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CREATIVE TECHNICAL SOLUTIONS

TECHNICAL MEMORANDUM

Date:	July 5, 2018
To:	Jim Webb, AICP; Robert McHaney, AICP; Monisha Khurana, AICP
From:	Roma Stevens, P.E., PTOE
Subject:	Operational Analysis for Improvements along Foster Drive

Project Description

This technical memorandum documents the operational impacts of converting Foster Drive from a 2-lane facility to 4-lane facility between SH 75 at the west end to FM 1314 (Conroe Porter Rd) at the east end. Figure 1 shows the project corridor and study area limits.

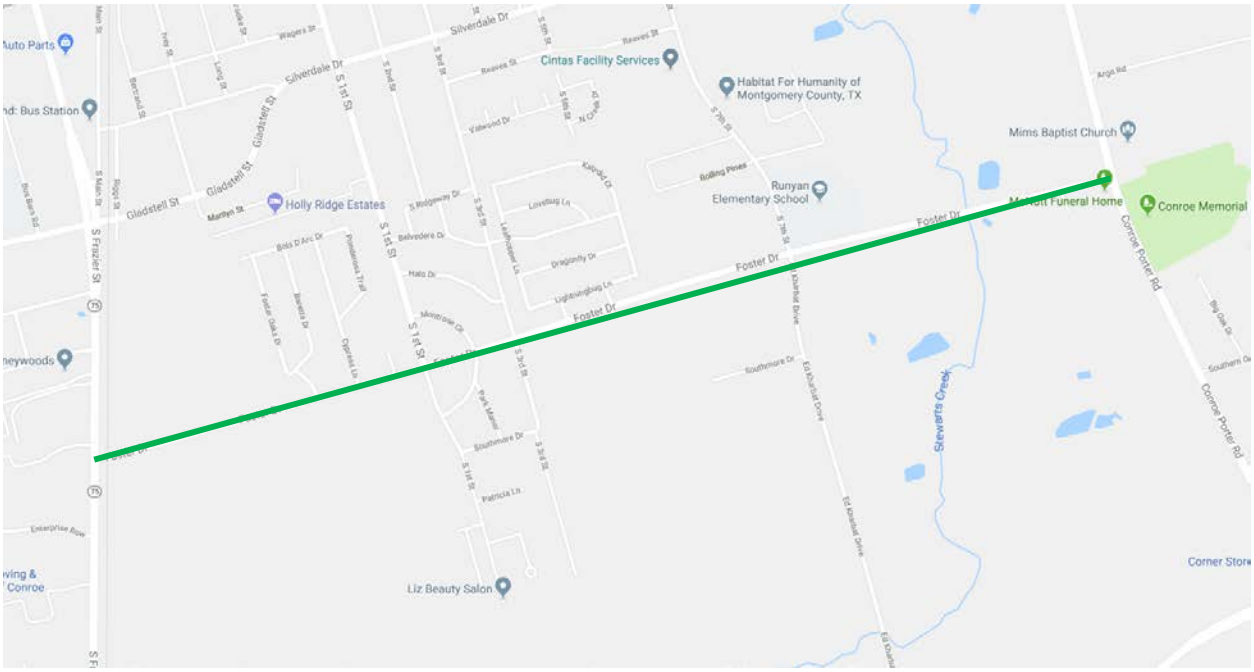

Figure 1. Project Area Showing Limits of Study Segment

Existing Conditions: In the existing condition, Foster Drive is a two-lane, two-way segment for the entire study segment. Land use along the corridor is mostly residential. In addition to multiple driveways along the segment, Foster drive intersects with 5 cross streets and serves as a minor arterial. In its current configuration – intersection of Foster Drive with FM 1314 is signalized while intersection of Foster Drive with Ed Kharbat Dr, with S 1st street, and with S 3rd street is All-way

stop controlled. Finally, the intersection of SH 75 with Foster Drive is stop controlled along Foster Drive.

Proposed Conditions: For the Proposed conditions, intersection of Foster Drive with SH 75 will be signalized, and Foster Drive will be widened to a four lane segment for the entire study segment.

Traffic Data Collection

Traffic volumes data in the form of turning movement counts for this study area were collected for a typical weekday in late February 2017.
Turning movement counts for signalized intersections in the study network were collected from 6:00 am to 7:00 pm for a typical weekday.

