AECOM

US 380 Collin County Feasibility Study

DRAFT

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1. Introduction

The Texas Department of Transportation (TxDOT) has undertaken this study to identify potential short-term and long-term improvements along the US 380 corridor within Collin County. This document identifies the potential alternatives and discusses the potential impacts and benefits of these alternatives. AECOM was contracted by TxDOT to conduct this study which could serve as a baseline for future studies along the corridor. This study's purpose is to evaluate the efficacy of the US 380 corridor for current and future growth along the corridor and recommend improvements to the corridor.

This project is approximately 15.3 miles and includes the section of US 380 from west of County Road (CR) 26 in Prosper to Farm-to-Market (FM) 1827 in McKinney, as shown in **FIGURE 1.** This project study team consisted of TxDOT, the North Central Texas Council of Governments (NCTCOG), Collin County, City of Frisco, City of McKinney, and the Town of Prosper.

The US 380 corridor is currently identified as a Regionally Significant Arterial in NCTCOG's Mobility 2040 Plan. Collin County's thoroughfare plan, along with the thoroughfare plans from Frisco, McKinney, and Prosper, represent the corridor as a 6-lane divided arterial with grade separations at Dallas North Tollway and State Highway (SH) 289. Existing traffic along the corridor and at intersections is at capacity (and exceeding at certain intersections) during AM/PM peak hours. Travel demand is expected to continue to grow along the corridor through the year 2040 and beyond.

NCTCOG provided all the necessary traffic projections for this feasibility study. These projections were utilized in performing traffic analysis. The environmental analysis primarily relied on existing environmental databases supplemented by inventory information obtained during field reconnaissance. Additional data pertaining to demographic and socioeconomic conditions for the region and the corridor were obtained from NCTCOG.

Project goals were identified through one-on-one discussions with the stakeholders and other agencies. One of the goals includes the need to maintain and improve the connectivity and accessibility. Other goals include minimizing the congestion along the corridor, improving the intersection operations, reducing travel time, providing access to businesses, and providing connectivity to the north-south highways that intersect with US 380.

From these goals, a number of alternatives were developed based on traffic operations and stakeholders' vested interests. Each of these alternatives were assessed for compatibility with regional plan and environmental constraints. The study is intended to be an informational resource to assist decision-makers in identifying a recommended alternative for corridor improvements.

Preliminary alternatives were developed based on input from the stakeholders during the project scoping. The following alternatives were evaluated as part of this study:

1. Analysis of intersection improvements (up to four options) at major arterial intersections including CR 26 (Mahard Parkway), SH 289, Coit Road, Lovers Lane, Hillcrest Road/La Cima Boulevard, Independence Parkway, Custer Road, Stonebridge Drive, Ridge Road, Lake Forest

Drive, Hardin Boulevard, Skyline Drive, Wisteria Way, Community Avenue, US 75, SH 5, Airport Drive, and FM 1827.

2. Reconstruct and upgrade facility to a freeway with frontage roads.

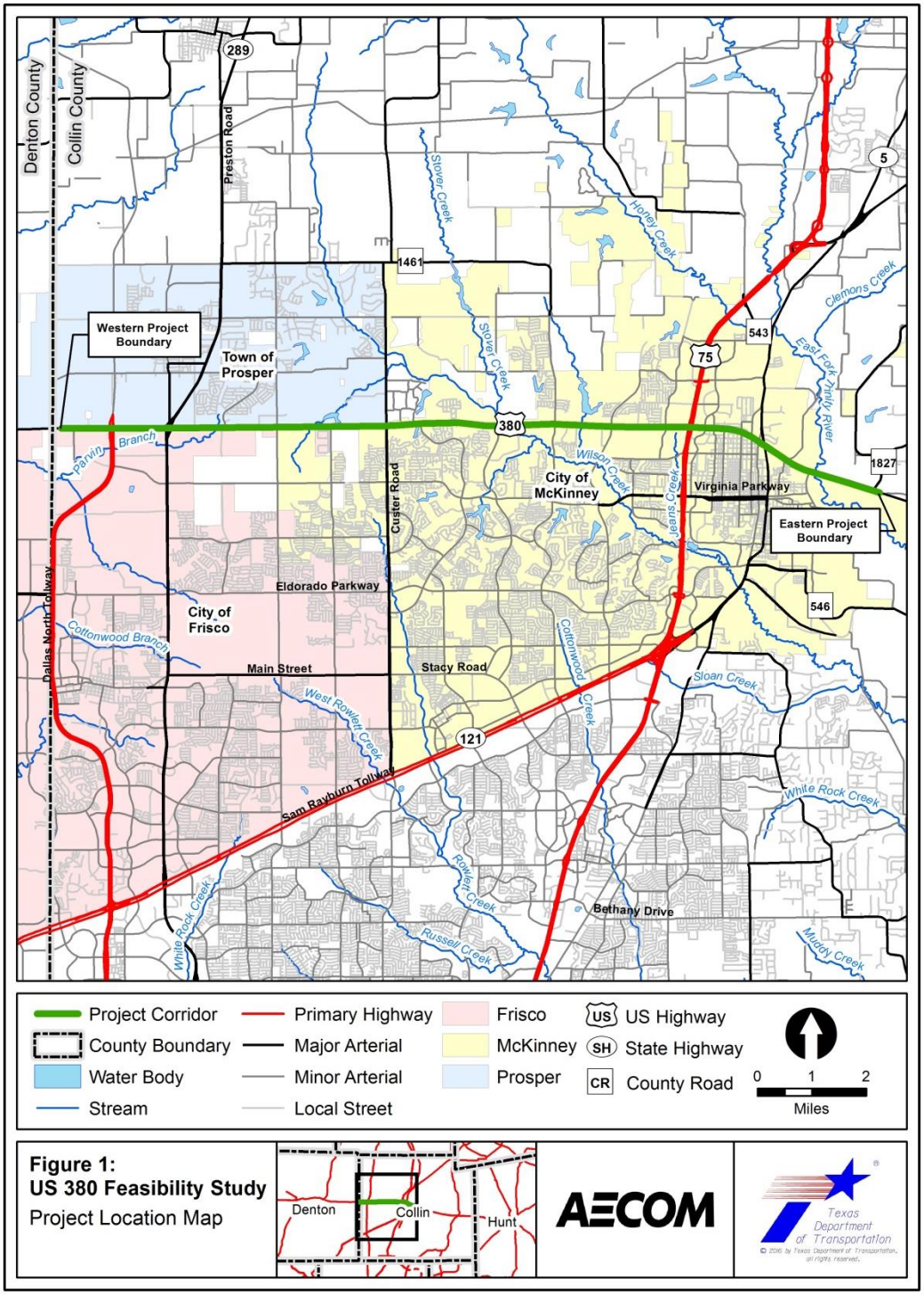
3. Convert facility to a super arterial consisting of grade separated interchanges (both underpass and overpass options) at major intersections (up to eight intersections).

4. Develop US 380 corridor as a segment of the Outer Loop.

5. No Build Option

The alternatives evaluated could be implemented over different time periods based on the need and available funding during that time period. The following chapters include the approach to derive the summary of findings and conclusions.

Figure 1: US 380 Project Location Map

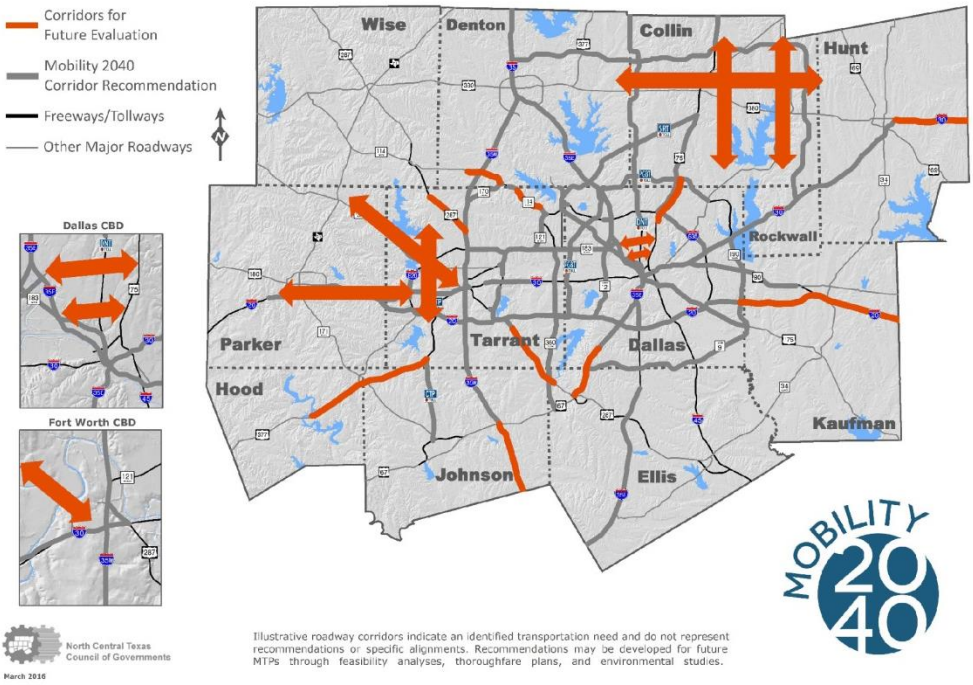


2. Purpose and Need

The need for improvements along the US 380 corridor is becoming more and more apparent as the region grows in population and jobs. The improvements discussed in this report could be further evaluated to address the regional population, employment growth, and travel demands.

Further, the Metropolitan Transportation Plan for the Dallas-Fort Worth region, Mobility 2040, has designated US 380 as a corridor that needs future evaluation. **FIGURE 2** illustrates the corridors in the Dallas-Fort Worth area that are recommended for further evaluation.

Figure 2: Illustrative Major Roadway Corridors for Future Evaluation



Source: NCTCOG, 2016

2.1 Regional Growth

The Dallas-Fort Worth area has consistently been one of the fastest growing metropolitan regions in the country. The State of Texas has been one of the fastest growing states, due in part to the significant growth the Dallas-Fort Worth region is experiencing. According to the US Census, Dallas-Fort Worth (Collin, Hunt, Rockwall, Dallas, Kaufman, Ellis, Johnson, Tarrant, Parker, Wise, and Denton Counties) 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.

Collin County has grown at an even more rapid pace. Collin County has grown by approximately 650,091 people since a 1990 population of 227,639. Between 1990 and 2000, Collin County grew by 86% and is expected to grow 71% by the year 2040. In 2040, the estimated population of Collin County would be

approximately 1.5 million people. **TABLE 1** illustrates the growth that is expected in both the region and Collin County.

Table 1: Regional Population Growth

	1990[1]	2000[1]	2010[1]	2015[2]	*2040 projected*[3]
Dallas-Fort Worth Metropolitan Statistical Area	4,018,778	5,204,126	6,426,214	6,822,730	*10,676,844*
Change		1,185,348	1,222,088	396,516	*3,854,114*
% Change		29%	23%	6%	*56%*
Collin County	264,036	491,675	782,341	914,127	*1,560,421*
Change		227,639	290,666	131,786	*646,294*
% Change		86%	59%	17%	*71%*

[1] US Census Bureau; [2] Annual Estimates of the Resident Population, US Census Bureau, Population Division;
[3] NCTCOG Demographic Forecast Information
Source: NCTCOG Mobility 2040

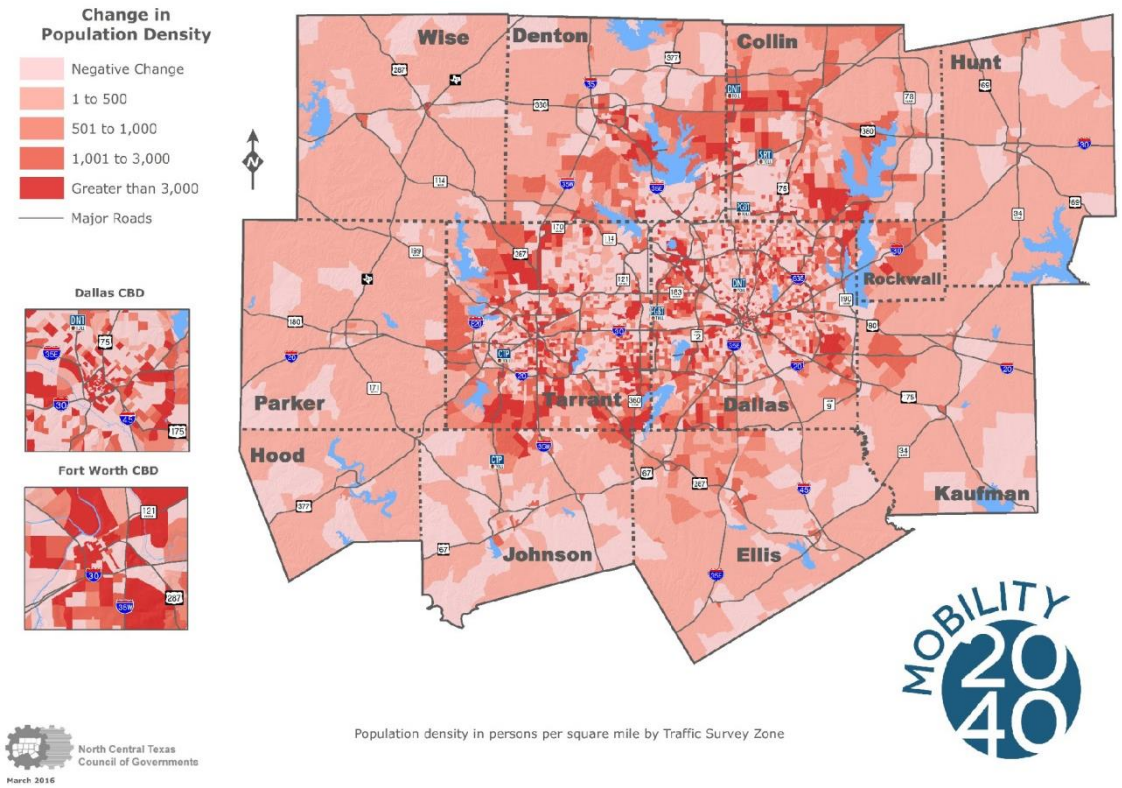
The southwestern portions of Collin County are generally built-out with cities such as Plano and Allen. The cities of Frisco and McKinney are growing rapidly. The outlying areas in the northeast quadrant of Collin County offer large amounts of available land for future development. As the population increases in the Dallas-Fort Worth area, the greatest increases are expected to occur in the fringes of current development.

FIGURE 3 (next page) illustrates population density increases that Collin County, and the greater Dallas-Fort Worth region, can expect as new developments continue to establish in this region. The population density map from NCTCOG predicts that substantial levels of high density growth will occur along the US 380 corridor between Dallas North Tollway (DNT) and US 75.

Employment in the region is projected to increase along with the population growth. **TABLE 2** illustrates employment growth in the Dallas-Fort Worth region by the year 2040. In 2014, there were an estimated 3.2 million jobs in the DFW region. That number is expected to increase 107% to 6.7 million by 2040.

A significant portion of this projected job growth in the region has occurred and is expected to continue to occur in Collin County. In 2014, Collin County had approximately 429,000 jobs. This is expected to increase approximately 78% to 762,000 jobs by the year 2040.

Figure 3: Change in Population Density 2017 - 2040



Source: NCTCOG, 2016

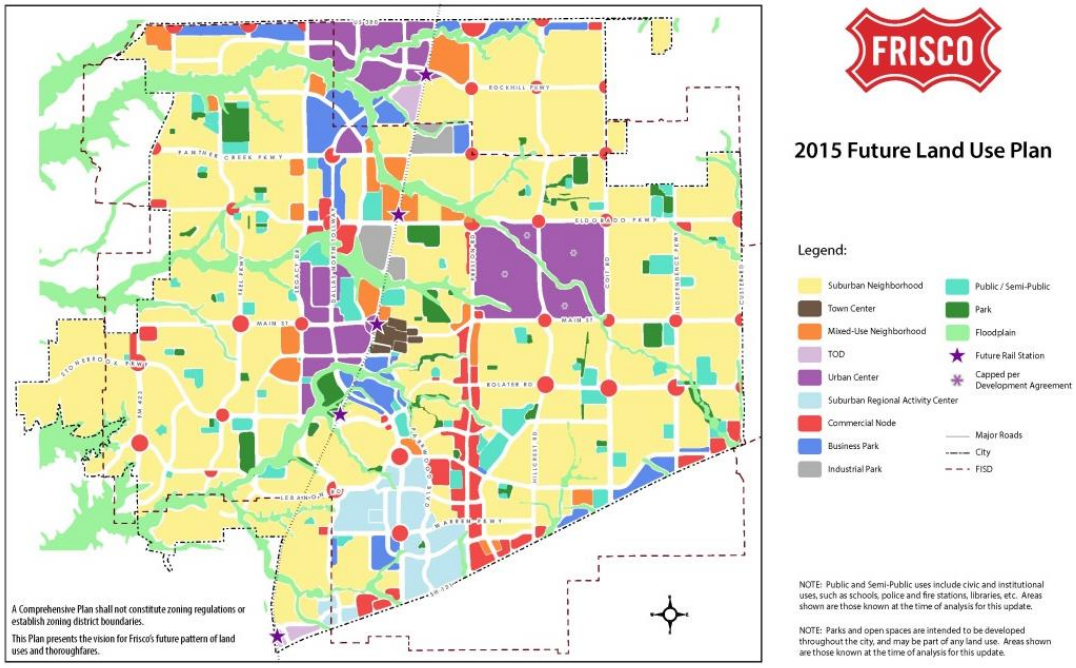
Table 2: Regional Employment Growth			
	2010	**2014 ****	***2040 projected ******
Dallas-Fort Worth Metropolitan Statistical Area Jobs	3,010,445	3,239,278	*6,691,449*
Total Change		228,833	*3,452,171*
Percent Change		8%	*107%*
Collin County Jobs	383,069	429,486	*762,920*
Total Change		46,417	*333,434*
Percent Change		12%	*78%*

Source: US Census Bureau, 2006-2010 American Community Survey 5-Year Estimates; US Census Bureau, 2010-2014 American Community survey 5-Year Estimates; NCTCOG Demographic Forecast Information

Future Land Use Plans

The cities of Frisco and McKinney and the Town of Prosper are some of the fastest growing communities in north Texas. In each of these communities, US 380 is identified as a major thoroughfare providing east-west connectivity.

