Traffic Noise Analysis Report

Farm-to-Market Road 1641 (FM 1641) and FM 548

From: FM 548 to FM 148
and From FM 1641 to US 80
Kaufman County, Texas

Control-Section-Job (CSJ): 1217-01-019 and 2588-01-020
TxDOT – Dallas District

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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The Texas Department of Transportation (TxDOT) Dallas District Office proposes the widening of existing Farm-to-Market (FM) 1641 from FM 548 to FM 148 and FM 548 from FM 1641 to United States (US) 80 in Kaufman County, Texas. This would include widening approximately 0.2 mile of FM 548 and approximately 5.4 miles of FM 1641. The proposed project would reconstruct and widen the section of FM 548 from a four-lane urban roadway and the section of FM 1641 from a two-lane rural roadway to an urban four-lane (ultimately six-lane) section with turn lanes. The Project Description, Project Location Map, Topographic Map, and the FM 1641 Design Schematic can be found in 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

Activity Category	FHWA (dB(A) Leq)	Description of Land Use Activity Areas
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.

Table 2. Traffic Noise Levels dB(A) Leq

Representative Receiver	NAC Category	NAC Level	Existing	Predicted 2045	Change (+/-)	Noise Impact (Yes/No)
R1 - Single-family Residential	B	67	65	69	+4	Yes
R2 - Single-family Residential	B	67	65	69	+4	Yes
R3 - Community Life Church (interior)	D	52	40	40	0[1]	No
R4 - Single-family Residential	B	67	66	70	+4	Yes
R5 - Single-family Residential	B	67	66	65	-1[1]	No
R6 - Single-family Residential	B	67	64	64	0[1]	No
R7 - Henderson Elementary (playground)	C	67	46	50	+4	No
R8 - Single-family Residential	B	67	54	55	+1	No
R9 - Single-family Residential	B	67	57	58	+1	No
R10 - First Presbyterian (playground)	C	67	56	57	+1	No
R11 - Church (playground)	C	67	53	54	+1	No
R12 - Single-family Residential	B	67	56	59	+3	No
R13 - Single-family Residential	B	67	63	66	+3	Yes
R14 - Single-family Residential	B	67	59	63	+4	No
R15 - Noah's Ark (day care, playground)	C	67	61	63	+2	No
R16 - Single-family Residential	B	67	63	65	+2	No
R17 - Single-family Residential	B	67	55	58	+3	No
R18 - Single-family Residential	B	67	59	59	0[1]	No
R19 - Single-family Residential	B	67	52	54	+2	No
R20 - Single-family Residential	B	67	58	58	0[1]	No
R21 - Single-family Residential	B	67	59	62	+3	No
R22 - Single-family Residential	B	67	61	64	+3	No
R23 - Single-family Residential	B	67	61	66	+5	Yes

Representative Receiver	NAC Category	NAC Level	Existing	Predicted 2045	Change (+/-)	Noise Impact (Yes/No)
R24 - Single-family Residential	B	67	64	69	+5	Yes
R25 - Saint Martin of Tours Catholic Church (gaga ball pit)	C	67	53	54	+1	No
R26 - Trinity Family Church (interior)	D	52	40	40	0[1]	No
R27 - Sonic (outdoor seating)	B	67	63	64	+1	No
R28 - Single-family Residential	B	67	60	61	+1	No
R29 - Single-family Residential	B	67	57	58	+1	No
R30 - Single-family Residential	B	67	58	59	+1	No
R31 - Single-family Residential (pool)	B	67	61	61	0[1]	No
R32 - Single-family Residential	B	67	58	59	+1	No
R33 - Single-family Residential	B	67	57	58	+1	No
R34 - Single-family Residential	B	67	51	54	+3	No

[1] – Sound levels are predicted by the traffic noise modeling software to perceptibly increase, remain the same, or decrease due to a change in roadway geometry (moving the traffic to/from the receiver).

As indicated in **Table 2**, the proposed project would result in a traffic noise impact at six 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 four 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 799 feet in length (three barriers, one 246 feet long, one 113 feet long, and two 440 feet long) and 14-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

R23 and **R24**: These receivers represent eight 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 1,686 feet in length (two barriers, one 1,021 feet long and one 665 feet long) and 10-foot tall non-continuous barrier segments would achieve the minimum feasible reduction of 5 dB(A) for five 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

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**).

R1, R2, and **R4**: These receivers represent 29 single-family residences. Based on preliminary calculations, a noise barrier 2,885 feet in length (three barriers, one 1,444 feet long, one 826 feet long, and one 585 feet long) and 10 feet in height along the ROW would reduce noise levels by at least 5 dB(A) for 27 first row receivers and achieve the 7 dB(A) design goal for at least one receiver at a total cost of $513,900 or $19,033 for each benefitted receiver. The estimated cost of the barrier is cost-effective stand alone; therefore, this noise barrier is proposed for incorporation into the proposed project.

Table 3. Noise Barrier Proposal (preliminary)

Barrier	Representative Receivers	Total # Benefited	Length (feet)	Height (feet)	Total Sq. Ft.	Sq. Ft. per Benefited Receptor
1	R1, R2, and R4	27	10	2,885[1]	$513,900	$19,033

Source: Project Team, March 2020.
[1] The proposed barrier consists of three barriers, one 1,444 feet long, one 826 feet long, and one 585 feet long.

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.

