TRANSPORTATION STUDY UPDATE

LIVINGSTON, MONTANA

Prepared for

CITY OF LIVINGSTON

Prepared by

MARVIN & ASSOCIATES
1300 North Transtech Way
Billings, MT 59102

September 1, 2017

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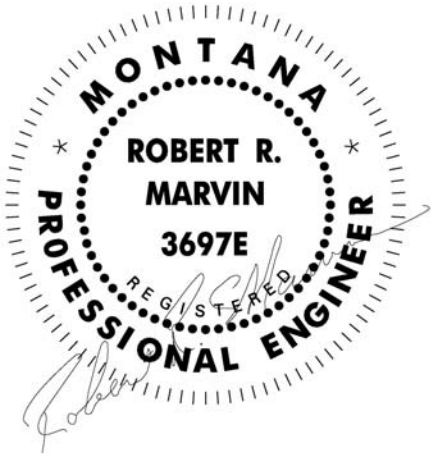

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Marvin & Associates

LIVINGSTON TRANSPORTATION STUDY UPDATE

INTRODUCTION

This report summarizes a Transportation Study Update for the City of Livingston. The original Transportation study was completed by Marvin & Associated in March of 2000. That study included typical planning level analysis along with extensive public information efforts involving both City and County officials. That study resulted in a number of short-term and long-term improvement project recommendations. Of those recommendations, two projects were eventually constructed (traffic signals on Park Street at 5th Street and 7th Street).

The study update differs from the original study in both scope and study area boundaries. The City of Livingston is intent on developing a capital improvements plan that includes transportation projects to be constructed with the next five to ten years. Thus, this study focuses on intersections and street corridors with definable operational deficiencies within the city limits. Intensive data collection efforts by TD&H Engineers and Marvin Associates were completed prior to completing capacity and crash analysis of all intersections and street corridors within the City. Problematic intersections and corridors were ranked according to safety and efficiency criteria which resulted in 4 corridors and 7 intersections being selected for evaluation of potential improvement projects. In addition, the study provides direction for incorporation of alternative transportation modes and parking within the Livingston Central Business District (CBD).

Figure 1 on the following page illustrates the approximate area included in the transportation study. The study area is somewhat smaller than the original transportation study since this study focuses on streets within the city limits, whereas the original study also included tracks of land within the jurisdiction of Park County.

MARVIN & ASSOCIATES

North

U-7406
Sewage Plant
BENNETT ST
U-7405
U-7406
MONTANA ST
GALLATIN
PARK ST (P11)
MRL
Lagoon
CALLANDER
U-7409
BUTTE ST
Country Club
Island
Fair Ground
Livingston
VIEW VISTA DR
U-7407
YELLOWSTONE
RESERVOIR
SUMMIT
2ND
3RD
MAIN
MONTANA
YELLOWSTONE
U-7402
GALLATIN
CHINOOK
MAIN
U-7406
5TH
6TH
7TH ST
U-7401
FRONT ST
U-7403
PARK ST (P11)
U-7404
U-7404 STAR RD
SUNRISE DR
SUMMIT ST
10TH
11TH
12TH
13TH
14TH
9TH
8TH
U-7402
U-7404 FRONT
U-7408
SUN AVE
Retail Mall
Main Post Office
MONTANA RAIL LINK
LEWIS
2ND
3RD
CLARK
GEYSER
BUTTE
5TH
6TH
7TH
8TH
9TH
10TH
11TH
12TH
13TH
14TH
U-7410
U-7412
Civic Center
Sacajawea Park
RIVER DR
U-7412
CRAWFORD
CAMBRIDGE
CLARENCE
OAK DR
MEADOWLARK LN
ROBIN LN
BLUEBIRD LN
FENCE LN
ROGERS
PARK ST (P11)
YELLOWSTONE
I-90
LOVES LN
U-7413
WINDMILL PARK RD
NN #33
MILLER DR
WILLOW DR
BILLMAN
U-7414
LN

