DIAGRAM C
FOR IH35 VOLUMES SOUTH OF 288
1,730,(2,610),[3,180]
SEE SHEET 9
NB FRONTAGE ROAD
30,(50),[60]
5,230,(7,880),[9,610]
NOT TO SCALE
LEGEND
=U;V U=2020 AM PEAK TURNING MOVEMENT VOLUME
(W;X) V=2020 PM PEAK TURNING MOVEMENT VOLUME
[Y;Z] W=2040 AM PEAK TURNING MOVEMENT VOLUME
X=2040 PM PEAK TURNING MOVEMENT VOLUME
Y=2050 AM PEAK TURNING MOVEMENT VOLUME
Z=2050 PM PEAK TURNING MOVEMENT VOLUME
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X,XXX = ADT VOLUMES TO BE PROVIDED UNDER SEPARATE STUDY
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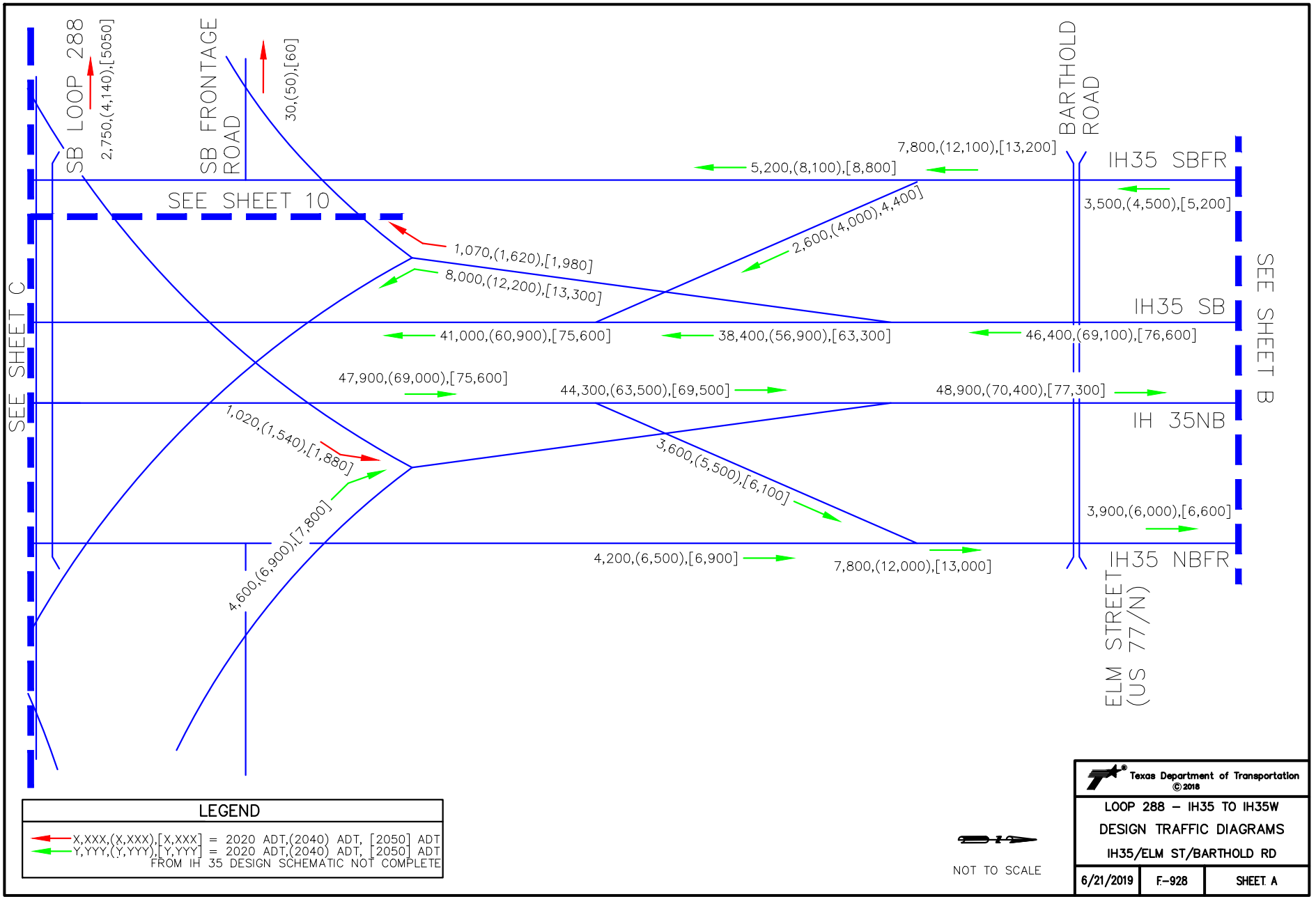
DESIGN TRAFFIC DIAGRAMS
IH35 CONNECTION
6/21/2019
F-928
SHEET 10 OF 10