Land Use	Impact Contour	Distance from Right of Way
NAC category B & C	66 dB(A)	75 feet
NAC category E	71 dB(A)	30 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 (TPP Approved)

NOISE RECEIVER LOCATION MAP

FARM-TO-MARKET
ROAD (FM) 1641
and FM 548

From FM 548 to FM 148
and from FM 1641 to
United States (US) 80

CSJs: 1217-01-019 & 2588-01-020

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Legend

- Existing Right-of-way
- Proposed Right-of-Way
- Proposed Noise Barrier
- Non-Impacted Noise
- Impacted Noise
- Mitigated Receiver

Base Map Source: TNRIS (2018)

NOISE RECEIVER LOCATION MAP

FARM-TO-MARKET ROAD (FM) 1641 and FM 548

From FM 548 to FM 148 and from FM 1641 to United States (US) 80

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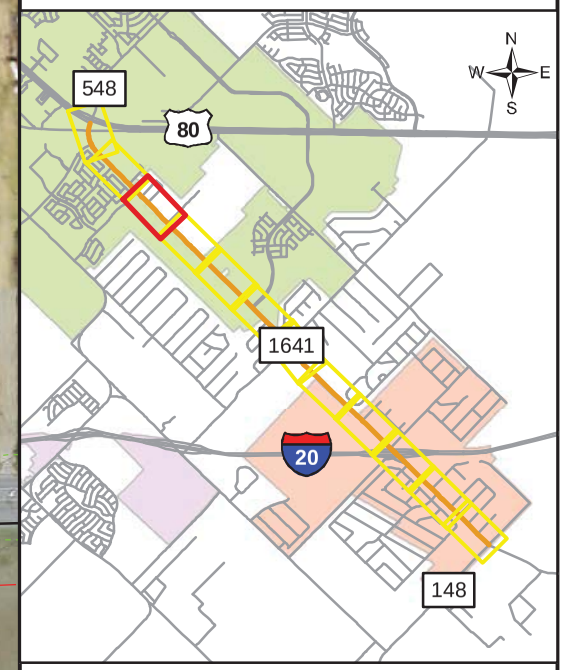

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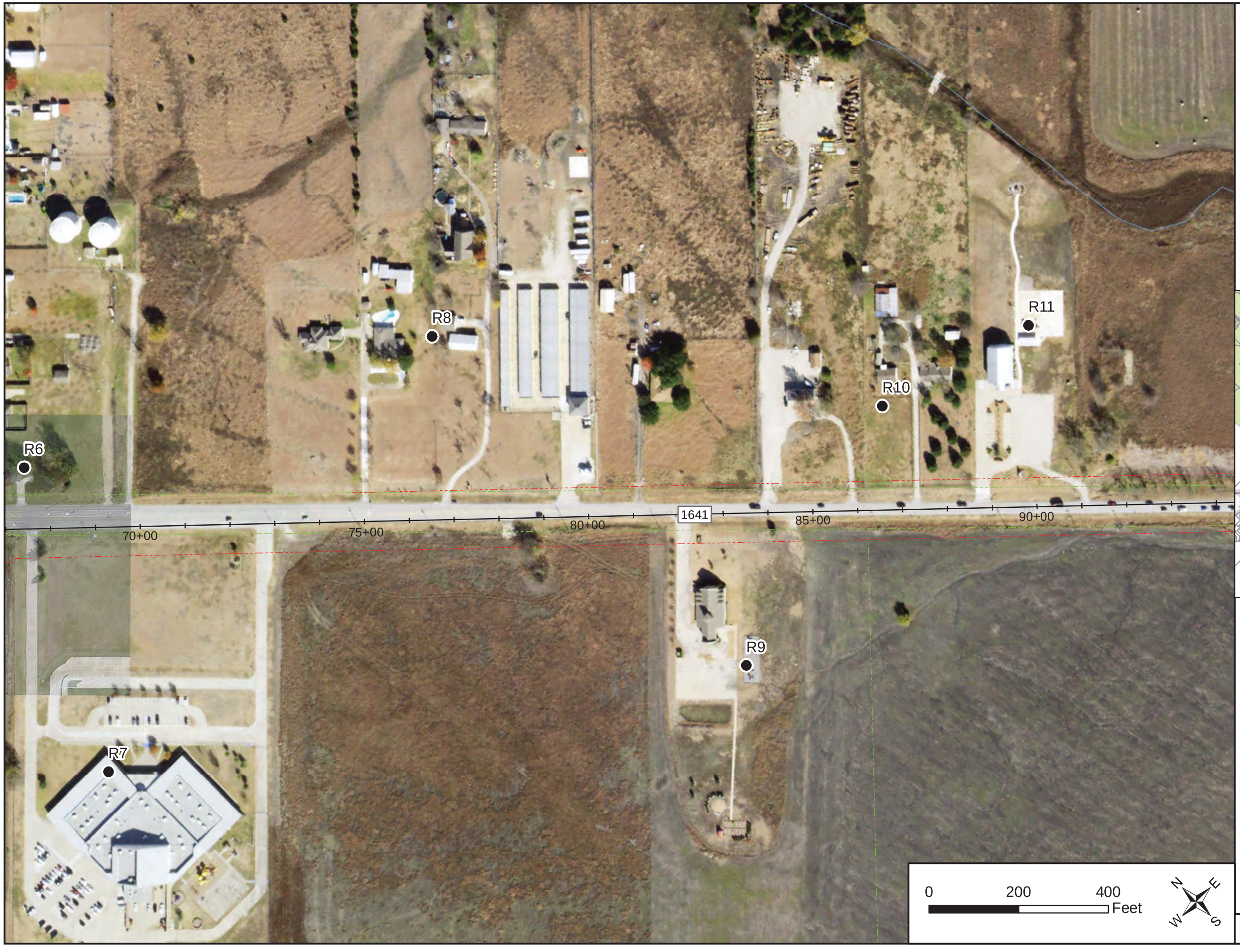

