

Traffic Demand Analysis

Traffic Analysis

BACKGROUND

Downtown Frisco is a unique area within the City of Frisco. With its origins beginning in the early 1900s, transportation in Downtown has evolved over time. In the present day, vehicle trips are the primary method of travel for people living in or traveling to Frisco. However, within Downtown Frisco, access is shared by pedestrians, vehicle traffic, and bicycle users. Downtown Frisco businesses, both existing and future, can thrive when customers are able to visit by car, bike and by foot.

The major thoroughfares in Downtown Frisco consist of Main Street,

5th Street, and North County Road. Main Street is the primary east-west corridor within Downtown and carries the majority of the traffic. 5th Street is an important corridor that connects Downtown Frisco to areas south as it changes into Parkwood Boulevard. North County Road is a collector that connects Main Street to Eldorado Parkway to the north. Although Cotton Gin Road does not currently connect from the Dallas North Tollway to 5th Street, it is an important connection on the Frisco Thoroughfare Plan that may be constructed in the future.

The majority of the lane miles within Downtown Frisco are characterized as local roadways. These local roadways have been designed as a traditional grid with a block spacing of 320'. This traditional grid provides many mobility opportunities to improve connectivity for all modes, including motor vehicles, pedestrians,

Figure 1: Frisco Thoroughfare Plan

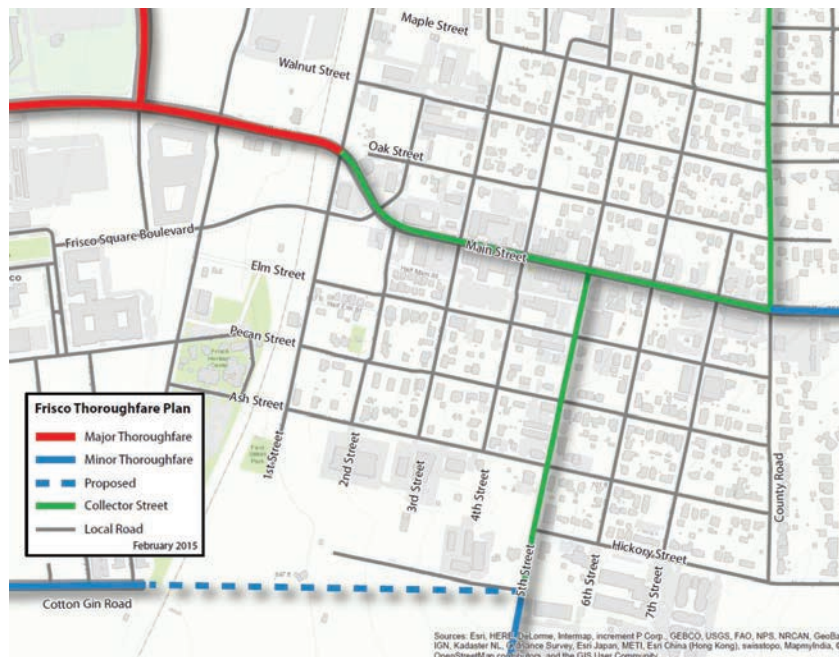


Figure 2: Downtown Intersection Control Map





and bicyclists. It also increases opportunities to provide on-street parking in proximity to key destinations within Downtown.

Currently, Downtown Frisco has traffic signals at the intersections of Main Street and 5th Street and North County/South County Road. All of the local streets within Downtown are controlled by stop signs. The east-west local roadways have stop signs at each intersection with the north/south movements having free-flow conditions. Figure 2, on the previous page, identifies the locations of traffic signals and stop signs within Downtown.

EXISTING 24-HOUR TRAFFIC & PEAK-HOUR TURNING MOVEMENT COUNTS (TMCs)

