



Memorandum

DATE: December 10, 2013

TO: Honorable Mayor and City Council
City Manager Glasscock

FROM: Gerald P. Cosgrove, P.E., Director of Public Works
Jack E. Carr, P.E., Director of Engineering

SUBJECT: Median Left Turn Update

A median left turn was constructed at Preston Road and Legacy Drive and was opened to traffic on July 27, 2010.

The median left constructed at Legacy Drive and Preston Road requires eastbound and westbound motorists on Legacy Drive that desire to turn left onto Preston Road to turn right and then make a u-turn onto Preston Road. This is not an intuitive movement and many motorists find themselves on the wrong side of the Legacy Drive as they approach the intersection. Motorists have not accepted the median left and have requested the intersection be changed back to a traditional intersection.

Our consultant has prepared plans and TxDOT has approved them to return the intersection to its pre –July 2010 operation.

A computer simulation study was completed by Parsons to compare the current intersection operation (median left) to a traditional operation (allowing left turns within the intersection).

- The study analyzed the level of service, average delay, and average queue length.
- Table 1 includes the results of the study for the current operation (with the median left) and shows a reasonable amount of delay and reasonable queue lengths, resulting in an acceptable Level of Service. The traffic volumes are based on current volumes where the left turns from Legacy to Preston have decreased significantly.
- Table 2 includes the results of the study for the proposed operation (allowing left turns within the intersection) and shows the amount of delay and the lengths of the queues will increase significantly and the Level of Service will reduce. These traffic volumes are based on pre –July 2010 volumes where the left turns from Legacy to Preston were significantly more than they are today.

- The study indicates restoring traditional left turn movements will have a negative effect on the capacity of the intersection and will be noticeable to the motorists, as follows:
 - Longer delays will be experienced for all movements. The greatest increase in delay will be for the southbound traffic during the morning peak hour, which will increase from 14.6 seconds to 79.2 seconds and the average queue length will increase from 46 feet to 1266 feet. The computer simulation indicates southbound motorists during the morning peak hour will need to wait through multiple cycles of the signal to pass through the intersection.
 - Longer delays for motorists that are turning from southbound to eastbound (due to the number of cars stacked in the eastbound through lanes).
 - Longer delays for motorists turning from westbound to southbound, resulting in longer queues for the eastbound through movement – to the point that the eastbound to southbound vehicles will not be able to enter the right-turn lane.

- Table 3 includes the results of the study for the proposed operation (allowing left turns within the intersection) and shows the amount of delay and the lengths of the queues will increase significantly and the Level of Service will reduce. These traffic volumes are based on current volumes and the turning volumes would be based on pre –July 2010 conditions.
 - Overall delays were similar to Table 2.

The comparison between Table 1 and Tables 2 & 3 are somewhat misleading. Staff expects the delays for Table 1 to be less because Table 1 handles less volume, especially the critical turning movements. The conditions as outlined in Tables 2 & 3 may never occur because many motorist have found alternate routes, and if the delays are as great as predicted, those motorists will likely continue to use their alternate route.

Recommendation:

- Because most motorists have not accepted the median left intersection configuration, staff recommends the removal of the median left.
- Staff should continue with its publicity and construction program to accomplish the removal of the Median Left Turn Project at Preston Road and Legacy Drive.

TECHNICAL MEMORANDUM

To: Lloyd Neal, P.E., City of Plano
James Caswell, P.E., City of Plano

From: Boro Dedeitch, P.E., Parsons

Date: October 17, 2013 (**Updated November 25, 2013**)

RE: Preston Road and Legacy Drive Left Turn Modifications

The recent decision by the City of Plano to restore left turn lanes along Legacy Drive at the Preston Road intersection will have a significant impact to drivers utilizing this intersection. In fact, the average delays to drivers particularly southbound along Preston Road will increase almost fivefold versus the existing conditions. There will also be longer delays to drivers attempting to make a southbound left turn onto Legacy Drive from Preston due to the number of cars stacked up in the through lanes. The eastbound through movement on Legacy Drive will also experience a large increase in cars waiting for the westbound left turns to make their movement. This will in turn create delays for the eastbound right turn movement from Legacy onto Preston since these right turning vehicles cannot get to this turn lane readily if the through lanes are stacked with waiting cars.

All of these impacts are noted in the recent engineering analysis which has been performed to determine the effects that the modification of this intersection -- from the current use of U-turn lanes to the full restoration of east/west left turn lanes -- will have on the traveling public. The analysis consisted of testing all scenarios utilizing the most optimal signal timing at the intersection.