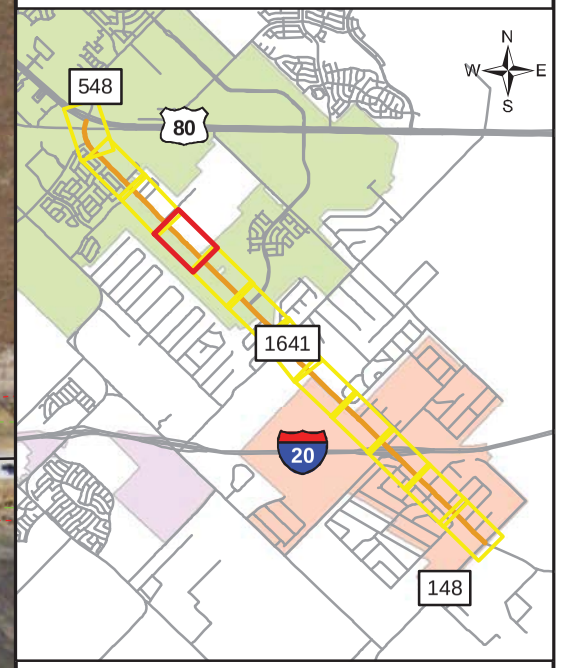

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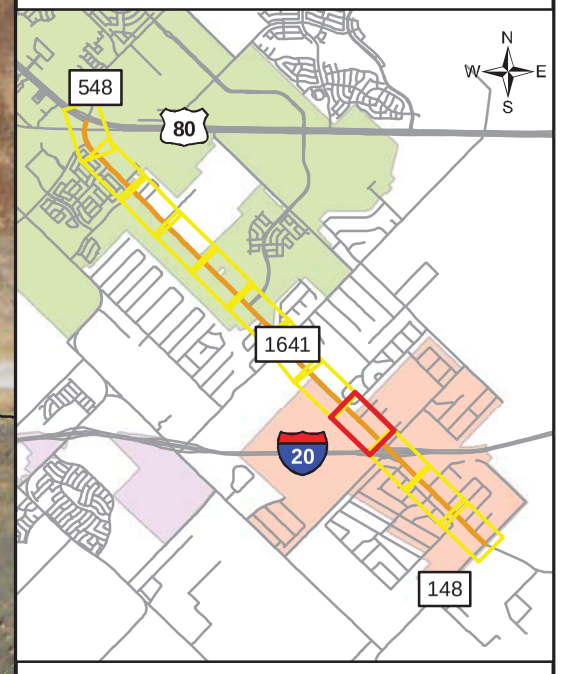

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TRAFFIC ANALYSIS FOR HIGHWAY DESIGN (OPTION C)

Dallas District

November 14, 2019

Description of Location	Average Daily Traffic 2025	Average Daily Traffic 2045	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 (2025 to 2045) Flexible Pavement	S N	Rigid Pavement	SLAB
FM 1641 Section 1 From FM 548 To Helms Trail Kaufman County	17,975	25,250	52 - 48	10.0	4.3	3.2	11,100	50	2,725,000	3	3,609,000	8"

Data for Use in Air & Noise Analysis

Vehicle Class	Base Year % of ADT	Base Year % of DHV
Light Duty	95.7	96.8
Medium Duty	1.5	1.1
Heavy Duty	2.8	2.1

Description of Location	Average Daily Traffic 2025	Average Daily Traffic 2055	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 (2025 to 2055) Flexible Pavement	S N	Rigid Pavement	SLAB
FM 1641 Section 1 From FM 548 To Helms Trail Kaufman County	17,975	28,275	52 - 48	10.0	4.3	3.2	11,200	50	4,374,000	3	5,792,000	8"

TRAFFIC ANALYSIS FOR HIGHWAY DESIGN (OPTION C)