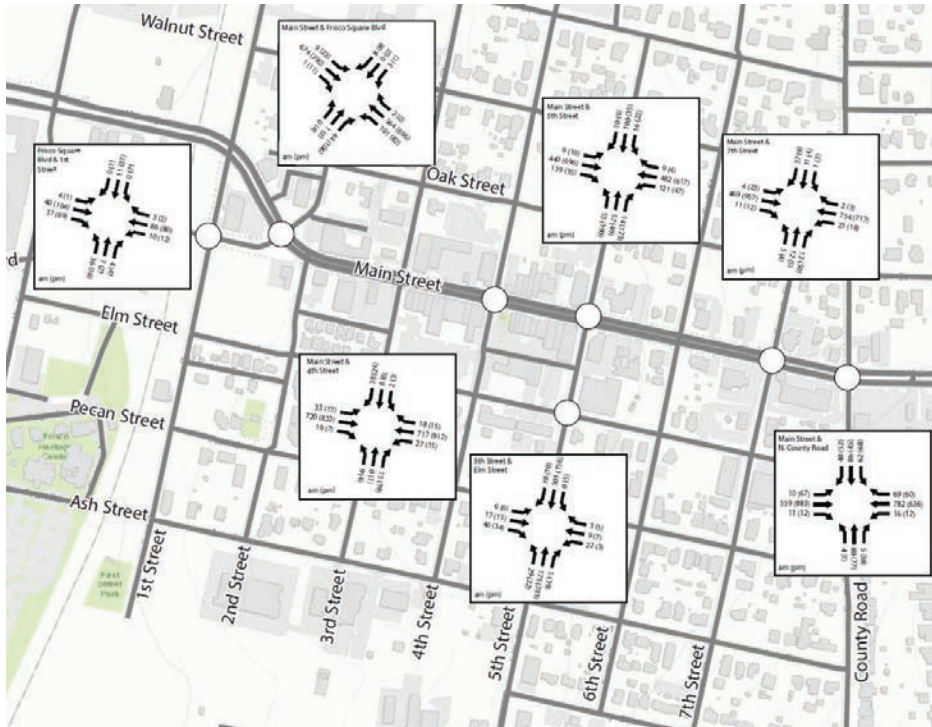
Traffic counts used for this traffic analysis were collected by the City of Frisco. 24-hour traffic counts were made available from the City of Frisco's online city maps page and TMCs were collected by the City of Frisco's engineering department. This data was used to evaluate the traffic conditions within Downtown Frisco. Figure 3 demonstrates the 24-hour traffic volumes in the area.

TMCs were collected to evaluate the traffic conditions during the peak times and to assist in evaluating the traffic conditions at intersections in the study area. The TMCs identify the traffic volumes for each turning movement at

Figure 3: 24-Hour Traffic Volumes



Figure 4: Turning Movement Count



the intersection to determine if operational changes are needed. TMCs were collected at the following intersections:

- Main Street @ 1st Street
- Main Street @ 2nd Street/Frisco Square Boulevard
- Main Street @ 3rd Street
- Main Street @ 4th Street
- Main Street @ 5th Street
- Main Street @ 6th Street
- Main Street @ 7th Street
- Main Street @ North County Road/South County Road
- Oak Street @ 5th Street
- Oak Street @ North County Road
- Frisco Square Boulevard @ 1st Street

Figure 5: Intersection Level-of-Service (LOS)



- Elm Street @ 5th Street
- Elm Street @ South County Road
- 5th Street @ Ash Street
- 5th Street @ Hickory Street
- Ash Street @ 1st Street

There are seven key intersections that were analyzed as part of this traffic study. Figure 4 identifies those locations and the turning movement volumes for the AM and PM peak periods. Since some of the intersections were collected on different days, the volumes along the Main Street corridor were balanced to account for daily traffic discrepancies. Each of the seven key intersections were inputted into Synchro to be analyzed further and to evaluate level-of-service (LOS) for each of the turning movements.



