Traffic Noise Analysis Report

Farm-to-Market Road (FM) 1173

From: FM 156
To: Interstate Highway (IH) 35
Denton County, Texas

Control-Section-Job (CSJ): 1059-01-047 and 1059-02-002
TxDOT – Dallas District

May 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.

Table of Contents

The Texas Department of Transportation (TxDOT) is proposing improvements to Farm-to-Market (FM) 1173, from west of FM 156 in the City of Krum, to Interstate Highway (IH) 35 in the City of Denton, Denton County, Texas; a distance of approximately 3.6 miles. The proposed project would require approximately 51.75 acres of additional right-of-way (ROW). Project location maps and a detailed project description are available in the TxDOT Environmental Compliance Oversight System (ECOS).

Introduction

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 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**).

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 extra-ordinary 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 receptor 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 receptor 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 (TNM 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**.

Results

Existing and predicted traffic noise levels were modeled at receiver locations (**Table 2** and the **Noise Receiver Location Map**) 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. Noise levels are expected to increase at most receivers. However, some receivers are not anticipated to experience increased noise levels and some are expected to experience decreased noise levels since the traffic noise modeling software is perceptible to changes in roadway geometry (moving traffic closer to or further from receivers).

Table 2. Traffic Noise Levels dB(A) Leq

Representative Receiver	NAC Cat`egory	NAC Level	Existing	Predicted 2040	Change (+/-)	Noise Impact (Yes/No)
R1 - Single-family Residential	B	67	50	52	+2	No
R2 - Single-family Residential	B	67	54	55	+1	No
R3 - Single-family Residential	B	67	53	57	+4	No
R4 - Single-family Residential	B	67	58	59	+1	No
R5 - Single-family Residential	B	67	58	59	+1	No
R6 - Baseball Field (bleachers)	C	67	58	59	+1	No
R7 - Krum Public Library (interior)	D	52	40	40	0	No
R8 - Krum Church of Christ (interior)	D	52	40	42	+2	No
R9 - Krum Middle School Gymnasium (interior)	D	52	40	43	+3	No
R10 - Krum ISD Tennis Courts	C	67	59	63	+4	No
R11 - Blanche Intermediate School (playground)	C	67	52	54	+2	No
R12 - First United Methodist Church (playground)	C	67	50	53	+3	No
R13 - Single-family Residential	B	67	66	67	+1	Yes
R14 - Miguelito's Mexican Restaurant (patio seating)	E	72	61	66	+5	No
R15 - Krum Early Education Center (playground)	C	67	52	54	+2	No

Table 2. Traffic Noise Levels dB(A) Leq

Representative Receiver	NAC Cat`egory	NAC Level	Existing	Predicted 2040	Change (+/-)	Noise Impact (Yes/No)
R16 - Single-family Residential	B	67	65	66	+1	Yes
R17 - Single-family Residential	B	67	57	55	-2	No
R18 - Single-family Residential	B	67	61	57	-4	No
R19 - Single-family Residential	B	67	60	55	-5	No
R20 - Single-family Residential	B	67	56	52	-4	No
R21 - Single-family Residential	B	67	59	54	-5	No
R22 - Single-family Residential	B	67	53	59	+6	No
R23 - Single-family Residential	B	67	60	64	+4	No
R24 - Single-family Residential	B	67	57	63	+6	No
R25 - Single-family Residential	B	67	60	67	+7	Yes

As indicated in **Table 2**, the proposed project would result in a traffic noise impact at three representative receiver locations. 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. 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 cost-effectiveness criterion of $25,000 per benefitted receiver.

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 (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 – 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:

R13: This receiver represents 12 single-family residences. A continuous noise barrier along the ROW would restrict access to these residences. Gaps in the noise barriers would satisfy access requirements but the resulting noise barrier 822 feet in length (three barriers, one 111 feet long, one 504 feet long, and one 207 feet long) and 12-foot tall non-continuous barrier segments would achieve the minimum feasible reduction of 5 dB(A) for two receptors while meeting the 7 dB(A) noise reduction design goal at one of those receptors. However, the noise barriers would exceed the reasonable, cost-effectiveness criterion of $25,000 per benefitted receiver.

R16: This receiver represents six single-family residences. A continuous noise barrier along the ROW would restrict access to these residences. Gaps in the noise barriers would satisfy access requirements but the resulting noise barrier 516 feet in length (two barriers, one 416 feet long and one 100 feet long) and 12-foot tall non-continuous barrier segments would achieve the minimum feasible reduction of 5 dB(A) for two receptors while meeting the 7 dB(A) noise reduction design goal at one of those receptors. However, the noise barriers would exceed the reasonable, cost-effectiveness criterion of $25,000 per benefitted receiver.

R25: This receiver represents a single-family residence with backyards adjacent to the roadway. A continuous noise barrier up to 20 feet in height, placed along the ROW would benefit the impacted receptor; however, it would fail to meet the 7 dB(A) noise reduction design goal. Therefore, a noise barrier is not proposed for this location.

None of the above noise abatement measures would be both feasible and reasonable; therefore, no abatement measures are proposed for this project.

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 (2040) noise impact contours.

Land Use	Impact Contour	Distance from Right of Way
NAC category B & C	66 dB(A)	65 feet
NAC category E	71 dB(A)	15 feet

