



FM 407 Feasibility Study REPORT

From West of FM 156 to FM 1830

DENTON COUNTY, TEXAS

CSJ: 1310-01-045

December 10, 2020

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1.0 Introduction

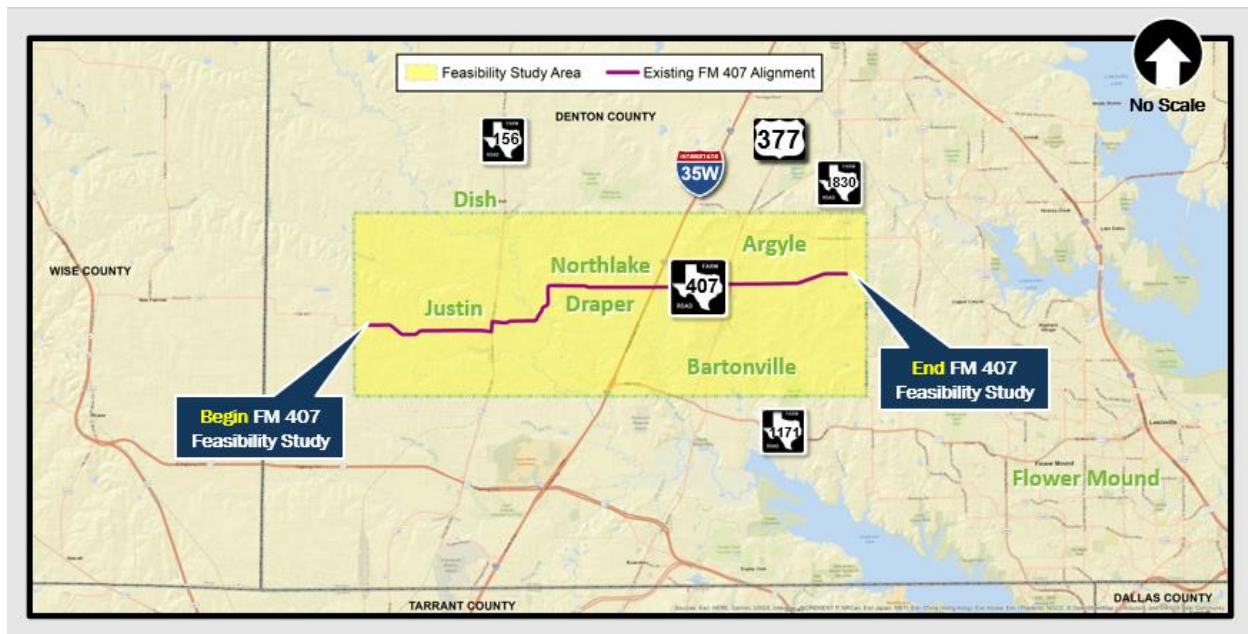
The Texas Department of Transportation (TxDOT) Dallas District Office initiated a Farm-to-Market (FM) 407 Roads Feasibility Study in 2018 to identify road-related capacity and operational improvements along the FM 407 corridor in Denton County. The Feasibility Study Report herein identifies the FM 407 improvement alternatives which were studied, presents the ultimate recommended FM 407 alternative improvements, and discusses the potential benefits and impacts of constructing the improvements.

Civil Associates, Inc. was contracted by TxDOT to conduct this study which is intended to serve as a baseline for future, more detailed FM 407 designs and evaluations undertaken by TxDOT to further analyze, design and construct the FM 407 improvements. The study purpose was producing and evaluating conceptual alternative solutions to improve FM 407 travel conditions through Year 2045, namely Traffic Operations, Mobility, and Reliability improvements and after doing so recommended an FM 407 improvement solution. Traffic operations assessments included current (near-term) and projected (long-term) traffic growth / travel demand, along FM 407 and at each major cross-street which intersects FM 407, in order to provide a solution to improve the FM 407 travel conditions, access and travel safety while foremost adhering to TxDOT's Roadway Design Manual and Access Management Manual guidelines.

A feasibility study is one planning tool TxDOT uses when a project is in the very early stages of development. It helps determine if the project should progress forward to more advanced phases of project development such as more in-depth environmental analysis, public involvement, schematic design and right of way (ROW) mapping pursuant to National Environmental Policy Act (NEPA) guidelines. The reason this type of study is performed is to identify high level fatal flaw elements or critical engineering design elements, impacts to stakeholders and the public, and the economic feasibility of installing potential new roadways or improvements to existing roadways. The study is also an informational resource to assist decision-makers in identifying the potential cost, environmental and ROW acquisition needs and impacts, and accessing impacts and accommodation adjustments.

The studied FM 407 corridor is approximately 13 miles in length and spans from West of FM 156 (in the City of Justin) eastward to FM 1830 (in the Town of Argyle). FM 407 Study Area is located in Denton County and spans the municipalities of Argyle, Bartonville, Denton County, Dish, Draper, Flower Mound, Justin, and Northlake as indicated on **FIGURE 1: FM 407 Study Location Map**.

Figure 1: FM 407 Study Location Map



FM 407 is identified as a Major / Minor Arterial in north Texas' Metropolitan Transportation Plan known as *Mobility 2045* which is overseen by the North Central Texas Council of Governments (NCTCOG), the local Metropolitan Planning Organization. In addition, Denton County's current Thoroughfare Plan (dated March 13, 2017) predominately lists FM 407 as a Major Arterial composed of six total travel lanes (three lanes in each direction separated by a roadway median).

The FM 407 study team assembled by the TxDOT Dallas District coordinated the study aspects and solution pursuit and speculation process by conducting Public Meetings and municipality (agency) outreach meetings composed of the various FM 407 corridor stakeholders, namely:

- Denton County
- Town of Argyle
- Town of Bartonville
- Town of Dish
- Town of Draper
- Town of Flower Mound
- City of Justin
- Town of Northlake
- US Army Corps of Engineers (USACE)
- North Central Texas Council of Governments (NCTCOG)
- Burlington Northern and Santa Fe Railway (BNSF RR)
- Union Pacific Railroad (UP RR)
- Multiple Utility Companies
- Multiple TxDOT Offices

The public and agency meetings conducted by the study team encouraged all-inclusive input to ideally arrive at consensus solutions to improve the FM 407 corridor. The meetings included study information-sharing, discussing study aspects and evaluation results, and conceptual FM 407 Build Alternatives (improvement solutions) and a comparison No Build or Do Nothing Alternative. The development of the Build Alternatives, and the production of an ultimate study-recommended Build Alternative, was guided by the following goals:

- Comparison the No Build and Build Alternatives;
- Production and evaluation of forecasted Design Year 2045 FM 407 Traffic Volumes (Travel Demand) within the FM 407 corridor;
- Incorporation of current roadway design and safety standards;
- Evaluation of Traffic Safety aspects;
- Minimizing the Build Alternative impacts; and
- Coordination with local municipalities and stakeholders.

As shown in the **Traffic Operational Analyses Report** produced for study and provided in the **APPENDIX**, Year 2018 peak hour traffic flows [Levels of Service (LOSs)] at the FM 407 signalized cross-street intersections, including the FM 407 / I-35W Frontage Road intersections, are predominately LOS F with the exception of one intersection which ranges from LOS D to E. These LOSs pertain to the worst case overall operating (LOS) condition during the morning or evening peak hour. As noted in the **Traffic Operational Analyses Report**, travel demand (traffic volume growth) along the corridor is projected to continue increasing through the year 2045.

The study-generated **Traffic Forecasting Methodology** calculations and the year 2045 **Traffic Projections** produced during the study are also provided in the **APPENDIX** and have been reviewed by the TxDOT Dallas District and the Texas Transportation Institute. The environmental analysis performed by the team primarily relied on existing environmental databases supplemented by inventory information which was partially obtained during the study team's field reconnaissance. Additional data pertaining to demographic and socioeconomic conditions for the region and the FM 407 corridor were obtained from Denton County, NCTCOG and other oversight agencies.

Based on the study purpose and study goals, the study's production and evaluation of the No Build Alternative and conceptual Build Alternatives factored in public and municipality / agency outreach and input. Described below, and visually presented on the color-coded **Build Alternative Alignment Concepts Diagrammatic** exhibit located in the **APPENDIX**, each alternative was also assessed for compatibility with the regional Metropolitan Transportation Plan and Regional Veloweb, known as *Mobility 2045*, municipal Thoroughfare Plans, and factored in environmental and design constraints and traffic operations and functionality. The alternatives are also visually presented in **FIGURE 2**.

No Build Alternative

FM 407 transportation improvements would not be constructed. This comparison alternative does not improve FM 407 beyond prior FM 407 improvement commitments and routine FM 407 road maintenance. The regional (*Mobility 2045*) improvements are assumed to be in place and operational with the exception of FM 407 improvements.

Green Build Alternative

This alignment predominately followed the existing FM 407 roadway centerline and spanned from Florance Road in Northlake eastward to the study's eastern study termini at FM 1830. This alignment also entailed two FM 407 / US 377 interchange options: intersecting the US 377 facility and the UP RR at-grade, or bridging / overpassing US 377 and the UP RR.

The following alternatives focused the City of Justin region of the studied corridor and each were intended to tie directly to the Green Alternative

Blue Build Alternative

This northernmost new location alignment spanned from Florance Road on predominately new location westward / northwestward, overpasses and connects to FM 156 via loop ramps, and tied directly to the west-east FM 1384 facility until bypassing the City of Justin when it turns directly southward and eventually tied to existing FM 407 west of Justin / FM 156.

Brown Build Alternative

Located south of the Blue Alternative and within Justin, this westward new location alignment spanned from Florance Road on new location and terminated at the north-south FM 156 facility within Justin via entrance and exit vehicular loop ramps to / from FM 156.

Red Build Alternative

Located south of the Brown Alternative and within Justin, this new location alignment spanned from Florance Road southwestward and was located to supplant or be located south of the east-west 12th Street facility, and at the western limit of 12th Street, veered directly southward before it tied directly to existing FM 407 west of Justin / FM 156 / Boss Range Road.

One-Way Couplet Build Alternative

This alignment veered immediately southwestward from Florance Road on predominately new location and 1) the westbound travel lanes veered along the existing west-east segment of FM 407 (which is also signed locally within Justin as E. 5th Street), and 2) the eastbound travel lanes veered southwestward on new location and tied directly into the existing FM 407 facility within Justin (west of FM 156) and continuing westward to the study's western termini west of Boss Range Road.

Purple Build Alternative

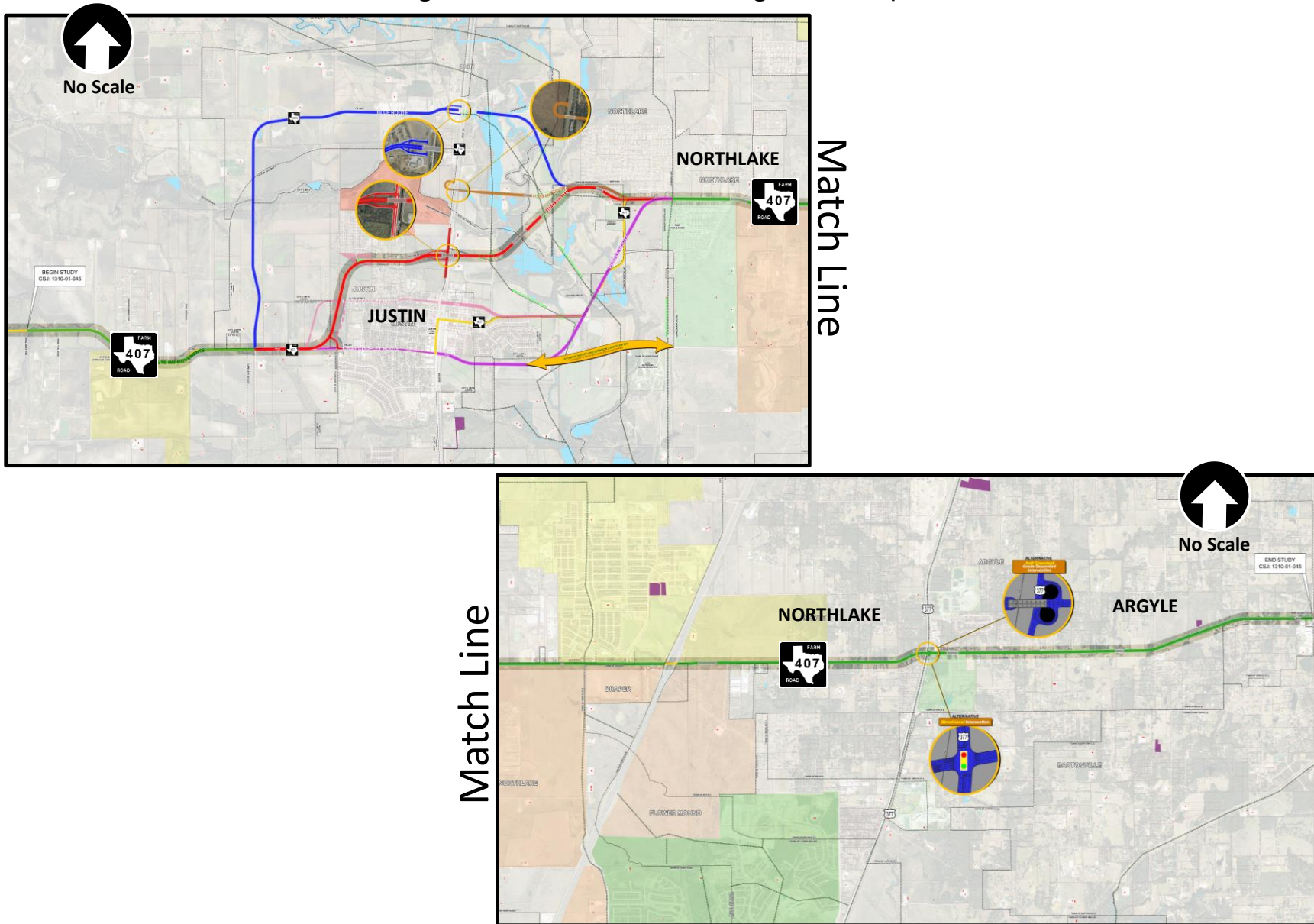
This southernmost alignment veered immediately southwestward of Florance Road and followed the Couplet Alternative's eastbound travel lanes but did not align with E. 5th Street, and unlike the Couplet Alternative was a two-way facility.

Each studied build alternative could be implemented over different time periods based on localized congestion relief needs and construction funding availability. Another potential mobility improvement considered by the study to further alleviate the FM 407 travel conditions and traffic volume demand, as well as serve future, planned, ongoing development between FM 156 in Justin and I-35W, was to potentially supplement the ultimate build alternative. This supplemental option which is also presented on the **Build Alternative Alignment Concepts Diagrammatic** exhibit located in the **APPENDIX**, entailed a new location facility which spanned from FM 156 in Justin eastward along Downe Road and

proceeded further eastward, and linked the east-west Mulkey Lane facility and eventually linked the north-south I-35E facility.

The following chapters within this report summarize the FM 407 Feasibility Study approach and evaluations and present the study findings, recommendation, and conclusions.

Figure 2: FM 407 Build Alternative Alignment Concepts



2.0 Purpose and Need

The need to improve the two-lane FM 407 facility is becoming more apparent as the Justin, Northlake and Argyle municipalities within the FM 407 corridor continue to grow in population and development, notably residential housing development which is a forerunner to increased commuter traffic and increasing service provider and first responder vehicles serving the residences. Also, commuter traffic is not limited to FM 407, but is also continuing to increase along the north-south facilities which intersect FM 407: FM 156, I-35E, US 377 and I-35W. Improving the FM 407 travel conditions, namely the Traffic Operations, Mobility, and Reliability, would provide several resulting benefits including: increased incident management capability; a timely means for FM 407 common and travelers and emergency vehicles to navigate across the BNSF RR tracks in Justin; optimal FM 407 access to and from adjacent property sites; improved management of stormwater within the ROW (curb-and-gutter drainage vs. the existing open ditch drainage); and improved traffic safety via a raised curbed median with optimum median openings for the lower speed cross-street traffic accessing FM 407.

Travel safety alone perhaps warrants improving the FM 407 facility due to crashes and fatalities which have occurred along the facility which crosses two railroads and intersects FM 156, I-35E, US 377 and the I-35W frontage roads. The geometric alignment of existing FM 407 is unconventional by current roadway design standards and driver expectations. Due to the geometry and the current urban and rural aspects associated with the facility, the posted travel speed is not consistent and differs along the facility. Also, the multiple cross-streets and driveways accessing FM 407 create major points of conflict between these low-speed turning movements and the higher-speed, two-way FM 407 traffic. These crossings continue to be a traffic safety concern due to increasing populations and ongoing corridor development located adjacent to the FM 407 facility, notably residential housing developments.

2.1 Regional Growth

The State of Texas has been one of the fastest growing states in the nation, due in part to the significant growth occurring in the DFW region (Collin, Hunt, Rockwall, Dallas, Kaufman, Ellis, Johnson, Tarrant, Parker, Wise, and Denton Counties). Locally, the Dallas-Fort Worth (DFW) region has consistently been one of the fastest growing metropolitan regions in the country which results in increased travel demand within each regional community and along regional facilities such as I-35W and US 377 and adjacent intersecting facilities such as FM 407. According to the US Census, the DFW region has grown by approximately 2.8 million people between 1990 and 2015. In 2015, the region reached an estimated 6.8 million people and is officially the fourth-largest urbanized area in the United States, behind New York City, Los Angeles, and Chicago.

Population density, size, and profiles were analyzed in *Mobility 2045* to assist in identifying areas where transportation improvements are determined to be needed. Existing and projected population data is discussed within *Mobility 2045* as follows:

- In 2010, the 12-county DFW region had a population of approximately 6.4 million persons. By 2045, the population of the 12-county Metropolitan Planning Area (MPA) is projected to be 11.2 million persons; an increase of approximately 75 percent over the 2010 population.

- The 2017 population of Denton County totaled 804,396 persons. In 2045, the population is projected to be 1,346,316 persons; an increase of 541,920 persons (67 percent) over the 2017 population.

- The Texas Water Development Board (TWDB) conducts population projections to assist in regional water planning. **TABLE 1** lists the TWDB's 2016 *Regional Water Plan - Population Projections* for the *Plan*-listed municipalities located within the FM 407 study area (Note: For some small municipalities listed in the *Plan*, the 2040 and 2070 populations listed within the *Plan* are the same).

Table 1: Projected Populations for the Municipalities in the FM 407 Study Area

CITY	YEAR		
	2020	2040	2070
Argyle	6,000	13,000	13,000
Bartonville	4,500	5,000	5,000
Denton County	901,645	1,348,271	2,090,485
Dish	Unavailable		
Draper	Unavailable		
Flower Mound	75,555	93,000	93,000
Justin	4,650	12,000	12,000
Northlake	4,500	31,010	55,000

Source: TWDB 2016 Regional Water Plan.
<https://www.twdb.texas.gov/waterplanning/data/projections/2017/popproj.asp> (Accessed 10-06-2020)

According to the NCTCOG, 4,584,235 persons were employed in the 12-county MPA in 2017. By 2045, 7,024,227 persons are projected to be employed in the 12-county MPA; an increase of 53 percent over 2017 employment numbers. In Denton County, 298,071 persons were employed in 2017. As shown in **FIGURE 3**, the County employment is projected to increase to 479,619 persons in 2045; an increase of 181,548 persons (61 percent) compared to the 2017 employed persons.

Figure 3: Forecasted Employment Growth by County (2017 to 2045)

County	2017 Employment	2045 Employment	Growth	
Collin	542,493	835,342	292,849	54%
Dallas	2,147,027	3,298,213	1,151,186	54%
Denton	298,071	479,619	181,548	61%
Ellis	68,913	102,692	33,779	49%
Hood	23,703	31,723	8,020	34%
Hunt	45,548	72,658	27,110	60%
Johnson	75,452	111,301	35,849	48%
Kaufman	46,312	68,285	21,973	47%
Parker	62,665	86,890	24,225	39%
Rockwall	39,879	58,611	18,732	47%
Tarrant	1,196,521	1,827,385	630,864	53%
Wise	37,651	51,508	13,857	37%
Totals	4,584,235	7,024,227	2,439,992	53%

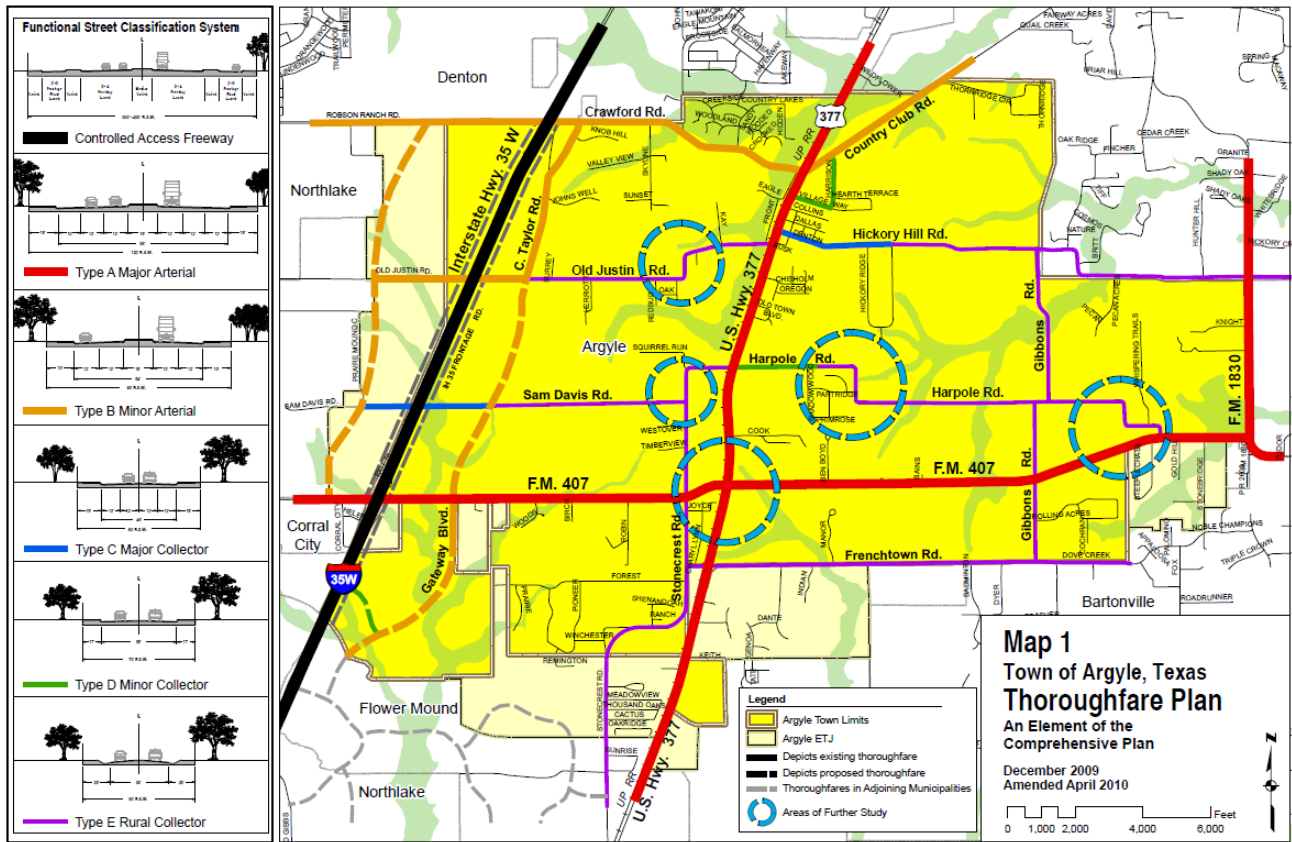
Source: NCTCOG, 2019

Future Land Use Plans and Thoroughfare Plans

The FM 407 study area municipalities of Argyle, Bartonville, Denton County, Dish, Draper, Flower Mound, Justin, and Northlake are growing communities within North Texas. FM 407 directly or indirectly serves each of these Denton County communities and therefore, is considered a significant transportation corridor as shown on each of the following municipal and Denton County maps which were available at the time this FM 407 Feasibility Study Report was prepared.

The land use plan for the Town of Argyle presented in **FIGURE 4** identifies FM 407 as a Major Arterial, and specifies improving FM 407 to a six-lane, curb-and-gutter arterial. The land use plan also specifies the need to study the major transportation interchange of FM 407 / US 377.

