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engineering paths to transportation solutions

May 5, 2016

Mr. Scott Murphy
City of Montrose
433 S. 1st Street
Montrose, CO 81401

Re: Woodgate Road/Townsend Road Intersection Alternatives
FHU Reference No. 116085-01

Dear Mr. Murphy:

This letter summarizes our analysis of the existing traffic patterns at the intersection of Woodgate Road and Townsend Road in Montrose, Colorado. In addition, several alternatives that were selected by the City have been analyzed for the 20-year future, including:

- Right-In/Right-Out at Woodgate Rd/Townsend Rd
- Realigning Woodgate Rd to Oak Grove Rd across from the Walgreens' access
- Realigning Woodgate Rd to Oak Grove Rd approximately 350 feet east of the Walgreens' access

Each of these alternatives was then analyzed with and without a connector street that will run parallel to Townsend Road between Oak Grove Road and Niagara Road.

I. EXISTING TRAFFIC CONDITIONS

Townsend Road is a four-lane state highway (US 550) running north/south through the City of Montrose. Woodgate Road is a two-lane roadway running northwest/southeast that ends when it intersects with Townsend Road at a two-way stop-controlled intersection. The intersection of Townsend Road and Woodgate Road is the focus of this study, but the study area also includes the signalized intersections of Townsend Road with Niagara Road and Oak Grove Road in addition to the roundabout located at the intersection of Ogden Road and Woodgate Road.

Traffic Operations

Morning and evening peak hour traffic volumes were collected in March 2016 at the following intersections:

- Townsend Rd / Niagara Rd
- Townsend Rd / Oak Grove Rd
- Townsend Rd / Woodgate Rd
- Ogden Rd / Woodgate Rd

Figure 1 provides the AM and PM peak hour counts. It should be noted that the south leg of the roundabout at Odgen Road and Woodgate Road was closed at the time that counts were conducted.

Traffic Operations

Traffic operations within the study area were evaluated according to techniques documented in the Highway Capacity Manual, (Transportation Research Board, 2010) using the existing traffic volumes and intersection geometry. Level of Service (LOS) is a qualitative measure of traffic operational conditions, based on intersection capacity and vehicle delay. LOS is described by a letter designation ranging from A to F, with LOS A representing almost free-flow conditions, while LOS F represents congested conditions. For unsignalized intersections, the LOS is calculated for movements which must yield right-of-way to other traffic movements.

As shown in **Figure 1**, the signalized intersections of Townsend Road with Niagara Road and Oak Grove Road both operate at LOS B or better during both peak hours. The yielding turn movements of the unsignalized intersection of Townsend Road and Woodgate Road operate at LOS C or better during both peak hours.

II. FUTURE TRAFFIC FORECASTING

Traffic volumes were forecasted for 2036 within the study area using a combination of forecasted land development and Colorado Department of Transportation (CDOT) state highway projections. The City of Montrose highlighted an area of almost four square miles that would contribute traffic to the study area. The area extended from Niagara Road on the north end to just south of Rio Grande Avenue and from Townsend Road on the west almost to 6800 Road on the east.

The City of Montrose Comprehensive Plan (March 2008) was then used to identify expected land use within the area. Land that is currently vacant was identified and measured to determine the amount of growth that could be expected. **Table 1** identifies the projected development.

Land Use	Acres	Quantity	Units
Residential Low Density	570	2,280	DU
Residential Medium Density	357	2,856	DU
General Commercial	5	76	KSF
Neighborhood Center	7	76	KSF
Central Business	10	152	KSF

Table 1. Projected Land Use

These projections are likely very conservative for a 20-year timeframe and use of the land.

The number of vehicle-trips that will be generated by the study area was forecasted based on trip rates and information documented in Trip Generation (Institute of Transportation Engineers, Ninth Edition, 2011). It was assumed that the residential will all be single family homes and the commercial centers will be evenly split between retail and office.

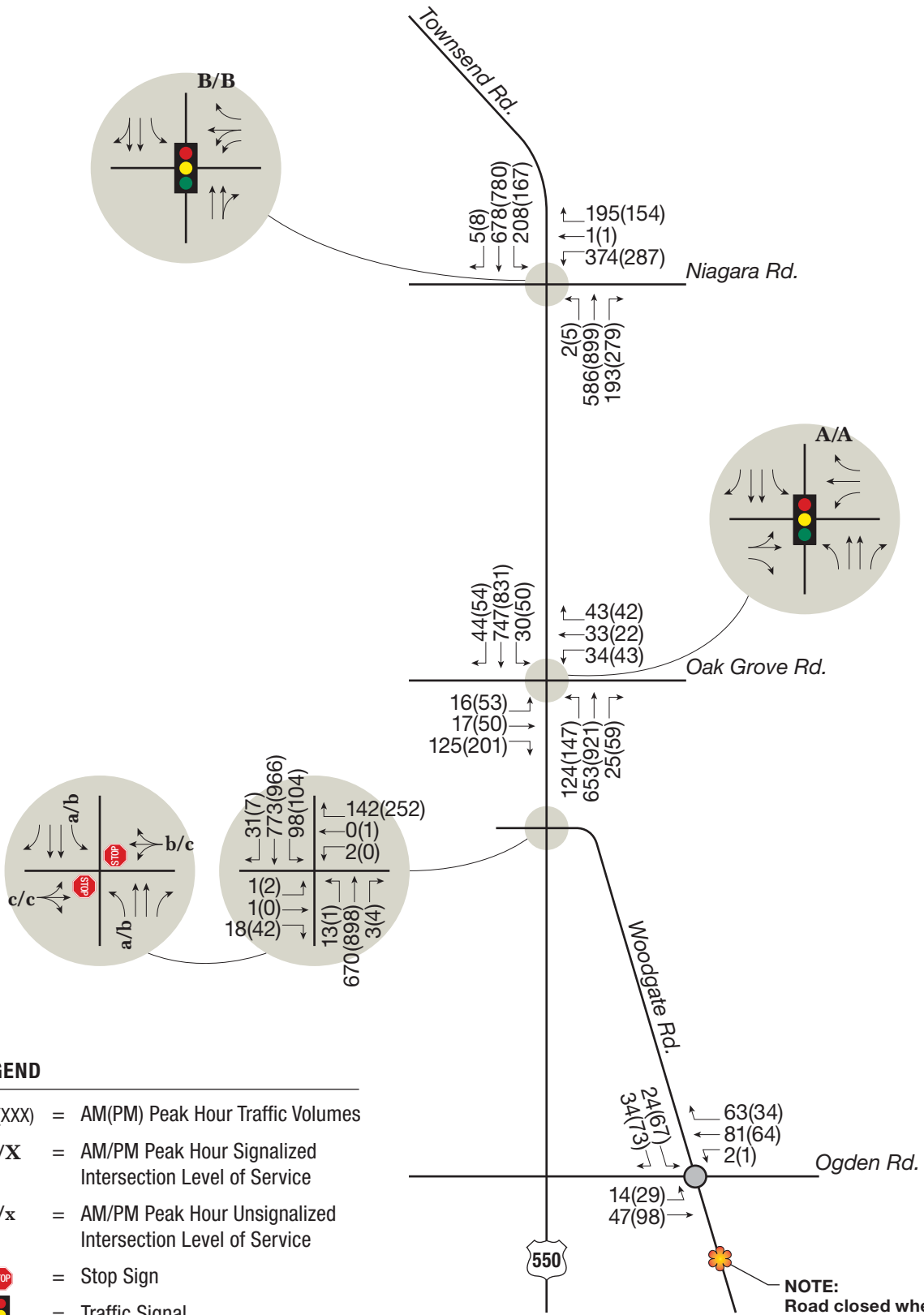


Figure 1
Existing Traffic Conditions



Table 2 provides the trip generation for the study area.

Land Use	Quantity	Units	AM Peak Hour			PM Peak Hour		
			In	Out	Total	In	Out	Total
Single Family Home	5136	DU	963	2,889	3,852	3,236	1,900	5,136
Office	152	KSF	209	28	237	39	188	226
Retail	152	KSF	90	55	146	271	271	564
Subtotal			1,262	2,973	4,235	3,545	2,359	5,926
Internal Trips			383	251	634	579	662	1,273
Total			879	2,722	3,601	2,966	1,697	4,654

Table 2. Peak Hour Trip Generation

As shown in **Table 2**, the entire area is expected to generate approximately 3,600 new AM peak hour trips and 4,650 new PM peak hour trips. This is after the internal trips to the area are removed because of these trips. Internal trips remain within the study area and because it is a large area with both residential and commercial uses, many trips will not travel outside onto the adjacent roadway network.

The new trips to the roadway network were then distributed onto the network based on location and adjacent land use. It was estimated that approximately 50 percent of these trips will end up on Townsend Road and at one of more of the study intersections. In addition, CDOT's 20-year growth rate was applied to Townsend Road to account for an increase in through trips to the roadway not generated by the adjacent land uses.

In the South Townsend Access Plan, the intersection of Townsend Road with Woodgate Road is not a full movement access in the future. **Figure 2** reflects the intersection as it is shown in the Access Plan, as a right-in/right-out with the forecasted 2036 traffic volumes. Because this access change is shown in the Access Plan, it has been assumed that it will occur. Therefore, this is the baseline future scenario against which all the other alternatives will be compared.

As shown in **Figure 2**, the signalized intersection of Townsend Road with Niagara Road is expected to operate at LOS C during the AM peak hour and LOS D during the PM peak hour. The signalized intersection of Townsend Road with Oak Grove Road is expected to operate at LOS B during both peak hours. The unsignalized intersection of Townsend Road with Woodgate Road has the eastbound right turn operating at LOS C during the both peak hours, while the westbound right turn operates at LOS D during the AM peak hour and LOS F during the PM peak hour. During the PM peak hour, the westbound right turn is projected to have a 95th percentile queue length greater than 450 feet, which would interfere with other intersections along Woodgate Road.

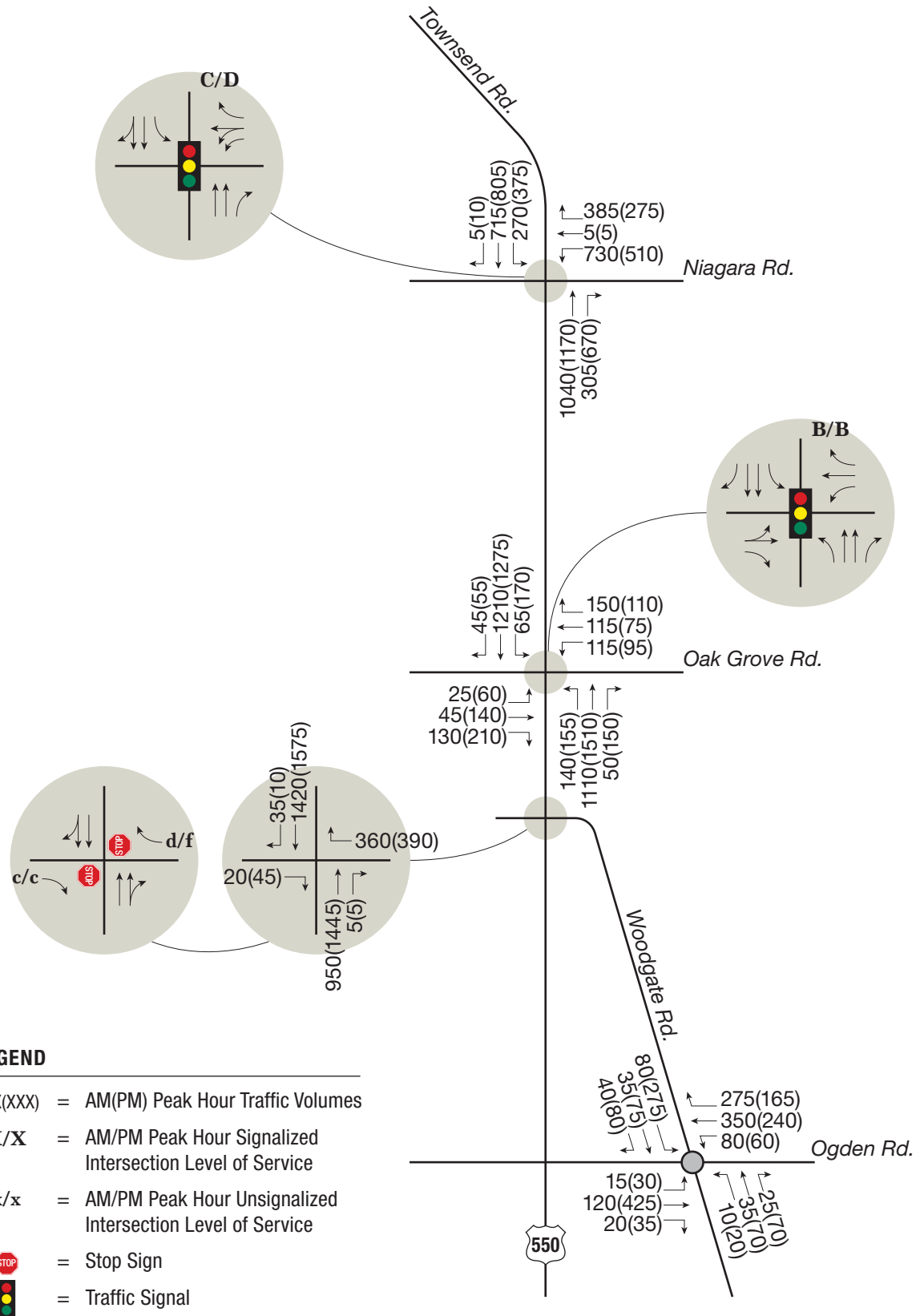


Figure 2
Future Right-In/Right-Out Alternative



III. ALTERNATIVE ANALYSIS

Woodgate Road Realignment 1

The first alternative for the Woodgate Road/Townsend Road intersection provided by the City of Montrose is to close the intersection and extend Woodgate Road to Oak Grove Road across from the Walgreens' access, which is located about 300 feet east of Townsend Road. As a result, most of the traffic using Woodgate to access Townsend Road will now use Oak Grove Road.

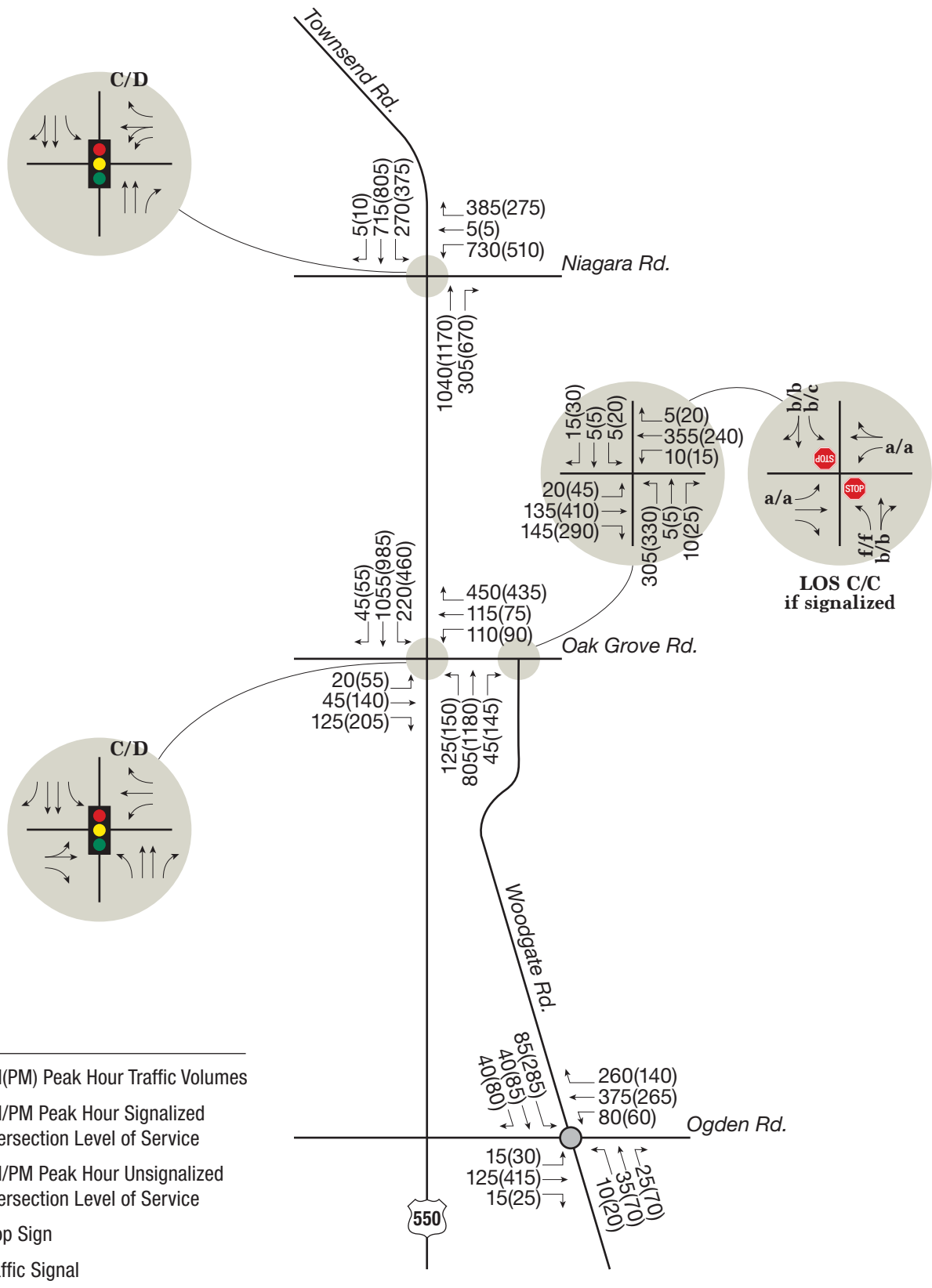
Figure 3 provides the traffic volumes and levels of service for this alternative. As shown, the levels of service at the signalized intersection of Townsend Road with Niagara Road remain unchanged with LOS C during the AM peak hour and LOS D during the PM peak hour. The intersection of Townsend with Oak Grove Road is expected to also operate at LOS C during the AM peak hour and LOS D during the PM peak hour. Although the overall intersection operates at LOS D during the evening peak hour, the southbound left turn experiences long delays and queues and the westbound right turn has a 95th percentile queue of 450 feet that will cause it to spill past the new intersection of Woodgate Road and Oak Grove Road. Adding a second southbound left turn lane and adding an overlapping protected westbound right turn phase will correct both these issues and allow the intersection to operate at LOS B during both peak hours.

As a two-way stop controlled intersection, the yielding turn movements at the new intersection of Oak Grove Road with Woodgate Road operate at LOS C or better with the exception of the northbound left turn. This turn has a very high volume and operates at LOS F during both peak hours and is expected to have a 95th percentile queue length exceeding 500 feet during the PM peak hour. This turn movement is above capacity. However, this intersection is right at the threshold of warranting signalization, which would result in LOS C for both peak hours. The need for signalization is partially warranted due to all the development expected to the east. If this alternative is constructed, traffic volumes will need to be monitored to see when it reaches the threshold for signalization. Because the growth assumptions in this report were very conservative, it may never require signalization.

One alternative to signalization would be to make the Oak Grove Road and Woodgate Road intersection a three-quarter movement intersection and prohibit northbound left turns. This would limit the queueing that occurs at the intersection. In addition, this would reduce the westbound right turn queue at the intersection of Oak Grove Road with Townsend Road, which would improve operations at this intersection as well.

Woodgate Road Realignment 2

The second realignment alternative has Woodgate Road still extending to Oak Grove Road, but aligning approximately 350 feet further east than the Walgreens' access. The traffic volumes and levels of service for this alternative are provided in **Figure 4**. The resulting levels of service are expected to be the same for the signalized intersections on Townsend Road. The intersection of Woodgate Road and Oak Grove Road is now a three-leg intersection, which does improve the levels of service experienced. As a stop-controlled intersection, all yielding turn movements are LOS B or better with the exception of the northbound left turn which is LOS D during the morning peak hour and LOS F during the evening peak hour. During the PM peak hour, the 95th percentile queue length for the northbound left turn is approximately 400 feet and the turn movement is above capacity.



LEGEND

- XXX(XXX) = AM(PM) Peak Hour Traffic Volumes
- X/X = AM/PM Peak Hour Signalized Intersection Level of Service
- x/x = AM/PM Peak Hour Unsignalized Intersection Level of Service
- = Stop Sign
- = Traffic Signal

Figure 3
Alternative I
Future Re-alignment Traffic Conditions



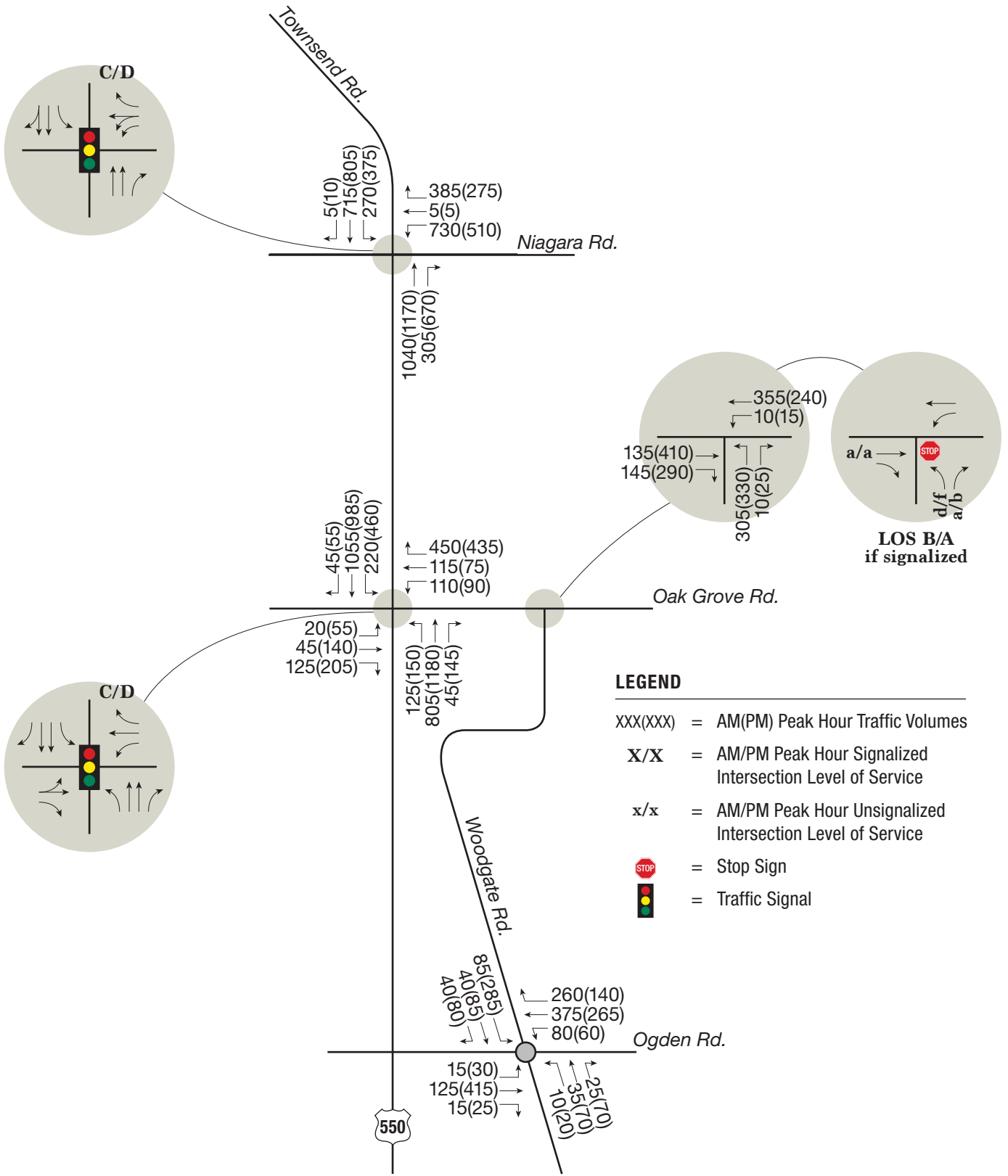


Figure 4
Alternative 2
Future Re-alignment Traffic Conditions



As with the first realignment alternative, this intersection is right on the threshold of warranting signalization. If signalized, it would operate at LOS B or better during both peak hours. As mentioned previously, the traffic volumes will need to be monitored because it is the developments to the east that will increase the eastbound/westbound traffic volumes which will determine the need for signalization.

Due to the potential need for signalization of the intersection of Woodgate Road with Oak Grove Road, this realignment is preferred over the previous realignment analyzed. Having signalized intersections only approximately 300 feet apart creates issues with queues extending back through the adjacent intersections. This realignment places the intersections approximately 650 feet apart eliminating this issue.

As with the previous alternative, it is recommended that a southbound left turn lane be added and the westbound right turn be given an overlapping protected phase at the intersection of Townsend Road and Oak Grove Road.

IV. OAK GROVE ROAD TO NIAGARA ROAD CONNECTOR

A connector road is being proposed in the future to run parallel to Townsend Road between Oak Grove Road and Niagara Road. This road will be located approximately 650 feet east of Townsend Road. This roadway will align with Woodgate Road in the second realignment alternative creating a four-leg intersection at Woodgate Road and Oak Grove Road. All three future alternatives have been analyzed with the addition of the connector road.

Right-In/Right-Out

Figure 5 provides the traffic volumes and levels of service for the right-in/right-out at Woodgate Road and Townsend Road with the addition of the connector road. As shown, the levels of service at the intersections on Townsend Road are unchanged from **Figure 2** with the addition of the connector road.

The intersections of the connector road with Niagara Road and Oak Grove Road will not warrant signalization. All the yielding turn movements at these unsignalized intersections operate at LOS C or better during the peak hours with the exception of the northbound left turn movement at the intersection of Niagara Road with the connector road. This turn movement operates at LOS F during both peak hours. It is not uncommon, however, for movements from driveways and side streets along higher volume roadways to experience poor levels of service. As noted in Chapter 19 (Two-Way Stop Controlled Intersections) of the Highway Capacity Manual (2010):

In evaluating the overall performance of two-way stop control intersections, it is important to consider measures of effectiveness in addition to delay, such as v/c ratios for individual movements, average queue lengths, and 95th percentile queue lengths. By focusing on a single measure of effectiveness for the worst movement only, such as delay for the minor street left turn, users may make less effective traffic control decisions.

During both peak hours, the v/c ratio of the northbound left turn is below 1.0 and the 95th percentile queue length is under 100 feet, which suggests there would be no significant operational issues at that location despite the LOS F.

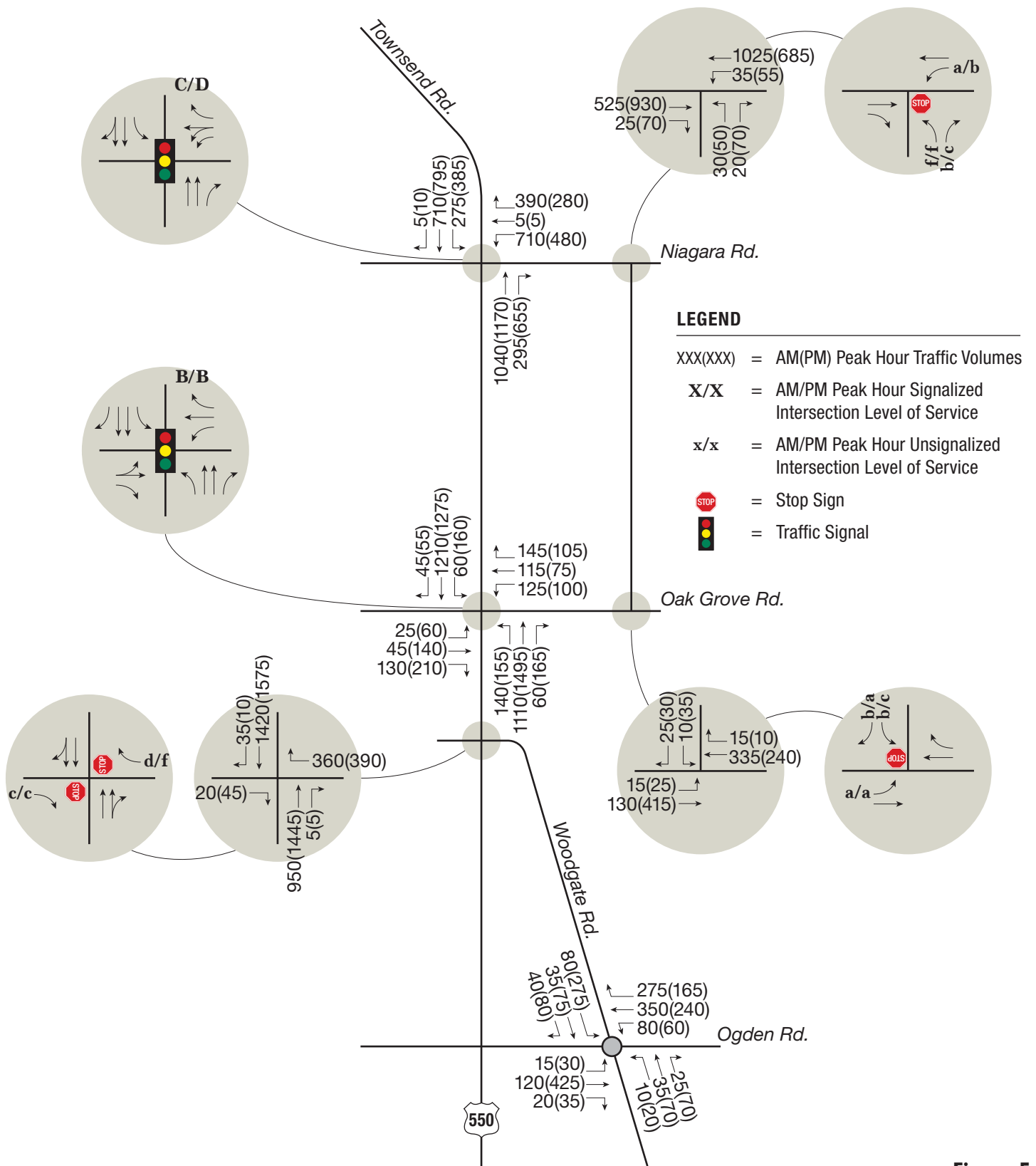


Figure 5
 Future Right-In/Right-Out Alternative
 with Connector



Woodgate Road Realignment 1

Figure 6 provides the traffic volumes and levels of service for this realignment with the addition of the connector road. As shown, the levels of service at the signalized intersections of Townsend Road with Niagara Road remain unchanged with the addition of the connector road. Even with the connector road, the southbound left turn experiences long delays and queues and the westbound right turn has a 95th percentile queue of 450 feet that will cause it to spill past the new intersection of Woodgate Road and Oak Grove Road. As mentioned previously, adding a second southbound left turn lane and adding an overlapping protected westbound right turn phase will correct both these problems.

As a two-way stop controlled intersection, the yielding turn movements at the new intersection of Oak Grove Road with Woodgate Road operate at LOS C or better with the exception of the northbound left turn. This movement operates at LOS E during the AM peak hour and LOS F during the PM peak hour. It is expected to have a 95th percentile queue length exceeding 450 feet during the PM peak hour with the volume exceeding capacity. As in the scenario without the connector road, this intersection is right at the threshold of warranting signalization, which would result in LOS B for both peak hours.

The yielding movements at the stop controlled intersection of Oak Grove Road and the connector all operate at LOS C or better. While the stop controlled intersection of Niagara Road with the connector road is projected to have all yielding turning movements operate at LOS C or better with the exception of the northbound left turn. This movement operates at LOS F during both peak hours. As mentioned previously, this LOS F is due to high volumes on Niagara Road and the turn movement operates under capacity with a 95th percentile queue of less than 100 feet 95th.

Woodgate Road Realignment 2

In this alternative, the connector road aligns with the Woodgate Road extension creating a four-leg intersection at Woodgate Road and Oak Grove Road. The resulting volumes and levels of service are shown in **Figure 7**. The signalized intersections along Townsend Road remain unchanged with LOS C in the AM peak hour and LOS D in the PM peak hour. Even with the connector road, there is still an issue of long delays for the southbound left turn movement and long queues for the westbound right turn movement. As in the other alternatives, this could be corrected by constructing a second southbound left turn lane and adding an overlapping westbound right protected phase.

As a stop-controlled intersection, all yielding turn movements at the intersection of Woodgate Road and Oak Grove Road are LOS B or better with the exception of the northbound left turn which is LOS E during the AM peak hour and LOS F during the PM peak hour. During the PM peak hour, the 95th percentile queue length for the northbound left turn is approximately 400 feet and the volume exceeds capacity.

As with the previous scenarios, this intersection is right on the threshold of warranting signalization. If signalized it would operate at LOS B during both peak hours. As mentioned previously, the traffic volumes will need to be monitored because it is the developments to the east that will increase the eastbound/westbound traffic volumes which will determine the need for signalization.

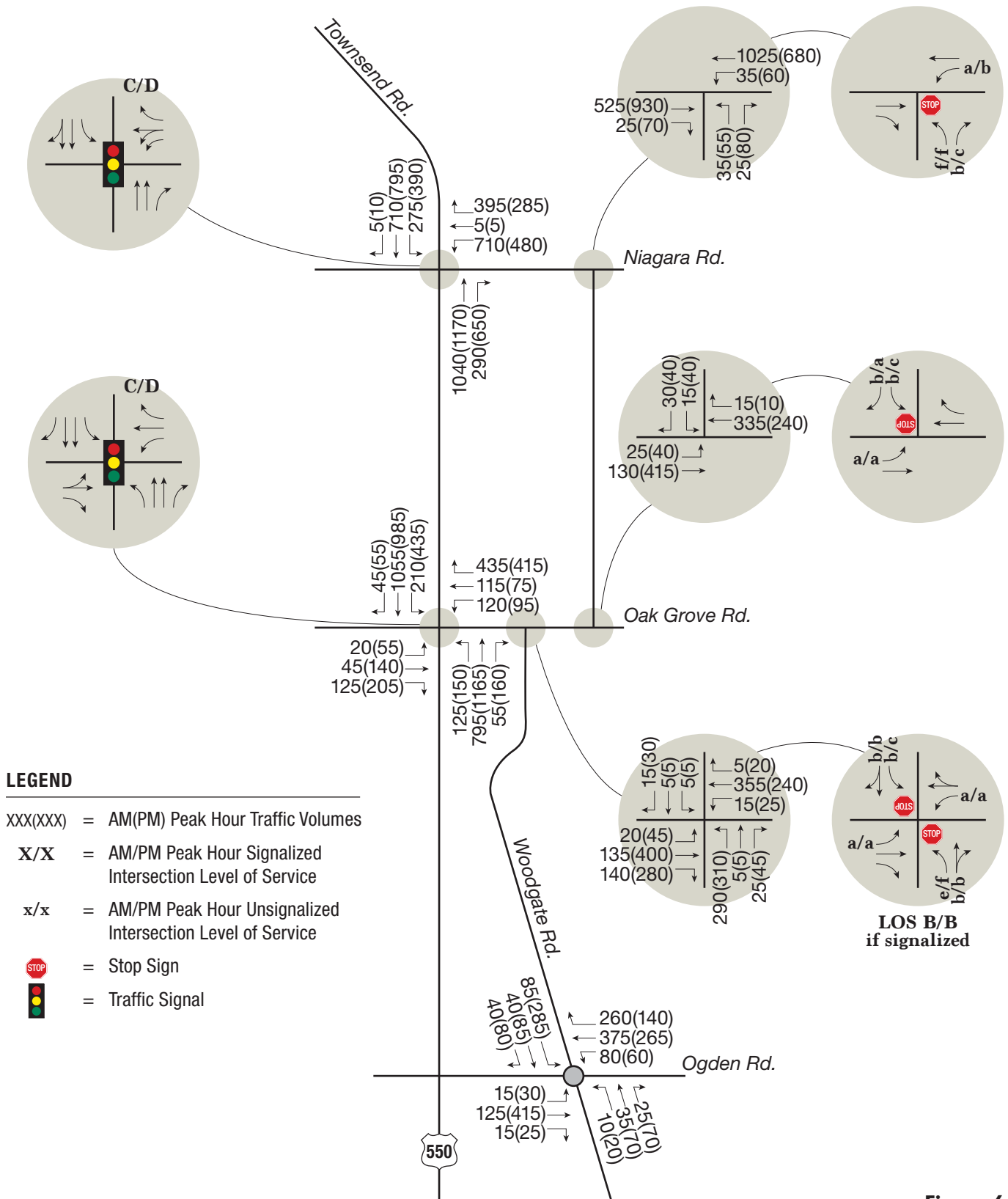


Figure 6
Alternative I
Future Re-alignment with Connector Traffic Conditions



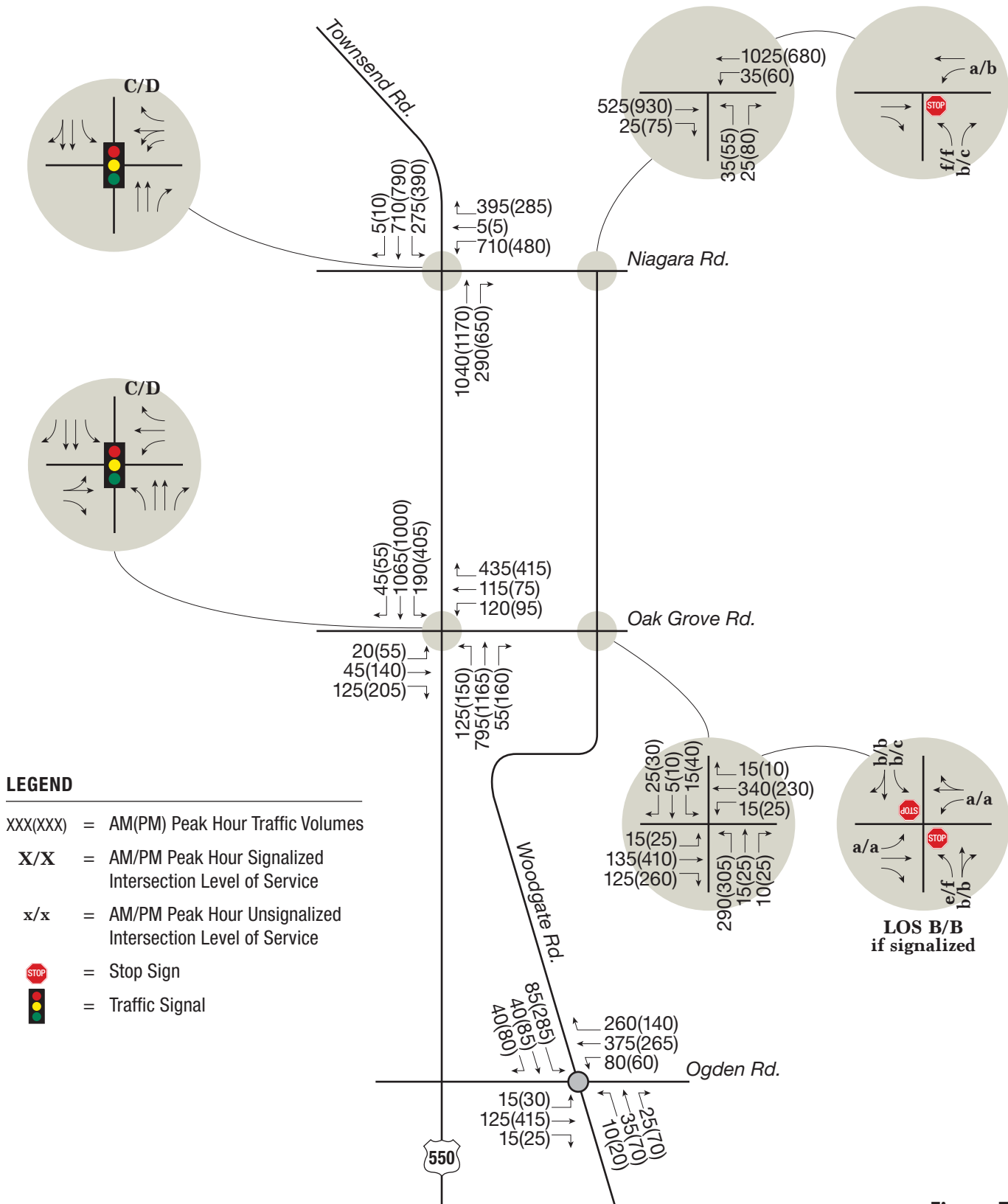


Figure 7
Alternative 2

Future Re-alignment with Connector Traffic Conditions



V. SUMMARY AND RECOMMENDATIONS

This report summarizes the analysis of several different alternatives for the intersection of Woodgate Road with Townsend Road in Montrose, Colorado. The following alternatives were analyzed with 2036 traffic forecasts both with and without the addition of a connector road between Oak Grove Road and Niagara Road:

- Right-In/Right-Out at Woodgate Rd/Townsend Rd
- Realigning Woodgate Rd to Oak Grove Rd across from the Walgreens' access
- Realigning Woodgate Rd to Oak Grove Rd approximately 350 feet east of the Walgreens' access

The following sections summarize the recommendations for each alternative.

Right-in/Right-out

- No recommendations

Realignment 1 – Woodgate Road extended to Oak Grove Road across from the Walgreens' access

- This alignment is not recommended with a full movement intersection at Woodgate Road and Oak Grove Road because the intersection may require signalization in the future and it is too closely spaced with the adjacent Townsend Road intersection.
- If the intersection of Oak Grove Road and Woodgate Road is a three-quarter movement, prohibiting the northbound left turn, then this intersection would not require signalization.

Realignment 2 – Woodgate Road extended to Oak Grove Road 350 feet east of the Walgreens' access

- Add a second southbound left turn lane at the intersection of Townsend Road and Oak Grove Road.
- Add an overlapping protected westbound right turn phase at the intersection of Townsend Road and Oak Grove Road.
- Monitor the intersection of Oak Grove Road with Woodgate Road to determine when it warrants signalization.

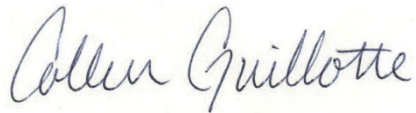
The analyses with the connector road between Oak Grove Road and Niagara Road showed very little difference in overall results, so the recommendations are unchanged with the addition of a connector road.

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We hope the information contained in this letter assists you. Please do not hesitate to call if you have any questions.

Respectfully,

FELSBURG HOLT & ULLEVIG

A handwritten signature in cursive script that reads "Colleen Guillotte". The signature is written in black ink on a light-colored background.






















Colleen Guillotte, PE
Traffic Engineer

Attachment

HCM 2010 Signalized Intersection Summary
























3: Townsend Ave & Niagara Rd

Existing
AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	0	374	1	195	0	586	193	208	678	5
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1863	1900	1863	1863	1863	0	1863	1863	1863	1863	1900
Adj Flow Rate, veh/h	0	0	0	408	0	212	0	637	210	226	737	5
Adj No. of Lanes	0	1	0	2	0	1	0	2	1	1	2	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	0	2	2	2	2	2
Cap, veh/h	0	330	0	804	0	280	0	1728	773	615	2416	16
Arrive On Green	0.00	0.00	0.00	0.18	0.00	0.18	0.00	0.98	0.98	0.12	0.67	0.67
Sat Flow, veh/h	0	1863	0	3548	0	1583	0	3632	1583	1774	3604	24
Grp Volume(v), veh/h	0	0	0	408	0	212	0	637	210	226	362	380
Grp Sat Flow(s),veh/h/ln	0	1863	0	1774	0	1583	0	1770	1583	1774	1770	1858
Q Serve(g_s), s	0.0	0.0	0.0	8.8	0.0	10.4	0.0	0.5	0.3	4.4	6.9	7.0
Cycle Q Clear(g_c), s	0.0	0.0	0.0	8.8	0.0	10.4	0.0	0.5	0.3	4.4	6.9	7.0
Prop In Lane	0.00		0.00	1.00		1.00	0.00		1.00	1.00		0.01
Lane Grp Cap(c), veh/h	0	330	0	804	0	280	0	1728	773	615	1186	1246
V/C Ratio(X)	0.00	0.00	0.00	0.51	0.00	0.76	0.00	0.37	0.27	0.37	0.31	0.31
Avail Cap(c_a), veh/h	0	738	0	1581	0	627	0	1728	773	767	1186	1246
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00	1.00	1.00	1.00
Upstream Filter(I)	0.00	0.00	0.00	1.00	0.00	1.00	0.00	0.97	0.97	1.00	1.00	1.00
Uniform Delay (d), s/veh	0.0	0.0	0.0	31.4	0.0	32.1	0.0	0.5	0.5	6.4	5.6	5.6
Incr Delay (d2), s/veh	0.0	0.0	0.0	0.5	0.0	4.1	0.0	0.6	0.8	0.4	0.7	0.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	0.0	0.0	4.4	0.0	4.9	0.0	0.3	0.3	2.1	3.5	3.7
LnGrp Delay(d),s/veh	0.0	0.0	0.0	31.9	0.0	36.2	0.0	1.1	1.3	6.7	6.3	6.2
LnGrp LOS				C		D		A	A	A	A	A
Approach Vol, veh/h		0			620			847			968	
Approach Delay, s/veh		0.0			33.4			1.1			6.4	
Approach LOS					C			A			A	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2		4		6		8				
Phs Duration (G+Y+Rc), s	14.9	64.0		21.0		79.0		21.0				
Change Period (Y+Rc), s	5.0	6.0		6.5		6.0		6.5				
Max Green Setting (Gmax), s	17.0	33.0		32.5		55.0		32.5				
Max Q Clear Time (g_c+I1), s	6.4	2.5		0.0		9.0		12.4				
Green Ext Time (p_c), s	0.5	12.3		0.0		13.9		2.1				
Intersection Summary												
HCM 2010 Ctrl Delay				11.4								
HCM 2010 LOS				B								
Notes												
User approved volume balancing among the lanes for turning movement.												

HCM 2010 Signalized Intersection Summary
6: Townsend Ave & Oak Grove Rd

Existing
AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	16	17	125	34	33	43	124	653	25	30	747	44
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1863	1863	1863	1863	1863	1863	1863	1863	1863	1863	1863
Adj Flow Rate, veh/h	17	18	136	37	36	47	135	710	27	33	812	48
Adj No. of Lanes	0	1	1	1	1	1	1	2	1	1	2	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	174	155	242	279	285	242	560	1923	860	480	1797	804
Arrive On Green	0.15	0.15	0.15	0.15	0.15	0.15	0.07	0.54	0.54	0.07	1.00	1.00
Sat Flow, veh/h	597	1014	1583	1228	1863	1583	1774	3539	1583	1774	3539	1583
Grp Volume(v), veh/h	35	0	136	37	36	47	135	710	27	33	812	48
Grp Sat Flow(s),veh/h/ln	1611	0	1583	1228	1863	1583	1774	1770	1583	1774	1770	1583
Q Serve(g_s), s	0.0	0.0	5.2	1.7	1.1	1.7	2.3	7.5	0.5	0.6	0.0	0.0
Cycle Q Clear(g_c), s	1.1	0.0	5.2	2.8	1.1	1.7	2.3	7.5	0.5	0.6	0.0	0.0
Prop In Lane	0.49		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	329	0	242	279	285	242	560	1923	860	480	1797	804
V/C Ratio(X)	0.11	0.00	0.56	0.13	0.13	0.19	0.24	0.37	0.03	0.07	0.45	0.06
Avail Cap(c_a), veh/h	936	0	865	761	1017	865	818	1923	860	746	1797	804
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00	2.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.92	0.92	0.92
Uniform Delay (d), s/veh	23.8	0.0	25.5	25.0	23.8	24.0	6.3	8.5	6.9	6.9	0.0	0.0
Incr Delay (d2), s/veh	0.1	0.0	2.0	0.2	0.2	0.4	0.2	0.5	0.1	0.1	0.8	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.6	0.0	2.4	0.6	0.6	0.8	1.1	3.7	0.2	0.3	0.2	0.0
LnGrp Delay(d),s/veh	23.9	0.0	27.5	25.2	24.0	24.4	6.5	9.0	7.0	7.0	0.8	0.1
LnGrp LOS	C		C	C	C	C	A	A	A	A	A	A
Approach Vol, veh/h		171			120			872			893	
Approach Delay, s/veh		26.8			24.5			8.6			1.0	
Approach LOS		C			C			A			A	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	7.2	76.3		16.4	9.6	74.0		16.4				
Change Period (Y+Rc), s	5.0	6.0		6.5	5.0	6.0		6.5				
Max Green Setting (Gmax), s	12.0	35.0		35.5	14.0	33.0		35.5				
Max Q Clear Time (g_c+I1), s	2.6	9.5		7.2	4.3	2.0		4.8				
Green Ext Time (p_c), s	0.0	12.7		1.1	0.2	14.0		1.1				
Intersection Summary												
HCM 2010 Ctrl Delay			7.7									
HCM 2010 LOS			A									

Intersection										
Int Delay, s/veh	2									

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR
Vol, veh/h	1	1	18	2	0	142	13	670	3
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	250	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2
Mvmt Flow	1	1	20	2	0	154	14	728	3

Major/Minor	Minor2			Minor1			Major1		
Conflicting Flow All	1462	1830	437	1392	1845	366	874	0	0
Stage 1	1070	1070	-	758	758	-	-	-	-
Stage 2	392	760	-	634	1087	-	-	-	-
Critical Hdwy	7.54	6.54	6.94	7.54	6.54	6.94	4.14	-	-
Critical Hdwy Stg 1	6.54	5.54	-	6.54	5.54	-	-	-	-
Critical Hdwy Stg 2	6.54	5.54	-	6.54	5.54	-	-	-	-
Follow-up Hdwy	3.52	4.02	3.32	3.52	4.02	3.32	2.22	-	-
Pot Cap-1 Maneuver	90	76	567	101	74	631	768	-	-
Stage 1	236	296	-	365	413	-	-	-	-
Stage 2	604	413	-	434	290	-	-	-	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	61	65	567	86	64	631	768	-	-
Mov Cap-2 Maneuver	61	65	-	86	64	-	-	-	-
Stage 1	232	260	-	358	405	-	-	-	-
Stage 2	448	405	-	366	254	-	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	17.3	13.5	0.2
HCM LOS	C	B	

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	768	-	-	315	580	868	-	-
HCM Lane V/C Ratio	0.018	-	-	0.069	0.27	0.123	-	-
HCM Control Delay (s)	9.8	-	-	17.3	13.5	9.7	-	-
HCM Lane LOS	A	-	-	C	B	A	-	-
HCM 95th %tile Q(veh)	0.1	-	-	0.2	1.1	0.4	-	-

Intersection

Int Delay, s/veh

Movement	SBL	SBT	SBR
Vol, veh/h	98	773	31
Conflicting Peds, #/hr	0	0	0
Sign Control	Free	Free	Free
RT Channelized	-	-	None
Storage Length	250	-	-
Veh in Median Storage, #	-	0	-
Grade, %	-	0	-
Peak Hour Factor	92	92	92
Heavy Vehicles, %	2	2	2
Mvmt Flow	107	840	34

Major/Minor Major2

Conflicting Flow All	732	0	0
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	4.14	-	-
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	2.22	-	-
Pot Cap-1 Maneuver	868	-	-
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %		-	-
Mov Cap-1 Maneuver	868	-	-
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-






















Approach SB

HCM Control Delay, s	1.1
HCM LOS	

Minor Lane/Major Mvmt
























HCM 2010 Signalized Intersection Summary
3: Townsend Ave & Niagara Rd

Existing
PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	0	287	1	154	0	899	279	167	780	8
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1863	1900	1863	1863	1863	0	1863	1863	1863	1863	1900
Adj Flow Rate, veh/h	0	0	0	313	0	167	0	977	303	182	848	9
Adj No. of Lanes	0	1	0	2	0	1	0	2	1	1	2	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	0	2	2	2	2	2
Cap, veh/h	0	272	0	701	0	232	0	1799	805	469	2496	26
Arrive On Green	0.00	0.00	0.00	0.15	0.00	0.15	0.00	0.68	0.68	0.12	0.70	0.70
Sat Flow, veh/h	0	1863	0	3548	0	1583	0	3632	1583	1774	3588	38
Grp Volume(v), veh/h	0	0	0	313	0	167	0	977	303	182	418	439
Grp Sat Flow(s),veh/h/ln	0	1863	0	1774	0	1583	0	1770	1583	1774	1770	1856
Q Serve(g_s), s	0.0	0.0	0.0	6.5	0.0	8.0	0.0	11.2	6.6	3.1	7.4	7.4
Cycle Q Clear(g_c), s	0.0	0.0	0.0	6.5	0.0	8.0	0.0	11.2	6.6	3.1	7.4	7.4
Prop In Lane	0.00		0.00	1.00		1.00	0.00		1.00	1.00		0.02
Lane Grp Cap(c), veh/h	0	272	0	701	0	232	0	1799	805	469	1231	1291
V/C Ratio(X)	0.00	0.00	0.00	0.45	0.00	0.72	0.00	0.54	0.38	0.39	0.34	0.34
Avail Cap(c_a), veh/h	0	766	0	1641	0	651	0	1799	805	630	1231	1291
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.33	1.33	1.00	1.00	1.00
Upstream Filter(I)	0.00	0.00	0.00	1.00	0.00	1.00	0.00	0.93	0.93	1.00	1.00	1.00
Uniform Delay (d), s/veh	0.0	0.0	0.0	31.6	0.0	32.2	0.0	8.1	7.4	7.1	4.8	4.8
Incr Delay (d2), s/veh	0.0	0.0	0.0	0.4	0.0	4.2	0.0	1.1	1.2	0.5	0.8	0.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	0.0	0.0	3.2	0.0	3.7	0.0	5.6	3.1	1.5	3.9	4.0
LnGrp Delay(d),s/veh	0.0	0.0	0.0	32.0	0.0	36.4	0.0	9.2	8.6	7.6	5.5	5.5
LnGrp LOS				C		D		A	A	A	A	A
Approach Vol, veh/h		0			480			1280			1039	
Approach Delay, s/veh		0.0			33.6			9.1			5.9	
Approach LOS					C			A			A	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2		4		6		8				
Phs Duration (G+Y+Rc), s	14.8	67.1		18.1		81.9		18.1				
Change Period (Y+Rc), s	5.0	6.0		6.5		6.0		6.5				
Max Green Setting (Gmax), s	17.0	33.0		32.5		55.0		32.5				
Max Q Clear Time (g_c+I1), s	5.1	13.2		0.0		9.4		10.0				
Green Ext Time (p_c), s	0.4	13.6		0.0		22.2		1.6				
Intersection Summary												
HCM 2010 Ctrl Delay				12.1								
HCM 2010 LOS				B								
Notes												
User approved volume balancing among the lanes for turning movement.												

HCM 2010 Signalized Intersection Summary
6: Townsend Ave & Oak Grove Rd

Existing
PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	53	50	201	43	22	42	147	921	59	50	831	54
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1863	1863	1863	1863	1863	1863	1863	1863	1863	1863	1863
Adj Flow Rate, veh/h	58	54	218	47	24	46	160	1001	64	54	903	59
Adj No. of Lanes	0	1	1	1	1	1	1	2	1	1	2	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	215	174	302	261	355	302	557	2060	921	402	1951	873
Arrive On Green	0.19	0.19	0.19	0.19	0.19	0.19	0.07	0.58	0.58	0.08	1.00	1.00
Sat Flow, veh/h	676	912	1583	1103	1863	1583	1774	3539	1583	1774	3539	1583
Grp Volume(v), veh/h	112	0	218	47	24	46	160	1001	64	54	903	59
Grp Sat Flow(s),veh/h/ln	1588	0	1583	1103	1863	1583	1774	1770	1583	1774	1770	1583
Q Serve(g_s), s	1.8	0.0	8.2	2.5	0.7	1.5	2.4	10.5	1.1	0.8	0.0	0.0
Cycle Q Clear(g_c), s	3.6	0.0	8.2	6.1	0.7	1.5	2.4	10.5	1.1	0.8	0.0	0.0
Prop In Lane	0.52		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	389	0	302	261	355	302	557	2060	921	402	1951	873
V/C Ratio(X)	0.29	0.00	0.72	0.18	0.07	0.15	0.29	0.49	0.07	0.13	0.46	0.07
Avail Cap(c_a), veh/h	1015	0	946	710	1113	946	852	2060	921	696	1951	873
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00	2.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.92	0.92	0.92
Uniform Delay (d), s/veh	22.2	0.0	24.2	24.9	21.1	21.4	5.0	7.7	5.8	5.9	0.0	0.0
Incr Delay (d2), s/veh	0.4	0.0	3.3	0.3	0.1	0.2	0.3	0.8	0.1	0.1	0.7	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.8	0.0	3.9	0.8	0.4	0.7	1.2	5.2	0.5	0.4	0.2	0.0
LnGrp Delay(d),s/veh	22.6	0.0	27.4	25.3	21.2	21.7	5.3	8.6	5.9	6.0	0.7	0.1
LnGrp LOS	C		C	C	C	C	A	A	A	A	A	A
Approach Vol, veh/h		330			117			1225			1016	
Approach Delay, s/veh		25.8			23.0			8.0			1.0	
Approach LOS		C			C			A			A	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	6.5	77.4		16.1	8.4	75.5		16.1				
Change Period (Y+Rc), s	4.0	4.0		4.0	4.0	4.0		4.0				
Max Green Setting (Gmax), s	13.0	37.0		38.0	15.0	35.0		38.0				
Max Q Clear Time (g_c+I1), s	2.8	12.5		10.2	4.4	2.0		8.1				
Green Ext Time (p_c), s	0.1	16.0		1.9	0.3	19.3		1.9				
Intersection Summary												
HCM 2010 Ctrl Delay			8.2									
HCM 2010 LOS			A									

Intersection									
Int Delay, s/veh	3.3								

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR
Vol, veh/h	2	0	42	0	1	252	1	898	4
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	250	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2
Mvmt Flow	2	0	46	0	1	274	1	976	4

Major/Minor	Minor2			Minor1			Major1		
Conflicting Flow All	1771	2263	529	1731	2264	490	1058	0	0
Stage 1	1280	1280	-	980	980	-	-	-	-
Stage 2	491	983	-	751	1284	-	-	-	-
Critical Hdwy	7.54	6.54	6.94	7.54	6.54	6.94	4.14	-	-
Critical Hdwy Stg 1	6.54	5.54	-	6.54	5.54	-	-	-	-
Critical Hdwy Stg 2	6.54	5.54	-	6.54	5.54	-	-	-	-
Follow-up Hdwy	3.52	4.02	3.32	3.52	4.02	3.32	2.22	-	-
Pot Cap-1 Maneuver	53	40	494	57	40	524	654	-	-
Stage 1	175	235	-	268	326	-	-	-	-
Stage 2	528	325	-	369	234	-	-	-	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	22	33	494	45	33	524	654	-	-
Mov Cap-2 Maneuver	22	33	-	45	33	-	-	-	-
Stage 1	175	197	-	268	326	-	-	-	-
Stage 2	251	325	-	281	196	-	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	22.8	21	0
HCM LOS	C	C	

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	654	-	-	250	495	700	-	-
HCM Lane V/C Ratio	0.002	-	-	0.191	0.556	0.161	-	-
HCM Control Delay (s)	10.5	-	-	22.8	21	11.1	-	-
HCM Lane LOS	B	-	-	C	C	B	-	-
HCM 95th %tile Q(veh)	0	-	-	0.7	3.3	0.6	-	-

Intersection

Int Delay, s/veh

Movement	SBL	SBT	SBR
Vol, veh/h	104	966	7
Conflicting Peds, #/hr	0	0	0
Sign Control	Free	Free	Free
RT Channelized	-	-	None
Storage Length	250	-	-
Veh in Median Storage, #	-	0	-
Grade, %	-	0	-
Peak Hour Factor	92	92	92
Heavy Vehicles, %	2	2	2
Mvmt Flow	113	1050	8

Major/Minor Major2

Conflicting Flow All	980	0	0
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	4.14	-	-
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	2.22	-	-
Pot Cap-1 Maneuver	700	-	-
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %		-	-
Mov Cap-1 Maneuver	700	-	-
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach SB






















HCM Control Delay, s 1.1

HCM LOS

Minor Lane/Major Mvmt
























HCM 2010 Signalized Intersection Summary
3: Townsend Ave & Niagara Rd

Future RIRO
AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	0	730	5	385	0	1040	305	270	715	5
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1863	1900	1863	1863	1863	0	1863	1863	1863	1863	1900
Adj Flow Rate, veh/h	0	0	0	797	0	418	0	1130	332	293	777	5
Adj No. of Lanes	0	1	0	2	0	1	0	2	1	1	2	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	0	2	2	2	2	2
Cap, veh/h	0	579	0	1258	0	492	0	1331	596	333	1996	13
Arrive On Green	0.00	0.00	0.00	0.31	0.00	0.31	0.00	0.50	0.50	0.12	0.55	0.55
Sat Flow, veh/h	0	1863	0	3548	0	1583	0	3632	1583	1774	3605	23
Grp Volume(v), veh/h	0	0	0	797	0	418	0	1130	332	293	381	401
Grp Sat Flow(s),veh/h/ln	0	1863	0	1774	0	1583	0	1770	1583	1774	1770	1859
Q Serve(g_s), s	0.0	0.0	0.0	18.4	0.0	22.8	0.0	25.5	13.4	8.9	11.3	11.3
Cycle Q Clear(g_c), s	0.0	0.0	0.0	18.4	0.0	22.8	0.0	25.5	13.4	8.9	11.3	11.3
Prop In Lane	0.00		0.00	1.00		1.00	0.00		1.00	1.00		0.01
Lane Grp Cap(c), veh/h	0	579	0	1258	0	492	0	1331	596	333	980	1029
V/C Ratio(X)	0.00	0.00	0.00	0.63	0.00	0.85	0.00	0.85	0.56	0.88	0.39	0.39
Avail Cap(c_a), veh/h	0	738	0	1562	0	627	0	1331	596	441	980	1029
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.33	1.33	1.00	1.00	1.00
Upstream Filter(I)	0.00	0.00	0.00	1.00	0.00	1.00	0.00	0.83	0.83	1.00	1.00	1.00
Uniform Delay (d), s/veh	0.0	0.0	0.0	28.2	0.0	29.7	0.0	20.7	17.7	19.9	11.7	11.7
Incr Delay (d2), s/veh	0.0	0.0	0.0	0.6	0.0	8.8	0.0	5.8	3.1	14.8	1.2	1.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	0.0	0.0	9.1	0.0	11.1	0.0	13.4	6.3	8.6	5.8	6.1
LnGrp Delay(d),s/veh	0.0	0.0	0.0	28.8	0.0	38.5	0.0	26.5	20.8	34.7	12.9	12.8
LnGrp LOS				C		D		C	C	C	B	B
Approach Vol, veh/h		0			1215			1462			1075	
Approach Delay, s/veh		0.0			32.1			25.2			18.8	
Approach LOS					C			C			B	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2		4		6		8				
Phs Duration (G+Y+Rc), s	16.4	48.5		35.1		64.9		35.1				
Change Period (Y+Rc), s	5.0	6.0		6.5		6.0		6.5				
Max Green Setting (Gmax), s	17.0	29.0		36.5		51.0		36.5				
Max Q Clear Time (g_c+I1), s	10.9	27.5		0.0		13.3		24.8				
Green Ext Time (p_c), s	0.5	1.3		0.0		21.7		3.8				
Intersection Summary												
HCM 2010 Ctrl Delay				25.6								
HCM 2010 LOS				C								
Notes												
User approved volume balancing among the lanes for turning movement.												

HCM 2010 Signalized Intersection Summary
6: Townsend Ave & Oak Grove Rd

Future RIRO
AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	25	45	130	115	115	150	140	1110	50	65	1210	45
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1863	1863	1863	1863	1863	1863	1863	1863	1863	1863	1863
Adj Flow Rate, veh/h	27	49	141	125	125	163	152	1207	54	71	1315	49
Adj No. of Lanes	0	1	1	1	1	1	1	2	1	1	2	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	154	248	348	294	409	348	373	1717	768	289	1652	739
Arrive On Green	0.22	0.22	0.22	0.22	0.22	0.22	0.07	0.49	0.49	0.11	0.93	0.93
Sat Flow, veh/h	393	1127	1583	1188	1863	1583	1774	3539	1583	1774	3539	1583
Grp Volume(v), veh/h	76	0	141	125	125	163	152	1207	54	71	1315	49
Grp Sat Flow(s),veh/h/ln	1520	0	1583	1188	1863	1583	1774	1770	1583	1774	1770	1583
Q Serve(g_s), s	0.0	0.0	5.5	7.1	4.0	6.5	3.1	19.2	1.3	1.4	6.9	0.2
Cycle Q Clear(g_c), s	4.1	0.0	5.5	11.2	4.0	6.5	3.1	19.2	1.3	1.4	6.9	0.2
Prop In Lane	0.36		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	402	0	348	294	409	348	373	1717	768	289	1652	739
V/C Ratio(X)	0.19	0.00	0.41	0.43	0.31	0.47	0.41	0.70	0.07	0.25	0.80	0.07
Avail Cap(c_a), veh/h	806	0	779	617	917	779	591	1717	768	491	1652	739
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00	2.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.80	0.80	0.80
Uniform Delay (d), s/veh	22.9	0.0	24.1	28.2	23.5	24.5	9.0	14.5	9.9	10.7	1.5	1.3
Incr Delay (d2), s/veh	0.2	0.0	0.8	1.0	0.4	1.0	0.7	2.4	0.2	0.4	3.3	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.2	0.0	2.5	2.4	2.1	2.9	1.6	9.8	0.6	0.7	2.9	0.1
LnGrp Delay(d),s/veh	23.1	0.0	24.9	29.2	24.0	25.5	9.7	16.9	10.1	11.0	4.8	1.4
LnGrp LOS	C		C	C	C	C	A	B	B	B	A	A
Approach Vol, veh/h		217			413			1413			1435	
Approach Delay, s/veh		24.3			26.1			15.9			5.0	
Approach LOS		C			C			B			A	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	8.8	68.9		22.4	10.1	67.5		22.4				
Change Period (Y+Rc), s	5.0	6.0		6.5	5.0	6.0		6.5				
Max Green Setting (Gmax), s	12.0	35.0		35.5	14.0	33.0		35.5				
Max Q Clear Time (g_c+I1), s	3.4	21.2		7.5	5.1	8.9		13.2				
Green Ext Time (p_c), s	0.1	12.2		2.8	0.2	19.9		2.7				
Intersection Summary												
HCM 2010 Ctrl Delay			13.1									
HCM 2010 LOS			B									

Intersection

Int Delay, s/veh 4.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR
Vol, veh/h	0	0	20	0	0	360	0	950	5
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None
Storage Length	-	-	0	-	-	0	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	0	22	0	0	391	0	1033	5

Major/Minor	Minor2			Minor1			Major1		
Conflicting Flow All	2079	2601	791	1807	2617	519	1582	0	0
Stage 1	1563	1563	-	1035	1035	-	-	-	-
Stage 2	516	1038	-	772	1582	-	-	-	-
Critical Hdwy	7.54	6.54	6.94	7.54	6.54	6.94	4.14	-	-
Critical Hdwy Stg 1	6.54	5.54	-	6.54	5.54	-	-	-	-
Critical Hdwy Stg 2	6.54	5.54	-	6.54	5.54	-	-	-	-
Follow-up Hdwy	3.52	4.02	3.32	3.52	4.02	3.32	2.22	-	-
Pot Cap-1 Maneuver	31	24	332	50	24	502	412	-	-
Stage 1	117	171	-	248	307	-	-	-	-
Stage 2	510	306	-	358	167	-	-	-	-
Platoon blocked, %									
Mov Cap-1 Maneuver	7	24	332	47	24	502	412	-	-
Mov Cap-2 Maneuver	7	24	-	47	24	-	-	-	-
Stage 1	117	171	-	248	307	-	-	-	-
Stage 2	112	306	-	335	167	-	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	16.6	33.1	0
HCM LOS	C	D	

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	412	-	-	332	502	665	-	-
HCM Lane V/C Ratio	-	-	-	0.065	0.779	-	-	-
HCM Control Delay (s)	0	-	-	16.6	33.1	0	-	-
HCM Lane LOS	A	-	-	C	D	A	-	-
HCM 95th %tile Q(veh)	0	-	-	0.2	7	0	-	-

Intersection

Int Delay, s/veh

Movement	SBL	SBT	SBR
Vol, veh/h	0	1420	35
Conflicting Peds, #/hr	0	0	0
Sign Control	Free	Free	Free
RT Channelized	-	-	None
Storage Length	-	-	-
Veh in Median Storage, #	-	0	-
Grade, %	-	0	-
Peak Hour Factor	92	92	92
Heavy Vehicles, %	2	2	2
Mvmt Flow	0	1543	38

Major/Minor Major2

Conflicting Flow All	1038	0	0
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	4.14	-	-
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	2.22	-	-
Pot Cap-1 Maneuver	665	-	-
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %		-	-
Mov Cap-1 Maneuver	665	-	-
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach SB






















HCM Control Delay, s 0

HCM LOS

Minor Lane/Major Mvmt
























HCM 2010 Signalized Intersection Summary
3: Townsend Ave & Niagara Rd

Future RIRO
PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	0	510	5	275	0	1170	670	375	805	10
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1863	1900	1863	1863	1863	0	1863	1863	1863	1863	1900
Adj Flow Rate, veh/h	0	0	0	558	0	299	0	1272	728	408	875	11
Adj No. of Lanes	0	1	0	2	0	1	0	2	1	1	2	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	0	2	2	2	2	2
Cap, veh/h	0	429	0	977	0	365	0	1372	614	425	2259	28
Arrive On Green	0.00	0.00	0.00	0.23	0.00	0.23	0.00	0.52	0.52	0.19	0.63	0.63
Sat Flow, veh/h	0	1863	0	3548	0	1583	0	3632	1583	1774	3579	45
Grp Volume(v), veh/h	0	0	0	558	0	299	0	1272	728	408	433	453
Grp Sat Flow(s),veh/h/ln	0	1863	0	1774	0	1583	0	1770	1583	1774	1770	1855
Q Serve(g_s), s	0.0	0.0	0.0	13.0	0.0	16.2	0.0	30.1	35.0	15.9	10.8	10.8
Cycle Q Clear(g_c), s	0.0	0.0	0.0	13.0	0.0	16.2	0.0	30.1	35.0	15.9	10.8	10.8
Prop In Lane	0.00		0.00	1.00		1.00	0.00		1.00	1.00		0.02
Lane Grp Cap(c), veh/h	0	429	0	977	0	365	0	1372	614	425	1117	1171
V/C Ratio(X)	0.00	0.00	0.00	0.57	0.00	0.82	0.00	0.93	1.19	0.96	0.39	0.39
Avail Cap(c_a), veh/h	0	629	0	1358	0	535	0	1372	614	425	1117	1171
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.33	1.33	1.00	1.00	1.00
Upstream Filter(l)	0.00	0.00	0.00	1.00	0.00	1.00	0.00	0.54	0.54	1.00	1.00	1.00
Uniform Delay (d), s/veh	0.0	0.0	0.0	31.7	0.0	33.0	0.0	20.7	21.9	26.2	8.1	8.1
Incr Delay (d2), s/veh	0.0	0.0	0.0	0.5	0.0	6.4	0.0	7.4	93.0	33.2	1.0	1.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	0.0	0.0	6.4	0.0	7.7	0.0	15.9	30.9	13.9	5.5	5.7
LnGrp Delay(d),s/veh	0.0	0.0	0.0	32.3	0.0	39.4	0.0	28.1	114.9	59.5	9.1	9.1
LnGrp LOS				C		D		C	F	E	A	A
Approach Vol, veh/h		0			857			2000			1294	
Approach Delay, s/veh		0.0			34.7			59.7			25.0	
Approach LOS					C			E			C	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2		4		6		8				
Phs Duration (G+Y+Rc), s	22.0	50.7		27.3		72.7		27.3				
Change Period (Y+Rc), s	5.0	6.0		6.5		6.0		6.5				
Max Green Setting (Gmax), s	17.0	35.0		30.5		57.0		30.5				
Max Q Clear Time (g_c+I1), s	17.9	37.0		0.0		12.8		18.2				
Green Ext Time (p_c), s	0.0	0.0		0.0		31.4		2.6				
Intersection Summary												
HCM 2010 Ctrl Delay				43.7								
HCM 2010 LOS				D								
Notes												
User approved volume balancing among the lanes for turning movement.												

HCM 2010 Signalized Intersection Summary
6: Townsend Ave & Oak Grove Rd

Future RIRO
PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	60	140	210	95	75	110	155	1510	150	170	1275	55
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1863	1863	1863	1863	1863	1863	1863	1863	1863	1863	1863
Adj Flow Rate, veh/h	65	152	228	103	82	120	168	1641	163	185	1386	60
Adj No. of Lanes	0	1	1	1	1	1	1	2	1	1	2	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	162	347	430	263	506	430	402	1732	775	250	1755	785
Arrive On Green	0.27	0.27	0.27	0.27	0.27	0.27	0.07	0.49	0.49	0.16	0.99	0.99
Sat Flow, veh/h	370	1277	1583	999	1863	1583	1774	3539	1583	1774	3539	1583
Grp Volume(v), veh/h	217	0	228	103	82	120	168	1641	163	185	1386	60
Grp Sat Flow(s),veh/h/ln	1647	0	1583	999	1863	1583	1774	1770	1583	1774	1770	1583
Q Serve(g_s), s	3.3	0.0	9.3	7.2	2.5	4.5	3.5	33.4	4.4	3.9	1.2	0.0
Cycle Q Clear(g_c), s	7.8	0.0	9.3	15.0	2.5	4.5	3.5	33.4	4.4	3.9	1.2	0.0
Prop In Lane	0.30		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	509	0	430	263	506	430	402	1732	775	250	1755	785
V/C Ratio(X)	0.43	0.00	0.53	0.39	0.16	0.28	0.42	0.95	0.21	0.74	0.79	0.08
Avail Cap(c_a), veh/h	875	0	796	494	936	796	624	1732	775	413	1755	785
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00	2.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.86	0.86	0.86
Uniform Delay (d), s/veh	22.8	0.0	23.4	29.1	21.0	21.7	8.0	18.4	11.0	15.3	0.2	0.2
Incr Delay (d2), s/veh	0.6	0.0	1.0	0.9	0.1	0.3	0.7	12.3	0.6	3.7	3.2	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.8	0.0	4.2	2.1	1.3	2.0	1.7	19.1	2.1	2.1	0.9	0.0
LnGrp Delay(d),s/veh	23.3	0.0	24.4	30.1	21.1	22.0	8.7	30.7	11.6	19.0	3.4	0.3
LnGrp LOS	C		C	C	C	C	A	C	B	B	A	A
Approach Vol, veh/h		445			305			1972			1631	
Approach Delay, s/veh		23.9			24.5			27.2			5.0	
Approach LOS		C			C			C			A	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	10.1	65.4		24.5	9.6	65.9		24.5				
Change Period (Y+Rc), s	4.0	4.0		4.0	4.0	4.0		4.0				
Max Green Setting (Gmax), s	13.0	37.0		38.0	15.0	35.0		38.0				
Max Q Clear Time (g_c+I1), s	5.9	35.4		11.3	5.5	3.2		17.0				
Green Ext Time (p_c), s	0.3	1.6		3.7	0.3	28.6		3.5				
Intersection Summary												
HCM 2010 Ctrl Delay			18.4									
HCM 2010 LOS			B									

Intersection										
Int Delay, s/veh	20									

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR
Vol, veh/h	0	0	45	0	0	390	0	1445	5
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None
Storage Length	-	-	0	-	-	0	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	0	49	0	0	424	0	1571	5

Major/Minor	Minor2			Minor1			Major1		
Conflicting Flow All	2502	3293	861	2429	3296	788	1723	0	0
Stage 1	1717	1717	-	1573	1573	-	-	-	-
Stage 2	785	1576	-	856	1723	-	-	-	-
Critical Hdwy	7.54	6.54	6.94	7.54	6.54	6.94	4.14	-	-
Critical Hdwy Stg 1	6.54	5.54	-	6.54	5.54	-	-	-	-
Critical Hdwy Stg 2	6.54	5.54	-	6.54	5.54	-	-	-	-
Follow-up Hdwy	3.52	4.02	3.32	3.52	4.02	3.32	2.22	-	-
Pot Cap-1 Maneuver	15	9	299	17	8	~ 334	363	-	-
Stage 1	93	143	-	115	169	-	-	-	-
Stage 2	352	168	-	319	142	-	-	-	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	-	9	299	14	8	~ 334	363	-	-
Mov Cap-2 Maneuver	-	9	-	14	8	-	-	-	-
Stage 1	93	143	-	115	169	-	-	-	-
Stage 2	-	168	-	267	142	-	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	19.4	175.5	0
HCM LOS	C	F	

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	363	-	-	299	334	414	-	-
HCM Lane V/C Ratio	-	-	-	0.164	1.269	-	-	-
HCM Control Delay (s)	0	-	-	19.4	175.5	0	-	-
HCM Lane LOS	A	-	-	C	F	A	-	-
HCM 95th %tile Q(veh)	0	-	-	0.6	19.4	0	-	-

Notes
 ~: Volume exceeds capacity \$: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

Intersection

Int Delay, s/veh

Movement	SBL	SBT	SBR
Vol, veh/h	0	1575	10
Conflicting Peds, #/hr	0	0	0
Sign Control	Free	Free	Free
RT Channelized	-	-	None
Storage Length	-	-	-
Veh in Median Storage, #	-	0	-
Grade, %	-	0	-
Peak Hour Factor	92	92	92
Heavy Vehicles, %	2	2	2
Mvmt Flow	0	1712	11

Major/Minor Major2

Conflicting Flow All	1576	0	0
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	4.14	-	-
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	2.22	-	-
Pot Cap-1 Maneuver	414	-	-
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %		-	-
Mov Cap-1 Maneuver	414	-	-
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-






















Approach SB

HCM Control Delay, s 0
 HCM LOS

Minor Lane/Major Mvmt
























HCM 2010 Signalized Intersection Summary
3: Townsend Ave & Niagara Rd

Future Realignment 1
AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	0	730	5	385	0	1040	305	270	715	5
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1863	1900	1863	1863	1863	0	1863	1863	1863	1863	1900
Adj Flow Rate, veh/h	0	0	0	797	0	418	0	1130	332	293	777	5
Adj No. of Lanes	0	1	0	2	0	1	0	2	1	1	2	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	0	2	2	2	2	2
Cap, veh/h	0	558	0	1213	0	474	0	1423	637	334	2057	13
Arrive On Green	0.00	0.00	0.00	0.30	0.00	0.30	0.00	0.53	0.53	0.12	0.57	0.57
Sat Flow, veh/h	0	1863	0	3548	0	1583	0	3632	1583	1774	3605	23
Grp Volume(v), veh/h	0	0	0	797	0	418	0	1130	332	293	381	401
Grp Sat Flow(s),veh/h/ln	0	1863	0	1774	0	1583	0	1770	1583	1774	1770	1859
Q Serve(g_s), s	0.0	0.0	0.0	19.6	0.0	24.2	0.0	24.9	13.0	8.8	11.4	11.4
Cycle Q Clear(g_c), s	0.0	0.0	0.0	19.6	0.0	24.2	0.0	24.9	13.0	8.8	11.4	11.4
Prop In Lane	0.00		0.00	1.00		1.00	0.00		1.00	1.00		0.01
Lane Grp Cap(c), veh/h	0	558	0	1213	0	474	0	1423	637	334	1010	1061
V/C Ratio(X)	0.00	0.00	0.00	0.66	0.00	0.88	0.00	0.79	0.52	0.88	0.38	0.38
Avail Cap(c_a), veh/h	0	628	0	1346	0	534	0	1423	637	440	1010	1061
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.33	1.33	1.00	1.00	1.00
Upstream Filter(I)	0.00	0.00	0.00	1.00	0.00	1.00	0.00	0.75	0.75	1.00	1.00	1.00
Uniform Delay (d), s/veh	0.0	0.0	0.0	30.5	0.0	32.1	0.0	19.2	16.4	19.6	11.3	11.3
Incr Delay (d2), s/veh	0.0	0.0	0.0	1.0	0.0	14.6	0.0	3.5	2.3	14.6	1.1	1.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	0.0	0.0	9.7	0.0	12.4	0.0	12.6	6.1	5.6	5.8	6.1
LnGrp Delay(d),s/veh	0.0	0.0	0.0	31.5	0.0	46.7	0.0	22.7	18.7	34.2	12.4	12.3
LnGrp LOS				C		D		C	B	C	B	B
Approach Vol, veh/h		0			1215			1462			1075	
Approach Delay, s/veh		0.0			36.7			21.8			18.3	
Approach LOS					D			C			B	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2		4		6		8				
Phs Duration (G+Y+Rc), s	16.2	48.4		35.4		64.6		35.4				
Change Period (Y+Rc), s	5.0	6.0		6.5		6.0		6.5				
Max Green Setting (Gmax), s	17.0	33.0		32.5		55.0		32.5				
Max Q Clear Time (g_c+I1), s	10.8	26.9		0.0		13.4		26.2				
Green Ext Time (p_c), s	0.5	5.3		0.0		22.9		2.7				
Intersection Summary												
HCM 2010 Ctrl Delay				25.6								
HCM 2010 LOS				C								
Notes												
User approved volume balancing among the lanes for turning movement.												

HCM 2010 Signalized Intersection Summary
6: Townsend Ave & Oak Grove Rd

Future Realignment 1
AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	20	45	125	110	115	450	125	805	45	220	1055	45
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1863	1863	1863	1863	1863	1863	1863	1863	1863	1863	1863
Adj Flow Rate, veh/h	22	49	136	120	125	489	136	875	49	239	1147	49
Adj No. of Lanes	0	1	1	1	1	1	1	2	1	1	2	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	169	353	536	424	631	536	308	1309	586	363	1446	647
Arrive On Green	0.34	0.34	0.34	0.34	0.34	0.34	0.07	0.37	0.37	0.21	0.82	0.82
Sat Flow, veh/h	353	1043	1583	1194	1863	1583	1774	3539	1583	1774	3539	1583
Grp Volume(v), veh/h	71	0	136	120	125	489	136	875	49	239	1147	49
Grp Sat Flow(s),veh/h/ln	1396	0	1583	1194	1863	1583	1774	1770	1583	1774	1770	1583
Q Serve(g_s), s	0.0	0.0	5.9	7.5	4.5	28.0	4.4	19.6	1.9	7.9	16.0	0.6
Cycle Q Clear(g_c), s	4.5	0.0	5.9	12.0	4.5	28.0	4.4	19.6	1.9	7.9	16.0	0.6
Prop In Lane	0.31		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	523	0	536	424	631	536	308	1309	586	363	1446	647
V/C Ratio(X)	0.14	0.00	0.25	0.28	0.20	0.91	0.44	0.67	0.08	0.66	0.79	0.08
Avail Cap(c_a), veh/h	571	0	594	467	699	594	450	1309	586	399	1446	647
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00	2.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.80	0.80	0.80
Uniform Delay (d), s/veh	21.5	0.0	22.6	26.4	22.2	29.9	17.3	25.0	19.4	15.9	6.6	5.2
Incr Delay (d2), s/veh	0.1	0.0	0.2	0.4	0.2	17.4	1.0	2.7	0.3	2.8	3.7	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.3	0.0	2.6	2.5	2.4	14.8	2.2	10.0	0.9	4.1	8.0	0.3
LnGrp Delay(d),s/veh	21.6	0.0	22.9	26.8	22.3	47.3	18.3	27.7	19.7	18.6	10.2	5.4
LnGrp LOS	C		C	C	C	D	B	C	B	B	B	A
Approach Vol, veh/h		207			734			1060			1435	
Approach Delay, s/veh		22.4			39.7			26.1			11.5	
Approach LOS		C			D			C			B	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	15.1	46.4		38.6	11.4	50.0		38.6				
Change Period (Y+Rc), s	5.0	6.0		6.5	5.0	6.0		6.5				
Max Green Setting (Gmax), s	12.0	35.0		35.5	14.0	33.0		35.5				
Max Q Clear Time (g_c+I1), s	9.9	21.6		7.9	6.4	18.0		30.0				
Green Ext Time (p_c), s	0.1	10.6		4.3	0.2	11.6		2.1				
Intersection Summary												
HCM 2010 Ctrl Delay			22.7									
HCM 2010 LOS			C									

Intersection									
Int Delay, s/veh	16.1								

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR
Vol, veh/h	20	135	145	10	355	5	305	5	10
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None
Storage Length	50	-	100	100	-	-	50	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2
Mvmt Flow	22	147	158	11	386	5	332	5	11

Major/Minor	Major1			Major2			Minor1		
Conflicting Flow All	391	0	0	147	0	0	611	603	147
Stage 1	-	-	-	-	-	-	190	190	-
Stage 2	-	-	-	-	-	-	421	413	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318
Pot Cap-1 Maneuver	1168	-	-	1435	-	-	406	413	900
Stage 1	-	-	-	-	-	-	812	743	-
Stage 2	-	-	-	-	-	-	610	594	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	1168	-	-	1435	-	-	384	402	900
Mov Cap-2 Maneuver	-	-	-	-	-	-	384	402	-
Stage 1	-	-	-	-	-	-	797	729	-
Stage 2	-	-	-	-	-	-	585	589	-

Approach	EB	WB	NB
HCM Control Delay, s	0.5	0.2	49.5
HCM LOS	E		

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	384	637	1168	-	-	1435	-	-	391	569
HCM Lane V/C Ratio	0.863	0.026	0.019	-	-	0.008	-	-	0.014	0.038
HCM Control Delay (s)	51.4	10.8	8.1	-	-	7.5	-	-	14.3	11.6
HCM Lane LOS	F	B	A	-	-	A	-	-	B	B
HCM 95th %tile Q(veh)	8.3	0.1	0.1	-	-	0	-	-	0	0.1

Intersection

Int Delay, s/veh

Movement	SBL	SBT	SBR
Vol, veh/h	5	5	15
Conflicting Peds, #/hr	0	0	0
Sign Control	Stop	Stop	Stop
RT Channelized	-	-	None
Storage Length	0	-	-
Veh in Median Storage, #	-	0	-
Grade, %	-	0	-
Peak Hour Factor	92	92	92
Heavy Vehicles, %	2	2	2
Mvmt Flow	5	5	16

Major/Minor

	Minor2		
Conflicting Flow All	608	600	389
Stage 1	410	410	-
Stage 2	198	190	-
Critical Hdwy	7.12	6.52	6.22
Critical Hdwy Stg 1	6.12	5.52	-
Critical Hdwy Stg 2	6.12	5.52	-
Follow-up Hdwy	3.518	4.018	3.318
Pot Cap-1 Maneuver	408	415	659
Stage 1	619	595	-
Stage 2	804	743	-
Platoon blocked, %			
Mov Cap-1 Maneuver	391	404	659
Mov Cap-2 Maneuver	391	404	-
Stage 1	607	590	-
Stage 2	774	729	-






















Approach

	SB
HCM Control Delay, s	12.1
HCM LOS	B

Minor Lane/Major Mvmt
























HCM 2010 Signalized Intersection Summary
3: Townsend Ave & Niagara Rd

Future Realignment 1
PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	0	510	5	275	0	1170	670	375	805	10
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1863	1900	1863	1863	1863	0	1863	1863	1863	1863	1900
Adj Flow Rate, veh/h	0	0	0	558	0	299	0	1272	728	408	875	11
Adj No. of Lanes	0	1	0	2	0	1	0	2	1	1	2	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	0	2	2	2	2	2
Cap, veh/h	0	434	0	991	0	369	0	1327	594	431	2236	28
Arrive On Green	0.00	0.00	0.00	0.23	0.00	0.23	0.00	0.50	0.50	0.19	0.62	0.62
Sat Flow, veh/h	0	1863	0	3548	0	1583	0	3632	1583	1774	3579	45
Grp Volume(v), veh/h	0	0	0	558	0	299	0	1272	728	408	433	453
Grp Sat Flow(s),veh/h/ln	0	1863	0	1774	0	1583	0	1770	1583	1774	1770	1855
Q Serve(g_s), s	0.0	0.0	0.0	12.6	0.0	15.7	0.0	30.4	33.0	15.5	10.7	10.7
Cycle Q Clear(g_c), s	0.0	0.0	0.0	12.6	0.0	15.7	0.0	30.4	33.0	15.5	10.7	10.7
Prop In Lane	0.00		0.00	1.00		1.00	0.00		1.00	1.00		0.02
Lane Grp Cap(c), veh/h	0	434	0	991	0	369	0	1327	594	431	1106	1159
V/C Ratio(X)	0.00	0.00	0.00	0.56	0.00	0.81	0.00	0.96	1.23	0.95	0.39	0.39
Avail Cap(c_a), veh/h	0	688	0	1474	0	585	0	1327	594	431	1106	1159
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.33	1.33	1.00	1.00	1.00
Upstream Filter(I)	0.00	0.00	0.00	1.00	0.00	1.00	0.00	0.24	0.24	1.00	1.00	1.00
Uniform Delay (d), s/veh	0.0	0.0	0.0	30.7	0.0	31.9	0.0	21.4	22.1	25.4	8.2	8.2
Incr Delay (d2), s/veh	0.0	0.0	0.0	0.5	0.0	4.6	0.0	5.7	105.7	30.2	1.0	1.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	0.0	0.0	6.2	0.0	7.3	0.0	15.7	31.7	13.4	5.5	5.7
LnGrp Delay(d),s/veh	0.0	0.0	0.0	31.2	0.0	36.5	0.0	27.1	127.7	55.7	9.2	9.2
LnGrp LOS				C		D		C	F	E	A	A
Approach Vol, veh/h		0			857			2000			1294	
Approach Delay, s/veh		0.0			33.1			63.8			23.9	
Approach LOS					C			E			C	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2		4		6		8				
Phs Duration (G+Y+Rc), s	22.0	51.0		27.0		73.0		27.0				
Change Period (Y+Rc), s	5.0	6.0		6.5		6.0		6.5				
Max Green Setting (Gmax), s	17.0	33.0		32.5		55.0		32.5				
Max Q Clear Time (g_c+I1), s	17.5	35.0		0.0		12.7		17.7				
Green Ext Time (p_c), s	0.0	0.0		0.0		30.4		2.8				
Intersection Summary												
HCM 2010 Ctrl Delay				45.0								
HCM 2010 LOS				D								
Notes												
User approved volume balancing among the lanes for turning movement.												

HCM 2010 Signalized Intersection Summary
6: Townsend Ave & Oak Grove Rd

Future Realignment 1
PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	55	140	205	90	75	435	150	1180	145	460	985	55
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1863	1863	1863	1863	1863	1863	1863	1863	1863	1863	1863
Adj Flow Rate, veh/h	60	152	223	98	82	473	163	1283	158	500	1071	60
Adj No. of Lanes	0	1	1	1	1	1	1	2	1	1	2	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	162	387	540	321	635	540	404	1392	623	340	1611	721
Arrive On Green	0.34	0.34	0.34	0.34	0.34	0.34	0.08	0.39	0.39	0.28	0.91	0.91
Sat Flow, veh/h	332	1135	1583	1003	1863	1583	1774	3539	1583	1774	3539	1583
Grp Volume(v), veh/h	212	0	223	98	82	473	163	1283	158	500	1071	60
Grp Sat Flow(s),veh/h/ln	1467	0	1583	1003	1863	1583	1774	1770	1583	1774	1770	1583
Q Serve(g_s), s	4.1	0.0	10.2	7.7	2.9	26.4	5.0	32.4	6.3	13.0	6.5	0.3
Cycle Q Clear(g_c), s	9.1	0.0	10.2	16.8	2.9	26.4	5.0	32.4	6.3	13.0	6.5	0.3
Prop In Lane	0.28		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	549	0	540	321	635	540	404	1392	623	340	1611	721
V/C Ratio(X)	0.39	0.00	0.41	0.31	0.13	0.88	0.40	0.92	0.25	1.47	0.66	0.08
Avail Cap(c_a), veh/h	637	0	640	385	753	640	551	1392	623	340	1611	721
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00	2.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.86	0.86	0.86
Uniform Delay (d), s/veh	23.2	0.0	23.8	29.8	21.4	29.1	14.6	27.1	19.2	20.4	2.6	2.3
Incr Delay (d2), s/veh	0.4	0.0	0.5	0.5	0.1	11.6	0.7	11.5	1.0	225.8	1.9	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.2	0.0	4.5	2.2	1.5	13.2	2.5	18.1	2.9	30.0	3.1	0.2
LnGrp Delay(d),s/veh	23.6	0.0	24.3	30.3	21.5	40.7	15.2	38.6	20.2	246.2	4.5	2.5
LnGrp LOS	C		C	C	C	D	B	D	C	F	A	A
Approach Vol, veh/h		435			653			1604			1631	
Approach Delay, s/veh		24.0			36.8			34.4			78.5	
Approach LOS		C			D			C			E	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	17.0	46.9		36.1	11.2	52.8		36.1				
Change Period (Y+Rc), s	4.0	4.0		4.0	4.0	4.0		4.0				
Max Green Setting (Gmax), s	13.0	37.0		38.0	15.0	35.0		38.0				
Max Q Clear Time (g_c+I1), s	15.0	34.4		12.2	7.0	8.5		28.4				
Green Ext Time (p_c), s	0.0	2.4		5.4	0.2	20.8		3.6				
Intersection Summary												
HCM 2010 Ctrl Delay			50.4									
HCM 2010 LOS			D									

Intersection									
Int Delay, s/veh	60.9								

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR
Vol, veh/h	45	410	290	15	240	20	330	5	25
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None
Storage Length	50	-	100	0	-	-	50	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2
Mvmt Flow	49	446	315	16	261	22	359	5	27

Major/Minor	Major1			Major2			Minor1		
Conflicting Flow All	283	0	0	446	0	0	866	858	446
Stage 1	-	-	-	-	-	-	543	543	-
Stage 2	-	-	-	-	-	-	323	315	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318
Pot Cap-1 Maneuver	1279	-	-	1114	-	-	~ 274	294	612
Stage 1	-	-	-	-	-	-	524	520	-
Stage 2	-	-	-	-	-	-	689	656	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	1279	-	-	1114	-	-	~ 248	279	612
Mov Cap-2 Maneuver	-	-	-	-	-	-	~ 248	279	-
Stage 1	-	-	-	-	-	-	504	500	-
Stage 2	-	-	-	-	-	-	645	647	-

Approach	EB	WB	NB
HCM Control Delay, s	0.5	0.5	239.1
HCM LOS			F

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	248	510	1279	-	-	1114	-	-	248	616
HCM Lane V/C Ratio	1.446	0.064	0.038	-	-	0.015	-	-	0.088	0.062
HCM Control Delay (s)	259.7	12.5	7.9	-	-	8.3	-	-	20.9	11.2
HCM Lane LOS	F	B	A	-	-	A	-	-	C	B
HCM 95th %tile Q(veh)	20.4	0.2	0.1	-	-	0	-	-	0.3	0.2

Notes
 ~: Volume exceeds capacity \$: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

Intersection

Int Delay, s/veh

Movement	SBL	SBT	SBR
Vol, veh/h	20	5	30
Conflicting Peds, #/hr	0	0	0
Sign Control	Stop	Stop	Stop
RT Channelized	-	-	None
Storage Length	0	-	-
Veh in Median Storage, #	-	0	-
Grade, %	-	0	-
Peak Hour Factor	92	92	92
Heavy Vehicles, %	2	2	2
Mvmt Flow	22	5	33

Major/Minor

	Minor2		
Conflicting Flow All	864	847	272
Stage 1	304	304	-
Stage 2	560	543	-
Critical Hdwy	7.12	6.52	6.22
Critical Hdwy Stg 1	6.12	5.52	-
Critical Hdwy Stg 2	6.12	5.52	-
Follow-up Hdwy	3.518	4.018	3.318
Pot Cap-1 Maneuver	274	299	767
Stage 1	705	663	-
Stage 2	513	520	-
Platoon blocked, %			
Mov Cap-1 Maneuver	248	283	767
Mov Cap-2 Maneuver	248	283	-
Stage 1	678	653	-
Stage 2	466	500	-






















Approach

	SB
HCM Control Delay, s	14.7
HCM LOS	B

Minor Lane/Major Mvmt
























HCM 2010 Signalized Intersection Summary
3: Townsend Ave & Niagara Rd

Future Realignment 2
AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	0	730	5	385	0	1040	305	270	715	5
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1863	1900	1863	1863	1863	0	1863	1863	1863	1863	1900
Adj Flow Rate, veh/h	0	0	0	797	0	418	0	1130	332	293	777	5
Adj No. of Lanes	0	1	0	2	0	1	0	2	1	1	2	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	0	2	2	2	2	2
Cap, veh/h	0	558	0	1213	0	474	0	1423	637	334	2057	13
Arrive On Green	0.00	0.00	0.00	0.30	0.00	0.30	0.00	0.53	0.53	0.12	0.57	0.57
Sat Flow, veh/h	0	1863	0	3548	0	1583	0	3632	1583	1774	3605	23
Grp Volume(v), veh/h	0	0	0	797	0	418	0	1130	332	293	381	401
Grp Sat Flow(s),veh/h/ln	0	1863	0	1774	0	1583	0	1770	1583	1774	1770	1859
Q Serve(g_s), s	0.0	0.0	0.0	19.6	0.0	24.2	0.0	24.9	13.0	8.8	11.4	11.4
Cycle Q Clear(g_c), s	0.0	0.0	0.0	19.6	0.0	24.2	0.0	24.9	13.0	8.8	11.4	11.4
Prop In Lane	0.00		0.00	1.00		1.00	0.00		1.00	1.00		0.01
Lane Grp Cap(c), veh/h	0	558	0	1213	0	474	0	1423	637	334	1010	1061
V/C Ratio(X)	0.00	0.00	0.00	0.66	0.00	0.88	0.00	0.79	0.52	0.88	0.38	0.38
Avail Cap(c_a), veh/h	0	628	0	1346	0	534	0	1423	637	440	1010	1061
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.33	1.33	1.00	1.00	1.00
Upstream Filter(I)	0.00	0.00	0.00	1.00	0.00	1.00	0.00	0.75	0.75	1.00	1.00	1.00
Uniform Delay (d), s/veh	0.0	0.0	0.0	30.5	0.0	32.1	0.0	19.2	16.4	19.6	11.3	11.3
Incr Delay (d2), s/veh	0.0	0.0	0.0	1.0	0.0	14.6	0.0	3.5	2.3	14.6	1.1	1.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	0.0	0.0	9.7	0.0	12.4	0.0	12.6	6.1	5.6	5.8	6.1
LnGrp Delay(d),s/veh	0.0	0.0	0.0	31.5	0.0	46.7	0.0	22.7	18.7	34.2	12.4	12.3
LnGrp LOS				C		D		C	B	C	B	B
Approach Vol, veh/h		0			1215			1462			1075	
Approach Delay, s/veh		0.0			36.7			21.8			18.3	
Approach LOS					D			C			B	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2		4		6		8				
Phs Duration (G+Y+Rc), s	16.2	48.4		35.4		64.6		35.4				
Change Period (Y+Rc), s	5.0	6.0		6.5		6.0		6.5				
Max Green Setting (Gmax), s	17.0	33.0		32.5		55.0		32.5				
Max Q Clear Time (g_c+I1), s	10.8	26.9		0.0		13.4		26.2				
Green Ext Time (p_c), s	0.5	5.3		0.0		22.9		2.7				
Intersection Summary												
HCM 2010 Ctrl Delay				25.6								
HCM 2010 LOS				C								
Notes												
User approved volume balancing among the lanes for turning movement.												

HCM 2010 Signalized Intersection Summary
6: Townsend Ave & Oak Grove Rd

Future Realignment 2
AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	20	45	125	110	115	450	125	805	45	220	1055	45
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1863	1863	1863	1863	1863	1863	1863	1863	1863	1863	1863
Adj Flow Rate, veh/h	22	49	136	120	125	489	136	875	49	239	1147	49
Adj No. of Lanes	0	1	1	1	1	1	1	2	1	1	2	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	169	353	536	424	631	536	308	1309	586	363	1446	647
Arrive On Green	0.34	0.34	0.34	0.34	0.34	0.34	0.07	0.37	0.37	0.21	0.82	0.82
Sat Flow, veh/h	353	1043	1583	1194	1863	1583	1774	3539	1583	1774	3539	1583
Grp Volume(v), veh/h	71	0	136	120	125	489	136	875	49	239	1147	49
Grp Sat Flow(s),veh/h/ln	1396	0	1583	1194	1863	1583	1774	1770	1583	1774	1770	1583
Q Serve(g_s), s	0.0	0.0	5.9	7.5	4.5	28.0	4.4	19.6	1.9	7.9	16.0	0.6
Cycle Q Clear(g_c), s	4.5	0.0	5.9	12.0	4.5	28.0	4.4	19.6	1.9	7.9	16.0	0.6
Prop In Lane	0.31		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	523	0	536	424	631	536	308	1309	586	363	1446	647
V/C Ratio(X)	0.14	0.00	0.25	0.28	0.20	0.91	0.44	0.67	0.08	0.66	0.79	0.08
Avail Cap(c_a), veh/h	571	0	594	467	699	594	450	1309	586	399	1446	647
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00	2.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.80	0.80	0.80
Uniform Delay (d), s/veh	21.5	0.0	22.6	26.4	22.2	29.9	17.3	25.0	19.4	15.9	6.6	5.2
Incr Delay (d2), s/veh	0.1	0.0	0.2	0.4	0.2	17.4	1.0	2.7	0.3	2.8	3.7	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.3	0.0	2.6	2.5	2.4	14.8	2.2	10.0	0.9	4.1	8.0	0.3
LnGrp Delay(d),s/veh	21.6	0.0	22.9	26.8	22.3	47.3	18.3	27.7	19.7	18.6	10.2	5.4
LnGrp LOS	C		C	C	C	D	B	C	B	B	B	A
Approach Vol, veh/h		207			734			1060			1435	
Approach Delay, s/veh		22.4			39.7			26.1			11.5	
Approach LOS		C			D			C			B	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	15.1	46.4		38.6	11.4	50.0		38.6				
Change Period (Y+Rc), s	5.0	6.0		6.5	5.0	6.0		6.5				
Max Green Setting (Gmax), s	12.0	35.0		35.5	14.0	33.0		35.5				
Max Q Clear Time (g_c+I1), s	9.9	21.6		7.9	6.4	18.0		30.0				
Green Ext Time (p_c), s	0.1	10.6		4.3	0.2	11.6		2.1				
Intersection Summary												
HCM 2010 Ctrl Delay			22.7									
HCM 2010 LOS			C									

Intersection	
Int Delay, s/veh	11.1

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Vol, veh/h	135	145	10	355	305	10
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	100	-	-	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	147	158	11	386	332	11






















Major/Minor	Major1	Major2	Minor1	Minor2
Conflicting Flow All	0	0	304	0
Stage 1	-	-	-	-
Stage 2	-	-	-	-
Critical Hdwy	-	-	4.12	-
Critical Hdwy Stg 1	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-
Follow-up Hdwy	-	-	2.218	-
Pot Cap-1 Maneuver	-	-	1257	-
Stage 1	-	-	-	-
Stage 2	-	-	-	-
Platoon blocked, %	-	-	-	-
Mov Cap-1 Maneuver	-	-	1257	-
Mov Cap-2 Maneuver	-	-	-	-
Stage 1	-	-	-	-
Stage 2	-	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.2	33.6
HCM LOS			D

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	439	813	-	-	1257	-
HCM Lane V/C Ratio	0.755	0.013	-	-	0.009	-
HCM Control Delay (s)	34.4	9.5	-	-	7.9	-
HCM Lane LOS	D	A	-	-	A	-
HCM 95th %tile Q(veh)	6.3	0	-	-	0	-
























HCM 2010 Signalized Intersection Summary
3: Townsend Ave & Niagara Rd

Future Realignment 2
PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	0	510	5	275	0	1170	670	375	805	10
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1863	1900	1863	1863	1863	0	1863	1863	1863	1863	1900
Adj Flow Rate, veh/h	0	0	0	558	0	299	0	1272	728	408	875	11
Adj No. of Lanes	0	1	0	2	0	1	0	2	1	1	2	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	0	2	2	2	2	2
Cap, veh/h	0	434	0	991	0	369	0	1327	594	431	2236	28
Arrive On Green	0.00	0.00	0.00	0.23	0.00	0.23	0.00	0.50	0.50	0.19	0.62	0.62
Sat Flow, veh/h	0	1863	0	3548	0	1583	0	3632	1583	1774	3579	45
Grp Volume(v), veh/h	0	0	0	558	0	299	0	1272	728	408	433	453
Grp Sat Flow(s),veh/h/ln	0	1863	0	1774	0	1583	0	1770	1583	1774	1770	1855
Q Serve(g_s), s	0.0	0.0	0.0	12.6	0.0	15.7	0.0	30.4	33.0	15.5	10.7	10.7
Cycle Q Clear(g_c), s	0.0	0.0	0.0	12.6	0.0	15.7	0.0	30.4	33.0	15.5	10.7	10.7
Prop In Lane	0.00		0.00	1.00		1.00	0.00		1.00	1.00		0.02
Lane Grp Cap(c), veh/h	0	434	0	991	0	369	0	1327	594	431	1106	1159
V/C Ratio(X)	0.00	0.00	0.00	0.56	0.00	0.81	0.00	0.96	1.23	0.95	0.39	0.39
Avail Cap(c_a), veh/h	0	688	0	1474	0	585	0	1327	594	431	1106	1159
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.33	1.33	1.00	1.00	1.00
Upstream Filter(I)	0.00	0.00	0.00	1.00	0.00	1.00	0.00	0.24	0.24	1.00	1.00	1.00
Uniform Delay (d), s/veh	0.0	0.0	0.0	30.7	0.0	31.9	0.0	21.4	22.1	25.4	8.2	8.2
Incr Delay (d2), s/veh	0.0	0.0	0.0	0.5	0.0	4.6	0.0	5.7	105.7	30.2	1.0	1.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	0.0	0.0	6.2	0.0	7.3	0.0	15.7	31.7	13.4	5.5	5.7
LnGrp Delay(d),s/veh	0.0	0.0	0.0	31.2	0.0	36.5	0.0	27.1	127.7	55.7	9.2	9.2
LnGrp LOS				C		D		C	F	E	A	A
Approach Vol, veh/h		0			857			2000			1294	
Approach Delay, s/veh		0.0			33.1			63.8			23.9	
Approach LOS					C			E			C	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2		4		6		8				
Phs Duration (G+Y+Rc), s	22.0	51.0		27.0		73.0		27.0				
Change Period (Y+Rc), s	5.0	6.0		6.5		6.0		6.5				
Max Green Setting (Gmax), s	17.0	33.0		32.5		55.0		32.5				
Max Q Clear Time (g_c+I1), s	17.5	35.0		0.0		12.7		17.7				
Green Ext Time (p_c), s	0.0	0.0		0.0		30.4		2.8				
Intersection Summary												
HCM 2010 Ctrl Delay				45.0								
HCM 2010 LOS				D								
Notes												
User approved volume balancing among the lanes for turning movement.												

HCM 2010 Signalized Intersection Summary
6: Townsend Ave & Oak Grove Rd

Future Realignment 2
PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	55	140	205	90	75	435	150	1180	145	460	985	55
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1863	1863	1863	1863	1863	1863	1863	1863	1863	1863	1863
Adj Flow Rate, veh/h	60	152	223	98	82	473	163	1283	158	500	1071	60
Adj No. of Lanes	0	1	1	1	1	1	1	2	1	1	2	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	162	387	540	321	635	540	404	1392	623	340	1611	721
Arrive On Green	0.34	0.34	0.34	0.34	0.34	0.34	0.08	0.39	0.39	0.28	0.91	0.91
Sat Flow, veh/h	332	1135	1583	1003	1863	1583	1774	3539	1583	1774	3539	1583
Grp Volume(v), veh/h	212	0	223	98	82	473	163	1283	158	500	1071	60
Grp Sat Flow(s),veh/h/ln	1467	0	1583	1003	1863	1583	1774	1770	1583	1774	1770	1583
Q Serve(g_s), s	4.1	0.0	10.2	7.7	2.9	26.4	5.0	32.4	6.3	13.0	6.5	0.3
Cycle Q Clear(g_c), s	9.1	0.0	10.2	16.8	2.9	26.4	5.0	32.4	6.3	13.0	6.5	0.3
Prop In Lane	0.28		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	549	0	540	321	635	540	404	1392	623	340	1611	721
V/C Ratio(X)	0.39	0.00	0.41	0.31	0.13	0.88	0.40	0.92	0.25	1.47	0.66	0.08
Avail Cap(c_a), veh/h	637	0	640	385	753	640	551	1392	623	340	1611	721
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00	2.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.86	0.86	0.86
Uniform Delay (d), s/veh	23.2	0.0	23.8	29.8	21.4	29.1	14.6	27.1	19.2	20.4	2.6	2.3
Incr Delay (d2), s/veh	0.4	0.0	0.5	0.5	0.1	11.6	0.7	11.5	1.0	225.8	1.9	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.2	0.0	4.5	2.2	1.5	13.2	2.5	18.1	2.9	30.0	3.1	0.2
LnGrp Delay(d),s/veh	23.6	0.0	24.3	30.3	21.5	40.7	15.2	38.6	20.2	246.2	4.5	2.5
LnGrp LOS	C		C	C	C	D	B	D	C	F	A	A
Approach Vol, veh/h		435			653			1604			1631	
Approach Delay, s/veh		24.0			36.8			34.4			78.5	
Approach LOS		C			D			C			E	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	17.0	46.9		36.1	11.2	52.8		36.1				
Change Period (Y+Rc), s	4.0	4.0		4.0	4.0	4.0		4.0				
Max Green Setting (Gmax), s	13.0	37.0		38.0	15.0	35.0		38.0				
Max Q Clear Time (g_c+I1), s	15.0	34.4		12.2	7.0	8.5		28.4				
Green Ext Time (p_c), s	0.0	2.4		5.4	0.2	20.8		3.6				
Intersection Summary												
HCM 2010 Ctrl Delay			50.4									
HCM 2010 LOS			D									

Intersection	
Int Delay, s/veh	36.8

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Vol, veh/h	410	290	15	240	330	25
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	0	-	-	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	446	315	16	261	359	27

Major/Minor	Major1	Major2	Minor1
Conflicting Flow All	0	0	603
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	-	4.12	6.22
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	-	2.218	3.318
Pot Cap-1 Maneuver	-	851	499
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	-	851	499
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-






















Approach	EB	WB	NB
HCM Control Delay, s	0	0.5	135.5
HCM LOS			F

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	305	499	-	-	851	-
HCM Lane V/C Ratio	1.176	0.054	-	-	0.019	-
HCM Control Delay (s)	144.8	12.6	-	-	9.3	-
HCM Lane LOS	F	B	-	-	A	-
HCM 95th %tile Q(veh)	15.4	0.2	-	-	0.1	-

Notes
 ~: Volume exceeds capacity \$: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon
























HCM 2010 Signalized Intersection Summary
3: Townsend Ave & Niagara Rd

Future RIRO with Connector
AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	0	710	5	390	0	1040	295	275	710	5
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1863	1900	1863	1863	1863	0	1863	1863	1863	1863	1900
Adj Flow Rate, veh/h	0	0	0	776	0	424	0	1130	321	299	772	5
Adj No. of Lanes	0	1	0	2	0	1	0	2	1	1	2	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	0	2	2	2	2	2
Cap, veh/h	0	583	0	1266	0	496	0	1305	584	338	1989	13
Arrive On Green	0.00	0.00	0.00	0.31	0.00	0.31	0.00	0.49	0.49	0.13	0.55	0.55
Sat Flow, veh/h	0	1863	0	3548	0	1583	0	3632	1583	1774	3605	23
Grp Volume(v), veh/h	0	0	0	776	0	424	0	1130	321	299	379	398
Grp Sat Flow(s),veh/h/ln	0	1863	0	1774	0	1583	0	1770	1583	1774	1770	1859
Q Serve(g_s), s	0.0	0.0	0.0	17.8	0.0	23.2	0.0	26.1	13.1	9.5	11.3	11.3
Cycle Q Clear(g_c), s	0.0	0.0	0.0	17.8	0.0	23.2	0.0	26.1	13.1	9.5	11.3	11.3
Prop In Lane	0.00		0.00	1.00		1.00	0.00		1.00	1.00		0.01
Lane Grp Cap(c), veh/h	0	583	0	1266	0	496	0	1305	584	338	976	1026
V/C Ratio(X)	0.00	0.00	0.00	0.61	0.00	0.86	0.00	0.87	0.55	0.88	0.39	0.39
Avail Cap(c_a), veh/h	0	736	0	1557	0	625	0	1305	584	436	976	1026
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.33	1.33	1.00	1.00	1.00
Upstream Filter(I)	0.00	0.00	0.00	1.00	0.00	1.00	0.00	0.83	0.83	1.00	1.00	1.00
Uniform Delay (d), s/veh	0.0	0.0	0.0	27.9	0.0	29.8	0.0	21.5	18.2	20.8	11.8	11.8
Incr Delay (d2), s/veh	0.0	0.0	0.0	0.5	0.0	9.3	0.0	6.7	3.1	15.9	1.2	1.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	0.0	0.0	8.7	0.0	11.4	0.0	13.7	6.2	8.9	5.8	6.1
LnGrp Delay(d),s/veh	0.0	0.0	0.0	28.4	0.0	39.1	0.0	28.2	21.3	36.7	13.0	12.9
LnGrp LOS				C		D		C	C	D	B	B
Approach Vol, veh/h		0			1200			1451			1076	
Approach Delay, s/veh		0.0			32.2			26.7			19.6	
Approach LOS					C			C			B	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2		4		6		8				
Phs Duration (G+Y+Rc), s	16.9	47.7		35.4		64.6		35.4				
Change Period (Y+Rc), s	5.0	6.0		6.5		6.0		6.5				
Max Green Setting (Gmax), s	17.0	29.0		36.5		51.0		36.5				
Max Q Clear Time (g_c+I1), s	11.5	28.1		0.0		13.3		25.2				
Green Ext Time (p_c), s	0.4	0.8		0.0		21.6		3.7				
Intersection Summary												
HCM 2010 Ctrl Delay				26.4								
HCM 2010 LOS				C								
Notes												
User approved volume balancing among the lanes for turning movement.												

HCM 2010 Signalized Intersection Summary
6: Townsend Ave & Oak Grove Rd

Future RIRO with Connector
AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	25	45	130	125	115	145	140	1100	60	60	1210	45
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1863	1863	1863	1863	1863	1863	1863	1863	1863	1863	1863
Adj Flow Rate, veh/h	27	49	141	136	125	158	152	1196	65	65	1315	49
Adj No. of Lanes	0	1	1	1	1	1	1	2	1	1	2	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	158	256	360	303	424	360	363	1704	762	283	1630	729
Arrive On Green	0.23	0.23	0.23	0.23	0.23	0.23	0.07	0.48	0.48	0.10	0.92	0.92
Sat Flow, veh/h	400	1124	1583	1188	1863	1583	1774	3539	1583	1774	3539	1583
Grp Volume(v), veh/h	76	0	141	136	125	158	152	1196	65	65	1315	49
Grp Sat Flow(s),veh/h/ln	1523	0	1583	1188	1863	1583	1774	1770	1583	1774	1770	1583
Q Serve(g_s), s	0.0	0.0	5.5	7.8	4.0	6.2	3.2	19.2	1.6	1.3	8.3	0.2
Cycle Q Clear(g_c), s	4.1	0.0	5.5	11.8	4.0	6.2	3.2	19.2	1.6	1.3	8.3	0.2
Prop In Lane	0.36		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	414	0	360	303	424	360	363	1704	762	283	1630	729
V/C Ratio(X)	0.18	0.00	0.39	0.45	0.30	0.44	0.42	0.70	0.09	0.23	0.81	0.07
Avail Cap(c_a), veh/h	802	0	773	613	910	773	578	1704	762	487	1630	729
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00	2.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.81	0.81	0.81
Uniform Delay (d), s/veh	22.6	0.0	23.8	28.2	23.3	24.1	9.5	14.8	10.2	10.9	1.9	1.6
Incr Delay (d2), s/veh	0.2	0.0	0.7	1.0	0.4	0.8	0.8	2.4	0.2	0.3	3.6	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.2	0.0	2.5	2.6	2.1	2.8	1.6	9.9	0.8	0.7	3.6	0.1
LnGrp Delay(d),s/veh	22.8	0.0	24.5	29.2	23.6	24.9	10.3	17.2	10.4	11.3	5.5	1.7
LnGrp LOS	C		C	C	C	C	B	B	B	B	A	A
Approach Vol, veh/h		217			419			1413			1429	
Approach Delay, s/veh		23.9			25.9			16.1			5.6	
Approach LOS		C			C			B			A	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	8.7	68.3		23.0	10.2	66.8		23.0				
Change Period (Y+Rc), s	5.0	6.0		6.5	5.0	6.0		6.5				
Max Green Setting (Gmax), s	12.0	35.0		35.5	14.0	33.0		35.5				
Max Q Clear Time (g_c+I1), s	3.3	21.2		7.5	5.2	10.3		13.8				
Green Ext Time (p_c), s	0.1	12.2		2.8	0.2	18.9		2.7				
Intersection Summary												
HCM 2010 Ctrl Delay			13.5									
HCM 2010 LOS			B									

Intersection

Int Delay, s/veh 4.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR
Vol, veh/h	0	0	20	0	0	360	0	950	5
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None
Storage Length	-	-	0	-	-	0	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	0	22	0	0	391	0	1033	5

Major/Minor	Minor2			Minor1			Major1		
Conflicting Flow All	2079	2601	791	1807	2617	519	1582	0	0
Stage 1	1563	1563	-	1035	1035	-	-	-	-
Stage 2	516	1038	-	772	1582	-	-	-	-
Critical Hdwy	7.54	6.54	6.94	7.54	6.54	6.94	4.14	-	-
Critical Hdwy Stg 1	6.54	5.54	-	6.54	5.54	-	-	-	-
Critical Hdwy Stg 2	6.54	5.54	-	6.54	5.54	-	-	-	-
Follow-up Hdwy	3.52	4.02	3.32	3.52	4.02	3.32	2.22	-	-
Pot Cap-1 Maneuver	31	24	332	50	24	502	412	-	-
Stage 1	117	171	-	248	307	-	-	-	-
Stage 2	510	306	-	358	167	-	-	-	-
Platoon blocked, %									
Mov Cap-1 Maneuver	7	24	332	47	24	502	412	-	-
Mov Cap-2 Maneuver	7	24	-	47	24	-	-	-	-
Stage 1	117	171	-	248	307	-	-	-	-
Stage 2	112	306	-	335	167	-	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	16.6	33.1	0
HCM LOS	C	D	

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	412	-	-	332	502	665	-	-
HCM Lane V/C Ratio	-	-	-	0.065	0.779	-	-	-
HCM Control Delay (s)	0	-	-	16.6	33.1	0	-	-
HCM Lane LOS	A	-	-	C	D	A	-	-
HCM 95th %tile Q(veh)	0	-	-	0.2	7	0	-	-

Intersection

Int Delay, s/veh

Movement	SBL	SBT	SBR
Vol, veh/h	0	1420	35
Conflicting Peds, #/hr	0	0	0
Sign Control	Free	Free	Free
RT Channelized	-	-	None
Storage Length	-	-	-
Veh in Median Storage, #	-	0	-
Grade, %	-	0	-
Peak Hour Factor	92	92	92
Heavy Vehicles, %	2	2	2
Mvmt Flow	0	1543	38

Major/Minor Major2

Conflicting Flow All	1038	0	0
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	4.14	-	-
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	2.22	-	-
Pot Cap-1 Maneuver	665	-	-
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %		-	-
Mov Cap-1 Maneuver	665	-	-
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach SB

HCM Control Delay, s 0
 HCM LOS

Minor Lane/Major Mvmt

Intersection	
Int Delay, s/veh	1.6

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Vol, veh/h	525	25	35	1025	30	20
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	150	150	-	250	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	571	27	38	1114	33	22

Major/Minor	Major1	Major2	Minor1
Conflicting Flow All	0	0	571
Stage 1	-	-	571
Stage 2	-	-	1190
Critical Hdwy	-	-	4.12
Critical Hdwy Stg 1	-	-	5.42
Critical Hdwy Stg 2	-	-	5.42
Follow-up Hdwy	-	-	2.218
Pot Cap-1 Maneuver	-	-	1002
Stage 1	-	-	565
Stage 2	-	-	289
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	-	-	1002
Mov Cap-2 Maneuver	-	-	89
Stage 1	-	-	565
Stage 2	-	-	278

Approach	EB	WB	NB
HCM Control Delay, s	0	0.3	45.2
HCM LOS			E

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	89	520	-	-	1002	-
HCM Lane V/C Ratio	0.366	0.042	-	-	0.038	-
HCM Control Delay (s)	67.2	12.2	-	-	8.7	-
HCM Lane LOS	F	B	-	-	A	-
HCM 95th %tile Q(veh)	1.4	0.1	-	-	0.1	-

Intersection

Int Delay, s/veh 1

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Vol, veh/h	15	130	335	15	10	25
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	150	-	-	-	150	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	16	141	364	16	11	27






















Major/Minor	Major1	Major2	Minor2
Conflicting Flow All	380	0	546
Stage 1	-	-	372
Stage 2	-	-	174
Critical Hdwy	4.12	-	6.42
Critical Hdwy Stg 1	-	-	5.42
Critical Hdwy Stg 2	-	-	5.42
Follow-up Hdwy	2.218	-	3.518
Pot Cap-1 Maneuver	1178	-	499
Stage 1	-	-	697
Stage 2	-	-	856
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	1178	-	492
Mov Cap-2 Maneuver	-	-	492
Stage 1	-	-	697
Stage 2	-	-	844

Approach	EB	WB	SB
HCM Control Delay, s	0.8	0	11.1
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	1178	-	-	-	492	674
HCM Lane V/C Ratio	0.014	-	-	-	0.022	0.04
HCM Control Delay (s)	8.1	-	-	-	12.5	10.6
HCM Lane LOS	A	-	-	-	B	B
HCM 95th %tile Q(veh)	0	-	-	-	0.1	0.1
























HCM 2010 Signalized Intersection Summary
3: Townsend Ave & Niagara Rd

Future RIRO with Connector
PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	0	480	5	280	0	1170	655	385	795	10
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1863	1900	1863	1863	1863	0	1863	1863	1863	1863	1900
Adj Flow Rate, veh/h	0	0	0	526	0	304	0	1272	712	418	864	11
Adj No. of Lanes	0	1	0	2	0	1	0	2	1	1	2	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	0	2	2	2	2	2
Cap, veh/h	0	433	0	983	0	368	0	1368	612	424	2253	29
Arrive On Green	0.00	0.00	0.00	0.23	0.00	0.23	0.00	0.51	0.51	0.19	0.63	0.63
Sat Flow, veh/h	0	1863	0	3548	0	1583	0	3632	1583	1774	3579	46
Grp Volume(v), veh/h	0	0	0	526	0	304	0	1272	712	418	427	448
Grp Sat Flow(s),veh/h/ln	0	1863	0	1774	0	1583	0	1770	1583	1774	1770	1855
Q Serve(g_s), s	0.0	0.0	0.0	12.1	0.0	16.5	0.0	30.3	35.0	16.6	10.7	10.7
Cycle Q Clear(g_c), s	0.0	0.0	0.0	12.1	0.0	16.5	0.0	30.3	35.0	16.6	10.7	10.7
Prop In Lane	0.00		0.00	1.00		1.00	0.00		1.00	1.00		0.02
Lane Grp Cap(c), veh/h	0	433	0	983	0	368	0	1368	612	424	1114	1168
V/C Ratio(X)	0.00	0.00	0.00	0.54	0.00	0.83	0.00	0.93	1.16	0.99	0.38	0.38
Avail Cap(c_a), veh/h	0	628	0	1355	0	533	0	1368	612	424	1114	1168
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.33	1.33	1.00	1.00	1.00
Upstream Filter(I)	0.00	0.00	0.00	1.00	0.00	1.00	0.00	0.57	0.57	1.00	1.00	1.00
Uniform Delay (d), s/veh	0.0	0.0	0.0	31.3	0.0	33.0	0.0	20.8	22.0	26.8	8.2	8.2
Incr Delay (d2), s/veh	0.0	0.0	0.0	0.5	0.0	7.0	0.0	7.9	83.8	39.8	1.0	1.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	0.0	0.0	6.0	0.0	7.9	0.0	16.2	29.3	15.0	5.4	5.7
LnGrp Delay(d),s/veh	0.0	0.0	0.0	31.8	0.0	40.0	0.0	28.7	105.8	66.6	9.2	9.1
LnGrp LOS				C		D		C	F	E	A	A
Approach Vol, veh/h		0			830			1984			1293	
Approach Delay, s/veh		0.0			34.8			56.4			27.7	
Approach LOS					C			E			C	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2		4		6		8				
Phs Duration (G+Y+Rc), s	22.0	50.5		27.5		72.5		27.5				
Change Period (Y+Rc), s	5.0	6.0		6.5		6.0		6.5				
Max Green Setting (Gmax), s	17.0	35.0		30.5		57.0		30.5				
Max Q Clear Time (g_c+I1), s	18.6	37.0		0.0		12.7		18.5				
Green Ext Time (p_c), s	0.0	0.0		0.0		31.1		2.5				
Intersection Summary												
HCM 2010 Ctrl Delay				43.0								
HCM 2010 LOS				D								
Notes												
User approved volume balancing among the lanes for turning movement.												

HCM 2010 Signalized Intersection Summary
6: Townsend Ave & Oak Grove Rd

Future RIRO with Connector
PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	60	140	210	100	75	105	155	1495	165	160	1275	55
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1863	1863	1863	1863	1863	1863	1863	1863	1863	1863	1863
Adj Flow Rate, veh/h	65	152	228	109	82	114	168	1625	179	174	1386	60
Adj No. of Lanes	0	1	1	1	1	1	1	2	1	1	2	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	165	353	437	269	515	437	395	1730	774	245	1739	778
Arrive On Green	0.28	0.28	0.28	0.28	0.28	0.28	0.07	0.49	0.49	0.15	0.98	0.98
Sat Flow, veh/h	372	1276	1583	999	1863	1583	1774	3539	1583	1774	3539	1583
Grp Volume(v), veh/h	217	0	228	109	82	114	168	1625	179	174	1386	60
Grp Sat Flow(s),veh/h/ln	1648	0	1583	999	1863	1583	1774	1770	1583	1774	1770	1583
Q Serve(g_s), s	3.2	0.0	9.2	7.7	2.5	4.3	3.5	32.9	4.9	3.7	2.4	0.1
Cycle Q Clear(g_c), s	7.8	0.0	9.2	15.4	2.5	4.3	3.5	32.9	4.9	3.7	2.4	0.1
Prop In Lane	0.30		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	517	0	437	269	515	437	395	1730	774	245	1739	778
V/C Ratio(X)	0.42	0.00	0.52	0.41	0.16	0.26	0.43	0.94	0.23	0.71	0.80	0.08
Avail Cap(c_a), veh/h	876	0	795	494	935	795	616	1730	774	414	1739	778
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00	2.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.87	0.87	0.87
Uniform Delay (d), s/veh	22.5	0.0	23.2	29.0	20.7	21.4	8.1	18.3	11.2	15.4	0.4	0.3
Incr Delay (d2), s/veh	0.5	0.0	1.0	1.0	0.1	0.3	0.7	11.4	0.7	3.3	3.4	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.8	0.0	4.2	2.2	1.3	1.9	1.7	18.5	2.3	1.9	1.2	0.1
LnGrp Delay(d),s/veh	23.1	0.0	24.1	30.0	20.9	21.7	8.8	29.7	11.9	18.7	3.8	0.5
LnGrp LOS	C		C	C	C	C	A	C	B	B	A	A
Approach Vol, veh/h		445			305			1972			1620	
Approach Delay, s/veh		23.6			24.4			26.3			5.2	
Approach LOS		C			C			C			A	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	9.8	65.3		24.9	9.6	65.5		24.9				
Change Period (Y+Rc), s	4.0	4.0		4.0	4.0	4.0		4.0				
Max Green Setting (Gmax), s	13.0	37.0		38.0	15.0	35.0		38.0				
Max Q Clear Time (g_c+I1), s	5.7	34.9		11.2	5.5	4.4		17.4				
Green Ext Time (p_c), s	0.3	2.1		3.7	0.3	27.6		3.5				
Intersection Summary												
HCM 2010 Ctrl Delay			18.0									
HCM 2010 LOS			B									

Intersection										
Int Delay, s/veh	20									

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR
Vol, veh/h	0	0	45	0	0	390	0	1445	5
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None
Storage Length	-	-	0	-	-	0	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	0	49	0	0	424	0	1571	5

Major/Minor	Minor2			Minor1			Major1		
Conflicting Flow All	2502	3293	861	2429	3296	788	1723	0	0
Stage 1	1717	1717	-	1573	1573	-	-	-	-
Stage 2	785	1576	-	856	1723	-	-	-	-
Critical Hdwy	7.54	6.54	6.94	7.54	6.54	6.94	4.14	-	-
Critical Hdwy Stg 1	6.54	5.54	-	6.54	5.54	-	-	-	-
Critical Hdwy Stg 2	6.54	5.54	-	6.54	5.54	-	-	-	-
Follow-up Hdwy	3.52	4.02	3.32	3.52	4.02	3.32	2.22	-	-
Pot Cap-1 Maneuver	15	9	299	17	8	~ 334	363	-	-
Stage 1	93	143	-	115	169	-	-	-	-
Stage 2	352	168	-	319	142	-	-	-	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	-	9	299	14	8	~ 334	363	-	-
Mov Cap-2 Maneuver	-	9	-	14	8	-	-	-	-
Stage 1	93	143	-	115	169	-	-	-	-
Stage 2	-	168	-	267	142	-	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	19.4	175.5	0
HCM LOS	C	F	

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	363	-	-	299	334	414	-	-
HCM Lane V/C Ratio	-	-	-	0.164	1.269	-	-	-
HCM Control Delay (s)	0	-	-	19.4	175.5	0	-	-
HCM Lane LOS	A	-	-	C	F	A	-	-
HCM 95th %tile Q(veh)	0	-	-	0.6	19.4	0	-	-

Notes
 ~: Volume exceeds capacity \$: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

Intersection

Int Delay, s/veh

Movement	SBL	SBT	SBR
Vol, veh/h	0	1575	10
Conflicting Peds, #/hr	0	0	0
Sign Control	Free	Free	Free
RT Channelized	-	-	None
Storage Length	-	-	-
Veh in Median Storage, #	-	0	-
Grade, %	-	0	-
Peak Hour Factor	92	92	92
Heavy Vehicles, %	2	2	2
Mvmt Flow	0	1712	11

Major/Minor Major2

Conflicting Flow All	1576	0	0
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	4.14	-	-
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	2.22	-	-
Pot Cap-1 Maneuver	414	-	-
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %		-	-
Mov Cap-1 Maneuver	414	-	-
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach SB

HCM Control Delay, s	0
HCM LOS	

Minor Lane/Major Mvmt

Intersection	
Int Delay, s/veh	4.9

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Vol, veh/h	930	70	55	685	50	70
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	150	150	-	250	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	1011	76	60	745	54	76

Major/Minor	Major1	Major2	Minor1
Conflicting Flow All	0	0	1011
Stage 1	-	-	1011
Stage 2	-	-	864
Critical Hdwy	-	-	4.12
Critical Hdwy Stg 1	-	-	5.42
Critical Hdwy Stg 2	-	-	5.42
Follow-up Hdwy	-	-	2.218
Pot Cap-1 Maneuver	-	-	686
Stage 1	-	-	352
Stage 2	-	-	413
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	-	-	686
Mov Cap-2 Maneuver	-	-	72
Stage 1	-	-	72
Stage 2	-	-	352
Stage 2	-	-	377

Approach	EB	WB	NB
HCM Control Delay, s	0	0.8	71.6
HCM LOS			F

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	72	291	-	-	686	-
HCM Lane V/C Ratio	0.755	0.261	-	-	0.087	-
HCM Control Delay (s)	141.4	21.7	-	-	10.7	-
HCM Lane LOS	F	C	-	-	B	-
HCM 95th %tile Q(veh)	3.5	1	-	-	0.3	-

Intersection	
Int Delay, s/veh	1.4

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Vol, veh/h	25	415	240	10	35	30
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	150	-	-	-	150	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	27	451	261	11	38	33

Major/Minor	Major1	Major2	Minor2
Conflicting Flow All	272	0	771
Stage 1	-	-	266
Stage 2	-	-	505
Critical Hdwy	4.12	-	6.42
Critical Hdwy Stg 1	-	-	5.42
Critical Hdwy Stg 2	-	-	5.42
Follow-up Hdwy	2.218	-	3.518
Pot Cap-1 Maneuver	1291	-	368
Stage 1	-	-	779
Stage 2	-	-	606
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	1291	-	360
Mov Cap-2 Maneuver	-	-	360
Stage 1	-	-	779
Stage 2	-	-	593

Approach	EB	WB	SB
HCM Control Delay, s	0.4	0	13.3
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	1291	-	-	-	360	773
HCM Lane V/C Ratio	0.021	-	-	-	0.106	0.042
HCM Control Delay (s)	7.8	-	-	-	16.2	9.9
HCM Lane LOS	A	-	-	-	C	A
HCM 95th %tile Q(veh)	0.1	-	-	-	0.4	0.1

Intersection	
Int Delay, s/veh	14.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR
Vol, veh/h	20	135	140	15	355	5	290	5	25
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None
Storage Length	50	-	100	150	-	-	50	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2
Mvmt Flow	22	147	152	16	386	5	315	5	27

Major/Minor	Major1	Major2	Minor1						
Conflicting Flow All	391	0	0	147	0	0	622	614	147
Stage 1	-	-	-	-	-	-	190	190	-
Stage 2	-	-	-	-	-	-	432	424	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318
Pot Cap-1 Maneuver	1168	-	-	1435	-	-	399	407	900
Stage 1	-	-	-	-	-	-	812	743	-
Stage 2	-	-	-	-	-	-	602	587	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	1168	-	-	1435	-	-	376	395	900
Mov Cap-2 Maneuver	-	-	-	-	-	-	376	395	-
Stage 1	-	-	-	-	-	-	797	729	-
Stage 2	-	-	-	-	-	-	575	580	-

Approach	EB	WB	NB
HCM Control Delay, s	0.6	0.3	44.9
HCM LOS			E

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	376	742	1168	-	-	1435	-	-	370	566
HCM Lane V/C Ratio	0.838	0.044	0.019	-	-	0.011	-	-	0.015	0.038
HCM Control Delay (s)	48.5	10.1	8.1	-	-	7.5	-	-	14.9	11.6
HCM Lane LOS	E	B	A	-	-	A	-	-	B	B
HCM 95th %tile Q(veh)	7.7	0.1	0.1	-	-	0	-	-	0	0.1

Intersection

Int Delay, s/veh

Movement	SBL	SBT	SBR
Vol, veh/h	5	5	15
Conflicting Peds, #/hr	0	0	0
Sign Control	Stop	Stop	Stop
RT Channelized	-	-	None
Storage Length	0	-	-
Veh in Median Storage, #	-	0	-
Grade, %	-	0	-
Peak Hour Factor	92	92	92
Heavy Vehicles, %	2	2	2
Mvmt Flow	5	5	16

Major/Minor

	Minor2		
Conflicting Flow All	628	611	389
Stage 1	421	421	-
Stage 2	207	190	-
Critical Hdwy	7.12	6.52	6.22
Critical Hdwy Stg 1	6.12	5.52	-
Critical Hdwy Stg 2	6.12	5.52	-
Follow-up Hdwy	3.518	4.018	3.318
Pot Cap-1 Maneuver	395	409	659
Stage 1	610	589	-
Stage 2	795	743	-
Platoon blocked, %			
Mov Cap-1 Maneuver	370	397	659
Mov Cap-2 Maneuver	370	397	-
Stage 1	599	582	-
Stage 2	751	729	-

Approach

	SB
HCM Control Delay, s	12.3
HCM LOS	B

Minor Lane/Major Mvmt
























HCM 2010 Signalized Intersection Summary
3: Townsend Ave & Niagara Rd

Future Realignment 1 with Connector
PM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	0	480	5	285	0	1170	650	390	790	10
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1863	1900	1863	1863	1863	0	1863	1863	1863	1863	1900
Adj Flow Rate, veh/h	0	0	0	526	0	310	0	1272	707	424	859	11
Adj No. of Lanes	0	1	0	2	0	1	0	2	1	1	2	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	0	2	2	2	2	2
Cap, veh/h	0	444	0	1008	0	377	0	1318	590	427	2221	28
Arrive On Green	0.00	0.00	0.00	0.24	0.00	0.24	0.00	0.50	0.50	0.19	0.62	0.62
Sat Flow, veh/h	0	1863	0	3548	0	1583	0	3632	1583	1774	3578	46
Grp Volume(v), veh/h	0	0	0	526	0	310	0	1272	707	424	425	445
Grp Sat Flow(s),veh/h/ln	0	1863	0	1774	0	1583	0	1770	1583	1774	1770	1855
Q Serve(g_s), s	0.0	0.0	0.0	11.7	0.0	16.4	0.0	30.8	33.0	16.8	10.6	10.6
Cycle Q Clear(g_c), s	0.0	0.0	0.0	11.7	0.0	16.4	0.0	30.8	33.0	16.8	10.6	10.6
Prop In Lane	0.00		0.00	1.00		1.00	0.00		1.00	1.00		0.02
Lane Grp Cap(c), veh/h	0	444	0	1008	0	377	0	1318	590	427	1098	1151
V/C Ratio(X)	0.00	0.00	0.00	0.52	0.00	0.82	0.00	0.97	1.20	0.99	0.39	0.39
Avail Cap(c_a), veh/h	0	683	0	1464	0	581	0	1318	590	427	1098	1151
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.33	1.33	1.00	1.00	1.00
Upstream Filter(I)	0.00	0.00	0.00	1.00	0.00	1.00	0.00	0.27	0.27	1.00	1.00	1.00
Uniform Delay (d), s/veh	0.0	0.0	0.0	30.2	0.0	32.0	0.0	21.8	22.4	26.5	8.4	8.4
Incr Delay (d2), s/veh	0.0	0.0	0.0	0.4	0.0	5.5	0.0	7.0	94.3	41.6	1.0	1.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	0.0	0.0	5.8	0.0	7.8	0.0	16.1	29.6	15.2	5.5	5.8
LnGrp Delay(d),s/veh	0.0	0.0	0.0	30.6	0.0	37.5	0.0	28.8	116.6	68.1	9.4	9.4
LnGrp LOS				C		D		C	F	E	A	A
Approach Vol, veh/h		0			836			1979			1294	
Approach Delay, s/veh		0.0			33.2			60.2			28.6	
Approach LOS					C			E			C	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2		4		6		8				
Phs Duration (G+Y+Rc), s	22.0	50.4		27.6		72.4		27.6				
Change Period (Y+Rc), s	5.0	6.0		6.5		6.0		6.5				
Max Green Setting (Gmax), s	17.0	33.0		32.5		55.0		32.5				
Max Q Clear Time (g_c+I1), s	18.8	35.0		0.0		12.6		18.4				
Green Ext Time (p_c), s	0.0	0.0		0.0		30.0		2.7				
Intersection Summary												
HCM 2010 Ctrl Delay				44.7								
HCM 2010 LOS				D								
Notes												
User approved volume balancing among the lanes for turning movement.												

HCM 2010 Signalized Intersection Summary
6: Townsend Ave & Oak Grove Rd

Future Realignment 1 with Connector
PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	55	140	205	95	75	415	150	1165	160	435	985	55
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1863	1863	1863	1863	1863	1863	1863	1863	1863	1863	1863
Adj Flow Rate, veh/h	60	152	223	103	82	451	163	1266	174	473	1071	60
Adj No. of Lanes	0	1	1	1	1	1	1	2	1	1	2	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	160	380	523	311	616	523	411	1414	633	351	1641	734
Arrive On Green	0.33	0.33	0.33	0.33	0.33	0.33	0.08	0.40	0.40	0.28	0.93	0.93
Sat Flow, veh/h	333	1149	1583	1003	1863	1583	1774	3539	1583	1774	3539	1583
Grp Volume(v), veh/h	212	0	223	103	82	451	163	1266	174	473	1071	60
Grp Sat Flow(s),veh/h/ln	1481	0	1583	1003	1863	1583	1774	1770	1583	1774	1770	1583
Q Serve(g_s), s	4.0	0.0	10.2	8.1	2.9	24.7	4.9	31.0	6.9	13.0	5.2	0.3
Cycle Q Clear(g_c), s	9.1	0.0	10.2	17.2	2.9	24.7	4.9	31.0	6.9	13.0	5.2	0.3
Prop In Lane	0.28		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	540	0	523	311	616	523	411	1414	633	351	1641	734
V/C Ratio(X)	0.39	0.00	0.43	0.33	0.13	0.86	0.40	0.90	0.28	1.35	0.65	0.08
Avail Cap(c_a), veh/h	652	0	650	391	764	650	563	1414	633	351	1641	734
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00	2.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.87	0.87	0.87
Uniform Delay (d), s/veh	23.6	0.0	24.2	30.4	21.7	29.0	14.0	26.0	18.8	19.4	2.0	1.8
Incr Delay (d2), s/veh	0.5	0.0	0.6	0.6	0.1	9.7	0.6	9.1	1.1	172.6	1.8	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.2	0.0	4.5	2.3	1.5	12.2	2.4	16.9	3.2	25.5	2.4	0.1
LnGrp Delay(d),s/veh	24.0	0.0	24.7	31.0	21.8	38.7	14.6	35.1	19.8	192.0	3.8	2.0
LnGrp LOS	C		C	C	C	D	B	D	B	F	A	A
Approach Vol, veh/h		435			636			1603			1604	
Approach Delay, s/veh		24.4			35.3			31.4			59.2	
Approach LOS		C			D			C			E	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	17.0	48.4		34.6	11.1	54.3		34.6				
Change Period (Y+Rc), s	4.0	4.0		4.0	4.0	4.0		4.0				
Max Green Setting (Gmax), s	13.0	37.0		38.0	15.0	35.0		38.0				
Max Q Clear Time (g_c+I1), s	15.0	33.0		12.2	6.9	7.2		26.7				
Green Ext Time (p_c), s	0.0	3.8		5.3	0.3	21.6		3.9				
Intersection Summary												
HCM 2010 Ctrl Delay			41.7									
HCM 2010 LOS			D									

Intersection	
Int Delay, s/veh	1.8

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Vol, veh/h	40	415	240	10	40	40
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	150	-	-	-	150	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	43	451	261	11	43	43

Major/Minor	Major1	Major2	Minor2
Conflicting Flow All	272	0	804
Stage 1	-	-	266
Stage 2	-	-	538
Critical Hdwy	4.12	-	6.42
Critical Hdwy Stg 1	-	-	5.42
Critical Hdwy Stg 2	-	-	5.42
Follow-up Hdwy	2.218	-	3.518
Pot Cap-1 Maneuver	1291	-	352
Stage 1	-	-	779
Stage 2	-	-	585
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	1291	-	340
Mov Cap-2 Maneuver	-	-	340
Stage 1	-	-	779
Stage 2	-	-	566

Approach	EB	WB	SB
HCM Control Delay, s	0.7	0	13.5
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	1291	-	-	-	340	773
HCM Lane V/C Ratio	0.034	-	-	-	0.128	0.056
HCM Control Delay (s)	7.9	-	-	-	17.1	9.9
HCM Lane LOS	A	-	-	-	C	A
HCM 95th %tile Q(veh)	0.1	-	-	-	0.4	0.2

Intersection	
Int Delay, s/veh	6.1

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Vol, veh/h	930	75	60	680	55	80
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	150	150	-	250	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	1011	82	65	739	60	87

Major/Minor	Major1	Major2	Minor1
Conflicting Flow All	0	0	1881
Stage 1	-	-	1011
Stage 2	-	-	870
Critical Hdwy	-	4.12	6.42
Critical Hdwy Stg 1	-	-	5.42
Critical Hdwy Stg 2	-	-	5.42
Follow-up Hdwy	-	2.218	3.518
Pot Cap-1 Maneuver	-	686	78
Stage 1	-	-	352
Stage 2	-	-	410
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	-	686	71
Mov Cap-2 Maneuver	-	-	71
Stage 1	-	-	352
Stage 2	-	-	371

Approach	EB	WB	NB
HCM Control Delay, s	0	0.9	79.9
HCM LOS			F

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	71	291	-	-	686	-
HCM Lane V/C Ratio	0.842	0.299	-	-	0.095	-
HCM Control Delay (s)	163.2	22.6	-	-	10.8	-
HCM Lane LOS	F	C	-	-	B	-
HCM 95th %tile Q(veh)	4.1	1.2	-	-	0.3	-

Intersection									
Int Delay, s/veh	54								

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR
Vol, veh/h	45	400	280	25	240	20	310	5	45
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None
Storage Length	50	-	100	150	-	-	50	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2
Mvmt Flow	49	435	304	27	261	22	337	5	49

Major/Minor	Major1			Major2			Minor1		
Conflicting Flow All	283	0	0	435	0	0	878	870	435
Stage 1	-	-	-	-	-	-	533	533	-
Stage 2	-	-	-	-	-	-	345	337	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318
Pot Cap-1 Maneuver	1279	-	-	1125	-	-	~ 268	290	621
Stage 1	-	-	-	-	-	-	531	525	-
Stage 2	-	-	-	-	-	-	671	641	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	1279	-	-	1125	-	-	~ 241	272	621
Mov Cap-2 Maneuver	-	-	-	-	-	-	~ 241	272	-
Stage 1	-	-	-	-	-	-	511	505	-
Stage 2	-	-	-	-	-	-	622	626	-

Approach	EB	WB	NB
HCM Control Delay, s	0.5	0.7	209.7
HCM LOS			F

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	241	550	1279	-	-	1125	-	-	229	612
HCM Lane V/C Ratio	1.398	0.099	0.038	-	-	0.024	-	-	0.095	0.062
HCM Control Delay (s)	241.5	12.3	7.9	-	-	8.3	-	-	22.4	11.3
HCM Lane LOS	F	B	A	-	-	A	-	-	C	B
HCM 95th %tile Q(veh)	18.7	0.3	0.1	-	-	0.1	-	-	0.3	0.2

Notes
 ~: Volume exceeds capacity \$: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

Intersection

Int Delay, s/veh

Movement	SBL	SBT	SBR
Vol, veh/h	20	5	30
Conflicting Peds, #/hr	0	0	0
Sign Control	Stop	Stop	Stop
RT Channelized	-	-	None
Storage Length	0	-	-
Veh in Median Storage, #	-	0	-
Grade, %	-	0	-
Peak Hour Factor	92	92	92
Heavy Vehicles, %	2	2	2
Mvmt Flow	22	5	33

Major/Minor

	Minor2		
Conflicting Flow All	886	859	272
Stage 1	326	326	-
Stage 2	560	533	-
Critical Hdwy	7.12	6.52	6.22
Critical Hdwy Stg 1	6.12	5.52	-
Critical Hdwy Stg 2	6.12	5.52	-
Follow-up Hdwy	3.518	4.018	3.318
Pot Cap-1 Maneuver	265	294	767
Stage 1	687	648	-
Stage 2	513	525	-
Platoon blocked, %			
Mov Cap-1 Maneuver	229	276	767
Mov Cap-2 Maneuver	229	276	-
Stage 1	661	632	-
Stage 2	450	505	-













Approach

	SB
HCM Control Delay, s	15.3
HCM LOS	C

Minor Lane/Major Mvmt
























HCM 2010 Signalized Intersection Summary
3: Townsend Ave & Niagara Rd

Future Realignment 2 with Connector
AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕		↕	↕	↕		↕	↕	↕	↕	↕
Volume (veh/h)	0	0	0	710	5	395	0	1040	290	275	710	5
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1863	1900	1863	1863	1863	0	1863	1863	1863	1863	1900
Adj Flow Rate, veh/h	0	0	0	776	0	429	0	1130	315	299	772	5
Adj No. of Lanes	0	1	0	2	0	1	0	2	1	1	2	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	0	2	2	2	2	2
Cap, veh/h	0	566	0	1227	0	481	0	1399	626	336	2045	13
Arrive On Green	0.00	0.00	0.00	0.30	0.00	0.30	0.00	0.53	0.53	0.12	0.57	0.57
Sat Flow, veh/h	0	1863	0	3548	0	1583	0	3632	1583	1774	3605	23
Grp Volume(v), veh/h	0	0	0	776	0	429	0	1130	315	299	379	398
Grp Sat Flow(s),veh/h/ln	0	1863	0	1774	0	1583	0	1770	1583	1774	1770	1859
Q Serve(g_s), s	0.0	0.0	0.0	18.9	0.0	25.1	0.0	25.5	12.4	9.2	11.4	11.4
Cycle Q Clear(g_c), s	0.0	0.0	0.0	18.9	0.0	25.1	0.0	25.5	12.4	9.2	11.4	11.4
Prop In Lane	0.00		0.00	1.00		1.00	0.00		1.00	1.00		0.01
Lane Grp Cap(c), veh/h	0	566	0	1227	0	481	0	1399	626	336	1004	1054
V/C Ratio(X)	0.00	0.00	0.00	0.63	0.00	0.89	0.00	0.81	0.50	0.89	0.38	0.38
Avail Cap(c_a), veh/h	0	624	0	1338	0	531	0	1399	626	434	1004	1054
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.33	1.33	1.00	1.00	1.00
Upstream Filter(I)	0.00	0.00	0.00	1.00	0.00	1.00	0.00	0.78	0.78	1.00	1.00	1.00
Uniform Delay (d), s/veh	0.0	0.0	0.0	30.1	0.0	32.2	0.0	20.0	16.9	20.2	11.6	11.6
Incr Delay (d2), s/veh	0.0	0.0	0.0	0.9	0.0	16.2	0.0	4.0	2.2	16.5	1.1	1.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	0.0	0.0	9.4	0.0	13.1	0.0	13.1	5.7	9.3	5.9	6.2
LnGrp Delay(d),s/veh	0.0	0.0	0.0	30.9	0.0	48.4	0.0	24.0	19.1	36.7	12.6	12.6
LnGrp LOS				C		D		C	B	D	B	B
Approach Vol, veh/h		0			1205			1445			1076	
Approach Delay, s/veh		0.0			37.1			22.9			19.3	
Approach LOS					D			C			B	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2		4		6		8				
Phs Duration (G+Y+Rc), s	16.7	47.4		36.0		64.0		36.0				
Change Period (Y+Rc), s	5.0	6.0		6.5		6.0		6.5				
Max Green Setting (Gmax), s	17.0	33.0		32.5		55.0		32.5				
Max Q Clear Time (g_c+I1), s	11.2	27.5		0.0		13.4		27.1				
Green Ext Time (p_c), s	0.5	4.7		0.0		22.7		2.4				
Intersection Summary												
HCM 2010 Ctrl Delay				26.5								
HCM 2010 LOS				C								
Notes												
User approved volume balancing among the lanes for turning movement.												

HCM 2010 Signalized Intersection Summary
6: Townsend Ave & Oak Grove Rd

Future Realignment 2 with Connector
AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	20	45	125	120	115	435	125	795	55	190	1065	45
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1863	1863	1863	1863	1863	1863	1863	1863	1863	1863	1863
Adj Flow Rate, veh/h	22	49	136	130	125	473	136	864	60	207	1158	49
Adj No. of Lanes	0	1	1	1	1	1	1	2	1	1	2	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	169	352	528	445	621	528	307	1349	604	356	1446	647
Arrive On Green	0.33	0.33	0.33	0.33	0.33	0.33	0.07	0.38	0.38	0.19	0.82	0.82
Sat Flow, veh/h	353	1057	1583	1194	1863	1583	1774	3539	1583	1774	3539	1583
Grp Volume(v), veh/h	71	0	136	130	125	473	136	864	60	207	1158	49
Grp Sat Flow(s),veh/h/ln	1410	0	1583	1194	1863	1583	1774	1770	1583	1774	1770	1583
Q Serve(g_s), s	0.0	0.0	5.8	7.8	4.4	26.1	4.2	18.3	2.2	6.6	15.9	0.6
Cycle Q Clear(g_c), s	2.4	0.0	5.8	10.2	4.4	26.1	4.2	18.3	2.2	6.6	15.9	0.6
Prop In Lane	0.31		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	522	0	528	445	621	528	307	1349	604	356	1446	647
V/C Ratio(X)	0.14	0.00	0.26	0.29	0.20	0.90	0.44	0.64	0.10	0.58	0.80	0.08
Avail Cap(c_a), veh/h	593	0	612	509	720	612	458	1349	604	420	1446	647
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00	2.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.80	0.80	0.80
Uniform Delay (d), s/veh	21.2	0.0	22.3	24.7	21.9	29.1	16.5	23.2	18.3	15.2	6.4	5.0
Incr Delay (d2), s/veh	0.1	0.0	0.3	0.4	0.2	14.5	1.0	2.3	0.3	1.2	3.9	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.3	0.0	2.5	2.6	2.3	13.4	2.1	9.3	1.0	3.2	7.9	0.3
LnGrp Delay(d),s/veh	21.3	0.0	22.6	25.1	22.0	43.5	17.5	25.6	18.6	16.4	10.3	5.2
LnGrp LOS	C		C	C	C	D	B	C	B	B	B	A
Approach Vol, veh/h		207			728			1060			1414	
Approach Delay, s/veh		22.1			36.6			24.2			11.0	
Approach LOS		C			D			C			B	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	13.7	49.2		37.1	11.2	51.7		37.1				
Change Period (Y+Rc), s	5.0	6.0		6.5	5.0	6.0		6.5				
Max Green Setting (Gmax), s	12.0	35.0		35.5	14.0	33.0		35.5				
Max Q Clear Time (g_c+I1), s	8.6	20.3		7.8	6.2	17.9		28.1				
Green Ext Time (p_c), s	0.2	11.4		4.2	0.2	11.7		2.5				
Intersection Summary												
HCM 2010 Ctrl Delay			21.2									
HCM 2010 LOS			C									

Intersection	
Int Delay, s/veh	1.9

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Vol, veh/h	525	25	35	1025	35	25
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	150	150	-	150	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	571	27	38	1114	38	27

Major/Minor	Major1	Major2	Minor1
Conflicting Flow All	0	0	571
Stage 1	-	-	571
Stage 2	-	-	1190
Critical Hdwy	-	-	4.12
Critical Hdwy Stg 1	-	-	5.42
Critical Hdwy Stg 2	-	-	5.42
Follow-up Hdwy	-	-	2.218
Pot Cap-1 Maneuver	-	-	1002
Stage 1	-	-	565
Stage 2	-	-	289
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	-	-	1002
Mov Cap-2 Maneuver	-	-	89
Stage 1	-	-	565
Stage 2	-	-	278

Approach	EB	WB	NB
HCM Control Delay, s	0	0.3	47.6
HCM LOS			E

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	89	520	-	-	1002	-
HCM Lane V/C Ratio	0.427	0.052	-	-	0.038	-
HCM Control Delay (s)	72.8	12.3	-	-	8.7	-
HCM Lane LOS	F	B	-	-	A	-
HCM 95th %tile Q(veh)	1.8	0.2	-	-	0.1	-

Intersection									
Int Delay, s/veh	14.5								

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR
Vol, veh/h	15	135	125	15	340	15	290	15	10
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None
Storage Length	50	-	0	100	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2
Mvmt Flow	16	147	136	16	370	16	315	16	11

Major/Minor	Major1			Major2			Minor1		
Conflicting Flow All	386	0	0	147	0	0	606	597	147
Stage 1	-	-	-	-	-	-	179	179	-
Stage 2	-	-	-	-	-	-	427	418	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318
Pot Cap-1 Maneuver	1172	-	-	1435	-	-	409	416	900
Stage 1	-	-	-	-	-	-	823	751	-
Stage 2	-	-	-	-	-	-	606	591	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	1172	-	-	1435	-	-	381	406	900
Mov Cap-2 Maneuver	-	-	-	-	-	-	381	406	-
Stage 1	-	-	-	-	-	-	812	741	-
Stage 2	-	-	-	-	-	-	570	584	-

Approach	EB	WB	NB
HCM Control Delay, s	0.4	0.3	43.8
HCM LOS	E		

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	381	520	1172	-	-	1435	-	-	386	606
HCM Lane V/C Ratio	0.827	0.052	0.014	-	-	0.011	-	-	0.042	0.054
HCM Control Delay (s)	46.5	12.3	8.1	-	-	7.5	-	-	14.7	11.3
HCM Lane LOS	E	B	A	-	-	A	-	-	B	B
HCM 95th %tile Q(veh)	7.5	0.2	0	-	-	0	-	-	0.1	0.2

Intersection

Int Delay, s/veh

Movement	SBL	SBT	SBR
Vol, veh/h	15	5	25
Conflicting Peds, #/hr	0	0	0
Sign Control	Stop	Stop	Stop
RT Channelized	-	-	None
Storage Length	0	-	-
Veh in Median Storage, #	-	0	-
Grade, %	-	0	-
Peak Hour Factor	92	92	92
Heavy Vehicles, %	2	2	2
Mvmt Flow	16	5	27

Major/Minor

	Minor2		
Conflicting Flow All	603	589	378
Stage 1	410	410	-
Stage 2	193	179	-
Critical Hdwy	7.12	6.52	6.22
Critical Hdwy Stg 1	6.12	5.52	-
Critical Hdwy Stg 2	6.12	5.52	-
Follow-up Hdwy	3.518	4.018	3.318
Pot Cap-1 Maneuver	411	421	669
Stage 1	619	595	-
Stage 2	809	751	-
Platoon blocked, %			
Mov Cap-1 Maneuver	386	411	669
Mov Cap-2 Maneuver	386	411	-
Stage 1	611	588	-
Stage 2	771	741	-

Approach

	SB
HCM Control Delay, s	12.4
HCM LOS	B

Minor Lane/Major Mvmt

Intersection	
Int Delay, s/veh	43.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR
Vol, veh/h	25	410	260	25	230	10	305	25	25
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None
Storage Length	0	-	0	0	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2
Mvmt Flow	27	446	283	27	250	11	332	27	27

Major/Minor	Major1	Major2	Minor1						
Conflicting Flow All	261	0	0	446	0	0	832	815	446
Stage 1	-	-	-	-	-	-	500	500	-
Stage 2	-	-	-	-	-	-	332	315	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318
Pot Cap-1 Maneuver	1303	-	-	1114	-	-	~288	312	612
Stage 1	-	-	-	-	-	-	553	543	-
Stage 2	-	-	-	-	-	-	681	656	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	1303	-	-	1114	-	-	~259	298	612
Mov Cap-2 Maneuver	-	-	-	-	-	-	~259	298	-
Stage 1	-	-	-	-	-	-	542	532	-
Stage 2	-	-	-	-	-	-	626	640	-

Approach	EB	WB	NB
HCM Control Delay, s	0.3	0.8	166.5
HCM LOS			F

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	259	401	1303	-	-	1114	-	-	246	559
HCM Lane V/C Ratio	1.28	0.136	0.021	-	-	0.024	-	-	0.177	0.078
HCM Control Delay (s)	191.3	15.4	7.8	-	-	8.3	-	-	22.8	12
HCM Lane LOS	F	C	A	-	-	A	-	-	C	B
HCM 95th %tile Q(veh)	16.6	0.5	0.1	-	-	0.1	-	-	0.6	0.3

Notes
 ~: Volume exceeds capacity \$: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

Intersection

Int Delay, s/veh

Movement	SBL	SBT	SBR
Vol, veh/h	40	10	30
Conflicting Peds, #/hr	0	0	0
Sign Control	Stop	Stop	Stop
RT Channelized	-	-	None
Storage Length	0	-	-
Veh in Median Storage, #	-	0	-
Grade, %	-	0	-
Peak Hour Factor	92	92	92
Heavy Vehicles, %	2	2	2
Mvmt Flow	43	11	33

Major/Minor

	Minor2		
Conflicting Flow All	837	810	255
Stage 1	310	310	-
Stage 2	527	500	-
Critical Hdwy	7.12	6.52	6.22
Critical Hdwy Stg 1	6.12	5.52	-
Critical Hdwy Stg 2	6.12	5.52	-
Follow-up Hdwy	3.518	4.018	3.318
Pot Cap-1 Maneuver	286	314	784
Stage 1	700	659	-
Stage 2	535	543	-
Platoon blocked, %			
Mov Cap-1 Maneuver	246	300	784
Mov Cap-2 Maneuver	246	300	-
Stage 1	685	643	-
Stage 2	475	532	-

Approach

	SB
HCM Control Delay, s	17.4
HCM LOS	C

Minor Lane/Major Mvmt