First, the current operations of the intersection with no east-west left turns were analyzed utilizing the latest Synchro software. The existing timings were provided by the City of Plano to Parsons. Traffic counts were undertaken in September 2013 to obtain the current traffic volumes using this intersection. The level of service, seconds of average delay, and average queue lengths are displayed in **Table 1**.

As evident from **Table 1**, the overall intersection operates satisfactorily including each of the approaches with existing traffic volumes. Likewise, the queues are also manageable during the peak periods.

Table 1 – Existing Conditions with No East/West Left Turns

Intersection	Approach	Average Delay (sec/veh) AM (PM)	Queue Length (ft) AM (PM)	Approach LOS AM (PM)	Overall Delay (sec/veh) AM (PM)	Overall LOS AM (PM)
SB Preston at Legacy Drive	SB Left	1.6 (23.1)	~ (339)	A (C)	18.2 (26.0)	B (C)
	EB Through	32.5 (41.8)	100 (481)	C (D)		
	WB Through	22.7 (17.3)	372 (67)	C (B)		
	SB Through	14.6 (22.7)	46 (349)	B (C)		
	EB Right	23.3 (0.3)	150 (~)	C (A)		
	SB Right	0.1 (0.0)	~ (~)	A (A)		
NB Preston at Legacy Drive	NB Left	38.2 (18.7)	543 (120)	D (B)	26.4 (22.7)	C (C)
	EB Through	13.4 (17.5)	50 (225)	B (B)		
	WB Through	41.5 (32.8)	466 (135)	D (C)		
	NB Through	12.1 (28.4)	510 (592)	B (C)		
	WB Right	36.6 (0.1)	366 (~)	D (A)		
	NB Right	2.5 (15.9)	40 (157)	A (B)		

“~” indicates minimal queues were calculated for these movements. The U-turn lanes just to the north and south of the intersection are not included in the table. However, the volumes utilizing these U-turns were quite low during the peak periods.

The next step in the analysis process was to incorporate the east/west left turns along Legacy Drive to allow full movements at both the northbound and southbound Preston Road intersections. These movements had been permitted prior to the U-turn lanes construction in 2010, so the initial Synchro input values utilized the older signal timing values as provided by the City of Plano. Assumptions were also made to establish the left turn volumes that would now return to utilize these permitted movements. Since the actual U-turn volumes as counted during September 2013 were quite low, it was more appropriate to utilize the pre-2010 percentage split of left turn volumes as a better (more conservative) surrogate for these movements. Once again, Synchro software was utilized to analyze the two intersections – this time with the left turns restored. The results are summarized in **Table 2**.

Table 2 – Future Conditions with East/West Left Turns Included

Intersection	Approach	Average Delay (sec/veh) AM (PM)	Queue Length (ft) AM (PM)	Approach LOS AM (PM)	Overall Delay (sec/veh) AM (PM)	Overall LOS AM (PM)
SB Preston at Legacy Drive	WB Left	22.4 (62.2)	319 (204)	C (E)	51.6 (32.2)	D (C)
	SB Left	25.6 (34.0)	90 (416)	C (C)		
	EB Through	59.4 (36.6)	108 (397)	E (D)		
	WB Through	20.7 (10.5)	206 (54)	C (B)		
	SB Through	79.2 (33.4)	1266 (428)	E (C)		
	EB Right	37.1 (29.5)	178 (336)	D (C)		
	SB Right	3.0 (0.1)	28 (~)	A (A)		
NB Preston at Legacy Drive	EB Left	22.2 (15.1)	20 (53)	C (B)	29.9 (24.5)	C (C)
	NB Left	33.5 (21.9)	467 (131)	C (C)		
	EB Through	14.5 (14.4)	50 (631)	B (B)		
	WB Through	38.2 (36.6)	343 (172)	D (D)		
	NB Through	27.2 (32.5)	438 (645)	C (C)		
	WB Right	31.1 (18.0)	323 (120)	C (B)		
	NB Right	7.6 (13.6)	57 (134)	A (B)		

“~” indicates minimal queues were calculated for these movements.