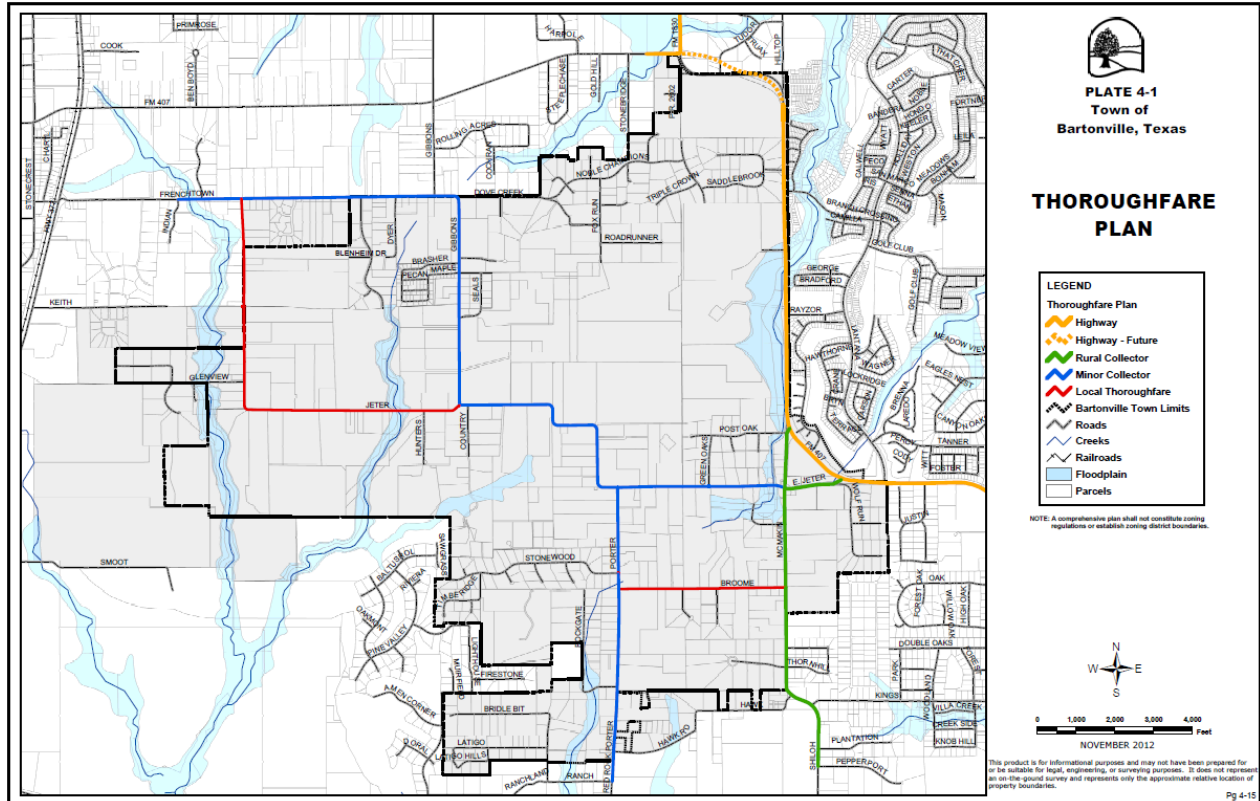
Figure 4: Town of Argyle Thoroughfare Plan



Source: Town of Argyle (October 2020)

As indicated in **FIGURE 5** Town of Bartonville Thoroughfare Plan, the Plan's designated, future improvements to FM 407 is limited due to the Bartonville's jurisdictional limits being predominately beyond the FM 407 corridor.

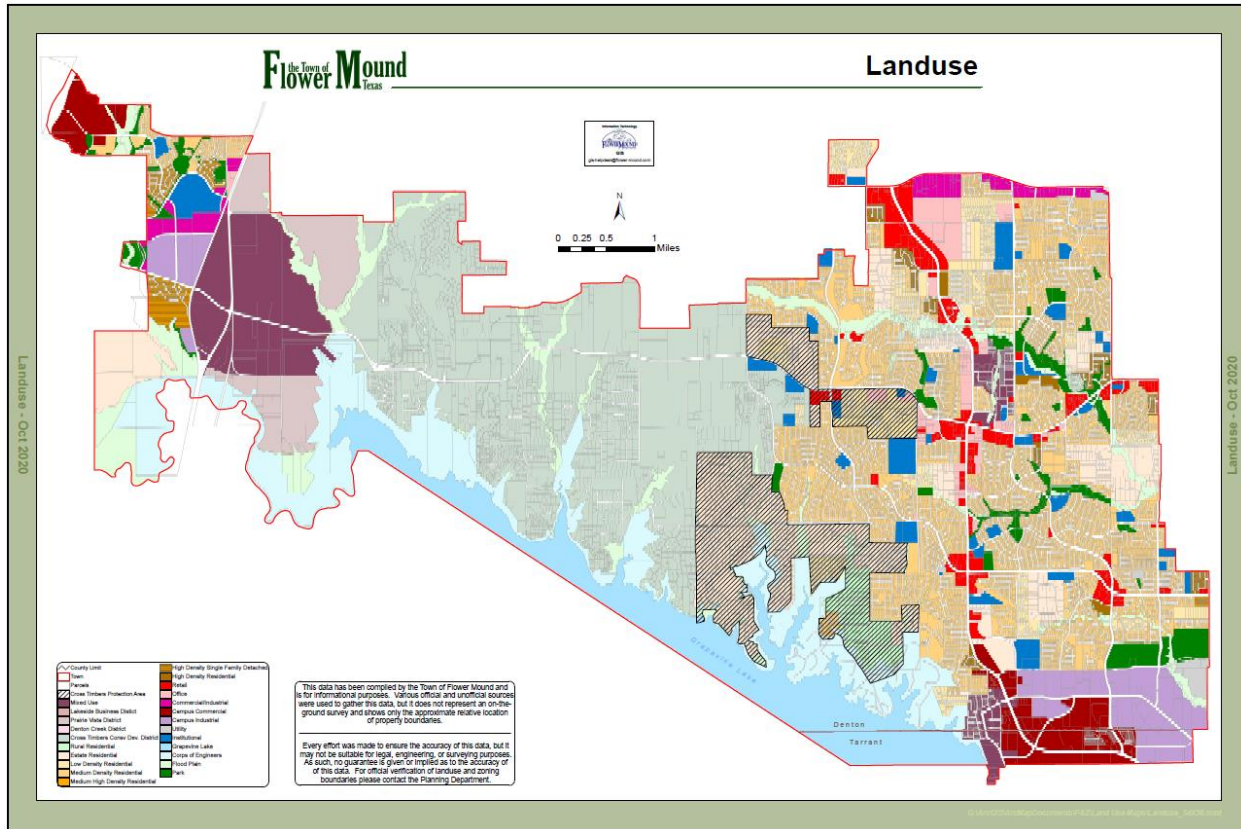
Figure 5: Town of Bartonville Thoroughfare Plan



Source: Town of Bartonville (October 2020)

Similar to the Town of Bartonville, the Town of Flower Mound jurisdictional limits are not located adjacent to or near FM 407, and therefore future Flower Mound land use development, as presented in **FIGURE 6**, is not anticipated to directly impact or involve the TxDOT-studied segment of the FM 407 corridor.

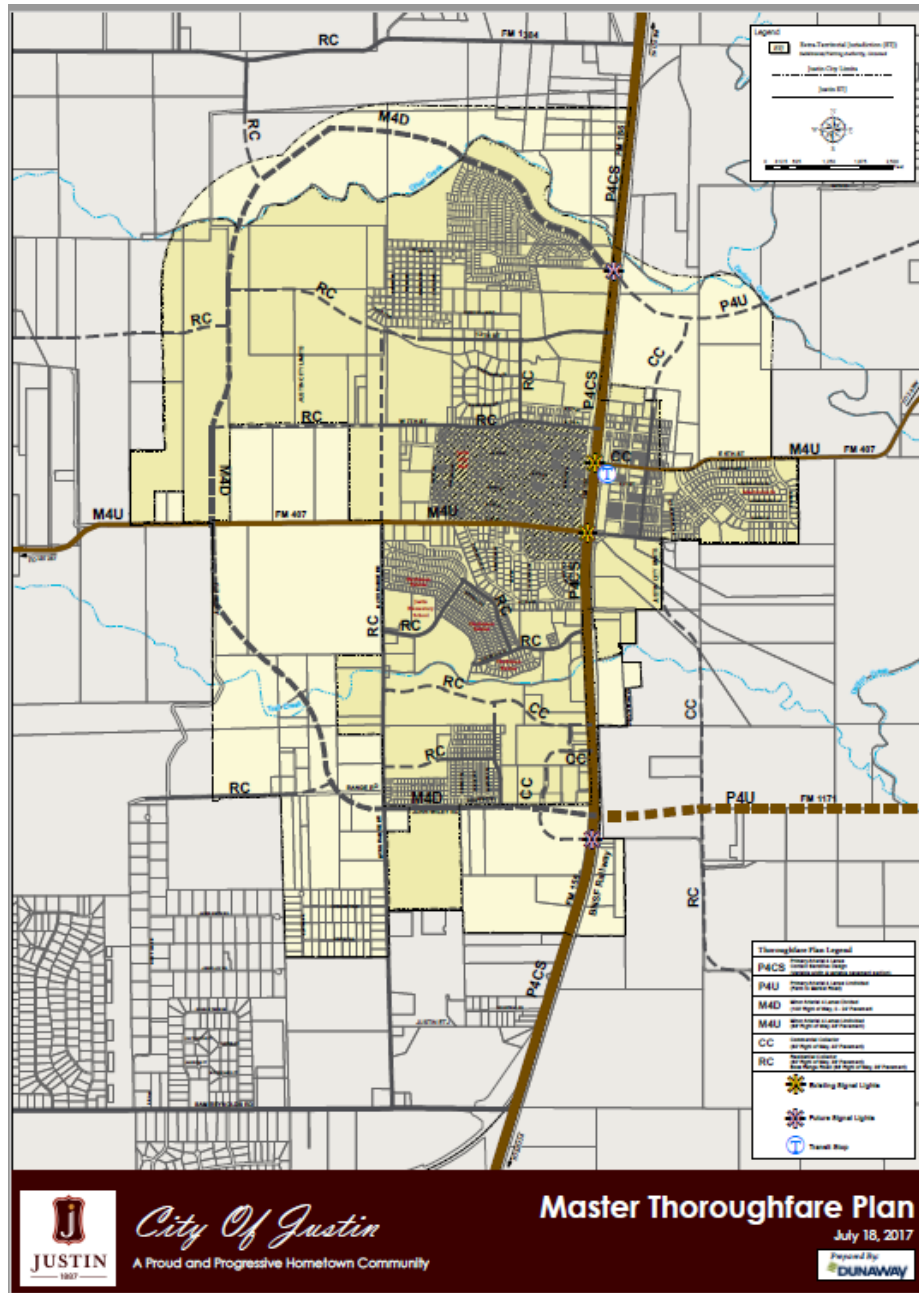
Figure 6: Town of Flower Mound Landuse Map



Source: Town of Flower Mound (October 2020)

As shown on the City of Justin Master Thoroughfare Plan and presented in **FIGURE 7**, the existing FM 407 facility is envisioned by the Plan to be improved to a four-lane undivided Minor Arterial. In addition, the Plan lists a new location roadway which partially encircles the city and incorporates Timberbrook Drive which is located west of FM 156 and BNSF RR and near the northern city limits. In addition to the ongoing Timberbrook residential development, other planned residential developments within Justin will add to the FM 156 and FM 407 travel demand since these two transportation facilities are heavily relied upon by Justin travelers.

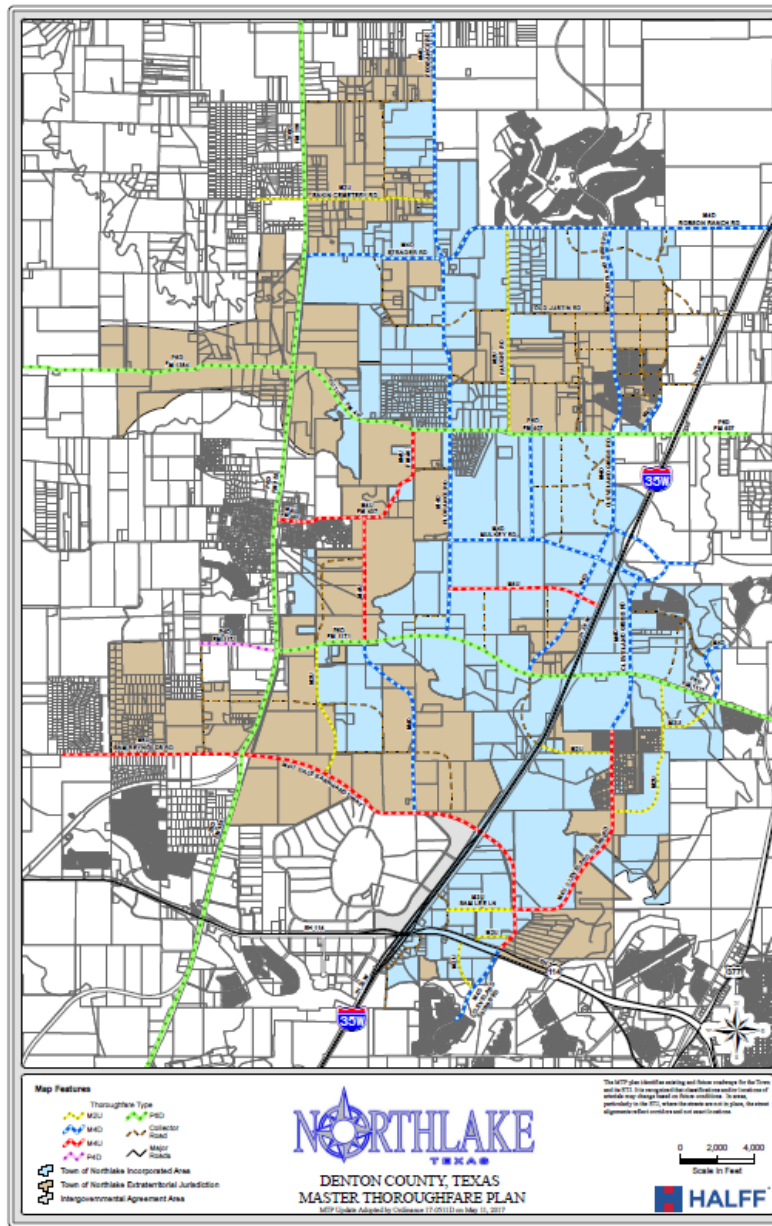
Figure 7: City of Justin Master Thoroughfare Plan



Source: City of Justin (2018)

Within the Town of Northlake Master Thoroughfare Plan (**FIGURE 8**), the existing FM 407 facility, from east of I-35W westward to Florance Road, is envisioned to be improved to a six-lane divided facility. In contrast to the Justin Master Thoroughfare Plan, the Northlake Plan indicates a new location route for FM 407 which would supplant FM 1384 located north of Justin’s Timberbrook Drive arterial. Similar to Justin, the Plan envisions improving existing FM 407 / E. 5th Street to a four-lane undivided facility. Also shown are improvements to the cross-streets intersecting FM 407, such as Florance Road and Cleveland Gibbs Road. The current FM 407 traffic demand is expected to continue growing in light of the multiple ongoing and planned residential developments which are located adjacent to and near FM 407.

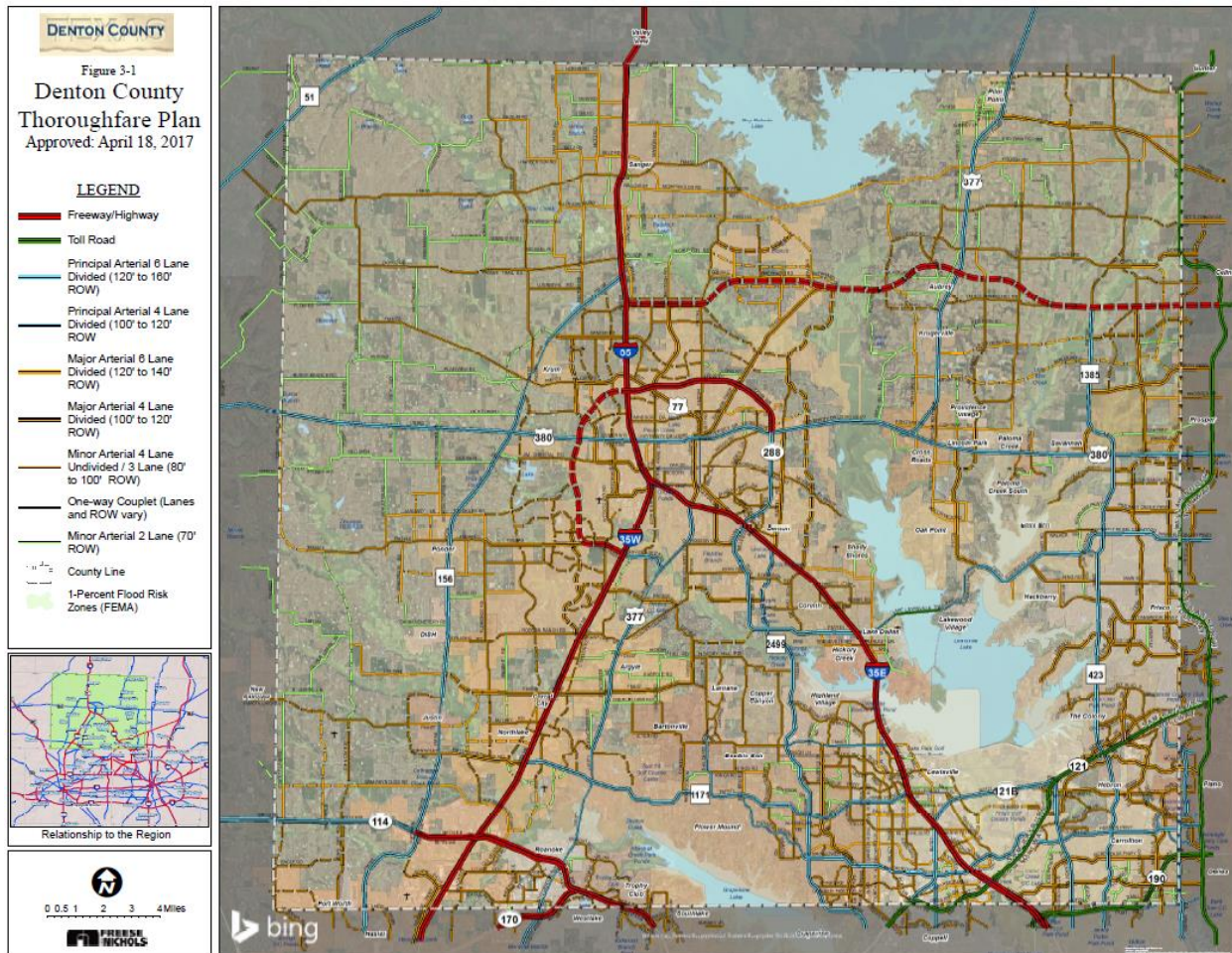
Figure 8: Town of Northlake Master Thoroughfare Plan



Source: Town of Northlake (October 2020)

Presented in **FIGURE 9** is the Denton County Thoroughfare Plan which compliments each of the previously presented individual municipal Plans. FM 407 is envisioned on this Plan to be improved to a six-lane divided Major Arterial, and similar to the Northlake Master Thoroughfare Plan, it indicates a new location route for FM 407 west of Florance Road which would supplant FM 1384. Unlike the Northlake Plan, the Denton County Plan earmarks the new location for FM 407 (west of FM 156) as four-lane divided Major Arterial.

Figure 9: Denton County Thoroughfare Plan



As presented thus far in this Feasibility Report, and discussed in subsequent chapters, the local municipalities in the FM 407 Study Area have varying objectives. The Thoroughfare and Land Use Plans were independently produced by each municipality at differing times and produced prior to TXDOT’s FM 407 Feasibility Study analyses and findings. As a result, the TxDOT Study may or may not add a new perspective to each Plan which might in turn result in a municipality revising its Plan; such as roadway capacity (number of lanes) and new location alignment revisions. The TxDOT Study Team outreached to each municipality with the objective of accommodating, as much as possible, each municipality’s current envisioned plans involving FM 407, and to ensure FM 407 remains a reliable local and regional transportation asset.

2.2 Travel Demand

Referenced previously in this Feasibility Report, *Mobility 2045* is a guidance document for the implementation of multimodal transportation improvements, policies, and programs in the 12-county MPA through the year 2045. One planning element that assisted in the development of *Mobility 2045* was the NCTCOG’s Expanded Dallas-Fort Worth Regional Travel Model which serves as the source for forecasting travel characteristics for the DFW region. The model utilizes historical traffic volume data and in turn is used to project future travel conditions and evaluate the performance of roadway and rail facilities in the 12-county MPA. According to the historical transportation traffic counts posted on the NCTCOG website, the year 2018 counts along FM 407 (between I-35W and FM 1830) ranged from 11,000 to 14,700 vehicles per day (vpd). The FM 407 counts from west of Justin to I-35W varies according to the varying adjacent development, but overall, the counts range from 5,300 to 14,300 vpd.

Mobility 2045 also identifies the transportation options considered essential to supporting the long-term transportation plan for the DFW region. The transportation plan outlines the mobility needs of the region and supports the development of a multimodal system; a network of transportation improvements necessary to serve the traffic needs in the growing region and outlines implementation strategies. Relatedly, it is noted that *Mobility 2045* includes a potential north-south High Speed (Transit) Rail at or near the BNSF RR located parallel to FM 156 within the City of Justin. This rail location would need to be coordinated with any future FM 407 and FM 156 construction plan improvements to ensure the improvements geometrically accommodate the rail and any envisioned rail stations.

The **TABLE 2** data presented below indicates the DFW region as a whole is forecasted to experience an increase in travel demand as the number of cars and the amount of time spent driving in traffic will increase. Year 2045 is expected to see an annual cost of congestion at \$27.3 billion due to traffic congestion compared to the 2018 \$12.1 billion cost. Therefore, it is imperative that as the region grows, the transportation networks are expanded to adequately serve both the population and job / commuter growth (travel demand).

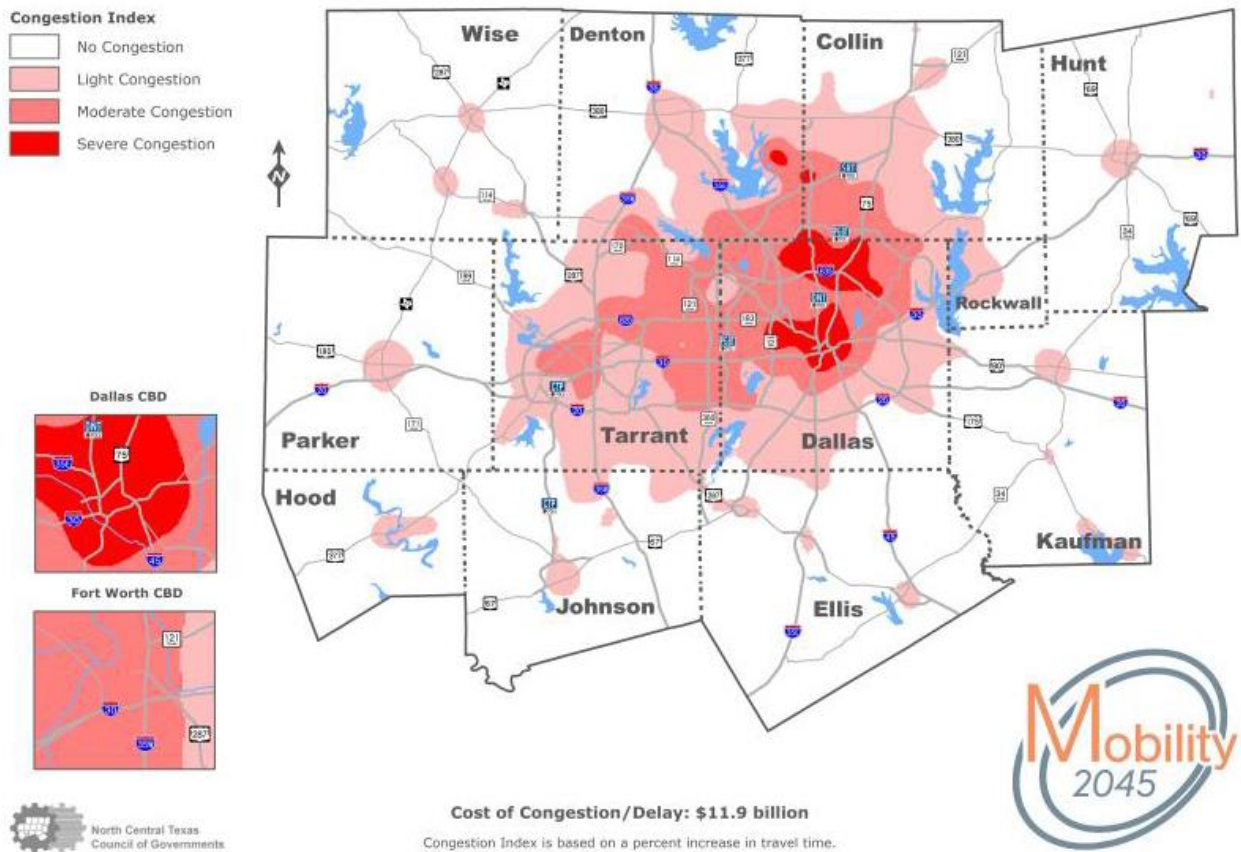
Table 2: Regional System Performance

Metric	2018	2045
Population	7,429,723	11,246,531
Employment	4,793,363	7,024,227
Vehicle Miles of Travel (Daily)	212,232,952	331,495,638
Hourly Capacity (Miles)	44,794,000	54,330,341
Vehicle Hours Spent in Delay (Daily)	1,680,685	3,788,105
Increase in Travel Time Due to Congestion	40.94%	59.32%
Annual Cost of Congestion (Billions)	\$12.1	\$27.3

Source: NCTCOG, *Mobility 2045*

FIGURE 10 presents the level of congestion the DFW region is experiencing now and in the short-term future. Based on this NCTCOG graphic, the FM 407 corridor congestion, or encroaching congestion, is expected to expand by year 2045 as indicated in the comparison **FIGURE 11**. As the population and jobs within and around Denton County continue to increase, the demand on transportation infrastructure is expected to intensify, and result in higher demand and increased traffic congestion along the network of interconnecting transportation facilities.