Figure 4: City of Frisco Future Land Use Plan



Source: City of Frisco Planning Division

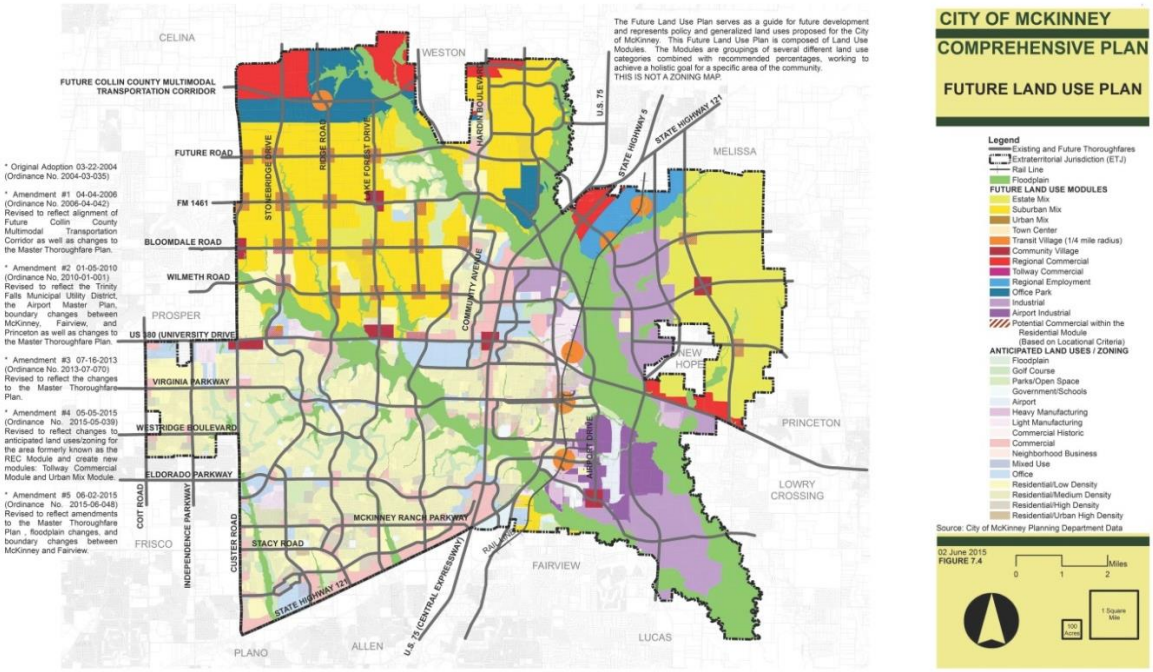
The future land use plan for the City of Frisco, **FIGURE 4** (above), indicates that the corridor will be a major business and commercial center for the City. An urban center is planned at the intersection of US 380 and the Dallas North Tollway. According to the Frisco Comprehensive Plan, the urban center will contain dense levels of development that will focus on employment, retail, and high-density housing choices while offering a walkable community.

In the City of McKinney, the corridor is expected to be a major commercial and retail hub. The City is currently undergoing an update to the comprehensive plan and the future land use plan. The anticipated release of the updated comprehensive plan and future land use plan is the fall of 2016. **FIGURE 5** illustrates the City of McKinney's current future land use plan.

US 380 travels the southern border of the Town of Prosper. **FIGURE 6** shows the future land use plan for the Town of Prosper. The Plan indicates that much of the US 380 corridor will be retail and commercial districts, specifically business parks.

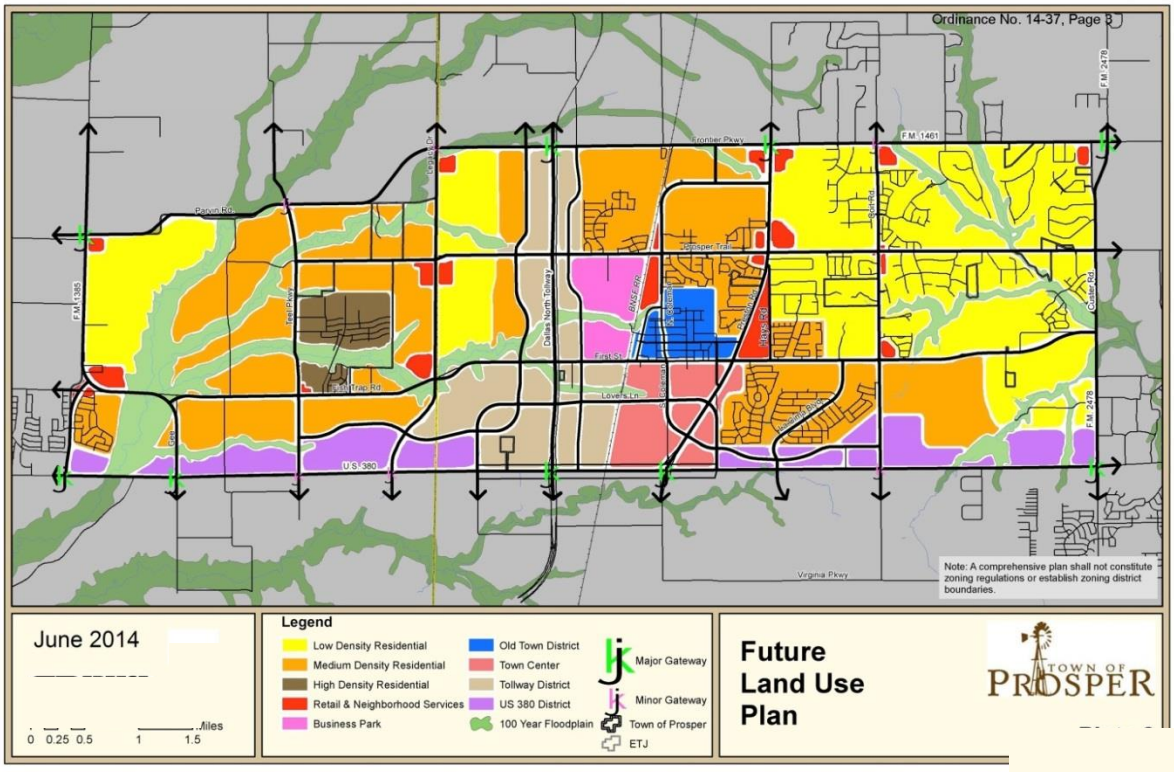
An analysis of the future land use plans in Frisco, McKinney, and Prosper indicate that considerable segments along the corridor will be major retail and commercial. There are also segments along US 380 that are zoned residential.

Figure 5: City of McKinney Future Land Use Plan



Source: City of McKinney Planning Department

Figure 6: Town of Prosper Future Land Use Plan



Source: Town of Prosper Planning Division

2.2 Travel Demand

As the population in and around Collin County continues to increase, the demand on transportation infrastructure will intensify. The higher demand will lead to greater traffic congestion.

Mobility 2040 identifies the transportation options that are essential to supporting the long-term transportation plan for the region. The plan outlines the mobility needs of the region and supports the development of a multimodal system. The plan presents a network of transportation improvements necessary to serve the traffic needs in the growing region and outlines implementation strategies.

TABLE 3 shows that the Dallas-Fort Worth region as a whole will experience an increase in travel demand as the number of cars and the amount of time spent driving and in traffic will increase. The year 2017 is expected to see an annual cost of congestion at $10.7 billion while 2040 is expected to see a $25.3 billion cost due to traffic congestion. It is imperative that as the region grows, the transportation networks are expanded to adequately service population and job growth.

Table 3: Dallas - Fort Worth Regional System Performance

	2017	***2040 (expected)***
Population	7,235,508	*10,676,844*
Employment	4,584,235	*6,691,449*
Vehicle Miles of Travel (Daily)	206,241,991	*319,727,680*
Hourly Capacity (Miles)	44,122,996	*52,476,266*
Vehicle Hours Spent in Delay (Daily)	1,520,582	*3,588,740*
Increase in Travel Time Due to Congestion	38.1%	*58.2%*
Annual Cost of Congestion (Billions)	***$10.70***	***$25.30***

Source: NCTCOG, 2016

FIGURE 8 (page 15) shows the level of congestion the region is experiencing now and in the short-term future. Based on this graphic from NCTCOG, Collin County experiences large areas with light to moderate congestion in the current year. However, a significant portion of Collin County is expected to experience moderate to severe congestion by year 2040, as shown in **FIGURE 9** (page 15). As the population and jobs in Collin County increase, travel demand will increase, resulting in more congestion.

2.3 Safety

Currently, US 380 serves truck and freight traffic mainly between Greenville and Denton. US 380 has proven to be a good alternative for truck and freight traffic from the east connecting to highways like IH-35, DNT, and US 75. Based on the expected future land uses along the corridor, it can be expected that more pedestrians will be attracted to US 380, along with more vehicular traffic. Between 2008 and 2012 there were seventeen confirmed pedestrian fatalities in Collin County. The National Highway Traffic Safety Administration (NHTSA) reported that approximately 15.6% of pedestrian deaths nationwide occurred on U.S. highways, ranking third among road types. Adequate pedestrian safety measures

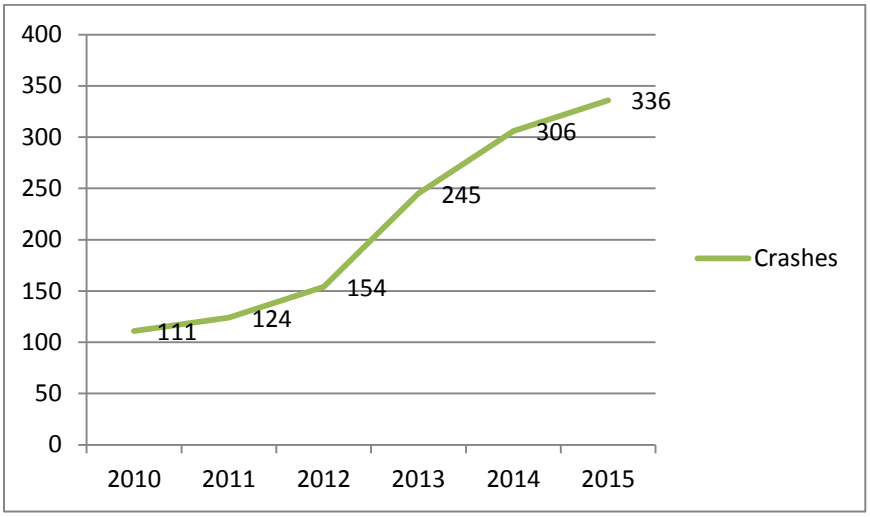
should be implemented to allow pedestrians easy and safe access across US 380. **TABLE 4** shows that the number of crashes each year in the study area is increasing.

Table 4: US 380 Study Area Vehicular Crashes and Average Daily Traffic		
Year	**Crashes**	**Average Daily Traffic ***
2010	111	76,170
2011	124	81,393
2012	154	85,667
2013	245	82,839
2014	306	94,828
2015	336	94,828

**ADT and crash number are based on sum of data collected across all 3 CSJs*

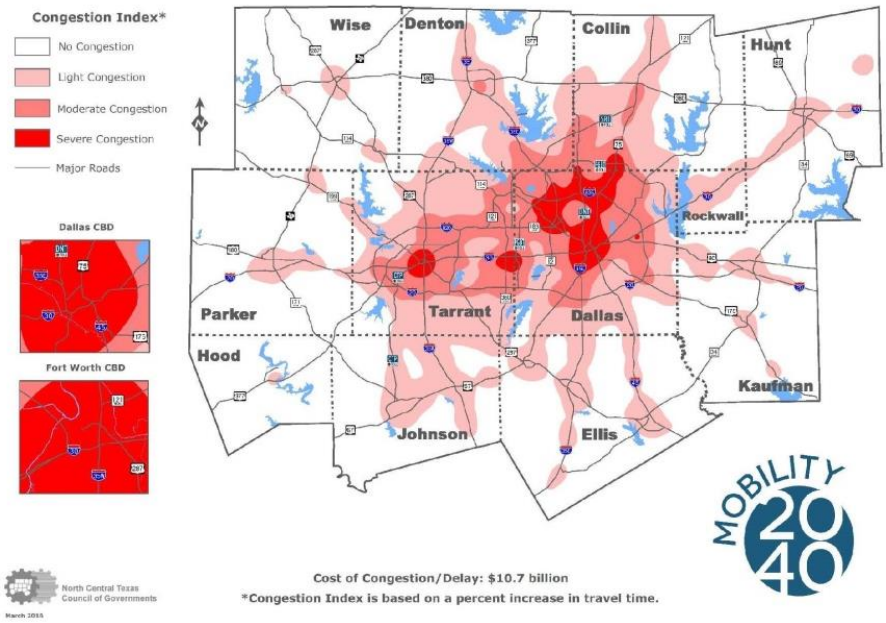
FIGURE 7 shows the rise in traffic crashes along the corridor. Increased travel demand and future land uses raise the potential for more vehicular crashes involving other vehicles and crashes involving pedestrians and/or bicyclists. This increases the need to improve the corridor with safety as one of the core goals for future development.

Figure 7: US 380 Collin County Crashes (2010-2015)



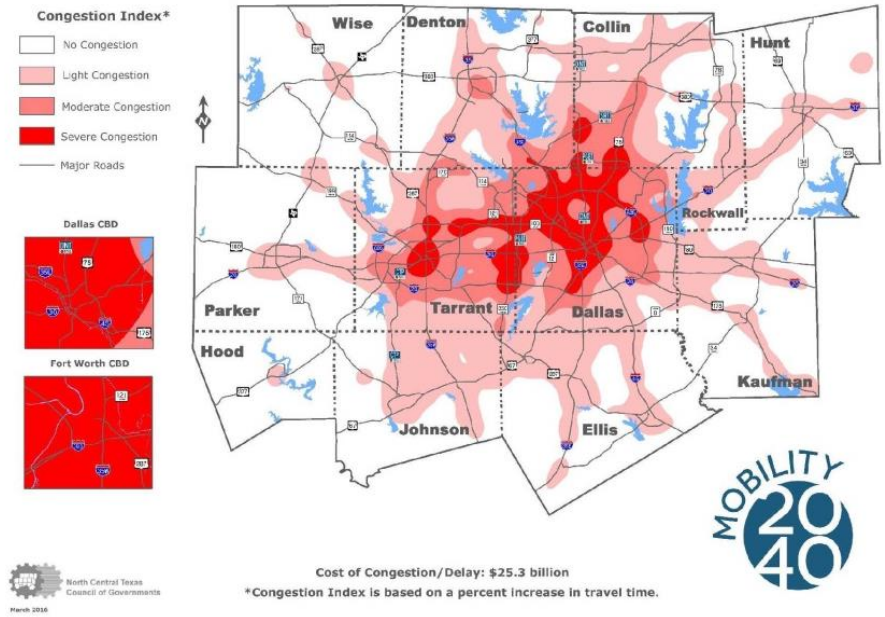
Source: TxDOT Dallas District – Traffic

Figure 8: Dallas - Fort Worth 2017 Levels of Congestion/Delay



Source: NCTCOG, 2016

Figure 9 Dallas - Fort Worth 2040 Levels of Congestion/Delay



Source: NCTCOG, 2016

3. Existing US 380 System Conditions

3.1 Roadway

The existing roadway along the study corridor consists, primarily, of a 6-lane divided curb and gutter highway. The western portion between CR 26 to Lovers Lane includes 6-lanes with access roads and grade separations at SH 289 and the Dallas North Tollway, shown in **FIGURE 10**. The eastern portion, from Lovers Lane to Airport Drive, is a 6-lane divided highway with curb and gutter, shown in **FIGURE 11**. The section between the County Line and CR 26 and Airport Drive to FM 1827 is 4-lanes with a raised median and 10 feet shoulders, shown in **FIGURE 12**.

Figure 10: Existing Roadway Typical Section – County Road 26 to Lovers Lane

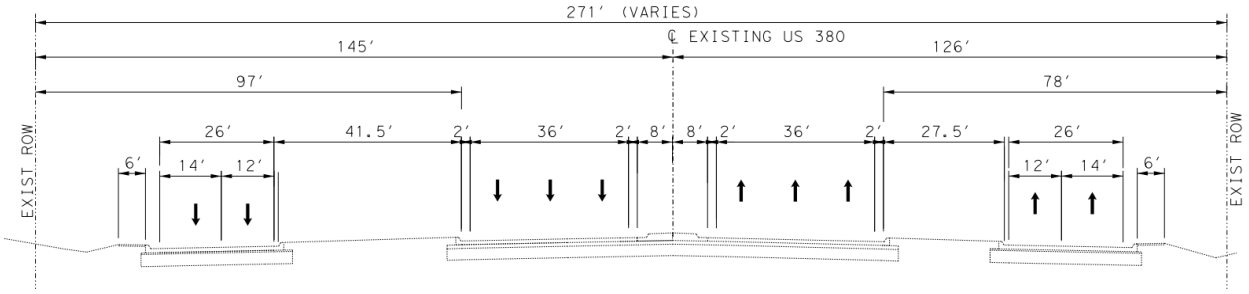


Figure 11: Existing Roadway Typical Section -- County Line to County Road 26 and Lovers Lane to Airport Drive

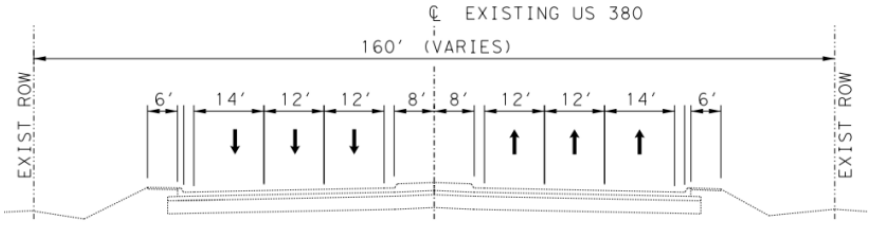
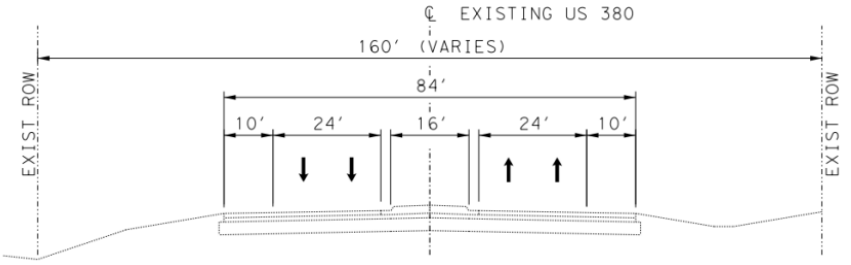


Figure 12: Existing Roadway Typical Section - Airport Drive to FM 1827



The existing ROW lines for the study area were estimated based on aerial images and field visits. Since the information is limited to only ROW estimations 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 onside slope designs and roadside treatments to arrive at ROW impacts.