Construction Noise

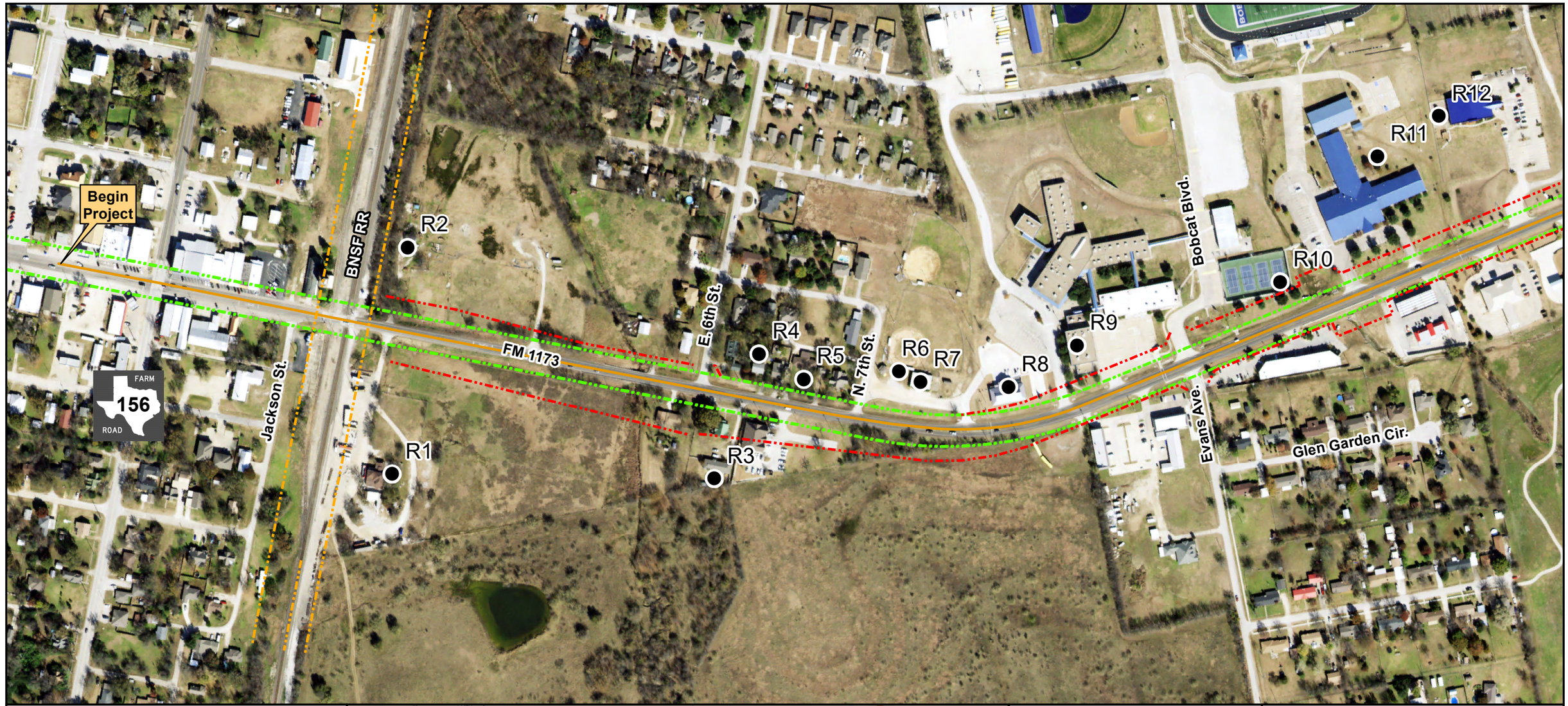
Noise associated with the construction of the project is difficult to predict. Heavy machinery, the major source of noise in construction, is constantly moving in unpredictable patterns. However, construction normally occurs during daylight hours when occasional loud noises are more tolerable. None of the receptors is 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 available to local officials. On the date of the environmental decision for this project (Date of Public Knowledge), FHWA and TxDOT are no longer responsible for providing noise abatement for new development adjacent to the project.

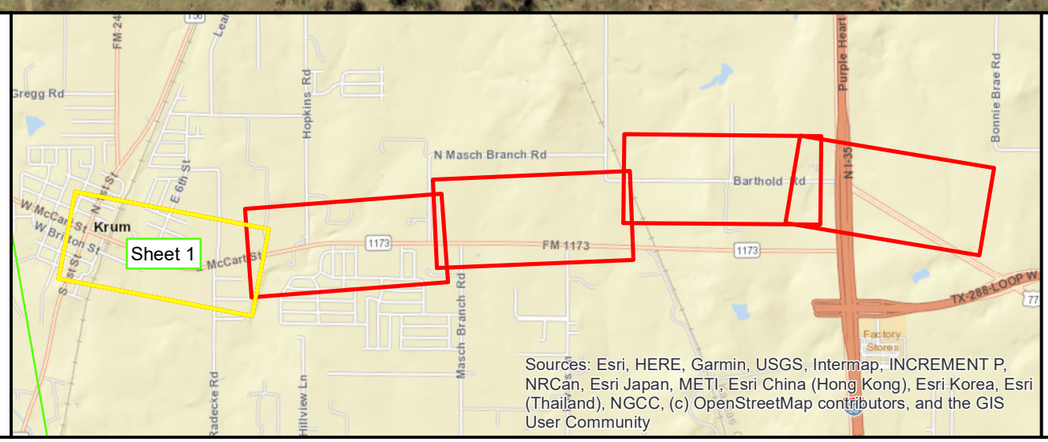
List of Attachments

A. Noise Receiver Location Map
B. Traffic Corridor Analysis Information Packet (TxDOT – Dallas District Approved)



Legend

- Project Location
- Existing Right-of-Way
- Proposed Right-of-Way
- Existing Railroad Easement
- Non-Impacted Noise Receiver
- Impacted Noise Receiver



N W E S

0 300 Feet

Base Map Source: TNRIS (2018).

NOISE RECEIVER LOCATION MAP

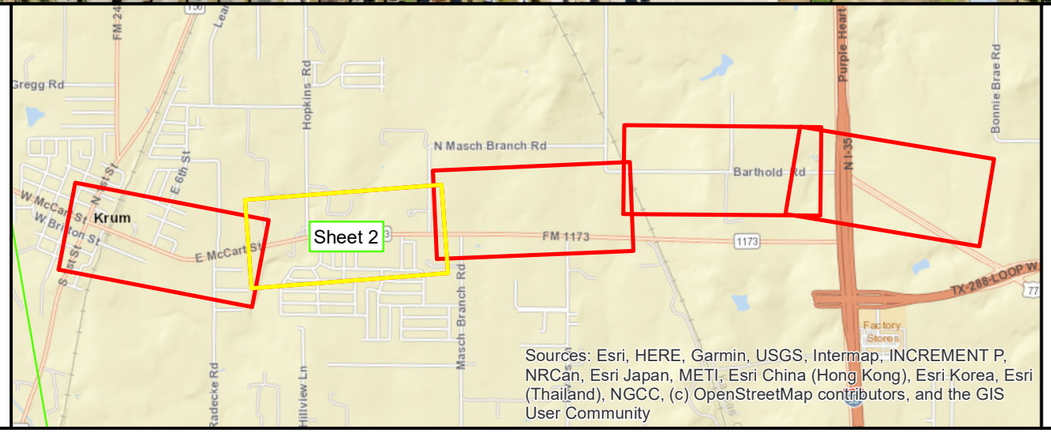
FARM-TO-MARKET ROAD (FM) 1173
FROM FM 156
TO INTERSTATE HIGHWAY 35 (I-35)
DENTON COUNTY

CSJs: 1059-01-047 & 1059-02-002

R12
R13
R14
R15
R16
Hopkins Rd.
Masch Branch Rd.
FM 1173
Dakota Trl.
Nighthawk Dr.
Blackforest Rd.
Thoroughbred Dr.
Palomino Ln.