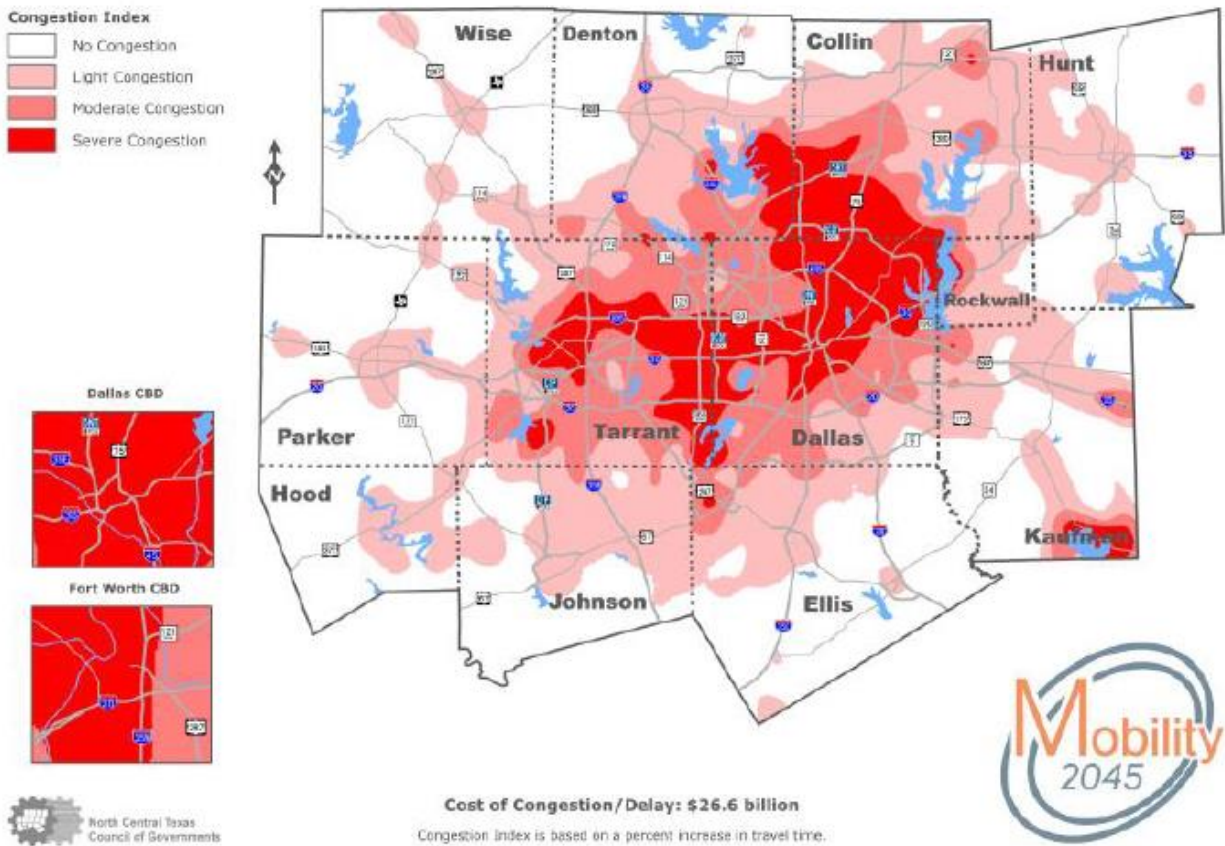
Figure 10: Levels of Congestion / Delay (2018 Build)
2018 Levels of Congestion/Delay



Source: NCTCOG, *Mobility 2045*

Figure 11: Levels of Congestion / Delay (2045 No-Build)

2045 Levels of Congestion/Delay

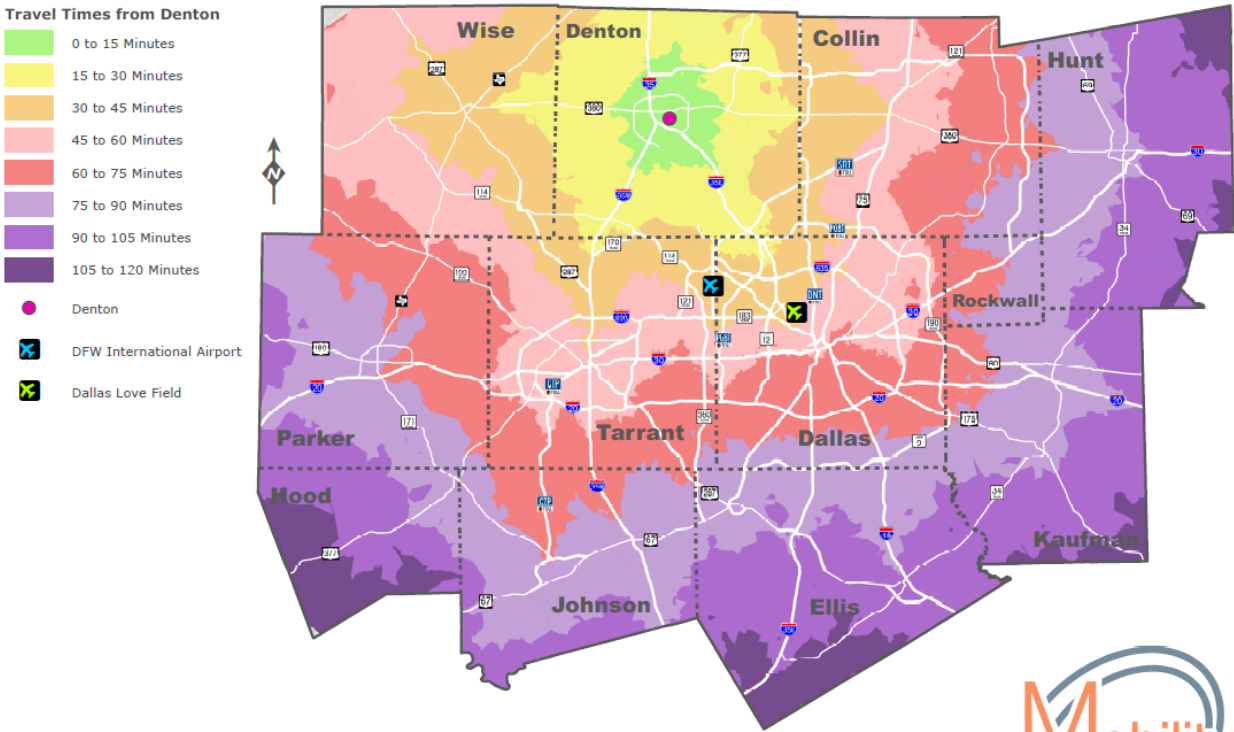


Source: NCTCOG, *Mobility 2045*

Another congestion perspective which may or may not apply to the FM 407 corridor, but which is influenced by the ongoing residential development surrounding the FM 407 facility, are travel times. **FIGURE 12** and **FIGURE 13** present a comparison travel times between years 2018 and 2045 and specific to the City of Denton located north of FM 407. As shown, future travel times will to varying degrees and based on location, continue to increase due to increasing populations and increasing traffic volumes which in turn creates both traffic congestion and time delays. Because of this increase in travel time, travelers within the corridor may shift to cross-streets and major arterials such as FM 407 to avoid the north-south commuter highway congestion.

Figure 12: Peak Period of Travel Times from Denton (2018 PM)

2018 PM Peak Period Travel Times from Denton



North Central Texas Council of Governments
December 2018

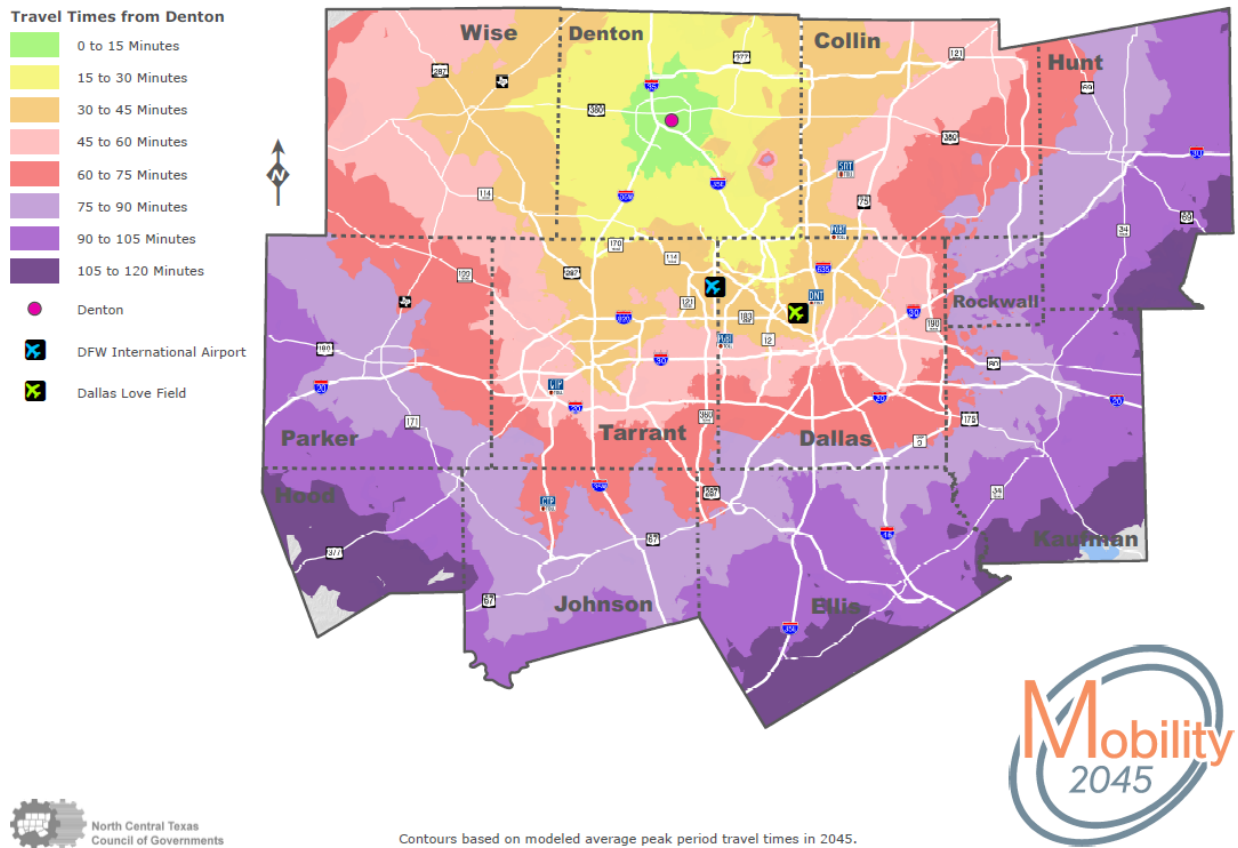
Contours based on modeled average peak period travel times in 2018.



Source: NCTCOG, *Mobility 2045*

Figure 13: Peak Period of Travel Times from Denton (2045 PM)

2045 PM Peak Period Travel Times from Denton



North Central Texas Council of Governments
December 2018

Contours based on modeled average peak period travel times in 2045.

Source: NCTCOG, *Mobility 2045*

2.3 Safety

FM 407 vehicle crash data documented between January 2010 and February 2018 was obtained from TxDOT and utilized to identify potential design or operational issues that possibly may be associated with the need to improve FM 407, specifically safety concern locations along the facility involving vehicular/driving movements, roadway horizontal and vertical geometry, intersection configurations, and railroad crossings.

The total crash concentration along the studied FM 407 facility was calculated by determining the number of crashes per mile, converting to percentages of the total number of crashes (225), and assigning the percentages to one of seven crash concentration ranges. The seven crash ranges were color-coded and mapped by the Feasibility Study team to produce **FIGURE 14** and **TABLE 3** which lists the crash concentration locations along FM 407.

Figure 14: FM 407 Crash Concentration Map

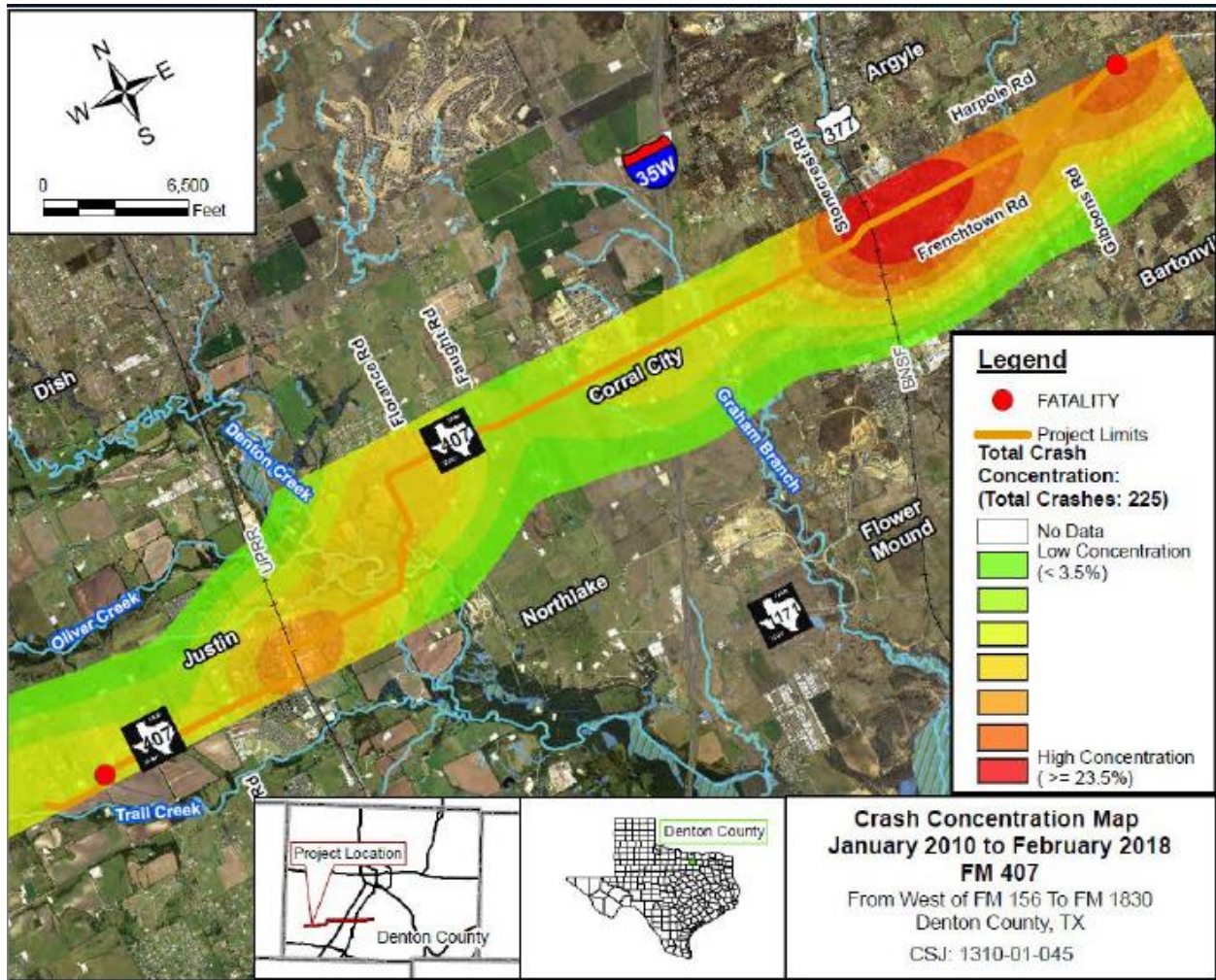


Table 3: FM 407 Highest Crash Concentration Locations

General FM 407 Location	Percent of Total Crashes
At FM 156 / BNSF RR	12%
At US 377 / UP RR	22%
West of FM 1830	6%

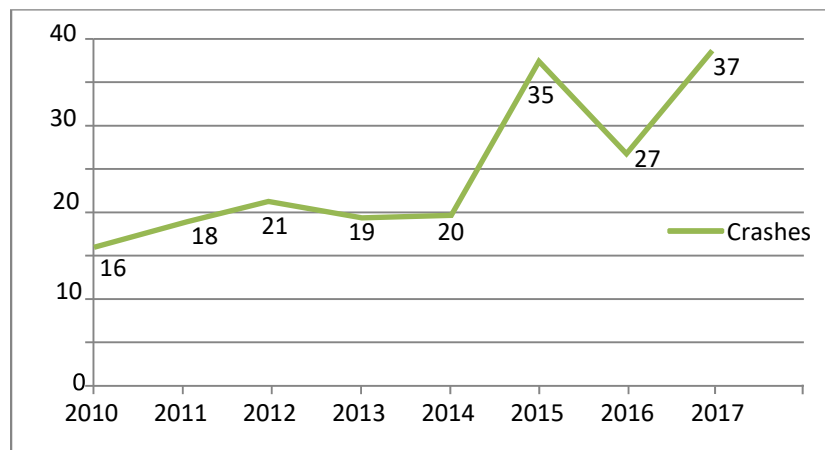
Source: Study Team November 2018.

As shown on **FIGURE 14** and listed in **TABLE 3**, the five highest crash concentrations are centered in the urban, high traffic volume / conflict areas. Two of the three roadway sections listed in **TABLE 3** involve at-grade railroad crossings and all three of the locations involve a nearby FM 407 intersection location.

When prior crashes have occurred along FM 407, the FM 407 travel lanes experience traffic back-ups and emergency responder response times, primarily because FM 407, a facility with increasing traffic and ongoing local residential development, predominately contains only one through travel lane in each direction.

The annual FM 407 total crashes presented in **FIGURE 15** shows an apparent upward trend in FM 407 crashes. Increased travel demand and future land uses along the FM 407 corridor (such residential development and increased morning and evening commuter trips) is expected to increase the potential for more occurring vehicular crashes, and the potential for more crash incidents involving pedestrians and bicyclists due to population increases and increases in multi-modal means of travel, namely bike and foot traffic.

Figure 15: FM 407 Annual Total Crashes (2010 - 2017)



Source: TxDOT

The crash data presented herein emphasizes the need to address safety improvements to the FM 407 facility which address all the expected FM 407 modes of travel and which should include implementing safe and efficient pedestrian and bicyclist accommodation, access and passage.

3.0 Existing FM 407 System Conditions

3.1 Roadway

The existing FM 407 facility is an undivided roadway consisting of two 11 to 12-foot wide travel lanes in each direction with 1 to 11-foot wide outside shoulders. Roadway drainage is conveyed in open ditches located along each side of FM 407. FM 407 crosses two north-south railroads at-grade (BNSF RR in the City of Justin and the UP RR in the Town of Argyle) and intersects north-south roadway facilities at-grade: FM 156, I-35W, US 377 and FM 1830.

Depending on the location along the FM 407 facility, TxDOT's functional classification of the facility is primarily a "Major Collector". The posted FM 407 speed limit ranges from 35 to 55 miles per hour.

The existing FM 407 right-of-way (ROW) boundaries utilized for the study area was initially based on GIS data acquired from the Denton County Appraisal District dated February 21, 2018, and supplemented by prior FM 407 construction plans (referred to as "As-builts"), field visits and FM 407 Feasibility Study Public Meeting (property owner) feedback. Since the ROW information utilized is limited to only ROW dimensioning and does not include property or parcel information, the best assessment of impacts can only be quantified based on potential impacts to existing buildings. Further assumptions were made on earthen side slope designs and roadside treatments to estimate ROW impacts which may result from improving the FM 407 facility as described within this Feasibility Report.

3.2 Traffic Conditions

The following is a summary of the FM 407 traffic conditions extracted from the more detailed **FM 407 Traffic Operational Analyses Report** located in the **APPENDIX**.

Existing Intersection Geometry

FM 407 intersection operational analyses were performed for the Base Year 2018 Existing Conditions utilizing the existing FM 407 intersection geometry obtained from on-site visits and aerial photographs (*Google Earth*). The photographs and the existing intersection / lane geometry exhibits are provided in the **Traffic Operational Analysis Report** located in the **APPENDIX**. A description of each studied FM 407 intersection configuration is listed below beginning at the study's western limit (west of FM 156 in the City of Justin).

FM 407 & Boss Range Rd

This intersection is a three-leg unsignalized intersection. The eastbound approach has one lane with one shared through-right lane. The westbound approach has one lane with one shared left-through lane. The northbound approach has one lane with one shared left-right lane.

FM 407/Downe Rd & FM 156

This under construction intersection is a four-leg signalized intersection. The eastbound approach has two lanes with one dedicated left turn lane and one shared through-right lane. The westbound approach has one lane with one shared left-through-right lane. The northbound approach has four lanes with one dedicated left turn lane, two through lanes, and one dedicated right turn lane. The

southbound approach has four lanes with one dedicated left turn lane, two through lanes, and one dedicated right turn lane.

FM 407/E. 5th St & FM 156

This under construction intersection is a four-leg signalized intersection. The eastbound approach has one lane with one shared left-through-right lane. The westbound approach has one lane with one shared left-through right lane. The northbound approach has four lanes with one dedicated left turn lane, two through lanes, and one dedicated right turn lane. The southbound approach has four lanes with one dedicated left turn lane, two through lanes, and one shared through-right lane.

FM 407 & Cleveland Gibbs Rd

This intersection is a four-leg unsignalized intersection. The eastbound approach has one lane with one shared left-through-right lane. The westbound approach has two lanes with one shared left through lane and one dedicated right turn lane. The northbound approach has two lanes with one dedicated left turn lane and one through-right lane. The southbound approach has two lanes with one shared left-through lane and one dedicated right turn lane.

FM 407 & I-35W SBFR

This intersection is a four-leg signalized intersection. The eastbound approach has two lanes with one through lane and one dedicated right turn lane. The westbound approach has two lanes with one dedicated left turn lane and one through lane. The southbound approach has two lanes with one dedicated left turn lane and one shared through-right lane.

FM 407 & I-35W NBFR

This intersection is a four-leg signalized intersection. The eastbound approach has two lanes with one dedicated left turn lane and one through lane. The westbound approach has two lanes with one through lane and one dedicated right turn lane. The northbound approach has two lanes with one dedicated left turn lane and one shared through-right lane. The southbound approach has one lane with one shared left-right lane.

FM 407 & US 377

This intersection is a four-leg signalized intersection. The eastbound approach has two lanes with one dedicated left turn lane and one shared through-right lane. The westbound approach has three lanes with one dedicated left turn lane, one through lane, and one dedicated right turn lane. The northbound approach has three lanes with one dedicated left turn lane, one through lane, and one dedicated right turn lane. The southbound approach has three lanes with one dedicated left turn lane, one through lane, and one dedicated right turn lane.

FM 407 & FM 1830

This intersection is a four-leg signalized intersection. The eastbound approach has two lanes with one dedicated left turn lane and one shared through-right lane. The westbound approach has three lanes with one dedicated left turn lane, one through lane, and one dedicated right turn lane. The northbound approach has two lanes with one dedicated left turn lane and one shared through-right lane. The southbound approach has two lanes with one dedicated left turn lane and one shared through-right lane.

Intersection Operational Analysis

The studied segment of FM 407 is currently a two-lane, undivided highway. The purpose of the intersection operational analysis was to evaluate both the existing intersection geometry and intersection traffic operations efficiency. The existing geometry was assumed as the base geometry for the design year (2045) Existing Conditions. The recommended geometry, explained subsequently within this Feasibility Report, was assumed as a base geometry for the design year 2045 Build Conditions analysis. The studied FM 407 intersections were evaluated based upon *Highway Capacity Manual 6 (HCM6) methodology* using the Synchro 10 software.

Methodology for SIGNAL Controlled Intersections

Traffic operational conditions for stop-controlled (“unsignalized”) roadway intersections are quantitatively measured in terms of average delay per vehicle in a one-hour period through the intersection as a function of roadway capacity and operational characteristics of the traffic signal. The standardized methodology applied herein was developed by the Transportation Research Board as presented in the HCM6. HCM6 also qualitatively rates the overall delay conditions in terms of “Level of Service” (LOS) ranging from “A” (low travel delay conditions) to “F” (high travel delay conditions). Generally, LOS D or better is considered an acceptable traffic flow condition for signalized intersections in urban and suburban conditions. The LOS thresholds for signalized intersection are summarized in **TABLE 4**.

Table 4: Signalized Intersection Capacity Thresholds
(Obtained from Exhibit 19-8 of HCM6)

Control Delay (sec/veh)	LOS
≤ 10	A
> 10-20	B
> 20-35	C
> 35-55	D
> 55-80	E
> 80	F

NOTE: According to HCM6, the above thresholds characterize the LOS for overall intersection or an approach. For a lane group LOS, both control delay and volume-to-capacity (v/c) ratios are evaluated.

Methodology for STOP Controlled Intersections

The standard methodology for measuring the operational conditions of Two-Way-Stop-Controlled (TWSC) and All-Way-Stop-Controlled (AWSC) intersection capacity was also developed by the Transportation Research Board and presented in the HCM6. These operational conditions are also qualitatively defined in terms of LOS ranging from “A” to “F” and are quantitatively measured in terms of average delay per vehicle in a one-hour period. LOS for unsignalized AWSC locations are measured for both the approaches and the entire intersection, however, LOS for unsignalized TWSC locations is only calculated for individual traffic movements that must stop or yield right-of-way. The LOS

thresholds for unsignalized TWSC and AWSC intersection are summarized in **TABLE 5** and **TABLE 6**, respectively.

LOS for unsignalized AWSC locations are measured for both the approaches and the entire intersection, however, LOS for unsignalized TWSC locations is only calculated for individual traffic movements that must stop or yield right-of-way. The LOS thresholds for unsignalized TWSC and AWSC intersection are summarized in **TABLE 5** and **TABLE 6**, respectively.

Table 5: Unsignalized (Two-Way-Stop-Controlled) Intersection Capacity Thresholds
(Obtained from Exhibit 20-2 of HCM6)

Control Delay (sec/veh)	LOS by Volume-to-Capacity Ratio	
	vol/cap ≤ 1.0	vol/cap > 1.0
0-10	A	F
> 10-15	B	F
> 15-25	C	F
> 25-35	D	F
> 35-50	E	F
> 50	F	F

NOTE: According to HCM6, the above thresholds apply to each lane on a given approach and each approach on a minor street. LOS is not calculated for major-street approaches or for the entire intersection.

Table 6: Unsignalized (All-Way-Stop-Controlled) Intersection Capacity Thresholds
(Obtained from Exhibit 21-8 of HCM6)

Control Delay (sec/veh)	LOS by Volume-to-Capacity Ratio	
	vol/cap ≤ 1.0	vol/cap > 1.0
0-10	A	F
> 10-15	B	F
> 15-25	C	F
> 25-35	D	F
> 35-50	E	F
> 50	F	F

NOTE: According to HCM6, for approaches and intersection wide assessment, LOS is defined solely by control delay.