Dallas District

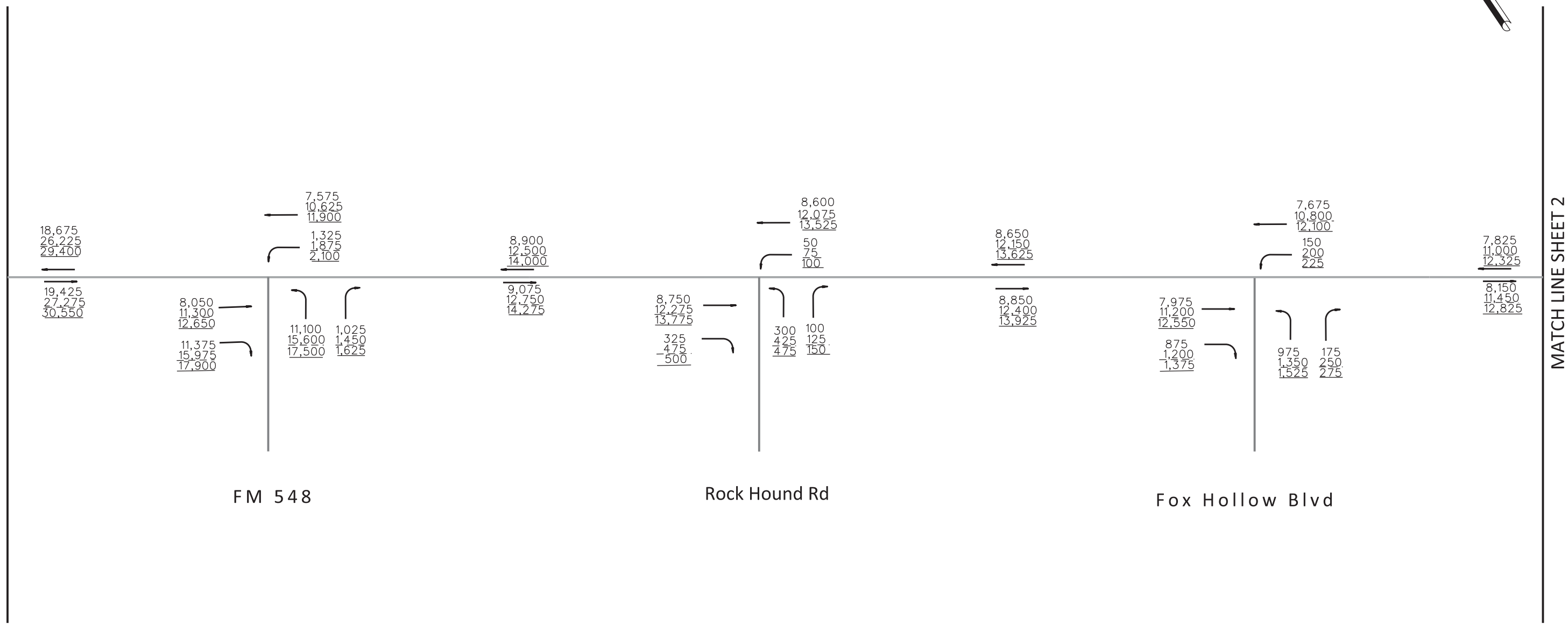
November 14, 2019

Description of Location	Average Daily Traffic 2025	Average Daily Traffic 2045	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 (2025 to 2045) Flexible Pavement	S N	Rigid Pavement	SLAB
FM 1641 Section 2 From Helms Trail To FM 148 Kaufman County	10,150	14,300	52 - 48	10.0	4.9	3.7	10,900	50	1,753,000	3	2,323,000	8"

Data for Use in Air & Noise Analysis

Vehicle Class	Base Year % of ADT	Base Year % of DHV
Light Duty	95.1	96.3
Medium Duty	1.7	1.3
Heavy Duty	3.2	2.4

Description of Location	Average Daily Traffic 2025	Average Daily Traffic 2055	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 (2025 to 2055) Flexible Pavement	S N	Rigid Pavement	SLAB
FM 1641 Section 2 From Helms Trail To FM 148 Kaufman County	10,150	15,975	52 - 48	10.0	4.9	3.7	10,900	50	2,809,000	3	3,724,000	8"



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BIDDING, OR PERMIT PURPOSES.
JACOBS ENGINEERING GROUP INC.
FIRM #2966
EDWARD J. PULTORAK, P.E.
TX PE #93881

LEGEND

TRAVEL DIRECTION
XX,XXX 2025 ADT
XX,XXX 2045 ADT
XX,XXX 2055 ADT

JACOBS
777 MAIN STREET
FORT WORTH, TX 76102-5300
Phone 817.735.6000
Firm Registration F-2966

LTRA
Lina T. Ramey & Associates, Inc.
3320 Belt Line Rd
Farmers Branch, Texas 75234
TBPE Registration No. F-782

