Attachment B – Future Conditions Memo

Technical Memo

TO: LCVMPO

FROM: Keller Associates

DATE: 11/22/2013

SUBJECT: Future Conditions - North Clarkston Circulation Study

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Introduction

The purpose of this technical memo is to present the future conditions of the North Clarkston Circulation Study. The memo presents future traffic volumes, level of service, and deficiencies for the years 2020 and 2040 at the following seven intersections:

- 2nd St. & Diagonal St.
- Bridge St. & 5th St.
- Bridge St. & 6th St.
- 5th St. & Walmart/Costco
- Bridge St. & 13th St.
- 13th St. & Fair St.
- Fair St. & 5th St.

Methodology

Operational Methods

The future operational conditions of the non-signalized intersections were evaluated using the Highway Capacity Software (HCS), while the signalized intersections were modeled using the Synchro/SimTraffic software. The signalized intersections were chosen to be modeled with Synchro/SimTraffic due to realistic results and as a check to verify that what was occurring in the field is what was being modeled. The operational analysis evaluated the queue lengths, signal timing, level of service (LOS), and delays for the intersections. Details of the operational analyses for each intersection are presented in **Appendix A**.

Traffic Projections

The process to forecast future traffic conditions was conducted utilizing LCVMPO's QRS II travel demand model, with certain revisions and modifications. The detailed process was as follows:

1. Modify the link geometry of the Calibration and Year 2040 LCVMPO QRS II models to: a) add four-leg intersections at Fair & 15th Streets, Fair & 5th Streets, and Bridge & 5th Streets; and b) add 5th Street from south of Bridge Street to north of Fair Street. *The existing regional models were not originally developed with links for streets functionally classified lower than major collectors.*
2. Modify the C03c Traffic Analysis Zone (TAZ) centroid attributes of the new models to split those attributes east and west of 5th Street.

3. Run the new models to determine directional roadway link Average Daily Traffic (ADT) forecasts, with the new link geometries.
4. Compare the new year 2040 model output to the new Calibration Year model, to obtain annual ADT increment increases (not percentage growth) on each link and in each direction. *This is performed because by their nature, travel demand models are much better at forecasting <u>changes</u> in traffic volumes, than in exactly matching corresponding ground counts.*
5. Obtain expected peak hour percentages of daily traffic ("K" factors) from WSDOT or by estimation; in the study area, these factors range from 10% to 14% of ADT.
6. Using the annual ADT increment increases and the K factors, prepare peak hour link increases for the 2020 PM and 2040 PM Peak Hours.
7. Using the forecast peak hour link increases, use a Furness-method iterative procedure to modify the existing 2013 Turning Movement Counts (TMCs) into 2020 and 2040 peak hour TMC forecasts.

Further detail of the modeling and Furness-method iterative process results is presented in **Appendix B.**

Short-Term and Long-Term Deficiencies

Existing and future deficiencies have been identified for each intersection. The short-term deficiencies are anticipated to occur between 2013 and 2020. The long-term deficiencies will occur between 2020 and 2040. The deficiencies range from operational, signing, striping, and geometric design.

Intersection Analysis

For this analysis we assumed the existing signal timing is not optimized for the 2020 traffic volumes, but is optimized for the 2040 traffic volumes.

Operating Conditions

Table 1 shows the existing and future level of service for each intersection. Out of the seven study area intersections, Bridge St. & 2nd St. was the only intersection operating worse than a LOS C in the year 2040. The majority of intersections LOS did not change in 2020 compared to 2013. The Bridge St. & 2nd St. intersection was the only intersection to have movements operating at a LOS E in the future analysis. Overall, the intersections are not anticipated to be operating much differently in 2040 relative to 2013, based on LOS.

Table 1: Existing and Future Intersection Level of Service, Delay and Critical Movement

Intersection	Type of Control	2013[1]	2020[1]	2040[2]
Bridge St. & 2nd St.	Signalized	Avg. LOS = C Avg. Delay = 34 sec CM = NE L CM LOS = D CM Delay = 54 sec	LOS = D Delay = 36 sec CM = NE L CM LOS = E CM Delay = 56 sec	LOS = D Delay = 43 sec CM = WB L CM LOS = E CM Delay = 70 sec
Bridge St. & 5th St.	Signalized	Avg. LOS = C Avg. Delay = 24 sec CM = WB T/R CM LOS = D CM Delay = 39 sec	LOS = C Delay = 25 sec CM = WB T/R CM LOS = D CM Delay = 40 sec	LOS = C Delay = 28 sec CM =WB T/R CM LOS = D CM Delay = 43 sec
Bridge St. & 6th St.	Two-Way Stop	Avg. LOS = A Avg. Delay = 2 sec CM = NB L CM LOS = C CM Delay = 22 sec	LOS = A Delay = 2 sec CM = NB L CM LOS = C CM Delay = 24 sec	LOS = A Delay = 3 sec CM = NB L CM LOS = D CM Delay = 31 sec
Bridge St. & 13th St.	Signalized	Avg. LOS = B Avg. Delay = 16 sec CM = SB T/R CM LOS = C CM Delay = 37 sec	Not Analyzed based on 2040 results	LOS = B Delay = 14 sec CM = SB T/R CM LOS = C CM Delay = 29 sec
Fair St. & 13th St.	Two-Way Stop	Avg. LOS = B Avg. Delay = 11 sec CM = WB CM LOS = B CM Delay = 12 sec	Not Analyzed based on 2040 results	LOS = B Delay = 11 sec CM = WB CM LOS = B CM Delay = 13 sec
Fair St. & 5th St.	Signalized	Avg. LOS = B Avg. Delay = 14 sec CM = WB R CM LOS = C CM Delay = 32 sec	LOS = B Delay = 14 sec CM = WB R CM LOS = C CM Delay = 32 sec	LOS = B Delay = 14 sec CM = WB R CM LOS = C CM Delay = 25 sec
5th St. & Walmart/Costco	All-Way Stop	Avg. LOS = C Avg. Delay = 17 sec CM = NB CM LOS = C CM Delay = 23 sec	LOS = C Delay = 18 sec CM = NB CM LOS = C CM Delay = 25 sec	LOS = C Delay = 23 sec CM = NB CM LOS = D CM Delay = 35 sec

[1] = 2013 and 2020 signalized analyses assume existing traffic signal timing
[2] = 2040 signalized analyses assume optimized traffic signal timing

Intersection Traffic Volumes

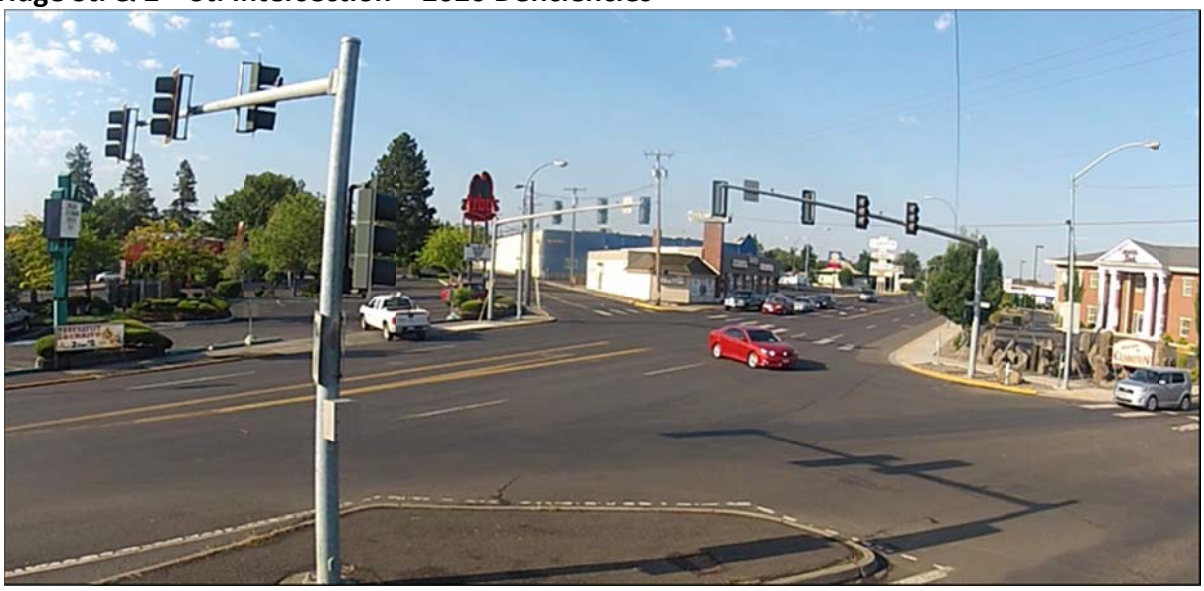
Table 2 shows the existing and future peak hour volumes of vehicles entering the intersections. The peak hour volumes from 2013 are projected to increase by 46 to 396 vehicles for the year 2040. The Bridge St. & 2nd St. intersection is anticipated to have the highest volume of vehicles entering the intersection in 2040 with 2,257 vehicles/hour, an increase of 396 veh/hour. The Fair St. & 13th St. intersection is anticipated to have the smallest change in vehicles from 2013 to 2040. An interesting aspect is that the stop controlled intersections at Bridge St. & 6th St. and 5th St. & Walmart/Costco have approximately the same peak hour traffic volumes as several of the signalized intersections.

Table 2: Existing and Future PM Peak Hour Entering Volumes

Intersection	Type of Control	2013 Peak Hour Volume (veh/hr)	2020 Peak Hour Volume (veh/hr)	2040 Peak Hour Volume (veh/hr)
Bridge St. & 2nd St.	Signalized	1,861	1,902	2,257
Bridge St. & 5th St.	Signalized	1,455	1,516	1,709
Bridge St. & 6th St.	Two-Way Stop	963	1,011	1,160
Bridge St. & 13th St.	Signalized	1,092	1,162	1,357
Fair St. & 13th St.	Two-Way Stop	392	404	434
Fair St. & 5th St.	Signalized	1,037	1,058	1,130
5th St. & Walmart/Costco	Four-Way Stop	1,056	1,077	1,155

Intersection Deficiencies

Bridge St. & 2nd St. Intersection – 2020 Deficiencies



Four movements at the Bridge St. and 2nd St. intersection experienced a LOS of D or possibly LOS E for the future 2020 analysis. The intersection had five movements that experienced queue lengths greater than 100 feet, with westbound Bridge St. and southbound 2nd St. exceeding 300 feet. The eastbound through had the longest queue length of 673 feet and it may be longer, as available storage limited the analysis. Both of these movements had delays greater than 35 seconds and were operating at LOS D. Three movements had delays in excess of 50 seconds. The average delay for the intersection was 36 seconds, which results LOS D for the intersection. Figure 1 shows the LOS and peak hour traffic volume for each movement at the intersection. Table 3 lists the short-term intersection deficiencies.

Figure 1: Bridge St. & 2nd St. Intersection 2020 Peak Hour Volumes

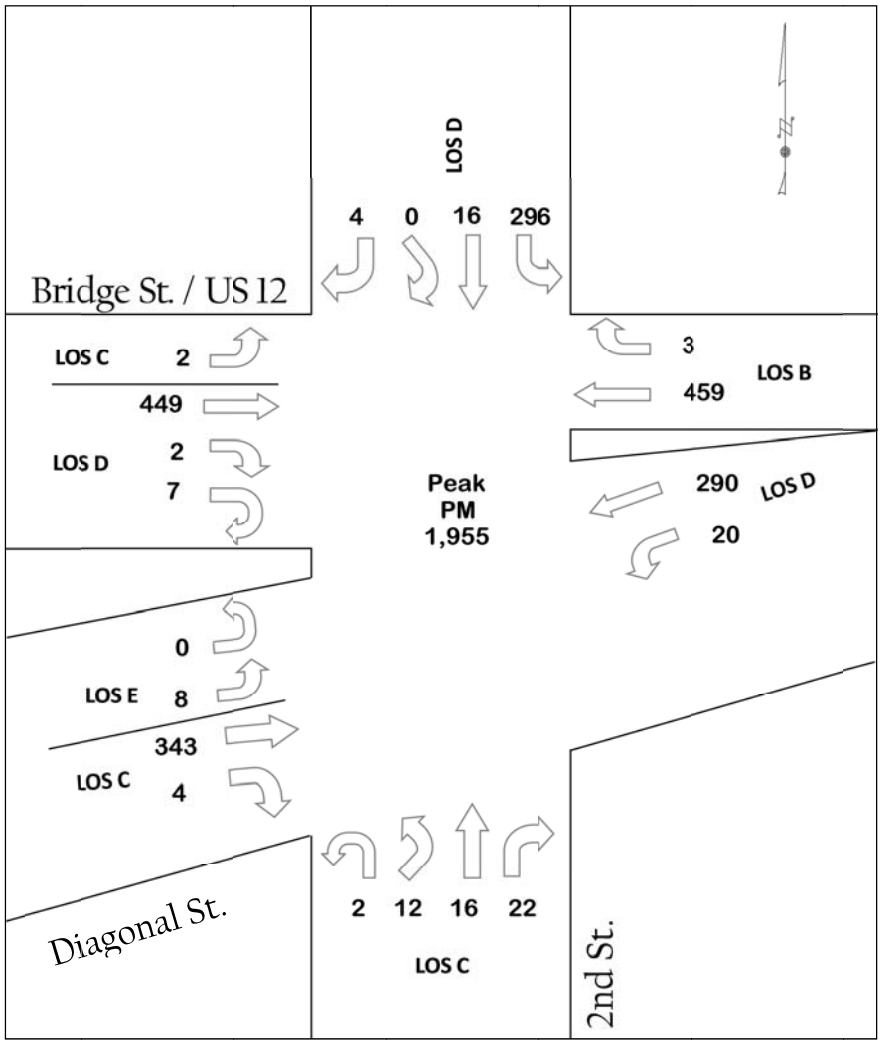


Table 3: Bridge St. & 2nd St. Intersection Short-Term Deficiencies

#	Intersection Deficiencies
1	Eastbound through movement is anticipated to have queue lengths that extend almost to the Bridge St. & 5th St. intersection.
2	The westbound through to Bridge St. is anticipated to have queue lengths that block vehicles from entering the right most left turn lane.
3	The west bound left movement is expected to have queue lengths that block vehicles from entering the westbound through to Bridge St. This results in additional delay and unused storage space in the westbound through to Bridge St.

Bridge St. & 2nd St. Intersection – 2040 Deficiencies

The Bridge St. & 2nd St. Intersection is expected to have four movements at LOS E in 2040. Five movements are anticipated to have queue lengths in excess of 200 feet. The overall delay for the intersection is 43 seconds, which is a LOS D. Even though the intersection as a whole is anticipated to be operating at a LOS D, the EB through, WB left, SB and NE left movements all are expected to be operating at a LOS E in 2040. In result these movements are considered to be at capacity. Figure 2 shows the traffic volumes and LOS for each leg of the intersection. Table 4 lists the 2040 intersection deficiencies.

Figure 2: Bridge St. & 2nd St. Intersection 2040 Peak Hour Volumes

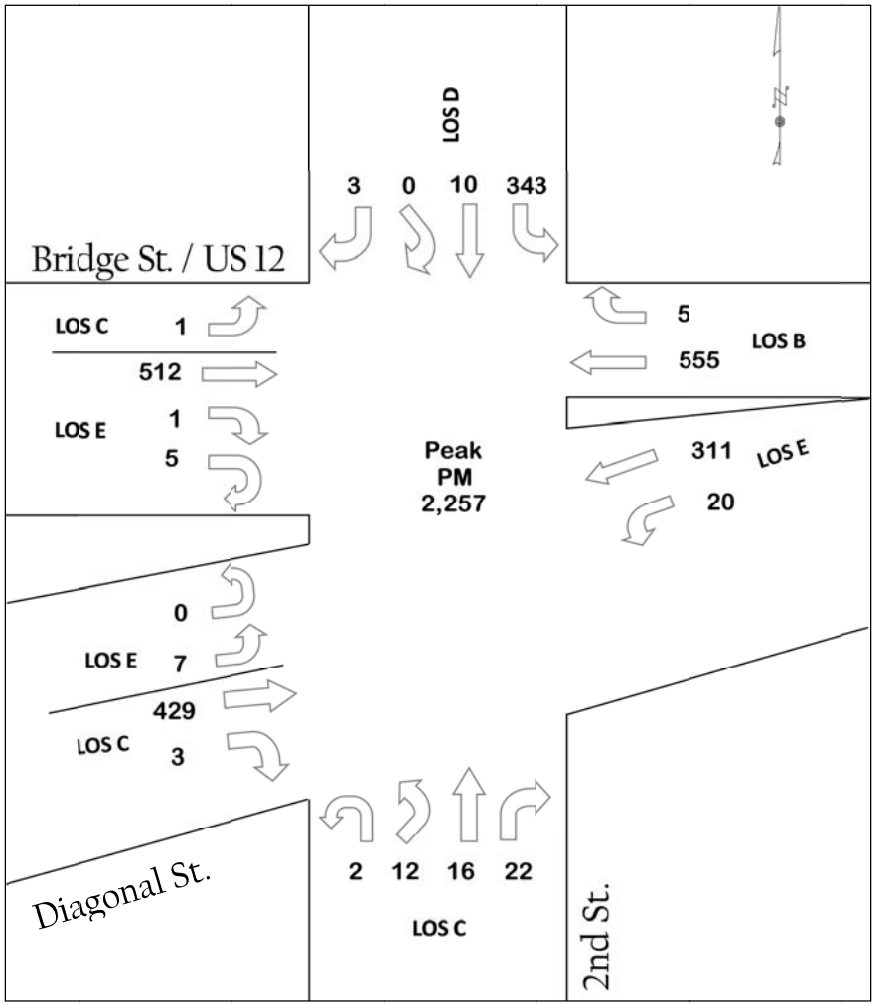


Table 4: Bridge St. & 2nd St. Intersection Long-Term Deficiencies

#	Intersection Deficiencies
1	Westbound queue lengths block vehicles from turning onto Confluence Way and or entering the westbound through lane.
2	Eastbound queue length almost backs up to the Bridge St. & 5th St. Intersection. This creates much congestion for business driveways that access Bridge St.
3	The southbound queue is expected to extend past the 2nd St. and Confluence Way intersection. This will most likely result in vehicles waiting through several signal cycles before being able to move through the intersection.
4	Signal coordination between 5th St. & Bridge St. intersection will be needed to prevent vehicles from arriving on red.

Bridge St. & 5th St. Intersection – 2020 Deficiencies

The Bridge St. & 5th St. intersection in 2020 is anticipated to have an overall intersection delay of 25 seconds, which is LOS C. The westbound through movement had the longest queue length of 390 feet and the longest delay at 40 seconds, which results in a LOS D. The signal timing between 2nd St. & Bridge St. is not interconnected. This is resulting in excessive queue lengths and delay times, which could be reduced by modifying the signal timing plans. The timing between these two intersections and the westbound movement should accommodate the westbound platoons such that they are arriving when the Bridge St. & 5th St. intersection is in a green phase. Figure 3 shows the LOS and traffic volumes for each movement. Table 5 lists the short-term intersection deficiencies.

Figure 3: Bridge St. & 5th St. Intersection 2020 Peak Hour Volumes

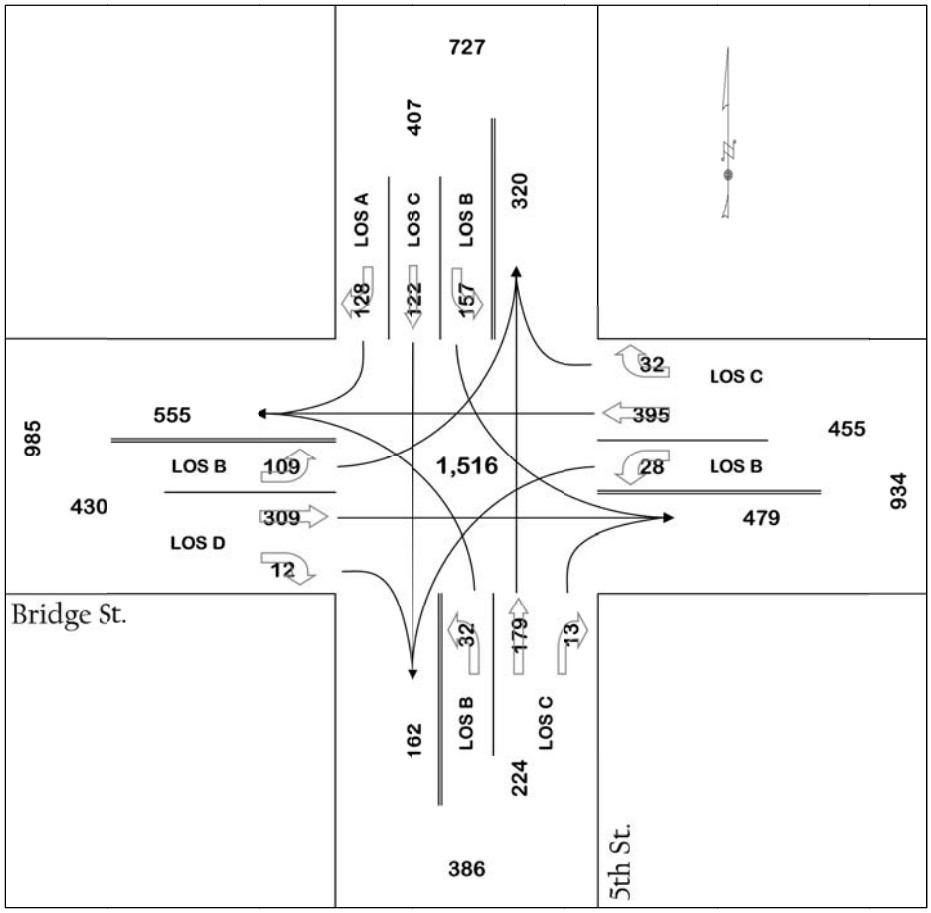


Table 5: Bridge St. & 5th St. Intersection Short-Term Deficiencies

#	Intersection Deficiencies
1	The westbound through movement has a queue length that extends past the Bridge St. & 4th St. Intersection, creating operational issues.
2	Signal coordination with Bridge St. and 2nd St. intersection would help to prevent vehicles from arriving at a red phase.
3	Westbound through queue length is anticipated to block the shopping mall entrance.

Bridge St. & 5th St. Intersection – 2040 Deficiencies

The Bridge St. & 5th St. intersection is anticipated to be operating at a LOS C with a delay of 28 seconds in 2040. The westbound through movement is expected to have a delay of approximately 43 seconds with a queue length in excess of 470 feet. Besides the westbound movement, the intersection should operate fairly well and at an acceptable LOS. The westbound movement also has the highest traffic volume compared to any of the other movements. Figure 4 shows the projected peak hour volumes and LOS for each movement. Table 6 lists the long-term intersection deficiencies.

Figure 4: 5th St. & Bridge St. Intersection 2040 Peak Hour Volume

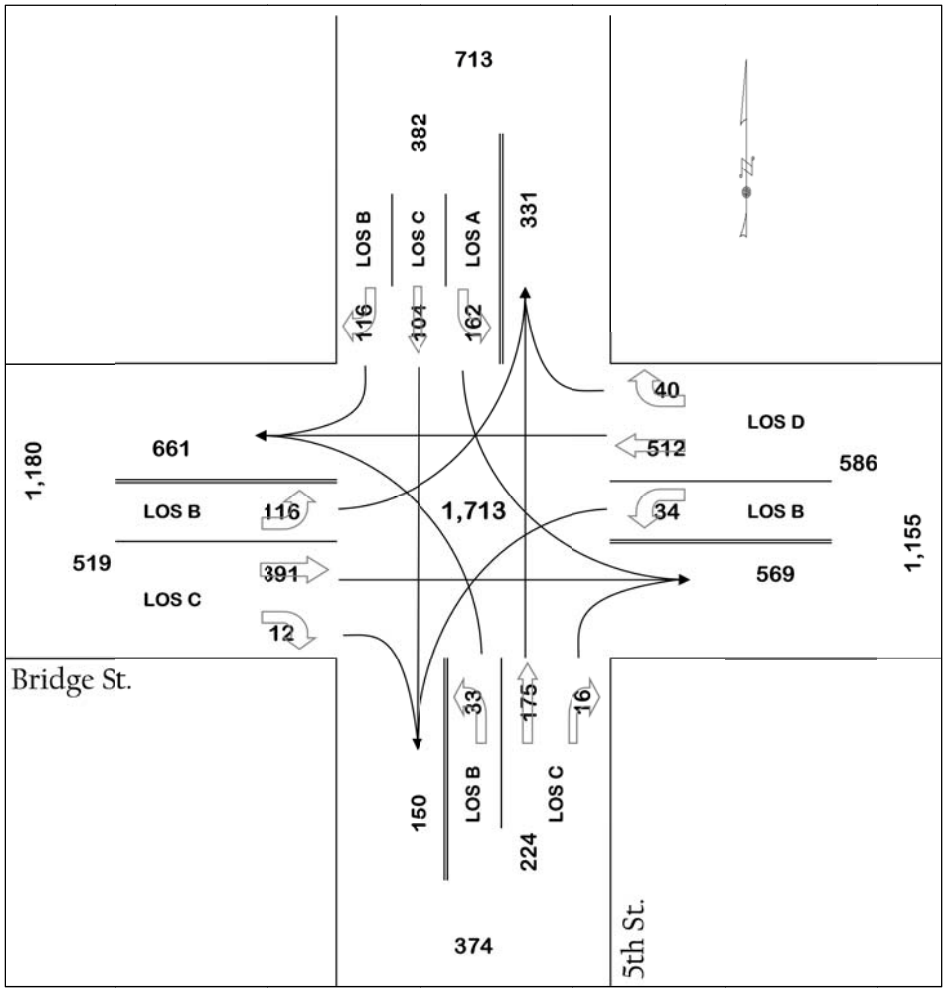


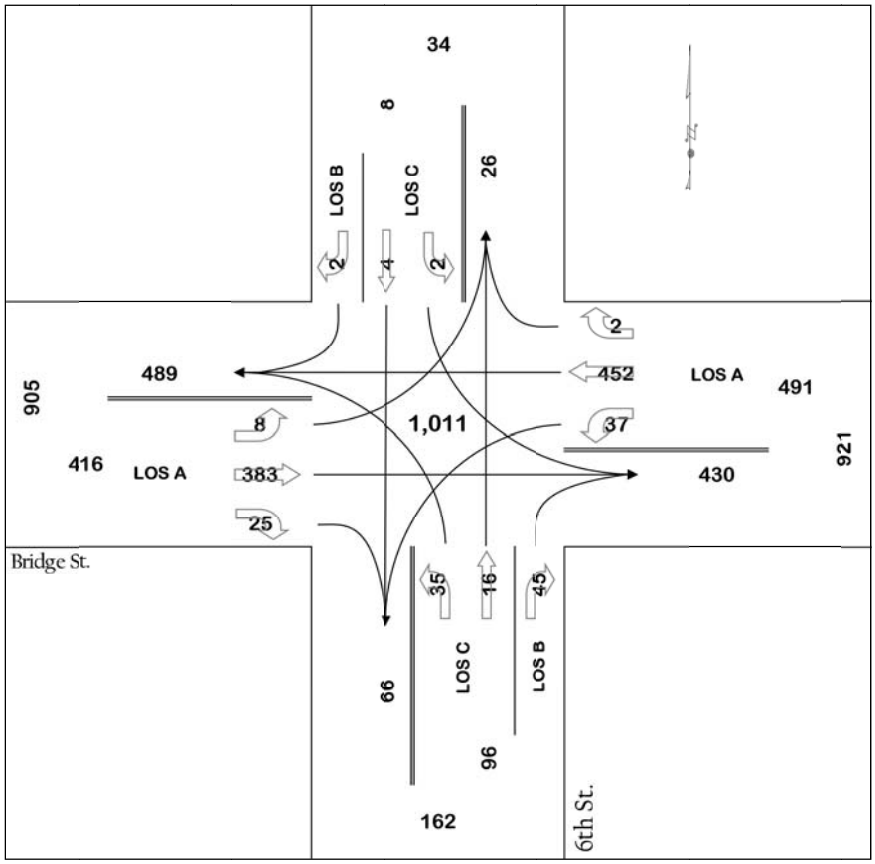
Table 6: Bridge St. & 5th St. Intersection Long-Term Deficiencies

#	Intersection Deficiencies
1	Westbound through queue lengths are anticipated to almost reach the 2nd St. and Bridge St. intersection.
2	Signal Coordination with Bridge St. and 2nd St. intersection will be needed to prevent vehicles from arriving at a red phase.

Bridge St. & 6th St. Intersection - 2020 Deficiencies

The Bridge St. & 6th St. intersection is not anticipated to operate much differently in 2020 compared to 2013. The intersection is expected to have an average delay of 3 seconds per vehicle, which is very low. The worst queue occurred on the northbound through movement, which had a queue length of approximately one vehicle. Figure 5 shows that all of the Bridge St. movements are expected to be operating at LOS A. The northbound and southbound through and left movements are expected to have delays of approximately 20 seconds, which results in LOS C. These are acceptable delays and are not detrimental to the intersection's operational condition as the north/south movements make up just 11% of the total vehicles entering the intersection. Overall this intersection should perform well at an acceptable LOS with very minor queues and delay times.

Figure 5: Bridge St. & 6th St. Intersection 2020 Peak Hour Volumes



Bridge St. & 6th St. Intersection - 2040 Deficiencies

The 2040 projections did not significantly affect this intersection relative to the 2020 analysis. The intersection is still anticipated to be operating at LOS A with all legs operating at a LOS D or better. The northbound and southbound movements are anticipated to be operating at a LOS D, with delays of approximately 30 seconds. These anticipated delays are acceptable as the northbound and southbound traffic volumes only make up 10% of the peak hour traffic volume entering this intersection. Figure 6 shows each movement's LOS and peak hour traffic volumes. Table 7 lists the intersection's long-term deficiencies.

Figure 6: Bridge St. & 6th St. Intersection 2040 Peak Hour Volumes

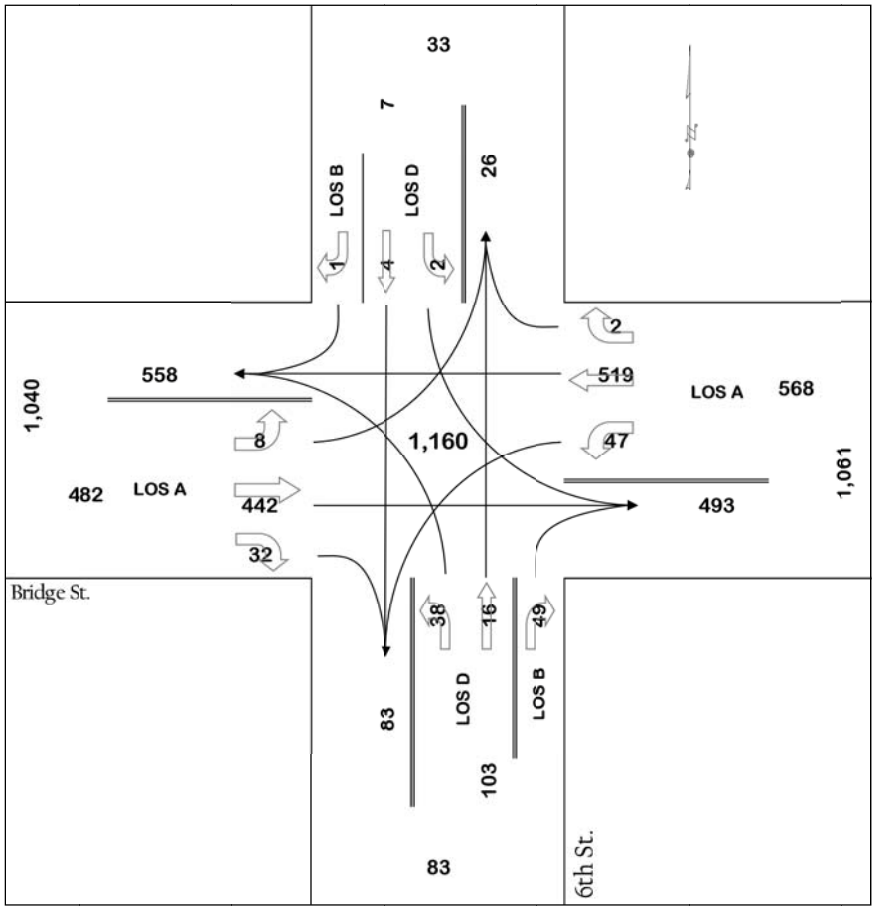


Table 7: Bridge St. & 6th St. Intersection Long-Term Deficiencies

#	Intersection Deficiencies
1	Northbound and southbound movements are expected to operate at a LOS D with delays of 31 seconds and 26 seconds respectively.

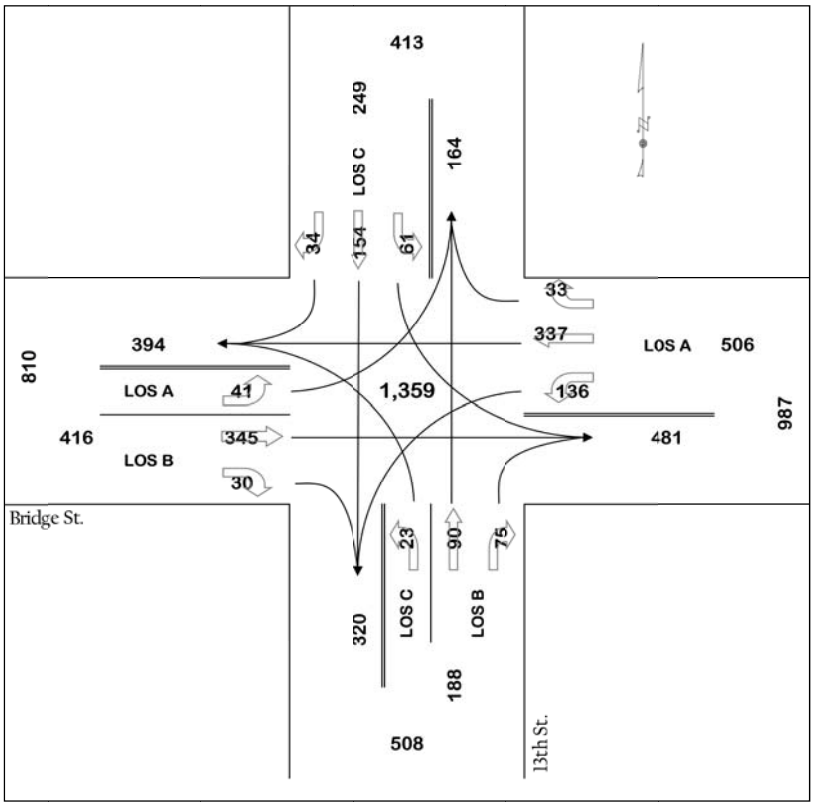
Bridge St. & 13th St. Intersection – 2020 Deficiencies

The Bridge St. & 13th St. intersection was not analyzed for 2020 as it operates very well for 2040.

Bridge St. & 13th St. Intersection – 2040 Deficiencies

The Bridge St. & 13th St. intersection is expected to be operating at LOS B with an average delay of 14 seconds in 2040. The northbound and southbound movements are expected to have delays between 20 and 30 seconds. The eastbound through had the longest queue length of approximately 160 feet. Figure 7 shows that the majority of the peak hour traffic volumes occur on Bridge St. while only a small portion occurs on 13th St.. Overall the Bridge St. & 13th St. intersection is expected to operate well with only minor delays in 2040.

Figure 7: Bridge St. & 13th St. Intersection 2040 Peak Hour Volumes



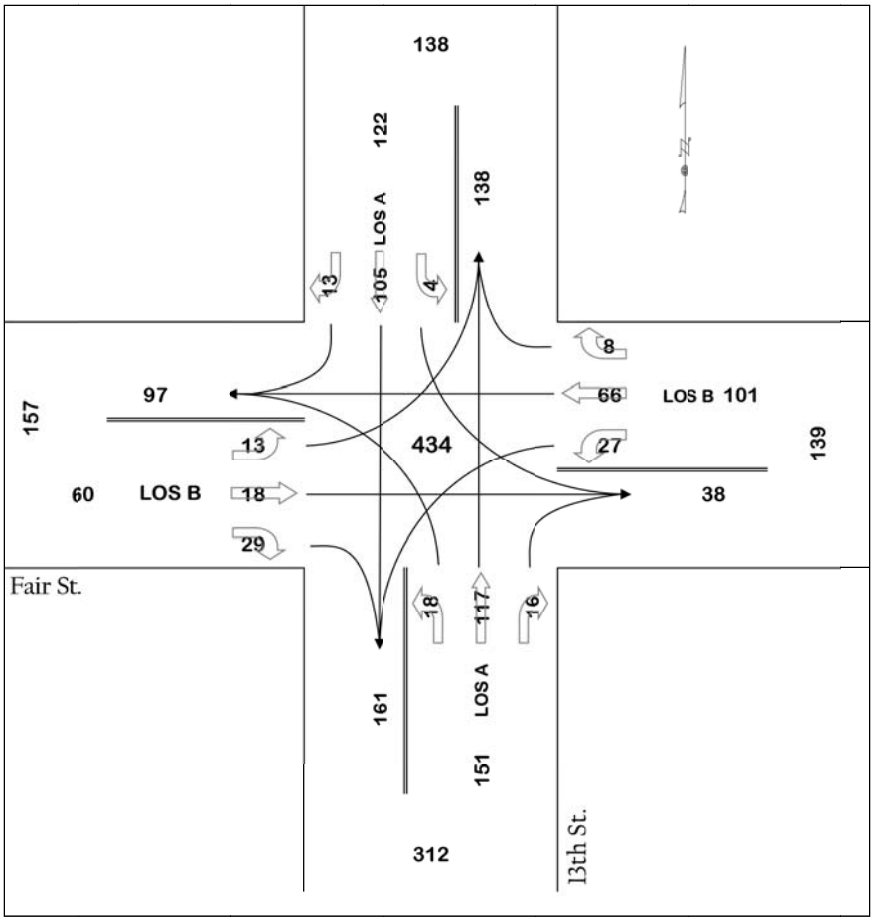
Fair St. & 13th St. Intersection – 2020 Deficiencies

The Fair St. & 13th St. Intersection was not analyzed in 2020 as it operates well in 2040.

Fair St. & 13th St. Intersection – 2040 Deficiencies

The Fair St. & 13th St. intersection is not expected to operate much differently in 2040 compared to 2013. The intersection is anticipated to still be operating at LOS B with average delays less than 12 seconds. Unless there is a large adjacent development constructed between 2013 and 2040, this intersection is not expected to see much of an increase in traffic volumes. Figure 8 presents the intersection's volumes and operating conditions.

Figure 8: Fair St. & 13th St. Intersection 2040 Peak Hour Volumes



Fair St. & 5th St. Intersection – 2020 Deficiencies

The Fair St. & 5th St. intersection is anticipated to operate at LOS B with approximately 15 seconds of delay in 2020. The westbound right is anticipated to be the worst movement with delays of 32 seconds and operate at LOS C. The westbound queue is anticipated to be greater than 200 feet. The intersection may operate at a worse LOS than what the HCM analysis shows, as interference from adjacent intersections is not incorporated in the Highway Capacity Methodology. Figure 9 shows the movement volumes and LOS for the intersection. Table 8 lists the intersections short-term deficiencies.

Figure 9: Fair St. & 5th St. Intersection 2020 Peak Hour Volumes

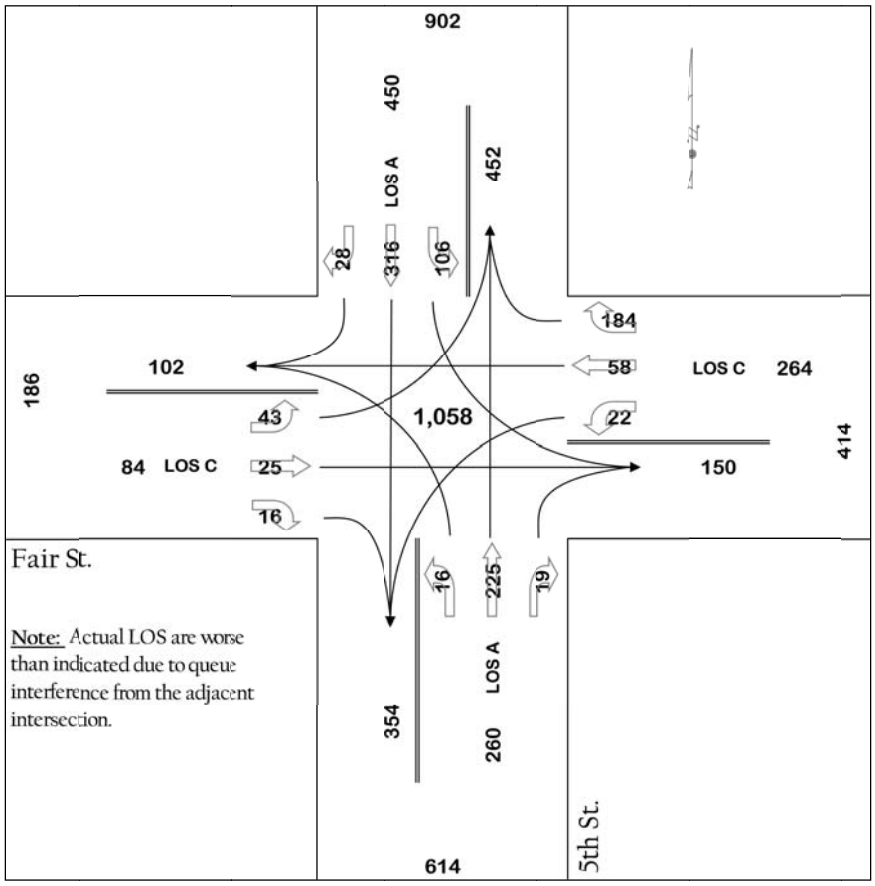


Table 8: Fair St. & 5th St. Intersection Short-Term Deficiencies

#	Intersection Deficiencies
1	The southbound queue will continue to back up into the 5th St. & Walmart/Costco intersection, creating operational and congestion issues.
2	Westbound approach is expected to have queue lengths greater than 200 feet.

Fair St. & 5th St. Intersection – 2040 Deficiencies

The Fair St. & 5th St. intersection is expected to be operating at LOS B in 2040 with a delay of 14 seconds. The westbound right movement will remain at LOS C. The reason for this improvement is due to the signal timing being optimized in 2040, whereas in 2020 existing signal timing was used. Figure 10 shows the intersection's movement volumes and LOS. Table 9 lists the long-term intersection deficiencies.

Figure 10: Fair St. & 5th St. Intersection 2040 Peak Hour Volumes

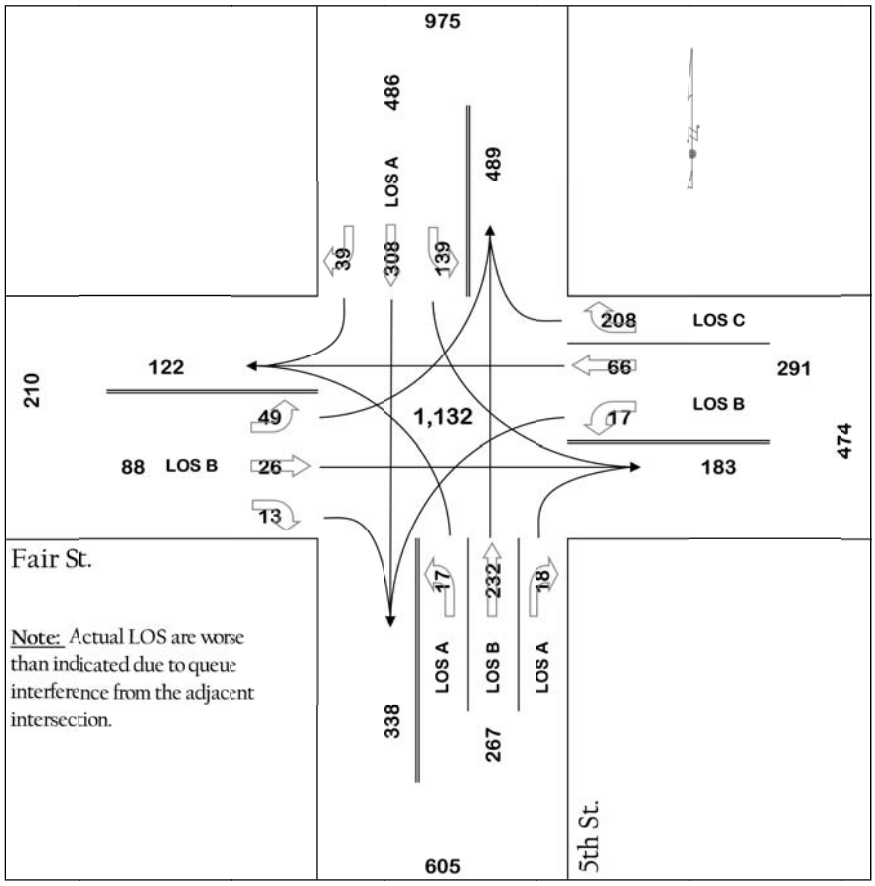


Table 9: Fair St. & 5th St. Intersection Long-Term Deficiencies

#	Intersection Deficiencies
1	Signal timing optimization will be needed to improve the intersection's operating conditions.

5th St. & Walmart/Costco Intersection – 2020 Deficiencies

The 5th St. and Walmart/Costco intersection is anticipated to operate at LOS C with an intersection delay of 18 seconds in 2020. Northbound will remain the worst movement for the intersection with an anticipated delay of 25 seconds. Since the intersection is controlled by an all-way stop, the northbound queue is also anticipated to be the longest, with greater than 7 vehicles, which clearly extends into the adjacent 5th St. & Fair St. intersection. The remaining intersection legs had delays between 12 and 14 seconds, which resulted in LOS B. The intersection may be operating at a worse LOS than what the HCM analysis shows, as interference from adjacent intersections is not incorporated in the Highway Capacity Methodology. Figure 11 shows the projected peak hour volumes and LOS for each movement. Table 10 lists the short-term deficiencies for the intersection.

Figure 11: 5th St. & Walmart/Costco Intersection 2020 Peak Hour Volumes

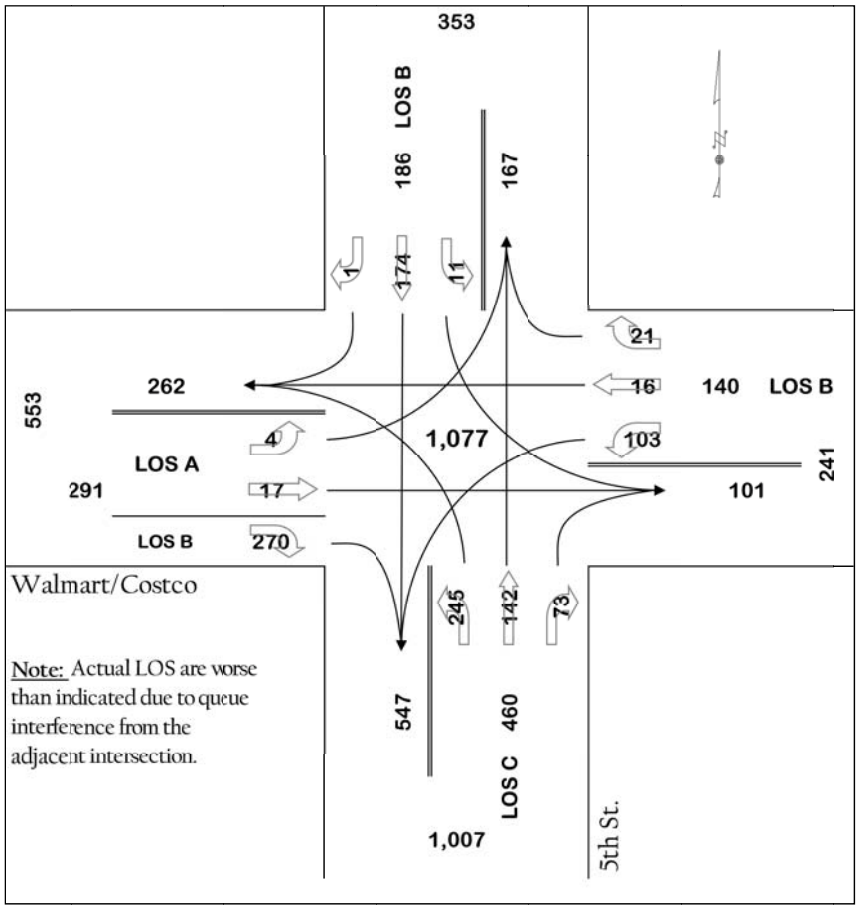


Table 10: 5th St. & Walmart/Costco Intersection Short-Term Deficiencies

#	Intersection Deficiencies
1	The northbound queue lengths will continue to exceed the storage lengths available and is anticipated to be backing up into 5th St. & Fair St. intersection.

5th St. & Walmart/Costco Intersection – 2040 Deficiencies

The 5th St. & Walmart/Costco intersection is anticipated to be operating at LOS C in 2040, which is the same as the 2020 projection. The intersection delay is anticipated to be around 23 seconds. The EB, WB, and SB movements are expected to operate well with a LOS C or better, while the northbound movement will operate at a LOS D. The northbound movement will continue as the weakest link of this intersection, as queue lengths will extend well into the Fair St. & 5th St. intersection causing congestion and operational issues. Figure 12 shows the intersection volumes and LOS. Table 14 lists the long-term intersection deficiencies.

Figure 12: 5th St. & Walmart/Costco Intersection 2040 Peak Hour Volumes

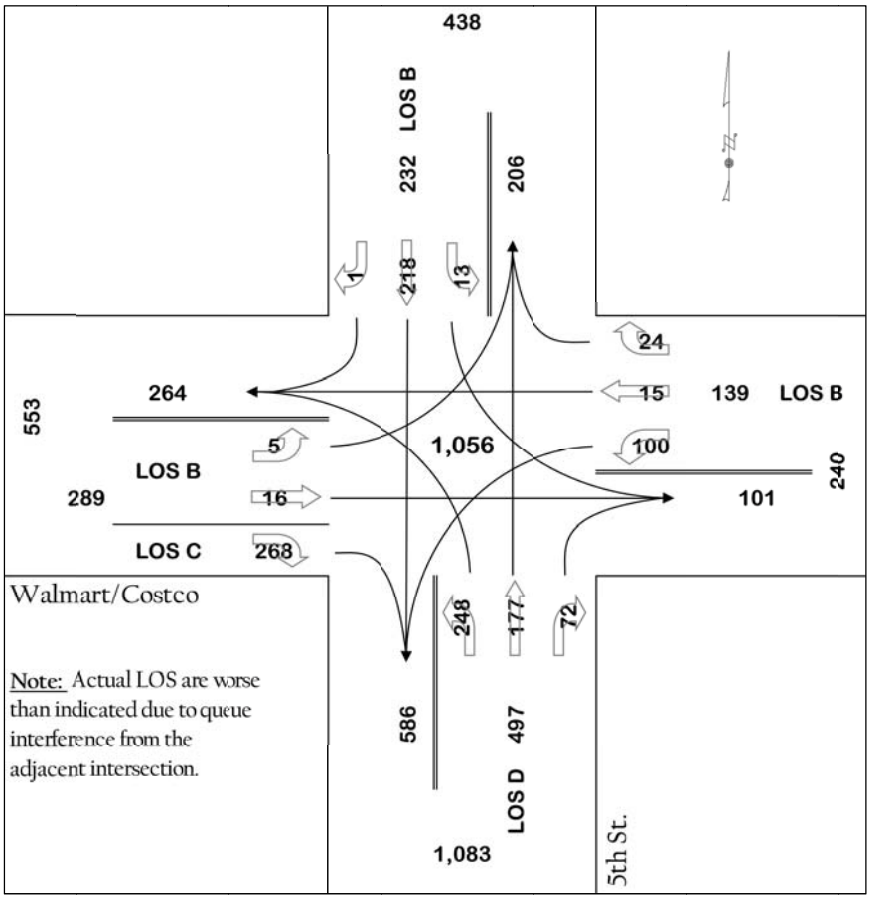


Table 11: 5th St. & Walmart/Costco Intersection Long-Term Deficiencies

#	Intersection Deficiencies
1	The northbound queue lengths will continue to exceed the storage lengths available and is anticipated to be backing up into 5th St. & Fair St. intersection.

Fair St. & 5th St. and 5th St. & Walmart/Costco – 2020 & 2040 Deficiencies

The previously reported operating conditions of the Fair St. & 5th St. and 5th St. & Walmart/Costco intersections may not have accurately represented what might actually occur in the future at these intersections. The major reason for this discrepancy is that the Highway Capacity Methodology does not incorporate interference from adjacent intersections. The HCM analyzes the intersections as being isolated, which portrays these intersections as operating better than they actually will, especially when there are queues backing up into adjacent intersections. The purpose of this section is to accurately forecast how the two intersections will operate together and not as isolated intersections as evaluated previously.

When evaluating these two intersections together in 2020 and 2040 it is expected that they will experience much worse queuing issues compared to the prior isolated intersection analysis.

This will create multiple issues as vehicles will have to wait for the northbound queue to diminish before proceeding, which will prevent traffic from completely clearing the intersection. The southbound movement at the 5th St. & Fair St. intersection will experience a similar issue as the queue length will be greater than available storage, which will partially block the 5th St. & Walmart/Costco Intersection. The worst case delay for a vehicle to navigate through both intersections is anticipated to take 48 seconds in 2020 and 60 seconds in 2040. These operational issues were not incorporated in the previous HCM LOS analysis and are major factors in the operating conditions of the intersections. Based on this evaluation it is likely that several legs of these intersections will be operating considerably worse than presented in the isolated intersection analysis. In addition, the northbound movement is of particular concern and may interfere with Bridge St. and 5th St. intersection.

Conclusion

The majority of intersections in this study are not anticipated to be operating much differently in the future than existing conditions. A major reason for this is that the cities of Lewiston and Clarkson are both anticipated to have relatively small growth rates over the next 30 years. Of the seven intersections studied, the 2nd St. & Bridge St. intersection is expected to have the greatest operational and safety issues. The intersection will have several movements operating at LOS D and E in 2020 and worse in 2040 with many movements experiencing queue lengths greater than 200 feet. The intersection also had the highest number of collisions relative to the other intersections studied. The close spacing of the 5th St. & Walmart/Costco intersection is causing congestion issues with queues backing up into the adjacent Fair St. & 5th St. intersection and vice versa. Both the Fair St. & 5th St. and the 5th St. & Walmart/Costco intersections are anticipated to operate poorly together as queues from both intersections will extend into the other intersection, resulting in much higher delays than projected. There is currently no signal coordination between the Bridge St. & 5th St. & 2nd St. & Bridge St. intersections. This is partially the reason for large queues on Bridge St., as vehicles are arriving at the intersections during red phases. Potential signal coordination will need to be studied further, while it would be of benefit to Bridge St., it could have significant negative impacts to side streets (e.g. 5th St., 2nd St., Diagonal St.).

Overall, the 2nd St. and Bridge St. intersection was the only intersection anticipated to have a lower LOS in 2040 compared to 2013. The majority of the anticipated deficiencies in 2020 and 2040 are current deficiencies for the intersections.

Year 2020 Analyses

HCM 2010 AWSC
5: 5th St/Port & Wal-Mart/Costco 11/5/2013

Intersection	
Intersection Delay, s/veh	18.2
Intersection LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	4	17	270	103	16	21	245	142	73	11	174	1
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	4	18	281	107	17	22	255	148	76	11	181	1
Number of Lanes	0	1	1	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	2	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	2	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	2
HCM Control Delay	14.2	12.5	24.7	12.6
HCM LOS	B	B	C	B

Lane	NBLn1	EBLn1	EBLn2	WBLn1	SBLn1
Vol Left, %	53%	19%	0%	74%	6%
Vol Thru, %	31%	81%	0%	11%	94%
Vol Right, %	16%	0%	100%	15%	1%
Sign Control	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	460	21	270	140	186
LT Vol	142	17	0	16	174
Through Vol	73	0	270	21	1
RT Vol	245	4	0	103	11
Lane Flow Rate	479	22	281	146	194
Geometry Grp	2	7	7	5	2
Degree of Util (X)	0.758	0.042	0.482	0.277	0.341
Departure Headway (Hd)	5.817	6.987	6.174	6.848	6.336
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes
Cap	628	514	585	526	568
Service Time	3.817	4.704	3.891	4.872	4.365
HCM Lane V/C Ratio	0.763	0.043	0.48	0.278	0.342
HCM Control Delay	24.7	10	14.5	12.5	12.6
HCM Lane LOS	C	A	B	B	B
HCM 95th-tile Q	6.9	0.1	2.6	1.1	1.5

Notes

~ : Volume Exceeds Capacity; $: Delay Exceeds 300 Seconds; Error : Computation Not Defined

Downtown Clarkston - PM Peak Hour 7/17/2013 2020 Model Projections - existing timing Synchro 8 Report
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Lanes, Volumes, Timings
2: 5th St & Bridge

11/5/2013

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	109	309	12	28	395	32	32	179	13	157	122	128
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	110		0	125		0	100		0	120		120
Storage Lanes	1		0	1		0	1		0	1		1
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.994			0.989			0.990				0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1770	1852	0	1770	1842	0	1770	1844	0	1770	1863	1583
Flt Permitted	0.172			0.462			0.674			0.483		
Satd. Flow (perm)	320	1852	0	861	1842	0	1255	1844	0	900	1863	1583
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		2			4			3				136
Link Speed (mph)		30			30			25			25	
Link Distance (ft)		332			1012			272			659	
Travel Time (s)		7.5			23.0			7.4			18.0	
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	116	329	13	30	420	34	34	190	14	167	130	136
Shared Lane Traffic (%)												
Lane Group Flow (vph)	116	342	0	30	454	0	34	204	0	167	130	136
Turn Type	pm+pt	NA		pm+pt	NA		pm+pt	NA		pm+pt	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4			8			2			6		6
Detector Phase	7	4		3	8		5	2		1	6	6
Switch Phase												
Minimum Initial (s)	6.0	10.0		6.0	10.0		6.0	6.0		6.0	6.0	6.0
Minimum Split (s)	11.1	30.2		11.1	25.2		11.1	22.0		11.1	25.0	25.0
Total Split (s)	19.2	34.2		19.2	34.2		19.0	29.0		19.0	29.0	29.0
Total Split (%)	18.9%	33.7%		18.9%	33.7%		18.7%	28.6%		18.7%	28.6%	28.6%
Maximum Green (s)	15.0	30.0		15.0	30.0		15.0	25.0		15.0	25.0	25.0
Yellow Time (s)	3.2	3.2		3.2	3.2		3.0	3.0		3.0	3.0	3.0
All-Red Time (s)	1.0	1.0		1.0	1.0		1.0	1.0		1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	4.2	4.2		4.2	4.2		4.0	4.0		4.0	4.0	4.0
Lead/Lag	Lead	Lag		Lead	Lag		Lead	Lag		Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes		Yes	Yes		Yes	Yes		Yes	Yes	Yes
Vehicle Extension (s)	1.0	2.5		1.5	2.5		1.0	1.0		1.0	1.0	1.0
Recall Mode	None	None		None	None		None	Max		None	Max	Max
Walk Time (s)		7.0			7.0			7.0			7.0	7.0
Flash Dont Walk (s)		19.0			14.0			11.0			11.0	11.0
Pedestrian Calls (#/hr)		0			0			0			0	0
Act Effct Green (s)	33.8	30.5		29.0	24.5		31.8	25.7		38.2	33.1	33.1
Actuated g/C Ratio	0.42	0.38		0.36	0.30		0.39	0.32		0.47	0.41	0.41
v/c Ratio	0.42	0.49		0.08	0.81		0.06	0.35		0.32	0.17	0.19
Control Delay	18.5	22.8		13.9	39.9		15.2	26.6		16.7	21.0	5.0
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Total Delay	18.5	22.8		13.9	39.9		15.2	26.6		16.7	21.0	5.0
LOS	B	C		B	D		B	C		B	C	A

Downtown Clarkston - PM Peak Hour 7/17/2013 2020 Model Projections - existing timing
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Synchro 8 Report
Page 1

Lanes, Volumes, Timings
2: 5th St & Bridge

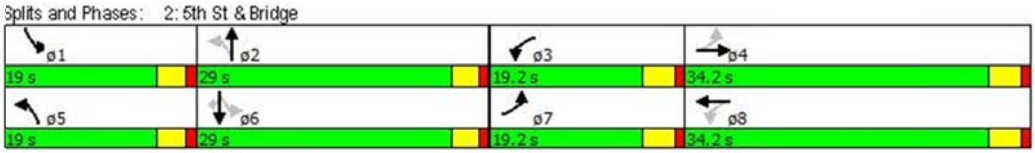
11/5/2013

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Approach Delay		21.7			38.3			24.9			14.3	
Approach LOS		C			D			C			B	
Queue Length 50th (ft)	34	115		8	217		10	83		52	49	0
Queue Length 95th (ft)	70	240		25	#690		29	166		103	99	39
Internal Link Dist (ft)		252			932			192			579	
Turn Bay Length (ft)	110			125			100			120		120
Base Capacity (vph)	410	782		534	702		690	586		593	760	726
Starvation Cap Reductn	0	0		0	0		0	0		0	0	0
Spillback Cap Reductn	0	0		0	0		0	0		0	0	0
Storage Cap Reductn	0	0		0	0		0	0		0	0	0
Reduced v/c Ratio	0.28	0.44		0.06	0.65		0.05	0.35		0.28	0.17	0.19

Intersection Summary

Area Type: Other
Cycle Length: 101.4
Actuated Cycle Length: 81
Natural Cycle: 80
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.81
Intersection Signal Delay: 25.2 Intersection LOS: C
Intersection Capacity Utilization 61.3% ICU Level of Service B
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 2: 5th St & Bridge



Downtown Clarkston - PM Peak Hour 7/17/2013 2020 Model Projections - existing timing
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Synchro 8 Report
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HCM 2010 TWSC
7: 6th St & Bridge

11/5/2013

Intersection	
Intersection Delay, s/veh	2.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	8	383	25	37	452	2	35	16	45	2	4	2
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	110	-	-	110	-	-	-	-	50	-	-	50
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	96	96	96	96	96	96	96	96	96	96	96	96
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	8	399	26	39	471	2	36	17	47	2	4	2

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	473	0	0	425	0	0	980	979	412	986	991	472
Stage 1	-	-	-	-	-	-	429	429	-	549	549	-
Stage 2	-	-	-	-	-	-	551	550	-	437	442	-
Follow-up Headway	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Capacity-1 Maneuver	1089	-	-	1134	-	-	229	250	640	227	246	592
Stage 1	-	-	-	-	-	-	604	584	-	520	516	-
Stage 2	-	-	-	-	-	-	519	516	-	598	576	-
Time blocked-Platoon, %		-	-		-	-						
Mov Capacity-1 Maneuver	1089	-	-	1134	-	-	218	240	640	193	236	592
Mov Capacity-2 Maneuver	-	-	-	-	-	-	218	240	-	193	236	-
Stage 1	-	-	-	-	-	-	600	580	-	516	498	-
Stage 2	-	-	-	-	-	-	495	498	-	534	572	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.2	0.6	19.6	19.3
HCM LOS			C	C

Minor Lane / Major Mvmt	NBLn1	NBLn2	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	263	640	1089	-	-	1134	-	-	234	592
HCM Lane V/C Ratio	0.261	0.049	0.008	-	-	0.034	-	-	0.03	0.002
HCM Control Delay (s)	23.5	10.9	8.331	-	-	8.286	-	-	20.9	11.1
HCM Lane LOS	C	B	A			A			C	B
HCM 95th %tile Q(veh)	1.019	0.154	0.023	-	-	0.105	-	-	0.091	0.007

Notes

~ : Volume Exceeds Capacity; $: Delay Exceeds 300 Seconds; Error : Computation Not Defined

Downtown Clarkston - PM Peak Hour 7/17/2013 2020 Model Projections - existing timing
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Synchro 8 Report
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Lanes, Volumes, Timings
12: 5th St & Fair

11/5/2013

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	43	25	16	22	58	184	16	225	19	106	316	28
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		50	130		130	160		0
Storage Lanes	0		0	0		1	1		1	1		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.974				0.850			0.850		0.988	
Flt Protected		0.975			0.987		0.950			0.950		
Satd. Flow (prot)	0	1769	0	0	1839	1583	1770	1863	1583	1770	1840	0
Flt Permitted		0.823			0.912		0.486			0.585		
Satd. Flow (perm)	0	1493	0	0	1699	1583	905	1863	1583	1090	1840	0
Right Turn on Red			Yes			No			Yes			Yes
Satd. Flow (RTOR)		12							55		4	
Link Speed (mph)		25			25			25			25	
Link Distance (ft)		290			660			659			258	
Travel Time (s)		7.9			18.0			18.0			7.0	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	48	28	18	24	64	204	18	250	21	118	351	31
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	94	0	0	88	204	18	250	21	118	382	0
Turn Type	Perm	NA		Perm	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8		8	2		2	6		
Detector Phase	4	4		8	8	8	5	2	2	1	6	
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0	10.0	6.0	10.0	10.0	6.0	10.0	
Minimum Split (s)	26.2	26.2		26.2	26.2	26.2	10.2	26.2	26.2	10.2	26.2	
Total Split (s)	39.2	39.2		39.2	39.2	39.2	29.2	39.2	39.2	29.2	39.2	
Total Split (%)	36.4%	36.4%		36.4%	36.4%	36.4%	27.1%	36.4%	36.4%	27.1%	36.4%	
Maximum Green (s)	35.0	35.0		35.0	35.0	35.0	25.0	35.0	35.0	25.0	35.0	
Yellow Time (s)	3.2	3.2		3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	
All-Red Time (s)	1.0	1.0		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	
Lost Time Adjust (s)		0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)		4.2			4.2	4.2	4.2	4.2	4.2	4.2	4.2	
Lead/Lag							Lag	Lead	Lead	Lag	Lead	
Lead-Lag Optimize?							Yes	Yes	Yes	Yes	Yes	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	2.0	3.0	3.0	2.0	3.0	
Recall Mode	None	None		None	None	None	None	Max	Max	None	Max	
Walk Time (s)	7.0	7.0		7.0	7.0	7.0		7.0	7.0		7.0	
Flash Dont Walk (s)	15.0	15.0		15.0	15.0	15.0		15.0	15.0		15.0	
Pedestrian Calls (#/hr)	0	0		0	0	0		0	0		0	
Act Effct Green (s)		14.1			14.1	14.1	41.5	35.4	35.4	43.9	41.4	
Actuated g/C Ratio		0.21			0.21	0.21	0.63	0.54	0.54	0.67	0.63	
v/c Ratio		0.29			0.24	0.60	0.03	0.25	0.02	0.15	0.33	
Control Delay		22.2			23.7	31.9	5.2	10.6	0.6	5.7	8.2	
Queue Delay		0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Delay		22.2			23.7	31.9	5.2	10.6	0.6	5.7	8.2	
LOS		C			C	C	A	B	A	A	A	

Downtown Clarkston - PM Peak Hour 7/17/2013 2020 Model Projections - existing timing
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Synchro 8 Report
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Lanes, Volumes, Timings
12: 5th St & Fair

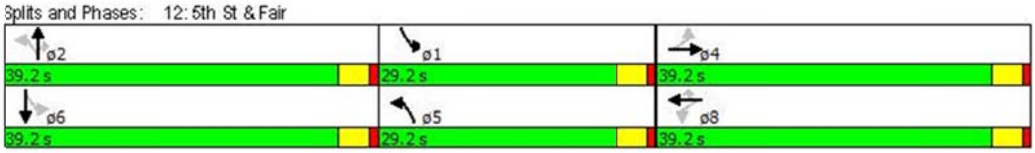
11/5/2013

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Approach Delay		22.2			29.4			9.5			7.6	
Approach LOS		C			C			A			A	
Queue Length 50th (ft)		29			31	77	2	53	0	14	53	
Queue Length 95th (ft)		65			65	138	10	112	3	39	175	
Internal Link Dist (ft)		210			580			579			178	
Turn Bay Length (ft)						50	130		130	160		
Base Capacity (vph)		808			913	851	1130	1002	876	1263	1158	
Starvation Cap Reductn		0			0	0	0	0	0	0	0	
Spillback Cap Reductn		0			0	0	0	0	0	0	0	
Storage Cap Reductn		0			0	0	0	0	0	0	0	
Reduced v/c Ratio		0.12			0.10	0.24	0.02	0.25	0.02	0.09	0.33	

Intersection Summary

Area Type: Other
Cycle Length: 107.6
Actuated Cycle Length: 65.8
Natural Cycle: 65
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.60
Intersection Signal Delay: 14.7 — Intersection LOS: B
Intersection Capacity Utilization 45.2% — ICU Level of Service A
Analysis Period (min) 15

Splits and Phases: 12: 5th St & Fair



Lanes, Volumes, Timings
17: Diagonal & 2nd St & Bridge

11/5/2013

Lane Group	EBL	EBT	EBR	EBR2	WBL2	WBL	WBT	WBR	NBL2	NBL	NBT	NBR
Lane Configurations												
Volume (vph)	2	449	2	7	20	290	459	3	2	12	16	22
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	125		0			0		150		0		0
Storage Lanes	1		0			2		1		0		0
Taper Length (ft)	25					25				25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	0.97	1.00	1.00	1.00	1.00	1.00	1.00
Flt		0.997					0.999				0.944	
Flt Protected	0.950					0.950					0.987	
Satd. Flow (prot)	1770	1857	0	0	0	3433	1861	0	0	0	1736	0
Flt Permitted	0.353					0.486					0.936	
Satd. Flow (perm)	658	1857	0	0	0	1756	1861	0	0	0	1646	0
Right Turn on Red				Yes				Yes				Yes
Satd. Flow (RTOR)											23	
Link Speed (mph)		30					30				30	
Link Distance (ft)		1012					313				335	
Travel Time (s)		23.0					7.1				7.6	
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	2	478	2	7	21	309	488	3	2	13	17	23
Shared Lane Traffic (%)												
Lane Group Flow (vph)	2	487	0	0	0	330	491	0	0	0	55	0
Turn Type	Perm	NA			custom	Prot	NA		Perm	Perm	NA	
Protected Phases		2				1	6				8	
Permitted Phases	2				1				8	8		
Detector Phase	2	2			1	1	6		8	8	8	
Switch Phase												
Minimum Initial (s)	8.0	8.0			8.0	8.0	8.0		8.0	8.0	8.0	
Minimum Split (s)	14.2	14.2			29.2	29.2	26.2		39.2	39.2	39.2	
Total Split (s)	41.2	41.2			41.2	41.2	51.2		39.2	39.2	39.2	
Total Split (%)	28.9%	28.9%			28.9%	28.9%	35.9%		27.5%	27.5%	27.5%	
Maximum Green (s)	35.0	35.0			35.0	35.0	45.0		33.0	33.0	33.0	
Yellow Time (s)	3.2	3.2			3.2	3.2	3.2		3.2	3.2	3.2	
All-Red Time (s)	3.0	3.0			3.0	3.0	3.0		3.0	3.0	3.0	
Lost Time Adjust (s)	0.0	0.0				0.0	0.0				0.0	
Total Lost Time (s)	6.2	6.2				6.2	6.2				6.2	
Lead/Lag	Lead	Lead			Lag	Lag						
Lead-Lag Optimize?	Yes	Yes			Yes	Yes						
Vehicle Extension (s)	2.5	2.5			2.5	2.5	2.5		1.5	1.5	1.5	
Recall Mode	None	None			None	None	Max		None	None	None	
Walk Time (s)					8.0	8.0	10.0					
Flash Dont Walk (s)					15.0	15.0	10.0					
Pedestrian Calls (#/hr)					0	0	0					
Act Effct Green (s)	36.1	36.1				24.7	67.2				22.9	
Actuated g/C Ratio	0.34	0.34				0.24	0.64				0.22	
v/c Ratio	0.01	0.76				0.80	0.41				0.15	
Control Delay	33.0	43.5				54.8	12.5				24.2	
Queue Delay	0.0	0.0				0.0	0.0				0.0	
Total Delay	33.0	43.5				54.8	12.5				24.2	
LOS	C	D				D	B				C	

Downtown Clarkston - PM Peak Hour 7/17/2013 2020 Model Projections - existing timing
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Synchro 8 Report
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Lanes, Volumes, Timings
17: Diagonal & 2nd St & Bridge

11/5/2013

Lane Group	SBL	SBT	SBR2	NEL	NER	NER2
Lane Configurations						
Volume (vph)	296	16	4	8	343	4
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0			150	0	
Storage Lanes	0			1	2	
Taper Length (ft)	25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	0.88	1.00
Flt		0.998			0.850	
Flt Protected		0.955		0.950		
Satd. Flow (prot)	0	1775	0	1770	2787	0
Flt Permitted		0.699		0.950		
Satd. Flow (perm)	0	1299	0	1770	2787	0
Right Turn on Red			Yes			Yes
Satd. Flow (RTOR)		119			119	
Link Speed (mph)		25		30		
Link Distance (ft)		387		480		
Travel Time (s)		10.6		10.9		
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	315	17	4	9	365	4
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	336	0	9	369	0
Turn Type	Perm	NA		NA	Over	
Protected Phases		4		9	1	
Permitted Phases	4					
Detector Phase	4	4		9	1	
Switch Phase						
Minimum Initial (s)	8.0	8.0		8.0	8.0	
Minimum Split (s)	39.2	39.2		14.2	29.2	
Total Split (s)	39.2	39.2		21.2	41.2	
Total Split (%)	27.5%	27.5%		14.8%	28.9%	
Maximum Green (s)	33.0	33.0		15.0	35.0	
Yellow Time (s)	3.2	3.2		3.2	3.2	
All-Red Time (s)	3.0	3.0		3.0	3.0	
Lost Time Adjust (s)		0.0		0.0	0.0	
Total Lost Time (s)		6.2		6.2	6.2	
Lead/Lag					Lag	
Lead-Lag Optimize?					Yes	
Vehicle Extension (s)	1.5	1.5		1.0	2.5	
Recall Mode	None	None		None	None	
Walk Time (s)	8.0	8.0			8.0	
Flash Dont Walk (s)	25.0	25.0			15.0	
Pedestrian Calls (#/hr)	0	0			0	
Act Effct Green (s)		22.9		8.3	24.7	
Actuated g/C Ratio		0.22		0.08	0.24	
v/c Ratio		0.89		0.06	0.50	
Control Delay		52.9		55.5	26.3	
Queue Delay		0.0		0.0	0.0	
Total Delay		52.9		55.5	26.3	
LOS		D		E	C	

Downtown Clarkston - PM Peak Hour 7/17/2013 2020 Model Projections - existing timing
SJL

Synchro 8 Report
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Lanes, Volumes, Timings
17: Diagonal & 2nd St & Bridge

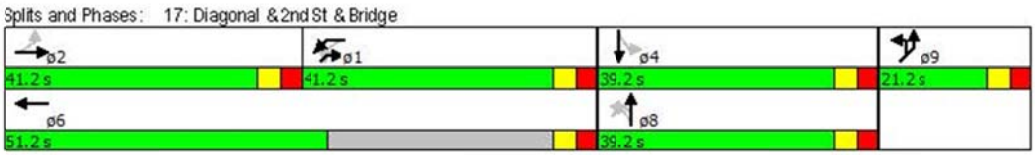
11/5/2013

Lane Group	EBL	EBT	EBR	EBR2	WBL2	WBL	WBT	WBR	NBL2	NBL	NBT	NBR
Approach Delay		43.5					29.5				24.2	
Approach LOS		D					C				C	
Queue Length 50th (ft)	1	283				104	141				17	
Queue Length 95th (ft)	9	#673				196	339				59	
Internal Link Dist (ft)		932					233				255	
Turn Bay Length (ft)	125											
Base Capacity (vph)	226	638				603	1392				548	
Starvation Cap Reductn	0	0				0	0				0	
Spillback Cap Reductn	0	0				0	0				0	
Storage Cap Reductn	0	0				0	0				0	
Reduced v/c Ratio	0.01	0.76				0.55	0.35				0.10	

Intersection Summary

Area Type: Other
Cycle Length: 142.8
Actuated Cycle Length: 105.1
Natural Cycle: 120
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.89
Intersection Signal Delay: 36.0 Intersection LOS: D
Intersection Capacity Utilization 90.0% ICU Level of Service E
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 17: Diagonal & 2nd St & Bridge



Lanes, Volumes, Timings
17: Diagonal & 2nd St & Bridge

11/5/2013

Lane Group	SBL	SBT	SBR2	NEL	NER	NER2
Approach Delay		52.9		27.0		
Approach LOS		D		C		
Queue Length 50th (ft)		141		6	78	
Queue Length 95th (ft)		#654		27	159	
Internal Link Dist (ft)		307		400		
Turn Bay Length (ft)				150		
Base Capacity (vph)		501		260	1035	
Starvation Cap Reductn		0		0	0	
Spillback Cap Reductn		0		0	0	
Storage Cap Reductn		0		0	0	
Reduced v/c Ratio		0.67		0.03	0.36	

Intersection Summary

Downtown Clarkston - PM Peak Hour 7/17/2013 2020 Model Projections - existing timing
SJL

Synchro 8 Report
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Year 2040 Analyses

HCM 2010 AWSC
5: 5th St/Port & Wal-Mart/Costco

11/5/2013

Intersection	
Intersection Delay, s/veh	23.4
Intersection LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	5	16	268	100	15	24	248	177	72	13	218	1
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	5	17	279	104	16	25	258	184	75	14	227	1
Number of Lanes	0	1	1	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	2	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	2	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	2
HCM Control Delay	15.3	13.3	35	14.6
HCM LOS	C	B	D	B

Lane	NBLn1	EBLn1	EBLn2	WBLn1	SBLn1
Vol Left, %	50%	24%	0%	72%	6%
Vol Thru, %	36%	76%	0%	11%	94%
Vol Right, %	14%	0%	100%	17%	0%
Sign Control	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	497	21	268	139	232
LT Vol	177	16	0	15	218
Through Vol	72	0	268	24	1
RT Vol	248	5	0	100	13
Lane Flow Rate	518	22	279	145	242
Geometry Grp	2	7	7	5	2
Degree of Util (X)	0.859	0.045	0.504	0.291	0.438
Departure Headway (Hd)	5.974	7.345	6.505	7.231	6.523
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes
Cap	606	487	553	495	551
Service Time	4.022	5.105	4.264	5.306	4.586
HCM Lane V/C Ratio	0.855	0.045	0.505	0.293	0.439
HCM Control Delay	35	10.5	15.7	13.3	14.6
HCM Lane LOS	D	B	C	B	B
HCM 95th-tile Q	9.6	0.1	2.8	1.2	2.2

Notes

~ : Volume Exceeds Capacity; $: Delay Exceeds 300 Seconds; Error : Computation Not Defined

Downtown Clarkston - PM Peak Hour 7/17/2013 2040 Model Projections - optimized timing
SJL

Synchro 8 Report
Page 1

Lanes, Volumes, Timings
2: 5th St & Bridge

11/5/2013

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	116	391	12	34	512	40	33	175	16	162	104	116
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	110		0	125		0	100		0	120		120
Storage Lanes	1		0	1		0	1		0	1		1
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.995			0.989			0.987				0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1770	1853	0	1770	1842	0	1770	1839	0	1770	1863	1583
Flt Permitted	0.140			0.335			0.685			0.450		
Satd. Flow (perm)	261	1853	0	624	1842	0	1276	1839	0	838	1863	1583
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		2			6			5				128
Link Speed (mph)		30			30			25			25	
Link Distance (ft)		332			1012			272			659	
Travel Time (s)		7.5			23.0			7.4			18.0	
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	123	416	13	36	545	43	35	186	17	172	111	123
Shared Lane Traffic (%)												
Lane Group Flow (vph)	123	429	0	36	588	0	35	203	0	172	111	123
Turn Type	pm+pt	NA		pm+pt	NA		pm+pt	NA		pm+pt	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4			8			2			6		6
Detector Phase	7	4		3	8		5	2		1	6	6
Switch Phase												
Minimum Initial (s)	6.0	10.0		6.0	10.0		6.0	6.0		6.0	6.0	6.0
Minimum Split (s)	11.1	30.2		11.1	25.2		11.1	22.0		11.1	25.0	25.0
Total Split (s)	11.2	32.8		11.1	32.7		11.1	22.7		13.4	25.0	25.0
Total Split (%)	14.0%	41.0%		13.9%	40.9%		13.9%	28.4%		16.8%	31.3%	31.3%
Maximum Green (s)	7.0	28.6		6.9	28.5		7.1	18.7		9.4	21.0	21.0
Yellow Time (s)	3.2	3.2		3.2	3.2		3.0	3.0		3.0	3.0	3.0
All-Red Time (s)	1.0	1.0		1.0	1.0		1.0	1.0		1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	4.2	4.2		4.2	4.2		4.0	4.0		4.0	4.0	4.0
Lead/Lag	Lead	Lag		Lead	Lag		Lead	Lag		Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes		Yes	Yes		Yes	Yes		Yes	Yes	Yes
Vehicle Extension (s)	1.0	2.5		1.5	2.5		1.0	1.0		1.0	1.0	1.0
Recall Mode	None	None		None	None		None	Max		None	Max	Max
Walk Time (s)		7.0			7.0			7.0			7.0	7.0
Flash Dont Walk (s)		19.0			14.0			11.0			11.0	11.0
Pedestrian Calls (#/hr)		0			0			0			0	0
Act Effct Green (s)	32.4	28.5		30.4	25.9		25.2	19.1		30.7	25.7	25.7
Actuated g/C Ratio	0.44	0.39		0.41	0.35		0.34	0.26		0.42	0.35	0.35
v/c Ratio	0.49	0.60		0.10	0.91		0.07	0.42		0.38	0.17	0.19
Control Delay	17.8	23.1		11.2	43.4		15.5	28.0		18.3	22.4	5.3
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Total Delay	17.8	23.1		11.2	43.4		15.5	28.0		18.3	22.4	5.3
LOS	B	C		B	D		B	C		B	C	A

Downtown Clarkston - PM Peak Hour 7/17/2013 2040 Model Projections - optimized timing
SJL

Synchro 8 Report
Page 1

Lanes, Volumes, Timings
2: 5th St & Bridge

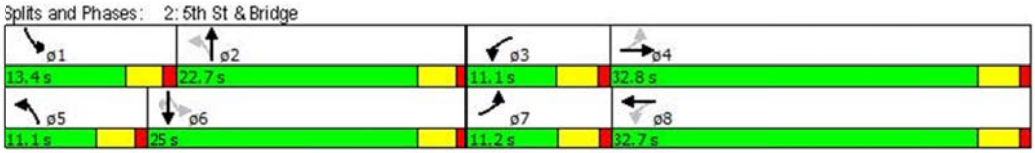
11/5/2013

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Approach Delay		22.0			41.6			26.2			15.5	
Approach LOS		C			D			C			B	
Queue Length 50th (ft)	31	168		9	264		10	84		56	43	0
Queue Length 95th (ft)	60	268		23	#466		28	149		99	83	36
Internal Link Dist (ft)		252			932			192			579	
Turn Bay Length (ft)	110			125			100			120		120
Base Capacity (vph)	260	790		371	730		504	479		472	648	634
Starvation Cap Reductn	0	0		0	0		0	0		0	0	0
Spillback Cap Reductn	0	0		0	0		0	0		0	0	0
Storage Cap Reductn	0	0		0	0		0	0		0	0	0
Reduced v/c Ratio	0.47	0.54		0.10	0.81		0.07	0.42		0.36	0.17	0.19

Intersection Summary

Area Type: Other
Cycle Length: 80
Actuated Cycle Length: 73.8
Natural Cycle: 80
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.91
Intersection Signal Delay: 27.8 Intersection LOS: C
Intersection Capacity Utilization 68.6% ICU Level of Service C
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 2: 5th St & Bridge



Downtown Clarkston - PM Peak Hour 7/17/2013 2040 Model Projections - optimized timing
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Synchro 8 Report
Page 2

HCM 2010 TWSC
7: 6th St & Bridge

11/5/2013

Intersection	
Intersection Delay, s/veh	2.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	8	442	32	47	519	2	38	16	49	2	4	1
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	110	-	-	110	-	-	-	-	50	-	-	50
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	96	96	96	96	96	96	96	96	96	96	96	96
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	8	460	33	49	541	2	40	17	51	2	4	1

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	543	0	0	494	0	0	1136	1135	477	1142	1150	542
Stage 1	-	-	-	-	-	-	494	494	-	640	640	-
Stage 2	-	-	-	-	-	-	642	641	-	502	510	-
Follow-up Headway	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Capacity-1 Maneuver	1026	-	-	1070	-	-	179	202	588	177	198	540
Stage 1	-	-	-	-	-	-	557	546	-	464	470	-
Stage 2	-	-	-	-	-	-	463	469	-	552	538	-
Time blocked-Platoon, %		-	-		-	-						
Mov Capacity-1 Maneuver	1026	-	-	1070	-	-	168	191	588	145	187	540
Mov Capacity-2 Maneuver	-	-	-	-	-	-	168	191	-	145	187	-
Stage 1	-	-	-	-	-	-	553	542	-	460	448	-
Stage 2	-	-	-	-	-	-	437	448	-	485	534	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.1	0.7	25.1	24.7
HCM LOS			D	C

Minor Lane / Major Mvmt	NBLn1	NBLn2	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	208	588	1026	-	-	1070	-	-	177	540
HCM Lane V/C Ratio	0.352	0.058	0.008	-	-	0.046	-	-	0.037	0.001
HCM Control Delay (s)	31.4	11.5	8.538	-	-	8.526	-	-	26.1	11.7
HCM Lane LOS	D	B	A			A			D	B
HCM 95th %tile Q(veh)	1.498	0.184	0.025	-	-	0.144	-	-	0.116	0.004

Notes

~ : Volume Exceeds Capacity; $: Delay Exceeds 300 Seconds; Error : Computation Not Defined

Downtown Clarkston - PM Peak Hour 7/17/2013 2040 Model Projections - optimized timing
SJL

Synchro 8 Report
Page 3

Lanes, Volumes, Timings
12: 5th St & Fair

11/5/2013

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	49	26	13	17	66	208	17	232	18	139	308	39
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		50	130		130	160		0
Storage Lanes	0		0	0		1	1		1	1		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Flt		0.981				0.850			0.850		0.983	
Flt Protected		0.973			0.990		0.950			0.950		
Satd. Flow (prot)	0	1778	0	0	1844	1583	1770	1863	1583	1770	1831	0
Flt Permitted		0.809			0.937		0.465			0.570		
Satd. Flow (perm)	0	1478	0	0	1745	1583	866	1863	1583	1062	1831	0
Right Turn on Red			Yes			No			Yes			Yes
Satd. Flow (RTOR)		14							91		11	
Link Speed (mph)		25			25			25			25	
Link Distance (ft)		290			660			659			258	
Travel Time (s)		7.9			18.0			18.0			7.0	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	54	29	14	19	73	231	19	258	20	154	342	43
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	97	0	0	92	231	19	258	20	154	385	0
Turn Type	Perm	NA		Perm	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8		8	2		2	6		
Detector Phase	4	4		8	8	8	5	2	2	1	6	
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0	10.0	6.0	10.0	10.0	6.0	10.0	
Minimum Split (s)	26.2	26.2		26.2	26.2	26.2	10.2	26.2	26.2	10.2	26.2	
Total Split (s)	26.2	26.2		26.2	26.2	26.2	10.2	28.5	28.5	10.3	28.6	
Total Split (%)	40.3%	40.3%		40.3%	40.3%	40.3%	15.7%	43.8%	43.8%	15.8%	44.0%	
Maximum Green (s)	22.0	22.0		22.0	22.0	22.0	6.0	24.3	24.3	6.1	24.4	
Yellow Time (s)	3.2	3.2		3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	
All-Red Time (s)	1.0	1.0		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	
Lost Time Adjust (s)		0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)		4.2			4.2	4.2	4.2	4.2	4.2	4.2	4.2	
Lead/Lag							Lag	Lead	Lead	Lag	Lead	
Lead-Lag Optimize?							Yes	Yes	Yes	Yes	Yes	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	2.0	3.0	3.0	2.0	3.0	
Recall Mode	None	None		None	None	None	None	Max	Max	None	Max	
Walk Time (s)	7.0	7.0		7.0	7.0	7.0		7.0	7.0		7.0	
Flash Dont Walk (s)	15.0	15.0		15.0	15.0	15.0		15.0	15.0		15.0	
Pedestrian Calls (#/hr)	0	0		0	0	0		0	0		0	
Act Effct Green (s)		13.9			13.9	13.9	31.8	25.7	25.7	34.3	31.9	
Actuated g/C Ratio		0.25			0.25	0.25	0.57	0.46	0.46	0.61	0.57	
v/c Ratio		0.26			0.21	0.59	0.03	0.30	0.03	0.21	0.37	
Control Delay		16.7			17.9	25.4	6.2	12.8	0.1	7.2	9.8	
Queue Delay		0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Delay		16.7			17.9	25.4	6.2	12.8	0.1	7.2	9.8	
LOS		B			B	C	A	B	A	A	A	

Downtown Clarkston - PM Peak Hour 7/17/2013 2040 Model Projections - optimized timing
SJL

Synchro 8 Report
Page 5

Lanes, Volumes, Timings
12: 5th St & Fair

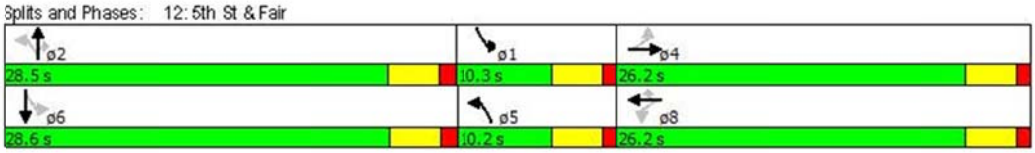
11/5/2013

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Approach Delay		16.7			23.2			11.5			9.0	
Approach LOS		B			C			B			A	
Queue Length 50th (ft)		23			25	69	2	54	0	18	51	
Queue Length 95th (ft)		54			55	127	11	122	0	52	184	
Internal Link Dist (ft)		210			580			579			178	
Turn Bay Length (ft)						50	130		130	160		
Base Capacity (vph)		594			691	627	589	855	776	730	1046	
Starvation Cap Reductn		0			0	0	0	0	0	0	0	
Spillback Cap Reductn		0			0	0	0	0	0	0	0	
Storage Cap Reductn		0			0	0	0	0	0	0	0	
Reduced v/c Ratio		0.16			0.13	0.37	0.03	0.30	0.03	0.21	0.37	

Intersection Summary

Area Type: Other
Cycle Length: 65
Actuated Cycle Length: 56
Natural Cycle: 65
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.59
Intersection Signal Delay: 13.9 — Intersection LOS: B
Intersection Capacity Utilization 45.6% — ICU Level of Service A
Analysis Period (min) 15

Splits and Phases: 12: 5th St & Fair



Lanes, Volumes, Timings
17: Diagonal & 2nd St & Bridge

11/5/2013

Lane Group	EBL	EBT	EBR	EBR2	WBL2	WBL	WBT	WBR	NBL2	NBL	NBT	NBR
Lane Configurations												
Volume (vph)	1	512	1	5	20	311	555	5	2	12	16	22
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	125		0			0		150		0		0
Storage Lanes	1		0			2		1		0		0
Taper Length (ft)	25					25				25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	0.97	1.00	1.00	1.00	1.00	1.00	1.00
Flt		0.998					0.999				0.944	
Flt Protected	0.950					0.950					0.987	
Satd. Flow (prot)	1770	1859	0	0	0	3433	1861	0	0	0	1736	0
Flt Permitted	0.237					0.458					0.929	
Satd. Flow (perm)	441	1859	0	0	0	1655	1861	0	0	0	1634	0
Right Turn on Red				Yes				Yes				Yes
Satd. Flow (RTOR)							1				23	
Link Speed (mph)		30					30				30	
Link Distance (ft)		1012					313				335	
Travel Time (s)		23.0					7.1				7.6	
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	1	545	1	5	21	331	590	5	2	13	17	23
Shared Lane Traffic (%)												
Lane Group Flow (vph)	1	551	0	0	0	352	595	0	0	0	55	0
Turn Type	Perm	NA			custom	Prot	NA		Perm	Perm	NA	
Protected Phases		2				1	6				8	
Permitted Phases	2				1				8	8		
Detector Phase	2	2			1	1	6		8	8	8	
Switch Phase												
Minimum Initial (s)	8.0	8.0			8.0	8.0	8.0		8.0	8.0	8.0	
Minimum Split (s)	14.2	14.2			29.2	29.2	26.2		39.2	39.2	39.2	
Total Split (s)	43.6	43.6			33.0	33.0	76.6		39.2	39.2	39.2	
Total Split (%)	33.5%	33.5%			25.4%	25.4%	58.9%		30.2%	30.2%	30.2%	
Maximum Green (s)	37.4	37.4			26.8	26.8	70.4		33.0	33.0	33.0	
Yellow Time (s)	3.2	3.2			3.2	3.2	3.2		3.2	3.2	3.2	
All-Red Time (s)	3.0	3.0			3.0	3.0	3.0		3.0	3.0	3.0	
Lost Time Adjust (s)	0.0	0.0				0.0	0.0				0.0	
Total Lost Time (s)	6.2	6.2				6.2	6.2				6.2	
Lead/Lag	Lead	Lead			Lag	Lag						
Lead-Lag Optimize?	Yes	Yes			Yes	Yes						
Vehicle Extension (s)	2.5	2.5			2.5	2.5	2.5		1.5	1.5	1.5	
Recall Mode	None	None			None	None	Max		None	None	None	
Walk Time (s)					8.0	8.0	10.0					
Flash Dont Walk (s)					15.0	15.0	10.0					
Pedestrian Calls (#/hr)					0	0	0					
Act Effct Green (s)	37.7	37.7				27.0	70.9				27.8	
Actuated g/C Ratio	0.33	0.33				0.24	0.62				0.24	
v/c Ratio	0.01	0.90				0.90	0.51				0.13	
Control Delay	31.0	56.3				69.7	15.6				23.2	
Queue Delay	0.0	0.0				0.0	0.0				0.0	
Total Delay	31.0	56.3				69.7	15.6				23.2	
LOS	C	E				E	B				C	

Downtown Clarkston - PM Peak Hour 7/17/2013 2040 Model Projections - optimized timing
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Synchro 8 Report
Page 8

Lanes, Volumes, Timings
17: Diagonal & 2nd St & Bridge

11/5/2013

Lane Group	SBL	SBT	SBR2	NEL	NER	NER2
Lane Configurations						
Volume (vph)	343	10	3	7	429	3
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0			150	0	
Storage Lanes	0			1	2	
Taper Length (ft)	25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	0.88	1.00
Flt		0.999			0.850	
Flt Protected		0.954		0.950		
Satd. Flow (prot)	0	1775	0	1770	2787	0
Flt Permitted		0.694		0.950		
Satd. Flow (perm)	0	1291	0	1770	2787	0
Right Turn on Red			Yes			Yes
Satd. Flow (RTOR)		131			131	
Link Speed (mph)		25		30		
Link Distance (ft)		387		480		
Travel Time (s)		10.6		10.9		
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	365	11	3	7	456	3
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	379	0	7	459	0
Turn Type	Perm	NA		NA	Over	
Protected Phases		4		9	1	
Permitted Phases	4					
Detector Phase	4	4		9	1	
Switch Phase						
Minimum Initial (s)	8.0	8.0		8.0	8.0	
Minimum Split (s)	39.2	39.2		14.2	29.2	
Total Split (s)	39.2	39.2		14.2	33.0	
Total Split (%)	30.2%	30.2%		10.9%	25.4%	
Maximum Green (s)	33.0	33.0		8.0	26.8	
Yellow Time (s)	3.2	3.2		3.2	3.2	
All-Red Time (s)	3.0	3.0		3.0	3.0	
Lost Time Adjust (s)		0.0		0.0	0.0	
Total Lost Time (s)		6.2		6.2	6.2	
Lead/Lag					Lag	
Lead-Lag Optimize?					Yes	
Vehicle Extension (s)	1.5	1.5		1.0	2.5	
Recall Mode	None	None		None	None	
Walk Time (s)	8.0	8.0			8.0	
Flash Dont Walk (s)	25.0	25.0			15.0	
Pedestrian Calls (#/hr)	0	0			0	
Act Effct Green (s)		27.8		8.1	27.0	
Actuated g/C Ratio		0.24		0.07	0.24	
v/c Ratio		0.92		0.06	0.60	
Control Delay		55.0		55.3	32.3	
Queue Delay		0.0		0.0	0.0	
Total Delay		55.0		55.3	32.3	
LOS		D		E	C	

Downtown Clarkston - PM Peak Hour 7/17/2013 2040 Model Projections - optimized timing
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Synchro 8 Report
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Lanes, Volumes, Timings
17: Diagonal & 2nd St & Bridge

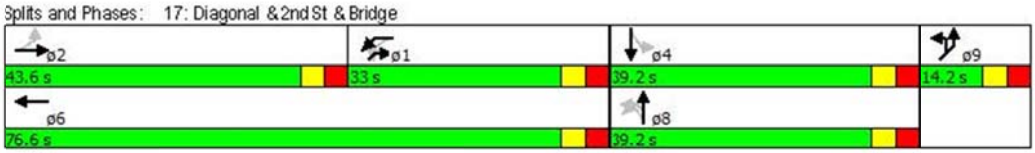
11/5/2013

Lane Group	EBL	EBT	EBR	EBR2	WBL2	WBL	WBT	WBR	NBL2	NBL	NBT	NBR
Approach Delay		56.2					35.7				23.2	
Approach LOS		E					D				C	
Queue Length 50th (ft)	1	386				130	231				17	
Queue Length 95th (ft)	6	#721				#263	441				56	
Internal Link Dist (ft)		932					233				255	
Turn Bay Length (ft)	125											
Base Capacity (vph)	146	615				393	1161				493	
Starvation Cap Reductn	0	0				0	0				0	
Spillback Cap Reductn	0	0				0	0				0	
Storage Cap Reductn	0	0				0	0				0	
Reduced v/c Ratio	0.01	0.90				0.90	0.51				0.11	

Intersection Summary

Area Type: Other
Cycle Length: 130
Actuated Cycle Length: 113.7
Natural Cycle: 130
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.92
Intersection Signal Delay: 42.6 Intersection LOS: D
Intersection Capacity Utilization 98.9% ICU Level of Service F
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 17: Diagonal & 2nd St & Bridge



Lanes, Volumes, Timings
17: Diagonal & 2nd St & Bridge

11/5/2013

Lane Group	SBL	SBT	SBR2	NEL	NER	NER2
Approach Delay		55.0		32.6		
Approach LOS		D		C		
Queue Length 50th (ft)		180		5	122	
Queue Length 95th (ft)		#404		22	213	
Internal Link Dist (ft)		307		400		
Turn Bay Length (ft)				150		
Base Capacity (vph)		470		125	761	
Starvation Cap Reductn		0		0	0	
Spillback Cap Reductn		0		0	0	
Storage Cap Reductn		0		0	0	
Reduced v/c Ratio		0.81		0.06	0.60	

Intersection Summary

Downtown Clarkston - PM Peak Hour 7/17/2013 2040 Model Projections - optimized timing
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Lanes, Volumes, Timings
3: 13th St & Bridge St

11/5/2013

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	41	345	30	136	337	33	23	90	75	61	154	34
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	125		150	125		150	60		0	60		0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.988			0.987			0.932			0.973	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1805	1827	0	1787	1842	0	1687	1761	0	1805	1834	0
Flt Permitted	0.531			0.438			0.496			0.564		
Satd. Flow (perm)	1009	1827	0	824	1842	0	881	1761	0	1072	1834	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		8			9			64			17	
Link Speed (mph)		30			30			25			25	
Link Distance (ft)		1000			1000			1000			1000	
Travel Time (s)		22.7			22.7			27.3			27.3	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Heavy Vehicles (%)	0%	3%	0%	1%	2%	0%	7%	1%	0%	0%	1%	0%
Adj. Flow (vph)	43	363	32	143	355	35	24	95	79	64	162	36
Shared Lane Traffic (%)												
Lane Group Flow (vph)	43	395	0	143	390	0	24	174	0	64	198	0
Turn Type	pm+pt	NA		pm+pt	NA		Perm	NA		Perm	NA	
Protected Phases	5	2		1	6			8			4	
Permitted Phases	2			6			8			4		
Detector Phase	5	2		1	6		8	8		4	4	
Switch Phase												
Minimum Initial (s)	6.0	10.0		6.0	10.0		6.0	6.0		6.0	6.0	
Minimum Split (s)	10.2	28.2		10.2	29.2		26.0	26.0		27.0	27.0	
Total Split (s)	10.2	32.0		11.0	32.8		27.0	27.0		27.0	27.0	
Total Split (%)	14.6%	45.7%		15.7%	46.9%		38.6%	38.6%		38.6%	38.6%	
Maximum Green (s)	6.0	27.8		6.8	28.6		23.0	23.0		23.0	23.0	
Yellow Time (s)	3.2	3.2		3.2	3.2		3.0	3.0		3.0	3.0	
All-Red Time (s)	1.0	1.0		1.0	1.0		1.0	1.0		1.0	1.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)	4.2	4.2		4.2	4.2		4.0	4.0		4.0	4.0	
Lead/Lag	Lead	Lag		Lead	Lag							
Lead-Lag Optimize?												
Vehicle Extension (s)	1.0	2.5		1.0	2.5		1.0	1.0		1.0	1.0	
Recall Mode	None	Max		None	Max		None	None		None	None	
Walk Time (s)		6.0			6.0		5.0	5.0		5.0	5.0	
Flash Dont Walk (s)		18.0			19.0		17.0	17.0		18.0	18.0	
Pedestrian Calls (#/hr)		0			0		0	0		0	0	
Act Effct Green (s)	34.0	29.4		36.0	33.6		9.1	9.1		9.1	9.1	
Actuated g/C Ratio	0.62	0.54		0.66	0.61		0.17	0.17		0.17	0.17	
v/c Ratio	0.06	0.40		0.22	0.34		0.16	0.50		0.36	0.62	
Control Delay	3.9	10.6		4.5	8.2		22.3	19.2		26.5	28.6	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	3.9	10.6		4.5	8.2		22.3	19.2		26.5	28.6	

Bridge &13th - PM Peak Hour 7/17/2013 2040 Model Projections - optimized
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Synchro 8 Report
Page 1

Lanes, Volumes, Timings
3: 13th St & Bridge St

11/5/2013

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
LOS	A	B		A	A		C	B		C	C	
Approach Delay		9.9			7.2			19.6			28.1	
Approach LOS		A			A			B			C	
Queue Length 50th (ft)	3	73		12	37		7	33		19	56	
Queue Length 95th (ft)	13	156		34	149		24	81		49	111	
Internal Link Dist (ft)		920			920			920			920	
Turn Bay Length (ft)	125			125			60			60		
Base Capacity (vph)	714	983		664	1134		372	780		452	784	
Starvation Cap Reductn	0	0		0	0		0	0		0	0	
Spillback Cap Reductn	0	0		0	0		0	0		0	0	
Storage Cap Reductn	0	0		0	0		0	0		0	0	
Reduced v/c Ratio	0.06	0.40		0.22	0.34		0.06	0.22		0.14	0.25	

Intersection Summary

Area Type: Other
Cycle Length: 70
Actuated Cycle Length: 54.8
Natural Cycle: 70
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.62
Intersection Signal Delay: 13.5 Intersection LOS: B
Intersection Capacity Utilization 56.3% ICU Level of Service B
Analysis Period (min) 15

Splits and Phases: 3: 13th St & Bridge St

Bridge & 13th - PM Peak Hour 7/17/2013 2040 Model Projections - optimized
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Synchro 8 Report
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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*KJM*	Intersection	*Fair St. & 13th St.*
Agency/Co.	*Keller Associates*	Jurisdiction	*City of Clarkston*
Date Performed	*7/23/2013*	Analysis Year	*2040*
Analysis Time Period	*PM Peak*		

Project Description *N. Clarkston Circulation Study*

East/West Street: *Fair St.*	North/South Street: *13th St.*
Intersection Orientation: *North-South*	Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*18*	*117*	*16*	*4*	*105*	*13*
Peak-Hour Factor, PHF	*0.85*	*0.85*	*0.85*	*0.85*	*0.85*	*0.85*
Hourly Flow Rate, HFR (veh/h)	*21*	*137*	*18*	*4*	*123*	*15*
Percent Heavy Vehicles	*0*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration	*LTR*			*LTR*		
Upstream Signal		*1*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*13*	*18*	*29*	*27*	*66*	*8*
Peak-Hour Factor, PHF	*0.85*	*0.85*	*0.85*	*0.85*	*0.85*	*0.85*
Hourly Flow Rate, HFR (veh/h)	*15*	*21*	*34*	*31*	*77*	*9*
Percent Heavy Vehicles	*0*	*0*	*0*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration		*LTR*			*LTR*	

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LTR*	*LTR*		*LTR*			*LTR*	
v (veh/h)	*21*	*4*		*117*			*70*	
C (m) (veh/h)	*1458*	*1438*		*589*			*686*	
v/c	*0.01*	*0.00*		*0.20*			*0.10*	
95% queue length	*0.04*	*0.01*		*0.73*			*0.34*	
Control Delay (s/veh)	*7.5*	*7.5*		*12.6*			*10.8*	
LOS	*A*	*A*		*B*			*B*	
Approach Delay (s/veh)	--	--	*12.6*			*10.8*		
Approach LOS	--	--	*B*			*B*		

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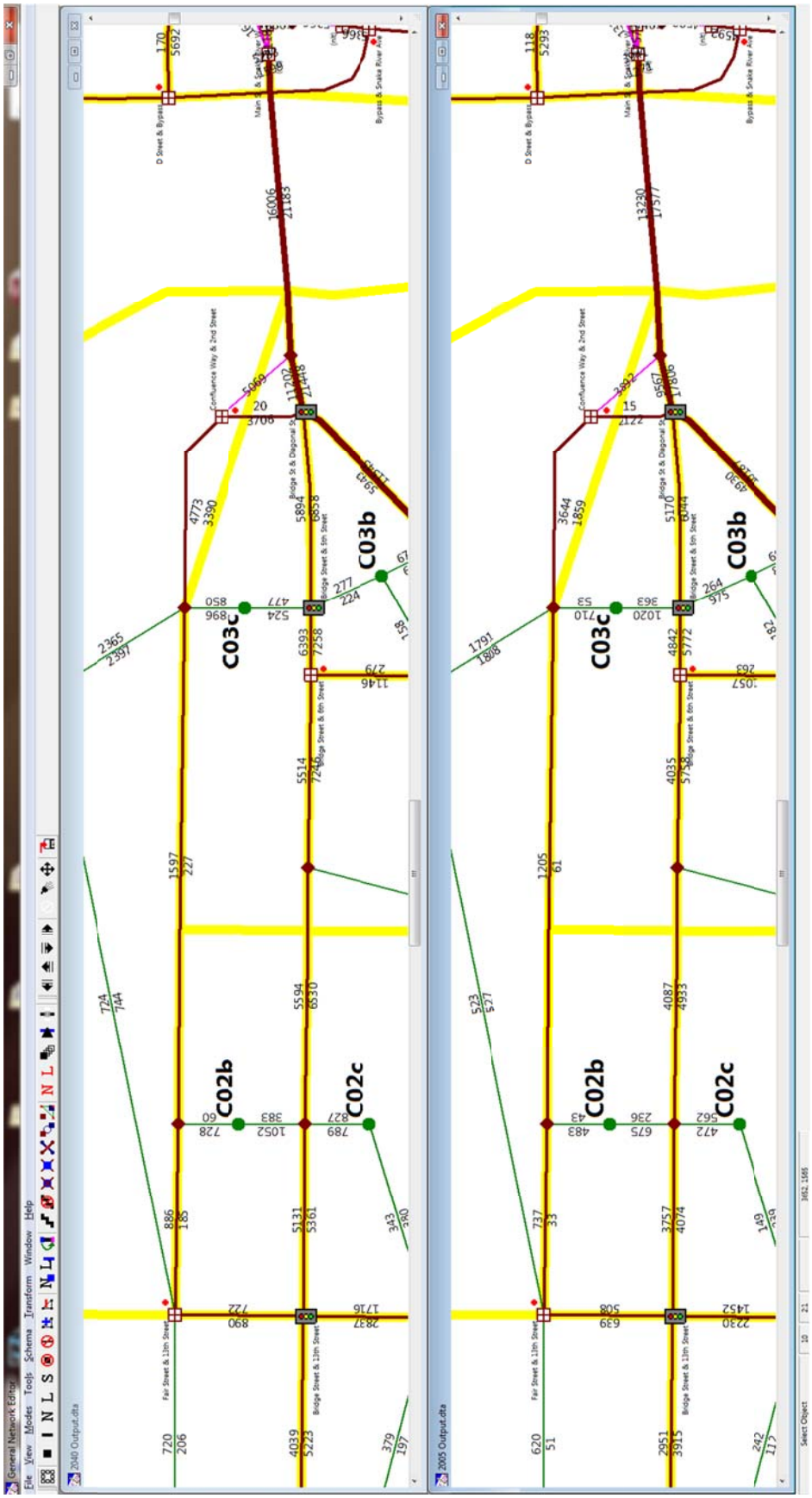
Appendix B – QRS II Model and Furness Iterative Process Data

Original Calibration Year and Year 2040 QRS II Models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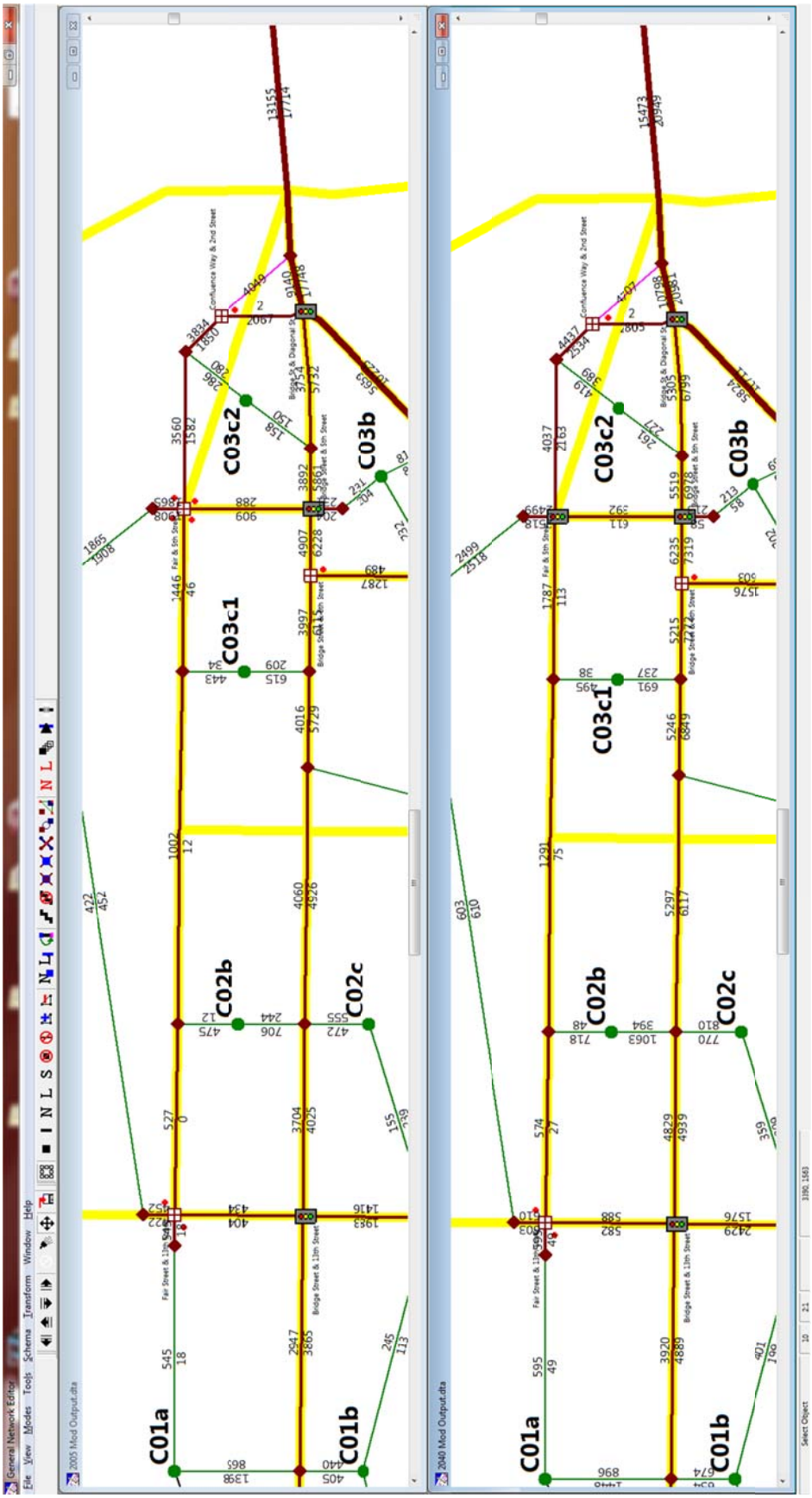
File View Modes Tools Schema Transform Window Help
2040 Output.dta
2005 Output.dta
C02b
C02c
C03b
C03c
Fair Street & 13th Street
Bridge Street & 13th Street
Bridge Street & 8th Street
Bridge St & Diagonal St
Confluence Way & 2nd Street
D Street & Bypass
Bypass & Snake River Ave
Select Object

Modified Calibration Year and Year 2040 QRS II Models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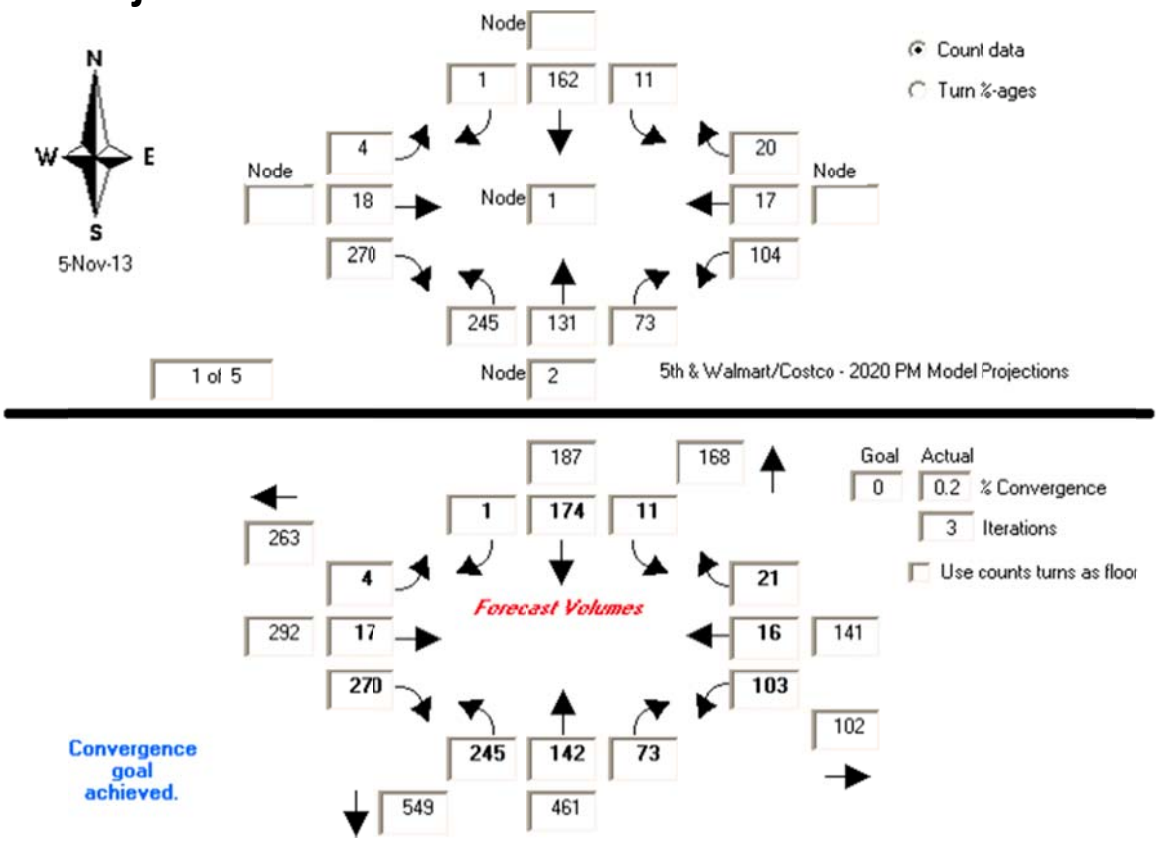
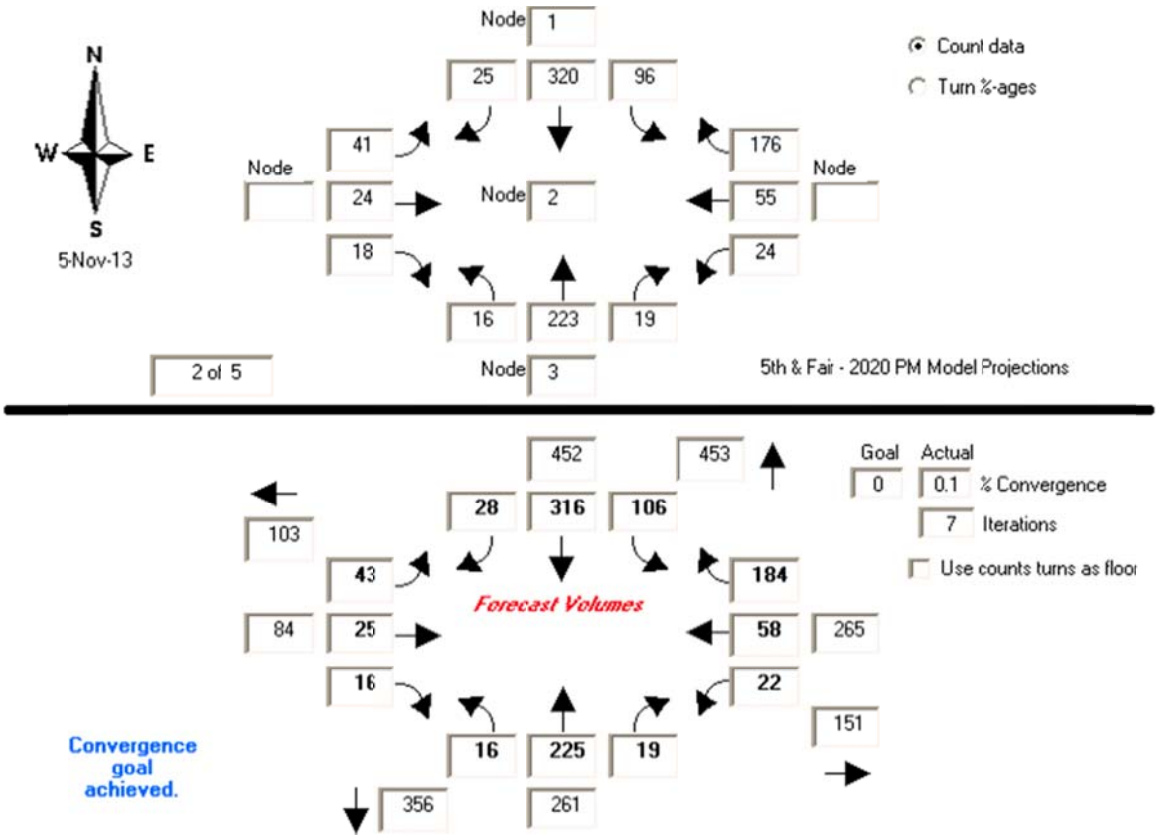
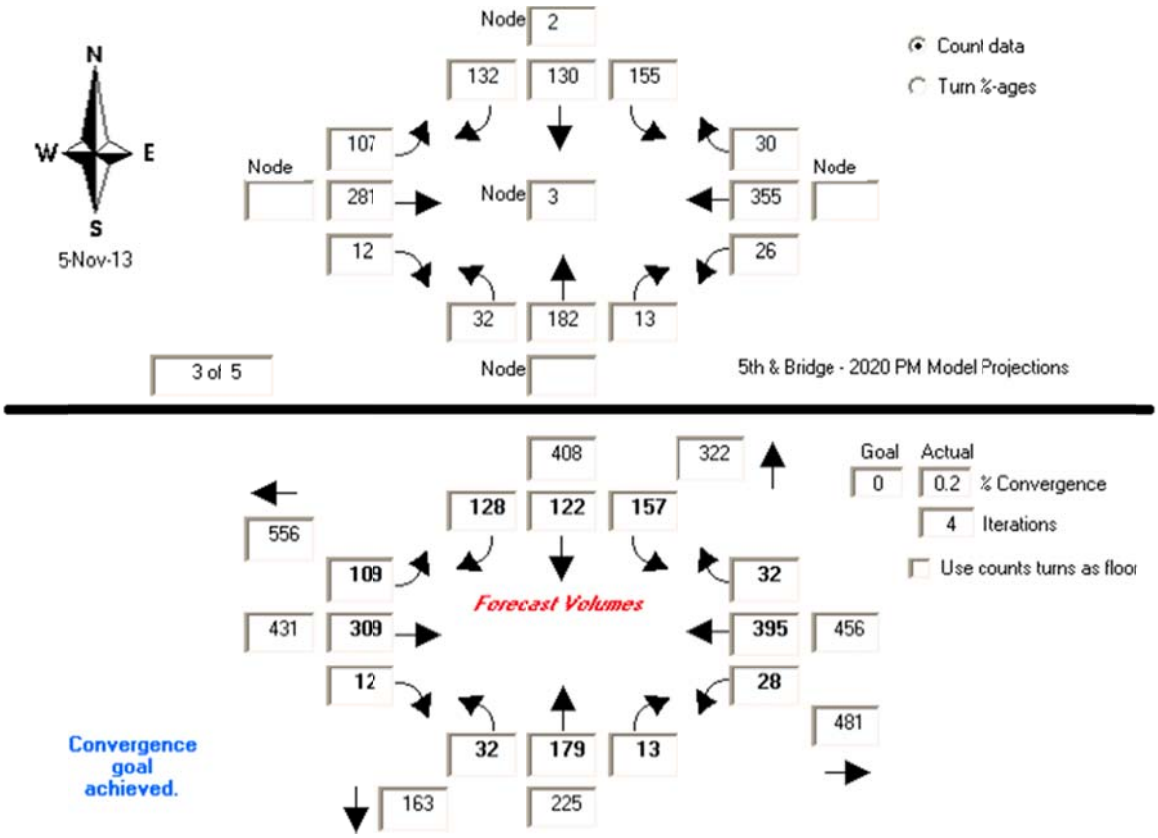
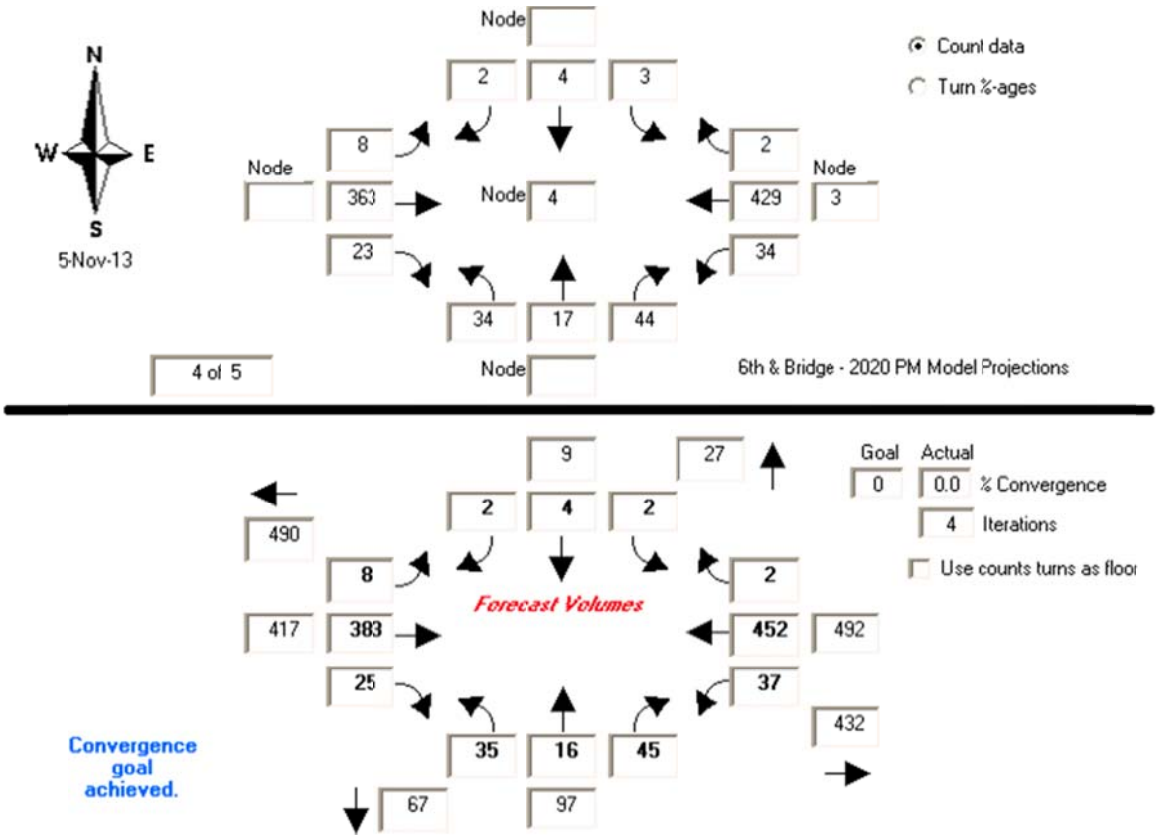
2005 Mod Output.dta
2040 Mod Output.dta
C01a
C01b
C02b
C02c
C03c1
C03c2
C03b
Fair Street & 13th Street
Bridge Street & 13th Street
Fair & 5th Street
Bridge Street & 5th Street
Confluence Way & 2nd Street
Select Object

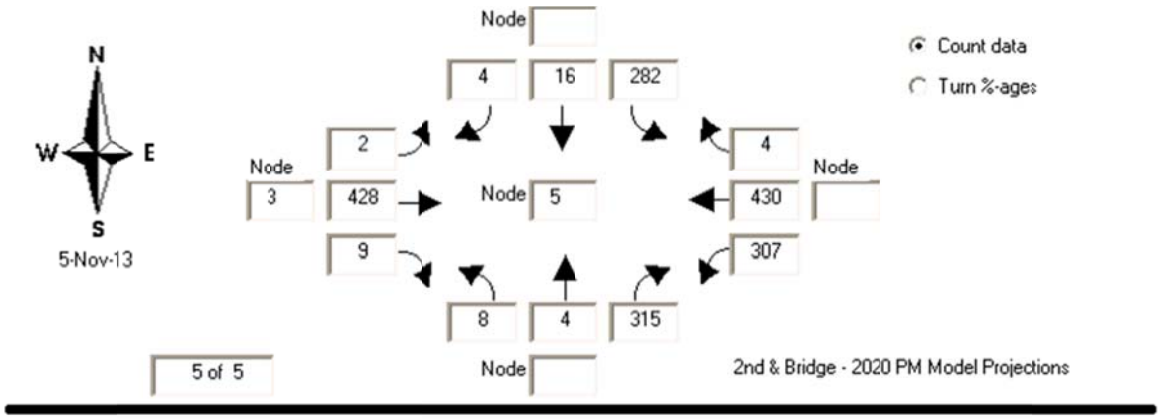
2020 Projections

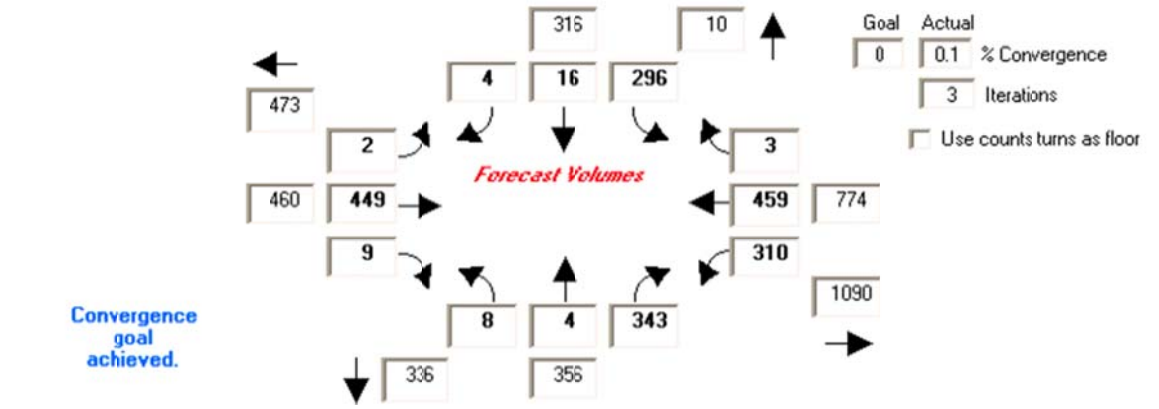



N
W
E
S
5-Nov-13
Node 1
25
320
96
Count data
Turn %-ages
41
176
Node
Node
24
Node 2
55
18
24
16
223
19
2 of 5
Node 3
5th & Fair - 2020 PM Model Projections
452
453
Goal
Actual
0
0.1
% Convergence
7
Iterations
Use counts turns as floor
103
28
316
106
43
184
Forecast Volumes
84
25
58
265
16
22
151
Convergence goal achieved.
16
225
19
356
261

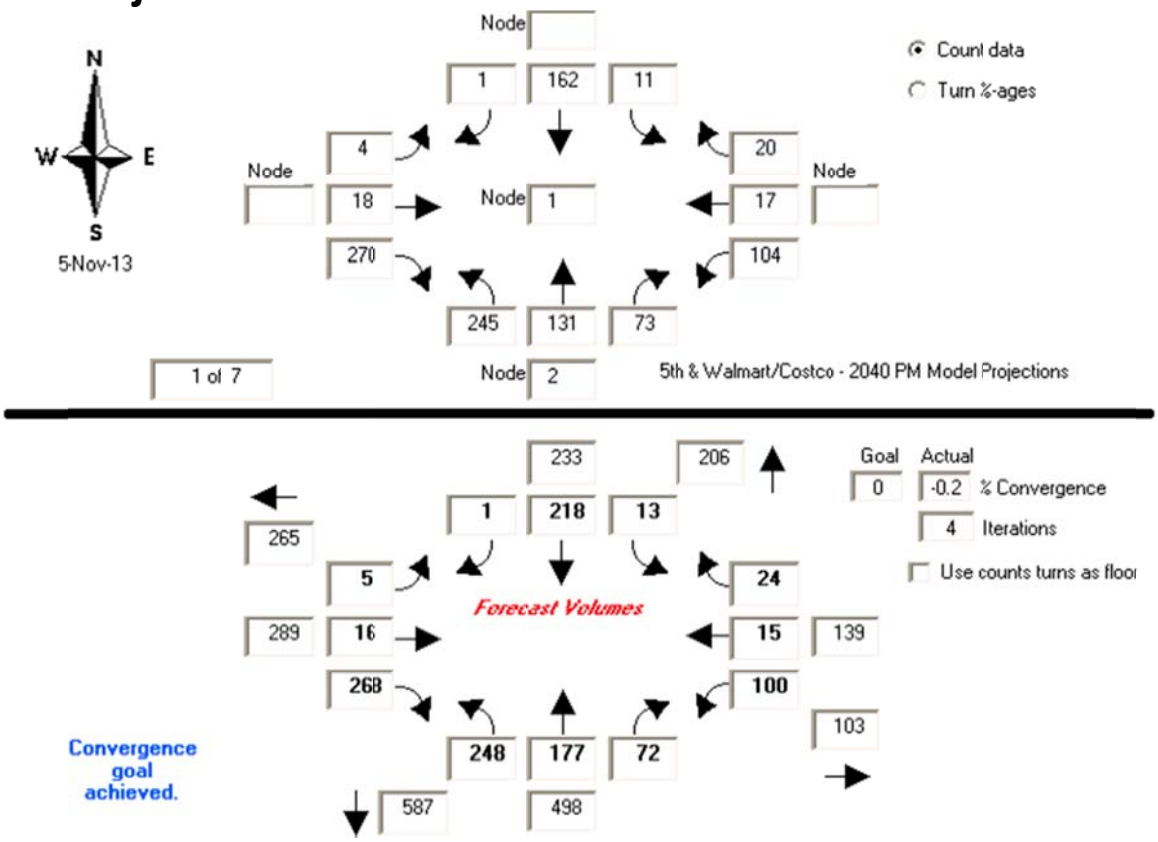

N
W
E
S
5-Nov-13
Node
2
132
130
155
Count data
Turn %-ages
107
30
Node
Node
281
Node
3
355
Node
12
26
32
182
13
3 of 5
Node
5th & Bridge - 2020 PM Model Projections
408
322
Goal
Actual
0
0.2
% Convergence
4
Iterations
Use counts turns as floor
556
128
122
157
109
32
Forecast Volumes
431
309
395
456
12
28
481
Convergence goal achieved.
32
179
13
163
225

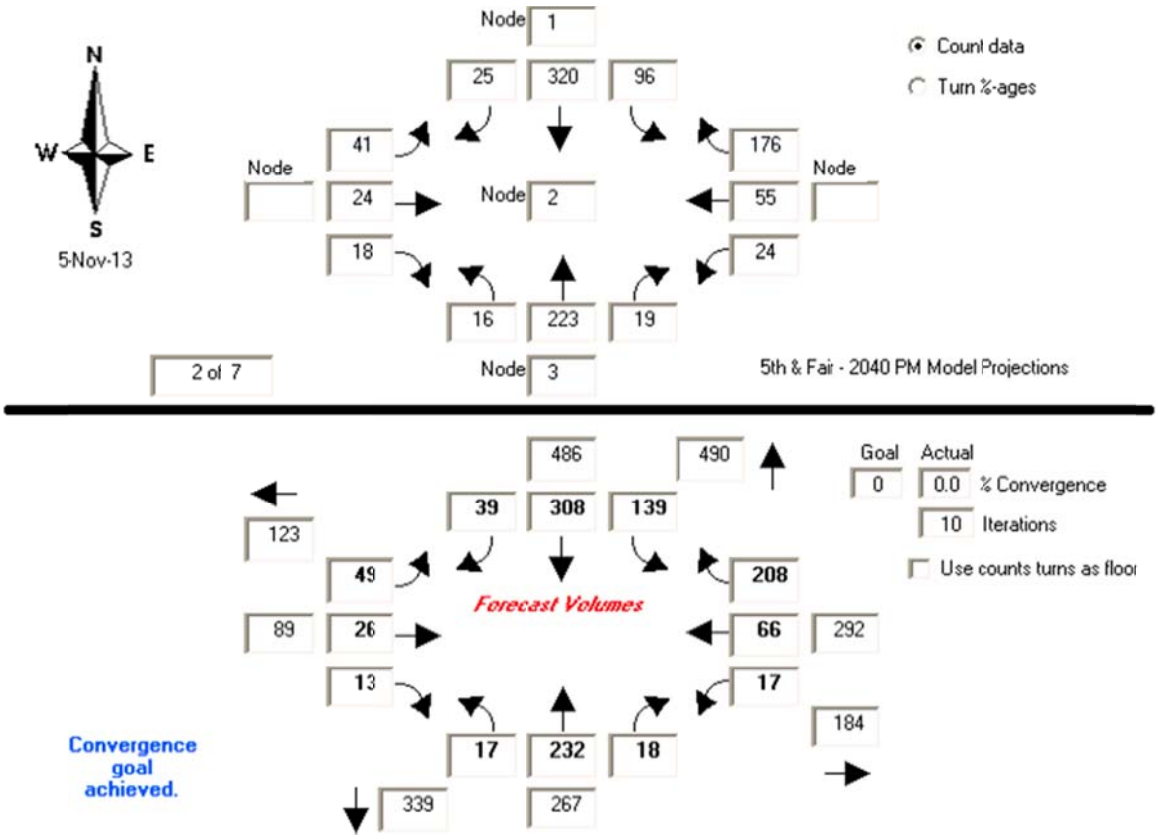

N
W
E
S
5-Nov-13
Node
2
4
3
8
Node
363
Node
4
2
429
Node
3
23
34
34
17
44
Node
Count data
Turn %-ages
4 of 5
6th & Bridge - 2020 PM Model Projections
9
27
Goal
Actual
0
0.0
% Convergence
4
Iterations
Use counts turns as floor
490
2
4
2
8
2
Forecast Volumes
417
383
452
492
25
37
432
35
16
45
67
97
Convergence goal achieved.

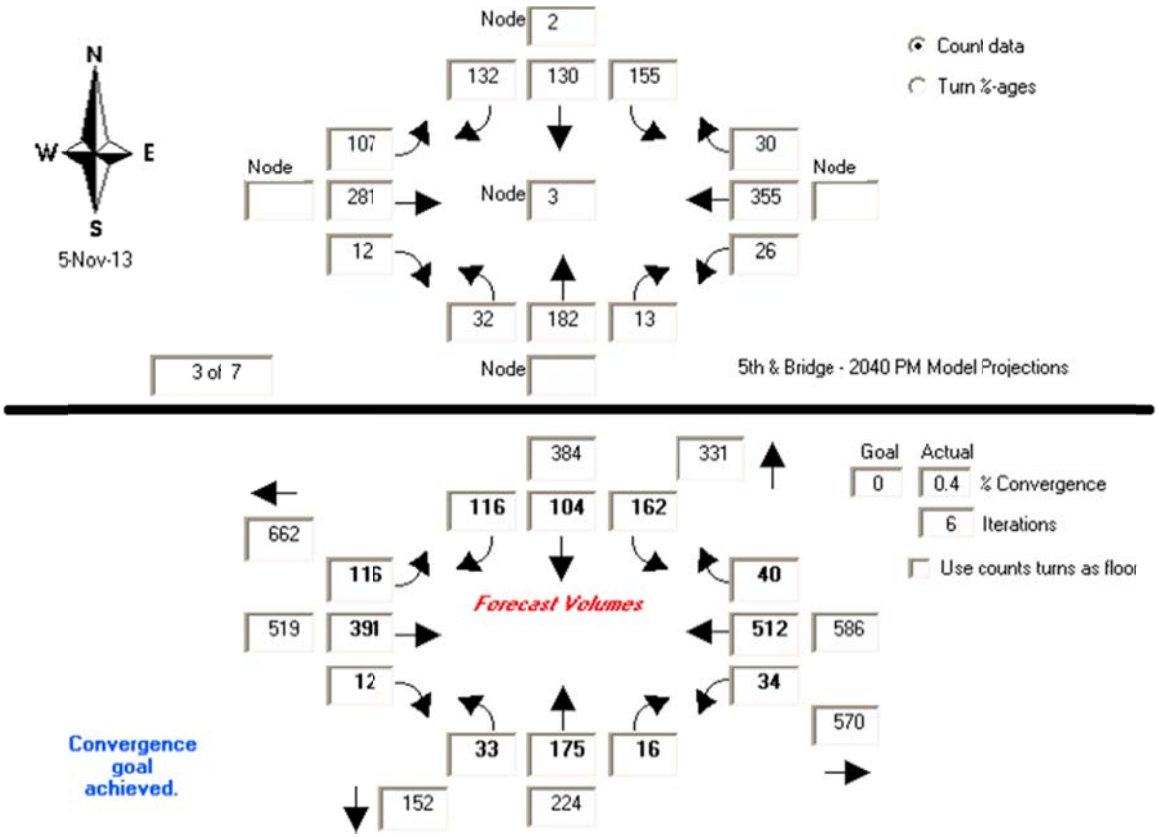

N
W
E
S
5-Nov-13
Node
4
16
282
Count data
Turn %-ages
2
4
Node
3
428
Node
5
430
Node
9
307
8
4
315
5 of 5
Node
2nd & Bridge - 2020 PM Model Projections

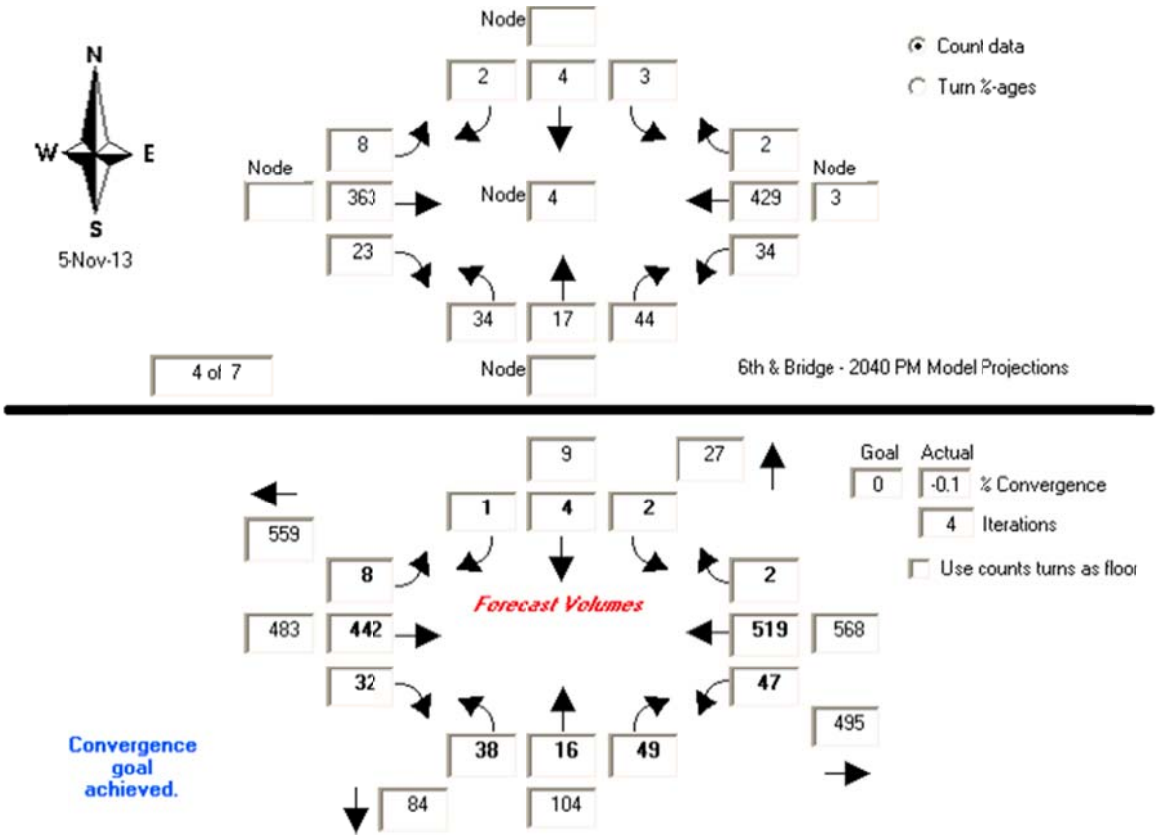

315
10
Goal
Actual
0
0.1
% Convergence
3
Iterations
Use counts turns as floor
473
4
16
296
2
3
Forecast Volumes
460
449
459
774
9
310
1090
Convergence goal achieved.
8
4
343
336
355

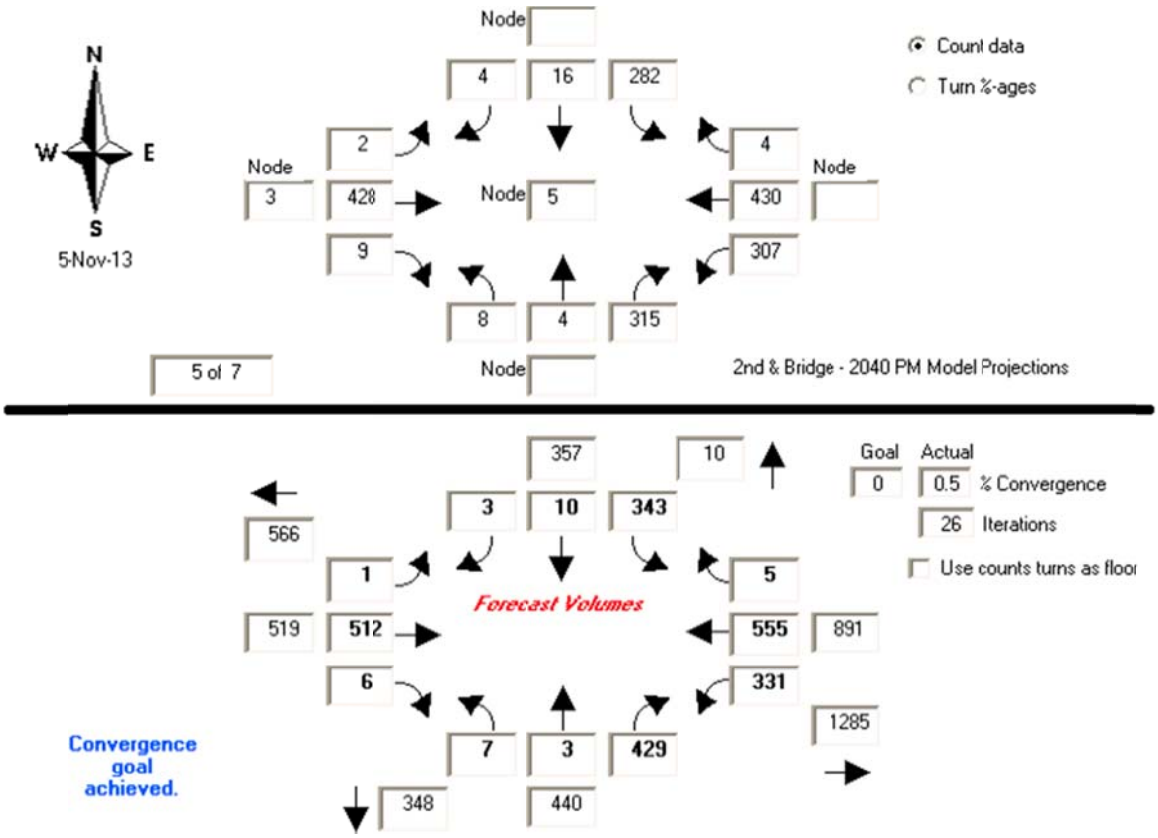
2040 Projections

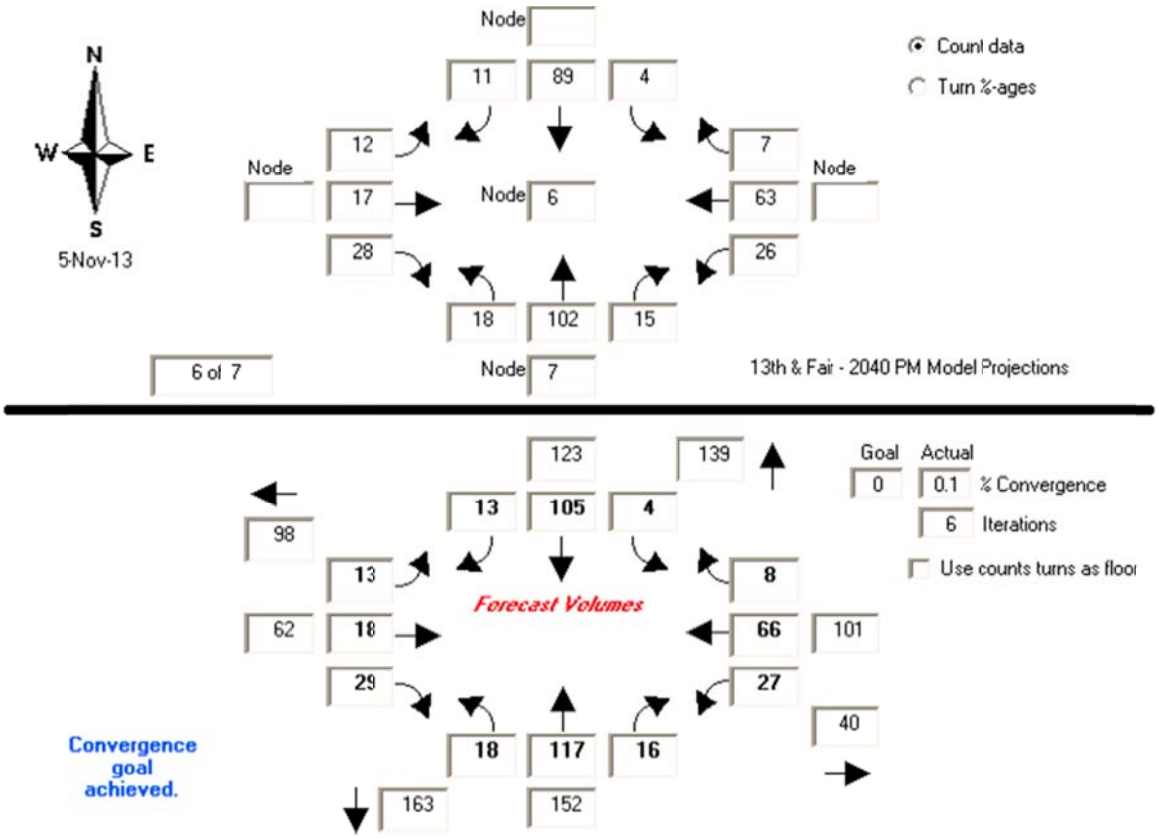


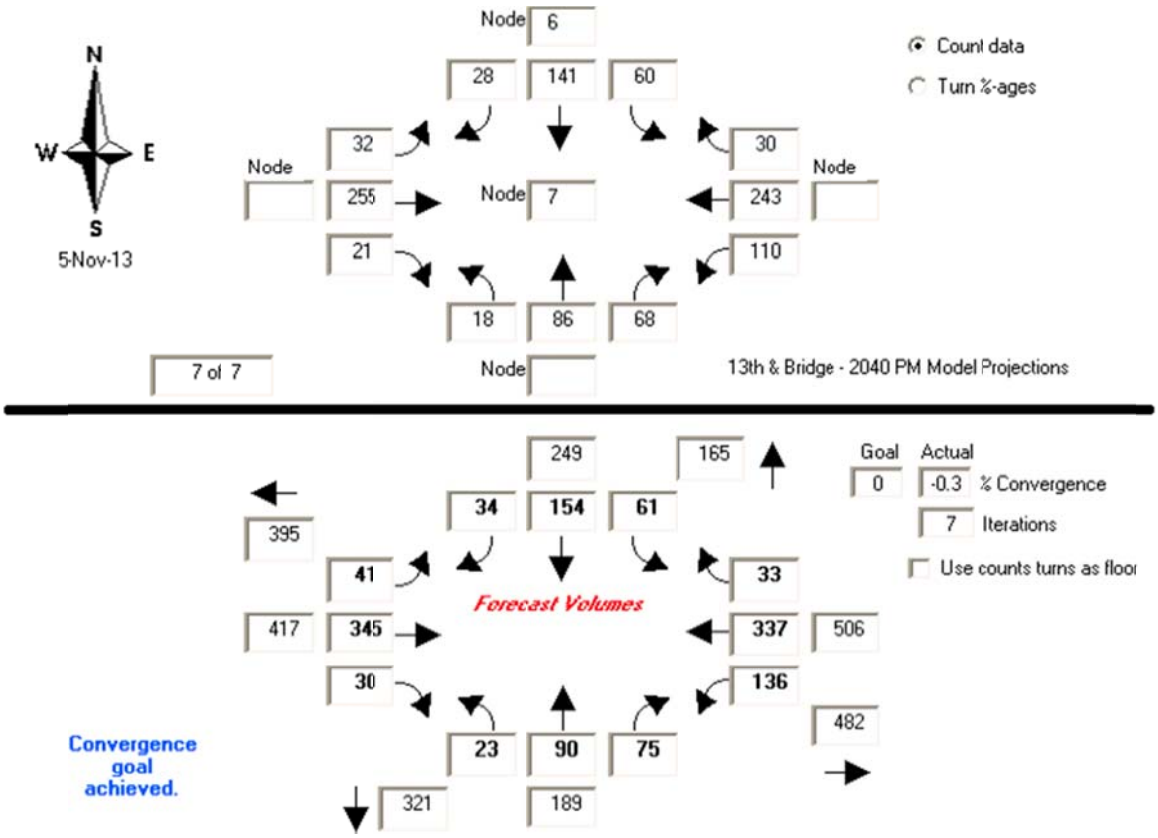

N
W
E
S
5-Nov-13
Node 1
25
320
96
Count data
Turn %-ages
41
176
Node
Node
24
Node 2
55
18
24
16
223
19
2 of 7
Node 3
5th & Fair - 2040 PM Model Projections
486
490
Goal
Actual
0
0.0
% Convergence
10
Iterations
Use counts turns as floor
123
39
308
139
49
208
Forecast Volumes
89
26
66
292
13
17
184
Convergence goal achieved.
17
232
18
339
267


N
W
E
S
5-Nov-13
Node 2
132
130
155
107
30
Node
281
Node 3
355
Node
12
26
32
182
13
Count data
Turn %-ages
3 of 7
Node
5th & Bridge - 2040 PM Model Projections
384
331
Goal
Actual
0
0.4
% Convergence
6
Iterations
Use counts turns as floor
662
116
104
162
115
40
Forecast Volumes
519
391
512
586
12
34
570
Convergence goal achieved.
33
175
16
152
224


N
W
E
S
5-Nov-13
Node
2
4
3
8
Node
363
Node
4
429
2
Node
3
23
34
34
17
44
Node
Count data
Turn %-ages
4 of 7
6th & Bridge - 2040 PM Model Projections
9
27
Goal
Actual
0
-0.1
% Convergence
4
Iterations
Use counts turns as floor
1
4
2
559
8
2
Forecast Volumes
483
442
519
568
32
47
495
38
16
49
84
104
Convergence goal achieved.


N
W
E
S
5-Nov-13
Node
4
16
282
Count data
Turn %-ages
2
Node
3
428
Node
5
4
Node
430
9
307
8
4
315
5 of 7
Node
2nd & Bridge - 2040 PM Model Projections
357
10
Goal
Actual
0
0.5
% Convergence
26
Iterations
Use counts turns as floor
566
3
10
343
1
5
Forecast Volumes
519
512
555
891
6
331
1285
Convergence goal achieved.
7
3
429
348
440


N
W
E
S
5-Nov-13
Node
11
89
4
Count data
Turn %-ages
12
7
Node
Node
17
Node
6
63
Node
28
26
18
102
15
6 of 7
Node
7
13th & Fair - 2040 PM Model Projections
123
139
Goal
Actual
0
0.1
% Convergence
6
Iterations
Use counts turns as floor
98
13
105
4
13
8
Forecast Volumes
62
18
66
101
29
27
40
Convergence goal achieved.
18
117
16
163
152


N
W
E
S
5-Nov-13
Node 6
28
141
60
32
30
Node
Node 7
Node
255
243
21
110
18
86
68
Count data
Turn %-ages
7 of 7
Node
13th & Bridge - 2040 PM Model Projections
249
165
Goal
Actual
0
-0.3 % Convergence
7 Iterations
Use counts turns as floor
395
34
154
61
41
33
Forecast Volumes
417
345
337
506
30
136
482
Convergence goal achieved.
23
90
75
321
189