Figure 6: Travel Demand Model Forecast Network



Figure 8: Travel Demand Model Adjusted Forecast Network



Figure 7: Travel Demand Model Forecast Demographics

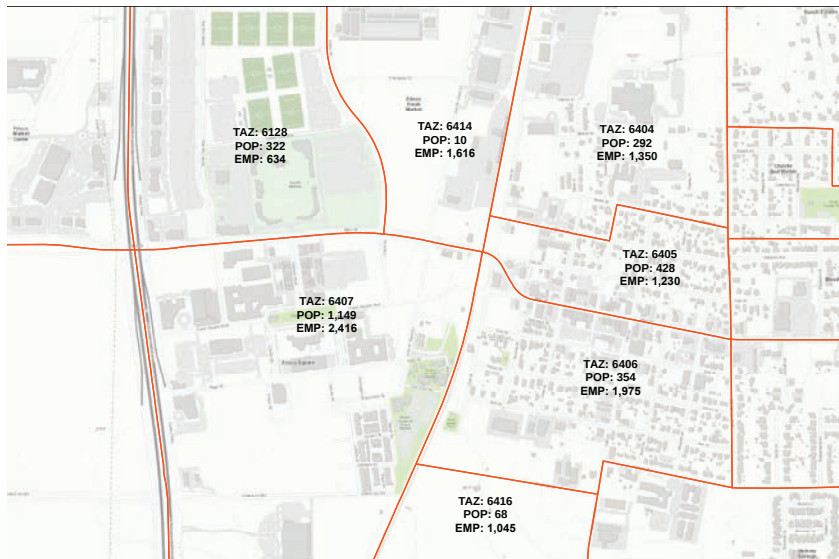
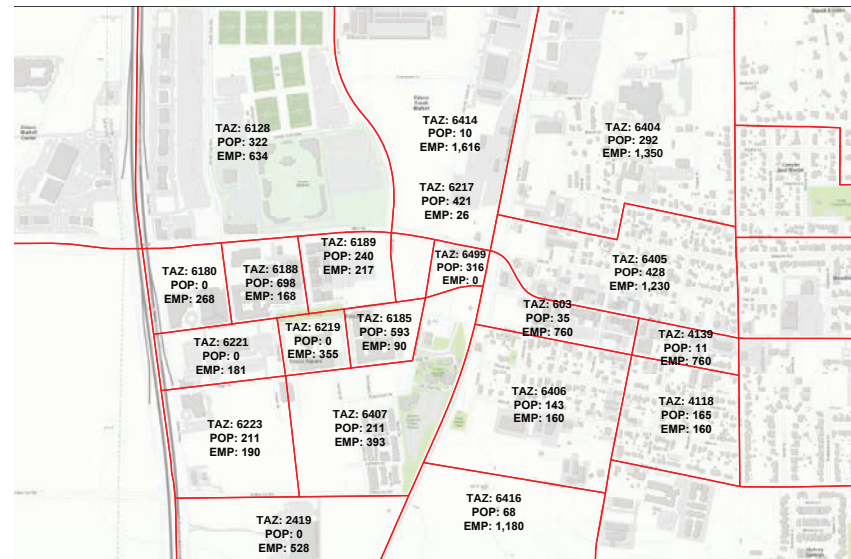


Figure 9: Travel Demand Model Adjusted Forecast Demographics



Future Traffic Demand

Future traffic projections are developed through a process of travel demand modeling. Travel demand modeling anticipates future traffic based on changes in the roadway network and demographics such as number of households and employment. The City of Frisco developed a regional travel demand model that takes into consideration these roadway and demographic changes that are expected by the year 2035. Future roadways in the Frisco travel demand model are based on the City's Thoroughfare Plan and future demographics are based on the City's most recent Comprehensive Plan. Both of these planning efforts were last updated in 2015.

For this traffic study, the Frisco travel demand model for 2035 was used to analyze alternatives for Downtown Frisco. Roadway configurations were updated to reflect a more refined network of streets within the Downtown and within Frisco Square. Demographics were updated to reflect changes in the loading of trips onto the model network based on the unique network present in both Frisco Square and Downtown Frisco. Due to increased residential development in the Frisco Square area, the population was increased to reflect these new characteristics. All other demographics in the area remained consistent with the approved 2035 model developed for the Frisco Comprehensive Plan.

Figures 6 - 8 demonstrate the updates to the model network and the demographics that were made for this traffic study.