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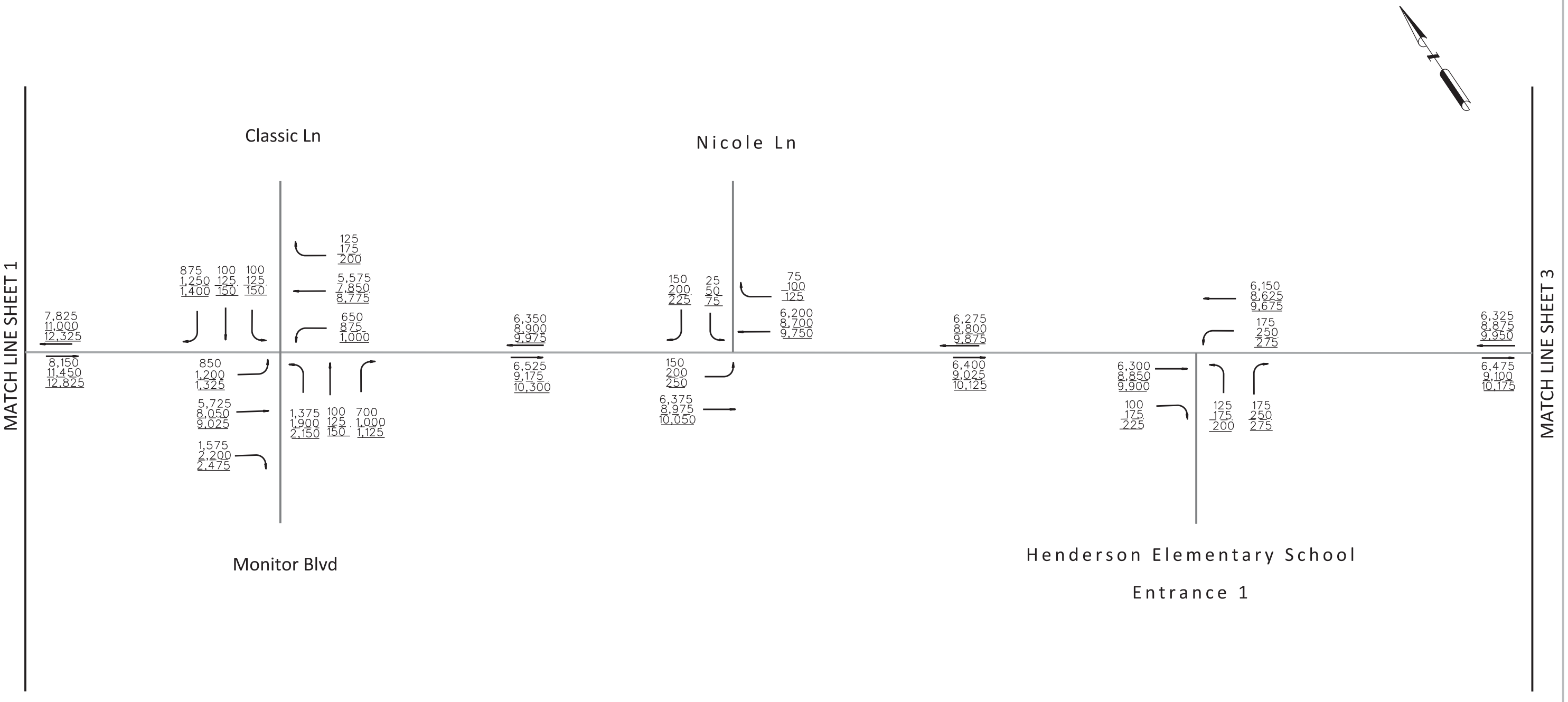
SHEET 1 OF 7

FM 1641
FROM FM 548 TO FM 148
NO-BUILD LINE DIAGRAM
NOVEMBER 2018



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LEGEND

TRAVEL DIRECTION
XX,XXX 2025 ADT
XX,XXX 2045 ADT
XX,XXX 2055 ADT

JACOBS
777 MAIN STREET
FORT WORTH, TX 76102-5300
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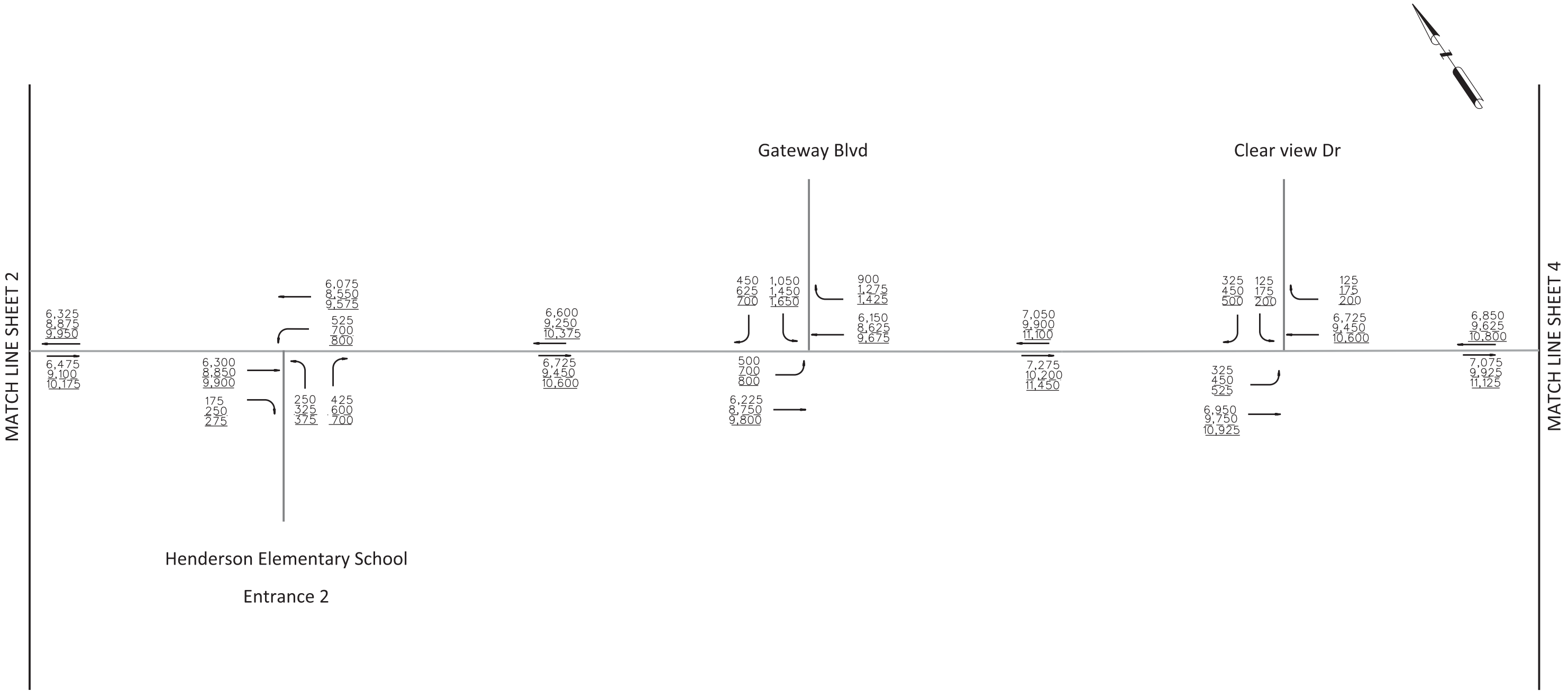
SHEET 2 OF 7