Legend

- Project Location
- Existing Right-of-Way
- Proposed Right-of-Way
- Existing Railroad Easement
- Non-Impacted Noise Receiver
- Impacted Noise Receiver



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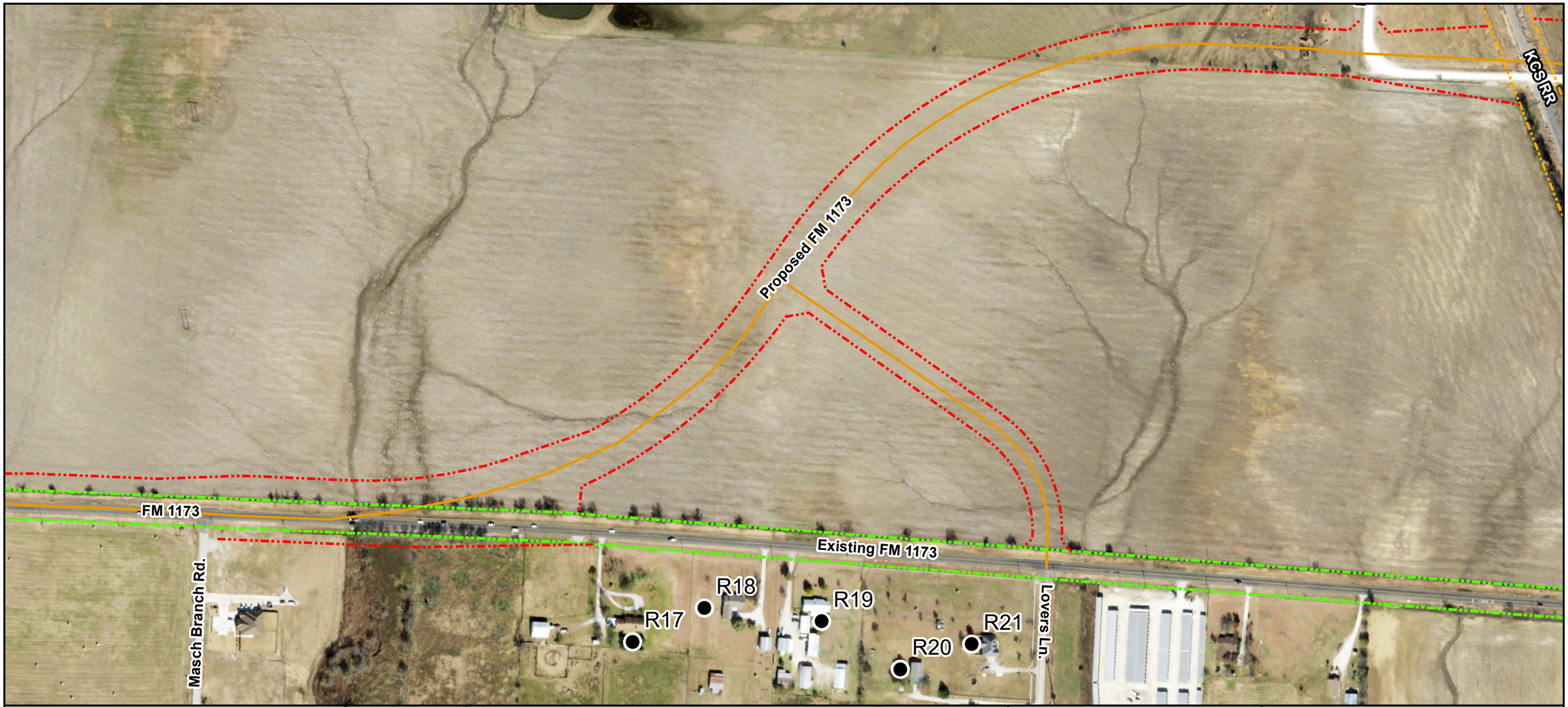
TO INTERSTATE HIGHWAY 35 (I-35)
DENTON COUNTY

CSJs: 1059-01-047 & 1059-02-002



Legend

- Project Location
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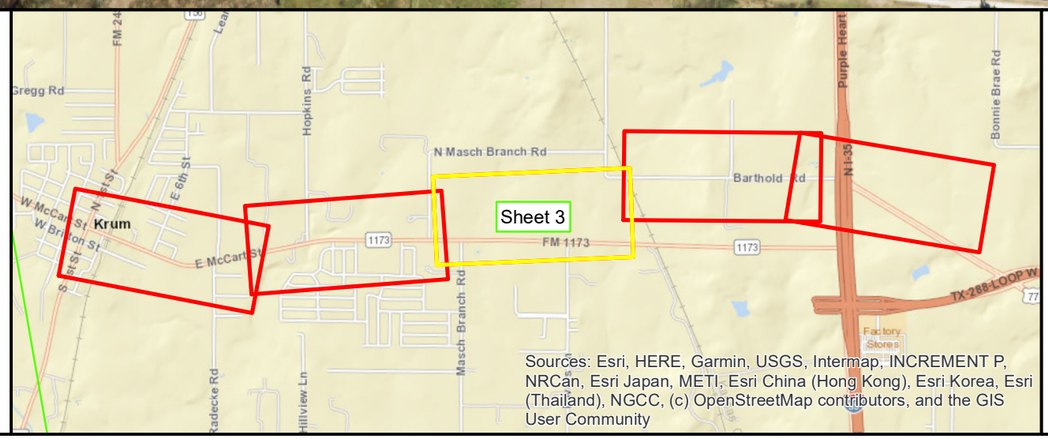
- Proposed Right-of-Way
- Existing Railroad Easement
- Non-Impacted Noise Receiver
- Impacted Noise Receiver



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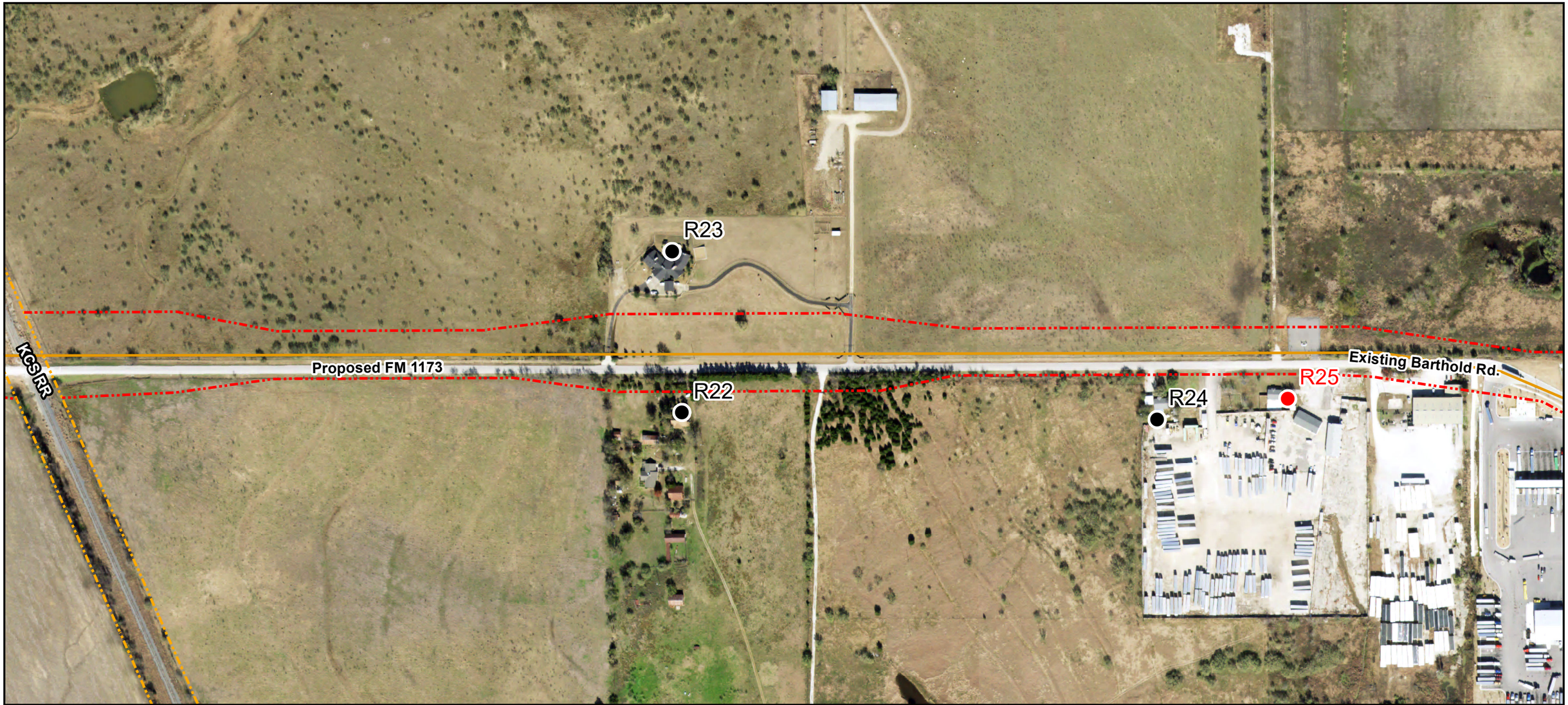
CSJs: 1059-01-047 & 1059-02-002