In order to evaluate and compare the traffic operational impact of the base year conditions, No Build conditions, and the recommended Build improvements, the following traffic impact scenarios were analyzed by the study:

- Base Year (2018) Existing Conditions (Existing Geometry);
- Design Year (2045) No Build Conditions (No Build Geometry); and
- Design Year (2045) Build Conditions (Recommended Conceptual Geometry).

The following section summarizes the Base Year (2018) Existing Conditions. Chapter 5 within this Feasibility Report summarizes the Design Year (2045) No Build Conditions (No Build Geometry) and the Design Year (2045) Build Conditions (Recommended Conceptual Geometry).

Base Year (2018) Existing Conditions (Existing Geometry)

FM 407 traffic volumes for the Base Year (2018) Existing Conditions were collected in May 2018. The Base Year (2018) AM and PM peak hour volume exhibits and the existing intersection geometry are provided in the **APPENDIX**. All the studied FM 407 intersections are currently signalized except for the FM 407 / Boss Range Rd and FM 407 / Cleveland Gibbs Rd intersections. The following technical parameters were utilized in the Base Year (2018) traffic analyses:

- Peak hour factors (PHF) = 0.92
- Truck Percentage = Variable and based on existing year 2018 collected traffic data. Truck Percentage values range from 2.0 to 50.0%. *(Note: Individual turning movements with very low volumes may have disproportionately high truck percentages).*

TABLE 7 summarizes the results of the peak hour intersection analysis during the Base Year (2018) Existing Conditions. Data was not collected for Cleveland Gibbs Rd for the base year since it was not included in the study's scope of services, and therefore is not included in **TABLE 7**. Detailed traffic analyses software outputs are included in the **APPENDIX**. As indicated in **TABLE 7**, the existing (May 2018) studied intersections operate at an unacceptable LOS E or F for the following movements:

1. FM 407 / Downe Rd at FM 156
 - Signalized approach (NBLTR) experiences significant delays during PM peak hours.
2. FM 407 / E. 5th St at FM 156
 - Signalized approach (WBLTR) experiences significant delays during PM peak hours.
3. FM 407 at I-35W SBFR
 - Signalized approaches (WBL and WBT) experience significant delays during AM and PM peak hours.
4. FM 407 at I-35W NBFR
 - Signalized approaches (WBR and NBL) experience significant delays during AM and PM peak hours
5. FM 407 at US 377
 - Signalized approaches (EBTR, WBL, and SBT) experience significant delays during AM and PM peak hours.

As shown in **Table 7**, the AM and PM LOSs for a specific intersection movement may vary. The reason for these variations is conveyed in the **Traffic Operational Analysis Report** located in the **APPENDIX**. Basically, the directional distribution "D" factor varies for the AM and PM (is 0.54 or 0.46 based on the peak hour traffic direction). Since the directional design hour volume (DDHV) is affected by the directional distribution "D", the resulting AM and PM DDHVs are different, thus the LOS analysis results are different between the AM and PM. The larger the "D", the LOS worsens and the traffic delay increases.

The existing 2018 AM and PM peak hour volumes can be viewed in the **Traffic Operational Analysis Report Appendix** as "Year 2018 Existing Peak Hour Volumes". As shown in the Appendix, the PM peak hour volumes are generally greater than the AM, thus the PM LOS and delay are worse. When there

are more vehicles in the PM, the PM delay at specific intersection movements is worse than the AM delay.

**Table 7: Peak Hour Intersection Analysis Results
[Base Year (2018) Existing Conditions / Existing Geometry]**

Intersection	Movement	Existing 2018 AM		Existing 2018 PM	
		LOS	Delay (s/veh)	LOS	Delay (s/veh)
FM 407 at Boss Range Rd <i>[Unsignalized]³</i>	WBLT	A	8.9	A	7.8
	NBLR	C	22.4	B	11.7
FM 407 / Downe Rd at FM 156 <i>[Signalized]¹</i>	Overall	B	17.7	F	>100.0
	EBLTR	C	34.4	D	42.6
	WBLTR	A	0	A	0
	NBLTR	B	10.3	F	>100.0
	SBLTR	B	10.2	A	4.8
FM 407 / E. 5th St at FM 156 <i>[Signalized]¹</i>	Overall	B	17.0	F	>100.0
	EBLTR	C	22.5	C	29.1
	WBLTR	D	38.7	F	>100.0
	NBLTR	A	7.8	A	2.3
	SBLTR	B	10.1	A	6.9
FM 407 at I-35W SBFR <i>[Signalized]²</i>	Overall	C	33.7	D	39.5
	EBT	D	38.2	C	25.4
	EBR	C	23.3	B	19.4
	WBL	E	59.3	C	26.8
	WBT	C	23.3	E	78.6
	SBL	C	27.5	C	21.9
	SBTR	C	24.1	C	20.5
FM 407 at I-35W NBFR <i>[Signalized]²</i>	Overall	C	32.7	D	40.5
	EBL	C	27.6	D	36.9
	EBT	C	23.5	B	15.0
	WBT	C	26.0	D	41.8
	WBR	D	35.6	F	94.9
	NBL	E	63.0	D	41.6
	NBTR	C	26.2	C	20.3
	SBLR	C	23.2	B	18.2

**Table 7: Peak Hour Intersection Analysis Results
[Base Year (2018) Existing Conditions / Existing Geometry]**

Intersection	Movement	Existing 2018 AM		Existing 2018 PM	
		LOS	Delay (s/veh)	LOS	Delay (s/veh)
FM 407 at US 377 <i>[Signalized]</i>	Overall	E	55.1	D	36.9
	EBL	C	23.7	C	34.2
	EBTR	D	38.6	E	69.9
	WBL	E	69.5	C	30.2
	WBT	C	30.3	C	27.9
	WBR	C	27.2	B	16.3
	NBL	C	23.3	C	26.9
	NBT	C	33.7	D	44.3
	NBR	B	20.0	C	24.7
	SBL	C	30.1	D	50.2
	SBT	F	>100.0	C	26.2
	SBR	B	16.3	C	22.5
FM 407 at FM 1830 <i>[Signalized]</i>	Overall	C	25.3	D	37.2
	EBL	B	16.7	D	41.8
	EBTR	C	27.7	C	29.6
	WBL	B	17.9	C	28.4
	WBT	C	24.6	D	38.3
	WBR	C	21.2	D	48.6
	NBL	C	27.5	C	32.6
	NBTR	C	29.8	C	31.6
	SBL	C	23.8	C	31.1
	SBTR	C	30.1	C	26.1

NOTES:

NB, SB, EB, WB = North-, South-, East-, Westbound Intersection Approach

L, T, R = Left, Through, Right, Intersection Approach Turning Movement

(1) -Perm+Prot left-turn type from a share lane intersection not supported by HCM6 methodology. LOS shown in table were obtained from HCM 2000 Intersection Analysis methodology.

(2) -Clustered intersections not supported by HCM6 methodology. The LOSs shown in table were obtained from HCM 2000 Intersection Analysis methodology.

3.3 Environmental Factors

The FM 407 Feasibility Study reviewed the potential environmental factors or constraints associated with the FM 407 Study Area including institutional sites such as schools, hospitals, cemeteries, airports, and water resources that could affect the means and methods of installing transportation improvements along the FM 407 corridor. A review of these constraints focused their proximity to the existing FM 407 facility, coupled with potential improvements to FM 407, in order to assess any improvements which might conflict with the constraints.

Institutional Facilities

TABLE 8 lists the institutional facilities (elementary schools, middle schools, high schools, and academies) located along or near the FM 407 Study Area. Some of these facilities may directly rely on FM 407 for mobility since FM 407 is considered a key transportation connector within the study area. Alterations and improvements to FM 407 would, to some pro or con degree, affect the travel time to a specific facility.

Table 8: Institutional Facilities Located within the Study Area

Name	Type	Address	Access to FM 407 via:
Justin Elementary School	Elementary	425 Boss Range Rd. Justin, TX 76247	Boss Range Rd.
Lance Thompson Elementary School	Elementary	821 Hawks Way Argyle, TX 76226	Cleveland Gibbs Rd.
The Goddard School Northlake	Pre-kindergarten	7851 Cleveland Gibbs Rd. Argyle, TX 76226	Cleveland Gibbs Rd.
Argyle West Elementary School	Elementary	1730 Old Justin Rd. Argyle, TX 76226	Harvest Way
Argyle Middle School	Middle School	6601 Canyon Falls Dr. Lantana, TX 76226	US 377
Liberty Christian School	Preschool - 12 th Grade	1301 US-377 Argyle, TX 76226	US 377
Argyle High School	High School	191 US-377 Argyle, TX 76226	US 377
Hilltop Elementary School	Elementary	1050 Harrison Ln. Argyle, TX 76226	US 377
Blanton Elementary School	Elementary	9501 Stacee Ln. Argyle, TX 76226	Hilltop Rd.
Harpool Middle School	Middle School	9601 Stacee Ln. Lantana, TX 76226	Hilltop Rd.
EP Rayzor Elementary School	Elementary	377 Rayzor Rd. Lantana, TX 76226	Rayzor Rd.
Montessori Country Day School	Pre-K - Elementary	7400 Hawk Rd. Flower Mound, TX 75022	McMakin Rd.
Justin Fine Arts Preschool	Preschool	9535 Industrial Rd. Justin, TX 76247	FM 156
Kid's Kampus Preschool	Preschool	427 Boss Range Rd. Justin, TX 76247	Boss Range Rd.
Argyle Fine Arts Preschool	Preschool	805 W Front St. Argyle, TX 76226	US 377
Bright Beginnings Preschool	Preschool	414 W US Hwy 377 N. Argyle, TX 76226	US 377

Table 8: Institutional Facilities Located within the Study Area

Name	Type	Address	Access to FM 407 via:
The Nest Preschool Argyle	Preschool	101 Frenchtown Rd. Argyle, TX 76226	US 377
Lionheart Children's Academy at Cross Timbers Church	Preschool	1119 South, N. US Hwy 377 Argyle, TX 76226	US 377
Guidance Preparatory Academy	Infants - Kindergarten	64 McMakin Rd. Bartonville, TX 76226	McMakin Rd.
North Star Academy of Lantana	Up to 6 th Grade	551 Rayzor Rd. Lantana, TX 76226	Rayzor Rd.

Emergency Services Facilities

TABLE 9 indicates there are three medical facilities located within the FM 407 Study Area. Medical-related emergency facilities are typically located near major roads to provide quick and easy access for responding to emergency situations. There are also three Police Stations and four Fire Stations within the Study Area.

Table 9: Emergency Services Facilities Located within the Study Area

Name	Type	Address	Access to FM 407 via:
Justin Police Department	Police	415 N College Ave. Justin, TX 76247	Pafford Ave.
Northlake Police Department	Police	1600 Commons Cir Northlake, TX 76247	Heron Way
Argyle Police Department	Police	506 US 377 Argyle, TX 76226	US 377
Argyle Fire District	Fire Station	511 Gibbons Rd. S Argyle, TX 76226	Gibbons Rd.
Fire Station 2	Fire Station	4401 Shiloh Rd. Flower Mound, TX 75022	McMakin Rd.
Argyle Fire Department 514	Fire Station	County Rd. 338 Argyle, TX 76226	Cleveland Gibbs Rd.
Justin Fire Department	Fire Station	P.O. Box 129 Justin, TX 76247	FM 156
Wise Health Surgical Hospital at Argyle	Medical	7218 Crawford Rd. Argyle, TX 76226	I-35W
Wise Health Emergency Center	Medical	7214 Crawford Rd. Argyle, TX 76226	I-35W
Justin Medical Clinic	Medical	111 W 5th St. Justin, TX 76247	W 5th St.

Cemeteries

As shown in **TABLE 10**, three cemeteries are located within the FM 407 Study Area.

Table 10: Cemeteries Located within the Study Area

Name	Address	Access to FM 407 via:
Graham-Argyle Cemetery	321 Country Club Rd. Argyle, TX 76226	US 377
Prairie Mound Cemetery	Prairie Mound Cemetery Rd. Argyle, Argyle, TX 76226	Harvest Way
Justin Cemetery	Justin Cemetery Rd. Justin, TX 76247	FM 156

Water Resources

There are 100-year flood zones along the length of the studied FM 407 corridor which are associated with Oliver Creek, Denton Creek, Graham Branch, White Branch, Hickory Creek and Loving Branch. Denton County is a participant in the National Flood Insurance Program. Streams and tributaries are located in Zones A and AE which are approximate 100-year floodplain boundaries. And there are multiple ponds / low lying earthen depressions of various sizes scattered throughout the Study Area and along the FM 407 corridor.

There are five stream crossings along the length of the FM 407 facility and wetlands may potentially be associated with many of the stream and culvert crossings, riparian areas, and flood zones along the length of the studied FM 407 corridor. And a total 34 drainage crossings exist along the facility.

Places of Worship

TABLE 11 indicates the places of worship located within the FM 407 Study Area.

Table 11: Places of Worship Within the Study Area

Name	Address
Lakeside Fellowship Church	15080 FM 156, Justin, TX 76247
North Texas Church of Christ	1290 FM 407, Northlake, TX 76247
Cross Timbers Church	1119 US 377, Argyle, TX 76226
Oak Hills Community Church	101 Frenchtown Rd., Argyle, TX 76226
The Well Community Church	191 US 377, Argyle, TX 76226
Lantana Community Church	2200 Jeter Rd. E, Lantana, TX 76226
Anchor Christian Center	120 Meadow View Dr., Justin, TX 76247
Justin Church of Christ	424 S. Snyder Ave., Justin, TX 76247
Fellowship of the Parks - Justin	116 N. Jackson Ave., Justin, TX 76247
Justin United Methodist Church	205 N. Jackson Ave., Justin, TX 76247
Radiant Life Fellowship Church	805 W. 1 st St., Justin, TX 76247
The Rock Church of Justin	411 Leuty Ave., Justin, TX 76247

Table 11: Places of Worship Within the Study Area

Name	Address
Bible Baptist Church	415 Leuty Ave., Justin, TX 76247
First Baptist Church of Justin	402 W. 8th St., Justin, TX 76247
Living Savior Church	7417 Faith Ln., Argyle, TX 76226
North Texas Church of Christ	1290 FM 407, Northlake, TX 76247
Northlake Bible Church	821 Hawks Way, Northlake, TX 76226
Tribes Church	West Elementary School, 1741 Old Justin Rd., Argyle, TX 76226
First Baptist Church Argyle	414 US 377, Argyle, TX 76226
Well Church	6601 Canyon Falls Dr., Argyle, TX 76226
The Grove Church	2650 FM 407 E., Ste. 145/110, Bartonville, TX 76226
The Light Church	970 Terrace Dr., Lantana, TX 76226
Shiloh Family Church	6500 Cross Timbers Rd., Flower Mound, TX 75022
One Church	531 John Wiley Rd., Justin, TX 76247

Airports

There are four airports located in the FM 407 Study Area and which have direct or indirect access to FM 407.

- **Blue Jay Air Field** is a privately-owned airport located approximately three miles east of the City of Justin/FM 156 and north of the north-south section of Mulkey Lane. Access to the airport is via Mulkey Lane which intersects FM 407.
- **Dooley Airport (oTS1)** is a privately-owned airport located approximately 1.5 miles northeast of the City of Justin/FM 156 and just west of the north-south section of FM 407. Access to the airport is via FM 407.
- **Leroux Airport (TX22)** is a privately-owned airport located at 1506 FM 407 E, Argyle, TX 76226; approximately 1 mile west of FM 1830. Access to the airport is via FM 407 and/or Gibbons Road which intersects FM 407.
- **Propwash Airport (16X)** is a privately-owned located 3 miles west of the City of Justin and flanked in between the north-south roads of Bonanza Road and Cessna Road. Access to the airport is via Sam Reynolds Road which is located less than 1 mile south of, and parallel to, FM 407.

Parks and Recreational Facilities

There are 21 park and recreational facilities within the Study Area which are listed in **TABLE 12**.

Table 12: Parks and Recreational Facilities Within the Study Area

Name	Address
Justin City Park	415 N. College Ave., Justin, TX 76247
Justin Community Park	420 Ovaletta Dr., Justin, TX 76247
Integrity Park	9119 Highway 377, Argyle, TX 76226
Canyon Falls Dog Park	555 Westbridge Dr., Northlake, TX 76262
Reatta Park	415 N. College Ave., Justin, TX 76247
Bishop Park	Justin, TX 76247
Tally Park	Justin, TX 76247
City Hall Park	Justin, TX 76247
Harvest Meadows Harrier Park	Northlake, TX 76226
Harvest Fun Fields - Field B	Bartonville, TX 76227
Harvest Meadows Park on Meadows Dr.	Bartonville, TX 76226
Harvest Meadows Park on Homestead Way	Northlake, TX 76226
Harvest Park	Bartonville, TX 76226
Harvest Sunflower Park	Lantana, TX 76226
Harvest Meadows Toddler Park	Bartonville, TX 76226
Unity Park	415 N. College Ave., Argyle, TX 76226
Tour 18 Dallas - Golf Course	8718 Amen Corner, Flower Mound, TX 75022
Knob Hills Bike Trail	Hwy 377, Roanoke, TX 76262
Cross Timbers Trail Head Park	Roanoke, TX 76262
Lantana North Pool Park	800 Golf Club Dr., Argyle, TX 76226
Justin Youth Sports Association	420 Ovaletta Dr., Justin, TX 76247

4.0 Public and Agency Coordination

The agencies and/or stakeholders which were invited to participate in this Feasibility Study included Denton County, the City of Justin, the Towns of Argyle, Bartonville, Dish, Draper, Flower Mound and Northlake, the USACE, NCTCOG, and the BNSF and UP RR industries. Therefore, the study team received significant assistance, and input from the participating agencies/stakeholders in order to prepare and present the contents of this Feasibility Report and its recommendations. This section summarizes the coordination activities TxDOT and its study team conducted for the study.

4.1 Study Kick-off Meeting

A Study Kick-off Meeting, formally known as a Design Concept Conference, was conducted by the TxDOT study team and included identified FM 407 corridor agencies / stakeholders which included the aforementioned town, city and county municipalities located with the FM 407 Study Area. During this meeting, the study goals and objectives were discussed and presented to the attendees alongside the study phases, timeline, existing and envisioned FM 407 typical sections, the Study Area Constraints, and an FM 407 Design Summary Report (DSR) composed of the design criteria to be adhered to as the subsequent FM 407 Build Alternative concepts were produced, scrutinized and evaluated. The design criteria included such items as design speed, horizontal and vertical curvature criteria, travel lane and border widths, and bicyclists and pedestrian accommodation. Feedback on the study, DSR, and potential FM 407 improvement concepts suggested by the attendees was encouraged by the study team

4.2 Agency / Stakeholder Meetings

After conducting the Kick-off Meeting, the TxDOT study team convened two Agency / Stakeholder Work Group Meetings. The purpose of these Meetings was to brainstorm the Build Alternative alignment concepts (described in Chapter 1) which were presented on markup diagrammatics superimposed on an aerial photograph of the FM 407 Study Area. This alignment concept scrutiny included stakeholder attendee-identification of perceived traffic problems spots and the No Build and Build Alternative benefits, disbenefits, impacts and fatal flaws.

A number of the attendees were familiar with potentially improving the FM 407 facility due to the current congestion along the facility, and included knowledge gained from a prior 2011-2012 Feasibility Study involving FM 407 which was conducted by Denton County and specifically involved the City of Justin and Town of Northlake. Within the County's study report, various new location FM 407 Build Alternative alignments were produced and studied. One of the alignments was located on undeveloped land located just north of Hillside Drive; land which has since been supplanted / precluded by Timberbrook Parkway and the ongoing Timberbrook residential development. Another scrutinized alignment was located approximately one quarter mile north of Oliver Creek (south of FM 1384). However, the county study was concluded with no City of Justin or Town of Northlake consensus on a recommended / consensus Build Alternative.

Supplementing the Work Group meetings were individual municipality outreach meetings convened by the study team. These one-on-one feedback meetings allowed the study team to receive input from each agency / stakeholder and address their municipal and community concerns and receive their suggested solutions to improve the FM 407 facility. These meetings included a prepared agenda of open discussion topics which included reviewing draft Build Alternative alignments produced to date, FM 407 traffic projections, typical sections, municipal-preferred objectives the study team needs to be aware of, adjacent tie-in roadway and trail / path projects, local development updates which may affect the FM 407 travel demand, and resident and municipal Town discussions and feedback concerning the study.

Between the various aforementioned meetings were in-person study team meetings with, and briefings to, various elected officials and their municipal staff representatives. Due to the COVID-19 pandemic, virtual meetings were conducted with various municipal staff and elected officials to discuss, revise and finalize a Recommended Build Alternative before it was presented by the TxDOT study team at an FM 407 July 2020 Virtual Public Meeting which is described in Section 4.3 of this report. The municipal virtual meetings, as well as the pre-COVID in-person meetings, occurred after the conduction of an initial (March 2019) FM 407 Public Meeting was conducted by TxDOT. Therefore, the in-person and virtual meetings were utilized to further screen the Build Alternatives in order to determine a conclusive team-recommended Build Alternative presented at the July 2020 Public Meeting.

The study team also coordinated with NCTCOG staff on the study team's generation of the projected (Year 2045) traffic volumes along FM 407 and reviewed, compared and reconciled these volumes with the current FM 407 volumes shown in the NCTCOG's Travel demand Modeling (TDM) network of North Texas roadway volumes. The objective of this coordination was to scrutinize and heighten the accuracy of the Year 2045 forecasted volumes.

The opinions and feedback received from each group and individual meeting aided the study team in developing the Recommended Build Alternative discussed later within this Feasibility Report.

4.3 Public Meetings

The study team conducted two Public Meetings for the FM 407 Feasibility Study which are each described below.

Tuesday, March 26, 2019
FM 407 Feasibility Study Public Meeting
Justin Elementary School
425 Boss Range Road, Justin, Texas 76247.

This first advertised Public Meeting occurred after the initial municipal outreach Work Group meetings were conducted. The municipal meetings scrutinized the study data and the Build Alternative concepts produced to date by the study team, as well as Alternatives suggested by the meeting / municipal attendees. Therefore, the meetings served to heighten the accuracy of the data and Alternatives before the same information was presented to the public at the Public Meeting. Various Public Meeting exhibits introduced the study, the study purpose and process, study timeline, Study Area aspects such as an Environmental Constraints Map, typical section concepts, and the No Build and Build Alternative

concepts produced to date by the study team; the same Alternatives previously described within the Introduction section of this Feasibility Report. The Public Meeting was conducted in an open house format with no formal presentation. The attendees were invited and encouraged to discuss the study with the study team members, complete provided Comment Forms and mark down their thoughts or suggestions directly on the Build Alternative alignment concepts (diagrammatic sheets) which were superimposed on an aerial photograph of the FM 407 Study Area.

The same information presented at the Public Meeting was also posted at: www.keepitmovingdallas.com/FM407FS and www.txdot.gov. Approximately 246 combined public, municipal, and elected official individuals signed in at the Meeting and 145 Comment Forms and emails were received during the 15-day Meeting comment period which ended on the April 10, 2019 deadline.

Thursday, July 30, 2020

FM 407 Feasibility Study Virtual Public Meeting

The second and final advertised Public Meeting was conducted in a virtual format due to State of Texas, TxDOT, and Denton County social distance guidelines established in the spring of 2020 as a means to avoid public gatherings due to the COVID-19 pandemic. Therefore, in lieu of an in-person Public Meeting, interested parties were invited to virtually access and view all the Public Meeting exhibits at www.keepitmovingdallas.com/FM407FS. The same exhibits were also located at www.txdot.gov.

Additional municipal meetings occurred after the March 2019 FM 407 Public Meeting to further scrutinize 1) the study data which included the existing and forecasted FM 407 traffic volumes, and 2) the most promising Build Alternative concepts (the Red Route and Blue Route each in combination with the common Green Route and an at-grade FM 407 / US 377 intersection) based on public and municipal feedback alongside alternative screening and evaluations conducted by the study team. Therefore, the municipal meetings served as an additional means to refine, optimize and determine a study team-recommended Build Alternative before presenting the recommended Build Alternative at the July 2020 FM 407 Virtual Public Meeting.

The explanatory July 2020 FM 407 Virtual Public Meeting exhibits posted on the aforementioned websites included a narrated presentation video introducing the study, study timeline and process, traffic analyses results, matrices of each screened alternative, and a diagrammatic of the study team-recommended Build Alternative superimposed on an aerial photograph of the FM 407 Study Area. All the exhibits were posted on the websites on July 30, 2020 and remained on the websites through August 14, 2020. Website views on July 30, 2020 totaled 405 views and the total views between July 30, 2020 through August 14, 2020 totaled 865 views.

A supplemental posting of the same narrated presentation video was posted on *YouTube* by TxDOT and had 990 viewings by the public from July 30, 2020 through August 14, 2020. A total of 119 comments were received during the Virtual Public Meeting comment period which ended on the posted deadline date of August 14, 2020.

Prior to conducting each of the two advertised FM 407 Public Meetings, notices for each Public Meeting were mailed by the TxDOT study team to property owners located adjacent to the existing FM 407 facility, property owners located adjacent to each of Build Alternative concept alignments, applicable federal, state and local elected officials, stakeholders and municipal staff members involved in the study, individuals who contacted TxDOT requesting to receive FM 407 notices, and the attendees who previously signed in at the March 2019 FM 407 Feasibility Study Public Meeting. Mailing addresses for the property owners were obtained from the Denton County Appraisal District. Other address sources included names and addresses provided to TxDOT by inquiring owners and interested individuals, and addresses provided by the attendees who signed in at the March 2019 FM 407 Feasibility Study Public Meeting.