Figure 1. Livingston Transportation Study Area Street System

EXISTING STREET SYSTEM

2017 Traffic Counts

TD&H Engineering provided Mio-vision camera files for 33 intersections within the City of Livingston. Twenty-seven intersection counts were taken in late November and December of 2016 and early January 2017. Subsequent to those counts, sorting of crash data lead to five additional intersections being counted in March 2017. Additional counts were taken in July of 2017 subsequent to review of the draft report by the City of Livingston. No tube counts were taken because of severe weather conditions during the course of the data collection study phase. However, it was determined that hourly traffic variation data from traffic counters used for two separate projects in 2005 and 2012 could provide reasonable factors to estimate current average annual daily traffic (AADT) volumes on specific street segments.

Figure 2 on the following page illustrates the intersection count locations and estimated AADT volumes on various street segments within the study area. The intersection reference numbers correspond to the chronological order of traffic count summaries contained in Appendix A of this report. Two hour counts were taken for both am and pm hour periods and the peak am and pm hour volumes were calculated. Also shown in Appendix A are the calculated peak hour factors, which are used in capacity analysis and represents the one hour equivalent of the highest 15-minute peak period.

AADT numbers were calculated by applying monthly and daily variation factors extracted from the latest Montana Department of Transportation (MDT) permanent count stations data on similar facilities within the proximity of Livingston. Monthly, daily, and hourly variation graphs contained in the original transportation study are similar to the 2016 factors used within this update. In comparing the AADT shown in Figure 2 to those contained in the year 2000 study, it can be seen that the most significant differences appear to be on Star Road, Front Street, and N 5th Street.

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11 — Intersection Count Number

5,000 — Average Annual Daily Traffic (AADT)

North

Figure 2. Year 2017 Traffic Volumes

Design Hour Traffic Estimates

The traffic count data contained in Appendix A was input to a traffic matrix spreadsheet used to calculate the AADT volumes. Monthly and daily traffic variations factors were used to determine the intersection traffic demand that is typically used for intersection design. Since traffic counts were taken in months where volumes are at their lowest levels, the design hour traffic volumes are appreciably higher than the count volumes. Because the peak pm hour counts were substantially higher than the am hour counts, design hour volume were only calculated for the pm hour periods. Appendix B contains the graphic illustration of year 2017 pm design hour traffic calculated for each of the intersections counted within this study. It should be mentioned that an additional count taken at the intersection of Park and 2nd Streets in July 2017 were slightly lower than design hour counts factored from the winter counts. Thus, the calculated design hour counts could be considered as a conservative estimate.

Capacity Calculations

Peak pm hour existing capacity calculations were completed for the existing intersections using the *HCS7* software package (see Appendix D). Table 1, on the following page, summarizes the results of the capacity calculations. Table 1 only includes 21 of the 33 intersections counted, since 12 of the intersection were uncontrolled. There are no methods available for calculating capacity at uncontrolled intersections since it is assumed traffic and delay at uncontrolled intersections would be minimal. Measures in Table 1 include control delay (seconds/vehicle) and level of service (LOS) for each intersection approach and for the intersection as a whole. The calculation results indicate that all approach movements for all the intersections currently operate at or above a LOS "C", with the exception of the westbound leg of the Park Street & I-90 Westbound Ramp intersection and the Front Street and 5th Street intersection.

Table 1 ranks the intersections by seconds of delay per vehicle entering the intersection. It was determined that the average delay for all intersections was 13.3 seconds per vehicle. Only 5 intersections exceeded the average, which qualified those intersections for additional analysis in the study. Since the Front Street and 5th Street Intersection has a movement that operates at a LOS less than LOS "C" and its operation is inter-related with operations at the Park and 5th Street intersection, it would also qualify for additional study.

Table 1. Year 2017 Average Design Hour Intersection Capacity Summary

Intersection	Rank by Delay	Eastbound Delay (s/v)	Eastbound LOS	Westbound Delay (s/v)	Westbound LOS	Northbound Delay (s/v)	Northbound LOS	Southbound Delay (s/v)	Southbound LOS	Intersection Delay (s/v)	Intersection LOS
Park Street & I-90 WB Ramps	1			55.8	F			10.9	B	45.5	F
Park St. & B St.	2	10.8	B	32.8	C	28.6	C	27.3	C	22.4	C
Park St.& 7th St.	3	21.1	C	16.1	B	14.1	B	26.7	C	20.5	C
Park St.& 5th St.	4	14.1	B	23.4	C	24.3	C	24.3	C	18.8	B
Park St.& Loves Lane	5	15.3	B	14.9	B	16.0	B	15.0	B	15.4	B
Front St. & 5th St.	6	11.8	B	27.7	D	8.0	A	7.7	A	11.4	B
Park St. & Main St.	7			9.0	A	20.7	C			11.0	B
Park St. & 2nd St.	8			9.4	A	20.4	C			10.6	B
Callander St. & B St.	9	7.6	A	7.4	A	14.2	B	11.9	B	10.4	B
Park St. & 6th St	10			10.2	B	19.7	C			10.3	B
Callander St. & Main St.	11	10.3	B	10.1	B	10.3	B	9.5	B	10.1	B
Sun Ave. & Star Road	12	8.6	A			7.4	A			10.0	B
Park St. & Rogers St.	13	21.2	C			9.5	A			9.8	A
Park St. & Geyser St.	14			16.6	C			8.7	A	9.7	A
Chinook St. & 5th St.	15	7.4	A	7.6	A	13.0	B	12.0	B	9.5	A
Callander St. & 2nd St.	16	9.1	A	9.6	A	9.3	A	9.1	A	9.4	A
Park St. & 8th St	17			14.9	B			9.0	A	9.1	A
Park St. & Old Clyde Park	18	8.1	A					11.4	C	9.0	A
Chinook St. & Main St.	19	8.3	A	9.5	A	9.2	A	7.9	A	8.7	A
Clark St. & 5th St.	20	10.0	B	9.7	A	7.3	A	7.3	A	8.5	A
Front St. & Main St.	21	11.6	B			7.6	A			8.3	A
								Average Delay =		13.3	

Crash Statistics

MDT Traffic Safety Section provided crash statistics for all Urban System Routes in Livingston for a five-year period between 2008 and 2013. The City of Livingston began using a separate crash reporting system in 2014 that was not compatible with the MDT system, so they were unable to provide data for years 2014 thru 2016. The City of Livingston provided crash data for the missing years, but that data did not provide the same level of detail as the MDT system data. Therefore, the city data was only used to determine if trends in the number of crashes at critical locations continued in the following three-year period.

There were approximately 640 crashes on the Livingston street system during the five-year reporting period. A number of data sorts were performed in order to categorize the data for statistical purposes and the following narratives and tables represent the crash analysis results. Figure 3 illustrates the location of intersections and street corridors that have higher than average crash rates.

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— Intersection with 5 or More Crashes

13 — Number of Crashes in Period

5,000 — Number of Crashes in Period

— Street Corridors with 20 or More Crashes

North

U-7406
Sewage Plant
BENNETT ST
U-7405
MONTANA ST
GALLATIN
20
182 MRL
PARK ST (P11)
Lagoon
CALLENDER
69
48
34
BUTTE ST
Country Club
Island
Fair Ground
Livingston
VIEW VISTA DR
U-7409
U-7410
U-7411
U-7412
Civic Center
YELLOWSTONE
RESERVOIR
SUMMIT
2ND
3RD
MONTANA
MAIN
U-7402
YELLOWSTONE
5TH
6TH
7TH ST
CHINOOK
U-25
FRONT ST
U-7403
U-7404
U-7401
SUNRISE DR
SUMMIT ST
10TH
11TH
12TH
13TH
14TH
9TH
8TH
U-7404 STAR RD
U-7404 FRONT
U-7408
SUN AVE
Retail Mall
Main Post Office
MONTANA RAIL LINK
LEWIS
2ND
3RD
CLARK
GEYSER
BUTTE
Sacajawea Park
RIVER DR
U-7412
CRAWFORD
CAMBRIDGE
CLARENCE
OAK DR
14TH
PARK ST (P11)
ROGERS
MEADOWLARK LN
ROBIN LN
BLUEBIRD LN
FENCE LN
I-90
LOVES LN
U-7413
WINDMILL PARK RD
NN #33
MILLER DR
WILLOW DR
BILLMAN
U-7414
LN