FM 1641
FROM FM 548 TO FM 148

NO-BUILD LINE DIAGRAM

NOVEMBER 2018



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JACOBS ENGINEERING GROUP INC.
FIRM #2966
EDWARD J. PULTORAK, P.E.
TX PE #93881

LEGEND

→ TRAVEL DIRECTION
XX,XXX 2025 ADT
XX,XXX 2045 ADT
XX,XXX 2055 ADT

JACOBS
777 MAIN STREET
FORT WORTH, TX 76102-5300
Phone 817.735.6000
Firm Registration F-2966

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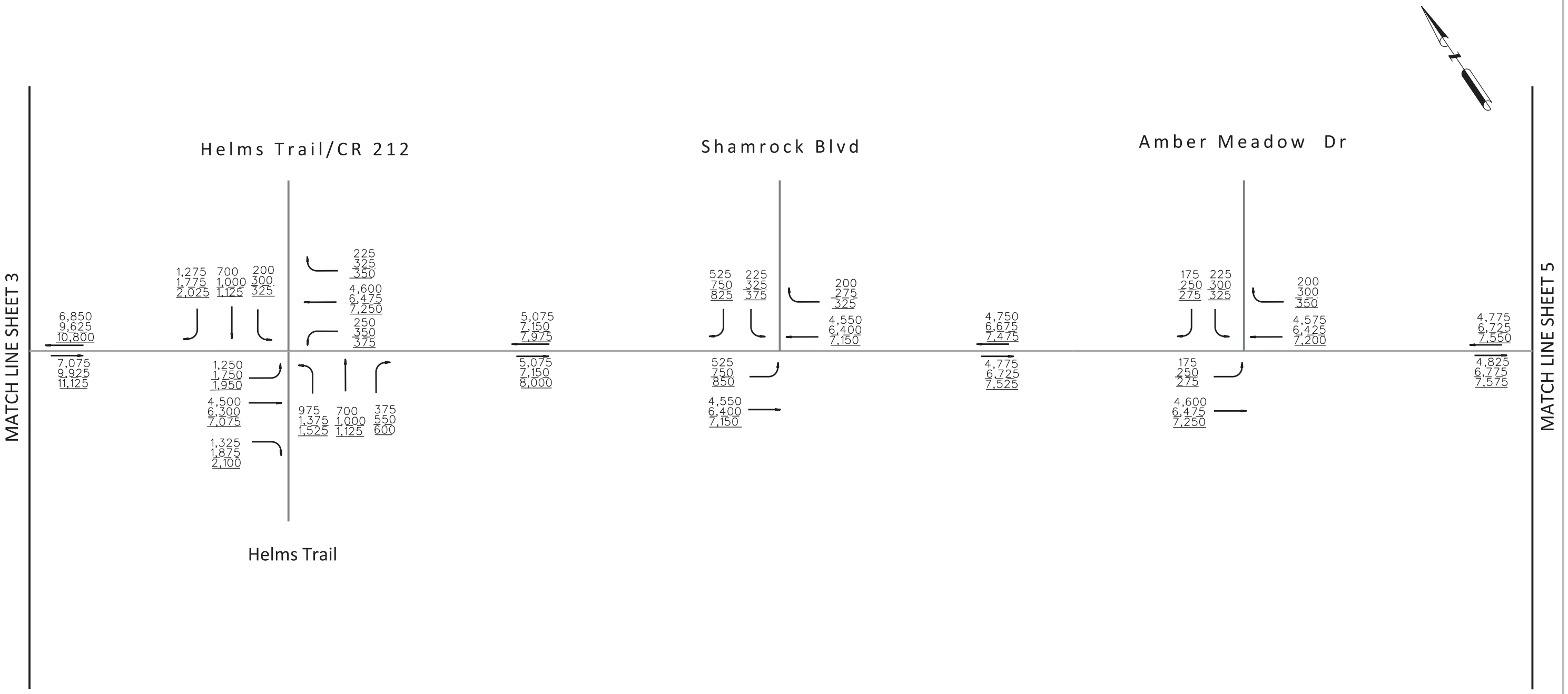
SHEET 3 OF 7

FM 1641
FROM FM 548 TO FM 148

NO-BUILD LINE DIAGRAM

NOVEMBER 2018



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JACOBS ENGINEERING GROUP INC.
FIRM #2966
EDWARD J. PULTORAK, P.E.
TX PE #93881

LEGEND

TRAVEL DIRECTION
XX,XXX 2025 ADT
XX,XXX 2045 ADT
XX,XXX 2055 ADT

JACOBS
777 MAIN STREET
FORT WORTH, TX 76102-5300
Phone 817.735.6000
Firm Registration F-2966

LTRA
Lina T. Ramey & Associates, Inc.
3320 Belt Line Rd
Farmers Branch, Texas 75234
TBPE Registration No. F-782