5.0 Alternatives

The FM 407 Feasibility Study evaluated a No Build Alternative and various Build Alternative alignment concepts to improve the FM 407 Traffic Operations, Mobility and Reliability. Each alternative was presented to the public and the agencies / stakeholders for comments, feedback and suggestions. Matrix-screening of the Alternatives also applied quantitative and qualitative evaluation criteria and tabulated the screening results for all the alternatives as discussed later within this report.

5.1 Traffic Projections

As outlined in the **Traffic Forecasting Methodology Memorandum** presented in the **APPENDIX**, the Pivot Method was used to calculate the Average Daily Traffic Volumes (ADTs). The Pivot Year is the last year of the initial growth rate (\leq 20-Yr G.R.). Simply stated, the Pivot Year is the year the traffic volume counts are taken plus 20 years. The counts were taken in 2019, which make the Pivot Year 2039 for this FM 407 study. Other analysis years include the Opening Year (2025), the 20-year Design Year (2045), and the 30-year future year (2055). The methodology chosen for this analysis is consistent with that used by the TP&P Division, which applies Growth Rates conforming to various opening, pivot and design year equation calculations. The methodology was reviewed and approved by the TxDOT Dallas District in association with the Texas Transportation Institute.

In addition to the Pivot Method, the following procedures were used in developing the ADT and Peak-Hour traffic volumes:

- Existing (year 2019) 24-hour traffic volumes and intersection turning movement counts were collected in May 2019 at selected intersection locations.
- The existing year 2019 traffic data were used to develop traffic projections for FM 407 (along the main travel lanes and at intersections) for opening year 2025, design year 2045 (opening plus 20 years) and pavement design year 2055 (design year plus 10 years). [NOTE: No temporal factors were applied to the existing year 2019 traffic counts.]
- ADT and the directional splits at the intersections were determined based on the existing turning movement counts (24-hour).
- Projected and approved traffic volumes from the adjacent projects.
- All ADT data including turning movements were rounded off to the nearest 50's.
 - If a turning movement is not allowed, then the directional arrow was removed. If a turning movement is not allowed in a previous year but is allowed starting in a forecast year, it was noted with a dash for the year(s) the movement is not open. All turning movements are required to have positive growth and must be arithmetically correct.

- The projected traffic volumes obtained from the above steps were adjusted to get a balanced network for both existing conditions, no-build conditions, and build conditions.
[NOTE: The 30-year growth was verified to not have a higher growth factor than the 20-year growth at the cut lines].

5.2 No Build Alternative

This No Build Alternative does not improve FM 407 beyond prior FM 407 improvement commitments and routine FM 407 road maintenance. The regional (*Mobility 2045*) improvements are assumed to be in place with the exception of FM 407 improvements. This alternative was the baseline for comparison to the Build Alternative color-coded concepts previously described in Chapter 1.

Existing Conditions

FM 407 is as a major east-west collector serving multiple municipalities and communities in Denton County. It also links the major north-south facilities of FM 156, I-35W and US 377.

Traffic

The intersection operational analyses were evaluated for the No Build Alternative using the Synchro 10 model and the Design Year (2045) traffic volumes.

The No Build alternative maintains the existing geometry at each studied intersection along FM 407. As previously indicated, the peak hour volumes used in this analysis were derived from the projected year 2045 volumes obtained from the traffic volume projections specifically prepared for the Feasibility Study by Othon, Inc. Year 2045 peak hour traffic volume projections are also provided in the **Traffic Operational Analysis Report** located in the **APPENDIX**. The following technical parameters were also used in this analysis:

For the purposes of the traffic operational analysis for the design year 2045 No Build and design year 2045 Build Conditions, ADT volumes obtained from the traffic data collection were converted to AM and PM peak hour volumes based on the DDHV method. *HCM6* provides an equation to calculate DDHV using the annual average daily traffic (AADT), the K-factor (the proportion of AADT occurring in the design hour) and the directional distribution “D”. This equation is shown below. [NOTE: The AADT in this equation is the total of both directions of traffic.]

$$DDHV = AADT * K * D * 2$$

The values of AADT were taken from the design year 2045 projected traffic volumes. Since the study AADT volumes were one-way, the AADT volumes in the above equations were multiplied by 2. The values of AADT, K (11.1) and D (54%/46%) were obtained from TP&P package dated March 16, 2018 (Appendix A). The directional distribution factor (54%) was applied accordingly to all turning movement volumes. Exhibits summarizing the base year 2018 AM and PM peak hour turning movement volumes and design year 2045 AM and PM peak hour volumes used in this analysis are provided in the **APPENDIX**.

The following technical parameters were also used in this analysis for No Build and Build Conditions:

- Peak hour factors (PHF) = 0.92
- Truck Percentage = 8.0% (obtained from TP&P package)

Design Year (2045) No Build Conditions (No Build Geometry)

The No Build alternative maintains the existing geometry at all study area intersections along FM 407. The AM and PM peak hour volumes used in this analysis were derived from the projected year 2045 volumes obtained from the design year 2045 ADT projections. Exhibits summarizing the AM and PM peak hour volumes for design year 2045 No Build Conditions are presented in the **APPENDIX** and were evaluated using the No Build Geometry. The following technical parameters were used in this analysis:

- Peak hour factors (PHF) = 0.92
- Truck Percentage= 8.0% (obtained from TP&P package)
- K Factor = 11.1 (obtained from TP&P package)
- Directional Distribution percentage (D) = 54% (obtained from TP&P package)

Information regarding proposed traffic volume-related developments along the FM 407 corridor were received from municipalities and residential developers within the Study Area, therefore, the traffic projections have been reconciled to account for projected growth in traffic volumes from corridor developments.

The following adjustments have been made to the 2045 No Build traffic projections using trip generation from the proposed developments within or adjacent to the project:

- Petrus Development
 - 4,600 bidirectional trips added to FM 407
 - 2,300 bidirectional trips added to Boss Range Rd.
- Petrus Industrial Development
 - 13,600 bidirectional trips added to FM 156
- Timberbrook Development
 - 4,400 bidirectional trips added to FM 156
- The Highlands Development
 - 2,100 bidirectional trips added to FM 407
- Pecan Square Development
 - 8,400 bidirectional trips added to FM 407
 - 14,000 bidirectional trips added to Cleveland Gibbs Rd.
- Harvest Development
 - 23,500 bidirectional trips added to Cleveland Gibbs Rd.
 - 3,400 bidirectional trips added to I-35W SBFR

- Indian Springs Development
 - 1,500 bidirectional trips added to I-35W NBFR
- Canyon Falls Development
 - 4,000 bidirectional trips added to I-35W NBFR
 - 6,000 bidirectional trips added to FM 407
- Argyle at Avalon Development
 - 5,300 bidirectional trips added to FM 407
- Heath Track Development
 - 6,600 bidirectional trips added to FM 407
- Waterbrook Development
 - 3,000 bidirectional trips added to US 377
 - 4,400 bidirectional trips added to FM 407

TABLE 13 summarizes the results of the design hourly intersection analysis for the design year 2045 No Build Conditions. Detailed traffic analysis software outputs are included in the **APPENDIX**. As shown in **TABLE 13**, multiple Study Area intersections operate at an unsatisfactory LOS E or F during the design year 2045 No Build Conditions and which are also summarized as follows:

1. FM 407 at Boss Range Rd
 - Unsignalized approach (NBL) experiences significant delays during AM and PM peak hours.
2. FM 407/Downe Rd at FM 156
 - Signalized approaches (EBL, EBTR, WBLTR, and NBL) experience significant delays during AM and PM peak hours.
3. FM 407/E. 5th St at FM 156
 - Signalized approaches (WBLTR, NBT, NBR, and SBL) experience significant delays during AM and PM peak hours.
4. FM 407 at Cleveland Gibbs Rd
 - Unsignalized approaches (EBL, NBLTR, and SBLTR) experience significant delays during AM and PM peak hours
5. FM 407 at I-35W SBFR
 - Signalized approaches (EBT, WBL, WBT, SBL, and SBTR) experience significant delays during AM and PM peak hours.
6. FM 407 at I-35W NBFR
 - Signalized approaches (EBL, EBT, WBT, WBR, NBL, and NBTR) experience significant delays during AM and PM peak hours.

7. FM 407 at US 377

- Signalized approaches (EBL, EBTR, WBL, WBT, WBR, NBL, NBT, NBR, SBL, SBT, and SBR) experience significant delays during AM and PM peak hours.

8. FM 407 at FM 1830

- Signalized approaches (EBL, EBTR, WBT, WBR, NBL, NBTR, SBL, and SBTR) experience significant delays during AM and PM peak hours.

**Table 13: Peak Hour Intersection Analysis Results
[Design Year (2045) No Build Conditions / No Build Geometry]**

Intersection	Movement	No Build 2045 AM		No Build 2045 PM	
		LOS	Delay (s/veh)	LOS	Delay (s/veh)
FM 407 at Boss Range Rd <i>[Unsignalized]²</i>	WBL	B	11.9	B	11.3
	NBL	F	>100.0	F	>100.0
FM 407 / Downe Rd at FM 156 <i>[Signalized]</i>	Overall	D	53.7	E	62.9
	EBL	F	>100.0	F	>100.0
	EBTR	F	88.0	C	27.4
	WBLTR	F	87.3	B	19.4
	NBL	F	>100.0	F	>100.0
	NBT	B	16.1	C	20.3
	NBR	B	11.1	B	11.8
	SBL	A	8.8	B	17.3
	SBTR	C	31.9	D	39.5
FM 407 / E. 5th St at FM 156 <i>[Signalized]</i>	Overall	F	>100.0	F	>100.0
	EBLTR	B	17.5	B	17.1
	WBLTR	F	>100.0	F	>100.0
	NBL	D	35.8	C	29.0
	NBT	F	>100.0	F	>100.0
	NBR	F	>100.0	F	>100.0
	SBL	F	>100.0	F	>100.0
	SBT	C	34.5	C	30.8
SBR	D	36.9	C	33.0	
FM 407 at Cleveland Gibbs Rd <i>[Unsignalized]</i>	EBL	D	26.1	F	63.9
	WBL	C	24.7	B	14.4
	NBLTR	F	>100.0	F	>100.0
	SBLTR	F	>100.0	F	99.8

**Table 13: Peak Hour Intersection Analysis Results
[Design Year (2045) No Build Conditions / No Build Geometry]**

Intersection	Movement	No Build 2045 AM		No Build 2045 PM	
		LOS	Delay (s/veh)	LOS	Delay (s/veh)
FM 407 at I-35W SBFR <i>[Signalized]¹</i>	Overall	F	>100.0	F	>100.0
	EBT	F	>100.0	D	47.7
	EBR	C	30.7	C	20.6
	WBL	F	>100.0	F	>100.0
	WBT	F	>100.0	F	>100.0
	SBL	F	>100.0	F	>100.0
	SBTR	F	>100.0	F	>100.0
FM 407 at I-35W NBFR <i>[Signalized]¹</i>	Overall	F	>100.0	F	>100.0
	EBL	F	>100.0	F	>100.0
	EBT	F	>100.0	D	52.4
	WBT	F	>100.0	F	>100.0
	WBR	F	>100.0	F	>100.0
	NBL	E	75.3	F	>100.0
	NBTR	F	>100.0	F	>100.0
SBLR	C	26.5	C	32.6	
FM 407 at US 377 <i>[Signalized]</i>	Overall	F	>100.0	F	>100.0
	EBL	F	>100.0	F	>100.0
	EBTR	F	>100.0	F	>100.0
	WBL	F	>100.0	F	>100.0
	WBT	F	>100.0	F	>100.0
	WBR	D	36.7	E	55.3
	NBL	F	>100.0	F	>100.0
	NBT	F	>100.0	F	>100.0
	NBR	F	97.8	D	53.7
	SBL	F	>100.0	F	>100.0
	SBT	F	>100.0	F	>100.0
SBR	F	>100.0	F	>100.0	

**Table 13: Peak Hour Intersection Analysis Results
[Design Year (2045) No Build Conditions / No Build Geometry]**

Intersection	Movement	No Build 2045 AM		No Build 2045 PM	
		LOS	Delay (s/veh)	LOS	Delay (s/veh)
FM 407 at FM 1830 <i>[Signalized]</i>	Overall	F	>100.0	F	>100.0
	EBL	F	>100.0	F	>100.0
	EBTR	F	>100.0	F	>100.0
	WBL	D	40.4	D	39.6
	WBT	F	>100.0	F	>100.0
	WBR	E	56.4	F	86.3
	NBL	E	59.5	E	59.9
	NBTR	E	68.7	E	68.1
	SBL	F	>100.0	F	>100.0
	SBTR	F	>100.0	F	>100.0

NOTES:

NB, SB, EB, WB = North-, South-, East-, Westbound Intersection Approach

L, T, R = Left, Through, Right, Intersection Approach Turning Movement

(1) -Clustered intersections not supported by HCM6 methodology. LOS shown in table were obtained from HCM 2000 Intersection Analysis methodology.

(2) -Two way stop controlled (TWSC) Intersection

Environmental Impacts

The No Build scenario retains the FM 407 corridor as it currently exists, with no recommended improvements, and therefore is not anticipated to result in any currently know or measurable environmental impacts.

Right-of-Way (ROW) Impacts

The No Build scenario retains the FM 407 corridor as it currently exists, with no recommended improvements, and therefore requires no ROW (proposed property acquisition).

Economic Impacts

FM 407 is a major east-west collector facility in Denton County and as the population and employment growth continues to increase, the FM 407 traffic congestion is also expected to increase. Currently, portions of the corridor experience intersection traffic congestion via traffic volumes which exceed the roadway capacity / intersection during peak travel hours.

Community Impacts

Not installing improvements along a transportation facility can potentially impact the community vitality, aesthetic characteristic and quality of life. To move forward on the No Build Alternative is in turn expected to increase the FM 407 traffic congestion within the communities along FM 407 and thereby negatively affect, as a minimum, reliable FM 407 travel conditions. Also, negative community safety impacts, such as vehicular crashes and fatalities along the corridor, if no traffic capacity or geometric roadway improvements are constructed along FM 407. As stated previously, crash

concerns are associated with specific locations along FM 407, such as the at-grade BNSF RR and UP RR crossing locations, and will continue to be a concern if no FM 407 improvements are constructed.

5.3 Build Alternatives

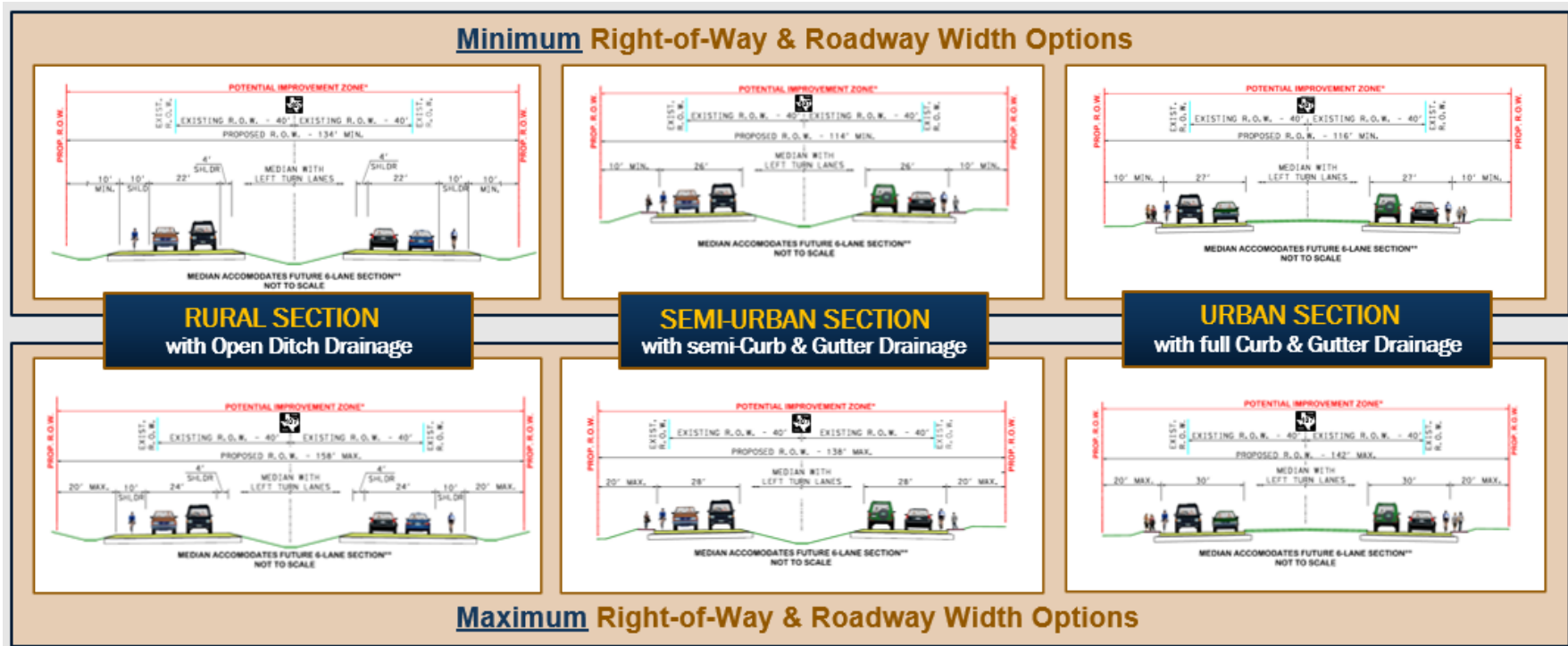
The Build Alternative concepts previously described in Chapter 1 were produced as a means to improve the FM 407 mobility, connectivity, and safety. Each of the Build Alternatives are visually presented on the color-coded **Build Alternative Alignment Concepts Diagrammatic** exhibit located in the **APPENDIX**. The typical section associated with the Build Alternatives are presented and described below.

Typical Section for Non-Couplet Build Alternatives

Two initial travel lanes would be installed in each direction and separated by an earthen median, the width of which would accommodate left-turn lanes and future expansion of FM 407 resulting in three total lanes in each direction. Roadway drainage would be managed via open ditch drainage or via curb and gutter. Pedestrians and bicyclists would be accommodated via sidewalks and Shared Use Lanes.

The proposed ROW width would vary according to the travel lane and border widths as shown in **FIGURE 16**. The specific dimensions of the potential roadway construction and land acquisition zone would be determined during TxDOT's future FM 407 Roadway Schematic Design, Environmental Analyses, and Public Involvement phase.

Figure 16: Typical Section for Non-Couplet Build Alternatives



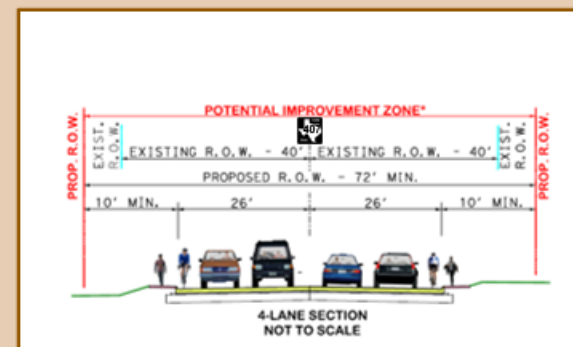
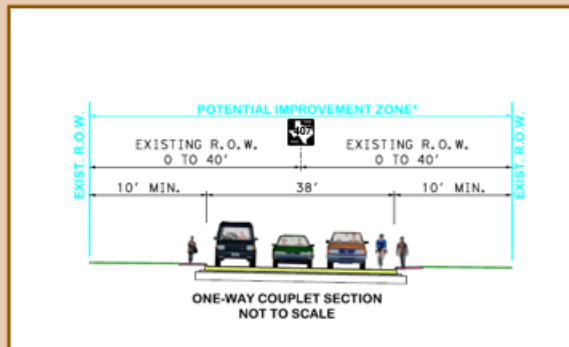
Typical Section for 1-Way Couplet Build Alternative

Three 1-way travel lanes would be installed and supplant the existing FM 407 facility west of FM 156 in the City of Justin: east of FM 156, two undivided lanes would be installed in each direction and continue eastward and eventually convert to the typical section shown in **FIGURE 17**. At the point of conversion, two westbound lanes would continue to FM 156. West of FM 156, three 1-way travel lanes would be installed and supplant the existing W. 7th Street facility.

West of the point of conversion, roadway drainage would be managed by curbs and gutters. Pedestrians and bicyclists would be accommodated via sidewalks and Shared Use Lanes. The proposed ROW width varies according to the varying travel lane and border widths shown in **FIGURE 17**. The specific dimensions of the potential roadway construction and land acquisition zone would be determined during TxDOT's future FM 407 Roadway Schematic Design, Environmental Analyses, and Public Involvement phase.

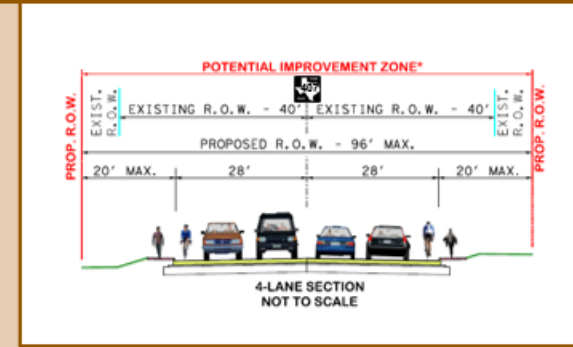
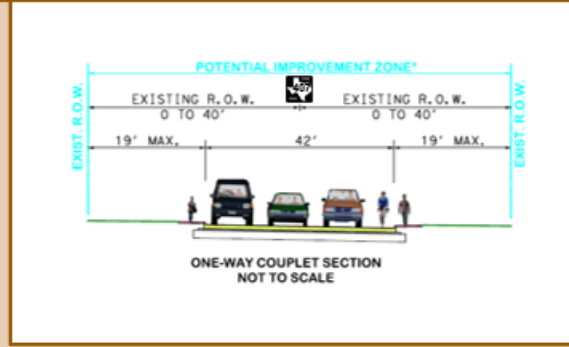
Figure 17: Typical Section for 1-Way Couplet Build Alternative

Minimum Right-of-Way & Roadway Width Options



1-WAY COUPLET STREET SECTION
with full Curb & Gutter Drainage

URBAN SECTION link to COUPLET
with full Curb & Gutter Drainage



Maximum Right-of-Way & Roadway Width Options

Traffic

Projected Design Year 2045 ADT volumes were calculated for the Red Route and Blue Route Build Alternatives (in combination with the common Green Route and an at-grade FM 407 / US 377 intersection) which emerged from the March 2019 FM 407 Public Meeting as the two most promising Build Alternative concepts. These volumes are presented on the **Build Alternatives (Red Route and Blue Route) Traffic Projections** exhibit presented in the **APPENDIX**. Comparatively, the Red Route and Blue Route Build Alternative volumes differ to the degree that the Red Route, which is nearer the City of Justin, is projected to be more utilized by FM 407 travelers and therefore, serves more travelers than the outlying Blue Route which is the northernmost of all the routes studied. Upon the completion of the Evaluation Matrix screening of the No Build and all the Build Alternatives, and upon further discussions with the stakeholders, municipalities and elected officials, a refined version of the original Red Route presented at the March 2019 FM 407 Public Meeting emerged as the study's "Recommended Build Alternative". In-depth traffic analysis involving LOS calculations were subsequently produced for this Recommended Build Alternative.

The Recommended Build Alternative is based on the traffic analyses performed and the study goals of enhanced mobility and safety, cost effectiveness, feasibility, and minimizing property impacts and environmental impacts.

The results of the study's high-level traffic and design related comparisons of the No-Build and Build Alternatives are presented in this report as a potential means to assist TxDOT and other FM 407 corridor stakeholders in prioritizing the design, funding and construction of recommended FM 407 improvements. The recommendations should be examined in further detail during subsequent post-study Roadway Design Schematic and Environmental Studies phase.

No Build and Build Alternative Evaluation

A quantitative and qualitative Evaluation Matrix screening comparison was used to rate the effectiveness of each FM 407 alternative. Screening Categories within the Matrix are listed and described as follows:

Mobility (Projected / Forecasted)

The screening criteria rating for this category is qualitative and based on the Design year 2045 travel conditions forecasted to occur for each alternative.

Safety

The screening criteria rating for this category is qualitative and based on how the alternative is expected to address known / reported crash-prone locations.

Travel Efficiency and Connectivity (Projected / Forecasted)

The screening criteria rating for this category is qualitative and based on enhancing travel route options through the study area which may further improve FM 407 traffic flow and circulation.

Municipality Objectives (Estimated / Anticipated)

The screening criteria rating for this category is qualitative and based on accommodating local (city and county) objectives such as Thoroughfare Plans.

Engineering Considerations (Estimated / Anticipated)

The screening criteria rating for this category is both qualitative and quantitative and based on how the alternative conforms to current design criteria and what is required by the alternative and the extent of utility impacts and required bridge structures.

Environmental Considerations (Potential impacts, etc.)

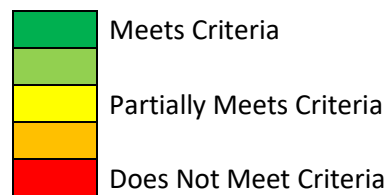
The screening criteria rating for this category is quantitative and based on known and projected NEPA-related impacts or avoidances created by the alternative.

The criteria includes Section 404 of the Clean Waters Act which regulates the discharge of dredged or fill material into waters of the United States, including wetlands, Section 4(f) of the USDOT Act of 1966 pertaining to publicly owned parks, recreation areas (including recreational trails), wildlife and water fowl refuges, or public and private historic properties impacts, and Section 6(f) of the Land and Water Conservation Fund (LWCF) Act pertaining to government acquisition of land and water and easements on land and water previously acquired with LWCF monies.

Construction Cost Considerations (Estimated)

The screening criteria rating for this category is both qualitative and quantitative and based on construction-related aspects and required alternative acreage (ROW acquisition) and costs.

