Traffic Noise Technical Report

Farm-to-Market (FM) 741: From United States Highway (US) 175 to FM 548

Kaufman County, Texas

CSJs: 1092-01-021

TxDOT Dallas District

August 2022

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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Project Description

The Texas Department of Transportation Dallas District is proposing improvements to FM 741 from US 175 to FM 548 in Kaufman County. The proposed project is located within the Cities of Forney, Heartland, and Crandall. Improvements include reconstruction and widening of the existing two-lane rural section to a proposed four-lane divided urban roadway (and ultimate six-lane divided urban roadway from US 175 to FM 2757).

Introduction

This analysis was accomplished in accordance with TxDOT's (FHWA-approved) Traffic Noise Policy (2019).

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 typically 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) 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)	Description of Land Use Activity Areas
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 sport areas, amphitheaters, auditoriums, campgrounds, cemeteries, day care centers, hospitals, libraries, medical facilities, parks, picnic areas, places of worship, playgrounds, public meeting rooms, public or nonprofit 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	--	Agricultural, 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

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

Absolute criterion: The predicted noise level at a receiver approaches, equals or exceeds the NAC. "Approach" is defined as one dB(A) below the FHWA 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.

Analysis

The FHWA traffic noise modeling software (version 2.5) 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.

The approved traffic data used in this analysis is included in **Attachment B.**

Validation

A validation study was performed in order to ensure that traffic noise is the main source of noise and to verify that the existing model accurately predicts existing traffic noise based on current conditions. Model validation compares field-collected sound level measurements to traffic noise levels calculated in an existing condition model that used field-collected traffic parameters. Differences between the measured and calculated levels for this project were within the +/- 3 dB(A) tolerance allowed by FHWA. Therefore, the existing noise model is considered validated for this project. Additional information on the validation study is included in **Attachment C.**

Results

Existing and predicted traffic noise levels were modeled at receiver locations (**Table 2** and **Figure 2**) that represent the land use activity areas adjacent to the proposed project that might be impacted by traffic noise and potentially benefit from feasible and reasonable noise abatement.

Table 2: Traffic Noise Levels dB(A) Leq

Receiver	NAC Category	NAC Level	Existing	Predicted 2045	Change (+/-)	Noise Impact
R1	C (Assisted Living)	67	50	51	+1	No
R2	B (Residence)	67	56	58	+2	No
R3	B (Residence)	67	49	51	+2	No
R4	B (Residence)	67	51	53	+2	No
R5	B (Residence)	67	54	55	+1	No
R6	B (Residence)	67	50	52	+2	No
R7	B (Residence)	67	59	61	+2	No
R8	B (Residence)	67	57	60	+3	No
R9	B (Residence)	67	61	64	+3	No
R10	B (Residence)	67	58	56	-2	No
R11	B (Residence)	67	48	48	0	No
R12	B (Residence)	67	56	55	-1	No
R13	B (Residence)	67	57	58	+1	No
R14	B (Residence)	67	47	50	+3	No
R15	B (Residence)	67	53	55	+2	No
R16	B (Residence)	67	53	54	+1	No
R17	B (Residence)	67	49	52	+3	No
R18	B (Residence)	67	62	65	+3	No
R19	B (Residence)	67	56	57	+1	No
R20	B (Residence)	67	54	56	+2	No
R21	B (Residence)	67	57	60	+3	No
R22	B (Residence)	67	60	64	+4	No
R23	B (Residence)	67	57	60	+3	No
R24	B (Residence)	67	48	51	+3	No
R25	B (Residence)	67	58	60	+2	No
R26	B (Residence)	67	53	56	+3	No
R27	B (Residence)	67	64	65	+1	No
R28	B (Residence)	67	66	69	+3	**Yes**
R29	B (Residence)	67	55	57	+2	No
R30	B (Residence)	67	60	61	+1	No

Table 2: Traffic Noise Levels dB(A) Leq						
Receiver	NAC Category	NAC Level	Existing	Predicted 2045	Change (+/-)	Noise Impact
R31	B (Residence)	67	56	58	+2	No
R32	B (Residence)	67	53	55	+2	No
R33	B (Residence)	67	56	58	+2	No
R34	B (Residence)	67	53	56	+3	No
R35	B (Residence)	67	60	62	+2	No
R36	B (Residence)	67	56	59	+3	No
R37	B (Residence)	67	67	68	+1	**Yes**
R38	B (Residence)	67	61	61	0	No
R39	B (Residence)	67	53	55	+2	No
R40	B (Residence)	67	56	58	+2	No
R41	B (Residence)	67	48	51	+3	No
R42	B (Residence)	67	49	52	+3	No
R43	B (Residence)	67	53	55	+2	No
R44	D (Church)	52	34	35	+1	No
R45	B (Residence)	67	58	61	+3	No
R46	B (Residence)	67	53	55	+2	No
R47	B (Residence)	67	58	59	+1	No
R48	B (Residence)	67	63	65	+2	No
R49	B (Residence)	67	51	53	+2	No
R50	C (School)	67	55	56	+1	No

As indicated in **Table 2**, the proposed project would result in a traffic noise impact at one or more representative receiver locations. Noise abatement measures were considered for each location with predicted noise impacts.

Abatement Analysis

Before any abatement measure can be proposed for incorporation into the project, it must be both feasible and reasonable. Feasibility and reasonableness considerations include constructability, the predicted acoustic reductions provided by an abatement measure, a cost allowance, and whether the adjacent receptors desire abatement. Receptors associated with an abatement measure that achieve a noise reduction of five dB(A) or greater are called benefited receptors.

In order to be "feasible," the abatement measure must benefit a minimum of two impacted receptors AND reduce the predicted noise level by at least five dB(A) at greater than 50% of first-row impacted receptors.

In order to be "reasonable," the abatement measure must also reduce the predicted noise level by at least seven dB(A) for at least one benefited receptor (noise reduction design goal) and not exceed the standard barrier cost of 1,500 square feet per benefited receptor. In addition, an abatement measure may not be reasonable if the construction costs are unreasonably high due to site constraints, as determined through an alternate barrier cost assessment.

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.

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 right of way 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 – Noise barriers in the form of noise walls are the most commonly used noise abatement measures and were considered for this project.