LEGEND

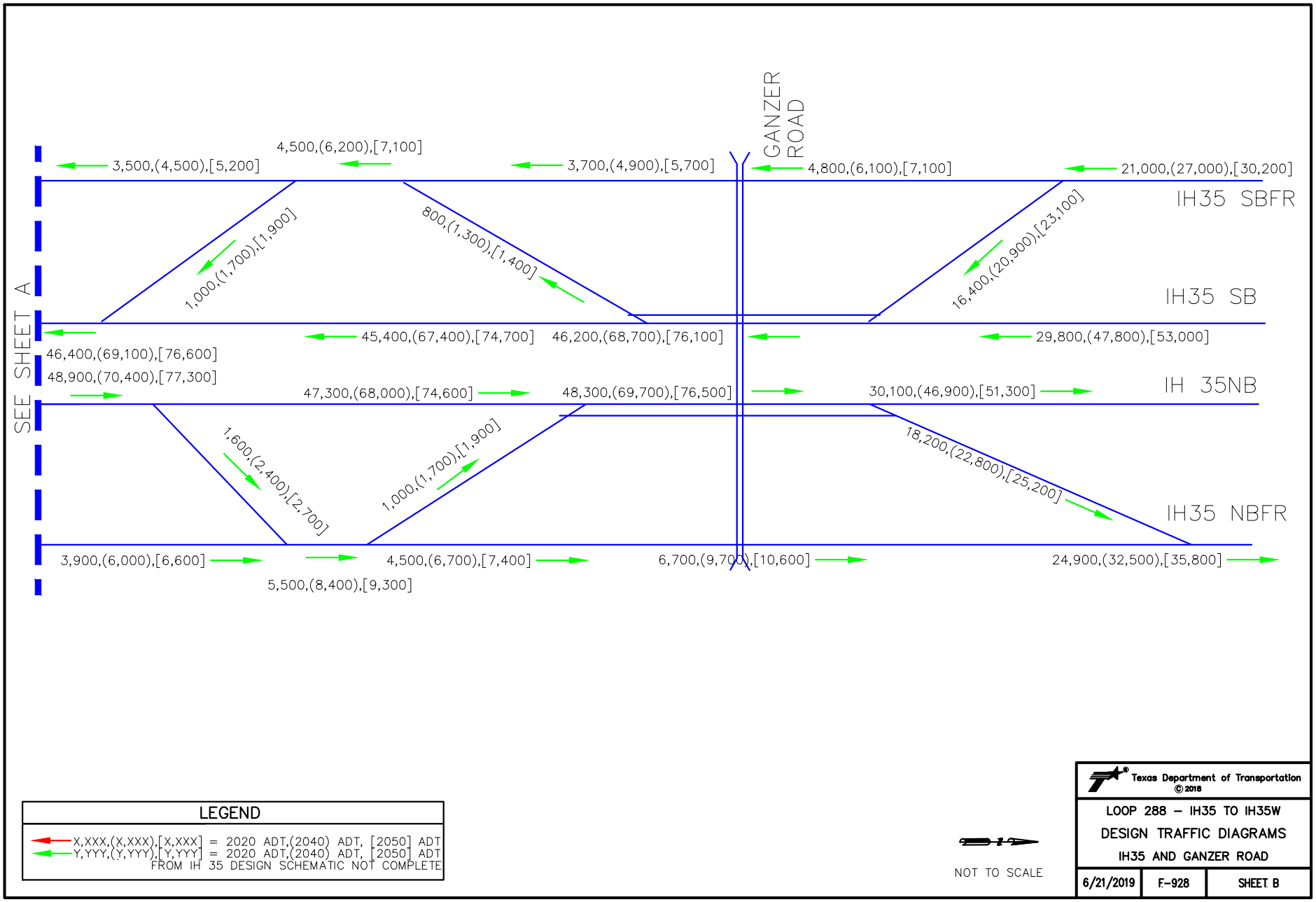
X,XXX,(X,XXX),[X,XXX] = 2020 ADT,(2040) ADT, [2050] ADT
Y,YYY,(Y,YYY),[Y,YYY] = 2020 ADT,(2040) ADT, [2050] ADT
FROM IH 35 DESIGN SCHEMATIC NOT COMPLETE