3.2 Traffic Conditions

The analysis results in this section have been determined using the definitions and methodology outlined in the 2010 edition of the *Highway Capacity Manual (HCM)*. The Synchro 9.0 software module was used to evaluate the signalized and unsignalized intersections within the study area. Various Measures of Effectiveness (MOEs), such as intersection delay and Level of Service (LOS) are being presented in this study.

The existing traffic count data was obtained from multiple sources: City of Frisco, City of McKinney, Collin County, NCTCOG, and TxDOT. The existing traffic volume data for both morning (AM) and afternoon (PM) peak hour scenarios is provided in **APPENDIX B-1.**

The existing traffic signal timing data at all the signalized intersections within the study boundary were obtained from two sources: the City of Frisco and the City of McKinney. The City of Frisco's Synchro files are both AM and PM peak hour scenarios and contain the timing information west of Dallas Tollway North (DNT) and Custer Road. The signal timing data between Custer Road to FM 1827 was obtained from the City of McKinney Synchro files.

Intersection Layout and Signalization

The existing study area analyzes seventeen (17) existing intersections and two (2) future intersections. The existing intersection operating conditions are presented in the existing and future year no-build scenarios; the operating conditions of the future intersections will be included in the future year build scenario. The study intersections are listed as follows:

Existing Intersections:

- County Road 26 – Unsignalized
- La Cima Boulevard – Signalized
- Coit Road – Signalized
- Custer Road/Farm-to-Market 2478 – Signalized
- Stonebridge Drive – Signalized
- Ridge Road – Signalized
- Lake Forest Drive/Farm-to-Market 1461 – Signalized
- Hardin Boulevard – Signalized
- Skyline Drive – Signalized
- Wisteria Way – Signalized
- Community Avenue – Signalized
- SH 121/US 75 Southbound Frontage Road– Signalized

- SH 121/US 75 Northbound Frontage Road – Signalized
- Redbud Boulevard – Signalized
- State Highway 5 – Signalized
- Airport Drive – Signalized
- Farm-to-Market 1827 – Signalized

Future Intersections:

- Lovers Lane, located between SH 289 and La Cima Boulevard – Unsignalized
- Independence Parkway, located between Coit Road and Custer Road – Signalized

Existing Intersection Configuration

A field study was performed during the first week of July 2015 to verify the lane configurations and the storage lane lengths at all study intersections. The current configurations at each of the study intersections along US 380 corridor are provided below:

- *County Road 26/Mahard Parkway intersection***:** This is an unsignalized intersection with a dirt road. Based on our discussions with the City of Frisco and the Town of Prosper, they are in the process of upgrading the facility to a 6-lane arterial on the Frisco side and a 4-lane divided arterial on the Prosper side. US 380 section through CR 26 is being upgraded to a 6-lane divided arterial.

- *La Cima Boulevard intersection:* This is a signalized T-intersection under existing conditions. The City and the Town have an agreement in place to line up the future Hillcrest Road from Frisco with La Cima Boulevard. In an eastbound direction, US 380 carries three through lanes and an exclusive left turn storage lane. In the opposite westbound direction, US 380 carries 3 through lanes and an exclusive right turn storage lane. The ultimate intersection should have a 4-lane section on the Prosper side and a 6-lane arterial on the Frisco side. The posted speed limit along La Cima Boulevard is 40 miles-per-hour (MPH).

- *Coit Road intersection:* In its current configuration, Coit road has 2-lanes each direction with a dedicated left and right turn in both directions. This is a signalized intersection with US 380. US 380 has 3-lanes each direction with a single left turn and right turn storage lane. The US 380 section is designed to accommodate dual left turn lanes in both eastbound and westbound directions. The posted speed limit along Coit Road is 45 miles per MPH on the Prosper side and 35 MPH on the Frisco side.

- *Custer Road/Farm-to-Market 2478 intersection:* This is a signalized intersection built to ultimate configuration with 3 through lanes and 2 left turns and a single right turn storage lanes on the south side. On the north side, there is a single through lane, and a dedicated right turn and left turn storage lane. US 380 has 3-lanes with a single left turn and right turn storage lane in the eastbound direction and 3-lanes with dual left turn and a single right turn storage lane in the westbound direction. The US 380 section is designed to accommodate 2 left turn lanes on both

eastbound and westbound directions. The posted speed limit along Custer Road is 50 MPH on the south side and 55 MPH on the north side.

- *Stonebridge Drive intersection:* This is a signalized T-leg intersection with 2 through lanes which transition to separate exclusive left and right turn storage lanes at the intersection. US 380 has 3-lanes each direction with a single left turn lane in both directions and a single right turn lane in the eastbound direction. The posted speed limit along Stonebridge Drive is 40 MPH.

- *Ridge Road intersection:* This is a signalized T-leg intersection with 2 through lanes which transition to separate exclusive dual left and a single right turn storage lane at the intersection. US 380 has 3-lanes each direction with a single left turn lane in both directions and a single right turn lane in the eastbound direction. The posted speed limit along Ridge Road is 40 MPH.

- *Lake Forest Drive/Farm-to-Market 1461 intersection:* This is a signalized four leg intersection with 2-lanes each direction and a dedicated left turn and right turn lane in each direction. US 380 has 3-lanes each direction with a single left turn and right turn lane in both directions. The posted speed limit along Lake Forest Drive is 40 MPH on south side and 45 MPH on the north side.

- *Hardin Boulevard intersection:* This is a signalized four leg intersection with a single left turn, through and right turn lane in the southbound direction. Northbound Hardin Boulevard carries two through lane and single exclusive left turn storage lane with capacity to add an additional left turn lane. US 380 has 3-lanes each direction with a single left turn in both directions. The posted speed limit along Hardin Boulevard is 40 MPH.

- *Skyline Drive intersection:* This is a signalized four leg intersection with the south side leading in to the Raytheon parking lot. Both the north and southbound Skyline Drive approaches carry single lanes to accommodate all three movements: left, through and right turns. Northbound Skyline Drive is currently gated and the gate remains closed. As a result, the existing traffic data shows no traffic volume along the northbound approach. US 380 has 3-lanes each direction with a single left turn in both directions. The posted speed limit along Skyline Drive is 30 MPH.

- *Wisteria Way intersection:* This is a signalized four leg intersection with the south side leading in to the Raytheon parking lot. Southbound Wisteria Way approach carries a single lane to accommodate all three movements: left, through and right turns. Northbound Wisteria Way carries a shared left-through lane and exclusive right turn lane. US 380 has 3-lanes each direction with a single left turn in both directions. The posted speed limit along Wisteria Way is 30 MPH.

- *Community Avenue intersection:* This is a signalized four leg intersection with a single left turn, through and right turn lane in the southbound direction and a single left turn, 2 through and a single right turn lane in the northbound direction. US 380 has 3-lanes each direction with

dedicated left turn lane. Only the eastbound direction has a dedicated right turn lane. The posted speed limit along Community Avenue is 40 MPH.

- *SH 121/US 75 interchange:* This is a signalized major interchange with south and northbound frontage roads. US 75 main lanes are grade separated and travel over US 380. At the southbound/eastbound intersection, US 380 has 4 through lanes with a right turn lane. The southbound frontage road has 2 through lanes, a shared through-left turn lane, exclusive left and right turn lanes and a dedicated U-turn lane. At the northbound/westbound intersection, US 380 has 4 through lanes with a right turn lane. The southbound frontage road has 2 through lanes, a shared through-left turn lane, exclusive left and right turn lanes and a dedicated U-turn lane. All right turn lanes at all approaches are shown as channelized right turn configurations. The posted speed limit along the frontage roads in both directions is 45 MPH.

- *Redbud Boulevard intersection:* This is a signalized four leg intersection with 2 thorough lanes and a single left turn lane in both directions. US 380 has 3-lanes with dedicated left turn lane in both directions. The posted speed limit along Redbud Boulevard is 35 MPH.

- *State Highway 5 intersection:* This is a signalized four leg intersection. According to the stakeholders, the SH 5 corridor study and schematic design is currently in progress. SH 5 carries 2 through lanes and a single exclusive left turn storage lane with a shared through-right turn lane in both north-south directions. In both directions, US 380 has 3 through lanes and an exclusive left turn storage lane. The outside lane in both eastbound and westbound directions is a shared through-right turn lane. The posted speed limit along SH 5 is 35 MPH.

- *Airport Drive intersection:* This is a signalized T-leg intersection with 2 left turn and 2 right turn lanes approaching the intersection. US 380 has 2 lanes each direction with a dedicated right turn lane in the eastbound direction and a dedicated left turn lane in the westbound direction. The posted speed limit along Airport Drive is 45 MPH.

- *Farm-to-Market 1827 intersection:* This is a signalized T-leg intersection with a shared left turn, through and right turn lane. US 380 has 2-lanes each direction with a dedicated left turn lane in the eastbound direction. The posted speed limit along Airport Drive is 45 MPH.

The existing lane configurations are shown in **APPENDIX B-2.** The same graphics also include the intersection delay and LOS results. The intersection overall delay is presented in seconds per vehicle.

Existing Intersection Operational Analysis

The intersection operational analysis results were evaluated using the Synchro model. All the study intersections were loaded with the existing traffic volumes and the existing signal timing data. The existing model was calibrated using the queue length data to ensure that the Synchro model shows the field traffic conditions.

The following paragraphs summarize the methodology for determining level-of-service (LOS) for stop-controlled and signalized intersections.

Methodology for STOP Controlled Intersections

The capacity analysis procedures provide an 'approach delay' for the stop sign controlled approaches to the unsignalized intersections. Based on these delay values, a "grade" or LOS ranging from LOS A, the best, to LOS F, the worst, are assigned. The intersection LOS "grades" as defined by the *Transportation Research Board* for two-way stop-controlled intersections are as follows in **TABLE 5**.

Table 5: Stop Controlled Intersection LOS Criteria

Level of Service	Two-Way Stop Delay (sec/veh)
A	≤ 10.0
B	10.0 to 15.0
C	15.0 to 25.0
D	25.0 to 35.0
E	35.0 to 50.0
F	> 50.0

Methodology for SIGNAL Controlled Intersections

At a signalized intersection, the total delay is dependent upon a number of factors, including the driver's approach to the intersection, the driver's position in the queue, and the traffic signal cycle length and green times. The control delay for a signalized intersection is determined for each lane group and aggregated for each approach and for the intersection as a whole. Based on these delay values, a grade or LOS ranging from LOS A, the best, to LOS F, the worst, are assigned. Each LOS represents a range of driver delay.

TABLE 6 presents the LOS criteria for signalized intersections (based on *Highway Capacity Manual*), which is directly related to the overall intersection control delay value. The intersection LOS grades for signalized intersections are as follows:

Table 6: Signal Controlled Intersection LOS Criteria

Level of Service	Signalized Intersection Delay (sec/veh)
A	≤ 10.0
B	10.0 to 20.0
C	20.0 to 35.0
D	35.0 to 55.0
E	55.0 to 80.0
F	> 80.0

Source: Highway Capacity Manual

Existing Intersection Operational Results

The operational analysis results for both 2015 AM and PM peak hour scenarios are presented in **TABLE 7.** The Synchro program output files included in **APPENDIX B-13.**

Table 7: Existing Intersection Operational Results				
Intersection Location	**AM Peak Hour**		**PM Peak Hour**	
	Delay (sec/veh)	**LOS**	**Delay (sec/veh)**	**LOS**
County Road 26*	111.8*	**F**	120.4*	**F**
Lovers Lane (*Proposed*)	-	-	-	-
La Cima Boulevard	13.3	B	11	B
Coit Road	20.9	C	43.3	D
Independence Boulevard (*Proposed*)	-	-	-	-
Custer Road	27.7	C	40.4	D
Stonebridge Drive	17.8	B	17.6	B
Ridge Road	16.3	B	6.8	B
Lake Forest Drive	21.1	C	46.9	D
Hardin Boulevard	19.0	B	73.7	**E**
Skyline Drive	5.4	A	12.4	B
Wisteria Way	8.0	A	9.4	A
Community Avenue	14.7	B	20.6	C
SH 121/US 75 Southbound Frontage Road	23.7	C	77.0	**E**
SH 121/US 75 Northbound Frontage Road	28.9	C	52.5	D
Redbud Boulevard	26.9	C	30.4	C
State Highway 5	32.4	C	24.2	C
Airport Drive	18.4	B	53.7	D
Farm-to-Market 1827	73.4	**E**	29.7	C

* *The critical cross street delay is presented for the unsignalized intersection*

The existing roadway intersection operational analysis results show that the majority of the study intersections currently operate at LOS D or better during both AM and PM peak hour traffic conditions. A few intersections, however, would operate at LOS E or worse during either of the two peak hours.

The stop controlled CR 26 cross street shows LOS F with an average delay of 112 seconds per vehicle during AM peak and 120 seconds per vehicle during PM peak hours. The gap between vehicles along existing US 380 is not sufficient for the cross-street traffic to allow drivers to make the left or right turn.

3.3 Environmental Factors

This section reviews the possible environmental factors, including institutional uses such as schools, hospitals, cemeteries, airports, and creeks/floodplains that could affect the improvements to US 380 corridor. A review of these uses were based on their proximity to the project area and their connections to the study corridor.

TABLE 8 shows the list of institutional facilities (pre-schools, elementary schools, middle schools, high schools, and community colleges) located along or near the Project Area. While there are no institutional uses with direct connections to US 380, many rely on US 380 for access and the corridor

serves as a major connector to these facilities. Alterations to US 380 would affect the ingress and egress to these facilities.

Table 8: Institutional Facilities Located near Project Area			
Name	**Type**	**Address**	**Access to US 380**
Primrose School of Prosper	Preschool	1185 La Cima Boulevard Prosper, TX	via La Cima Boulevard
R. Steve Folsom	Elementary	800 Sommerville Drive Prosper, TX	via La Cima Boulevard / Coit Road
Lorene Rogers	Middle School	1001 Coit Road Prosper, TX	via Coit Road
Wilmeth	Elementary	901 La Cima Drive McKinney, TX	via Stonebridge Drive
Lizzie Nell Cundiff McClure	Elementary	1753 North Ridge Road McKinney, TX	via Ridge Road
Dr. Jack Cockrill	Middle School	1351 Hardin Boulevard McKinney, TX	via Hardin Boulevard
Vega	Elementary	2511 Cattleman Drive McKinney, TX	via Skyline Drive / Community Avenue
Collin College	Community College	2200 West University Drive McKinney, TX	via Community Avenue
North Texas Job Corps	Job Training Center	1701 North Church Street McKinney, TX	via College Street and/or Church Street
Serenity	High School	2100 West White Avenue McKinney, TX	via Redbud Boulevard/ US 75 (Central Expressway)
Webb	Elementary	810 East Louisiana Street McKinney, TX	via SH 5 (McDonald Street) / Airport Drive

Medical Facilities

TABLE 9 indicates that there are two medical facilities located along and/or near the Project Area. Medical centers are typically located near major roads to provide quick and easy access for responding to emergency situations. Both medical facilities located within the Project Area are in McKinney.

Table 9: Medical Facilities located near Project Area		
Hospitals	**Address**	**Access to US 380**
Emergency Room at Stonebridge	8995 West University Drive McKinney, TX	via Custer Road/ US 380
Baylor Scott and White Medical Center McKinney	5252 West University Drive McKinney, TX	via Lake Forest Drive

Cemeteries

TABLE 10 indicates that there is one cemetery located near the Project Area. Buckner Cemetery is a small, historic cemetery located along US 380, between Lake Forest Drive and Hardin Boulevard. It is located near the McKinney Trade Days Flea Market.

Table 10: Cemeteries located near Project Area	
Cemetery	**Location**
Buckner Cemetery	US 380, between Lake Forest Drive and Hardin Boulevard

Creeks and Floodplains

TABLE 11 indicates the creeks and floodplains located on or near the Project Area. The Project Area crosses several creeks /streams and one river (East Fork Trinity River and Floodplain). The largest and most extensive water body is the East Fork Trinity River floodplain, located on the east side of McKinney. The area in and around the floodplain is generally rural and vacant due to the floodplain designation.

Table 11: Creeks and Floodplains located on and near Project Area	
Water Body	**Location**
Parvin Branch	West of La Cima Boulevard
Rutherford Branch	East of Prestwick Hollow Drive
Soil Conservation Service Site 1B Reservoir	East of Redbud Drive
Floodplain	West of Custer Road
Floodplain/Drainage Ponds	West of Stonebridge Drive
Wilson Creek and Floodplain	East of Ridge Road
Franklin Branch and Floodplain	East of Meadow Ranch Road
Jeans Creek	East of Community Avenue
East Fork Trinity River and Floodplain	Generally east of Airport Drive

Places of Worship

TABLE 12 indicates places of worship that are located on and/or near the Project Area.

Table 12: Places of Worship on and near Project Area	
Place of Worship	**Location**
Stonebridge United Methodist Church	1800 South Stonebridge Drive McKinney, TX
Freedom Church	2414 West University Drive McKinney, TX
Kingdom Hall of Jehovah's Witness	2417 Taylor Burk Drive McKinney, TX
Community North Baptist Church	2500 Community Avenue McKinney, TX
McKinney Church of Christ	1808 White Avenue McKinney, TX
Waddill Street Baptist Church	1401 North Waddill Street McKinney, TX
Victory Christian Church	1008 West Erwin Street McKinney, TX
Northwest Christian Church	1513 North Bradley Street McKinney, TX
Church of God	1100 Florence Street McKinney, TX
McKinney First Baptist	401 West Erwin Avenue McKinney, TX
New Beginning New Life Church	704 Drexel Street McKinney, TX

Airports

There are two airports that have access near US 380.

- Aero Country Airport located at 230 Aero Country Road, McKinney, Texas. This privately owned airport does not have direct access to US 380. Access to US 380 can be made via Virginia Parkway and Custer Road, Coit Road, and the future expansion to Independence Parkway.
- McKinney National Airport located at 1500 Industrial Boulevard, McKinney, Texas. This airport has access to US 380 via Airport Boulevard.

Utility Lines

Based on field observations conducted in July 2015 and data provided by NCTCOG, there are several existing utility lines within the study corridor. Electric transmission lines run across the study corridor in the following locations:

- Approximately 700 feet west of La Cima Boulevard
- Approximately 1,190 feet east of La Cima Boulevard
- Approximately 325 feet west of Graves Road

For detailed maps of the environmental factors, please refer to **APPENDICES C-F**.