Figure 3.
Crash History Years 2008–2013

Intersection Crashes

All junction related crash data was sorted by intersection location. It was determined that intersections with at least one crash per year (five crashes during the reporting period) would provide a representative sample of intersections with a persistent crash history. Table 2 presents the crash experience of 17 intersections that have had 5 or more crash in the five-year reporting period. The crash and severity rates were calculated for each of the intersections based on the AADT volumes entering each intersection. Average number of crash for all intersections was calculated to be 7.82 while the average crash rate for all intersections was 0.92 crashes per million vehicles entering.

Table 2. Intersections with Five or More Crashes 2008 thru 2013

Intersection	# Crashes	AADT Entering	mve	Crashes/mve Rate	Rank	Severity Possible Inj	Rate
Callander Street & F Street	5	800	1.46	3.42	1	0	0.00
Lewis & Alley Between 2nd & Main	7	1600	2.92	2.40	2	0	0.00
Callander Street & S 8th Street	5	1500	2.74	1.83	3	1	0.37
N Main Street & Front Street	9	3400	6.21	1.45	4	0	0.00
C Street & Chinook Street	7	3380	6.17	1.13	5	0	0.00
Callander Street & S 3rd Street	6	3500	6.39	0.94	6	0	0.00
Park Street & Main Street	14	11650	21.26	0.66	7	0	0.00
Callender Street & Main Street	6	5000	9.13	0.66	8	0	0.00
Park Street & Loves Lane	16	15500	28.29	0.57	9	4	0.14
Park Street & 5th Street	13	14150	25.82	0.50	10	3	0.12
Park Street & 2nd Street	8	11650	21.26	0.38	11	1	0.05
Park Street & 8th Street	7	11510	21.01	0.33	12	2	0.10
5th Street & Front Street	6	10360	18.91	0.32	13	1	0.05
Park Street & 3rd Street	6	11680	21.32	0.28	14	2	0.09
Park Street & W Park (7th Street)	7	14100	25.73	0.27	15	1	0.04
Park Street & Geyser Street	6	13700	25.00	0.24	16	0	0.00
Park Street & Rogers Lane	5	13690	24.98	0.20	17	1	0.04
Average of Intersections =	7.82	8657	15.80	0.92		0.94	0.06

Fortunately, there were not a lot of injury accidents at any of the intersections so the average severity rate was very low. The intersections in Table 2 were ranked by crash rate and it was determined that 6 intersections had crash rates higher than the average. Those intersections were evaluated further as potential improvement locations.

Table 3 provides specific crash statistics associated with the six highest ranked intersections. There were 39 crashes at the six intersections. Forty-one percent of the crashes were angle crashes while 33% were rear-end crashes. Only 44% of the crashes were on dry roads with 22% occurring on snow cover streets and 25% on icy streets. Very few crashes occurred during hours of darkness.

Table 3. Highest Ranked Intersections - Crash Statistics

Intersection	Number of Crashes by Type				Weather Conditions			Road Conditions				Light Conditions		
	Angle	Rear-end	Sideswipe	Left-turn	Clear	Cloudy	Snow	Dry	Wet	Snow	Ice	Day	Dusk	Dark
Callander Street & F Street	3	0	1	1	4	0	1	1	1	1	2	5	0	0
Lewis & Alley Between 2nd & Main	1	4	2	0	5	2	0	5	0	1	1	6	1	0
Callander Street & S 8th Street	4	1	0	0	3	1	1	3	0	2	0	4	1	0
N Main Street & Front Street	2	5	1	1	1	5	0	3	0	1	2	5	1	0
C Street & Chinook Street	5	0	2	0	1	0	6	0	0	2	5	5	1	1
Callander Street & S 3rd Street	1	3	2	0	5	0	1	4	1	1	0	5	0	1
Totals =	16	13	8	2	19	8	9	16	2	8	10	30	4	2
Percentages =	41%	33%	21%	5%	53%	22%	25%	44%	6%	22%	28%	83%	11%	6%

Street Corridor Crashes

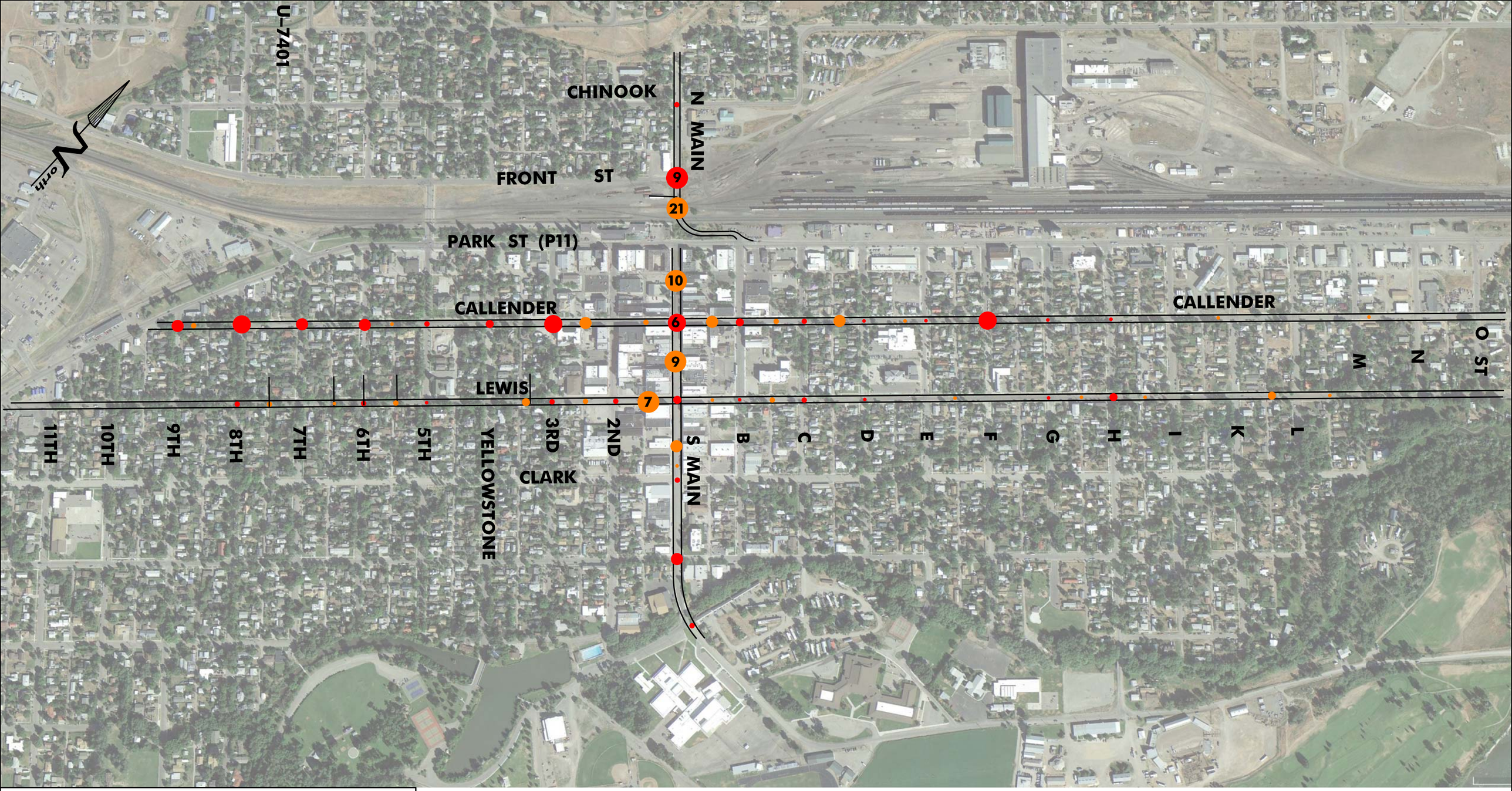
All crash data was sorted by street corridors. Approximately 40 corridors had crash records. All but six of the corridors had less than 20 crashes in the reporting period. Table 2 presents the crash experience on the six corridors with more than 20 crashes. The crash rates were calculated for each of the corridors based on the average AADT volumes on each corridor and the length of the corridor.