NOT TO SCALE

Texas Department of Transportation

LOOP 288 – IH35 TO IH35W
DESIGN TRAFFIC DIAGRAMS
IH35/ELM ST/BARTHOLD RD

6/21/2019	F-928	SHEET A



LEGEND
X,XXX,(X,XXX),[X,XXX] = 2020 ADT,(2040) ADT, [2050] ADT
Y,YYY,(Y,YYY),[Y,YYY] = 2020 ADT,(2040) ADT, [2050] ADT
FROM IH 35 DESIGN SCHEMATIC NOT COMPLETE

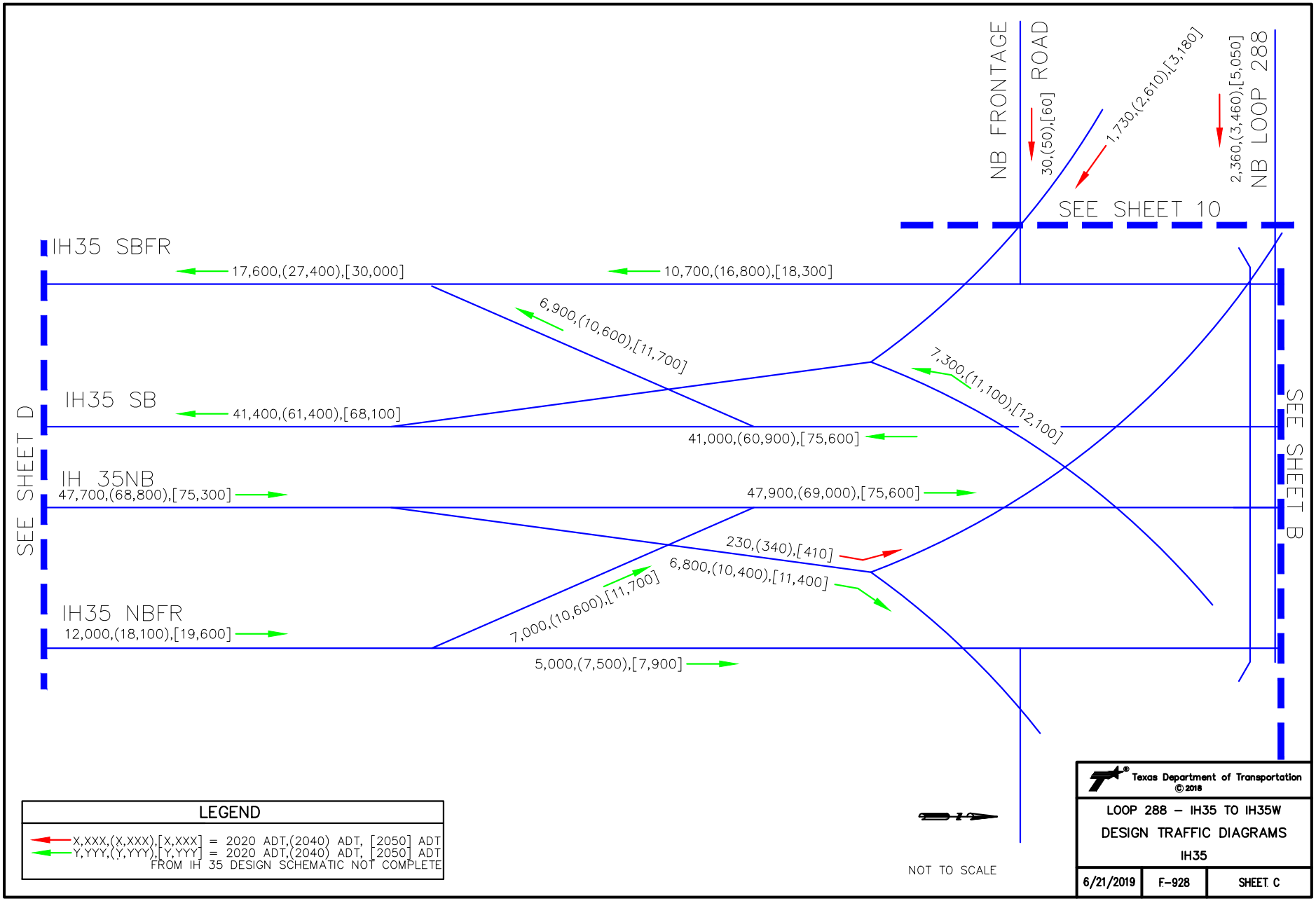
NOT TO SCALE

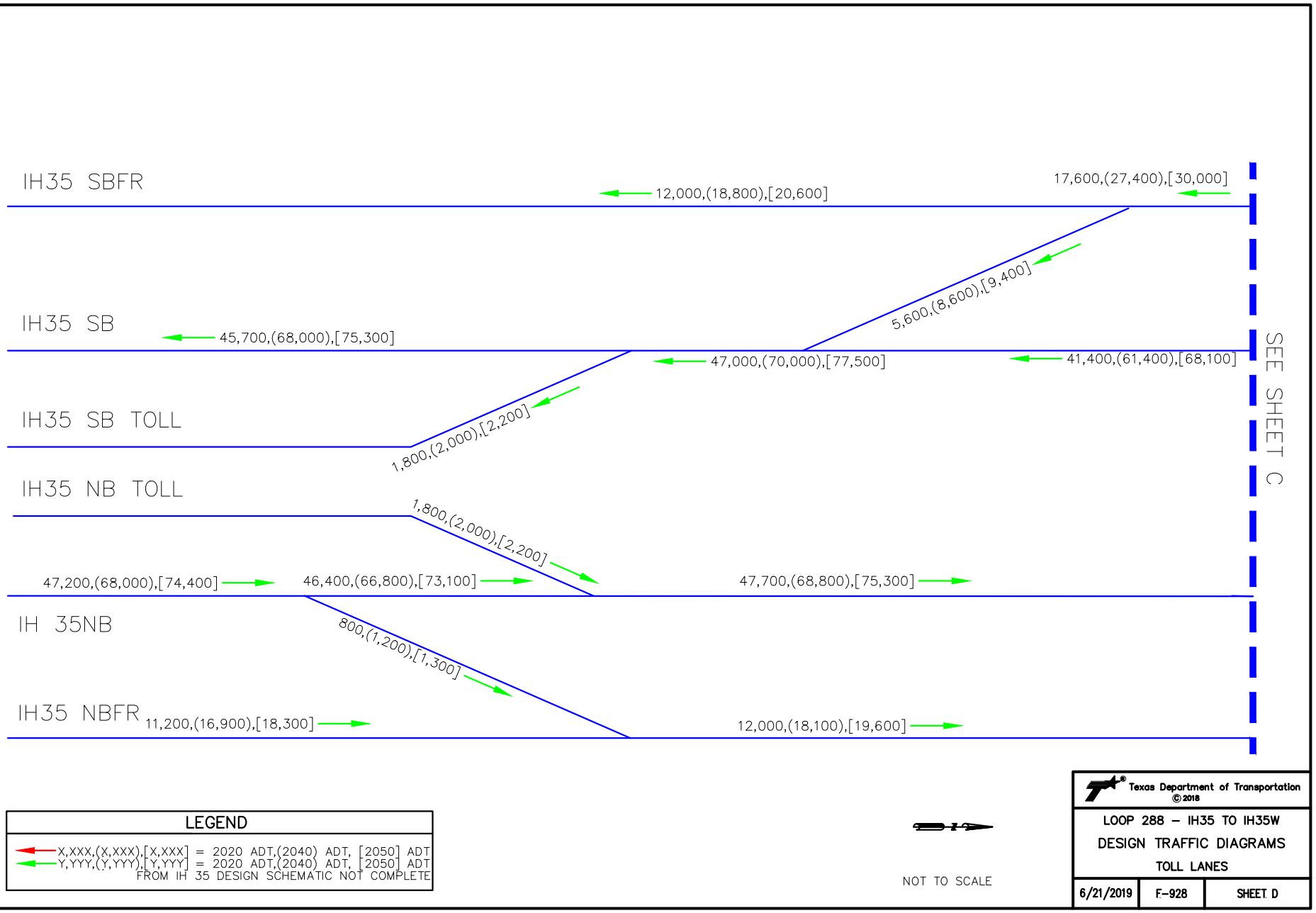
LOOP 288 – IH35 TO IH35W

DESIGN TRAFFIC DIAGRAMS

IH35 AND GANZER ROAD