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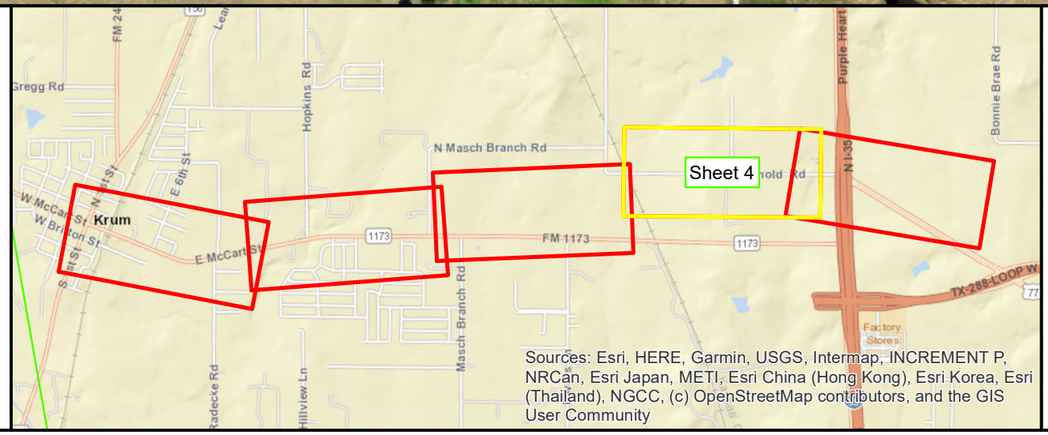

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NOISE RECEIVER LOCATION MAP

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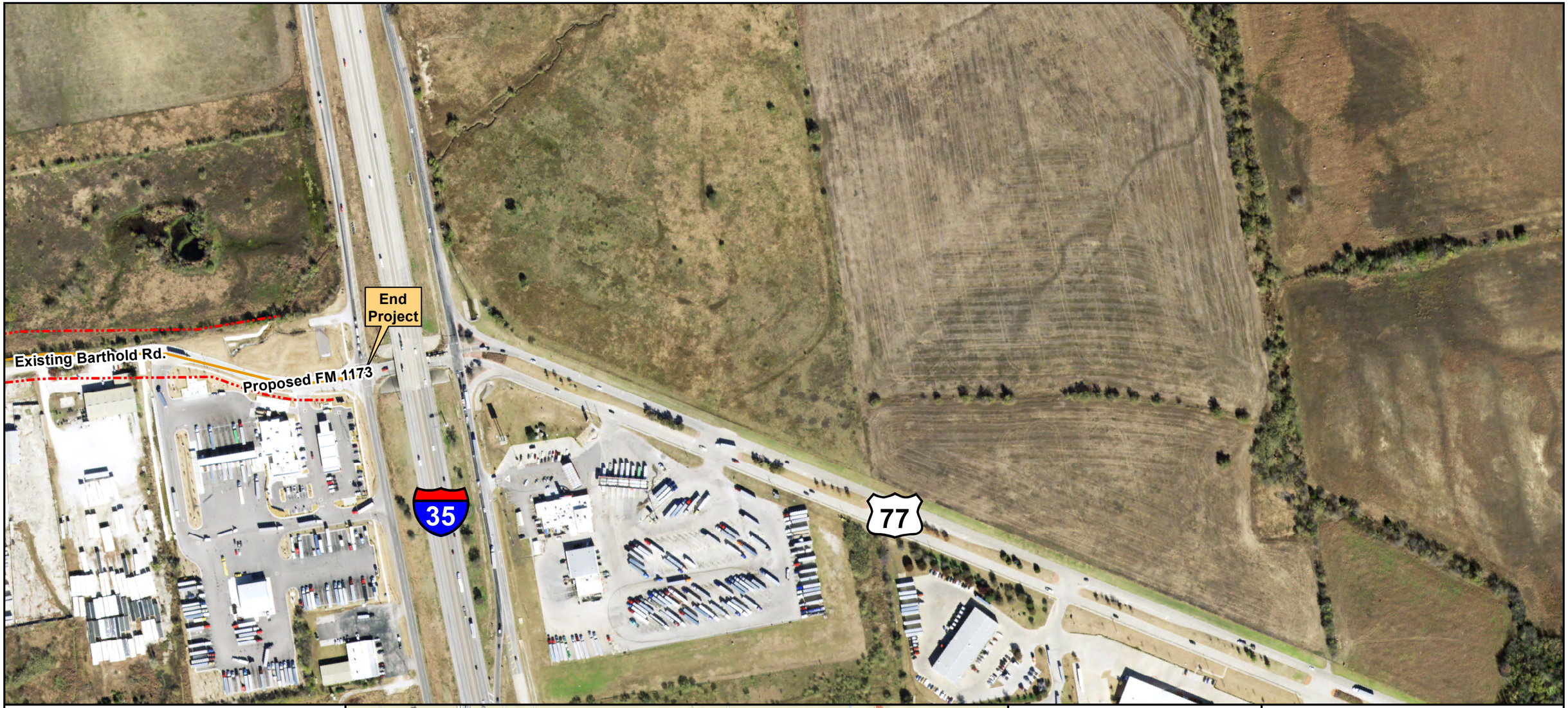
FROM FM 156
TO INTERSTATE HIGHWAY 35 (I-35)
DENTON COUNTY