4. Public and Agency Coordination

The stakeholders for this project include Collin County, City of Frisco, City of McKinney, Town of Prosper, and NCTCOG. The project team received significant cooperation, assistance, and input from the stakeholders in preparing this feasibility report. This section summarizes the coordination activities that TxDOT, along with AECOM, conducted on this project.

Initial Kick-off Meeting

TxDOT scheduled the initial kick-off meeting and invited all identified stakeholders. See **APPENDIX I** for the sign-in sheet showing the list of attendees. During this meeting, project goals were discussed and the objectives of this study were presented to the stakeholders. The project team sought feedback from the stakeholders for this study. See **APPENDIX I** for the meeting minutes from this initial kick-off meeting.

One-on-One Meetings with Stakeholders

TxDOT, along with AECOM, met with the stakeholders on a one-on-one basis soliciting input from the stakeholders. The following questions were posed to each stakeholder:

1. What is the vision for the City?
2. How do you envision the growth of US 380 in the future?
3. What kinds of developments are anticipated along the corridor and within 2 miles north and south of the corridor?
4. What kind of traffic growth is expected along the corridor?
5. Are there any land use plan changes based on the type of facility?
6. Is there a preference towards an access controlled facility vs. non-access controlled facility?

The meetings with stakeholders, and their opinions and feedback, aided the project team in aggregating the recommendation for this study.

Meeting with NCTCOG

NCTCOG has been an integral partner on this project. Meetings with NCTCOG resulted in understanding the methodology that NCTCOG utilized for traffic projections. The study team worked together with NCTCOG in providing input on the existing road network and provided the proposed roadway network for various alternatives to aid in NCTCOG's traffic projections. This network was coded in the NCTCOG's regional TransCAD model in arriving at the traffic projections for all alternatives.

5. Alternatives

The study analyzed five alternatives for the US 380 corridor to accommodate future population growth, safety, and traffic. These alternatives include:

1. No Build
2. Intersection Improvements
3. Freeway with Continuous Frontage Roads
4. Grade Separated Interchanges At Major Intersections (Super Arterial)
5. Outer Loop

Traffic models were developed to identify the short-term/long-term improvements that would be viable, cost-effective, and meet the traffic needs. These short-term improvements were focused on intersection level improvements (Alternative 2 and Alternative 4), while the long-term improvements (Alternative 3 and Alternative 5) focused on corridor level improvements.

TxDOT, along with AECOM, worked together with NCTCOG to run these models in NCTCOG's region wide TRANSCAD model.

5.1 No-Build Alternative

The no build alternative assumes US 380 in Collin County remains a 6-lane divided arterial with no proposed improvements along the corridor. This alternative is considered the baseline for comparison to the four build alternatives.

Existing Conditions

US 380 is as a major east-west corridor serving many communities in Hunt, Collin, Denton, and Wise counties. It also connects to major north-south highways, including IH 35, Dallas North Tollway, and US 75. The current typical section of US 380 varies along the 15.3 miles of the corridor. The portion of US 380 between the Collin/Denton County line and FM 2478 (Custer Road) is being widened from 4-lanes to 6-lanes with grade separations at SH 289 (Preston Road) and the Dallas North Tollway. The existing typical section along US 380 is discussed in detail in Chapter 3 (Existing Conditions).

Traffic Analysis

The intersection operational analyses results were evaluated using the Synchro model. All the study intersections were loaded with the future year traffic projections and the existing signal timing data. The existing phasing combinations were optimized at all study intersections to accommodate the future traffic demand.

The CR 26 is currently a STOP controlled intersection. In future years, CR 26 will warrant a traffic signal to accommodate the increased traffic demand. Therefore, the 2040 no-build scenario was evaluated with a traffic signal at CR 26.

Currently Lovers Lane does not exist and Independence Boulevard does not connect to US 380. But in the future year both these cross streets tie-in with US 380, warranting new traffic signals. As a result, the future year no-build scenario is evaluated with two new traffic lights at Lovers Lane and Independence Boulevard.

All other study intersections currently have traffic signals and will continue to warrant traffic lights for the design year. The operational analysis results for 2040 no-build AM and PM peak hour scenarios are presented in **TABLE 13**. The Synchro program output files for 2040 no-build AM and PM peak hours are included in **APPENDIX B-13**.

Table 13: No Build Future Intersection Operational Analysis

Intersection Location	AM Peak Hour		PM Peak Hour	
	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
County Road 26	162.0	**F**	150.9	**F**
Lovers Lane (*Proposed*)	42.5	D	88.4	**E**
La Cima Boulevard	181.4	**F**	231.8	**F**
Coit Road	143.7	**F**	157.4	**F**
Independence Boulevard (*Proposed*)	89.1	**F**	13.7	**F**
Custer Road	135.4	**F**	176.0	**F**
Stonebridge Drive	134.3	**F**	163.1	**F**
Ridge Road	135.0	**F**	149.0	**F**
Lake Forest Drive	144.5	**F**	149.2	**F**
Hardin Boulevard	149.5	**F**	195.3	**F**
Skyline Drive	16.5	B	40.2	D
Wisteria Way	24.7	C	33.0	C
Community Avenue	131.6	**F**	106.2	**F**
SH 121/US 75 Southbound Frontage Road	218.3	**F**	182.1	**F**
SH 121/US 75 Northbound Frontage Road	183.4	**F**	207.3	**F**
Redbud Boulevard	177.7	**F**	193.7	**F**
State Highway 5	210.1	**F**	220.6	**F**
Airport Drive	182.3	**F**	272.5	**F**
Farm-to-Market 1827	339.5	**F**	330.6	**F**

Environmental Impacts

This section discusses the anticipated impacts associated with the no build alternative.

Economic Impacts

US 380 is a major east-west corridor in Collin County. As the population and employment growth continues to increase, the traffic congestion can be expected to increase. Today, the corridor is already experiencing heavy traffic and many intersections are exceeding capacity during peak hours.

Further, the future land use plans in Frisco, McKinney, and Prosper indicate that the US 380 corridor will most likely become a predominately retail and commercial corridor. It can be expected that the corridor will experience a rise in traffic congestion and usage.

The corridor is important to the economic growth of the region, due to the high volume of passenger and freight traffic and the support that the corridor provides to the growing communities of Prosper, Frisco, and McKinney. US 380 currently serves truck and freight traffic for trips between Greenville and Denton as it is generally less congested than more southerly routes closer to Dallas and Fort Worth. It is broadly anticipated that freight traffic will increase as the population and employers grow. The increased traffic could have negative impacts on economic growth throughout the region.

Although the no-build option involves no cost or environmental impacts, there could be greater impact to the region's economy from the cost associated with congestion and traffic delays. Another potential impact is from lost tax bases and less attractive to future tax bases, leading to further decline in revenues for the local economy.

5.2 Alternative 2 Intersection Improvements

Intersection Improvement Design and Cost

The intersection improvements at major arterial intersections include: County Road 26 (Mahard Parkway), Coit Road, Lovers Lane, Hillcrest/La Cima Road, Independence Parkway, Custer Road, Stonebridge Drive, Ridge Road, Lake Forest Drive, Hardin Boulevard, Skyline Drive, Wisteria Way, Community Avenue, SH121/US 75 Northbound Frontage Road, SH121/US 75 Southbound Frontage Road, Red Bud Boulevard, State Highway 5, Airport Drive, and FM 1827.

Up to four options were established at each intersection to increase capacity and LOS. These options include innovative intersection designs based on Federal Highway Administration Research and Technology report No. FHWA-HRT-09-060. These innovative intersections can offer substantial advantages over conventional at-grade intersections and grade-separated diamond interchanges when applied appropriately. The options below were analyzed at each intersection individually.

Option 1: Turn Lane Improvements

Option 1 adds additional right and left turn lanes to improve the intersection capacity. Traffic analysis was performed to determine the length needed for the storage of turning movements. Option 1 also optimizes the signal timing along the corridor.
Dual left turn and a single right turn lane were added to the following intersections.

- County Road 26
- La Cima Boulevard
- Independence Parkway
- Stonebridge Drive
- Ridge Road
- Lake Forest Drive
- Hardin Boulevard

- State Highway 5
- Airport Drive
- Farm-to-Market Road 1827

Lovers Lane, Skyline Drive and Wisteria Way provide adequate intersection capacity and no intersection capacity improvements are recommended. Minor revisions were made to the storage lengths at Coit Road and Custer Road. Right turn lanes were added at Community Avenue and Red Bud Boulevard. No improvements were recommended at SH121/US 75 intersection. See **APPENDIX C** for the Intersection Improvements Exhibits.

The estimated costs for Option 1 improvements are shown in **TABLE 14**. Detailed cost estimate breakdown can be found in **APPENDIX G.**

Table 14: Option 1 Cost Estimates

Intersection	Total
County Road 26	$395,583
Lovers Lane[1]	$0
La Cima Boulevard	$517,155
Coit Road	$72,460
Independence Parkway	$618,541
Custer Road	$80,097
Stonebridge Drive	$1,067,533
Ridge Road	$1,001,742
Lake Forest Drive	$763,320
Hardin Boulevard	$970,614
Skyline Drive[1]	$0
Wisteria Way[1]	$0
Community Avenue	$523,891
Red Bud Boulevard	$187,544
State Highway 5	$646,468
Airport Drive	$1,166,691
Farm-to-Market 1827	$1,344,698
TOTAL	**$9,356,337**

[1] *zero costs indicates no improvements needed*

Option 2: Displaced Left Movement

This alternative design called a displaced left-turn (DLT) intersection laterally displaces the left turn movement. In other words, left-turning traffic crosses over the opposing through movement at a location that is several hundred feet upstream of the major intersection. This upstream location is typically signal controlled. The left-turning traffic then travels on a separated roadbed, which is on the outside of the opposing through lanes, as those vehicles proceed toward the major intersection.

These DLT intersections allow left-turning vehicles to move at the same time as through traffic. The left-turn traffic signal phase is eliminated, allowing more vehicles to move through the main intersection. This can result in shorter cycle lengths, shorter delays, and higher intersection capacities compared to conventional intersections.

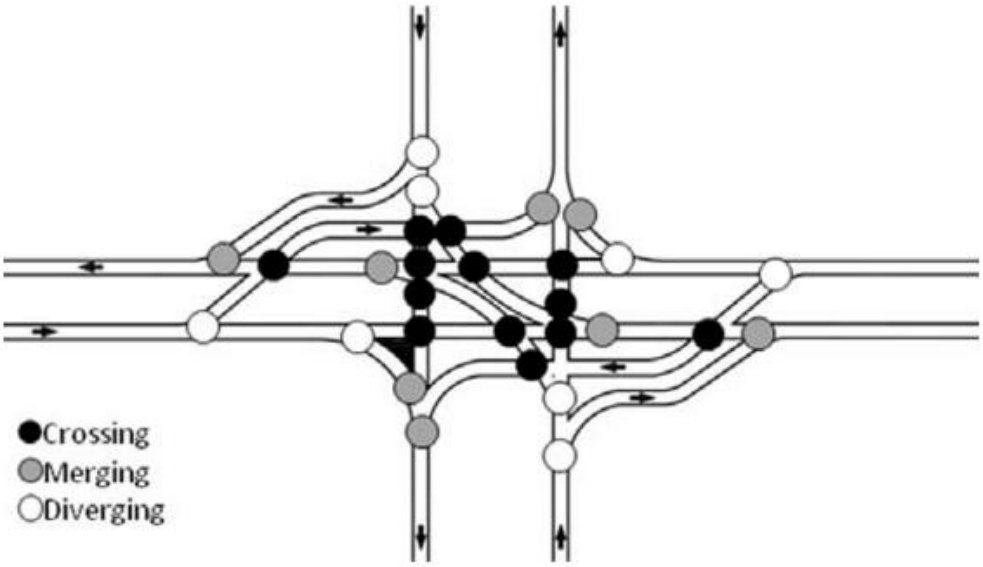
There are many advantages and disadvantages to the addition of displaced left turns. The main advantages and disadvantages from the U.S. Department of Transportation Federal Highway Administration are outlined below:

Advantages	Disadvantages
Non-Motorized Users	
• Bicycles and Pedestrians accommodated at grade • Bicyclists have refuge (room for bicycle box) in making two-stage left turns	• Pedestrians may require 2-stage crossings • Indirect movements may be necessary for pedestrians • Longer pedestrian crossings • Unique challenges for visually impaired pedestrians
Safety	
• Fewer conflict points than interchanges and conventional intersections • Lower delay and fewer stops on major roads could reduce rear-end crash rates	• Drivers may be less familiar with intersection design • Potential for wrong-way movements • Issues with signal in flashing mode/going dark
Operations	
• Increase in lane-by-lane capacity due to efficient 2-phase or 3-phase signal operation • Compatible with high-volume turning movements • More green time for major movements offers better progression when used as a corridor solution	• Complex signal operations • Pedestrian crossing time and phasing may limit cycle length flexibility • Potential for additional user delay during off-peak periods • No right turn on red without bypass right turn lane
Access Management	
• Compatible with access-restricted corridors	• May change ingress/egress patterns to corner businesses or development • Medians and wide separators required
Cost and Right-of-Way Impact	
• Smaller footprint than interchange • Lower cost than interchange	• Required right-of-way likely larger than conventional intersection • More traffic signals, pavement, curbs and median/refuge islands

Source: Displaced Left Turn Intersection Informational Guide: U.S. Department of Transportation Federal Highway Administration (August 2014).

FIGURE 13 shows the conflict points of a partial DLT intersection with left-turn crossovers present on the mainline approaches. A partial DLT intersection has a total of 30 conflict points compared to the 32 conflict points at a conventional intersection. The slightly lower number of conflict points could translate to fewer collisions.

Figure 13: Displaced Left Turn Conflict Points



Source: AIIR, 2010

The following intersections along US 380 were evaluated for displaced left turns:

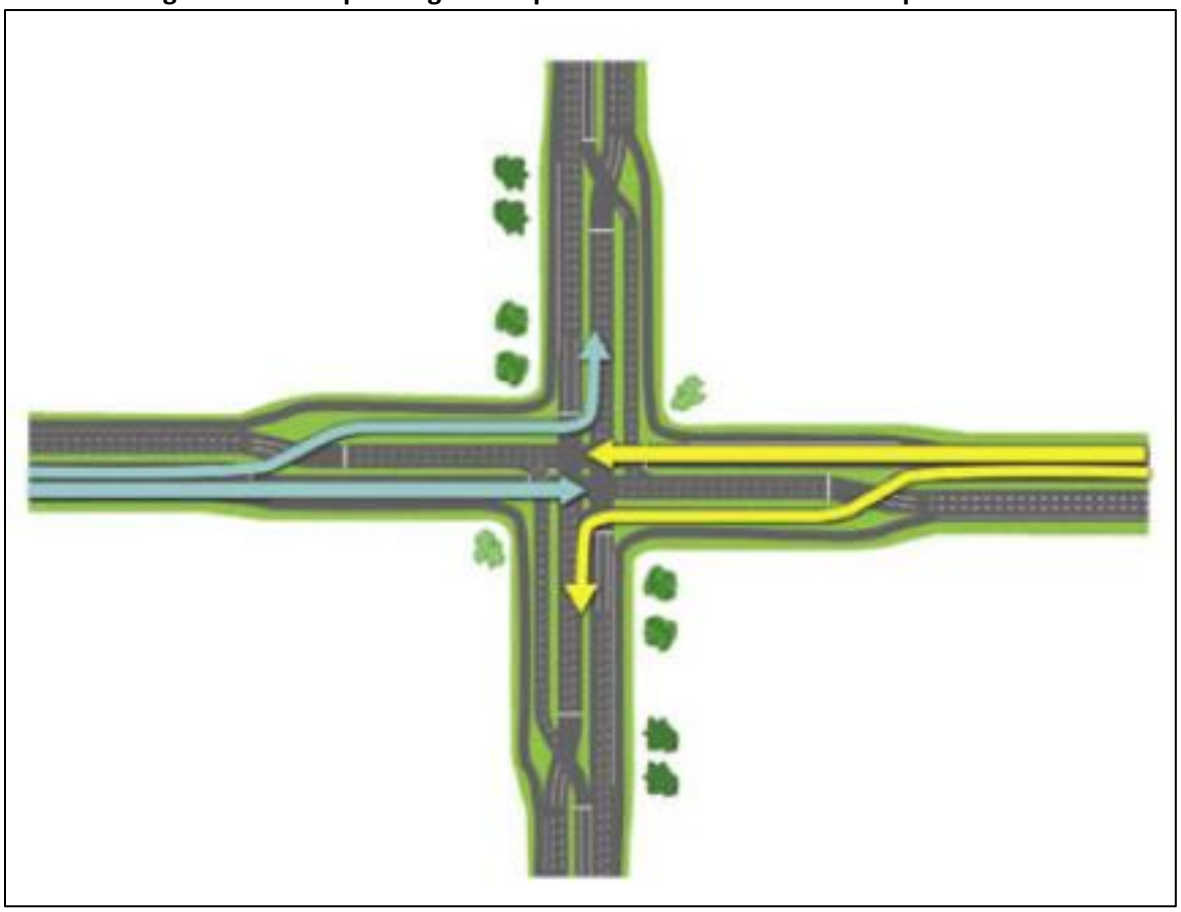
- East-West displaced left at La Cima Boulevard
- East-West displaced left at Coit Road
- East-West displaced left at Stonebridge Drive
- North-South displaced left at Ridge Road
- North-South displaced left at Lake Forest Drive
- East-West displaced left at Hardin Boulevard
- East-West displaced left at Community Avenue
- East-West displaced left at State Highway 121/US 75
- North-South displaced left at State Highway 5
- East-West displaced left at Airport Drive
- East-West displaced left at Farm-to-Market Road 1827

A concept design of the displaced left options is provided in **FIGURE 14**.

See **APPENDIX C** for the Intersection Improvements Exhibits showing the proposed DLT design at the proposed study intersections.

The estimated costs for DLT improvements are shown in **TABLE 15**. Details for the cost estimate can be found in **APPENDIX G.**

Figure 14: Concept Design of Displaced Left Turn Geometric Improvement



Source: Unconventional Arterial Design (UAID), prepared for Department of Transportation, State Highway Administration (SHA)

Table 15: Option 2 Cost Estimates	
Intersection	**Total**
La Cima Boulevard	$2,064,615
Coit Road	$1,507,471
Stonebridge Drive	$1,913,939
Ridge Road	$1,412,031
Lake Forest Drive	$1,185,558
Hardin Boulevard	$1,706,374
Community Avenue	$2,579,109
SH 121/US 75 Frontage Roads	$1,665,673
State Highway 5	$2,891,752
Airport Drive	$1,633,538
Farm-to-Market 1827	$1,949,280
TOTAL	**$20,509,342**

Option 3: Miscellaneous At-Grade Improvements

For this option, the study intersections were evaluated with miscellaneous at-grade geometric improvements. The following at-grade geometric improvements are proposed:

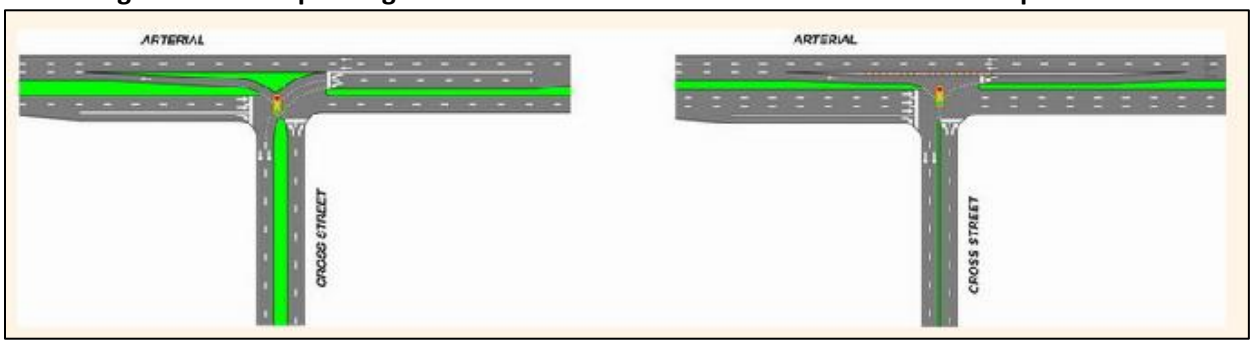
- Continuous Green T-intersection concept at Lovers Lane and Independence Parkway intersections
- Modified Jughandle concept at Coit Road and State Highway 5
- Continuous Flow Intersection (CFI) concept at Custer Road and FM 1827

Continuous Green T-intersection: The continuous Green T-intersection is designed to accommodate one of the through directions with no stop control. In this concept, the arterial progression is more likely to be optimal (in the direction of signal control) when intersection demands for left turns to/from the T-approach are moderate to low. There are two basic design variations of the operation of Continuous Green T-intersection. The free flow movement can be either merge-control or lane-control.

- Merge-control: includes a free flow left merge lane onto the arterial. This study recommended merge-control Continuous Green T-intersection at study intersections.
- Lane-control: includes an option on the arterial with signal control to eliminate the cross street left-turn lane merge.

One of the major advantages of this concept is that, the arterial right-of-way requirements are modest while providing considerable benefit to intersection delay and LOS. A wider median is needed on the arterial in the merge-control design concept to accommodate the merge and taper. However, in the future, if this 3-legged intersection needs to be converted to a more traditional 4-legged intersection, the traffic advantage from this option wanes away. A typical concept design of the Continuous Green-T intersection is provided in **FIGURE 15**.

Figure 15: Concept Design of Continuous Green-T Intersection Geometric Improvement



Source: Unconventional Arterial Design (UAID), prepared for Department of Transportation, State Highway Administration (SHA)

Below is the summary of advantages and disadvantages to Continuous Green-T intersection.

Advantages	Disadvantages
• More green time for major through movement offers better progression when used as a corridor solution • Compatible with access-restricted corridors • Smaller footprint than interchange • Lower cost to implement the design • Bicycles and Pedestrians accommodated at grade • Very effective in reducing angle crashes and injury rates	• Could be challenging to accommodate pedestrians • Reduced efficiency if the side street volume increases in the future • Need to accommodate the future through volumes in the future may void the benefits from this design • May change ingress/egress patterns to corner businesses or development • Medians and wide separators required • Required right-of-way likely larger than conventional intersection

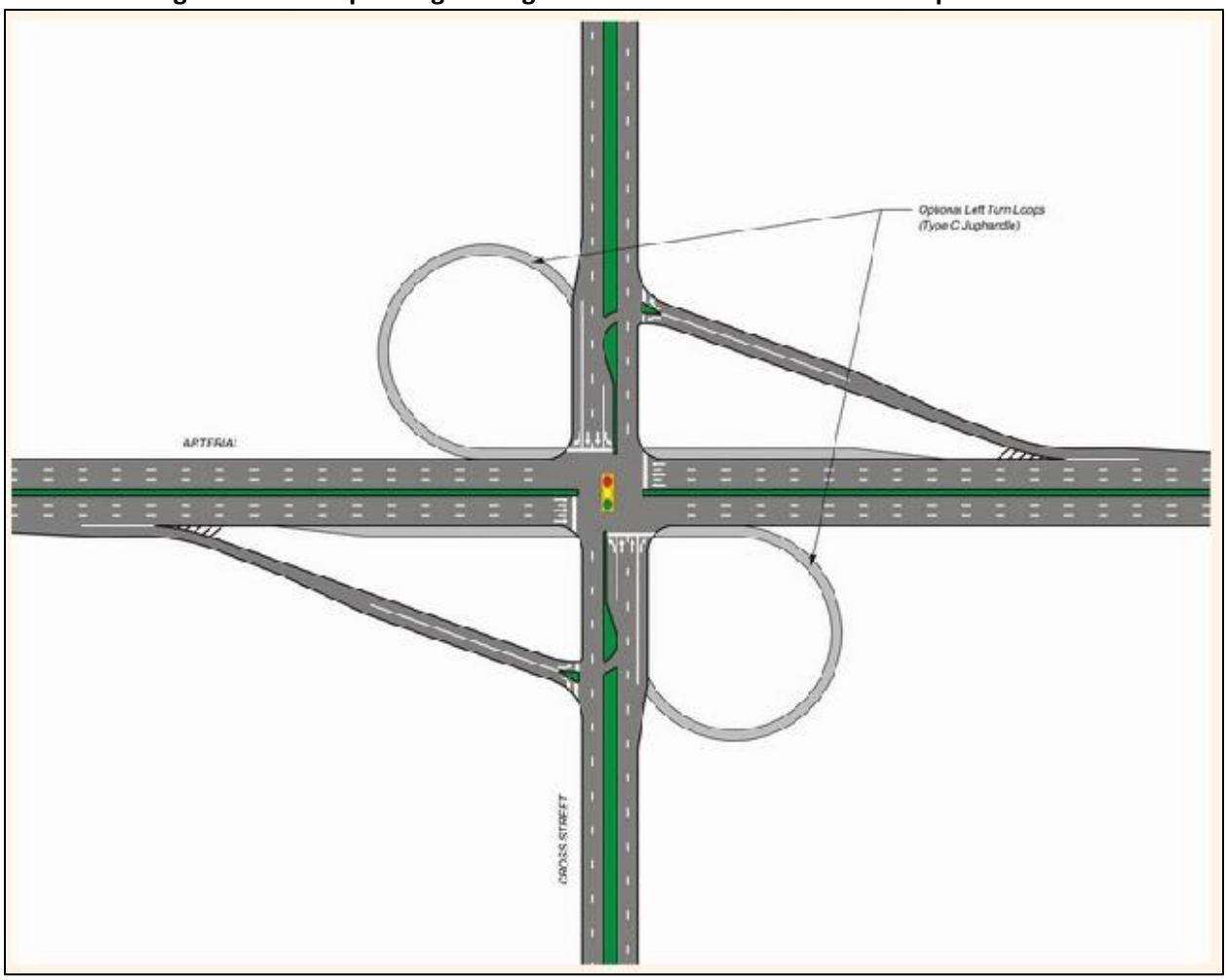
Modified Jughandle Intersection: In this concept, the Jughandle ramps diverge from the right side of the arterial in advance of the intersection, removing the left turn movement from the cross street intersection. This configuration provides greater safety and reduced delay to through traffic. Arterial left turns are made at minor, stop-controlled/signalized intersections on the cross street. Left turns from the cross street remain as direct movements at the intersection. Studies have shown that the Jughandle design provides the greatest travel time savings on arterials that have high through movements (like US 380), moderate or low left turn volumes, and moderate to low cross street volumes. The Jughandle concept is particularly suitable for arterials with limited ROW, often requiring less width along the corridor (although more ROW is needed for Jughandle quadrants) compared to the conventional median-divided highway corridor.

Intersections along the arterial often are controlled by two-phase signals. A third phase may be required for left turns from the cross street if the volume is heavy, but the Jughandle design typically eliminates the direct left turn movements and signal phase on the arterial. Since no U-turns or left turns are allowed directly from the arterial, the median on the arterial may be narrow.

The typical Jughandle concept is modified slightly for this project and applied at two of the study intersections – Coit Road and SH 5. They are proposed as a Modified Jughandle concept. In this Modified Jughandle concept, the north-south left turns from Coit Road have been removed and these two left turn movements are accommodated through a parallel street located just west of Coit Road, named Prosper Commons. Similarly, the north-south left turns along SH 5 have been removed and they have been accommodated along Tennessee Street.

A typical concept design of the Jughandle intersection is provided in **FIGURE 16**.

Figure 16: Concept Design of Jughandle Intersection Geometric Improvement



Source: Unconventional Arterial Design (UAID), prepared for Department of Transportation, State Highway Administration (SHA)

Below is the summary of advantages and disadvantages to Jughandle intersection design.

Advantages	Disadvantages
• Potential reduction in left-turn collisions. • Potential reduction in overall travel time and stops. • Pedestrian crossing distance may be less due to lack of left-turn lanes on the major street.	• Longer travel time and more stops for left-turning vehicles using the jughandle. • Additional right-of-way may be required. • Driver education may be needed unless good visual cues are provided. • Greater potential for driver confusion • If the quadrant roadway does not exist, may be high construction and right-of-way costs. • Number of intersections to cross increases. • Potential minor increase in rear-end collisions.

Continuous Flow Intersection: CFI are the same as DLT described in Option 2 of this section. However, for this option, the displaced left turns are implemented along all four intersection approaches. The signal cycle is reduced to two phases, enabling a reduction in overall cycle lengths and maximizing through movement green times. The result is a reduction in travel delays and increased capacity at the intersection. The left turn lane crosses the opposing traffic at an intersection 400 to 500 feet in advance of the cross street. The distance is a balance between the costs of a longer storage and the spillback potential from the main intersections.

Figure 17: Concept Design of CFI Intersection Geometric Improvement

Source: Unconventional Arterial Design (UAID), prepared for Department of Transportation, State Highway Administration (SHA)

A recent Federal Highway Administration research and development study showed the CFI to have considerable capacity improvements compared to the conventional intersection under certain conditions. The advantages of the CFI design concept include fewer conflict points, which in return will have fewer crash occurrences, fewer signal phases (reduced to two-phase) at the main intersection, a

higher green time percentage for through and left turn movements, significantly low construction costs, and shorter construction period compared to an interchange design. Studies have also shown that the CFI concept can reduce delay for the arterial traffic, reduce stops for through arterial traffic, and ease progression for arterial through traffic. Several recent planning and design studies completed for state highway agencies have shown the CFI to have significant cost savings compared to various interchange alternatives. The advantages and disadvantages associated with CFI are very similar to DLT design.

In this study, the CFI concept has been proposed at two intersection locations: Custer Road and FM 1827. A typical concept design of the CFI intersection is provided in **FIGURE 17**.

See **APPENDIX C** for the Intersection Improvements Exhibits showing the concept design proposed for this option at the study intersections.

The estimated costs for Option 3 miscellaneous improvements are shown in **TABLE 16.** Details for the cost estimate can be found in **APPENDIX G.**

Table 16: Option 3 Cost Estimates

Intersection	Total
Lovers Lane (Florida-T)	$547,701
Coit Road	$950,092
Independence Parkway (Florida-T)	$1,257,679
Custer Road-CFI	$3,150,011
State Highway 5	$1,955,838
FM 1827-CFI	$3,184,056
TOTAL	**$11,045,376**

Option 4: Partially Grade Separated Interchanges

In this option, the study intersections were evaluated with miscellaneous grade-separated geometric improvements along US 380 corridor.

- Grade-separated left turn movement concept at four intersections: CR 26, La Cima Boulevard, State Highway 5, and Airport Drive intersections with US 380
- Single Point Urban Interchange (SPUI) concept at Custer Road intersection with US 380
- Underpass concept at TX 121/US 75 interchange

Grade Separated Left Turn Intersection: In this concept the left-turn movements along the primary arterial and cross streets are separated from the through and right turn movements by elevating all left turn lanes into a separate and elevated intersection using narrow ramps within the median. Both the elevated and at-grade intersections are controlled by simple two-phase signals. Left turn traffic descends from the elevated intersection and merges with the through traffic travel lanes. Unlike the freeway style flyover design, the center elevated left turn ramps fit vertically mostly within the wide center median, replacing dual left turn bay slots with two-lane roadways on structure. At an intersection

with heavy left turn movements, the spillback from the left turn bay will be eliminated, which would result in a much smoother through traffic flow.

The center left turn concept will be easier to construct compared to a traditional grade separation. Column and retaining wall support are confined to the center wide median, minimizing their impact on outside right-of-way and adjacent properties.

Several studies have been conducted to compare the operational analysis results of the center left turn lane concept versus the other geometric concepts. The study results reveal that the center left turn concept will have significant operational benefits for six-lane or more arterial with moderate to heavy left turn movements. Capacity studies have also shown that the center left turn concept will have 75% more green time for the elevated left turn movements compared to a dual at-grade left turn movement at a conventional intersection. Similarly the at-grade through movements will also have 40% more green time by the separation of the left turn movements.

Figure 18: Concept Design of Grade Separated Left Turn Intersection Geometric Improvement

Source: Unconventional Arterial Design (UAID), prepared for Department of Transportation, State Highway Administration (SHA)

Pedestrian movements are accommodated at-grade and can take one or two-stage crossings. Pedestrian phases are at greater frequency due to shorter cycle lengths, and pedestrian crossing with left turning vehicles are eliminated at-grade.

A concept design of the center left turn lane intersection is provided in **FIGURE 18**.

Below is the summary of advantages and disadvantages to Grade Separated Left-Turn intersection.

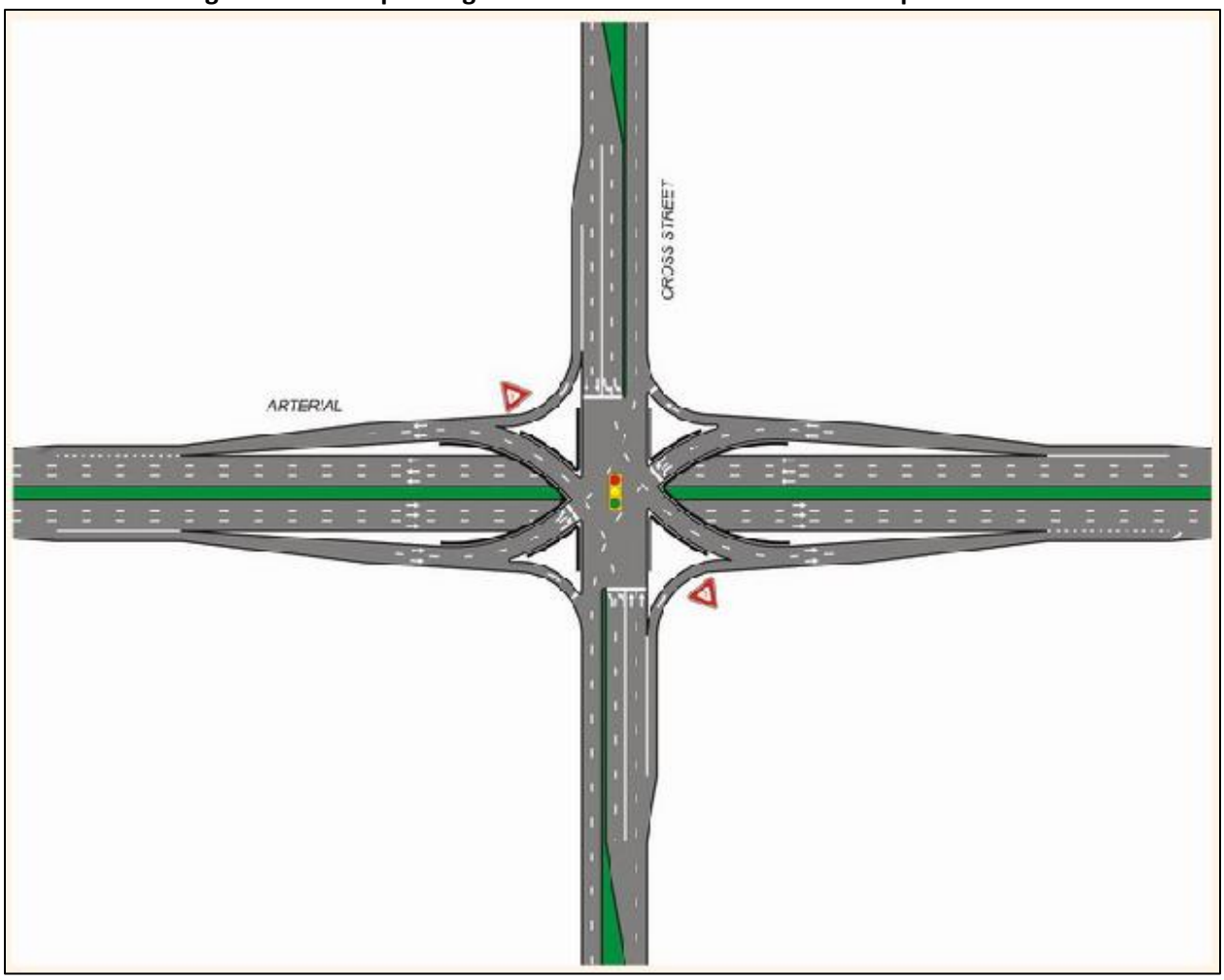
Advantages	Disadvantages
• Potential reduction in left-turn collisions. • Potential reduction in overall travel time and stops. • Implement 2-phase signal design, resulting in more green time for through movements. • Considerable reduction is overall intersection delay. Aiding overall corridor progression. • Cheaper than a fully grade separated intersection. • Potential reduction in crashes along intersection due to fewer conflict points. • Potentially improves the overall safety of the intersection.	• Additional right-of-way may be required. • Driver education may be needed unless good visual cues are provided. • Greater potential for driver confusion • Higher initial cost compared to a traditional intersection. • Could impact the ingress/egress for businesses at the intersection, due to the left-turn structure at median.