6/21/2019	F-928	SHEET B


NB FRONTAGE ROAD
30,(50),[60]
1,730,(2,610),[3,180]
2,360,(3,460),[5,050]
NB LOOP 288
SEE SHEET 10
IH35 SBFR
17,600,(27,400),[30,000]
10,700,(16,800),[18,300]
6,900,(10,600),[11,700]
7,300,(11,100),[12,100]
IH35 SB
41,400,(61,400),[68,100]
41,000,(60,900),[75,600]
SEE SHEET D
SEE SHEET B
IH 35NB
47,700,(68,800),[75,300]
47,900,(69,000),[75,600]
230,(340),[410]
6,800,(10,400),[11,400]
7,000,(10,600),[11,700]
IH35 NBFR
12,000,(18,100),[19,600]
5,000,(7,500),[7,900]
LEGEND
X,XXX,(X,XXX),[X,XXX] = 2020 ADT,(2040) ADT, [2050] ADT
Y,YYY,(Y,YYY),[Y,YYY] = 2020 ADT,(2040) ADT, [2050] ADT
FROM IH 35 DESIGN SCHEMATIC NOT COMPLETE
NOT TO SCALE
Texas Department of Transportation
© 2018
LOOP 288 – IH35 TO IH35W
DESIGN TRAFFIC DIAGRAMS
IH35
6/21/2019
F-928
SHEET C



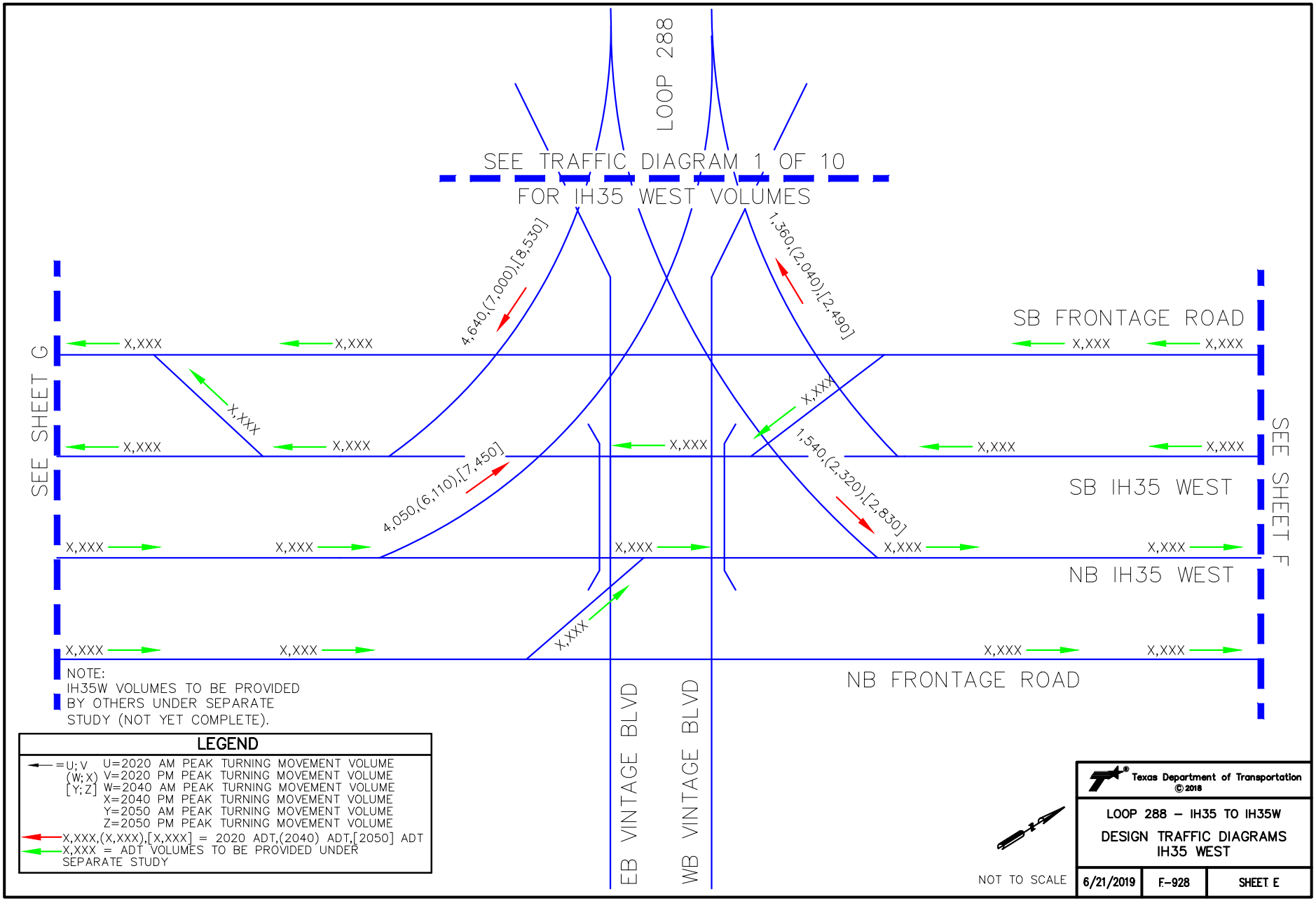
LEGEND
X,XXX,(X,XXX),[X,XXX] = 2020 ADT,(2040) ADT, [2050] ADT
Y,YYY,(Y,YYY),[Y,YYY] = 2020 ADT,(2040) ADT, [2050] ADT
FROM IH 35 DESIGN SCHEMATIC NOT COMPLETE