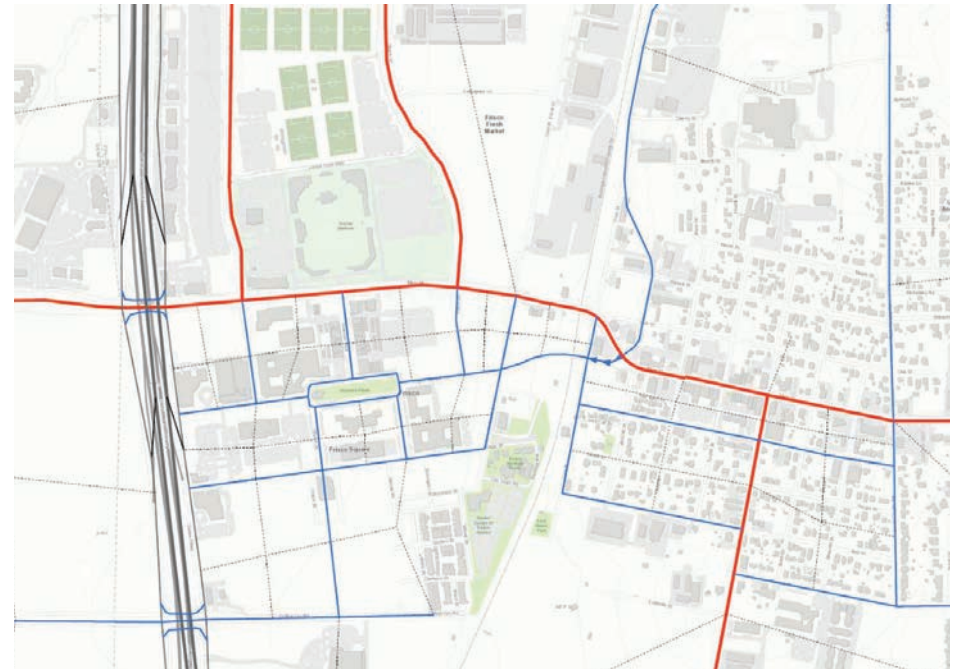
Traffic Scenarios

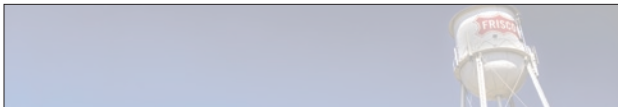
To better understand the implications of proposed improvements for Downtown Frisco and the surrounding area, a number of model scenarios were developed. These scenarios were developed to determine how much each improvement affects traffic conditions in the area. Below is a description of each scenario.

Scenario 1: Base Scenario

Using the model network demonstrated in Figure 8, this scenario is the base to which the other two scenarios are compared. The base scenario assumes the existing roadway network will be in place plus the extension of Church Street south to Cotton Gin Road in the Frisco Square district. In addition, the base scenario includes the changes to the Main Street corridor recommended in this report: the realignment of 1st Street north of Main Street to connect with 2nd Street, one-way operation of Frisco Square Boulevard between Main Street and 1st Street, and the Option B cross section for Main Street. An update of the base network is demonstrated in Figure 10.

Figure 10: Scenario 1 - Base



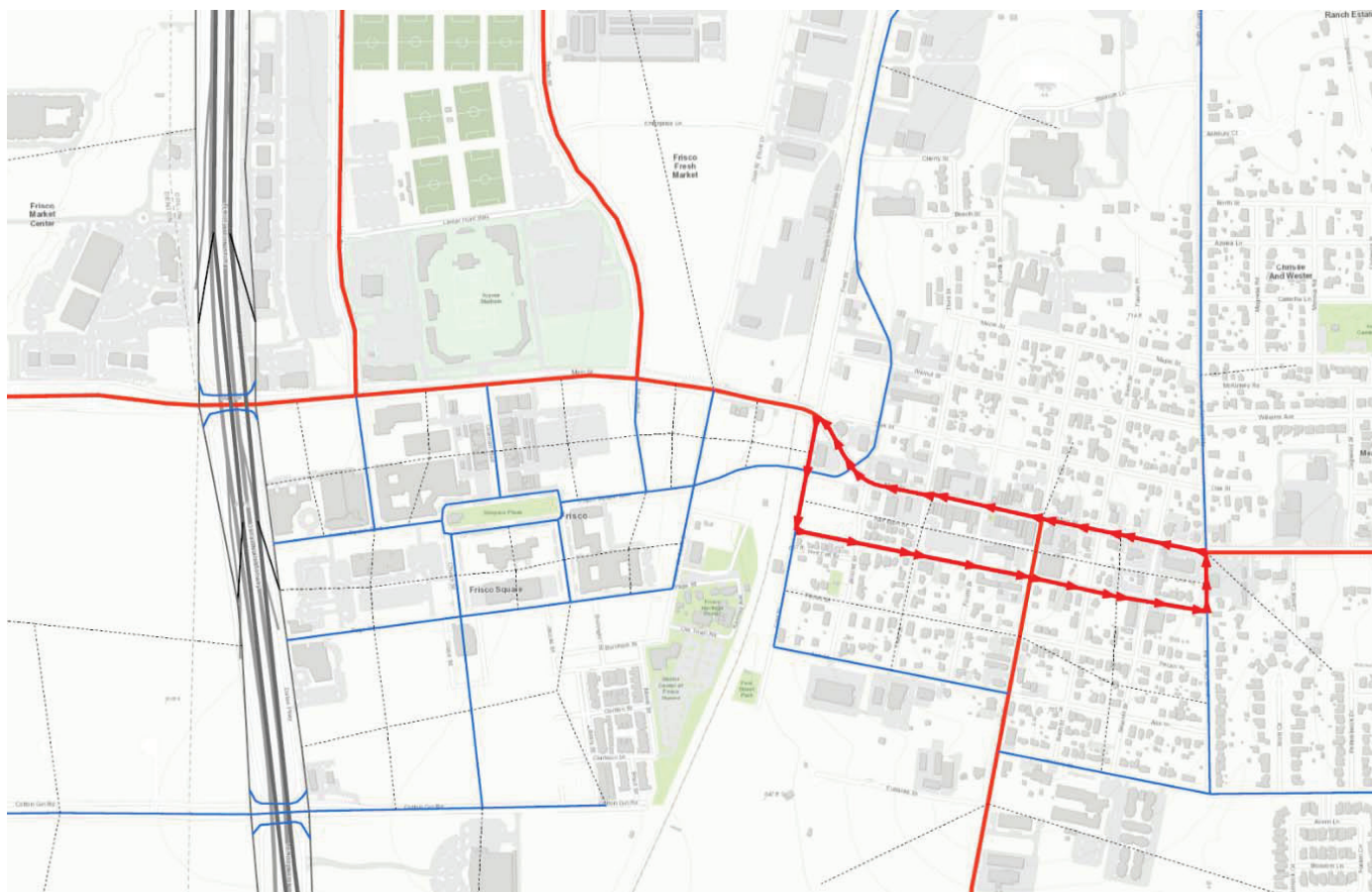


Scenario 2: Main Street Couplet

Using the network from Scenario 1 as a starting point for Scenario 2, this scenario tests additional capacity on Main Street in Frisco Downtown. The Main Street Couplet creates one-way operation in the westbound direction on Main Street between North County Road and 1st Street. In the eastbound direction, Elm Street is used as the primary connection. Each of these corridors were tested with two lanes

in one direction. Although this scenario tests a specific alignment from North County Road to 1st Street, it is important to note that the actual alignment, if implemented, could vary from what is being presented. All that was being tested is the potential benefit of creating a one-way couplet to accommodate more traffic through this area. Figure 11 demonstrates the roadway network that was tested in this scenario.