Noise barriers would not be feasible and reasonable for any of the following impacted receptors, and therefore, are not proposed for incorporation into the project:

> **R28**: This receiver represents five impacted homes adjacent to the project. A noise barrier 10 feet in height and approximately 8,225 feet in total length was modeled along the ROW, with a gap to accommodate Shawnee Trail. This barrier would achieve the minimum feasible reduction of 5 dB(A) and the 7 dB(A) noise reduction design goal for four receptors. However, the square footage of abatement (8,225 square feet or 2,056 square feet per benefited receptor) would exceed the reasonable, cost-reasonableness criterion of 1,500 square feet per benefited receptor.

Proposed Abatement

Noise barriers would be feasible and reasonable for the following impacted receptors, and therefore, are proposed for incorporation into the project (**Table 3**).

R37: This receiver represents 10 impacted homes just north of Regency Trail with backyards facing the roadway. Based on preliminary calculations, a noise barrier approximately 496 feet in length and 10 feet in height would reduce noise levels by at least 5 dB(A) for eight benefited receptors and meet the noise reduction design goal of 7 dB(A) for six of those receptors. With a total area of abatement of 4,962 square feet or 620 square feet per benefited receptor, the barrier would also be cost reasonable.

Table 3: Noise Barrier Proposal (preliminary)

Barrier	Representative Receivers	Total # Benefited	Length (feet)	Height (feet)	Total Sq. Ft.	Sq. Ft. per Benefited Receptor
1	R37	8	496	10	4,962	620

Any subsequent project design changes may require a reevaluation of this preliminary noise barrier proposal. The final decision to construct the proposed noise barrier will not be made until completion of the project design, utility evaluation, and polling of all benefited and adjacent property owners and residents.

Noise Contours for Land Use Planning

To avoid noise impacts that may result from future development of properties adjacent to the project, local officials responsible for land use control programs must ensure, to the maximum extent possible, that no new activities are planned or constructed along or within the following predicted (2045) noise impact contours (**Table 3**).

Table 4: Land Use Contours for Undeveloped Land

Land Use	Impact Contour	Distance from Right-of-Way
NAC Category B & C	66 dB(A)	30 feet
NAC Category E	71 dB(A)	Within Right-of-Way

Construction Noise

Noise associated with the construction of the 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 not expected. Provisions will 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.

Local Official Notification and Date of Public Knowledge Statement

A copy of this traffic noise analysis will be made available to local officials to ensure, to the maximum extent possible, future developments are planned, designed, and programmed in a manner that would avoid traffic noise impacts. 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 project.

List of Attachments

A. Map Figures
B. Traffic Data
C. Existing Model Validation Study

Attachment A

Map Figures

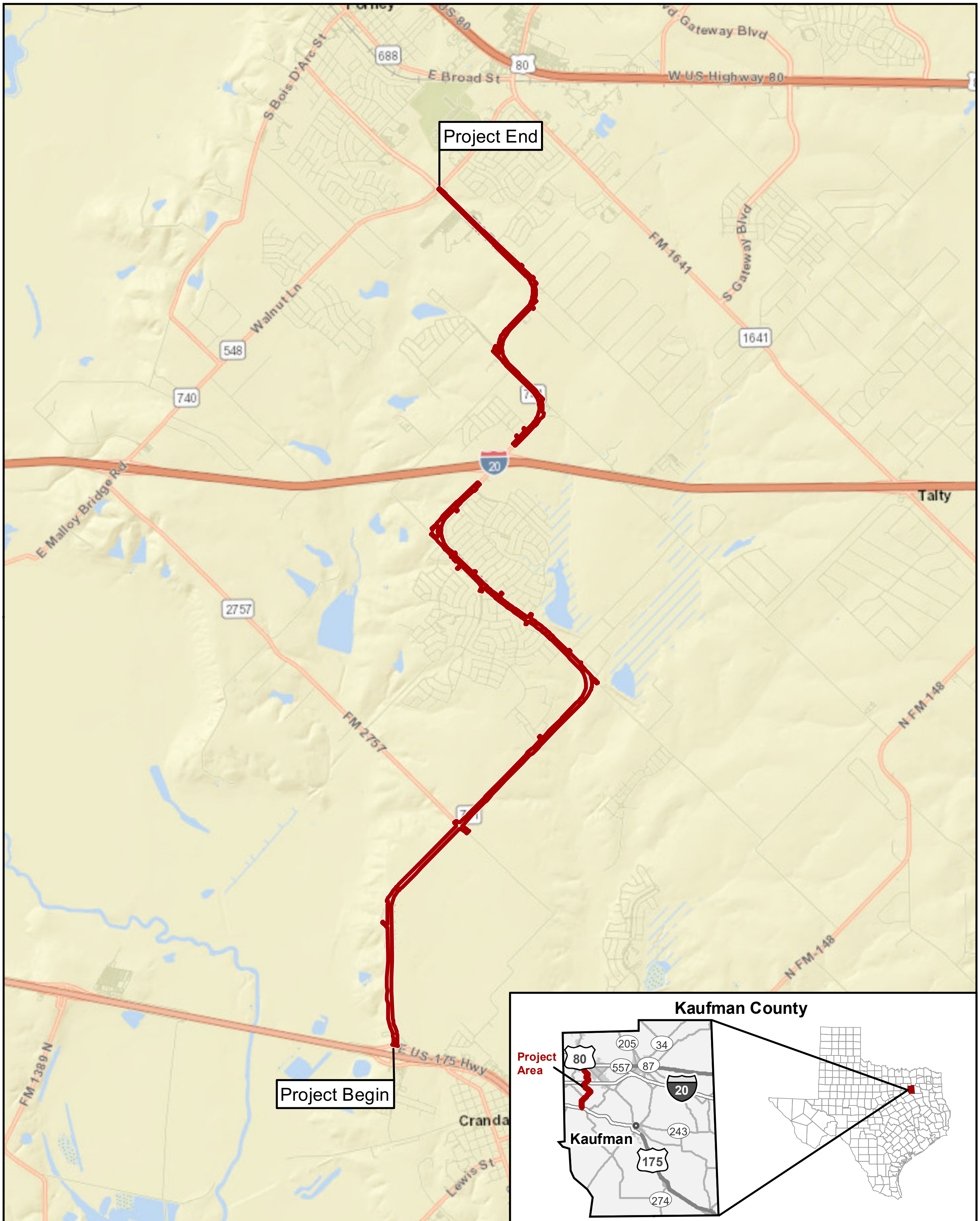

Figure 1.
Project Location (Road Base)

Project Location

CSJ: 1092-01-021

0 1 Mile
0 1.5 km

1 in = 1 mile
Scale: 1:63,360
Date: 12/9/2021

FM 741

Basemap Source: Esri (2021)

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Figure 2a. Receivers

FM 741

Existing Right-of-Way
Proposed Right-of-Way
Sheet Limits
Non-impacted Receiver
Model Validation Site

Data Sources: TxDOT (2021), Stantec (2022)
Aerial Source: Hexagon (2020, 2021)

CSJ: 1092-01-021

0 500 Feet
0 150 Meters
1 in = 500 feet
Scale: 1:6,000
Date: 4/20/2022

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Figure 2b. Receivers

FM 741

Existing Right-of-Way
Proposed Right-of-Way
Sheet Limits
Non-impacted Receiver
Model Validation Site

Data Sources: TxDOT (2021), Stantec (2022)
Aerial Source: Hexagon (2020, 2021)

CSJ: 1092-01-021

0 500 Feet
0 150 Meters

1 in = 500 feet
Scale: 1:6,000
Date: 4/20/2022

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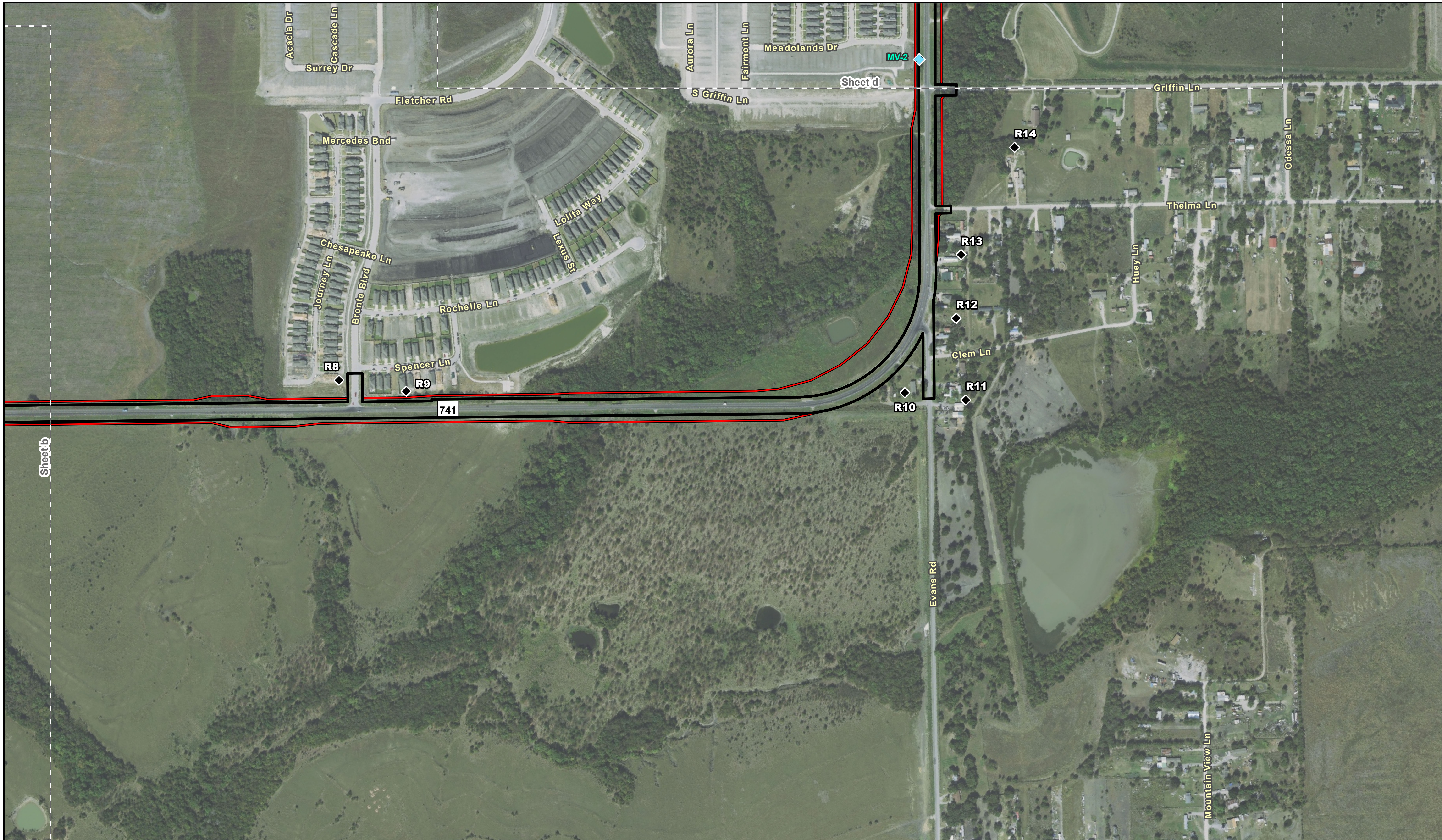

Figure 2c. Receivers

FM 741

Existing Right-of-Way
Proposed Right-of-Way
Sheet Limits
Non-impacted Receiver
Model Validation Site

Data Sources: TxDOT (2021), Stantec (2022)
Aerial Source: Hexagon (2020, 2021)

CSJ: 1092-01-021

0 500 Feet
0 150 Meters

1 in = 500 feet
Scale: 1:6,000
Date: 4/20/2022

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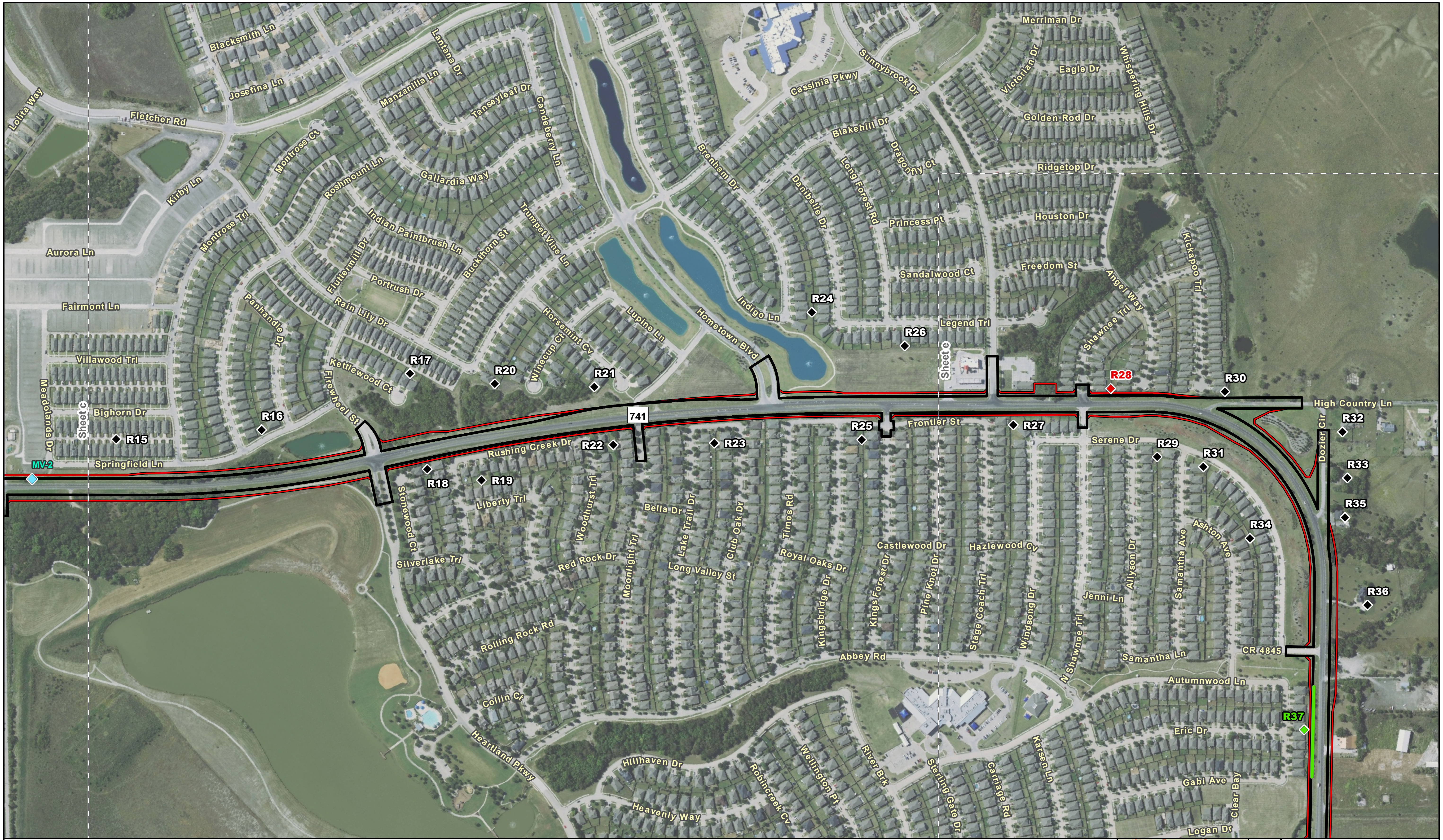

Figure 2d. Receivers

FM 741

- Existing Right-of-Way
- Proposed Right-of-Way
- Sheet Limits
- Benefited Receiver
- Non-impacted Receiver
- Impacted Receiver
- Model Validation Site
- Proposed Wall

Data Sources: TxDOT (2021), Stantec (2022)
Aerial Source: Hexagon (2020, 2021)

d

CSJ: 1092-01-021

0 500 Feet
0 150 Meters

1 in = 500 feet
Scale: 1:6,000
Date: 4/20/2022

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Figure 2e. Receivers

FM 741

Existing Right-of-Way
Proposed Right-of-Way
Sheet Limits
Benefited Receiver
Non-impacted Receiver
Impacted Receiver
Existing Wall
Proposed Wall

Data Sources: TxDOT (2021), Stantec (2022)
Aerial Source: Hexagon (2020, 2021)

CSJ: 1092-01-021

0 500 Feet
0 150 Meters

1 in = 500 feet
Scale: 1:6,000
Date: 4/20/2022

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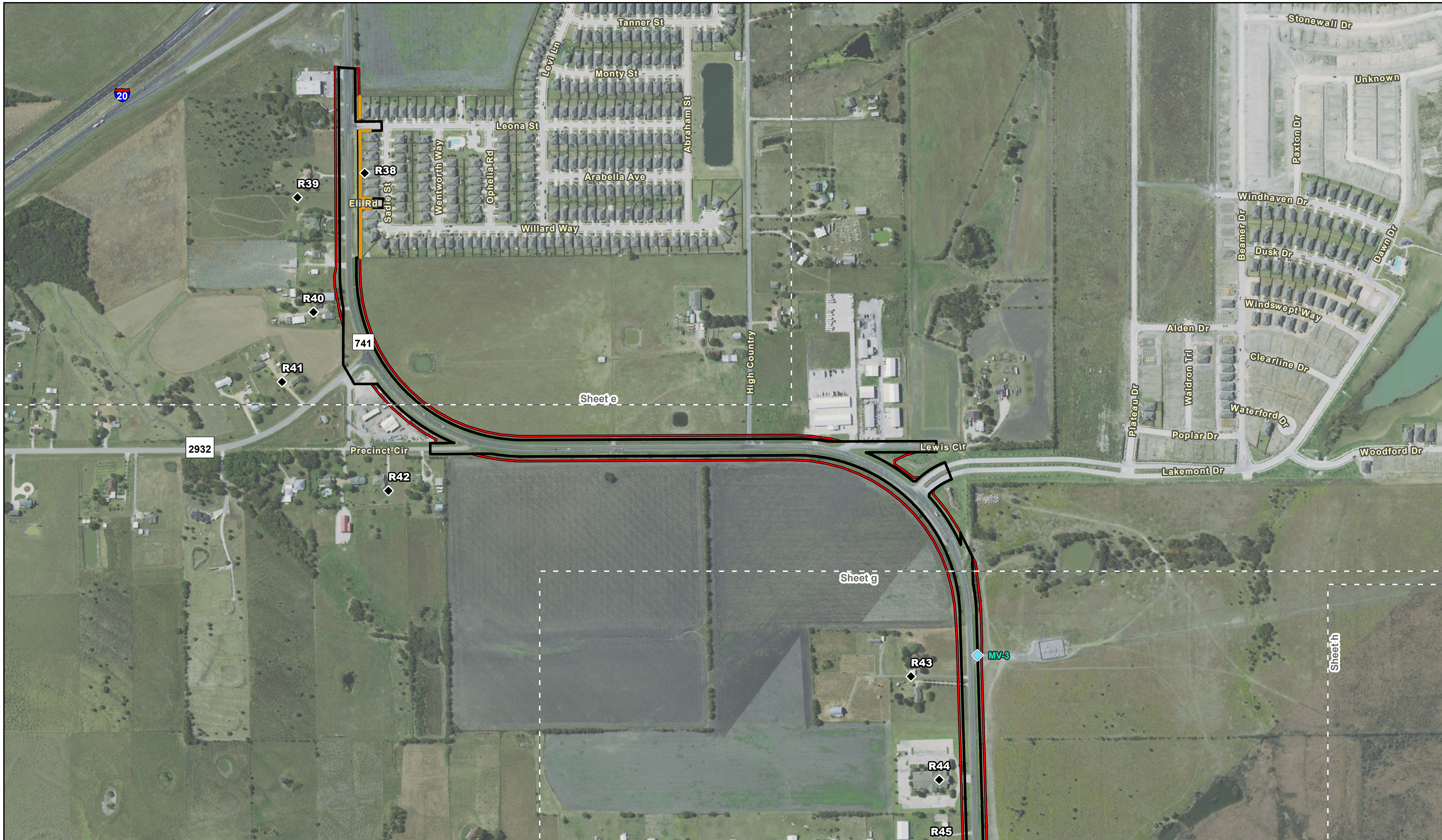

Figure 2f. Receivers

- Existing Right-of-Way
- Proposed Right-of-Way
- Sheet Limits
- Non-impacted Receiver
- Model Validation Site
- Existing Wall

FM 741

Data Sources: TxDOT (2021), Stantec (2022)
Aerial Source: Hexagon (2020, 2021)

CSJ: 1092-01-021

0 500 Feet
0 150 Meters

1 in = 500 feet
Scale: 1:6,000
Date: 4/20/2022

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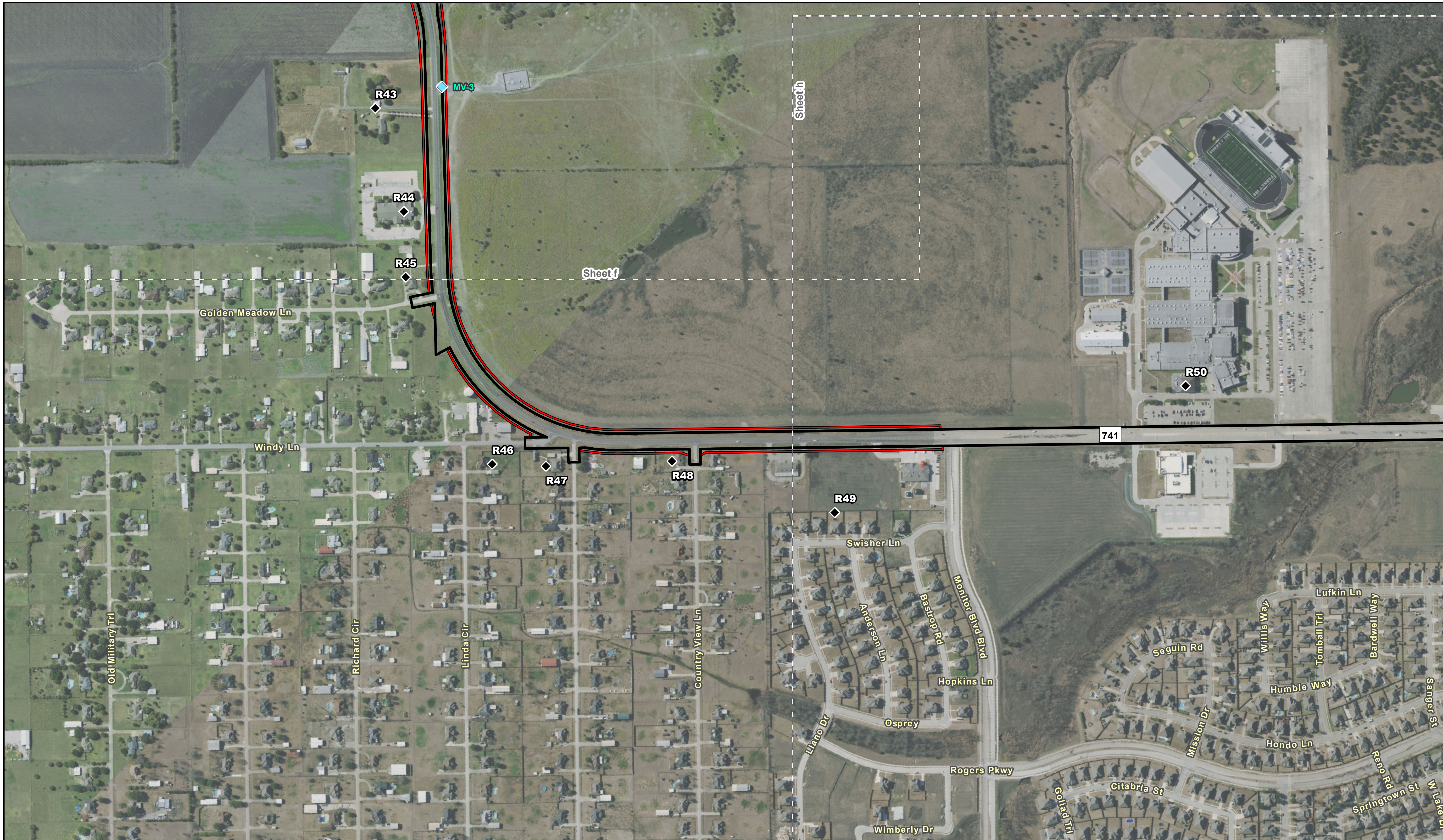

Figure 2g. Receivers

FM 741

Existing Right-of-Way
Proposed Right-of-Way
Sheet Limits
Non-impacted Receiver
Model Validation Site

Data Sources: TxDOT (2021), Stantec (2022)
Aerial Source: Hexagon (2020, 2021)

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CSJ: 1092-01-021

0 500 Feet
0 150 Meters

1 in = 500 feet
Scale: 1:6,000
Date: 4/20/2022

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Figure 2h. Receivers

FM 741

Existing Right-of-Way

Proposed Right-of-Way

Sheet Limits

■ Non-impacted Receiver

Data Sources: TxDOT (2021), Stantec (2022)
Aerial Source: Hexagon (2020, 2021)

CSJ: 1092-01-021

0 500 Feet
0 150 Meters

1 in = 500 feet
Scale: 1:6,000
Date: 4/20/2022

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Attachment B

Traffic Data

Traffic Analysis for Highway Design

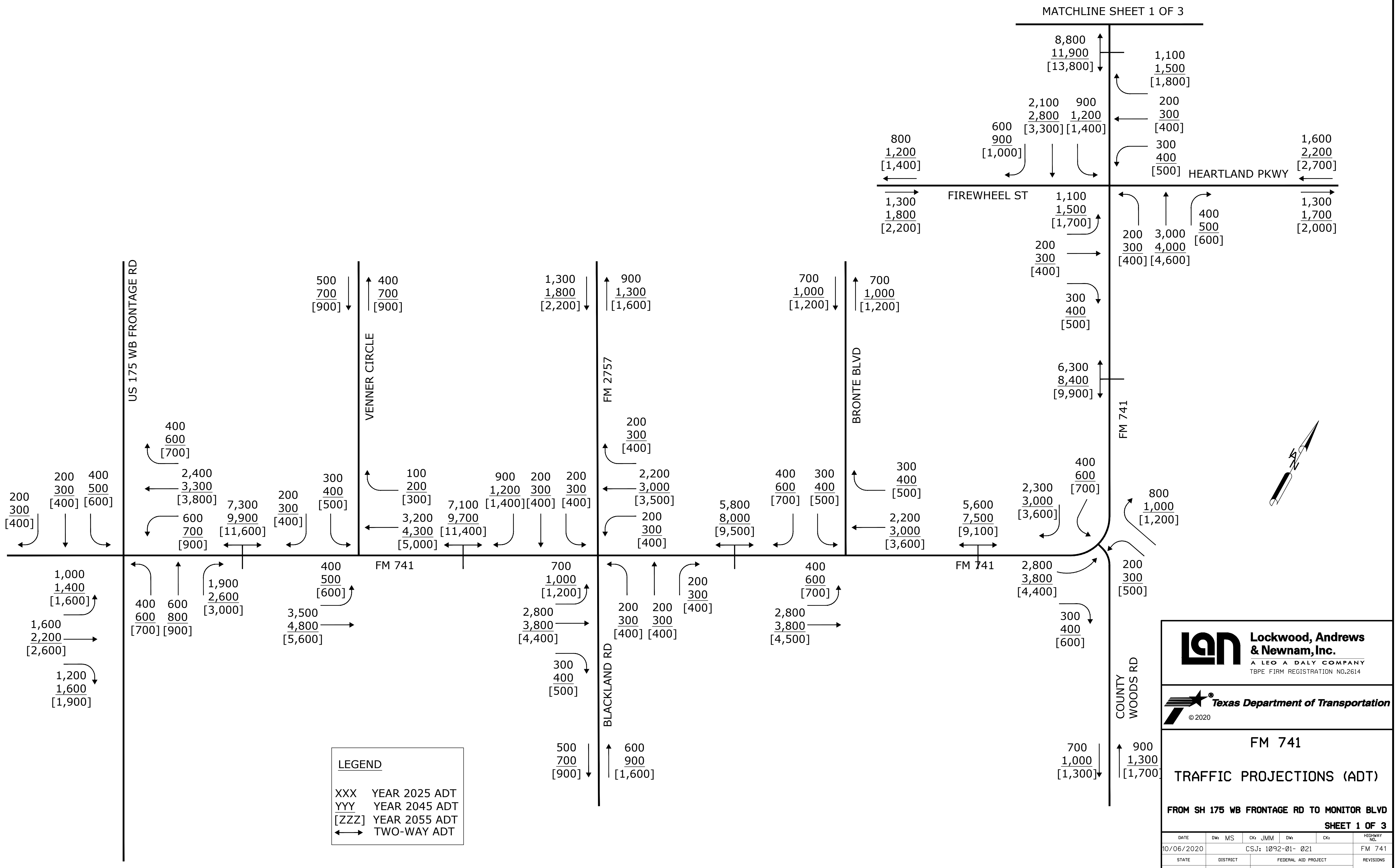
Dallas District

Description of Location	Average Daily Traffic		Base Year				ATHWLD	Percent Tandem Axles in ATHWLD	Total Number of Equivalent 18k Single Axle Load Applications One Direction Expected for a 20 Year Period (2025 to 2045)				
	2025	2045	Dir Dist %	K Factor	Percent Trucks ADT	Percent Trucks DHV			Flexible Pavement	S	N	Rigid Pavement	SLAB
FM 741 from US 175 to FM 548	19,100	30,300	54 - 46	11.8	4.8	2.9	–	–	–	–		–	–

Data for Use in Air & Noise Analysis

Vehicle Class	Base Year % of ADT	Base Year % of DHV
Light Duty	-	97.1
Medium Duty	-	2.0
Heavy Duty	-	0.9

Description of Location	Average Daily Traffic		Base Year				ATHWLD	Percent Tandem Axles in ATHWLD	Total Number of Equivalent 18k Single Axle Load Applications One Direction Expected for a 30 Year Period (2025 to 2045)				
			Dir Dist %	K Factor	Percent Trucks ADT	Percent Trucks DHV			Flexible Pavement	S	N	Rigid Pavement	SLAB
–	–	–	–	–	–	–	–	–	–	–		–	–