NOT TO SCALE

Texas Department of Transportation

LOOP 288 – IH35 TO IH35W
DESIGN TRAFFIC DIAGRAMS
TOLL LANES

6/21/2019	F-928	SHEET D



NOTE:
IH35W VOLUMES TO BE PROVIDED BY OTHERS UNDER SEPARATE STUDY (NOT YET COMPLETE).

LEGEND

← =U;V (W;X) [Y;Z]	U=2020 AM PEAK TURNING MOVEMENT VOLUME V=2020 PM PEAK TURNING MOVEMENT VOLUME W=2040 AM PEAK TURNING MOVEMENT VOLUME X=2040 PM PEAK TURNING MOVEMENT VOLUME Y=2050 AM PEAK TURNING MOVEMENT VOLUME Z=2050 PM PEAK TURNING MOVEMENT VOLUME
←	X,XXX,(X,XXX),[X,XXX] = 2020 ADT,(2040) ADT,[2050] ADT
←	X,XXX = ADT VOLUMES TO BE PROVIDED UNDER SEPARATE STUDY

NOT TO SCALE

Texas Department of Transportation

LOOP 288 – IH35 TO IH35W
DESIGN TRAFFIC DIAGRAMS
IH35 WEST

6/21/2019	F-928	SHEET E

APPENDIX C

FIELD NOISE MEASUREMENT DATA

FIELD NOISE MEASUREMENT DATA

ID

Site ID: South by observatory Date: 4/10/19
Address or Location: Tom Cole rd Observer: CM & JM

Weather

Temperature: 70 F Relative Humidity: _____%
Wind speed (sustained): 12 mph Wind speed (gusts): _____mph Wind direction: SSE
Sky: **Overcast** **Part Cldy** **Clear** **Sunny** **Fog** **Rain** **Other:** _____

Acoustic Measurements

Instrument: Larson Davis SoundTrack LxT2 Serial #: 0002940
Calibrator: .10 Larson Davis CAL 150 Serial #: 4794

	Time	Leq
Count #1:	7:49 AM	57.5
Count #2:	8:05	59.6

Comments: _____

Noise Source and Traffic Counts

Primary Noise Source(s): **Traffic** **Aircraft** **Rail** **Industrial** **Other:** _____
Roadway Name: _____

Count #1: Count Duration 15 min Traffic Speed: 35 mph

Autos	Medium Trucks	Large Trucks
2	_____	1

Count #2: Count Duration _____min Traffic Speed: _____mph

Autos	Medium Trucks	Large Trucks
2	_____	2

Other Noise Source(s): **Traffic** **Aircraft** **Rail** **Industrial** **Birds** **Landscaping** **Barking Dogs** **Other:** _____
Comments: Light Industrial for count 1, Heavy Industrial for count 2

Site Description and Sketch

Terrain: **Hard** **Soft** **Mixed** **Slope:** ____% # Photos: _____
Comments/Sketch: