

Date: March 9th, 2015
 To: University Heights City Council
 From: Darian Nagle-Gamm; Traffic Engineering Planner
 Re: One University Place - Updated Traffic Analysis

Background

This analysis is an update to the technical memorandum performed by MPOJC (dated May 19th, 2014) and submitted to the University Heights City Council. This update uses the most recent data available with respect to the residential and commercial components of the proposed development and provides a review of traffic operations at both the Melrose/Sunset and Melrose/Main Entrance intersections as they relate to the One University Place development (**Figure 1**).

The following assumptions are used for the analysis:

- 104 residential units with 14,600 sq. feet of commercial space are proposed and are allocated accordingly: convenience market (20%), fitness center (20%), high-turnover sit down restaurant (10%), specialty retail (40%), and community space (10%). The community space was not included in the vehicle trip generation figures as it was assumed trips to/from this space would occur during *off-peak* hours which is outside the scope of this study.
- The main entrance to the development includes both left and right turn lanes for exiting traffic and one lane for entering traffic
- The driveway north of Melrose on Sunset Street (shown in Figure 2) is for exiting traffic only; and the realignment of Sunset Street improves intersection operations by allowing for improved traffic signal operations
- 100% of *entering* traffic uses the Main Entrance – 50% from the east, 10% from the south, and 40% from the west
- 80% of the *exiting* traffic uses the Main Entrance – 50% to the east, 10% to the south, and 40% to the west
- 20% of the *exiting* traffic uses the Sunset exit only drive – 50% to the east, 10% to the south, and 40% to the west



Figure 1 - Development Site



Figure 2 – Proposed Site Plan

Table 1 shows the estimated traffic generated by the proposed development. Projected trips to and from the development were calculated using the Institute of Traffic Engineers (ITE) Trip Generation manual 7th Edition.

Table 1 – Estimated Trip Generation

Land Use (ITE Code)	Time of Day	Est'd Leasable Area (1000 sf)	Dwelling Units	Average Rate	Total Trips	Entering Trips	Exiting Trips
Residential Condominium / Townhouse (230)	AM Peak Hour (17% in / 83% out)		104	0.44	46	8	38
	PM Peak Hour (67% in / 33% out)		104	0.52	54	36	18
	Average Daily Traffic (50% in / 50% out)		104	5.86	609	305	305
Convenience Market (852)	AM Peak Hour (50% in / 50% out)	2.92		31.02	91	45	45
	PM Peak Hour (49% in / 51% out)	2.92		34.57	101	49	51
	Average Daily Traffic (50% in / 50% out)	2.92		*	--	--	--
Fitness Center (492)	AM Peak Hour (42% in / 58% out)	2.92		1.21	4	1	2
	PM Peak Hour (51% in / 49% out)	2.92		4.05	12	6	6
	Average Daily Traffic (50% in / 50% out)	2.92		*	--	--	--
High Turnover Sit-Down Restaurant (932)	AM Peak Hour (52% in / 48% out)	1.46		11.52	17	9	8
	PM Peak Hour (61% in / 39% out)	1.46		10.92	16	10	6
	Average Daily Traffic (50% in / 50% out)	1.46		127.51	186	93	93
Specialty Retail (814)	AM Peak Hour (44% in / 56% out)	5.84		1.55	9	4	5
	PM Peak Hour (44% in / 56% out)	5.84		1.49	9	4	5
	Average Daily Traffic (50% in / 50% out)	5.84		11.01	64	32	32
Total AM Peak Hour					166	67	98
Total PM Peak Hour					191	105	86

*Data not available

Eastbound Left-Turn Lane Warrant Analyses

To complete the eastbound left-turn lane warrant analyses at the intersections adjacent to the proposed development, the estimated development trip generation figures from **Table 1** were added to the existing peak hour traffic data collected in February 2014. **Figures 3 and 4** indicate that a dedicated eastbound left-turn lane is not warranted at the intersection of Melrose Avenue and Sunset Street during peak hours.

Melrose Avenue / Sunset Street

Figure 3: AM Peak Hour Left-Turn Lane Warrant Not Warranted (L= % of Left-Turns in Advancing Volume)

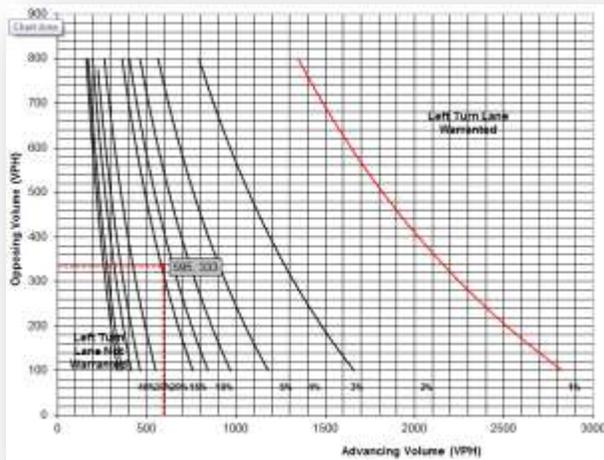
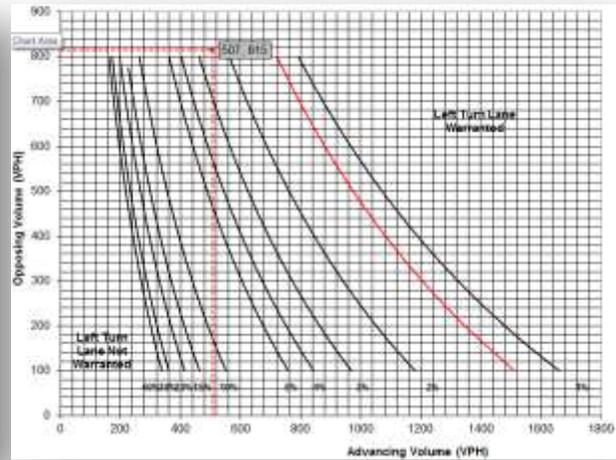


Figure 4: PM Peak Hour Left-Turn Lane Warrant Not Warranted



Melrose Avenue / Main Entrance

Figures 5 and 6 show that an eastbound dedicated left-turn lane is warranted at the Main Entrance during both peak hours. The left-turn lane is warranted during the PM peak period even with a 50% reduction in estimated left-turning residential traffic (accounting for 2006-2010 American Community Survey information shows that 43% of University Heights residents used modes other than private vehicles to get to work).

Figure 5: AM Peak Hour Left-Turn Lane Warrant Warranted

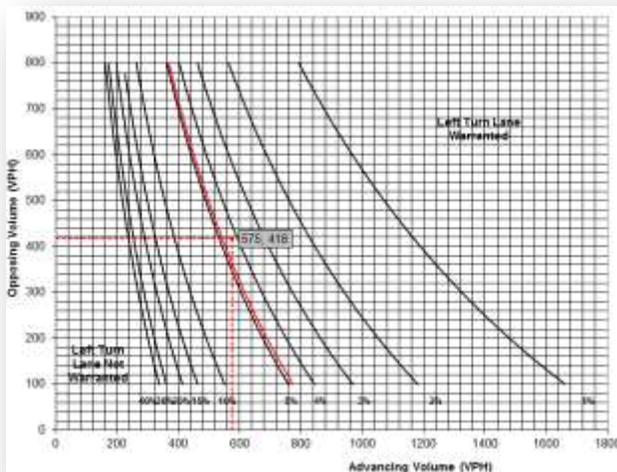
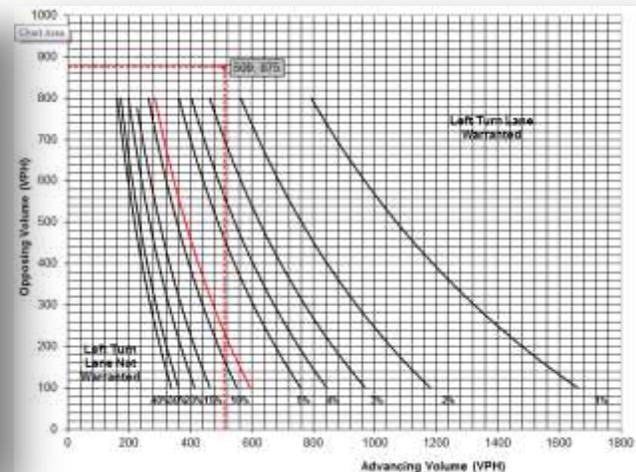


Figure 6: PM Peak Hour Left-Turn Lane Warrant Warranted



Intersection Capacity Analyses

To determine how the development would impact traffic delay at the intersections adjacent to the proposed development, a level-of-service (LOS) analysis was performed by applying the estimated trip generation figures from **Table 1** to the existing peak hour traffic data and modeled using Synchro 9.0 software.

Melrose Avenue / Sunset Street Intersection

Delay and LOS are calculated using the same methodology as unsignalized intersections, but the delay parameters are a little longer. Longer delays are acceptable at signalized intersections because the driver has a longer delay expectancy than at unsignalized intersections. **Table 2** (Synchro Exhibit 16-2) exhibits the LOS with its control delay ranges at signalized intersections. A LOS of A represents the best operating conditions (free-flow movement) and LOS F represents the worst conditions, i.e. extreme congestion and stop-and-go conditions.

Table 2 - Level of Service Criteria for Signalized Intersections

Level of Service	Average Control Delay (s/veh)
A	< 10
B	> 10 - 20
C	> 20 - 35
D	> 35 - 55
E	> 55 - 80
F	> 80

Figure 7 shows the level-of-service (LOS) results of both existing and proposed conditions at the Melrose/Sunset intersection. Under existing conditions, the eastbound through/left movement operates at a LOS F and the southbound through and northbound left-turning movement operates at a LOS E during the PM peak hour – all other movements in the AM and PM peak hours operate at an acceptable level of service of D or better.

Figure 7 – Melrose / Sunset Intersection Operations

Direction	Existing Conditions (with split-phase)				Proposed Conditions without EB Left-Turn Lane (split-phase removed – add development traffic)			
	Control Delay (s/veh)		LOS		Control Delay (s/veh)		LOS	
	AM	PM	AM	PM	AM	PM	AM	PM
Melrose Avenue								
Eastbound	14.5	86.3	B	F	18.6	17.6	B	B
- Through/Left	14.6	125.1	B	F	19.4	19.1	B	B
- Right	14.1	17.0	B	B	10.6	14.7	B	B
Westbound	11.1	34.9	B	C	8.8	21.9	A	C
- Through/Right	11.4	39.5	B	D	8.8	24.2	A	C
- Left	9.7	12.2	A	B	8.5	9.6	A	A
Sunset Street								
Northbound	41.6	50.9	D	D	33.3	48.3	C	D
- Through/Right	39.6	28.2	D	C	29.4	26.2	C	C
- Left	44.4	60.3	D	E	38.3	57.0	D	E
Southbound	48.5	80.0	D	E	28.9	26.1	C	C
Intersection	20.1	54.0	C	D	19.4	24.8	B	C

When comparing existing to proposed conditions, the intersection improves from LOS C to LOS B during the AM peak hour and LOS D to LOS C during the PM peak hour. LOS for all movements improves to a LOS D or better except for the northbound left-turn movement at LOS E. The 'proposed condition' scenario shows improvement to the LOS of the intersection (even with the addition of development traffic) primarily as a result of the elimination of the split-signal phasing for the north and southbound movements.

The removal of the split-phase also reduces the eastbound AM peak hour traffic queue from approximately 545' to 400' – the main entrance to the development would be blocked when the queue reaches approximately 400'. The elimination of the split-phase becomes possible due to the realignment of the north leg of Sunset Street and the removal of the skewed geometry currently present.

Melrose Avenue / Main Entrance Intersection

Existing intersection capacity was analyzed using unsignalized intersection capacity analysis methods outlined in the latest edition of the Highway Capacity Manual (HCM) and using Synchro software. By using HCM methods, control delay is calculated as seconds of delay per vehicle and a corresponding level of service (LOS) is also shown. Level of service describes operating conditions based on a number of factors including speed and travel time, freedom to maneuver, traffic interruptions, and comfort & convenience. **Table 3** (Synchro Exhibit 17-2) exhibits the LOS with its control delay ranges at two-way stop-controlled intersections. A LOS A represents the best operating conditions (free-flow movement) and LOS F represents the worst conditions, i.e. extreme congestion and stop-and-go conditions.

Table 3 - Level of Service Criteria for Stop-Controlled Intersections

Level of Service	Average Control Delay (s/veh)
A	0 - 10
B	> 10 - 15
C	> 15 - 25
D	> 25 - 35
E	> 35 - 50
F	> 50

Figure 8 shows the level-of-service (LOS) of both existing and proposed conditions at the Melrose / Main Entrance intersection. Under both conditions, all east and westbound movements experience negligible delay of less than 12 seconds per vehicle. However, southbound left-turning movements experience lengthy delays during the PM peak hour under existing and proposed conditions at a LOS E (39.3 sec/veh) and LOS F (106.7 sec/veh) respectively.

Although the proposed southbound left-turning movements will experience lengthy delays; queuing traffic will be on private property and should not affect mainline movements. The main source of concern when excessive delays are anticipated is that motorists become frustrated and exhibit unsafe driving behaviors which can create safety concerns within the public right-of-way. Staff anticipates that much of this delay will 'self-correct' as motorists choose to exit the development at the Sunset/Melrose intersection – taking advantage of the signalized / controlled environment.

Figure 8 – Melrose / Main Entrance Intersection Operations

Direction	Existing Conditions				Proposed Conditions with EB Left-Turn Lane on Melrose + Development traffic			
	Control Delay (s/veh)		LOS		Control Delay (s/veh)		LOS	
	AM	PM	AM	PM	AM	PM	AM	PM
Melrose Avenue								
Eastbound	0.0	0.0	A	A	0.4	0.9	A	A
- Through	0.0	0.0	A	A	0.0	0.0	A	A
- Left	8.2	10.4	A	B	8.4	11.3	A	B
Westbound	0.0	0.0	A	A	0.0	0.0	A	A
- Through	0.0	0.0	A	A	0.0	0.0	A	A
- Right	0.0	0.0	A	A	0.0	0.0	A	A
Main Entrance								
Southbound	14.9	31.8	B	D	20.9	71.8	C	F
- Left	19.6	39.3	C	E	27.4	106.7	D	F
- Right	10.7	18.0	B	C	11.3	20.6	B	C
Intersection	0.0	0.1	A	A	1.8	3.7	A	A

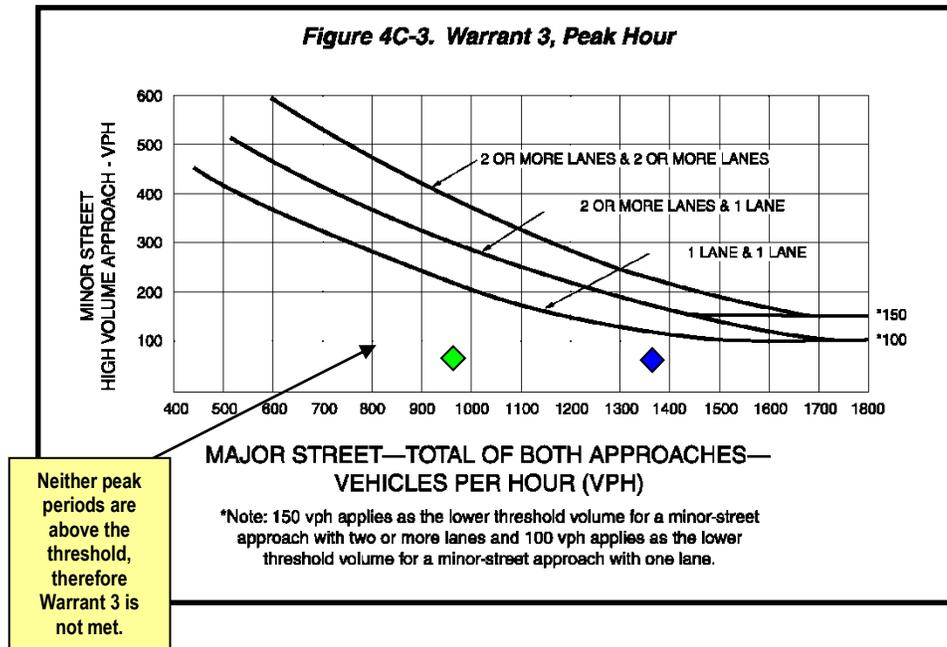
Traffic Signal Evaluation at Melrose Avenue / Main Entrance

To evaluate whether a traffic signal is warranted at the 'main entrance' intersection we utilize peak hour trip generation figures from **Table 1** applied to existing traffic counts and evaluate them against the Manual on Uniform Traffic Control Devices (MUTCD) peak-hour signal Warrant 3. As shown in **Figure 9**, using our current assumptions, a signal is not warranted in either the AM or PM peak hour. For a traffic signal to become warranted there would need to be an additional (approximate) 130 vehicles exiting in the AM peak hour and approximately 35 additional vehicles exiting the development in the PM peak hour. However, if assumptions on commercial uses should change, a signal may become warranted upon 'build-out' of the development – the signal analysis should be updated at that time.

Figure 9 – MUTCD Peak Hour Signal Warrant #3

Warrant 3, Peak Hour Melrose Avenue / Main Entrance							
Main Entrance		Melrose Avenue Entering Traffic		Warranted?		Legend	
AM	PM	AM	PM	AM	PM	AM	PM
79	69	990	1379	No	No	◆	◆

Figure 10 – Peak Hour Signal Warrant & Observed Volumes



Bicycle, Pedestrian and Transit Accommodations

Pedestrian Level-of-Service

While not included in this analysis, staff has begun to perform a pedestrian level-of-service evaluation at the Melrose/Sunset intersection. This analysis will provide information as to the level-of-service that pedestrians can expect to receive upon completion of the proposed improvements at the intersection – including the removal of the split-phase signal phasing as a result of the realignment of the north leg of Sunset Street. Staff will submit this evaluation to the City of University Heights upon completion.

Bicycle Accommodations

It is assumed that the existing wide-sidewalk on the north side of Melrose Avenue will remain – connecting to the existing wide-sidewalk to the east and west of the subject parcel. This wide-sidewalk is a critical piece of infrastructure given the pedestrian/bicycle activity in the area (2006-2010 American Community Survey information shows that 43% of University Heights residents used modes other than private vehicles to get to work).

While it is not currently feasible to add bike lanes to Melrose Avenue west of Sunset Street (the current street width is 28'), consideration should be given to the use of 'shared-lane arrows'. The MPO conducted an analysis of the feasibility of adding on-street bike facilities on Melrose Avenue (east of Sunset Street) through University Heights as part of the MPO FY15 Work Program. If University Heights implements on-street bike facilities east of Sunset Street, consideration should be given to on-street bicycle facilities west of Sunset Street if/when street improvements are made as part of the St. Andrew Presbyterian Church site redevelopment.

Transit

Bus movements/stops are infrequent in nature and do not typically cause measureable delay with respect overall level-of-service. While a bus pull-off is not necessary at this location, it should be viewed as an amenity. A bus pull-off does not appear to be included in the most recent concept plans.

Conclusions

The number of proposed residential units has increased from 78 units to 104 units since the traffic study dated May 19th, 2014, however the commercial space has decreased from 19,000 to 14,600 square feet. On the whole, this has resulted in net decrease in the expected traffic to be generated by the development. This is because commercial square footage tends to generate more trips than residential uses. Ultimately, the change in traffic volumes is relatively minor, therefore the conclusions and recommendations from previous traffic studies completed in 2014 remain the same. Should assumptions change based on type of commercial tenants or number of residential units, this analysis should be revised.

- A dedicated eastbound left-turn lane *is* warranted at the main entrance to the development.
- A dedicated eastbound left-turn lane *is not* warranted at the Sunset/Melrose intersection.
- A traffic signal *is not* warranted during the AM or PM peak hour at the main entrance to the development¹. Staff recommends revisiting this study at full 'build-out' of the development to analyze the need for a traffic signal or other traffic engineering improvements.
- A realignment of the north leg of Sunset Street eliminates the need for the existing split-phase signalization. Even with the additional traffic generated by the development, overall intersection level-of-service is improved – this should be viewed favorably by University Heights.
- At the main entrance, southbound left-turning movements experience lengthy delays under proposed conditions at a LOS F (106.7 sec/veh). Staff anticipates that much of this delay will 'self-correct' as motorists choose to exit the development at the Sunset/Melrose intersection.

¹The addition of approximately 35 more vehicles would satisfy the PM peak hour warrant. The MUTCD has 9 warrants that can be met to indicate the need for a traffic signal; meeting one warrant does not mandate that a signal be installed.