Analysis Methodology and Results

To evaluate the operational impacts of proposed geometric configuration, we utilized traffic analysis software Synchro 10.1.
The analysis was completed for the Existing Condition (2017), No Build Condition (year 2025), Build Condition (Year 2025), No Build Condition (year 2040), and Build Condition (Year 2040) for the AM and PM peak hour. For the Future years (2025 and 2040) analysis, a growth rate of 5.2% and 2.4% per annum respectively were used to estimate traffic volumes in the study area.
Analysis results are presented in Table 1 thru 2 for the Intersection Delay and LOS for the AM and PM peak hours. Table 3 shows network delay and emissions results for AM and PM peak hours. Using analysis results for the AM and PM peak hours, daily delay was calculated proportionally using hourly volumes collected in the field along Foster Dr in the study area. Daily delay was calculated for hours of 6 am to 7 pm, since traffic volumes at other times of the day are not that significant as such delay savings realized from using proposed roadway cross-section will be insignificant for these hours. The daily values for network delay and emissions results are shown in Table 4.
Table 1 and 2 present delay/vehicle (seconds) at each intersection in the study area for AM and PM peak respectively.

Table 1. Intersection Delay (seconds/vehicle) for AM Peak Hour (7:15 to 8:15 am)

Intersection	Existing (2017)		No Build (2025)		Build (2025)		No Build (2040)		Build (2040)	
	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
Foster Dr at SH 75	5.8	A	34.7	D	11.8	B	141.4	F	12.5	B
Foster Dr at S 1st St	6.9	A	7.7	A	6.9	A	12.2	B	7.0	A
Foster Dr at S 3rd St	7.0	A	7.7	A	6.8	A	8.0	A	6.9	A
Foster Dr at Ed Kharbat Dr	6.0	A	6.9	A	5.7	A	7.6	A	6.0	A
Foster Dr at FM 1314	4.7	A	6.9	A	6.2	A	8.9	A	7.3	A

Table 2. Intersection Delay (seconds/vehicle) for PM Peak Hour (4:15 to 5:15 pm)

Intersection	Existing (2017)		No Build (2025)		Build (2025)		No Build (2040)		Build (2040)	
	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
Foster Dr at SH 75	4.0	A	24.2	C	11.5	B	70.2	F	14.0	B
Foster Dr at S 1st St	7.1	A	7.9	A	6.7	A	8.5	A	6.9	A
Foster Dr at S 3rd St	6.5	A	6.9	A	6.4	A	7.5	A	6.6	A
Foster Dr at Ed Kharbat Dr	5.1	A	5.3	A	5.0	A	5.5	A	5.2	A
Foster Dr at FM 1314	4.2	A	5.9	A	5.3	A	6.4	A	6.5	A

Table 3 presents the measures of effectiveness for the entire study network for the AM and PM peak hours while Table 3 presents the estimated daily measures of effectiveness for the entire study network.

Table 3. Network Measures of Effectiveness for AM and PM Peak Hour

MOE	Existing (2017)		No Build (2025)		Build (2025)		No Build (2040)		Build (2040)	
	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
Delay (Veh-hrs)	6.6	4.9	22.4	17.5	12.7	11.6	77.9	45.6	15.1	15.2
Fuel Used (Gallons)	43.7	37.3	63.0	53.8	63.9	55.0	81.3	65.4	70.9	63.0
VOC Emissions (Kg)	1.1	0.9	1.6	1.3	1.6	1.4	2	1.6	1.8	1.6
NOx Emissions (Kg)	0.7	0.6	1.1	0.9	1.1	0.9	1.4	1.1	1.2	1.1
CO Emissions (kg)	9.9	8.5	14.3	12.2	14.5	12.5	18.4	14.8	16.1	14.3

Table 4. Network Measures of Effectiveness for a Typical Weekday*

MOE	Existing (2017)	No Build (2025)	Build (2025)	No Build (2040)	Build (2040)
Total Delay (Veh-Hours)	53.6	186.9	115.5	560.8	145.7
Fuel Used (Gallons)	382.9	552	562.5	688.9	635.5
VOC Emissions (Kg)	9.5	13.8	14	17.2	15.8
NOx Emissions (Kg)	6.4	9.2	9.4	11.5	10.6
CO Emissions (kg)	86.8	125.1	127.4	156.1	144

*calculated proportionally using AM and PM Peak Hour Analysis Results for Other Hours of the Day between 6 am and 7 pm.

Results Discussion

The operational analysis to assess the impacts of converting Foster Dr from a 2-lane segment to a 4-lane segment from SH 75 to FM 1314 shows a decrease in total network delay of approximately 10 vehicle-hours during the AM peak and 6 vehicle-hours during the PM peak for the 2025 build year. The total network delay for a typical weekday decreased by 63 vehicle-hours during the AM peak hour of the 2040 build year and by 30 vehicle-hours for the PM peak hour of the 2040 build year. In addition to delay savings, motorists will experience significant fuel and emissions benefits from the improved operations in this corridor.

It should be noted here that signalizing the intersection of SH 75 with Foster Drive results in majority of the benefits, however widening of the roadway from 2 lane to 4 lanes will allow for future development along the corridor and improved qualitative level of service for vehicles turning in and out of driveways and cross streets.