Single Point Urban Interchange: The Single Point Urban Interchange (SPUI) design allows free flow operations along the priority roadway by creating a separate, signalized intersection of major and minor roadway left turns and minor roadway through movement on a separate grade, with free flow operations on priority roadway.

The creation of a single signalized intersection on the arterial improves the ability to progress traffic on the arterial compared to a conventional diamond interchange. While SPUI design ROW requirements are similar to the conventional diamond interchange, the pavement area and the footprint of the structure at the intersection is considerably wider. The larger intersection width requires greater structure length and depth, which increases costs for bridge construction, retaining walls and earthwork. There are two basic variations in SPUI design, ‘overpass’ (the at-grade intersection is underneath the priority roadway overpass) and ‘underpass’ (the at-grade intersection is elevated on structure over the priority roadway. The overpass SPUI design concept has been proposed for the Custer Rd/FM 2478 interchange.

A concept design of the SPUI intersection is provided in **FIGURE 19**.

Figure 19: Concept Design of SPUI Intersection Geometric Improvement



Source: Unconventional Arterial Design (UAID), prepared for Department of Transportation, State Highway Administration (SHA)

Below is the summary of advantages and disadvantages to SPUI intersection.

Advantages	Disadvantages
• Improved operational efficiency at the intersection. • Allows concurrent left turns for greater capacity • Potential for decrease in all types of collisions. • May be constructible in confined right-of-way. • Potentially ease movement for large vehicles such as trucks and RVs	• Increased cost due to the need for a longer or wider bridge • Additional right-of-way may be required. • Complex intersection and signal phases may be unfamiliar to drivers • Higher initial cost compared to a traditional intersection. • Could impact the access to businesses at the intersection • More free-flow motor vehicle movements (part of what increases the SPUI's capacity) makes it harder for pedestrians to safely cross

Underpass Concept: For this underpass option at SH 121/US 75 interchange, US 380 corridor is proposed to travel underneath the SH 121/US 75 grade separation. The existing frontage roads will remain and they will accommodate the traffic exiting and entering the US 75. Two travel lanes in each direction are proposed along US 380 underpass. Turn movements in the east west direction, along with access to businesses at the intersection are maintained through at-grade travel lanes.

The transition of the US 380 underpass would occur between Community Avenue and Redbud Boulevard cross streets.

See **APPENDIX C** for the Intersection Improvements Exhibits proposed for option 4.

The estimated costs for option 4 improvements are shown in **TABLE 17.** Details for the cost estimate can be found in **APPENDIX G**.

Table 17: Option 4 Cost Estimates

Intersection	Total
County Road 26	$4,766,255
La Cima Boulevard	$5,116,039
Custer Road - SPUI	$10,425,529
SH 121/US 75 - Underpass	$24,353,541
State Highway 5	$6,680,097
Airport Drive	$5,345,537
TOTAL	**$56,686,999**

Below is the summary of advantages and disadvantages to Underpass intersection.

Advantages	Disadvantages
• Potential for a significant decrease in collisions involving major street through traffic • Offers the potential for a significant decrease in midblock collisions • Significantly increases the intersection capacity and relieve congestion.	• Potential for a minor increase in merge/diverge collisions • Increased cost due to the need for a longer structure for the main lanes. • Additional right-of-way may be required.

Traffic

Option 1: Turn Lane Improvement

The proposed geometric configuration along with intersection delay and LOS information for the turn lane improvement option is shown previously in **FIGURE 18**. The intersection operational analyses results were evaluated using the Synchro model. All the study intersections were loaded with the future year traffic projections (received from NCTCOG) and the optimized signal timing data. The operational analysis results for year 2040 AM and PM peak hour scenarios are presented in **TABLE 18**. The Synchro program output files for this analysis are included in **APPENDIX B-13**.

Table 18: Future Build (2040) Intersection Operational Analysis (Turn Lane Improvement Option)				
Intersection Location	**AM Peak Hour**		**PM Peak Hour**	
	Delay (sec/veh)	**LOS**	**Delay (sec/veh)**	**LOS**
County Road 26	126.1	**F**	133.4	**F**
Lovers Lane (*Proposed*)	33.0	C	55.5	**E**
La Cima Boulevard	114.7	**F**	168.1	**F**
Coit Road	108.1	**F**	127.9	**F**
Independence Boulevard (*Proposed*)	69.8	**E**	80.8	**F**
Custer Road	120.1	**F**	153.6	**F**
Stonebridge Drive	97.9	**F**	121.9	**F**
Ridge Road	100.6	**F**	112.3	**F**
Lake Forest Drive	136.9	**F**	145.2	**F**
Hardin Boulevard	117.6	**F**	139.1	**F**
Skyline Drive	16.5	D	40.2	D
Wisteria Way	24.7	C	33.0	C
Community Avenue	108.2	**F**	93.9	**F**
SH 121/US 75 Southbound Frontage Road	218.3	**F**	182.1	**F**
SH 121/US 75 Northbound Frontage Road	183.4	**F**	207.3	**F**
Redbud Boulevard	177.7	**F**	193.7	**F**
State Highway 5	114.2	**F**	132.3	**F**
Airport Drive	38.4	D	88.4	**F**
Farm-to-Market Road 1827	89.4	**F**	114.2	**F**

The 2040 build intersection operational analysis results with the turn lane improvement option show that the delay at all study intersections would improve slightly compared to the no-build condition during both peak hours. However, all study intersections, except Lovers lane (AM peak), Skyline Drive (AM and PM peak hours), Wisteria Way (AM and PM peak hours), and Airport Drive (AM peak) will continue to operate at LOS E or worse. The operational results show that adding additional turn lanes would not improve the capacity of the intersection and the study intersections would continue to operate at an unacceptable LOS.

Option 2: Displaced Left Turn Movement

The DLT is achieved through dedicated left-turn bays located several hundred feet prior to the main intersection, which allow left-turning vehicles to move at the same time as through traffic. The left-turn traffic signal phase is eliminated, allowing more vehicles to move through the main intersection and thus reducing traffic congestion and delays.

The intersection operational analyses results were evaluated using the Synchro model. All the study intersections were loaded with the future year traffic projections and the optimized signal timing data. The operational analysis results for both 2040 build AM and PM peak hour scenarios for DLT concept are presented in **TABLE 19**. The Synchro program output files are included in **APPENDIX B-13**.

Table 19: Future Build (2040) Intersection Operational Analysis (Displaced Left Turn Improvement Option)

Intersection Location	AM Peak Hour		PM Peak Hour	
	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
County Road 26	-	-	-	-
Lovers Lane (*Proposed*)	-	-	-	-
La Cima Boulevard	15.2/46.5/8.7	B/D/A	10.4/85.4/15.2	B/**F**/B
Coit Road	19.2/60.8/11.6	B/**E**/B	16.5/86.1/22.2	B/**F**/C
Independence Boulevard (*Proposed*)	-	-	-	-
Custer Road	-	-	-	-
Stonebridge Drive	12.6/72.4/17.5	B/**E**/B	19.3/80.1/24	B/**F**/C
Ridge Road	9.4/76.1/10.3	A/**E**/B	10.5/78.7/15.8	B/**E**/B
Lake Forest Drive	10.9/69.2/13.5	B/**E**/B	9.1/68.3/11.7	A/**E**/B
Hardin Boulevard	8.7/68.3/19.4	A/**E**/B	12.5/82.2/31.7	B/**F**/C
Skyline Drive	-	-	-	-
Wisteria Way	-	-	-	-
Community Avenue	38/100/8.9	D/**F**/A	15.5/63.7/15.9	B/**E**/D
SH 121/US 75 Southbound Frontage Road	27/68.9	C/**E**	29.5/111.4	C/**F**
SH 121/US 75 Northbound Frontage Road	66.8/29.1	**E**/C	67/16.8	**E**/B
Redbud Boulevard	-	-	-	-
State Highway 5	8.3/76.3/11.2	A/**E**/B	8.5/102.5/12.1	A/**F**/B
Airport Drive	23.9/43.8/41.7	C/D/D	15.3/80.4/27.2	B/**F**/C
Farm-to-Market Road 1827	10.5/55.8/11.1	B/**E**/B	11.9/88.1/19.9	B/**F**/B

The DLT option was proposed only at the major intersections along the US 380 corridor. Therefore, **TABLE 18** includes the results at those specific intersections and also includes the LOS results along US 380 corridor, which include the crossover intersections.

The 2040 build intersection operational analysis results with the Displaced Left improvement option show that the delay at all study intersections would improve significantly compared to the No Build and option 1 scenarios, during both peak hours.

Option 3: Miscellaneous At-Grade Improvements

The study intersections were evaluated with miscellaneous at-grade geometric improvements along either US 380 or cross streets. The following at-grade geometric improvements are proposed:

- Continuous Green T-intersection concept at Lovers Lane intersection
- Modified Jug-handle concept at Prosper Commons and Coit Road cross streets with US 380
- Continuous Flow Intersection (CFI) concept at two study intersections: Custer Road and FM 1827 with US 380 arterial
- Modified Jug-handle concept at SH 5 intersection

The intersection operational analyses results were evaluated using the Synchro model. All the study intersections were loaded with the future year traffic projections and the optimized signal timing data. The operational analysis results for both 2040 build AM and PM peak hour scenarios for the Miscellaneous At-Grade improvement condition are presented in **TABLE 20**. The Synchro program output files are included in **APPENDIX B-13**.

Table 20: Future Build (2040) Intersection Operational Analysis (Misc. At-Grade Improvement Option)

Intersection Location	AM Peak Hour		PM Peak Hour	
	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
County Road 26	-	-	-	-
Lovers Lane (*Proposed*)	28.7	C	46.7	D
La Cima Boulevard	-	-	-	-
Coit Road	71.7	**E**	81.8	**F**
Independence Boulevard (*Proposed*)	35.5	D	50.9	D
Custer Road	31.4/14.3/10.4/37.8	C/B/B/D	31.9/19.1/10/9/37.2	C/B/B/D
Stonebridge Drive	-	-	-	-
Ridge Road	-	-	-	-
Lake Forest Drive	-	-	-	-
Hardin Boulevard	-	-	-	-
Skyline Drive	-	-	-	-
Wisteria Way	-	-	-	-
Community Avenue	-	-	-	-
SH 121/US 75 Southbound Frontage Road	-	-	-	-
SH 121/US 75 Northbound Frontage Road	-	-	-	-
Redbud Boulevard	-	-	-	-
State Highway 5	113.8	**F**	106.1	**F**
Airport Drive	-	-	-	-
Farm-to-Market Road 1827	19.1/12.9/16.6/29.3	B/B/B/C	31.2/28.6/30.3/42.9	C/C/C/D

The 2040 build intersection operational analysis results for the Miscellaneous At-Grade improvement option show that the delay at all study intersections would improve significantly compared to the No Build and Option 1 scenarios, during both peak hours. The LOS letter grade will also improve at all of the modified intersections with Miscellaneous At-Grade design concept, during both peak hours.

Option 4: Miscellaneous Grade Separated Options

The study intersections were evaluated with miscellaneous grade-separated geometric improvements along US 380 corridor. The following grade-separated geometric improvements were proposed:

- Grade-separated left turn movement concept at four intersections: CR 26, La Cima Boulevard, SH 5 and Airport Drive intersections with US 380.
- Single Point Urban Interchange (SPUI) concept at Custer Road intersection with US 380
- Underpass concept at TX 121/US 75 interchange

Table 21: Future Build (2040) Intersection Operational Analysis (Misc. Grade-Separated Improvement Option)

Intersection Location	AM Peak Hour		PM Peak Hour	
	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
County Road 26	12.8 / 34.6	B / C	14.7 / 56.5	B / **E**
Lovers Lane (*Proposed*)	-	-	-	-
La Cima Boulevard	13.5 / 20.4	B / C	18.4 / 24.1	B / C
Coit Road	-	-	-	-
Independence Boulevard (*Proposed*)	-	-	-	-
Custer Road	40.0	D	52.9	D
Stonebridge Drive	-	-	-	-
Ridge Road	-	-	-	-
Lake Forest Drive	-	-	-	-
Hardin Boulevard	-	-	-	-
Skyline Drive	-	-	-	-
Wisteria Way	-	-	-	-
Community Avenue	-	-	-	-
SH 121/US 75 Southbound Frontage Road	12.1 / 67.9	B / **E**	43.8 / 25.9	B / D
SH 121/US 75 Northbound Frontage Road	37.1 / 24.4	D / C	49.0 / 60.9	D / **E**
Redbud Boulevard	-	-	-	-
State Highway 5	23.0 / 26.1	C / C	17.2 / 37.3	B / D
Airport Drive	18.0 / 23.7	B / C	15.9 / 34.4	B / C
Farm-to-Market Road 1827	-	-	-	-

The intersection operational analyses results were evaluated using the Synchro model. All the study intersections were loaded with the future year traffic projections and the optimized signal timing data. The operational analysis results for both 2040 build AM and PM peak hour scenarios for Miscellaneous

Grade-Separated improvement condition are presented in **TABLE 21**. The Synchro program output files are included in **APPENDIX B-13**.

The 2040 build intersection operational analysis results for the miscellaneous grade-separated improvement option show that the delay at the modified study intersections would improve significantly compared to the other intersection improvement options during both peak hours. The LOS letter grade will also improve at all of the modified intersections with the miscellaneous grade-separated design concept, during both peak hours.

Right-of-Way Impacts

While the general character of the Intersection Improvements in this alternative match the existing road structure, each option does propose right-of-way acquisitions. Options 1 and 3 would require the least amount of additional right-of-way. **TABLE 22** lists the proposed ROW acquisitions for each option. Option 2 would affect the greatest number of parcels with 73. Option 3 would affect 32. Option 1 would affect 29 and Option 4 would affect 40.

Option 2 would also affect the greatest acreage with a total of 11.23, which is much greater than Option 4, the next largest, with 3 acres required.

Economic Impacts

Most of the options proposed for this alternative does not impact the properties or structures. There should be no major economic impacts to adjacent property owners.

Option 1: No structures would be displaced and access would remain to all properties. No economic impacts are expected for adjacent property owners.

Option 2: No structures would be displaced. Access impacts could have negative economic impacts to the some of the properties at the intersections.

Option 3: No structures would be displaced but access to Redbud Estates (via Redbud Boulevard) would be negatively impacted.

Option 4: The grade separated left turn options impacts a few structures at Custer Road and SH 5. These impacts could, however, be minimized or eliminated through design refinements.

Table 22: Proposed ROW Acquisitions at Intersections		
Option	**Intersection**	**Acres Proposed/Parcels Affected**
Add Turn Lanes (1)	Independence Parkway	.10 / 2
Add Turn Lanes (1)	Stonebridge Drive	0.01/ 1
Add Turn Lanes (1)	Ridge Road	.09 / 3
Add Turn Lanes (1)	Lake Forest Drive	.20 / 7
Add Turn Lanes (1)	Hardin Boulevard	.24 / 6
Add Turn Lanes (1)	Community Avenue	.38 /3
Add Turn Lanes (1)	State Highway 5	.25 / 4
Add Turn Lanes (1)	FM 1827	.08 / 3
TOTAL OPTION 1		**1.34 /29**
Displaced Left Turns (2)	La Cima Boulevard	1.32 / 4
Displaced Left Turns (2)	Coit Road	1.11 / 2
Displaced Left Turns (2)	Stonebridge Drive	.78 / 11
Displaced Left Turns (2)	Ridge Road	1.64 / 3
Displaced Left Turns (2)	Lake Forest Drive	.51 / 4
Displaced Left Turns (2)	Hardin Boulevard	1.45 / 7
Displaced Left Turns (2)	Community Avenue	.90 / 12
Displaced Left Turns (2)	US 75	.25 / 6
Displaced Left Turns (2)	State Highway 5	2.49/ 10
Displaced Left Turns (2)	Airport Drive	.25 / 5
Displaced Left Turns (2)	FM 1827	.53 / 9
TOTAL OPTION 2		**11.23 acres / 73**
Continuous flow intersections (3)	Coit Road	.05 / 2
Continuous flow intersections (3)	Independence Parkway	.23 / 4
Continuous flow intersections (3)	Custer Road	.75 / 12
Continuous flow intersections (3)	State Highway 5	.15 / 2
Continuous flow intersections (3)	FM 1827	.76 / 12
TOTAL OPTION 3		**1.94 acres / 32**
Grade separated interchange (4)	La Cima Boulevard	.05 / 2
Grade separated interchange (4)	Custer Road	1.76 / 21
Grade separated interchange (4)	US 75	.34 / 12
Grade separated interchange (4)	State Highway 5	.69/ 5
TOTAL OPTION 4		**3 acres / 40**

Community Impacts

All four intersection improvements options generally match the aesthetics and community characteristics that exist today. These options do not impact the public facilities, alter travel patterns or change the landscape along the study corridor.

Option 1: The Intersection Improvements in this alternative would not negatively impact community cohesion or access to the businesses and residences along the corridor.

Option 2: By the nature of DLT design, the access along the leg with displaced left turn storage may be impacted. This would alter the ingress/egress patterns for business along this section. However, this could be accommodated through Side Street or a shared driveway with adjacent businesses. See some examples below for ingress/egress options for some of the businesses that may be affected by this option.

The O'Reilly Auto Parts at 3800 West University Drive McKinney, Texas would be negatively impacted by this option. Only the traffic moving west on the displaced left turn lane would have direct access at this entrance. There is an alternate entrance along Hardin Boulevard that would become the primary access for this business.

The QuikTrip gas station at 2285 West University Drive McKinney, Texas would generally maintain the same level of access. Currently, traffic can only turn right onto US 380. With this option, however, traffic could still turn right but would first enter the displaced turn lane and then merge onto the main corridor. This could become a potential negative impact to this business.

Option 3: Besides the access issues involving the CFI/DLT design at Custer Road and FM 1847, this option also has access issues at the continuous green t-intersections. For example, at Independence Boulevard, the entrance to the Redbud Estates neighborhood (via Redbud Boulevard) would be negatively impacted. A median would be constructed that would prevent westbound traffic on US 380 from turning into the neighborhood. Travelers would need to U-turn at Prestwick Hollow Drive. Similarly, travelers leaving the neighborhood would be unable to turn directly left to go west. They would need to turn right and travel approximately 0.3 miles before doing a U-turn. The neighborhood also does not have another entrance or exit, therefore, the addition of a median would negatively impact the neighborhood.