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Texas Department of Transportation
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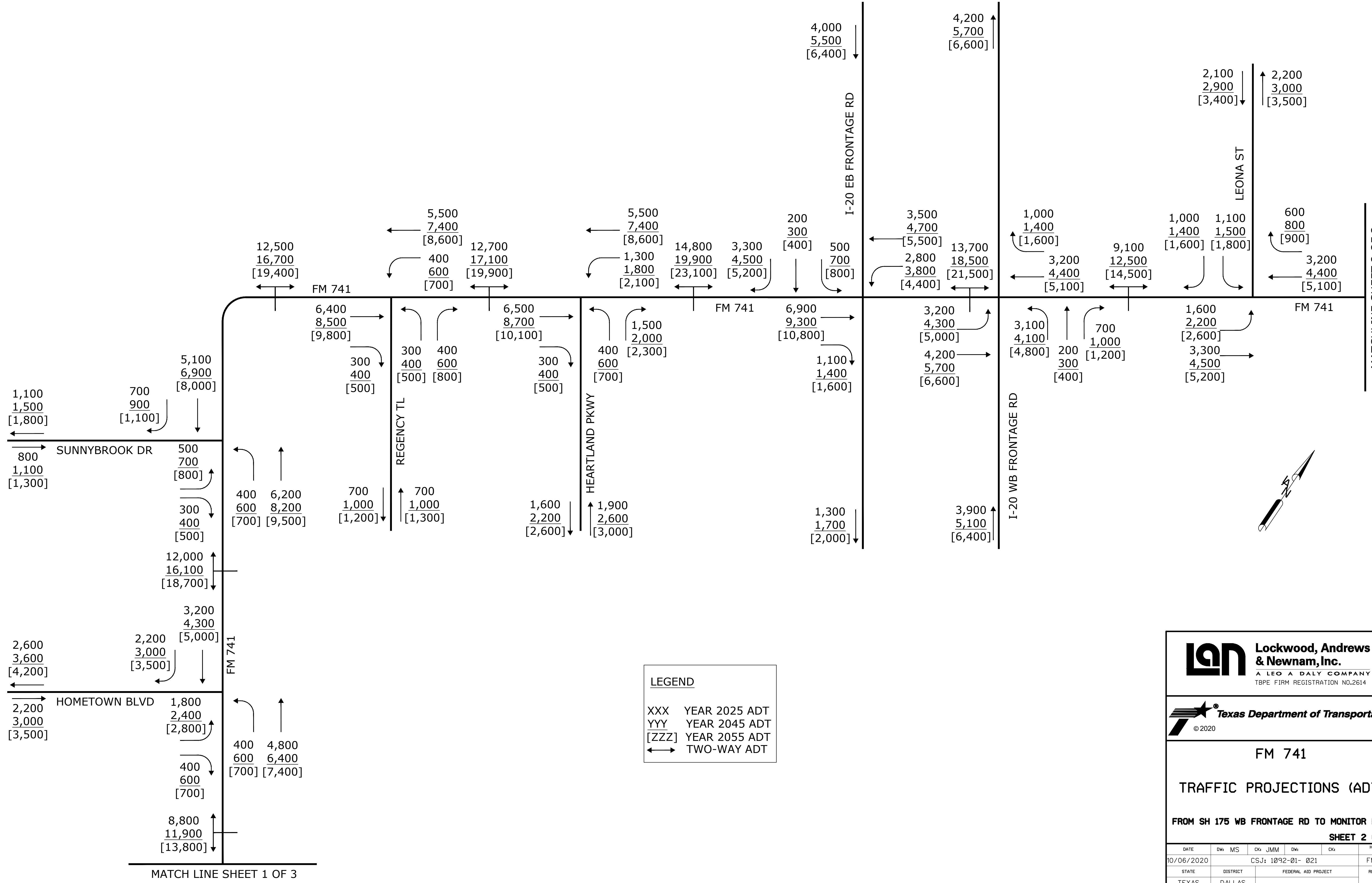
FM 741

TRAFFIC PROJECTIONS (ADT)

FROM SH 175 WB FRONTAGE RD TO MONITOR BLVD

SHEET 1 OF 3

DATE	DW: MS	CK: JMM	DW:	CK:	HIGHWAY NO.
10/06/2020	CSJ: 1092-01-021				FM 741
STATE	DISTRICT	FEDERAL AID PROJECT			REVISIONS
TEXAS	DALLAS				
CONTROL	SECTION NO.	COUNTY			
		WILLIAMSON			



LEGEND

XXX	YEAR 2025 ADT
YYY	YEAR 2045 ADT
[ZZZ]	YEAR 2055 ADT
⟷	TWO-WAY ADT

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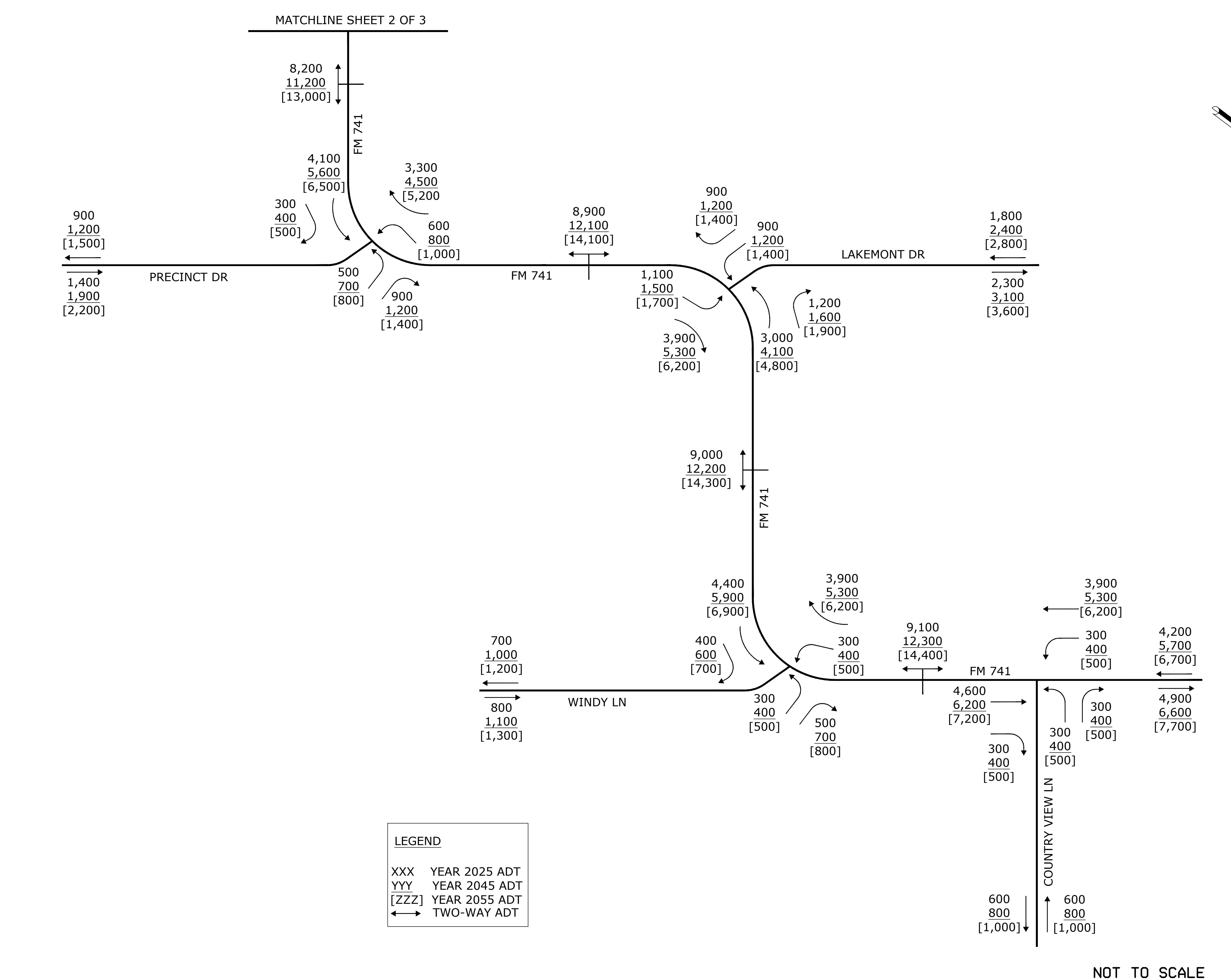
FM 741