A comparison between **Tables 1** and **2** clearly shows that including the left turn movements will increase the seconds of delay experienced by many drivers, which will lead to degradation of the level of service. This is most notable during the morning peak hour for the southbound through movement, where the average delay experienced by each driver will increase from 14.6 seconds to 79.2 seconds (a 442% increase). Likewise, the average queues will become much longer for this movement (jumping from 46 feet to 1,266 feet), since this traffic will now have to wait for the processing of the added westbound left turn phase. The eastbound right turn and westbound right turn movements will also experience delays during the afternoon peak period that will be noticeable compared to current conditions. Although, both intersections theoretically will still operate with acceptable levels of service, the increased delays at the southbound Preston intersection with Legacy, with its drop from LOS B to LOS D, will certainly be noticed by morning commuters.

Following discussions with the City of Plano staff, a third analysis was performed which assumed all through movements and right turn movements at the intersection would match the September 2013 traffic counts, while the new left turn movements would match the volumes recorded in 2010 prior to the construction of the special U-turn lanes. This can be considered as a “worst case” scenario. **Table 3** summarizes these results. The table shows little change from **Table 2** indicating the same conclusions as stated in the previous paragraph.

Table 3 – Additional Scenario Future Conditions with East/West Left Turns Included

Intersection	Approach	Average Delay (sec/veh) AM (PM)	Queue Length (ft) AM (PM)	Approach LOS AM (PM)	Overall Delay (sec/veh) AM (PM)	Overall LOS AM (PM)
SB Preston at Legacy Drive	WB Left	15.8 (42.0)	563 (258)	B (D)	49.7 (30.7)	D (C)
	SB Left	25.6 (34.0)	90 (416)	C (C)		
	EB Through	59.7 (36.6)	115 (397)	E (D)		
	WB Through	16.5 (8.0)	197 (50)	B (A)		
	SB Through	79.2 (33.4)	1266 (428)	E (C)		
	EB Right	37.1 (29.5)	178 (336)	D (C)		
	SB Right	3.0 (0.1)	28 (~)	A (A)		
NB Preston at Legacy Drive	EB Left	21.5 (16.6)	~ (58)	C (B)	31.5 (24.8)	C (C)
	NB Left	31.7 (21.9)	467 (131)	C (C)		
	EB Through	12.7 (14.4)	42 (631)	B (B)		
	WB Through	40.9 (37.1)	466 (190)	D (D)		
	NB Through	27.6 (32.5)	438 (645)	C (C)		
	WB Right	30.8 (18.0)	323 (120)	C (B)		
	NB Right	7.6 (13.6)	57 (134)	A (B)		

“~” indicates minimal queues were calculated for these movements.

For both **Table 2** and **Table 3**, the same cycle length of 160 seconds during the AM peak, and 150 seconds during the PM peak were utilized. The east-west movement provides for 19 seconds of combined movements (AM peak) plus an additional 27 seconds of protected westbound left turn movement during this time period. A total of 76 seconds of time is provided for the northbound/southbound Preston Road movement during the morning peak period. During the afternoon peak period, the Preston Road movement is reduced to 67 seconds, while the east-west movement along Legacy is increased to 42 seconds with an additional 20 seconds provided to accommodate the eastbound left turn movement.



Again, as mentioned at the beginning of this memorandum, these are optimized traffic signal timings that will support as efficiently as possible the traffic volumes entering this intersection. It is also important to note that the Preston/Legacy intersection is coordinated along Preston Road with the upstream and downstream intersections of Hedgcoxe Road and Tennyson Parkway, respectively. Once the left turn phases are implemented at Legacy Road, the City should re-examine the coordination scheme to confirm that no adjustments are necessary at these other two intersections.

To summarize, the previously utilized signal timings (pre-2010) for the Legacy Drive east-west movements can once again be incorporated into the overall signal phasing cycle at the Preston/Legacy intersection. Although levels of service remain acceptable overall, there will be significant impacts during the morning peak period, and especially for the southbound through movement once these left turns are implemented. To possibly slightly improve the operations of the traffic signals, the City should carefully monitor the actual traffic movements after the reinstallation of the left turn phases, and make small field adjustments within the signal controller.



Median Left Turn Preston Road at Legacy Drive

Legacy Drive @ Preston Road



History

- Opened July 27, 2010
- Public has not accepted design
- Lower accident rate
- Lower number of left turns
- Now working with TxDOT to remove MLT



Changes required to remove MLT

Remove Overhead Sign & Guardrail on Legacy



Modify or Remove Signs on Legacy



Remove No Left Turn Signs on Legacy



Modify Pavement Markings to add left turns on Legacy



Modify Traffic Signal to add left turn signal heads on Legacy



Leave or Remove Signs on Preston



Remove MLT Signals on Preston





Questions