Texas Department of Transportation

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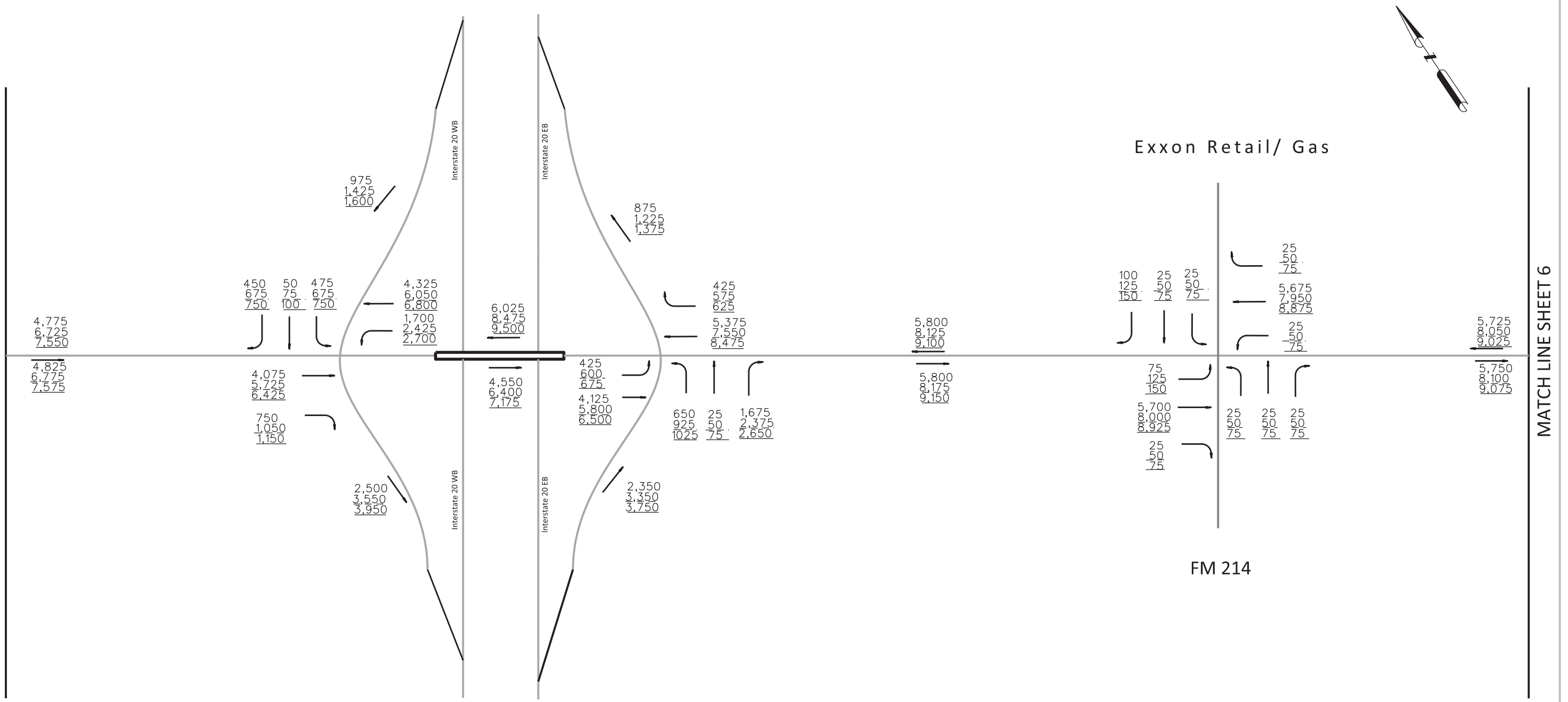
SHEET 4 OF 7

FM 1641
FROM FM 548 TO FM 148

NO-BUILD LINE DIAGRAM

NOVEMBER 2018



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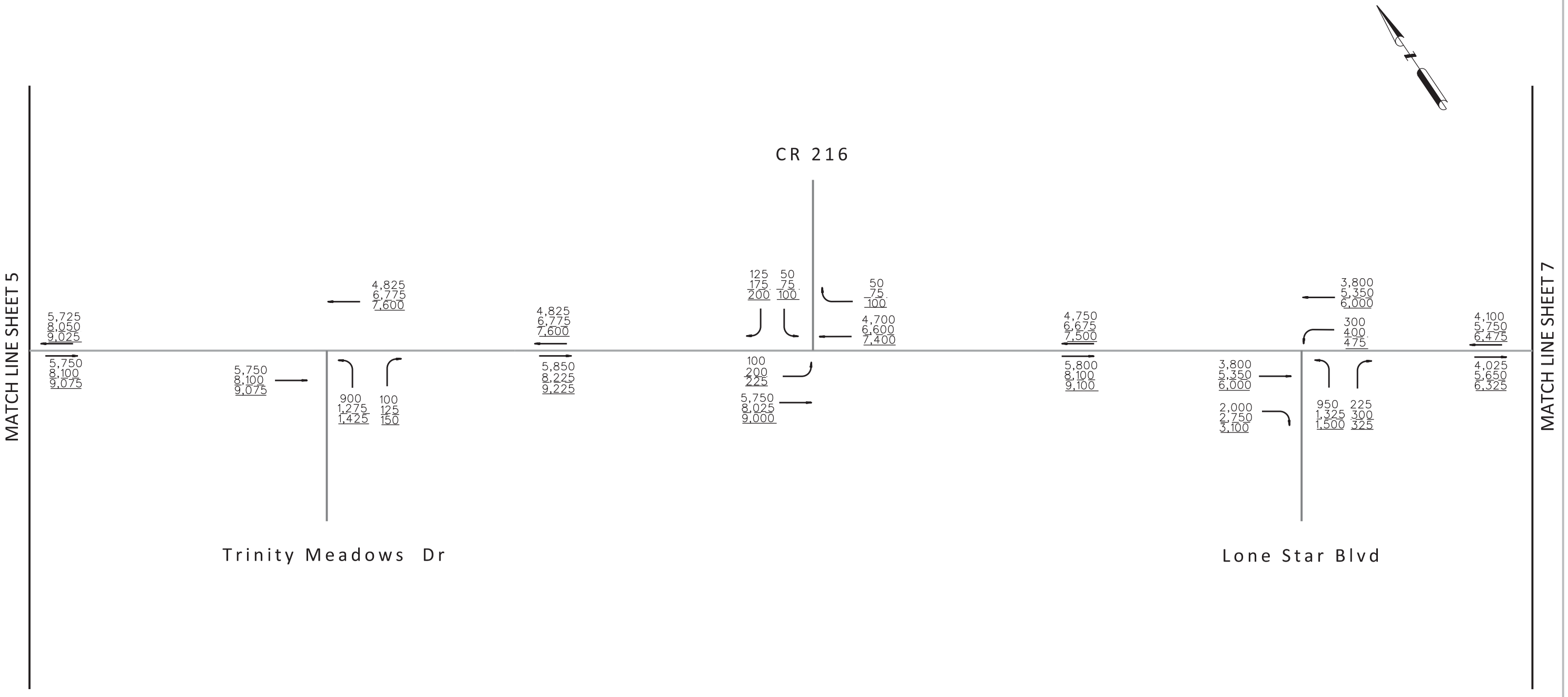
FM 1641
FROM FM 548 TO FM 148