Overall, the qualitative rating methodology utilized to screen each alternative was a five-level rating system which scrutinized how well each alternative met or did not meet each established criterion as shown in the following diagram:



Each alternative was evaluated (screened) using the rating system and was supplemented by applicable quantitative measurable units such as ROW acreage, number of building displacements and cost. The Alternative Evaluation Matrix results are shown in **TABLE 14** which entails three specific, unique sections of the corridor: Beginning of the study eastward to Florance Rd; Florance Rd eastward to Stonecrest Rd; and Stonecrest Rd eastward to FM 1830. It is noted the study focus was to improve the FM 407 facility including the FM 407 intersections.

Table 14: FM 407 Alternative Evaluation Matrix



 FM 407 FEASIBILITY STUDY Alternative Solutions Screening		SECTION I (Beginning of Study to Florance Rd)							
Screening Category & Evaluation Criteria	Unit	No Build Alt	Build Alt I-A ¹	Build Alt I-B ²	Build Alt I-C ³	Build Alt I-D ⁴	Build Alt I-E ⁵	Build Alt I-F ⁶	
Mobility (Projected / Forecasted)									
Provide an acceptable Year 2045 Level of Service (FM 407 traffic flow) along existing FM 407 (No Build Alt) or along FM 407 Build Alt	LDS								
Increase FM 407 travel capacity, reliability, and accessibility	*scale								
Safety									
Address crash-prone FM 407 locations with roadway geometry and water conveyance upgrades related to road / driver safety	*scale								
Avoid at-Grade Railroad Crossings on FM 407	*scale								
Travel Efficiency & Connectivity (Projected / Forecasted)									
Enhance travel route options through the study area which in turn can possibly alleviate FM 407 with improved traffic flow and circulation*	*scale								
Municipality Objectives (Estimated / Anticipated)									
Accommodate local (town, city and county) objectives such as Thoroughfare Plans and adjacent residential developments	*scale								
Engineering Considerations (Estimated / Anticipated)									
Conforms to design criteria (shoulder / lane widths, curve geometry, weave / taper lengths, design speed)	*scale								
Future Expandability	*scale								
Utilities (Oil and Gas Pipeline Infrastructure, Major Transmission Lines, etc)	# of	0	0	0	1	0	0	0	
Bridges in riverine locations requiring hydraulic considerations, permitting, and constructability challenges	# of	0	2	1	1	1	1	2	
Environmental Considerations (Potential impacts, etc.)									
Historic / Archeological Resources within 1/4 mile of Proposed ROW	# of	0	6	4	1	1	2 to 3	0	
Potential for encountering wildlife habitat / vegetation / Threatened & Endangered Species impacts within the proposed ROW	Y / N	N	Y	Y	Y	Y	Y	Y	
Clean Water Act Section 404 Jurisdictional Waters Impacts	# of	0	12	11	13	5	8	8	
Hazardous Material sites within 300 feet of Proposed ROW	# of	0	8	8	6	4	4	3	
Section 4(f) / Section 6(f) sites within the Proposed ROW	# of	0	0	0	0	1 to 2	1 to 2	0	
Agricultural Land Use Impacts and Prime Soils	acres	0	30.01	38.02	34.1	3.92	30.1	11.88	
Potential Noise Receiver Impacts to residences within 600 feet	# of	0	7	18	18	63 - 70	34	11	
Environmental Justice / Limited English Proficiency Population Impacts	Y / N	N	N	Y	Y	Y	Y	N	
Building Displacements	# of	0	1-2	3-4	11 ⁷	11	3-5	0	
Cost Considerations (Estimated)									
Alignment Length (miles)	miles	2.0	6.8	3.0	5.5	7.8	5.4	1.7	
Construction difficulty, disruption and cost	* scale								
Land (proposed Right-of-Way) Acquisition Acreage	acres	0	101.1	82.7	79.4	58.0	65.0	55.4	
Land (proposed Right-of-Way) Acquisition Acreage and Displacement Cost (2019 dollars)	dollars	\$0	\$11.97M	\$9.8M	\$9.40M	\$6.87M	\$7.8M	\$6.56M	
NOTE: Screening is based on a worst case (6-lane typical section) with shared use lanes; data is preliminary and requires detailed evaluations and engineering design via a subsequent rdwy design schematic / environmental studies phase. * Each alt is expected to enhance travel route options if Mulkey Lane (located east of FM 156) is extended eastward to I-35W and therefore likely relieve the FM 407 travel demand. ¹ During the March 2019 Public Meeting, this Section III Build Alt was presented as the "Blue Route". ² Prior to the March 2019 Public Meeting, this Section III Build Alt was eliminated as a Build Alt. This Alt routed westward along 12th St and linked the same alignment as the southern (north-south) alignment. ³ During the March 2019 Public Meeting, this Section III Build Alt was presented as the "Red Route" linking 12th Street. ⁴ During the March 2019 Public Meeting, this Section III Build Alt was presented as the "1-Way Couplet Route". ⁵ During the March 2019 Public Meeting, this Section III Build Alt was presented as the "Purple Route". ⁶ During the March 2019 Public Meeting, this Section III Build Alt was presented as the "Brown Route".									

Table 14: FM 407 Alternative Evaluation Matrix





		FM 407 FEASIBILITY STUDY Alternative Solutions Screening		SECTION II (Florance Rd to Stonecrest Rd)			
Screening Category & Evaluation Criteria		Unit	No Build Alt	Build Alt II-A* (Rural)	Build Alt II-B* (Semi-Urban)	Build Alt II-C* (Urban)	
Mobility (Projected / Forecasted)							
Provide an acceptable Year 2045 Level of Service (FM 407 traffic flow) along existing FM 407 (No Build Alt) or along FM 407 Build Alt	LOS						
Increase FM 407 travel capacity, reliability, and accessibility	*scale						
Safety							
Address crash-prone FM 407 locations with roadway geometry and water conveyance upgrades related to road / driver safety	*scale						
Avoid at-Grade Railroad Crossings on FM 407	*scale	N/A	N/A	N/A	N/A	N/A	
Travel Efficiency & Connectivity (Projected / Forecasted)							
Enhance travel route options through the study area which in turn can possibly alleviate FM 407 with improved traffic flow and circulation	*scale						
Municipality Objectives (Estimated / Anticipated)							
Accommodate local (town, city and county) objectives such as Thoroughfare Plans and adjacent residential developments	*scale						
Engineering Considerations (Estimated / Anticipated)							
Conforms to design criteria (shoulder / lane widths, curve geometry, weave / taper lengths, design speed)	*scale						
Future Expandability	*scale						
Utilities (Oil and Gas Pipeline Infrastructure, Major Transmission Lines, etc)	# of	0	0	0	0	0	
Bridges in riverine locations requiring hydraulic considerations, permitting, and constructability challenges	# of	0	4	4	4	4	
Environmental Considerations (Potential impacts, etc.)							
Historic / Archeological Resources within 1/4 mile of Proposed ROW	# of	0	0	0	0	0	
Potential for encountering wildlife habitat / vegetation / Threatened & Endangered Species impacts within the proposed ROW	Y / N	N	Y	Y	Y	Y	
Clean Water Act Section 404 Jurisdictional Waters Impacts	# of	0	7	7	7	7	
Hazardous Material sites within 300 feet of Proposed ROW	# of	0	1 to 2	1 to 2	1 to 2	1 to 2	
Section 4(f) / Section 6(f) sites within the Proposed ROW	# of	0	0	0	0	0	
Agricultural Land Use Impacts and Prime Soils	acres	0	3 to 5	3 to 5	3 to 5	3 to 5	
Potential Noise Receiver Impacts to residences within 600 feet	# of	0	43	43	43	43	
Environmental Justice / Limited English Proficiency Population Impacts	Y / N	N	N	N	N	N	
Building Displacements	# of	0	1-2	1-2	1-2	1-2	
Cost Considerations (Estimated)							
Alignment Length (miles)	miles	4.1	4.1	4.1	4.1	4.1	
Construction difficulty, disruption and cost	*scale						
Land (proposed Right-of-Way) Acquisition Acreage	acres	0	38.8	28.8	30.8	30.8	
Land (proposed Right-of-Way) Acquisition Acreage and Displacement Cost (2019 dollars)	dollars	\$0	\$4.6M	\$3.4M	\$3.5M	\$3.5M	
NOTE: Screening is based on a worst case (6-lane typical section) with shared use lanes; data is preliminary and requires detailed evaluations and eng. design via a subsequent rdwy design schem./env. studies phase. * During the March 2019 Public Meeting these Section II Build Alts were presented as a single green-color alignment (with accompanying urban, semi-urban and rural typical sections).							

Table 14: FM 407 Alternative Evaluation Matrix

 FM 407 FEASIBILITY STUDY Alternative Solutions Screening		SECTION III (Stonecrest Rd to End of Study/FM 1830)						
Screening Category & Evaluation Criteria	Unit	No Build Alt	Build Alt III-	Build Alt III-	Build Alt III-	Build Alt III-	Build Alt III-	
Mobility (Projected / Forecasted)								
Provide an acceptable Year 2045 Level of Service (FM 407 traffic flow) along existing FM 407 (No Build Alt) or along FM 407 Build Alt	LOS							
Increase FM 407 travel capacity, reliability, and accessibility	*scale							
Safety								
Address crash-prone FM 407 locations with roadway geometry and water conveyance upgrades related to road / driver safety	*scale							
Avoid at-Grade Railroad Crossings on FM 407								
Travel Efficiency & Connectivity (Projected / Forecasted)								
Enhance travel route options through the study area which in turn can possibly alleviate FM 407 with improved traffic flow and circulation	*scale							
Municipality Objectives (Estimated / Anticipated)								
Accommodate local (town, city and county) objectives such as Thoroughfare Plans and adjacent residential developments	*scale							
Engineering Considerations (Estimated / Anticipated)								
Conforms to design criteria (shoulder / lane widths, curve geometry, weave / taper lengths, design speed)	*scale							
Future Expandability	*scale							
Utilities (Oil and Gas Pipeline Infrastructure, Major Transmission Lines, etc)	# of	0	0	0	0	0	0	
Bridges in riverine locations requiring hydraulic considerations, permitting, and constructability challenges.	# of	0	2	2	2	2	2	
Environmental Considerations (Potential impacts, etc.)								
Historic / Archeological Resources within 1/4 mile of Proposed ROW	# of	0	1 to 2	1 to 2	1 to 2	1 to 2	1 to 2	
Potential for encountering wildlife habitat / vegetation / Threatened & Endangered Species impacts within the proposed ROW	Y / N	N	Y	Y	Y	Y	Y	
Clean Water Act Section 404 Jurisdictional Waters Impacts	# of	0	7 to 8	7 to 8	7 to 8	7 to 8	7 to 8	
Hazardous Material sites within 300 feet of Proposed ROW	# of	0	2 to 3	2 to 3	2 to 3	2 to 3	2 to 3	
Section 4(f) / Section 6(f) sites within the Proposed ROW	# of	0	0	0	0	0	0	
Agricultural Land Use Impacts and Prime Soils	acres	0	3 to 5	3 to 5	3 to 5	3 to 5	3 to 5	
Potential Noise Receiver Impacts to residences within 600 feet	# of	0	35	35	35	35	35	
Environmental Justice / Limited English Proficiency Population Impacts	Y / N	N	N	N	N	N	N	
Building Displacements	# of	0	1 to 2	1 to 2	1 to 2	2 to 3	1 to 2	
Cost Considerations (Estimated)								
Alignment Length (miles)	miles	3.2	3.2	3.2	3.2	3.2	3.2	
Construction difficulty, disruption and cost	* scale							
Land (proposed Right-of-Way) Acquisition Acreage	acres	0	18.7	20.1	20.4	21.6	19.5	
Land (proposed Right-of-Way) Acquisition Acreage and Displacement Cost (2019 dollars)	dollars	\$0	\$2.21M	\$2.38M	\$2.42M	\$2.56M	\$2.31M	
NOTE: Screening is based on a worst case (6-lane typical section) with shared use lanes; data is preliminary and requires detailed evaluations and engineering design via a subsequent rdwy design schematic / env. studies phase. During the March 2019 Public Meeting, two Section III Build Alts at the FM 407 / US 377 / UPRR location were presented: an At-grade signalized intersection alternative and a grade-separated alternative. ¹ At-grade FM 407 / US 377 / UPRR signalized intersection. ² Traditional grade-separated FM 407 / US 377 / UPRR interchange. ³ Single Point Urban Interchange (SPUI) grade-separated FM 407 / US 377 / UPRR interchange; Prior to the March 2019 Public Meeting, this Section III Build Alt was eliminated as a Build Alt based on Agency Meet. ⁴ Partial Cloverleaf grade-separated FM 407 / US 377 / UPRR interchange. ⁵ Roundabout grade-separated FM 407 / US 377 / UPRR interchange; Prior to the March 2019 Public Meeting, this Section III Build Alt was eliminated as a Build Alt. Depressing the UPRR beneath FM 407 or depressing FM 407 beneath the UPRR will be considered during the future roadway design schematic phase.								

6.0 Recommendations

The public-reviewed and Matrix-screened alternative analyses phases of the FM 407 Feasibility Study resulted in the production of a “Recommended Build Alternative” recommended by the study to be carried forward to the post-study Roadway Design Schematic and Environmental Studies phase.

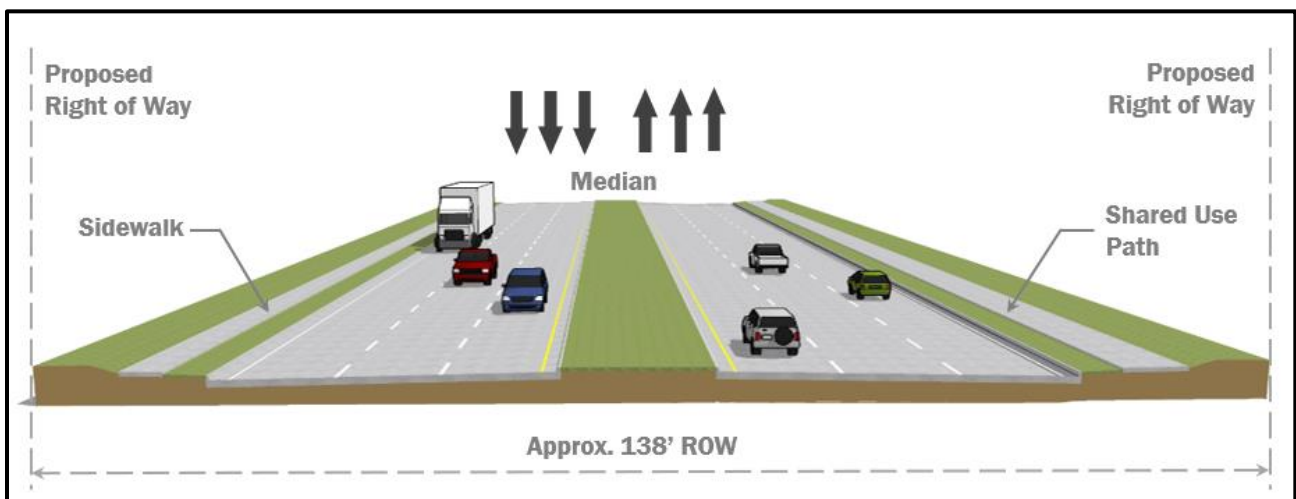
Upon the completion of the Evaluation Matrix screening of the No Build and all the Build Alternatives, and based on further discussions with the stakeholders, municipalities and elected officials, a refined version of the original Red Route (in combination with the common Green Route and an at-grade FM 407 / US 377 intersection) presented at the March 2019 FM 407 Public Meeting, emerged as the study’s “Recommended Build Alternative”. The refinement included geometric / alignment modifications to the original Red Route to lessen building displacements and sensitive site impacts. This refinement also factored in one-on-one agency stakeholder meeting comments and feedback which were conducted both by TxDOT and the municipalities after the initial March 2019 FM 407 Public Meeting was conducted by the Study. In doing so, the one-on-one meetings and decision-making factored in the public comments received at the March 2020 FM 407 Public Meeting. The refinement process ultimately produced the Recommended Build Alternative which was subsequently presented at the study’s second and final July 2020 Virtual Public Meeting conducted by the Study.

6.1 Recommended Build Alternative

The overall Recommended Build Alternative typical section is presented in **FIGURE 18** and is composed of three FM 4-7 urban (curb-and-gutter) travel lanes in each direction flanked by a continuous sidewalk and a continuous Shared Use Path. Continued coordination with the NCTCOG and local municipalities would be required on how best to link the Shared Use Path with the envisioned Regional Veloweb routes which are planned/overseen by the NCTCOG. The current NCTCOG Veloweb routes have been superimposed and noted on the **Recommended Build Alternative Diagrammatic** located in the **APPENDIX**.

The specific width dimensions of the typical section are presented on the **Recommended Build Alternative Diagrammatic** located in the **APPENDIX**.

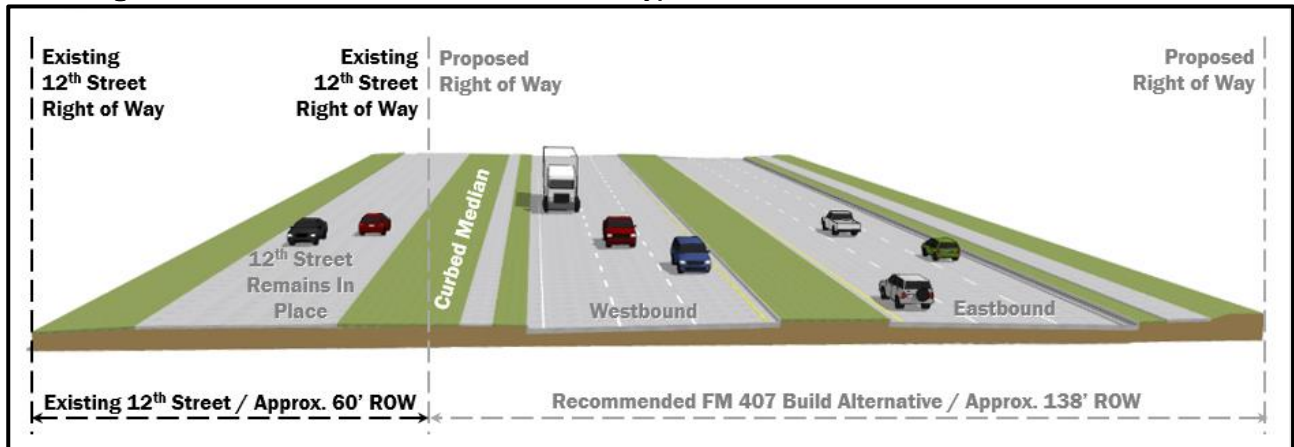
Figure 18: Recommended Build Alternative Typical Section



The City of Justin

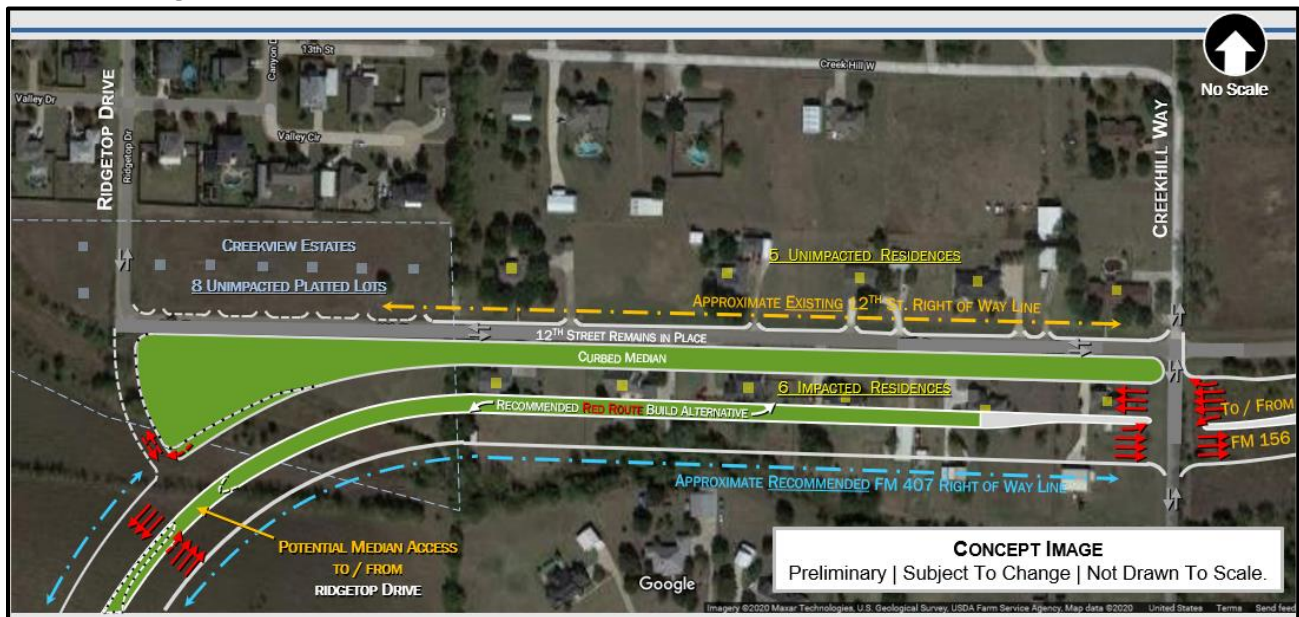
The Recommended Build Alternative FM 407 alignment located within the City of Justin, specifically west of FM 156 and south of 12th Street, is presented in **FIGURE 19**.

Figure 19: Recommended Build Alternative Typical Section located South of 12th Street



The conceptual plan view of the Recommended Build Alternative associated with the **FIGURE 19** typical section is presented as **FIGURE 20**.

Figure 20: Recommended Build Alternative Plan View located South of 12th Street



As shown in **FIGURE 20**, this segment of the refined Red Route (alignment) is located south of 12th Street and separated from the street by a raised curbed median. The alignment would directly impact the six existing residences located south of, and adjacent to, 12th Street. In comparison, if the alignment were located along the 12th Street centerline, all the existing residences and property sites located north and south of 12th Street would be directly and indirectly impacted. The alignment would provide bicyclist and pedestrian accommodation, left and right turn lanes accessing the connecting

cross-streets, and accommodation of potential landscaping and noise (wall) mitigation within the median. The basis for recommending this refined Red Route segment is the Alternative Evaluation Matrix screening performed by the study, consensus feedback received from the offices of Denton County and City of Justin, and this segment is projected to serve more driver-desired destinations through the year 2045 than the remote Blue Route. Also, the segment, like the Blue Route, offers the benefit of overpassing (bridging over) FM 156 and the BNSF RR to provide continual FM 407 daily and emergency vehicle flow, as compared to the existing FM 407 traffic flow which is interrupted / blocked by the at-grade, multi-track BNSF RR cars.

Traffic

According to the Design Year 2045 traffic projections produced by the study, approximately 12,000 to 40,000 vehicles per day would travel the Recommended Build Alternative. The intersection traffic operations associated with the Alternative are forecasted to result in an acceptable LOS D or better. Traffic volumes and LOSs at specific locations along the corridor can be viewed on the **Recommended Build Alternative Traffic Exhibits** presented in the **APPENDIX**.

Recommended Intersection Geometry

As shown on the previously presented typical sections, the recommended FM 407 facility would be composed of six travel lanes with curbs and gutters and a curbed median with median openings which allow for left turn lane access to adjacent cross-streets intersecting FM 407. The location of the ultimate median openings would be determined in coordination with the local municipalities during a potential future design phase entailing the production of FM 407 construction plans.

Intersection operational analyses were performed for the Recommended Build Alternative (Build Condition) which is visually presented on the **Recommended Build Alternative Diagrammatic** located in the **APPENDIX**. The specific, recommended intersection configurations can be viewed in the **Traffic Operational Analyses Report** or on the **Recommended Build Alternative Traffic Exhibits** which are each located in the **APPENDIX**. The recommended intersection lane configuration is described as follows:

Recommended FM 407 (12th St) at Boss Range Rd

This intersection is a three-leg signalized intersection. The westbound approach has two lanes with one dedicated left turn lane and one dedicated right turn lane. The northbound approach has four lanes with three through lanes and one dedicated right turn lane. The southbound approach has four lanes with one dedicated left turn lane and three through lanes.

FM 407 & Boss Range Rd

This intersection is a three-leg signalized intersection. The westbound approach has two lanes with one dedicated left turn lane and one dedicated right turn lane. The northbound approach has two lanes with one through lane and one dedicated right turn lane. The southbound approach has one dedicated left turn lane and one through lane.

FM 407/Downe Rd & FM 156

This intersection is a four-leg signalized intersection. The eastbound approach has four lanes with one dedicated left turn lane, one through lane, and two dedicated right turn lanes. The westbound approach has two lanes with one shared left-through lane and one shared through-right lane. The

northbound approach has four lanes with one dedicated left turn lane, two through lanes, and one dedicated right turn lane. The southbound approach has four lanes with one dedicated left turn lane, two through lanes, and one dedicated right turn lane.

FM 407/E. 5th St & FM 156

This intersection is a four-leg signalized intersection. The eastbound approach has three lanes with one dedicated left turn lane, one through lane, and one dedicated right turn lane. The westbound approach has four lanes with two dedicated left turn lanes, one through lane, and one dedicated right. The northbound approach has four lanes with one dedicated left turn lane, two through lanes, and one dedicated right turn lane. The southbound approach has five lanes with two dedicated left turn lanes, two through lanes, and one dedicated right turn lane.

Recommended FM 407 (12th St) WB Ramp at FM 156

This intersection is a three-leg signalized intersection. The eastbound approach has two lanes with one dedicated left turn lane and one dedicated right turn lane. The northbound approach has three lanes with one dedicated left turn lane and two through lanes. The southbound approach has three lanes with two through lanes and one dedicated right turn lane. All the recommended FM 407 travel lanes will overpass FM 156 and the BNSF RR, which is located east of FM 156.