Additionally, at the future intersection of Independence Parkway and US 380, the raised median would cause a negative impact to future development north of this intersection and would likely need to be removed as development occurs on the north side of US 380. Similar impact can be assessed at the Lovers Lane intersection with a continuous green t-intersection.

Option 4: The SPUI design would prevent the off-ramp access from US 380 to go through the intersection affecting the access to the properties in the northwest and southeast quadrants. However, these properties could be accessed through Custer Road with additional maneuvers from US 380.

The grade separated left turn would prevent the median openings at the location for a considerable distance, negatively affecting the approved median openings and altering the access to the properties at the intersections.

5.3 Alternative 3 Freeway with Continuous Frontage Roads

Design and Cost

This alternative focuses on corridor level improvements upgrading the facility to accommodate the growth and meet travel demands. This alternative takes US 380 and develops it into a freeway with

continuous frontage roads with ramp access to major cross streets along the corridor. Upgrading US 380 to a freeway with frontage roads would require a minimum ROW width of 250 feet along the corridor and up to 300 feet at the interchanges. The Typical Section Exhibit for this Alternative can be found in **FIGURE 20.**

For this study, it was assumed that the freeway with frontage road terminates at CR 26 to the west and FM 1827 to the east. Beyond the study limits, US 380 transition back to 6-lane arterial west of CR 26 and east of FM 1827. The location of the entrance and exit ramps along both directions of the travel are proposed at the following locations.

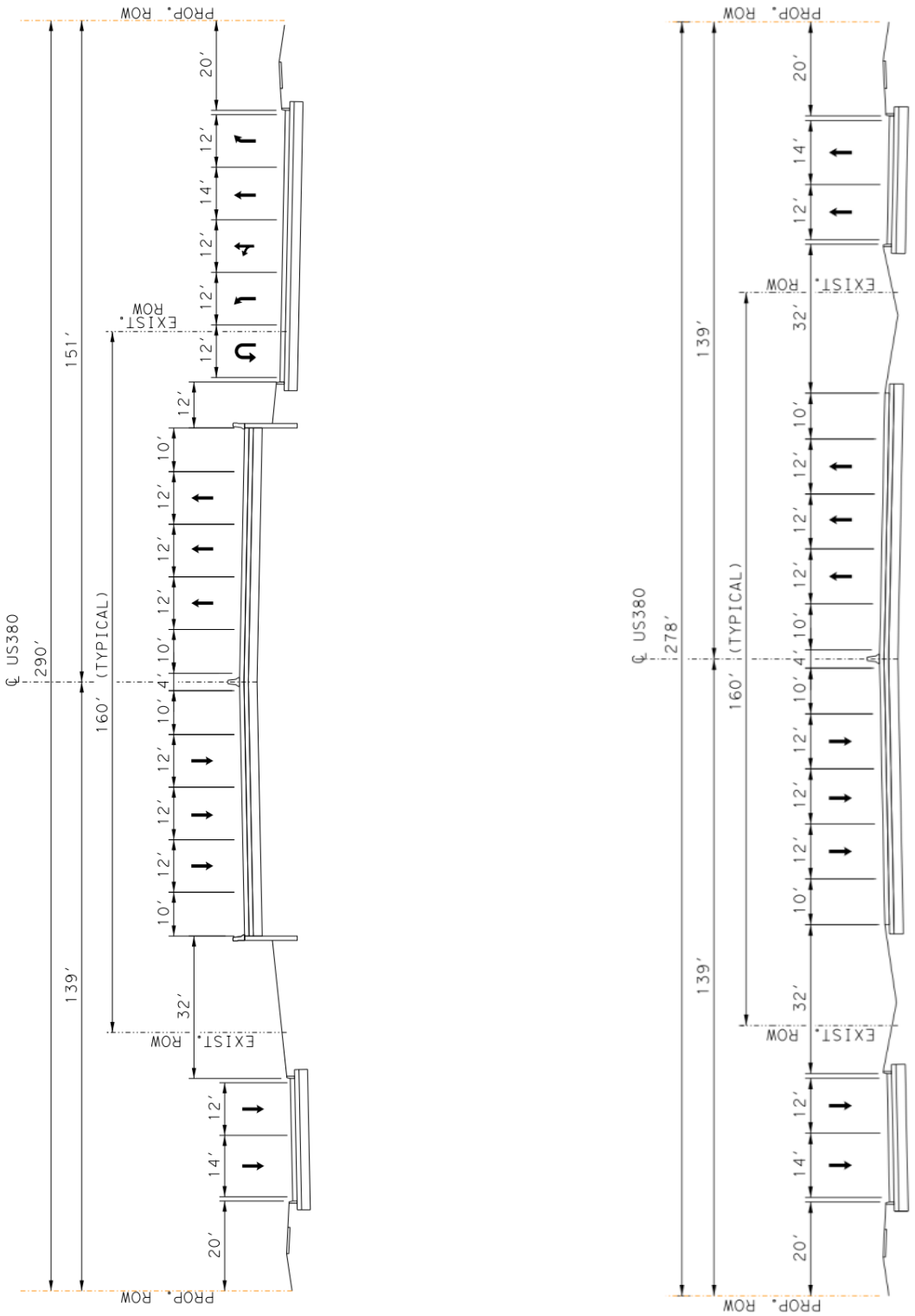
- West side of the County Road 26 interchange
- West and east sides of Coit Road interchange
- West and east sides of Custer Road interchange
- West and east sides of Lake Forest Drive interchange
- West and east sides of Hardin Boulevard interchange
- West and east sides of TX 121/US 75 interchange
- West side of State Highway 5
- West and east sides of Airport Drive interchange
- West and east sides of FM 1827 interchange

The ramp locations/placements dictate that several interchanges would be served by the common ramp. Further analysis needed to determine additional ramp locations along the study corridor.

The estimated cost for the freeway alternative including ROW purchases is shown in **TABLE 23.** Details for the cost estimate can be found in **APPENDIX G.**

Table 23: Freeway with Continuous Frontage Roads Facility Cost Estimates	
Construction	$372,712,674
Utilities	$42,340,594
Engineering	$27,540,016
ROW	$120,630,232
Total	**$563,223,516**

Figure 20: Freeway with Continuous Frontage Roads Typical Section



Traffic

The traffic projections for a freeway with continuous frontage roads in both directions are analyzed in this section. The future year projections were developed by NCTCOG for both 2040 AM and 2040 PM peak hour scenarios along US 380 corridor and the cross streets. The AM and PM peak hour traffic projections are provided in **APPENDIX B-7.** The NCTCOG model outputs are included at the end of Synchro output files in **APPENDIX B-13**. No modifications, alternations or adjustments were made to the traffic projections received from NCTCOG for both 2040 AM and PM peak hour scenarios.

This option was analyzed as an elevated 6-lane freeway with 3-lanes in each direction within the study limits. Continuous 2-lane frontage roads are proposed along the US 380 corridor in both directions. The proposed intersection operational condition results are shown graphically in **APPENDIX B-8**.

The intersection operational analyses results were evaluated using the Synchro model. All the study intersections were loaded with the future year traffic projections and the optimized signal timing data. The operational analysis results for both 2040 build AM and PM peak hour scenarios for Freeway and Frontage Road (FWY+FR) improvement condition are presented in **TABLE 24**. The results are also shown graphically in **APPENDIX B-7**. The Synchro program output files for both 2040 build AM and PM peak hours are included in **APPENDIX B-13**.

The 2040 build intersection operational analysis results for the freeway with continuous frontage road option show that the intersection delay and LOS at the intersections would improve during both peak hours. All study intersections except Lake Forest Drive and Hardin Boulevard intersections would operate at LOS D or better during both peak hours. These two intersections would operate at LOS E or worse during the AM peak hour due to heavy southbound traffic demand. The proposed geometric layout shows that both Lake Forest Drive and Hardin Boulevard will have 6-lane segment north of US 380 and 4-lane segment south of US 380. As a result, the southbound traffic will back up at the intersection and will increase the overall delay. Widening Lake Forest Drive and Hardin Boulevard to a six-lane facility on both the north and south side of US 380 would improve the LOS to an acceptable LOS.

Table 24: Future Build (2040) Intersection Operational Analysis (Freeway with Continuous Frontage Roads)				
Intersection Location	**AM Peak Hour**		**PM Peak Hour**	
	Delay (sec/veh)	**LOS**	**Delay (sec/veh)**	**LOS**
	EB Ramp / WB Ramp	**EB Ramp / WB Ramp**	**EB Ramp / WB Ramp**	**EB Ramp / WB Ramp**
County Road 26	25.2 / 23.9	C / C	29.8 / 24.0	C / C
Lovers Lane (*Proposed*)	11.5 / 10.0	B / A	8.0 / 7.2	A / A
La Cima Boulevard	10.2 / 6.9	B / A	9.2 / 7.2	A / A
Coit Road	32.8 / 51.6	C / D	23.9 / 20.8	C / C
Independence Boulevard (*Proposed*)	4.4 / 7.7	A / A	4.5 / 18.2	A / B
Custer Rd	48.3 / 45.5	D /D	48.9 / 44.7	D / D
Stonebridge Drive	17.8 / 26.7	B / C	13.7 / 14.9	B / B
Ridge Road	9.8 / 19.4	A / B	9.0 / 9.3	A / A
Lake Forest Drive	**73.1 / 78.2**	**E / E**	43.3 / 48.2	D / D
Hardin Boulevard	**78.3 / 92.3**	**E / F**	49.7 / 33.9	D / C
Skyline Drive	- / 8.1	- / A	- / 12.1	- / B
Wisteria Way	N/A	N/A	N/A	N/A
Community Avenue	13.2 / 17.9	B / B	52.2 / 29.4	D / C
SH 121/US 75 Southbound Frontage Road	26.9 / 14.8	C / B	14.0 / 49.2	B / D
SH 121/US 75 Northbound Frontage Road	24.4 / 13.9	C / B	31.0 / 42.3	C / D
Redbud Boulevard	13.3 / 11.5	B / B	12.7 / 6.9	B / A
State Highway 5	10.7 / 21.9	B / C	28.9 / 19.8	C / B
Airport Drive	9.3 / 19.0	A / B	25.4 / 20.8	C / C
Farm-to-Market Road 1827	11.4 / 16.7	B / B	14.1 / 9.9	B / B

N/A: The NCTCOG model did not provide any traffic projections at Wisteria Way intersection.

Environmental Impacts

This section discusses the anticipated impacts associated with the freeway alternative.

Businesses and residences along the US Highway 380 corridor will experience significant impacts to access with this alternative. The freeway option will generally increase speed throughout the corridor for both regional and local travelers. It would transform the corridor from an east-west arterial to a more significant thoroughfare with increased truck traffic and large scale developments within the vicinity of the corridor.

While the freeway option would allow greater mobility and ease congestion along US Highway 380, especially for long range travelers, it would be more difficult for local users to travel.

Right of Way Impacts

Upgrading to a freeway would require a minimum of 250 feet for ROW along the corridor with up to 300 feet of ROW at intersections. Considering a typical existing ROW width of 160 feet, significant ROW acquisitions would be required due to the wider ROW needs for a freeway. A total of 173.89 additional acres would be required from 375 parcels to accommodate this alternative

Based on conceptual engineering, this alternative would result in 111 displacements: 36 residential, 67 businesses and commercial centers, and 8 gas stations.

If this option is selected, further evaluation would be required to access accurate damage to the existing properties and structures along the corridor.

Community Impacts

At intersections, the proposed main lanes would have a minimum vertical clearance of 16.5 feet for an overall height of over 22 feet at intersections. The proposed bridge and retaining walls along the corridor would likely change the character of the roadway.

Most of the proposed relocations and buildings are located within the City of McKinney, thus there are significant impacts that affect the community character within the City. US 380, generally east of Community Avenue and west of State Highway 5, is a retail and service corridor that has many of the area's restaurants and shopping amenities. This alternative will remove several structures that are currently located along US 380. The pedestrian movement could also be impacted by the proposed freeway facility.

The Freeway with Frontage Roads Alternative does extend into the Collin County Community College located at the intersection of University Avenue (US 380) and Community Avenue. While the alignment extends into the property, some parking on the south side of the college would likely be removed but no structures will be impeded.

Economic Impacts

As discussed in the previous section, relocations will be necessary for this alternative, especially within the City of McKinney. This affects the existing economics of the City along the study corridor. The value of the subdivisions and neighborhoods would also be negatively impacted by the relocation from the freeway facility. Other impacts include access due to the one-way frontage roads. Businesses that used to rely on traffic from both directions would become harder to access from the other side of the road.

Although there is a possibility that freeway corridors tend to attract much large scale developments (like Nebraska Furniture Mart, IKEA, Stonebriar Mall along SH 121), it is not a guaranteed proposition. A freeway facility would largely impact the zoning along the corridor and the future vision of the City along corridor. Per current zoning and the vision of the City for the US 380 corridor, a freeway is not a part of the long-term plan for this segment of the corridor.

Advantages of this alternative include lack of traffic congestion which will improve the area's connection to the greater region – increasing the possibility of further economic investment as the area would have quicker access to other population centers. Another advantage is that businesses would still be able to front the corridor on frontage roads and the general land uses along the corridor could be redeveloped for future needs. The future land use plans along the corridor dictate denser retail and commercial development – this alternative would support these visions and goals.

5.4 Alternative 4 Grade Separated Intersections at Major Intersections

Design and Cost

This alternative focusses on grade separating major arterials along US 380. This alternative would provide the needed grade separations at select arterial crossings without impacting the ROW along the corridor. This minimizes the environmental impacts compared to a freeway facility at the same time improving the mobility along the corridor. Combining this alternative with some of the at-grade intersection options would greatly improve the mobility along the corridor converting the facility in to a super arterial. Grade separations were recommended at the eight major intersections listed below:

- County Road 26
- Coit Road
- Custer Road
- Lake Forest Boulevard
- Hardin Boulevard
- State Highway 5
- Airport Drive
- Farm-to-Market Road 1827

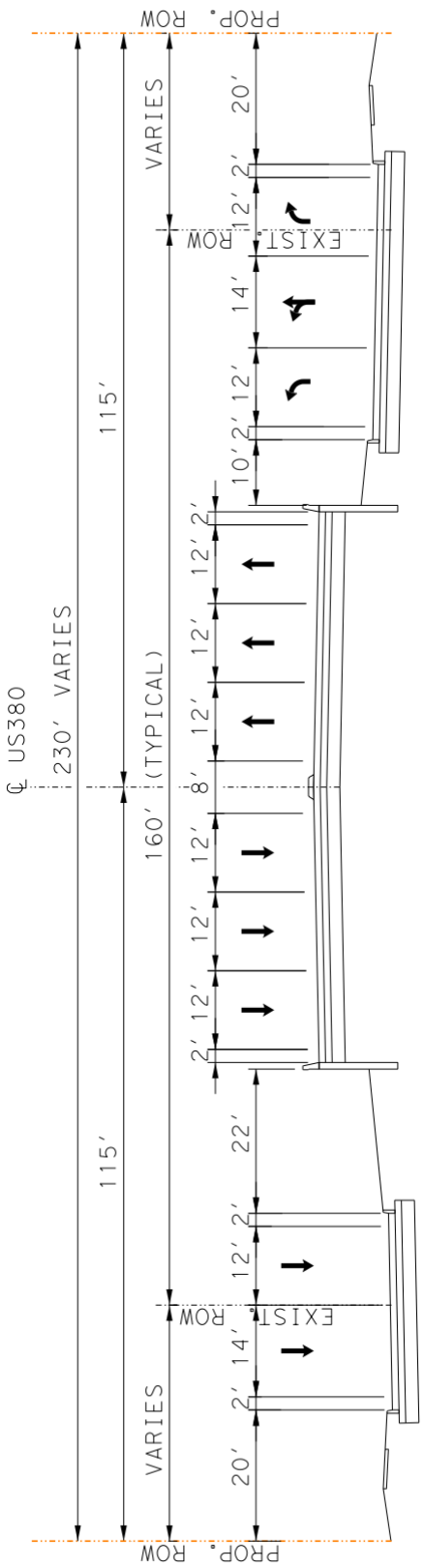
The Typical Section Exhibit for this Alternative can be found in **FIGURE 21.**

The cross streets were selected based on feedback from the stakeholders, the projected future traffic volumes and available ROW. The estimated cost for the grade separations at major intersections alternative is shown in **TABLE 25.** Details for the cost estimate can be found in **APPENDIX G.**

Table 25: Grade Separated Intersections Cost Estimates

Intersection	Total
County Road 26	$14,622,663
Coit Road	$11,355,413
Custer Road	$11,259,096
Lake Forest Drive	$11,194,474
Hardin Boulevard	$11,712,480
State Highway 5	$14,785,959
Airport Drive	$11,529,856
Farm-to-Market Road 1827	$11,370,187
TOTAL	**$97,830,128**

Figure 21: Grade Separated Intersections Typical Section



Traffic

The future year analysis was performed for year 2040 using the NCTCOG traffic projections. The traffic projections received from the NCTCOG model were used directly in the Synchro operational analysis. No modifications or assumptions were made.

The NCTCOG Travel Demand Model proposes continuous frontage roads in both directions of travel in the Super Arterial option between CR 26 intersection and just east of La Cima Boulevard intersection. The frontage roads will merge into US 380 mainlanes just east of La Cima Boulevard, near Coit Road intersection. East of the frontage road merge near the Coit Road intersection; the NCTCOG Travel Demand Model does not propose any frontage roads. Therefore, the intersections at Lovers Lane and La Cima Blvd would show two delay and LOS results along both directions of the frontage roads. The study documents that these two intersections would remain at-grade; and not be proposed as grade-separated.

The geometric configurations of the 2040 proposed geometric layout for the Super Arterial concepts are shown graphically in **APPENDIX B-10**.

The intersection operational analyses results were evaluated using the Synchro model for 2040 AM and PM peak hour scenarios. The eight grade separated intersections (i.e. US 380 Super Arterial option) were loaded with the future year traffic projections. The signal timings were optimized.

The operational analysis results for 2040 build AM and PM peak hour scenarios for US 380 Super Arterial condition are presented in **APPENDIX B-9**. The Synchro program output files for 2040 build AM and PM peak hours are included in **APPENDIX B-13**.