NO-BUILD LINE DIAGRAM

NOVEMBER 2018



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FM 1641
FROM FM 548 TO FM 148

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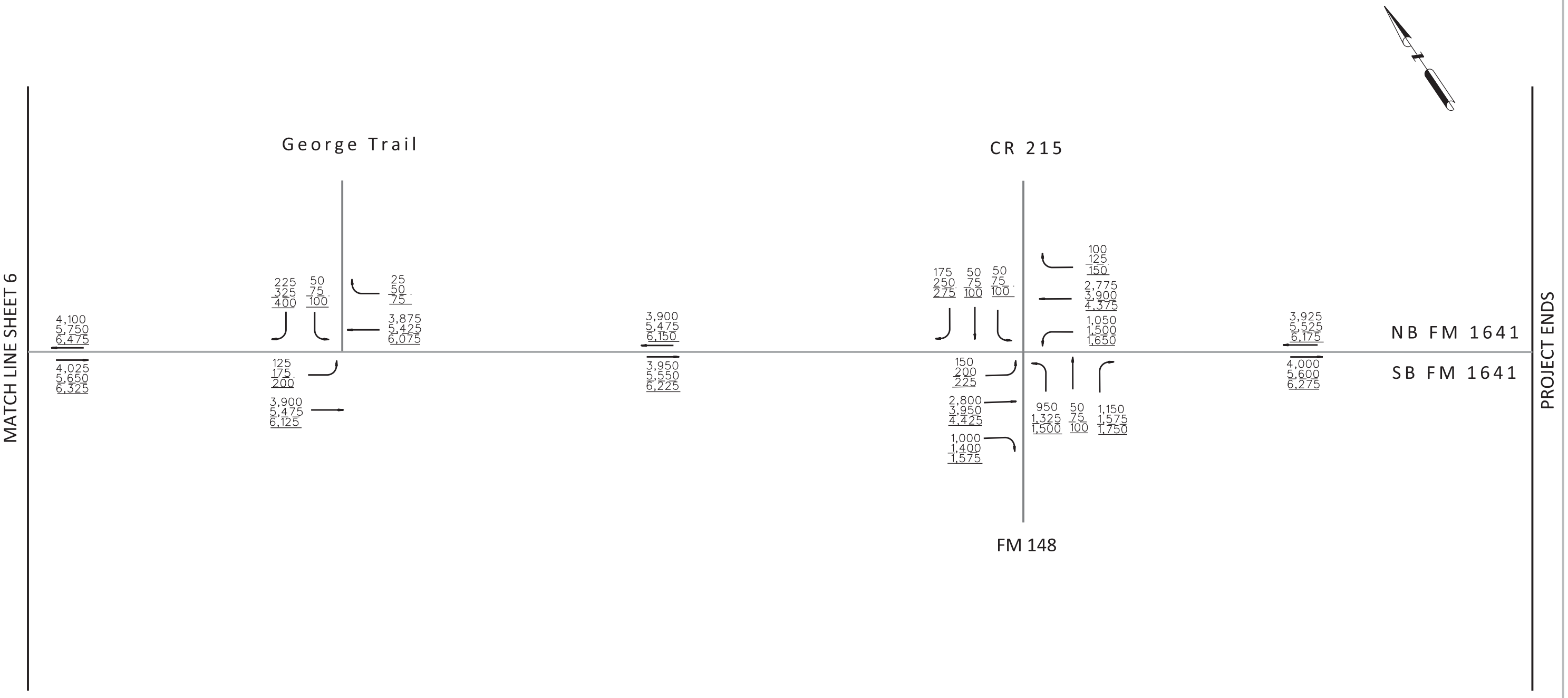
NOVEMBER 2018



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NO-BUILD LINE DIAGRAM

NOVEMBER 2018