Recommended FM 407 (12th St) EB Ramp at FM 156

This intersection is a three-leg signalized intersection. The eastbound approach has two lanes with one dedicated left turn lane and one dedicated right turn lane. The northbound approach has three lanes with one dedicated left turn lane and two through lanes. The southbound approach has three lanes with two through lanes and one dedicated right turn lane. All the recommended FM 407 travel lanes will overpass FM 156 and the BNSF RR, which is located east of FM 156.

Recommended FM 407 at FM 407

This intersection is a three-leg signalized intersection. The eastbound approach has four lanes with two through lanes, one shared through-right lane, and one dedicated right turn lane. The westbound approach has four lanes with one dedicated left turn lane and three through lanes. The northbound approach has two lanes with one dedicated left turn lane and one dedicated right turn lane.

FM 407 & Cleveland Gibbs Rd

This intersection is a four-leg signalized intersection. The eastbound approach has five lanes with one dedicated left turn lane, two through lanes, one shared through-right lane, and one dedicated right turn lane. The westbound approach has six lanes with two dedicated left turn lanes, three through lanes, and one dedicated right turn lane. The northbound approach has six lanes with two dedicated left turn lanes, two through lanes, and two dedicated right turn lanes. The southbound approach has six lanes with two dedicated left turn lanes, two through lanes, and two dedicated right turn lanes.

FM 407 & I-35W SBFR

This intersection is a four-leg signalized intersection. The eastbound approach has six lanes with four through lanes and two dedicated right turn lanes. The westbound approach has six lanes with two dedicated left turn lanes and four through lanes. The southbound approach has four lanes with two dedicated right turn lanes, one through lane, and one dedicated right turn lane.

FM 407 & I-35W NBFR

This intersection is a four-leg signalized intersection. The eastbound approach has six lanes with two dedicated left turn lanes and four through lanes. The westbound approach has six lanes with four through lanes and two dedicated right turn lanes. The northbound approach has six lanes with two dedicated left turn lanes, two through lanes, and two dedicated right turn lanes.

FM 407 & US 377

This intersection is a four-leg signalized intersection. The eastbound approach has six lanes with two dedicated left turn lanes, three through lanes, and one dedicated right turn lane. The westbound approach has six lanes with two dedicated left turn lanes, three through lanes, and one dedicated right turn lane. The northbound approach has seven lanes with two dedicated left turn lanes, three through lanes, and two dedicated right turn lanes. The southbound approach has seven lanes with two dedicated left turn lanes, three through lanes, and two dedicated right turn lanes. All the recommended FM 407 travel lanes will merge with US 377 at-grade, as well as cross the UP RR, which is located west of US 377.

FM 407 & FM 1830

This intersection is a four-leg signalized intersection. The eastbound approach has six lanes with two dedicated left turn lanes, three through lanes, and one dedicated right turn lane. The westbound approach has six lanes with one dedicated left turn lane, three through lanes, and two dedicated right turn lanes. The northbound approach has three lanes with one dedicated left turn lane, one through lane, and one dedicated right turn lane. The southbound approach has four lanes with two dedicated left turn lanes, one through lane, and one dedicated right turn lane.

Design Year 2045 Build Conditions (Recommended Geometry)

The recommended intersection configuration described in the prior section of this Report has been analyzed as the Build Condition. The AM and PM peak hour volumes for the Design Year 2045 were derived from the 2045 ADT projections presented in the **Traffic Operational Analyses Report** located in the **APPENDIX**.

Exhibits summarizing AM and PM peak hour volumes for the Design Year 2045 Build Condition are included in the **Traffic Operational Analyses Report** and were evaluated using the comparison No Build Geometry. The following technical parameters were used in the analyses:

- Peak hour factors (PHF) = 0.92
- Truck Percentage= 8.0% (obtained from TP&P package)
- K Factor = 11.1 (obtained from TP&P package)
- Directional Distribution percentage (D) = 54% (obtained from TP&P package)

Traffic generator information regarding proposed private developments along or near the FM 407 corridor were received from the agency / stakeholder meeting attendees to account for the projected growth in traffic volumes from ongoing and planned development projects.

The following adjustments have been made to the 2045 Build traffic projections using trip generation from the currently proposed private developments, namely residential developments:

- Petrus Development
 - 4,600 bidirectional trips added to FM 407
 - 2,300 bidirectional trips added to Boss Range Rd.
- Petrus Industrial Development
 - 13,600 bidirectional trips added to FM 156
- Timberbrook Development
 - 4,400 bidirectional trips added to FM 156
- The Highlands Development
 - 2,100 bidirectional trips added to FM 407
- Pecan Square Development
 - 8,400 bidirectional trips added to FM 407
 - 14,000 bidirectional trips added to Cleveland Gibbs Rd.
- Harvest Development
 - 23,500 bidirectional trips added to Cleveland Gibbs Rd.
 - 3,400 bidirectional trips added to I-35W SBFR
- Indian Springs Development
 - 1,500 bidirectional trips added to I-35W NBFR
- Canyon Falls Development
 - 4,000 bidirectional trips added to I-35W NBFR
 - 6,000 bidirectional trips added to FM 407
- Argyle at Avalon Development
 - 5,300 bidirectional trips added to FM 407
- Heath Track Development
 - 6,600 bidirectional trips added to FM 407
- Waterbrook Development
 - 3,000 bidirectional trips added to US 377
 - 4,400 bidirectional trips added to FM 407

TABLE 15 summarizes the results of the peak hour intersection analysis for the Design Year 2045 Build Conditions (Recommended Conceptual Geometry). Detailed software outputs are included in the **Traffic Operational Analyses Report** located in the **APPENDIX**.

As shown in **TABLE 15**, all the Build Condition intersection movements operate at and acceptable LOS D or better for the Recommended Build Alternative (Build Condition).

Table 15: Peak Hour Intersection Analysis Results [Design Year (2045) Build Condition]

Intersection	Movement	Build 2045 AM		Build 2045 PM	
		LOS	Delay (s/veh)	LOS	Delay (s/veh)
Recommended FM 407 (12th St) at Boss Range Rd <i>[Signalized]¹</i>	Overall	C	16.1	B	12.2
	WBL	C	29.4	C	22.2
	WBR	C	24.2	B	16.0
	NBT	B	19.9	B	12.0
	NBR	C	20.8	B	13.0
	SBL	A	5.0	A	6.5
	SBT	A	4.0	A	5.8
FM 407 at Boss Range Rd <i>[Signalized]</i>	Overall	C	21.5	C	27.2
	WBL	B	19.1	B	16.5
	WBR	C	26.8	D	41.7
	NBT	A	6.7	A	8.5
	NBR	A	8.2	B	10.2
	SBL	C	29.9	C	32.0
	SBT	A	6.5	A	8.2
FM 407 / Downe Rd at FM 156 <i>[Signalized]</i>	Overall	C	31.3	C	28.8
	EBL	C	34.5	D	53.7
	EBT	C	24.0	C	22.6
	EBR	D	37.8	C	26.2
	WBLTR	C	24.3	C	22.9
	NBL	C	33.6	B	15.0
	NBT	D	36.5	C	34.9
	NBR	B	18.9	B	16.3
	SBL	C	31.4	C	25.4
	SBT	B	19.4	B	17.9
SBR	A	0.0	A	0.0	

Table 15: Peak Hour Intersection Analysis Results [Design Year (2045) Build Condition]

Intersection	Movement	Build 2045 AM		Build 2045 PM	
		LOS	Delay (s/veh)	LOS	Delay (s/veh)
FM 407 / E. 5th St at FM 156 <i>[Signalized]</i>	Overall	C	29.6	C	26.4
	EBL	C	23.9	C	23.0
	EBT	C	26.7	C	25.5
	EBR	B	11.2	B	11.0
	WBL	D	40.9	D	39.5
	WBT	C	23.2	C	22.7
	WBR	D	38.2	D	39.6
	NBL	B	19.8	B	19.3
	NBT	B	17.0	C	20.3
	NBR	D	37.2	C	21.7
	SBL	C	31.6	C	24.9
	SBT	C	23.6	C	22.3
	SBR	A	9.7	A	9.7
Recommended FM 407 (12 th St) WB Ramp at FM 156 <i>[Signalized]</i>	Overall	C	31.6	C	21.4
	EBL	C	53.0	D	41.6
	EBR	D	36.0	C	25.4
	NBL	D	43.9	C	30.6
	NBT	B	12.2	B	12.4
	SBT	D	40.8	C	25.3
	SBR	A	3.4	A	3.4
Recommended FM 407 (12 th St) EB Ramp at FM 156 <i>[Signalized]</i>	Overall	B	13.5	B	11.9
	EBL	C	34.1	D	35.1
	EBR	C	25.6	C	26.8
	NBL	C	23.4	B	16.7
	NBT	A	4.5	A	0.4
	SBT	B	11.5	B	13.2
	SBR	B	13.8	B	15.2

Table 15: Peak Hour Intersection Analysis Results [Design Year (2045) Build Condition]

Intersection	Movement	Build 2045 AM		Build 2045 PM	
		LOS	Delay (s/veh)	LOS	Delay (s/veh)
Recommended FM 407 at Existing FM 407 <i>[Signalized]¹</i>	Overall	C	30.4	C	22.3
	EBTT	C	30.6	C	22.6
	EBR	C	27.3	C	22.0
	WBL	C	28.0	D	44.3
	WBT	B	15.6	B	13.5
	NBL	B	14.7	B	12.3
	NBR	D	50.7	C	26.5
FM 407 at Cleveland Gibbs Rd <i>[Signalized]</i>	Overall	D	40.1	D	37.2
	EBL	C	30.3	C	30.6
	EBT	D	37.3	C	32.7
	EBR	D	50.7	D	35.7
	WBL	D	51.1	D	49.3
	WBT	C	23.6	C	23.8
	NBL	D	53.3	D	53.4
	NBT	D	37.1	C	33.6
	NBR	D	52.9	D	37.3
	SBL	C	27.5	C	22.6
	SBT	C	26.1	C	27.1
	SBR	D	50.2	D	54.1
FM 407 at I-35W SBFR <i>[Signalized]¹</i>	Overall	C	33.2	C	33.4
	EBT	C	27.4	C	21.0
	EBR	C	33.9	C	30.8
	WBL	D	51.1	D	48.2
	WBT	C	32.9	C	33.3
	SBL	D	36.0	D	46.7
	SBT	C	26.6	C	32.9
	SBR	C	29.4	D	35.2

Table 15: Peak Hour Intersection Analysis Results [Design Year (2045) Build Condition]

Intersection	Movement	Build 2045 AM		Build 2045 PM	
		LOS	Delay (s/veh)	LOS	Delay (s/veh)
FM 407 at I-35W NBFR <i>[Signalized]¹</i>	Overall	D	39.5	D	42.1
	EBL	D	54.4	D	53.8
	EBT	C	29.9	B	19.4
	WBT	C	34.2	D	38.7
	WBR	D	39.7	D	51.3
	NBL	C	32.0	D	53.7
	NBT	C	29.2	D	38.4
	NBR	D	54.2	D	46.9
FM 407 at US 377 <i>[Signalized]</i>	Overall	D	35.6	D	37.5
	EBL	C	21.5	D	52.6
	EBT	D	41.8	C	26.3
	EBR	C	32.7	C	30.2
	WBL	D	39.7	C	33.4
	WBT	C	26.7	D	36.1
	WBR	D	36.7	D	47.7
	NBL	D	45.3	D	52.3
	NBT	C	32.8	D	35.7
	NBR	C	32.7	C	30.8
	SBL	C	24.6	C	27.7
	SBT	D	40.6	D	37.1
	SBR	D	41.8	D	44.2

Table 15: Peak Hour Intersection Analysis Results [Design Year (2045) Build Condition]

Intersection	Movement	Build 2045 AM		Build 2045 PM	
		LOS	Delay (s/veh)	LOS	Delay (s/veh)
FM 407 at FM 1830 <i>[Signalized]</i>	Overall	C	28.9	C	33.1
	EBL	C	32.9	D	45.8
	EBT	C	26.3	C	21.3
	EBR	B	12.9	B	14.9
	WBL	C	22.9	B	19.1
	WBT	C	25.6	D	42.9
	WBR	A	5.7	B	11.9
	NBL	D	51.6	D	51.7
	NBT	D	50.9	D	52.5
	NBR	D	47.6	D	46.1
	SBL	D	49.0	C	33.6
	SBT	C	30.4	C	27.3
	SBR	D	53.1	D	54.9

NOTES:

NB, SB, EB, WB = North-, South-, East-, Westbound Intersection Approach

L, T, R = Left, Through, Right, Intersection Approach Turning Movement

(1) -Clustered intersections and Non-NEMA phasing not supported by HCM6 methodology. LOS shown in table were obtained from HCM 2000 Intersection Analysis methodology.

In summary, the LOS analysis performed by the Feasibility Report and previously presented within this Feasibility Report indicate the comparison Base Year 2018 Existing Conditions and comparison Design Year 2045 No Build Conditions at the various analyzed FM 407 intersection (traffic movements) operate at a LOS E or F, whereas all the analyzed intersections for the Design Year 2045 Build Conditions (Recommended Build Alternative) operate at a LOS D or better.

Environmental Impacts

As presented previously in **TABLE 6: FM 407 Alternative Evaluation Matrix**, constructing the Recommended Build Alternative (presented as Build Alt I-C, II-C and III-A within the previously presented Matrices) is forecasted to potentially result in various direct or indirect environmental impacts which may involve jurisdictional waters, proximity to historic or archeological sites, land use, necessary land acquisition, and building displacements. Also, a preliminary noise analysis was conducted for the Recommended Build Alternative and is on file at the TxDOT Dallas District; noise analysis which is further discussed within the **Supplemental Data and Analyses** section of this Feasibility Study.

Right-of-Way (ROW) Impacts

The Recommended Build Alternative alignment was conceptually engineered to be constructed within the existing FM 407 ROW limits, to the maximum extent possible. However, ROW (land) acquisition would be required at various locations along the existing FM 407 facility and at locations where the

Alternative alignment is recommended to be located at new locations where no roadway currently exists. One of the new locations is south of 12th Street within the City of Justin where the construction of the Alternative alignment would impact six existing residential buildings.

Economic Impacts

Installing the Recommended Build Alternative may, to some currently unknown extent, create negative economic impacts to existing properties located adjacent to FM 407 depending on the property location and the degree of property impact. Similarly, positive economic impacts may be realized by installing the Alternative. As observed along other transportation facilities which have been upgraded and improved with increased travel capacity and pedestrian friendly intersections, the improved facilities directly or indirectly generate economic activity in the form of commercial, retail and residential development adjacent to the roads and increase property values within and beyond the transportation corridor.

Community Impacts

Although the cross-street and driveway access to and from FM 407 would be temporarily interrupted by constructing the Recommended Build Alternative, access to adjacent property sites would be maintained during the construction and would be re-established to access the newly constructed FM 407 facility. This temporary access and construction maintenance zone scenario would also apply to any reconstructed / improved intersections. If any portion of the Recommended Build Alternative is selected for potential construction, further evaluation within a future FM 407 Roadway Design Schematic and Environmental Studies phase would assess in more detail any resulting impacts to existing properties and structures along the FM 407 corridor.

Installing the Recommended Build Alternative would increase the FM 407 corridor's mobility and reliability. For example, the Alternative includes routing / bridging FM 407 over FM 156 and the BNSF RR. This grade-separation is expected to decrease emergency / first responder travel times, particularly when BNSF RR train cars are blocking the current City of Justin roadway facilities, including existing FM 407, which cross the BNSF RR. However, installing this bridge structure where no bridge currently exists can be viewed as a negative visual impact, depending on the aesthetic style of the bridge and its visual / context sensitive integration within the community and surroundings.

The character of the FM 407 facility is expected to change from a rural, open ditch asphalt pavement facility to an urban, curb and gutter concrete pavement facility which provides for bicyclist and pedestrian modes of travel. Future municipality decision-making would determine exactly how the landscape, hardscape features and community fabric and development should evolve and be integrated within the FM 407 corridor. Local municipalities commonly confer with TxDOT to strategize and co-fund the incorporation of particular elements within and along a TxDOT corridor. These elements which may be applicable to constructing the Recommended Build Alternative and may include gateway accent signage, upgraded luminaires and signal poles, landscaping, and traffic rail designs and rustication.

6.2 Supplemental Data and Analyses

Additional study-related tasks and evaluations were performed by the study team to broaden the No Build and Build Alternative evaluations including assessing their potential impacts and related implications. These evaluations are summarized as follows.

Environmental Constraints

The study team considered impacts to environmentally sensitive sites identified and mapped by the study team during the conceptual alternative production and evaluation process. Identified sensitive sites involve the natural, cultural, and the human environment such as, but not limited to, historic and archeological resources, burial grounds, neighborhood communities and residential areas, farmland, floodplains, wetlands, parks and nature preserves, geologic features, undeveloped areas, and schools.

Presented in the **APPENDIX**, the Feasibility Study's **FM 407 Constraints Map** identifies sites and areas of concern which in turn influenced the production of the various Build Alternative alignments. Further evaluation within a future FM 407 Roadway Design Schematic and Environmental Studies phase would assess and evaluate in more detail the following environmental constraint topics:

- Land Use
- Hazardous Materials
- Threatened and Endangered Species/Habitat
- Vegetation
- Cultural Resources
- Waters of the U.S. (including Wetlands)
- Floodplains
- Soils
- Socio-Economic
- Traffic Noise
- Air Quality

The future Environmental Studies would also include documented constraint recommendations or determinations and related exhibits which would include:

- Project Location Map
- USGS Topographic Map
- 2010 Census Tracts
- Land Use
- Environmental Constraints Map
- FEMA Floodplain
- Historic Resources
- Hazardous Material Sites
- Photographs

Preliminary Traffic Noise Analysis

A preliminary Traffic Noise Analysis was performed for the Recommended Build Alternative to preliminarily assess potential noise impacts and the potential noise mitigation. This analysis was accomplished in accordance with TxDOT's (Federal Highway Administration [FHWA] approved) Guidelines for Analysis and Abatement of Roadway Traffic Noise (2019). The FHWA traffic noise

modeling software (Traffic Noise Model 2.5) was used to calculate existing and predicted traffic noise levels. The model primarily considers the number, type and speed of vehicles; roadway 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. Existing and predicted traffic noise levels were modeled at receiver locations that represent the land use activity areas adjacent to the study-recommended FM 407 improvements and that might be impacted by traffic noise and potentially benefit from feasible and reasonable noise abatement.

To avoid noise impacts that may result from future development of properties adjacent to the FM 407 corridor, local officials responsible for land use control programs would need to ensure, to the maximum extent possible, that no new activities are planned or constructed along or within the predicted (2045) noise impact contours presented in the preliminary Traffic Noise Analysis.

Preliminary Drainage Memorandum

Preliminary existing FM 407 drainage analyses were performed which included feasibility level evaluations of the existing FM 407 drainage features such as bridges and culverts and documenting potential drainage issues. The analyses entailed field recon, identification of drainage constraints, review of local land use plans, cultural resources, prior FM 407 construction plans BRINSAP reports, and Federal Emergency Management Agency (FEMA) maps, and Flood Insurance Study (FIS) requests.

Future action items involving more in-depth FM 407 drainage analysis would need to be undertaken within a future FM 407 Roadway Design Schematic and Environmental Studies phase and would need to include more detailed items commonly produced for the Roadway Design Schematic:

- Survey coordination and review;
- Roadside Ditch and storm sewer analysis;
- Roadway Drainage, channel design, scour analyses, or erosion control;
- Bridge and culvert design layout sheets;
- Hydraulic data sheets for all crossings;
- Floodplain / floodway mapping;
- Storage / Detention analysis; and
- FEMA submittals (CLOMR / LOMR).

Preliminary Construction Sequencing

A **Recommended Build Alternative Preliminary Construction Sequence Exhibit** was prepared during the Feasibility Study and depicts the concept phasing and traffic detours anticipated to construct the Recommended Build Alternative. This exhibit is presented in the **APPENDIX** and a general description of the construction sequencing is described as follows alongside **FIGURE 21** which generally presents the six construction phases described below.

Existing FM 407 consists of two 12-foot wide undivided travel lanes with 1 to 11-foot wide outside shoulders. The Recommended Build Alternative consists of three 12-foot wide travel lanes with 2-foot outside shoulders, an 18-foot median and 20-foot outside border zones located between the recommended ROW line to pavement outside travel lane curb. The typical overall pavement width is 98 feet and typical recommended (proposed) ROW width is 138 feet.

Subsequent to TxDOT's acquisition of the recommended (proposed) ROW beyond the existing FM 407 ROW, the border width adjacent to the existing outside travel lane is approximately 56 feet wide. This width is considered sufficient to construct crossing culverts wide enough to permit the construction of two 12-foot wide permanent travel lanes with a 12-foot wide buffer between the permanent pavement and the existing pavement. Therefore, the potential construction phasing associated with the Recommended Build Alternative is generally presented as follows:

Phase 1

Place advance warning signs and traffic control devices. Construct the permanent westbound lanes drainage and pavement from Florance Road eastward to the existing FM 470 / FM 1830 intersection.

Phase 2

After construction of the permanent westbound FM 407 travel lanes, relocate the traffic and traffic control devices pertaining to the permanent pavement as needed. Construct the permanent eastbound lanes from Florance Road eastward to the FM 470 / FM 1830 intersection.

Phase 3

Initial coordination with the BNSF Railway is assumed to be complete before phasing the construction. The ROW to be acquired is sufficient for the proposed FM 407 overpass of FM 156 and the BNSF RR Tracks.

Construct the permanent FM 407 westbound and eastbound lanes from Creekhill Road eastward to Florance Road. Maintain access to the Creekhill Estates Development by constructing the intersection of Creekhill Road and 12th Street in the initial stage of Phase 3. Subsequently, construct the FM 156 / FM 407 interchange connecting access roads which will provide additional access from the Creekhill Estates Development to existing FM 156.

Construct the FM 407 overpass of FM 156 and BNSF RR tracks. Construct the remainder of proposed new location FM 407 from FM 156 to Florance Road (Phase 2 construction limits.)

Phase 4

Construct all the permanent FM 407 lanes from existing FM 407 (south end of Phase 4) eastward to Creekhill Road. Sections of the permanent FM 407 roadway can be opened to traffic after pavement markings and traffic signing are provided.

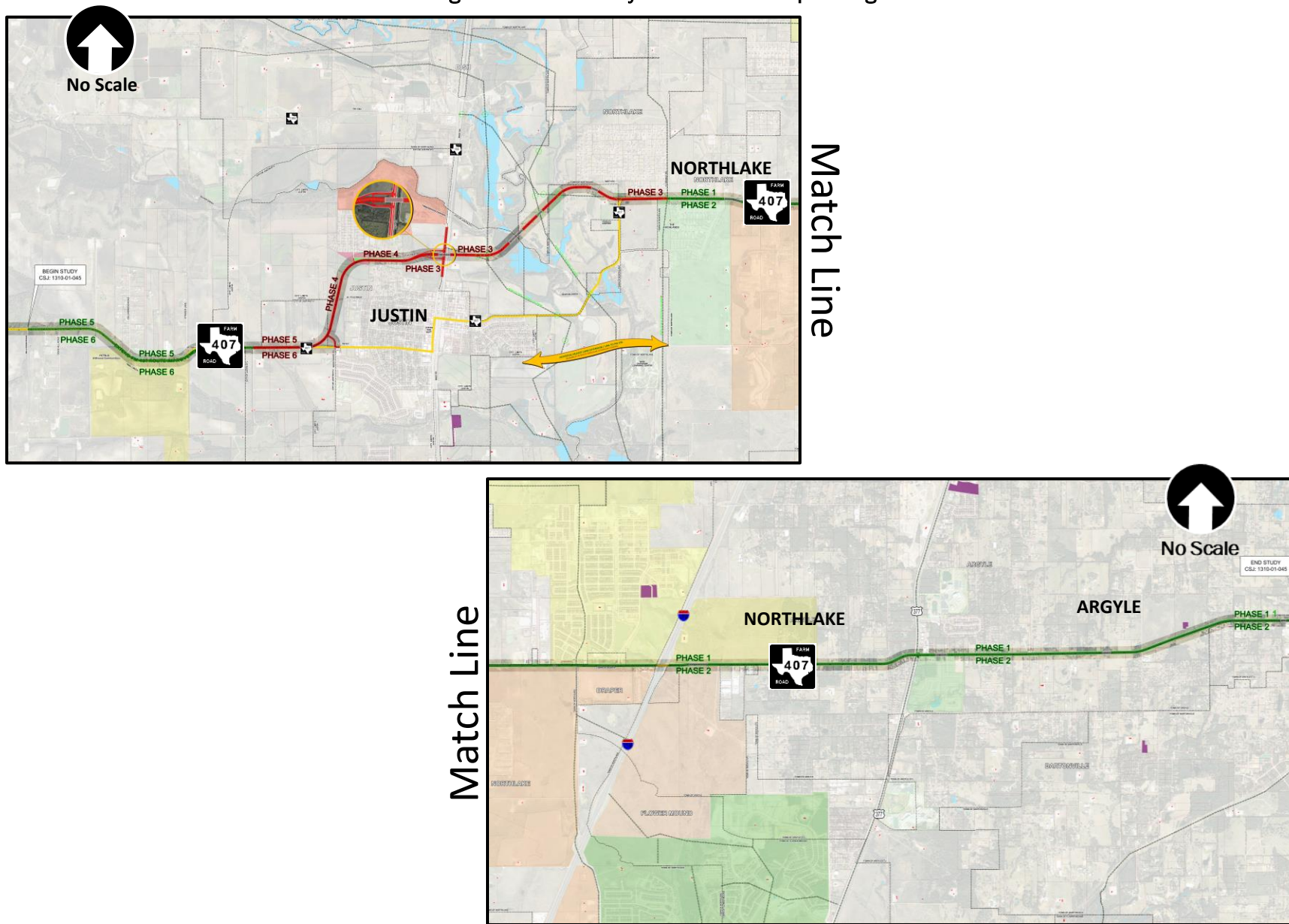
Phase 5

Place traffic control devices and warning / guide signage. Construct the permanent westbound lanes of FM 407 from Bill Cook Road (the western end of Phase 5) eastward to the completed construction of Phase 4 lanes (eastern end of Phase 5).