Figure 11: Scenario 2 - Main Street Couplet

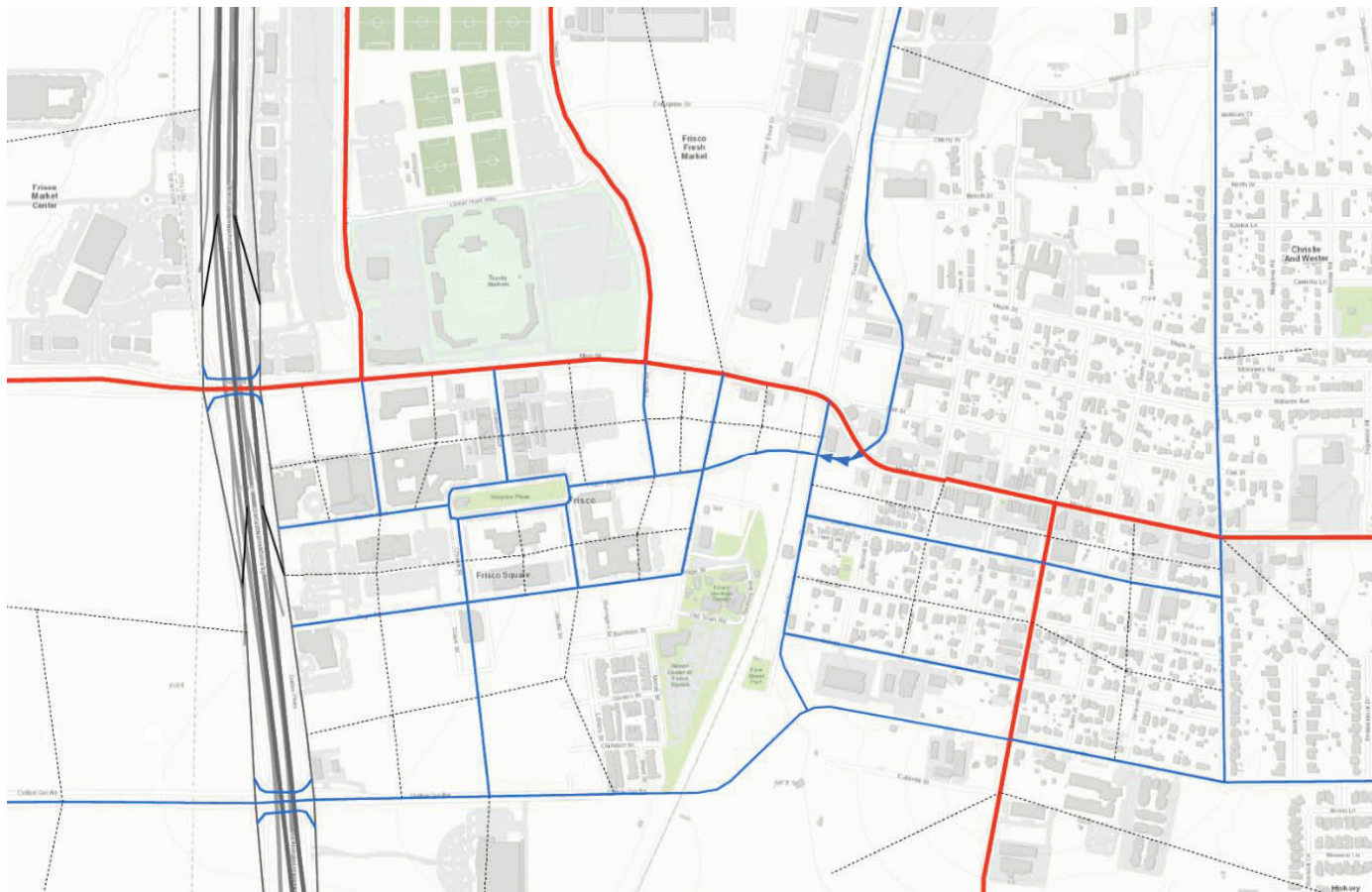


Scenario 3: Cotton Gin Road Extension

The City of Frisco's Thoroughfare Plan identifies Cotton Gin Road as a potential connection from the Dallas North Tollway to 5th Street. Currently, Cotton Gin terminates at the railroad and is not planned to connect to 5th Street in the near future. The purpose of this scenario is to test the travel demand model to see how much traffic this connection pulls from the Main Street corridor. The evaluation of this

scenario will assist in determining the value that Cotton Gin has on the overall street network in Frisco. Figure 12 demonstrates a potential configuration of Cotton Gin Road, but does not indicate an actual or preferred alignment. Further study would be needed to determine the alignment and whether it would be a tunnel or an overpass.

Figure 12: Scenario 3 - Cotton Gin Road Extension





2035 Travel Demand Model Results

The Frisco travel demand model uses future demographic growth expected in the year 2035 to evaluate traffic characteristics and trip patterns. The travel demand model network generally reflect functionally classified roadways such as highways, arterials, and collectors. For the purposes of this analysis, the model results were developed to compare how different scenarios responded to changing network conditions in Downtown Frisco and Frisco Square.

2035 SCENARIO 1: BASE NETWORK

Scenario 1 demonstrates the base condition including Main Street as one lane in each direction, Frisco Square Boulevard as one-way between Main Street and 1st Street, and the inclusion of collector roadways in Frisco Square and Downtown Frisco. Volumes on Main Street are similar to the current conditions and similar to the future volumes established in the Frisco Comprehensive Plan. In this scenario, more traffic has been distributed onto Elm Street, 1st Street, Ash Street and Hickory Street as they are not included in the original 2035 Comprehensive Plan model run.



2035 SCENARIO 2: MAIN STREET COUPLET

Scenario 2 demonstrates an increased east west traffic flow utilizing Main Street and Elm Street as one-way pairs. Each of the pairs has 2 lanes in each direction which essentially doubles the roadway capacity in the corridor. In Scenario 1, the volume along the corridor is under 20,000 vehicles per day. Combining the volumes on Main Street and

Elm Street in Scenario 2 increases the volumes to over 30,000 vehicles per day. In this scenario volumes on Ash Street and Hickory Street are reduced, however volumes on 5th Street increases between Scenario 1 and Scenario 2. This reduction of volumes of some of the collector may be attributed to the expanded capacity on the Main/Elm Street corridor.





2035 SCENARIO 3: COTTON GIN ROAD EXTENSION

Scenario 3 maintains the same network as Scenario 1 with the exception of the extension of Cotton Gin across the railroad to 5th Street to connect with Hickory Street. This is a similar network connection that is demonstrated in Frisco's Thoroughfare Plan. In Scenario 3, model volumes along Main Street are reduced in comparison to Scenario 1 and Scenario 2. Additional traffic is distributed to Cotton Gin, but not a

significant amount to impact surrounding neighborhoods.

The connection of Cotton Gin provides improved network connectivity between Downtown Frisco and Frisco Square and reduces the traffic on Main Street. If feasible, it would be recommended to make the connection of Cotton Gin across the railroad to 5th Street.



Intersection Operations Analysis

TRAFFIC SCENARIOS

The following traffic scenarios were analyzed for AM and PM peak hours in this study:

- Existing Conditions: Analysis of the existing traffic conditions, utilizing the collected traffic counts and traffic signal timing data.
- Proposed Conditions: Analysis of redistributed traffic per the Base Scenario travel demand model.

Growth Rate

To determine future TMCs, the existing 2018 TMCs were grown by 1.5% for 10 years to align with prior Main Street studies.

TRAFFIC ANALYSIS

After developing the projected turning movement volumes for the AM and PM peak hours, capacity analyses were performed for existing conditions and proposed conditions. Intersection operations were analyzed using Synchro 9 and VISSIM, software developed to automate procedures found in the Highway Capacity Manual. Results of the existing and proposed conditions analyses were compared to determine the impact of the proposed modifications.