CSJs: 1059-01-047 & 1059-02-002



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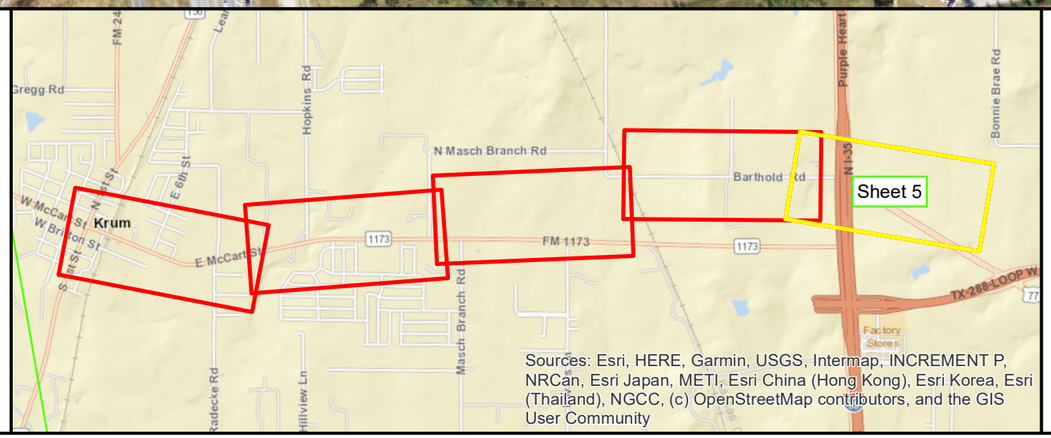

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Base Map Source: TNRIS (2018).

NOISE RECEIVER LOCATION MAP

FARM-TO-MARKET ROAD (FM) 1173
FROM FM 156
TO INTERSTATE HIGHWAY 35 (I-35)
DENTON COUNTY

CSJs: 1059-01-047 & 1059-02-002

TRAFFIC ANALYSIS FOR HIGHWAY DESIGN (OPTION C)

Dallas District **March 26, 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
FM 1173 From FM 156 To I-35 Denton County	13,554	18,618	54 - 46	11.1	8.4	6.3	11,500	60	4,997,000	3	7,110,000	8"

Data for Use in Air & Noise Analysis

Vehicle Class	Base Year % of ADT	Base Year % of DHV
Light Duty	91.6	93.7
Medium Duty	1.8	1.4
Heavy Duty	6.6	4.9

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
FM 1173 From FM 156 To I-35 Denton County	13,554	21,186	54 - 46	11.1	8.4	6.3	11,600	60	8,095,000	3	11,516,000	8"

AIA ENGINEERS **MEMORANDUM**

Date: October 17,2018

To: Nelson Underwood, PE
Texas Department of Transportation

From: Kishore Juluru, PE, PTOE
AIA Engineers

Subject: Updated FM 1173 Corridor Improvements Traffic Forecasting Methodology
CSJ:1059-01-047

PROJECT DETAILS

Project Limits: FM 156 (S. 1st Street) to IH 35 SB Frontage Road)
Project Length: 3.6 miles
CSJ:1059-01-047

DATA COLLECTION

- Obtain Travel Demand Model (TDM) traffic projections from NCTCOG (MPO) for the project limits.
- Coordinate with TxDOT to obtain TP&P analysis package. The analysis package should include historical data along the corridor and 20-year and 30-year growth factors. Include any previous traffic forecasting performed for this project.
- Collect existing year 2017 traffic (24‐hour volume counts) along FM 1173 at following intersections and major driveways within the project limits:

1. FM 1173 at FM 156 (S. 1st St.)
2. FM 1173 at Jackson St.
3. FM 1173 at E 6th St.
4. FM 1173 at N 7th St.
5. FM 1173 at Evans Ave.
6. FM 1173 at 1st United Methodist Church Driveway
7. FM 1173 at Hopkins Rd.
8. FM 1173 at Nighthawk Dr.
9. FM 1173 at Blackforest Rd.
10. FM 1173 at Thoroughbred Dr.
11. FM 1173 at Masch Branch Rd.
12. FM 1173 at Lovers Lane Rd.
13. FM 1173 at IH 35 E. Frontage Rd.

TRAFFIC PROJECTIONS

NCTCOG's TDM data were used as a reference for estimating growth factors in the study area. The traffic volumes obtained from the TDM at various locations along the FM 1173 corridor are shown in Table 1.

Table 1 Growth Rate based on NCTCOG's TDM data

FM 1173 Location	Daily Traffic (Years)			Linear Annual Growth Rate	
	2017	2027	2040	2017-2027	2027-2040
West of IH 35	12028	13957	16042	1.6%	1.3%
East of FM 156	9841	11933	12954	2.1%	0.8%

Based on TPP analysis package, the estimated growth rates are summarized in Table 2.

Table 2 The Traffic Analysis for Highway Design Table Growth Rates

FM 1173 Location	Daily Traffic (Years)				Linear Annual Growth Rate		
	2016	2020	2040	2050	2016-2020	2020-2040	2040-2050
From FM 156 to IH 35	10668	11500	15800	17900	2.0%	2.0%	2.0%

Following a conservative approach, the growth rates developed from TP&P data will be used. The steps in developing the traffic projections for years 2020, 2040, and 2050 are as follows:

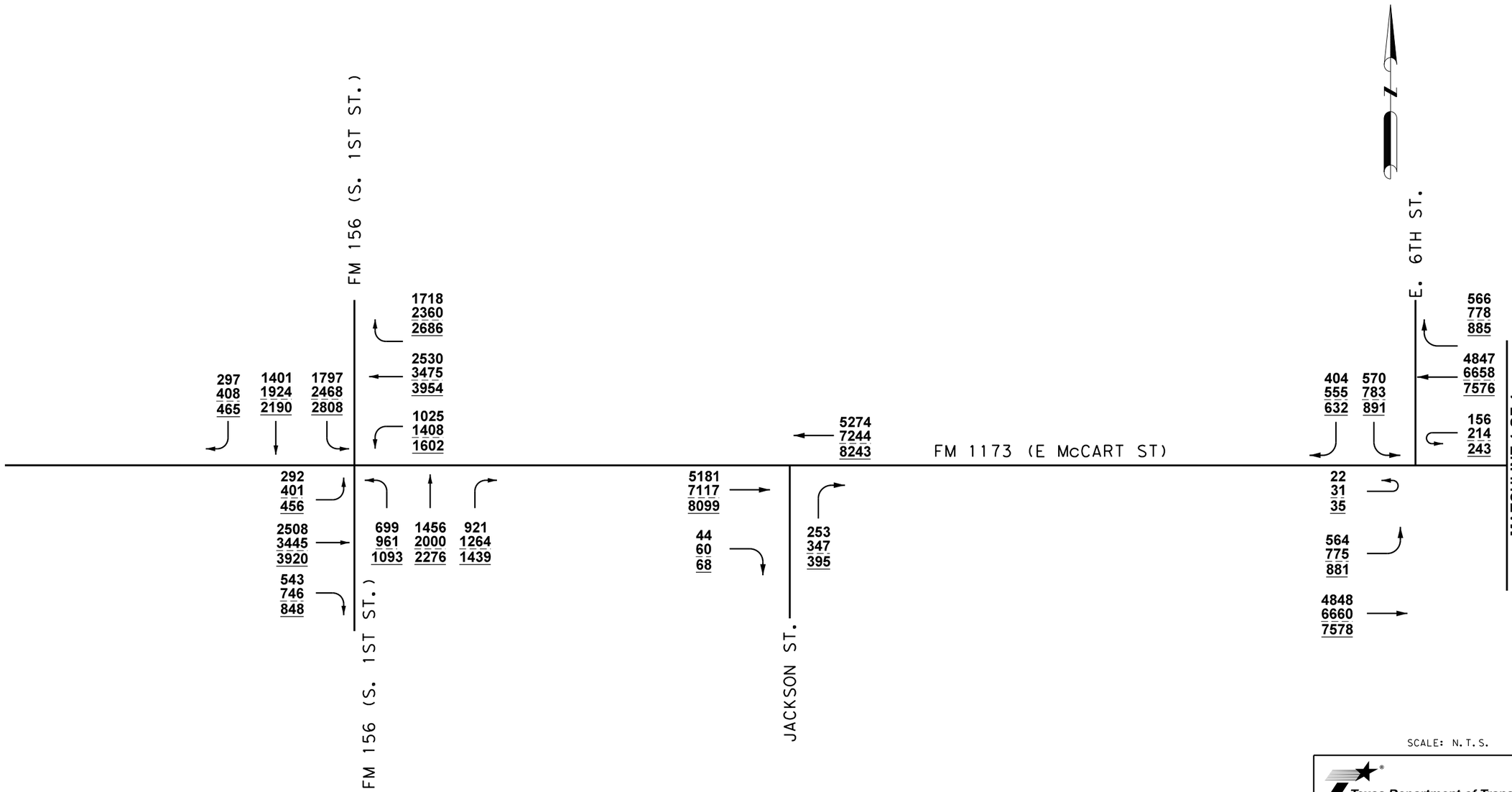
- Existing roadway 24 - hour (daily) traffic volumes along FM 1173 within the project limit will be used as the base for the traffic projection.
- Respective growth factors previously obtained from the TP&P will then be applied to the existing 24-hour traffic volumes to calculate projected traffic data for opening year 2020, design year 2040 (opening plus 20 years), and 2050 (design year plus 10 years for pavement design calculations).
- Year 2020 ADT (projected) =
  Existing 2017 Volumes + Existing 2017 Volumes * (G1) * (Y1-Y0)
- Year 2040 ADT (projected) =
  Year 2020 ADT + Existing 2017 Volumes * (G2) * (Y2-Y1)
- Year 2050 ADT (projected) =
  Year 2040 ADT + Existing 2017 Volumes * (G3) * (Y3-Y2)

NOTE:
G1 (2.0%), G2 (2.0%) and G3 (2.0%) are linear annual growth rates obtained from TP&P Corridor Analysis Worksheet.
Y0 (2017), Y1 (2020), Y2 (2040), and Y3 (2050) are the count year, project base year and the forecast years.

- From the TP&P corridor analysis information packet, the K- factor = 11.1% and directional distribution (D) = 54% / 46% will be used
- The proposed alignment shifts the FM 1173 road northeast of the intersection of FM 1173 and Masch Branch Rd. The following assumptions were used to estimate the turning movement counts for the intersections on the proposed FM 1173 alignment:
    - 90 % of the SBR and EBR from FM 1173 at I-35 will be redirected to the proposed FM 1173 at I-35 intersection.
    - 50% of the right-turn traffic from Lovers Lane to FM 1173 will turn left and then right at the intersection of old FM 1173 and proposed FM 1173.
- TP&P does not allow zero turns. If a turning movement is not allowed then remove the direction arrow.
- All turning movements are required to have growth. All turning movements must be arithmetically correct.
- The projected traffic volumes obtained from the above steps will be adjusted to get a balanced network for the proposed roadway conditions.

SUBMITTALS

- Line diagrams showing years 2020, 2040, and 2050 ADT volumes for proposed roadway configuration will be submitted to TxDOT.



LEGEND

XXX - YEAR 2020 ADT
XXX - YEAR 2040 ADT
XXX - YEAR 2050 ADT

SCALE: N.T.S.

Texas Department of Transportation

AIA ENGINEERS
CONSULTANTS
15310 PARK ROW, HOUSTON, TX 77084
PHONE: (281) 493-4140 F-2801

FM 1173

BUILD (2020, 2040, 2050) TRAFFIC PROJECTIONS (ADT) FOR FM 1173 FROM FM 156 (S. 1ST STREET) TO IH 35 SB FRONTAGE ROAD

SHEET 1 OF 5

FED RD DIV NO.	FEDERAL AID PROJECT		SHEET NO.
STATE	DISTRICT	COUNTY	
TEXAS	DAL	DENTON	
CONTROL	SECTION	JOB	HIGHWAY
1059	01	047	FM 1173

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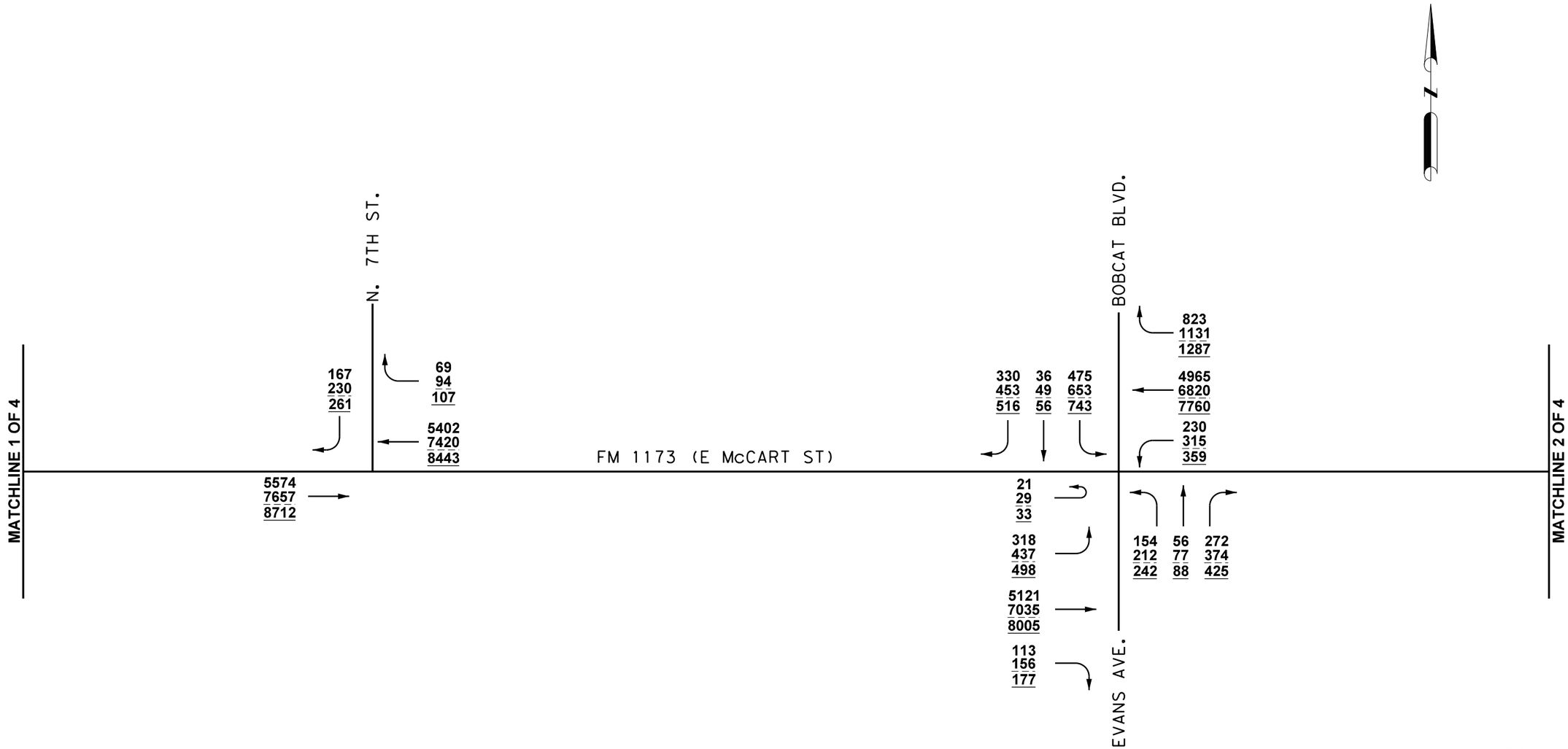