TRAFFIC PROJECTIONS (ADT)

FROM SH 175 WB FRONTAGE RD TO MONITOR BLVD

SHEET 2 OF 3

DATE	DN: MS	CK: JMM	DW:	CK:	HIGHWAY NO.
10/06/2020	CSJ: 1092-01-021				FM 741
STATE	DISTRICT	FEDERAL AID PROJECT			REVISIONS
TEXAS	DALLAS				
CONTROL	SECTION NO.	COUNTY			
		WILLIAMSON			



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Texas Department of Transportation

FM 741

TRAFFIC PROJECTIONS (ADT)

FROM SH 175 WB FRONTAGE RD TO MONITOR BLVD

SHEET 3 OF 3

DATE	DW: MS	CK: JMM	DW:	CK:	HIGHWAY NO.
10/06/2020	CSJ: 1092-01-021				FM 741
STATE	DISTRICT	FEDERAL AID PROJECT			REVISIONS
TEXAS	DALLAS				
CONTROL	SECTION NO.	COUNTY			
		WILLIAMSON			

Attachment C

Existing Model Validation Study

Existing Model Validation Study

A validation study was performed in order verify that the existing model accurately predicts existing traffic noise based on current conditions and to ensure that traffic noise is the main source of noise. Model validation compares field-collected sound level measurements to traffic noise levels calculated in an existing condition model that used field-collected traffic parameters.

Three validation sites were selected along the project ROW (**Figure 2**) after consultation with TxDOT district staff and ENV noise subject matter experts. Field measurements were collected on January 11th, 2022 beginning at 1:00 PM. The weather was sunny and dry, with light easterly winds. During the measurements, traffic was free-flowing and traveling at a relatively constant speed.

A 3M SoundPro SE/DL sound level meter was used to measure sound levels in dB(A) Leq. The sound level meter was positioned on a tripod with the microphone facing the roadway and set at a height of five feet. The measurement duration was 15 minutes. The meter was calibrated before measurements were taken.

Concurrently with the sound level measurement, manual traffic counts recorded traffic conditions for all existing travel lanes adjacent to the noise meter. Vehicles were counted according to classification (car, medium truck, and heavy truck.) Traffic speeds were estimated by driving the project area prior to sound level measurements. The field data sheet is included below (**Figure 1.)**

Because the noise modeling software uses a vehicle per hour input, vehicle counts for the 15-minute measurement interval were multiplied by four to convert the values to the hourly condition. Traffic counts and model inputs are shown on **Figure 1**. The FHWA traffic noise modeling software (TNM 2.5) was used to calculate existing traffic noise levels at each validation location, based on the field-observed conditions. The validation model run(s) used the existing roadway parameters, observed hourly traffic counts, and observed speeds. The traffic noise model validation results are shown in **Table 1**.

Table 1: Model Validation

Validation Site	Field-Measured Level dB(A) Leq	Modeled Level dB(A) Leq	Difference (+/-)	Validated?
MV-1	71.1	69.3	1.8	Yes
MV-2	68.9	66.8	2.1	Yes
MV-3	74.4	71.5	2.9	Yes

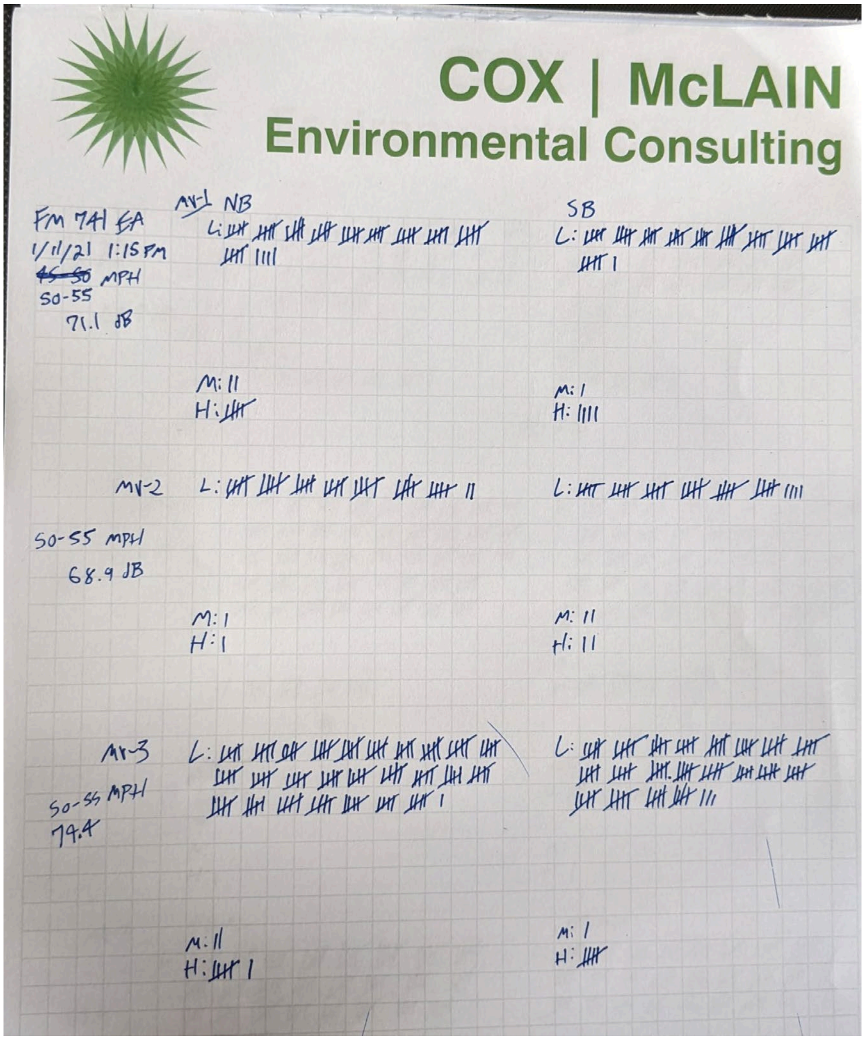

Figure 1: Field Data Sheet for Model Validation