Results of the capacity analyses are reported in standard level of service (LOS) format, with the most favorable conditions being designated as LOS A and the poorest conditions indicated by LOS F. Intersection level of service is based on the amount of delay that each vehicle encounters at a given intersection. The level of service criteria for signalized intersections, roundabouts, and unsignalized intersections can be seen in Figure 13.

Transportation agencies generally consider operations at or above

Figure 13: Level of Service Criteria

LEVEL OF SERVICE	STOPPED DELAY (SECONDS/VEHICLE)		
	SIGNALIZED INTERSECTIONS	ROUNDABOUTS	UNSIGNALIZED INTERSECTIONS
A	≤ 10	≤ 10	≤ 10
B	≤ 10 and ≤ 20	> 10 and ≤ 25	> 10 and ≤ 15
C	> 20 and ≤ 35	> 20 and ≤ 35	> 15 and ≤ 25
D	> 35 and ≤ 55	> 35 and ≤ 50	> 25 and ≤ 35
E	> 55 and ≤ 80	> 50 and ≤ 70	> 35 and ≤ 50
F	> 80	> 70	> 50

LOS C to be acceptable. In more dense areas, operations at or above LOS D may also be considered acceptable during peak traffic hours.

The following sections describe focus intersections within the Frisco Downtown Master Plan. An overall comparison of existing and proposed AM and PM peak hour level of service and delay can be found in Figure 14 and Figure 15.



Figure 14: AM Peak Hour Level of Service Comparison

ANALYSIS PERIOD	LEVEL OF SERVICE (DELAY IN SECONDS PER VEHICLE) BY APPROACH AND MOVEMENT												INTERSECTION
	EASTBOUND			WESTBOUND			NORTHBOUND			SOUTHBOUND			
	LEFT	THRU	RIGHT	LEFT	THRU	RIGHT	LEFT	THRU	RIGHT	LEFT	THRU	RIGHT	
(1) Frisco Square Boulevard and 1st Street*													
Existing	A			A			B			B			N/A
	0.5			0.9			10.8			11.1			
Proposed	A			A			B			B			N/A
	0.5			3.8			10.2			10.4			
(2) Main Street and 2nd Street*													
Existing	C			E			A			A			N/A
	17.7			47.7			0.2			1.5			
Proposed #	F	F	E	A	A	A	-	-	-	A	B	A	D
	63.8	66.4	46.6	5.7	5.1	3.4	-	-	-	6.1	10.1	4.9	31.9
(3) Main Street and 4th Street*													
Existing	A			A			E			D			N/A
	0.4			0.3			47.6			27.4			
Proposed	A			A			F			E			N/A
	0.4			0.4			93.4			41.4			
(4) Main Street and 5th Street													
Existing	A	B	B	A	A	A	F	E	E	E	E	E	C
	2.7	19.5	19.5	3.5	3.1	3.1	121.0	74.8	74.8	61.4	71.7	71.7	21.6
Proposed	A	B	A	A	A	A	F	E	E	E	E	E	B
	3.7	13.9	1.5	3.4	3.6	3.6	131.5	74.5	74.5	60.5	70.4	70.4	18.8
(5) Main Street and 7th Street*													
Existing	A			A			E			D			N/A
	0.1			0.3			39.0			26.5			
Proposed	A			A			F			E			N/A
	0.1			0.3			70.4			40.1			
(6) Main Street and County Road													
Existing	A	A	A	A	B	A	E	E	E	F	F	F	C
	7.6	8.3	8.3	4.2	12.0	2.9	57.0	57.0	57.0	85.1	85.1	85.1	21.0
Proposed	A	A	A	A	B	A	D	D	D	F	F	F	C
	5.0	5.6	5.6	5.3	18.5	3.6	53.7	53.7	53.7	84.8	84.8	84.8	22.9
(7) Elm Street and 5th Street*													
Existing	C			C			A			A			N/A
	15.5			20.2			1.2			0.0			
Proposed	C			D			A			A			N/A
	18.3			26.3			1.5			0.0			