Phase 6

Relocate traffic as needed and construct the permanent eastbound lanes of FM 407 from Bill Cook Road to the completed Phase 4 lanes. Complete the pavement markings and traffic sign placement.

Figure 21: Preliminary Construction Sequencing



6.3 Cost Effectiveness: Construction, and ROW

At the time this Feasibility Study Report was produced, the Recommended Build Alternative was preliminarily cost-estimated with the most recent available year 2020 construction unit costs. This estimate was based on the scenario of constructing the Alternative as one entire construction project. It is noted however, that potential future construction of the Alternative would likely let and be constructed as individual, timelier funded segments (individual construction projects).

The cost estimate includes TxDOT’s standard Annual Scope & Estimate Documentation (ASED) cost estimation items (earthwork, subgrade / base, pavement, drainage, structures, and miscellaneous construction) for the Recommended Build Alternative elements: travel lanes/pavement, sidewalk and paved path, below-ground drainage lines, grading, and culverts and bridges. It is noted utility that any currently unconfirmed utility adjustments required to construct the Alternative was not included in the cost estimate.

TABLE 16 presents the preliminary construction cost estimate to construct the Recommended Build Alternative improvements as conceptually depicted on the **Recommended Build Alternative Diagrammatic** located in the **APPENDIX**.

Table 16: FM 407 Construction Cost Estimates (2020 Dollars)

Segment	ASED Cost	ROW Cost	Total	Cost / Mile
West of FM 156 to FM 1830	\$211,038,784	\$15,200,000	\$226,238,784	\$17,400,000

The cost estimates are based on the concept level Recommended Build Alternative Diagrammatic. The ROW cost portion of the estimates is based on Denton County Appraisal District valuations. Overall, the estimated costs are considered high-level estimates and do not account for inflation associated with the Recommended Build Alternative implementation exact timeline which is currently unknown.

The costs are presented in this Feasibility Report as a means to assist TxDOT and other FM 407 corridor municipal stakeholders in prioritizing the design, funding and construction of the Recommended Build Alternative or portions thereof. Therefore, this conceptual Alternative would need to be examined in further detail, holistically or partially, during a subsequent post-study Roadway Design Schematic and Environmental Studies phase.

7.0 Conclusion

The FM 407 Recommended Build Alternative produced by TxDOT's FM 407 Feasibility Study entails reconstructing the facility into a six-lane facility with roadway geometric upgrades, particularly vertical and horizontal alignment upgrades, in order to improve the FM 407 Traffic Operations, Mobility, and Reliability while adhering to TxDOT's Roadway Design Manual and Access Management Manual. This conceptual Build Alternative addresses the long-term FM 407 transportation needs and minimizes, as much as possible, based on currently available information, impacts to adjacent properties and sensitive sites.

However, due to the existing FM 407 ROW width and private development fronting the facility, the Recommended Build Alternative would require ROW acquisition along the Alternative and six residential displacements immediately south of 12th Street within the City of Justin. The natural environment, such as, but not limited to threatened and endangered species and jurisdictional waters, and existing utility locations were taken into account and evaluated as part of the alternative screening and selection process. These current feasibility-level evaluations determined that neither the natural environment nor utilities would undergo major impacts if the Recommended Build Alternative was constructed.

Safety upgrades provided by the Recommended Build Alternative are a curbed median separating the bi-directional FM 407 traffic and providing a slow speed dedicated left turn lane, removal of the awkward roadway alignment curvature, and bridging over FM 156 and the adjacent BNSF Railway tracks. Relatedly, the Alternative also upgrades the various existing FM 407 and cross-street intersections via traffic flow, mobility operations and travel lane capacity upgrades. And to achieve a multi-modal solution, the Alternative ROW width provides pedestrian and bicyclist accommodation and access in the form of continuous Shared Use Path and sidewalk installations along the entire corridor and at the cross-street intersections.

Based on traffic analyses performed by the study, this Recommended Build Alternative is forecasted to meet the mobility and traffic operations needs of the FM 407 corridor through the Design Year 2045. The various interim or break-out projects or portions of the Alternative could potentially be implemented according to funding availability and prioritizing the high traffic volume / travel demand and safety concern locations. These envisioned interim projects would focus the immediate travel demand and safety-related needs and are subject to further TxDOT discussion and coordination with each municipality where each project is located:

- FM 407 lane capacity upgrades between US 377 and FM 1830 (Town of Argyle);
- FM 477 / I-35W intersection signalization with lane capacity upgrades (Town of Northlake);
- FM 407 / Cleveland Gibbs Road signalization with lane capacity upgrades (Town of Northlake); and
- FM 407 new location alignment and lane capacity upgrades with bridge overpasses at FM 156 and BNSF RR (City of Justin).

The Feasibility Study was performed according to currently available information and the Study's limited, high concept Scope of Services. The Study outreach to local municipalities and the resulting Recommended Build Alternative is intended to be a guide to initiate the next, more detailed phase of potentially improving the FM 407 facility: Roadway Design Schematic composed of formal NEPA document preparation and further public involvement which would include a Public Hearing.

Funding

No funding sources have been currently identified to construct the Recommended Build Alternative; however, funding could be identified from national, state, and local funding sources. Future pursuits to identify specific funding sources may include discussions with, or funding allocations or landbanking involving, TxDOT, the NCTCOG, Denton County, FM 407 corridor municipalities, the Unified Transportation Plan (UTP), and the Transportation Improvement program (TIP).

The Recommended Build Alternative is not currently included in the region's MTP or TxDOT's UTP, but would need to be included in those documents as well as the TIP. The UTP is TxDOT's statewide 10-year plan that guides the development of transportation work across the state. Organized into 12 funding categories, with each one addressing a specific type of work, the UTP authorizes the distribution of construction dollars expected to be available over the next 10 years. The outcome of the UTP process is a list of projects TxDOT intends to develop or begin constructing over the next 10 years, as well as information on the available funding associated with those projects.

The funding categories FM 407 would be eligible for would likely include categories 2, 4, and 12. The funding allocation for the 2020 UTP for these categories for projects in the TxDOT Dallas District, which includes Denton County, totals \$38,442,260,000 and are as follows:

- **Category 2** (Metropolitan and Urban Corridors) – \$11,481,710,000 for the DFW region which includes the Dallas, Fort Worth and Paris TxDOT Districts, an average of approximately \$1.15 billion per year for three districts.
- **Category 4** (Connectivity Corridors) – \$11,220,550,000 for the Dallas District, an average of approximately \$1.12 billion per year for the District.
- **Category 12** (Strategic Priority) – \$15,740,000,000 for the Dallas District, an average of approximately \$1.60 billion per year for the District.

However, it is important to note there are many transportation needs in the DFW region which would need to also utilize these categories. In fact, according to NCTCOG, the region's most current 10-year plan contains \$7 billion in transportation projects that need funding in the DFW region from FY 2017-2029. The funding in UTP is allocated already to other projects, but those funds could be moved to new projects. The UTP is updated every year.

The currently estimated cost for the Recommended Build Alternative (\$226.2 million in 2020 dollars) is within the amount the Dallas District receives in Category 12 funding for each of the UTP's 10 years.

TxDOT, Denton County, and NCTCOG plan to continue to work together to identify funding as this project (Recommended Build Alternative) moves forward.

Timeline

No definite or planned timeline has been established for the post-Study phase of developing the FM 407 Recommended Build Alternative. However, successive timeline phases currently envisioned by TxDOT are listed below and remain subject to change, particularly since no funding has been assigned to construct the Recommended Build Alternative.

- 2 to 4 years – FM 407 Roadway Schematic Design, Environmental Studies and Public Involvement (Public Meeting & Public Hearing)
- 5 to 8 years – FM 407 Final Design, Construction Plans and Utilities Coordination
- 9 to 11 years – Phased FM 407 Construction

After the future Roadway Schematic Design and Environmental Studies are finalized, and the Public Hearing is conducted, ROW preservation required to construct the Recommended Build Alternative should occur via land use planning and ROW acquisition.

Bibliography

Town of Argyle Thoroughfare Plan (April 2010)

Town of Bartonville Thoroughfare Plan (November 2012)

Town of Flower Mound Landuse Map (October 2020)

City of Justin Thoroughfare Plan (July 2017)

Town of Northlake Master Thoroughfare Plan (May 2017)

Denton County Thoroughfare Plan (April 2017)

North Central Texas Council of Governments (NCTCOG). *Mobility 2045: The Metropolitan Transportation Plan for North Central Texas* (June 2018).

APPENDIX
Executive Summary

Introduction

The TxDOT FM 407 Feasibility Study identified and evaluated road-related capacity, operational and geometric improvements along FM 407 in Denton County. In doing so, the study produced and recommended conceptual solutions to improve FM 407 travel conditions through Year 2045, namely Traffic Operations, Mobility, and Reliability improvements. Traffic operations assessments included current (near-term) and projected (long-term) traffic growth / travel demand along FM 407, and at each major cross-street which intersects FM 407.

Presented in **FIGURE 1**, the studied FM 407 study corridor is approximately 13 miles in length and spans from West of FM 156 (in the City of Justin) to FM 1830 (in the Town of Argyle). The FM 407 Study Area is located in Denton County and spans the municipalities of Argyle, Bartonville, Denton County, Dish, Draper, Flower Mound, Justin, and Northlake.

Figure 1: FM 407 Study Location Map



The FM 407 study team assembled by the TxDOT Dallas District coordinated the study aspects and solution pursuit and speculation process by conducting Public Meetings and agency-invited outreach meetings with the various FM 407 corridor stakeholders, namely:

- Denton County
- Town of Argyle
- Town of Bartonville
- Town of Dish
- Town of Draper
- Town of Flower Mound
- City of Justin
- Town of Northlake
- US Army Corps of Engineers (USACE)

- North Central Texas Council of Governments (NCTCOG)
- Burlington Northern and Santa Fe Railway (BNSF RR)
- Union Pacific Railroad (UP RR)
- Multiple Utility Companies
- Multiple TxDOT Offices

The public and agency outreach conducted by the study team encouraged all-inclusive input to arrive at consensus solutions to improve the FM 407 corridor. This outreach included information-sharing results of the study and conceptual FM 407 Build Alternatives (improvement solutions), as well as a comparison No Build or Do Nothing Alternative.

Study Goal

The overriding study goal was to improve travel conditions along the FM 407 facility pertaining to safety, access, and mobility. The development of the Build Alternatives, and the resulting production of an ultimate Recommended Build Alternative, was guided by the following study actions:

- Comparison the No Build and Build Alternatives;
- Evaluation and production of forecasted Design Year 2045 FM 407 Traffic Volumes (Travel Demand) within the FM 407 corridor;
- Incorporation of current roadway design and safety standards;
- Evaluation of Traffic Safety aspects;
- Minimizing the Build Alternative near-term and long-term impacts; and
- Coordination with local municipalities and stakeholder agencies.

The study evaluation involved the need to minimize traffic congestion along FM 407, improve the FM 407 / cross-street intersection operations, maintain adjacent property site access to FM 407, and maintain the FM 407 connectivity to the major north-south transportation facilities which intersect FM 407 (FM 156, I-35W, US 377 and FM 1830).

Alternatives Evaluated

Based on the study purpose and study goals, the study's production and evaluation of the No Build Alternative and conceptual Build Alternatives factored in public and municipality / agency outreach and input. Described below, and presented at the study's initial advertised FM 407 Public Meeting conducted by TxDOT in March 2019, each alternative was assessed for compatibility with the regional Metropolitan Transportation Plan, known as *Mobility 2045*, local / municipal Thoroughfare Plans, and factored in environmental and design constraints and traffic operations and functionality.

No Build Alternative

FM 407 transportation improvements would not be constructed. This comparison alternative does not improve FM 407 beyond prior FM 407 improvement commitments and routine FM 407 road maintenance. The regional (*Mobility 2045*) improvements are assumed to be in place and operational with the exception of FM 407 improvements.

Green Build Alternative

This alignment predominately followed the existing FM 407 roadway centerline and spanned from Florance Road in Northlake eastward to the study's eastern study termini at FM 1830. This alignment also entailed two sub-options: intersecting the US 377 and UPRR at-grade, or bridging / overpassing the two facilities.

The following alternatives focused the City of Justin region of the studied corridor and each were intended to tie directly to the Green Alternative.

Blue Build Alternative

This northernmost new location alignment spanned from Florance Road on predominately new location westward / northwestward and tied directly to the west-east FM 1384 facility until it bypassed the City of Justin when it turned directly southward and eventually tied to existing FM 407 west of Justin / FM 156.

Brown Build Alternative

Located south of the Blue Alternative and within Justin, this westward new location alignment spanned from Florance Road on new location and terminated at the north-south FM 156 facility within Justin via entrance and exit vehicular access ramps to / from the Alternative and FM 156.

Red Build Alternative

Located south of the Brown Alternative and within Justin, this new location alignment spanned from Florance Road southwestward and was located to supplant or be located south of east-west 12th Street, and at the western limit of 12th Street, veered directly southward before it tied directly to existing FM 407 west of Justin / FM 156 / Boss Range Road.

One-Way Couplet Build Alternative

This alignment veered immediately southwestward from Florance Road on predominately new location and 1) the westbound travel lanes veered along the existing west-east segment of FM 407 (which is also signed locally within Justin as E. 5th Street), and 2) the eastbound travel lanes veered southwestward on new location and tied directly into the existing FM 407 facility within Justin (west of FM 156) and continuing westward to the study's western termini west of Boss Range Road.

Purple Build Alternative

This southernmost alignment veered immediately southwestward of Florance Road and followed the Couplet Alternative's eastbound travel lanes but did not align with E. 5th Street, and unlike the Couplet Alternative was a two-way facility.

Each studied build alternative could be implemented over different time periods based on localized congestion relief needs and construction funding availability. Another potential mobility improvement considered by the study to further alleviate the FM 407 travel conditions and traffic volume demand, as well as serve future, planned, ongoing development between FM 156 in Justin and I-35W, was to potentially supplement the ultimate build alternative. This supplemental option which is also presented on the **Build Alternative Alignment Concepts Diagrammatic** exhibit located in the **APPENDIX**,

entailed a new location facility which spanned from FM 156 in Justin eastward along Downe Road and proceeded further eastward and linked the Mulkey Lane facility and eventually linked the I-35E facility.

Data Collection

The study team collected data and corridor-related information from multiple entities including TxDOT, NCTCOG, Denton County, the City of Justin and the Towns of Argyle, Bartonville, Flower Mound and Northlake. Collecting this information was undertaken via a Study Kick-off Meeting conducted by the TxDOT Dallas District / Study Team, participating agencies, one-on-one town, city and county meetings, and publicly-accessible municipal and oversight agency websites.

One major, highlighted source of information collected and utilized by the Study were the county and municipal Thoroughfare Plans which served a prominent and guiding role in establishing and assessing the Build Alternatives according to conformance / accommodation of FM 407-related aspects involving each Thoroughfare Plan.

FM 407 traffic volume projections for the Design Year 2045 which were utilized for the Study's traffic evaluations were produced by the Study and approved by the Dallas District in association with the Texas Transportation Institute.

Study Process and Results

The Study investigations and evaluations focused high concept, high-level comparisons of the No-build and Build Alternative (presented at the March 2019 FM 407 Public Meeting) concepts which were each screened via standard and corridor-specific screening categories composed of quantitative and qualitative criteria. This Measure of Effectiveness matrix screening scrutinized and rated each alternative's functionality, benefits, disbenefits and impacts in order to determine an optimal recommended solution (alternative) which most adhered to the Study goal. The screening categories were Mobility, Safety, Travel Efficiency and Connectivity, Municipality Objectives, Engineering Considerations, Environmental Considerations, and Construction Cost Considerations and public and municipality feedback.

The potential environmental impacts resulting from the theorized construction of each Build Alternative were based on available public database information and field reconnaissance conducted by the study team along the FM 407 corridor. No detailed analysis was performed to analyze all the possible environmental impacts which may or may result from constructing each Build Alternative. Specific ROW impacts were assessed based on the FM 407 corridor aerial photography, Google imagery and field reconnaissance.

Each Build Alternative was scrutinized to gauge its effectiveness in providing a long-term (twenty-year) FM 407 travel demand and capacity solution which could satisfy the Design Year 2045 travel demand (traffic volume projections). The solution search not only involved the addition of travel lanes to the FM 407 corridor, but also improved the FM 407 / cross-street intersections, specifically alleviating the intersection congestion by improving the intersection traffic flow [Level of Service (LOS)], and grade-separating FM 407 over FM 156 and the BNSF Railway tracks. Design Year 2045 FM 407 traffic projections were therefore, evaluated and analyzed using Synchro software to determine the ability of

each alternative to improve the LOS at each major existing and proposed (recommended) FM 407 intersection. The No-Build Alternative traffic analysis resulted in undesirable, failing LOSs through Design Year 2045 at multiple intersections. Whereas, the ultimate recommended solution to improve FM 407, and discussed in the following section, resulted in acceptable LOSs through Design Year 2045.

Conclusions and Recommendations

The FM 407 Feasibility Study performed various very high-level design alternative concepts, evaluations and analyses to produce a transportation solution (“Recommended Build Alternative”) to improve travel and safety-related conditions along the FM 407 facility. Determination and selection of this Alternative was also based on input received from the FM 407 corridor municipalities, elected officials, and from the two advertised March 2019 and July 2020 FM 407 Public Meetings conducted for the Study by TxDOT.

Upon the completion of the Evaluation Matrix screening of the study’s No Build and all the Build Alternatives, and upon further study team discussions with the stakeholders, municipalities and elected officials after the initial March 2019 FM 407 Public Meeting was conducted by the Study, a refined version of the original Red Route (in combination with the common Green Route and an at-grade FM 407 / US 377 intersection) presented at the same Public Meeting emerged as the study’s Recommended Build Alternative.

The refinement included geometric / alignment modifications to the original Red Route to lessen building displacements and sensitive site impacts as much as possible. The refinement also factored in the public comments received at the March 2020 FM 407 Public Meeting.

In-depth traffic analysis during the refinement process also entailed LOS calculations which were produced to scrutinize and confirm the refined Red Route alternative would achieve acceptable LOSs through year 2045. Subsequently, the refined red Route was presented as the Recommended Build Alternative at the study’s second and final July 2020 FM 407 Public Meeting which was conducted in a virtual format due to COVID-19 pandemic social distancing requirements and mandates which surfaced in the spring of 2020. At this Public Meeting, the Recommended Build Alternative was explained as a conceptual design solution which would be carried forward and processed as a formal post-Feasibility Study FM 407 improvement project and entail the production of FM 407 Roadway Design Schematics, Environmental Studies and further Public Involvement.

The overall Recommended Build Alternative is composed of three 12-foot wide travel lanes in each direction separated by a curbed median with left turn lane accommodation at major cross-street intersections. Drainage would be conveyed in curb and gutter inlets. The recommended alignment on the eastern portion of the corridor would follow the existing FM 407 alignment.

On the western portion of the corridor near Florance Road, the recommended alignment would be on new location and overpass the Denton Creek floodplain, FM 156 facility and adjacent BNSF Railway tracks. Access from FM 156 to and from the new location FM 407 alignment would be provided by access ramps. Further westward, the alignment would be located south of, and adjacent to the 12st Street ROW and continue southwesterly until merging with the existing FM 407 alignment west of

Justin. The 12th Street facility would be separated from the FM 407 alignment by a curbed median and therefore, would not be physically impacted by the alignment. The separation median is considered a potential landscaping and noise (wall) mitigation zone. However, the six residential structures located of 12th Street would be directly impacted by the alignment. The Alternative also includes a continuous sidewalk and a continuous Shared Use Path along the entire corridor. Coordination with the NCTCOG and local municipalities would be required on how best to locate and link the Shared Use Path with the envisioned Regional Veloweb routes which are planned/overseen by the NCTCOG.

Based on traffic analyses performed by the study, this Recommended Build Alternative is forecasted to meet the mobility and traffic operations needs of the FM 407 corridor through the Design Year 2045. The various interim or break-out projects or portions of the Alternative could potentially be implemented according to funding availability and prioritizing the high traffic volume / travel demand and safety concern locations. These envisioned interim projects would focus the immediate travel demand and safety-related needs and are subject to further TxDOT discussion and coordination with each municipality where each project is located:

- FM 407 lane capacity upgrades between US 377 and FM 1830 (Town of Argyle);
- FM 477 / I-35W intersection signalization with lane capacity upgrades (Town of Northlake);
- FM 407 / Cleveland Gibbs Road signalization with lane capacity upgrades (Town of Northlake); and
- FM 407 new location alignment and lane capacity upgrades with bridge overpasses at FM 156 and BNSF RR (City of Justin).

Cost

The Recommended Build Alternative was preliminarily cost-estimated with the most recent available year 2020 construction unit costs. This estimate was based on the scenario of constructing the Alternative as one entire construction project. It is noted however, that potential future construction of the Alternative would likely let and be constructed as individual, timelier funded segments (individual construction projects).

The cost estimate includes TxDOT's standard Annual Scope & Estimate Documentation (ASED) cost estimation items (earthwork, subgrade / base, pavement, drainage, structures, and miscellaneous construction) for the Recommended Build Alternative elements: travel lanes/pavement, sidewalk and paved path, below-ground drainage lines, grading, and culverts and bridges.

TABLE 1 presents the preliminary construction cost estimate to construct the Recommended Build Alternative improvements.

Table 1: FM 407 Construction Cost Estimates (2020 Dollars)

Segment	ASED Cost	ROW Cost	Total	Cost / Mile
West of FM 156 to FM 1830	\$211,038,784	\$15,200,000	\$226,238,784	\$17,400,000

The cost estimates are based on the concept level Recommended Build Alternative Diagrammatic. The ROW cost portion of the estimates is based on Denton County Appraisal District valuations. Overall, the estimated costs are considered high-level estimates and do not account for inflation associated with the Recommended Build Alternative implementation exact timeline which is currently unknown.

The costs are presented in this Feasibility Report as a means to assist TxDOT and other FM 407 corridor municipal stakeholders in prioritizing the design, funding and construction of the Recommended Build Alternative or portions thereof. Therefore, this conceptual Alternative would need to be examined in further detail, holistically or partially, during a subsequent post-study Roadway Design Schematic and Environmental Studies phase.

Funding

No funding sources have been currently identified to construct the Recommended Build Alternative; however, funding could be identified from national, state, and local funding sources. Future pursuits to identify specific funding sources may include discussions with, or funding allocations or landbanking involving, TxDOT, the NCTCOG, Denton County, FM 407 corridor municipalities, the Unified Transportation Plan (UTP), and the Transportation Improvement program (TIP).

The Recommended Build Alternative is not currently included in the region's MTP or TxDOT's UTP, but would need to be included in those documents as well as the TIP. The UTP is TxDOT's statewide 10-year plan that guides the development of transportation work across the state. Organized into 12 funding categories, with each one addressing a specific type of work, the UTP authorizes the distribution of construction dollars expected to be available over the next 10 years. The outcome of the UTP process is a list of projects TxDOT intends to develop or begin constructing over the next 10 years, as well as information on the available funding associated with those projects.

The funding categories FM 407 would be eligible for would likely include categories 2, 4, and 12. The funding allocation for the 2020 UTP for these categories for projects in the TxDOT Dallas District, which includes Denton County, totals \$38,442,260,000 and are as follows:

- **Category 2** (Metropolitan and Urban Corridors) – \$11,481,710,000 for the DFW region which includes the Dallas, Fort Worth and Paris TxDOT Districts, an average of approximately \$1.15 billion per year for three districts.
- **Category 4** (Connectivity Corridors) – \$11,220,550,000 for the Dallas District, an average of approximately \$1.12 billion per year for the District.
- **Category 12** (Strategic Priority) – \$15,740,000,000 for the Dallas District, an average of approximately \$1.60 billion per year for the District.

However, it is important to note there are many transportation needs in the DFW region which would need to also utilize these categories. In fact, according to NCTCOG, the region's most current 10-year plan contains \$7 billion in transportation projects that need funding in the DFW region from FY 2017-2029. The funding in UTP is allocated already to other projects, but those funds could be moved to new projects. The UTP is updated every year.

The currently estimated cost for the Recommended Build Alternative (\$226.2 million in 2020 dollars) is within the amount the Dallas District receives in Category 12 funding for each of the UTP's 10 years.

TxDOT, Denton County, and NCTCOG plan to continue to work together to identify funding as this project (Recommended Build Alternative) moves forward.

Timeline

No definite or planned timeline has been established for the post-Study phase of developing the FM 407 Recommended Build Alternative. However, successive timeline phases currently envisioned by TxDOT are listed below and remain subject to change, particularly since no funding has been assigned to construct the Recommended Build Alternative.

- 2 to 4 years – FM 407 Roadway Schematic Design, Environmental Studies and Public Involvement (Public Meeting & Public Hearing)
- 5 to 8 years – FM 407 Final Design, Construction Plans and Utilities Coordination
- 9 to 11 years – Phased FM 407 Construction

After the future Roadway Schematic Design and Environmental Studies are finalized, and the Public Hearing is conducted, ROW preservation required to construct the Recommended Build Alternative should occur via land use planning and ROW acquisition.

APPENDIX
Constraints Map

APPENDIX
Traffic Forecasting Methodology Memorandum

APPENDIX
Traffic Operational Analyses Report

APPENDIX
Build Alternative Alignment Concepts Diagrammatic
and Alternative Typical Sections

APPENDIX

Build Alternatives (Red Route and Blue Route) Traffic Projections

APPENDIX
Recommended Build Alternative Diagrammatic

APPENDIX
Recommended Build Alternative Traffic Exhibits

APPENDIX
Recommended Build Alternative Preliminary Construction Sequence Exhibit