LEGEND

XXX - YEAR 2020 ADT
XXX - YEAR 2040 ADT
XXX - YEAR 2050 ADT

SCALE: N.T.S.

Texas Department of Transportation

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FM 1173

BUILD (2020, 2040, 2050) TRAFFIC PROJECTIONS (ADT) FOR FM 1173 FROM FM 156 (S. 1ST STREET) TO IH 35 SB FRONTAGE ROAD

SHEET 2 OF 5

FED RD DIV NO.	FEDERAL AID PROJECT		SHEET NO.
STATE	DISTRICT	COUNTY	
TEXAS	DAL	DENTON	
CONTROL	SECTION	JOB	HIGHWAY
1059	01	047	FM 1173

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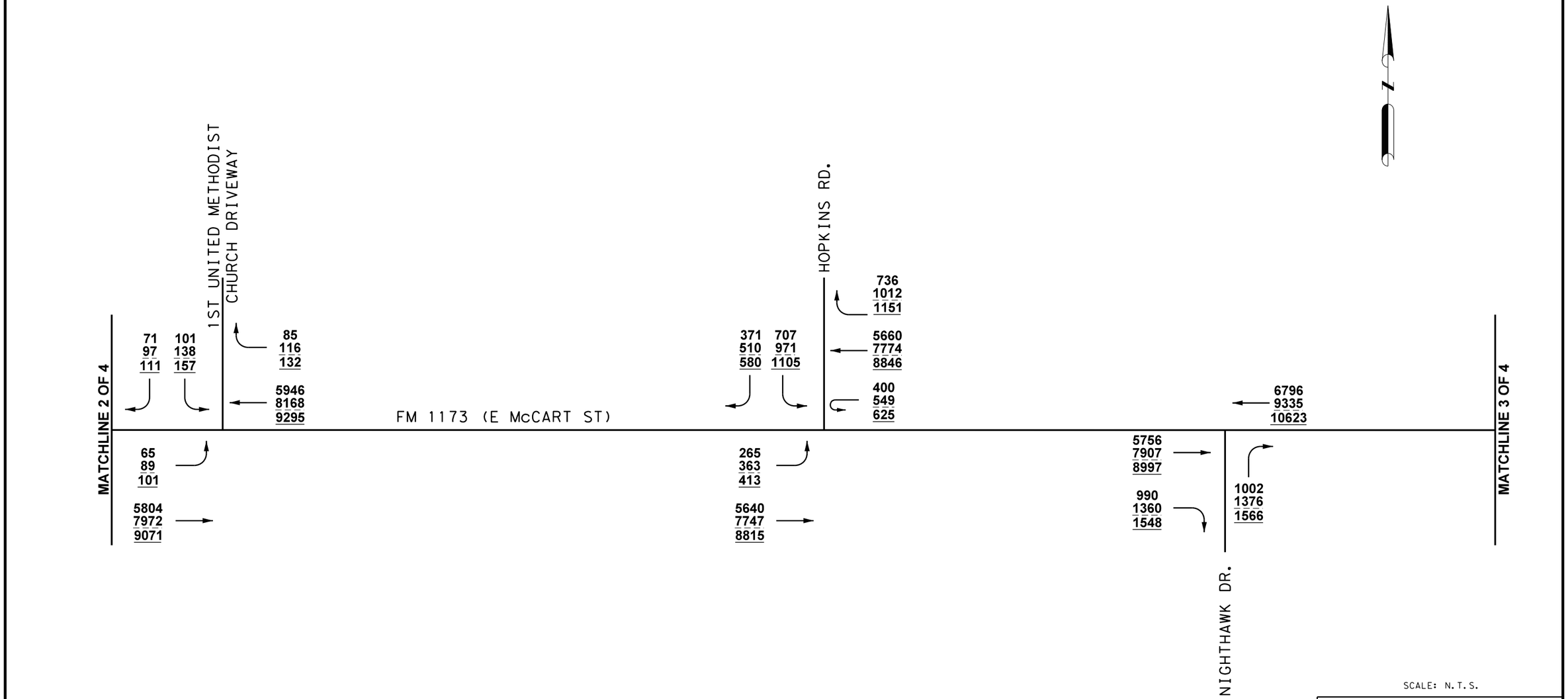

LEGEND

XXX - YEAR 2020 ADT
XXX - YEAR 2040 ADT
XXX - YEAR 2050 ADT

SCALE: N.T.S.

Texas Department of Transportation

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CONSULTANTS
15310 PARK ROW, HOUSTON, TX 77084
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FM 1173

BUILD (2020, 2040, 2050) TRAFFIC PROJECTIONS (ADT) FOR FM 1173 FROM FM 156 (S. 1ST STREET) TO IH 35 SB FRONTAGE ROAD

SHEET 3 OF 5

FED RD DIV NO.	FEDERAL AID PROJECT		SHEET NO.
STATE	DISTRICT	COUNTY	
TEXAS	DAL	DENTON	
CONTROL	SECTION	JOB	HIGHWAY
1059	01	047	FM 1173