*Unsignalized Intersection
#Roundabout

Figure 15: PM Peak Hour Level of Service Comparison

ANALYSIS PERIOD	LEVEL OF SERVICE (DELAY IN SECONDS PER VEHICLE) BY APPROACH AND MOVEMENT												INTERSECTION
	EASTBOUND			WESTBOUND			NORTHBOUND			SOUTHBOUND			
	LEFT	THRU	RIGHT	LEFT	THRU	RIGHT	LEFT	THRU	RIGHT	LEFT	THRU	RIGHT	
(1) Frisco Square Boulevard and 1st Street*													
Existing	A			A			B			B			N/A
	0.1			0.9			14.4			12.8			
Proposed	A			A			C			C			N/A
	0.0			0.9			16.8			15.3			
(2) Main Street and 2nd Street*													
Existing	D			F			A			A			N/A
	28.9			64.6			1.5			0.4			
Proposed #	F	F	E	B	A	A	-	-	-	B	A	A	D
	70.8	76.4	60.7	10.8	9.0	8.8	-	-	-	12.1	9.2	9.3	34.0
(3) Main Street and 4th Street*													
Existing	A			A			E			D			N/A
	0.2			0.2			40.2			31.3			
Proposed	A			A			F			E			N/A
	0.2			0.2			76.7			46.8			
(4) Main Street and 5th Street													
Existing	A	B	B	A	A	A	E	C	C	D	E	E	C
	2.5	15.1	15.1	3.1	3.7	3.7	77.3	27.6	27.6	54.5	73.2	73.2	20.0
Proposed	A	D	A	B	A	A	F	C	C	E	E	E	C
	6.5	35.3	1.0	16.9	4.7	4.7	86.7	30.9	30.9	55.2	76.7	76.7	29.8
(5) Main Street and 7th Street*													
Existing	A			A			E			F			N/A
	0.2			0.3			40.4			53.7			
Proposed	A			A			F			F			N/A
	0.2			0.2			96.2			108.0			
(6) Main Street and County Road													
Existing	A	A	A	A	C	A	E	E	E	F	F	F	C
	3.6	3.9	3.9	4.2	23.0	2.5	56.7	56.7	56.7	103.6	103.6	103.6	21.6
Proposed	A	A	A	A	C	A	D	D	D	F	F	F	C
	5.2	5.0	5.0	4.9	32.0	3.4	54.6	54.6	54.6	103.2	103.2	103.2	25.1
(7) Elm Street and 5th Street*													
Existing	B			B			A			A			N/A
	12.2			14.1			0.4			0.2			
Proposed	B			C			A			A			N/A
	13.4			15.6			0.4			0.3			

*Unsignalized Intersection
#Roundabout



MAIN STREET AND FRISCO SQUARE BOULEVARD ROUNDBOUT

Scenario 1 Base Scenario includes converting Main Street and Frisco Square Boulevard to a single-lane roundabout. In addition, Frisco Square Boulevard was modeled as one-way westbound between the proposed roundabout and 1st Street. To understand how a roundabout would function in this location a VISSIM model was developed for both AM and PM peak hours. As can be seen in Figure 14 and Figure 15, both AM and PM peak hours operate at an acceptable level of service. Queue length at the roundabout is especially critical due to the railroad the west. Maximum queue lengths are about 300 feet in both directions along Main Street. This is acceptable.

Main Street and 5th Street

Main Street and 5th Street is a key intersection in downtown Frisco. It connects Main Street, downtown's east-west connection, with 5th Street, a vital connection to the south. Turning movement volumes between Main Street and 5th Street south are fairly high and were specifically analyzed to determine if an eastbound right-turn lane would be necessary. From Synchro analysis, a right-turn lane is not operationally necessary, but from a safety and efficiency standpoint it is recommended. Due to the high amount of pedestrian expected along Main Street in the future, right-turning vehicles will most likely have to wait to turn. A stopped vehicle in the through lane may increase rear-end crashes while also reduce the capacity. Figure 16 details the recommended right-turn lane length in the AM and PM peak hours.

Under the Base Scenario, Main Street and 5th Street will have an acceptable Level of Service for both AM and PM peak hours, Figure

14 and Figure 15. No additional improvements are recommended at this time.

Elm Street and 5th Street

Due to the conversion of Frisco Square Boulevard east of 1st Street to a one-way westbound, a larger volume of vehicles traveling eastbound on Frisco Square Boulevard will turn right and utilize Elm Street to continue east. To accommodate this increased volume, the intersections along Elm Street will remain two-way stop-controlled (TWSC), but with Elm Street as the through street. The only exception to this will be Elm Street and 5th Street where 5th Street will be the through street. Elm Street and 5th Street was analyzed to ensure that a TWSC will still function properly into the future. Figure 14 and Figure 15 details the results of analysis of Elm Street and 5th Street after the new street configurations are in place.

Main Street and County Road

Main Street and County Road was specifically analyzed due to the minimal right-of-way on County Road and increased traffic due to the conversion of Frisco Square Boulevard to a one-way. Under the Base Scenario, Main Street and County Road will have an acceptable Level of Service for both AM and PM peak hours, Figure 14 and Figure 15. No additional improvements are recommended at this time.

Figure 16: Main Street & 5th Street Right-Turn Storage Lengths

	RIGHT-TURN STORAGE LENGTH (FT)
AM Peak	75
PM Peak	20
Recommended	100