Table 26: Future Build (2040) Intersection Operational Analysis (Super Arterial Improvement Option)

Intersection Location	AM Peak Hour		PM Peak Hour	
	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
	EB ramp/ WB ramp	EB ramp/ WB ramp	EB ramp/ WB ramp	EB ramp/ WB ramp
County Road 26	7.0 / 30.0	A / C	9.8 / 36.6	A / D
Coit Road	3.1 / 8.4	A / A	8.6 / 4.9	A / A
Custer Road	51.5 / 41.8	D / D	12.2 / 9.0	B / A
Lake Forest Drive	28.1 / 8.3	C / A	54.1 / 11.5	D / B
Hardin Boulevard	14.6 / 32.0	B / C	27.0 / 21.6	C / C
State Highway 5	17.9 / 19.5	B / B	18.3 / 16.2	B / B
Airport Drive	27.8 / 21.5	C / C	13.9 / 14.7	B / B
Farm-to-Market Road 1827	8.8 / 11.4	A / B	12.1 / 9.7	B / A

Note: The overall delay and LOS information is presented for the at-grade intersections without any overpass/underpass
N/A: The NCTCOG model does not provide any traffic projections at Wisteria Way intersection.

In the 2040 Super Arterial option, the US 380 corridor has been evaluated for underpass and overpass geometric concepts. **TABLE 26** shows all study intersections would operate at an acceptable LOS.

Along with the 8 grade separations listed above, SH 121/US 75 intersection was evaluated as the 9th intersection. The grade separation design proposed will be same as the underpass option proposed as the Option 4 within Alternate 1. However, even with this grade separation, this intersection will perform at LOS E during afternoon peak hour. The excessive demand along US 380 westbound through movement and northbound left turn movement triggers the failure at this intersection. The traffic projections show 886 vehicles per hour travelling along northbound to westbound left turn movement; which is excessively high to accommodate within traditional Diamond interchange. This study recommends converting this traditional Diamond interchange into a Diverging Diamond Interchange (DDI). In the DDI concept design, the left turns to/from the exit ramps travel freely, increasing the intersection capacity to accommodate the heavy left turns from the northbound frontage road.

Environmental Impacts
This section discusses the anticipated impacts associated with the Grade Separation at Major Interchanges alternative.

Right of Way Impacts
This alternative would reconfigure US 380 so that it traveled over major intersections and to improve speed and capacity along the corridor. A total of eight intersections would be reconfigured and a total of 36.95 acres of additional right-of-way would be required. A total of 120 parcels would be affected.

Community Impacts
The land uses that front the corridor would generally maintain their current form. The intersections, however, would have a design that is in contrast to the current design. The aesthetics of the corridor would be a mix between a major highway, for example SH 121/US 75, and the corridor that exists today. Traffic would move more easily through intersections because the corridor would travel over them. The land uses that currently front the corridor would still be able to front the corridor.

Additionally, the TxDOT *Landscape and Aesthetics Design Manual* would dictate that the intersections built over the existing intersections would have design aesthetics that reflect the unique and local heritage of the communities. TxDOT would require that aesthetic sensibilities be intertwined with the function of the intersection overpasses.

The Grade Separation at Major Interchanges Alternative would not greatly affect community character and cohesion as the design is similar to what exists today and interchanges would adhere to aesthetic mandates to reflect the community's character.

Economic Impacts
Due to the additional right-of-way required at the reconfigured intersections, a total of nine structures would be displaced. The majority of the displacements would occur in McKinney, due to the generally more developed nature of McKinney versus the predominantly rural land uses surrounding the corridor

in Frisco and Prosper. The total displacements would include: 7 businesses, 3 gas stations, and 1 residence. All of the displacements would occur in the City of McKinney.

This alternative would be a hybrid between intersection improvements (Alternative 1) and a freeway section (Alternative 2). The existing land uses would still front onto US 380 and local users would be able to access the businesses easily. Regional users, however, would find fewer signals and would be able to travel across the corridor with minimal congestion at traffic signals. These factors create economic advantages because there would be reduced traffic congestion for both local and regional users. Additionally, the future land use plans along the corridor call for increased retail and commercial density.

5.5 Alternative 5 Outer Loop

Design and Cost

The Outer Loop typical section was selected based on the schematics and EA from the original Outer Loop study that Collin County performed. The Outer Loop has an ultimate right-of-way width of 500 feet with a 70-mile per hour design speed, 10-lane controlled-access roadway with access ramps and two-lane frontage roads. See **FIGURE 20** for the proposed typical section for the Outer Loop alternative.

This alternative would involve removal and relocation of a 72-inch waterline. This waterline stretches from west of FM 423 in Denton County to east of Prosper Commons Boulevard. This waterline is within 75 feet of easement abutting the north ROW line for US 380. The estimated cost for removal and relocation of this waterline is approximately $1 Million for every 1000 feet of relocation. The total estimated cost for the Outer Loop alternative including the relocation of the 72-inch waterline is shown in **TABLE 27.** Details for the cost estimate can be found in **APPENDIX G.**

Table 27: Outer Loop Cost Estimates

Construction	$798,155,091
Utilities	$64,050,673
Engineering	$56,593,400
ROW	$382,910,892
TOTAL	**$1,301,710,055**

Traffic

The 2040 operational analyses results for the Outer Loop alternative were evaluated using the Synchro model. All the study intersections were loaded with the future year traffic projections and the optimized signal timing data. The operational analysis results for both 2040 build AM and PM peak hour scenarios for Outer Loop improvement conditions are presented in **TABLE 28**. The Synchro program output files for both 2040 build AM and PM peak hours are included in **APPENDIX B-13**.

Figure 22: Outer Loop Typical Section

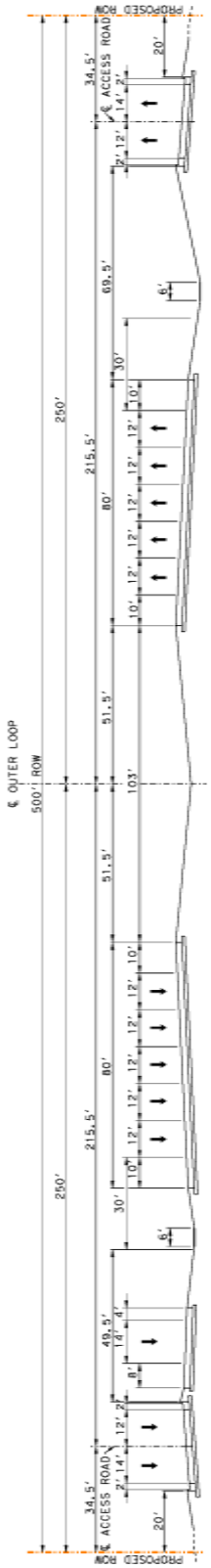


Table 28: Future Build (2040) Intersection Operational Analysis (Outer Loop Improvement Option)				
Intersection Location	**AM Peak Hour**		**PM Peak Hour**	
	Delay (sec/veh)	**LOS**	**Delay (sec/veh)**	**LOS**
	EB Ramp / WB Ramp	**EB Ramp / WB Ramp**	**EB Ramp / WB Ramp**	**EB Ramp / WB Ramp**
County Road 26	21.5 / 16.9	C / B	13.7 / 25.0	B / C
Lovers Lane (*Proposed*)	14.3 / 12.1	B / B	8.0 / 4.8	A / A
La Cima Boulevard	9.8 / 4.8	A / A	9.5 / 6.4	A / A
Coit Road	33.8 / 52.8	C / D	26.3 / 18.3	C / B
Independence Boulevard (*Proposed*)	10.0 / 11.9	B / B	12.9 / 23.9	B / C
Custer Road/FM 2478	54.9 / 51.9	D / D	44.7 / 34.1	D / C
Stonebridge Drive	19.3 / 32.3	B / C	14.1 / 13.7	B / B
Ridge Road	10.4 / 19.4	B / B	9.8 / 11.1	A / B
Lake Forest Drive/FM 1461	50.7 / 46.3	D / D	53.9 / 47.4	D / D
Hardin Boulevard	50.7 / 52.9	D / D	29.6 / 30.2	C / C
Skyline Drive	- / 6.2	- / A	- / 4.9	- / A
Wisteria Way	N/A	N/A	N/A	N/A
Community Avenue	12.4 / 18.2	B / B	27.4 / 15.4	C / B
TX 121/US 75 southbound off-ramp	16.5 / 40.5	B / D	11.3 / 42.8	B / D
TX 121/US 75 northbound off-ramp	25.1 / 13.9	C / B	14.7 / 12.8	B / B
Redbud Boulevard	10.7 / 8.8	B / A	10.6 / 6.1	B / A
State Highway 5	9.4 / 24.5	A / C	28.8 / 17.5	C / B
Airport Drive	15.4 / 25.9	B / C	26.5 / 19.1	C / B
FM 1827	11.8 / 13.7	B / B	17.3 / 10.0	B / A

N/A: The NCTCOG model did not provide any traffic projections at Wisteria Way intersection.

In the Outer Loop alternative, the ramp terminal intersections were evaluated. The results are also shown graphically in **APPENDIX B-12**. The 2040 build intersection operational analysis results for the Outer Loop alternative show that the intersection delay and LOS at the intersections would improve significantly during both peak hours.

Environmental Impacts

This section discusses the anticipated impacts associated with the Outer Loop alternative.

Businesses and residences along the US Highway 380 corridor will experience significant impacts to access with this alternative. This alternative will generally increase speed throughout the corridor for

both regional and local travelers. It would transform the corridor from an east-west arterial to a more significant thoroughfare with increased truck traffic and large scale developments within the vicinity of the corridor.

Right of Way Impacts
The Collin County Outer Loop would require a typical right-of-way width of 500 feet. This right-of-way is significantly wider than the current roadway design. The right-of-way would extend equally to both the north and south sides of the current roadway.

The Outer Loop alternative would affect an estimated 558 parcels and 551.73 acres. The impacts to the area around this option would be significant and may not be suitable along a mostly developed corridor like US 380.

Community impacts
The Outer Loop alternative would have significant impacts to the community character, especially in McKinney, where most of the displacements will occur. US 380, generally east of Community Avenue and west of SH 5, is a retail and service corridor that has many of the area's restaurants and shopping amenities. This alternative will remove most structures that are currently located along US 380 and may significantly impact the cohesion between the communities and business north and south of the corridor.

This alternative would have the aesthetics similar to a large multi-modal freeway. Being a TxDOT road, however, it would be required to adhere to the *Landscape and Aesthetics Design Manual.* The attractiveness and design of the corridor would be created in a way that integrates into the fabric of the landscape and/or complements that setting. A common example includes highway murals on intersection retaining walls that usually reflect the unique natural or heritage features of a community. The ROW for this alternative would extend into the Collin County Community College located at the intersection of Community Avenue. While the ROW extends into the property impacting parking on the south side of the college, no structures will be removed.

Economic Impacts
A total of 292 displacements would be required. Based on conceptual engineering, this alternative would result in 292 displacements: 136 residential, 139 businesses and commercial centers, and 17 gas stations. This alternative would allow faster travel along the corridor, which could help the area better connect to the overall region. A decrease in traffic congestion and travel times would likely be a boon to economic development in the area, particularly with freight travel. Further, the surrounding land uses would still have access to the corridor and the future land use plans in the communities' indicate a desire for denser retail and commercial growth. Easy and quick access would likely help the area attract and retain dense retail.

Advantages of this alternative include lack of traffic congestion which will improve the area's connection to the greater region – increasing the possibility of further economic investment as the area would have quicker access to other population centers. Although this alternative provides mobility and relieves congestion, it comes at a great economic impact. The Outer Loop planned and partially built (and ROW

acquired) north of US 380 would mostly go unused. Also a corridor of this magnitude through some of most developed segments of US 380 corridor would wreak havoc on the local economy due to the loss of several major businesses and the tax base. Furthermore, it would impact the communities and neighborhoods that are established along the corridor, likely creating a divide within the City of McKinney.

Outer Loop alternative is also the least favored among the stakeholders, just short of the no build alternative.

6. Summary

The traffic analysis and the corridor recommendations proposed for this study are based on the project goals defined in earlier chapters (enhanced mobility and safety, cost effectiveness, engineering feasibility, and minimal environmental impacts) and were developed to minimize, to the extent practicable, any bias in the evaluation process.

This study provides high level comparisons of the alternatives for corridor improvements that could be implemented over different time periods. The results presented in this report, could potentially assist TxDOT and other stakeholders in prioritizing improvement projects along the US 380 corridor. These projects would need to be examined in further detail during subsequent project development phases.

A quantitative rating system was used to compare the effectiveness of the alternatives. The methodology used a five-level rating system as described below:

2 Significant Positive Effects
1 Some Positive Effects
0 No Effect, Neutral
-1 Some Negative Effects
-2 Significant Negative Effects

Each of the alternatives were evaluated using the established five-level rating system. **TABLE 29** shows the results of the evaluation using the five-level rating system.

6.1 Mobility and Safety

Based solely on mobility, the Freeway and the Outer Loop alternatives provide the most capacity along the corridor and is a long-term viable alternative for the corridor. This alternative also resulted in corridor attracting most travel demand and provided ample capacity to continue to provide the best travel times and speeds within the study corridor.

At-grade intersection improvements appear to solve the mobility issues at only the select intersections along the corridor. They still do not address the congestion at certain major intersections such as Custer Road, US 75, State Highway 5, etc. The intersection improvements also do not solve the mobility problems that currently exist along the corridor.

Grade-separating major intersections along US 380 had the best effect at the intersection for short and long term needs. This alternative, however, did not attract as much travel demand as the access controlled options. Selective grade separations along with at-grade intersection improvements resulted in better travel times and travel speeds along the study corridor.

Finally, it should be noted that this study focused only on improving the US 380 corridor. No analysis was done to determine the need for direct connectors at Dallas North Tollway, US 75, and other major intersections.

Table 29: Five-Level Evaluation Matrix									
Alternatives	Mobility & Safety		Cost Effectiveness			Environmental Impacts			**Overall Score**
	Accessibility	Safety	Construction Costs	ROW	Utilities	Land Use	Economic	Public Support	
1. No build	-2	-2	2	2	2	0	-2	-2	**-2**
2. Intersection Improvements									
Option 1: Turn Lane Improvements	1	-1	2	2	2	0	-2	-1	**3**
Option 2:Displaced Left	1	1	2	1	2	1	1	0	**9**
Option 3: Misc. at Grade Improvements	1	2	2	1	1	1	1	1	**10**
Option 4: Misc. Grade Separated	2	2	1	1	1	2	1	1	**11**
3. Upgrade to Freeway with continuous Frontage Roads	2	2	-1	0	0	2	1	0	**6**
4. Grade separated interchanges at Major Interchanges	2	2	0	1	1	2	-1	2	**9**
5. Segment of Outer Loop	2	2	-2	-2	-2	0	-1	-2	**-5**

6.2 Cost Effectiveness: Construction, ROW, and Utilities Relocation

Overall, the Intersection Improvements alternative (Alternative 1) scored the best from the cost effectiveness evaluation. The Option 4 for Alternative 1 (miscellaneous grade-separated option) and Alternative 4 (grade separating US 380 at major arterial crossings) costs more than at-grade intersection improvements, however, considering that these alternatives had minimal ROW and relocation needs, scored better in the evaluation criteria. Freeway alternative (Alternative 3) is considerably more expensive to build and the Outer Loop alternative (Alternative 5) costs even more than twice that of the freeway. Both these access-controlled alternatives had significant ROW needs along with utility relocations. Both Outer Loop and Freeway alternatives also involved reconstructing a section of US 75 to accommodate the grade separation at this interchange, with Outer Loop having a larger impact because of its wider typical section.

6.3 Environmental Impacts

The smaller the footprint of the alternative and the shorter the distance of the alternative would causes fewer impacts to the environment along the corridor.

Overall, the Intersection Improvements alternative (Alternative 2) had the least impact to the land use and scored highest based on potential impacts to both the natural and land use environment. However, this alternative had significant impacts to the local economy, caused severe traffic congestion, and negatively affected the overall travel demand in the region. Based on discussions with stakeholders, this option had mixed feedback with most stakeholders not supporting at-grade intersection improvements only as a solution for this corridor. Although intersection improvements were considered acceptable for

the short term, they were in support of doing much largescale improvements to the corridor to address the stakeholder's future vision of the corridor.

The alternatives/options (Option 4 of Alternative 1 and Alternative 4) with grade separations at select arterials had the second best score for impacts to land use. This option addressed the longer term needs at some of the critical intersections and improved mobility, thereby reducing congestion and improving air quality. Most stakeholders were in support of this option as opposed to solely implementing just the at-grade intersection improvements. Furthermore, the design for these grade separations can be refined to minimize the impacts to the existing structures and reduce ROW acquisition costs.

The Freeway alternative (Alternative 3) had major impacts to the natural and land use environment. This alternative also resulted in major relocations along the developed segments of the corridor. Substantial impacts to the neighborhoods were also revealed based on the concept level proposed ROW maps for the freeway section. Based on stakeholder input, this option could potentially divide the communities on the north and south side of the US 380 (particularly in McKinney). This option had some support, but had significant opposition from stakeholders resulting in an overall negative score.

Outer Loop alternative (Alternative 5) had significant impacts to the land use along the corridor because of the 500 feet ROW requirements. This option relocated the businesses and the neighborhoods impacting the overall community. This option did not receive any support from the stakeholders.

7. Conclusion

Based on the limited scope of this study, the Alternate 3 (Freeway with Continuous Frontage Roads) provides the best mobility and safety, and addresses the long term needs of the communities. However, the ROW and relocation necessary to accommodate the freeway typical section, along with the negative environmental and economic impacts, would potentially outweigh the benefits of having the corridor upgraded as a freeway. The cost associated with building a freeway section through the mostly developed segment of US 380 also plays a significant role in downplaying this alternative.

A combination of Alternative 1 (Intersection Improvements) and Alternative 3 (Super Arterial) could be implemented at a reasonable cost. This combination could also have minimal impacts to the ROW and relocations, at the same time providing the needed mobility and safety improvements along the corridor. Based on the traffic projections from NCTCOG, this solution should meet the needs of the corridor for the design year 2040.

This study was performed based on the available aerial survey data, google maps, field visits, and NCTCOG traffic projections within a segment of Collin County. Currently, the study corridor traverses mostly developed areas within Collin County. An additional detailed study covering Denton, Collin, and Hunt Counties is likely necessary to further evaluate the economic, environmental, ROW, and traffic impacts for the freeway improvements. This would help evaluate the benefits versus impacts for the freeway alternative for the entire corridor. If the overall benefit outweighs the limited impact the freeway section has over segments of US 380 within developed areas, the freeway alternative could potentially be the most a viable alternative for future corridor improvements.

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