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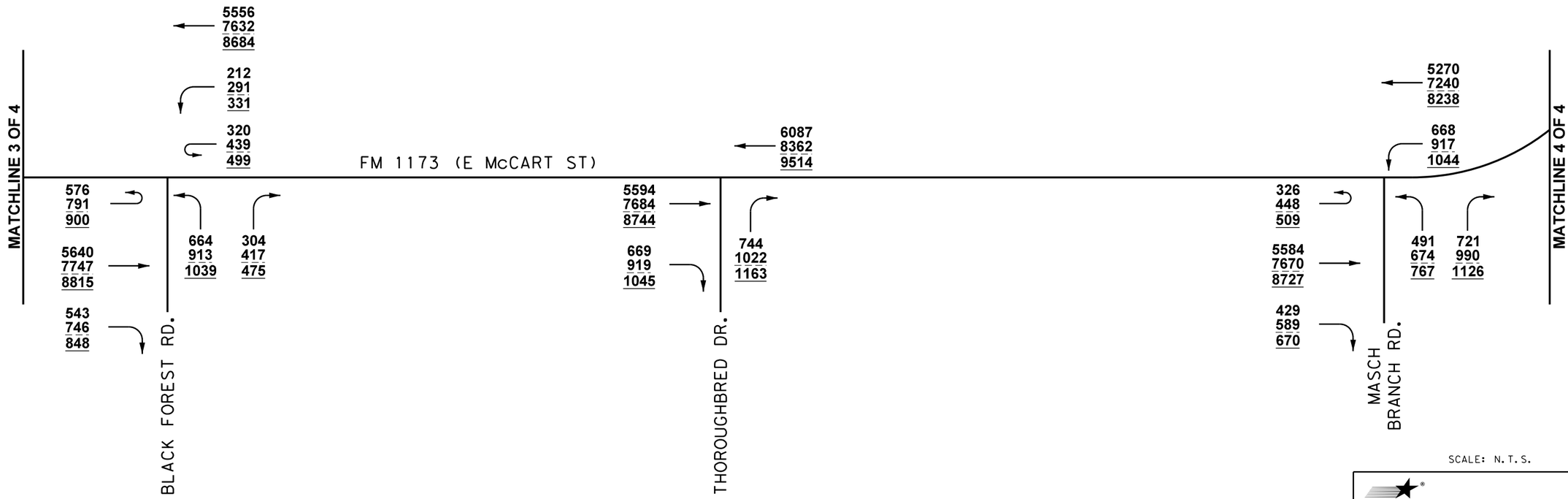

SCALE: N.T.S.

LEGEND

XXX - YEAR 2020 ADT
XXX - YEAR 2040 ADT
XXX - YEAR 2050 ADT

Texas Department of Transportation

AIA ENGINEERS
CONSULTANTS
15310 PARK ROW, HOUSTON, TX 77084
PHONE: (281) 493-4140 F-2801

FM 1173

BUILD (2020, 2040, 2050) TRAFFIC PROJECTIONS (ADT) FOR FM 1173 FROM FM 156 (S. 1ST STREET) TO IH 35 SB FRONTAGE ROAD

SHEET 4 OF 5

FED RD DIV NO.	FEDERAL AID PROJECT		SHEET NO.
STATE	DISTRICT	COUNTY	
TEXAS	DAL	DENTON	
CONTROL	SECTION	JOB	HIGHWAY
1059	01	047	FM 1173

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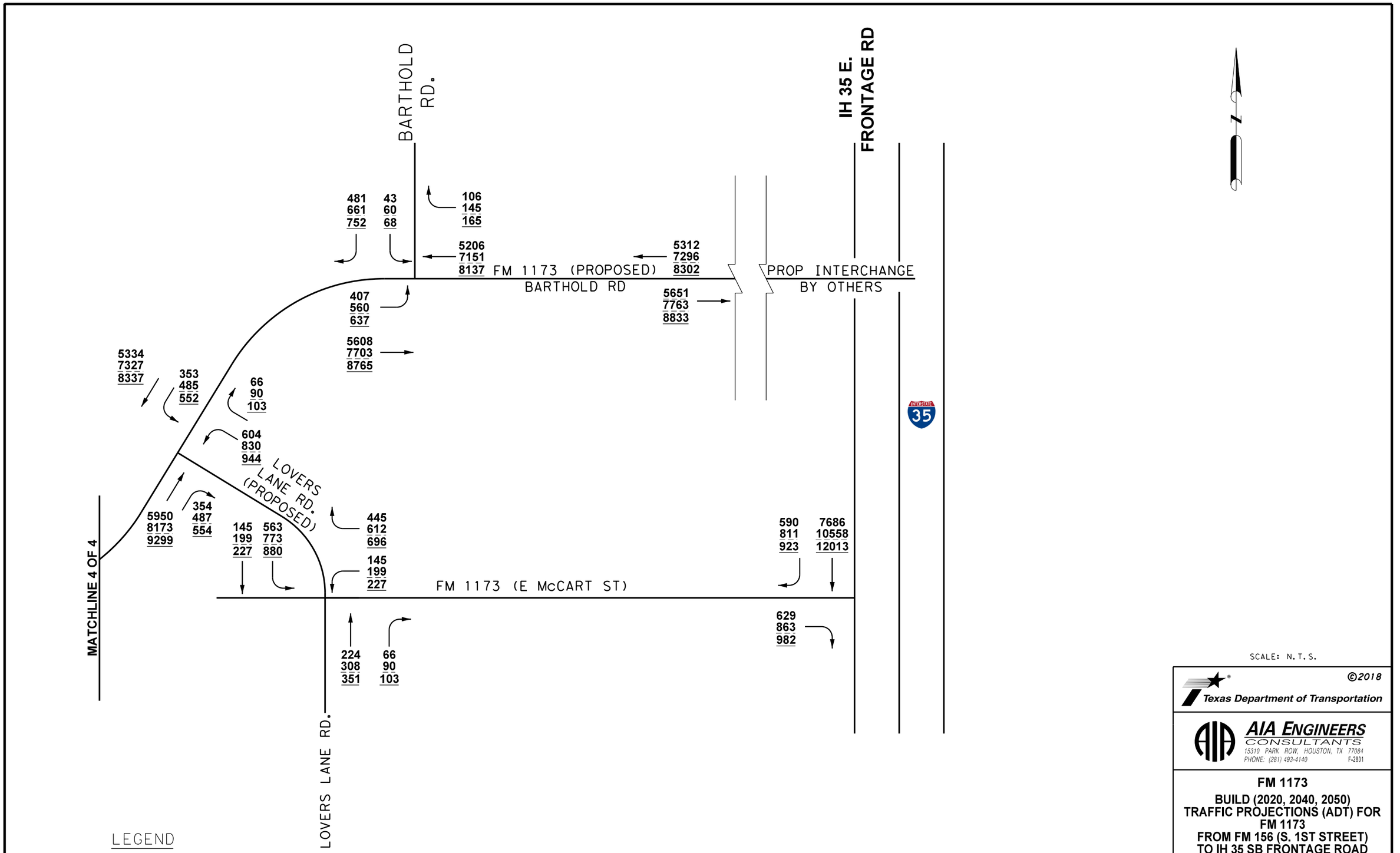

SCALE: N.T.S.

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FM 1173

BUILD (2020, 2040, 2050) TRAFFIC PROJECTIONS (ADT) FOR FM 1173 FROM FM 156 (S. 1ST STREET) TO IH 35 SB FRONTAGE ROAD

SHEET 5 OF 5

FED RD DIV NO.	FEDERAL AID PROJECT		SHEET NO.
STATE	DISTRICT	COUNTY	
TEXAS	DAL	DENTON	
CONTROL	SECTION	JOB	HIGHWAY
1059	01	047	FM 1173

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