Table 4. Corridor Crashes 2008 to 2013

Corridor Name	No. Crashes	Average Per Year	Length Miles	Average AADT	Crash Rate/mvm
Callender Street	67	13.40	1.60	1300	17.65
S Main	35	7.00	0.50	2200	17.43
N Main Street	29	5.80	0.35	3500	12.97
Lewis Street	47	9.40	1.80	1600	8.94
Park Street	182	36.40	3.55	11450	2.45
Gallatin Street	20	4.00	1.40	3500	2.24

It can be seen in Table 2 that the number of crashes per million vehicle miles of travel for the first four corridors are significantly higher than the last two corridors. Thus, four street corridors were evaluated further for potential improvements. Figure 4 illustrates the crash locations and number of crashes at each location along each of the four corridor within this study.

An inventory of physical conditions was completed on each of the corridors to determine traffic controls and operational issues that could be involved in the crash history experience on those corridors. Appendix F contains as summary of physical and traffic control conditions noted at crash locations along all four corridors.



Number of Intersection Crashes

- One
- Two
- Three
- Four
- Five

Number of Non–intersection Crashes

- One
- Two
- Three
- Four
- Five

Figure 4.
Top Four Corridor Crash Rates Location Map

FUTURE OPERATIONS 2027

Traffic Projections

Future traffic projections can be determined in a number of ways. In the original transportation study a computer model was developed to determine traffic increases based on anticipated land development and population growth. Prior to updating the model, it was decided to examine the overall level of population growth that has occurred since the year 2000. In examining official census data, it was determined that population has been stagnant. Within the City of Livingston, the 2000 census listed a population of 7,089 while in the year 2015 the estimate population was 7,302 or approximately 3% growth. During that same period, Park County went from a population of 15,694 to a population of 15,586, which resulted in negative growth of 0.6%.

Since traffic growth can have other influences other than population, especially in a region with a robust tourist industry, a comparison of traffic volumes on the street system was made to determine if traffic growth factors were similar to population growth. Table 5 provides a summary of historic traffic volumes on 20 different street segments between 2001 and 2015. Traffic volumes were extracted from the MDT "Traffic by Section Reports". It can be seen that some street had traffic volume increases while other streets saw decreased volumes. Overall, there appears to have been a 25% increases in traffic on the Livingston street system. The calculated annual growth is 1.6% per year. At that annual growth rate, year 2027 traffic would be 17% greater than 2017 traffic and the year 2037 traffic would be 37% higher. Because of the flat population growth and unknown elements of the tourist industry along with other economic factors, extending traffic projections beyond the 20-year level would probably not produce meaningful information for long term improvements. Thus, the 10-year growth factor would be appropriate for the scope of this project. Appendix C contains the resultant year 2027 traffic projections at all intersections along with AADT volumes of the Livingston street system.

Table 5. Livingston Urban Streets - Historic Traffic Volumes*

* MDT Traffic by Section Reports	2001	2003	2011	2012	2015	Difference 2001-2015	Percent Change
Park Street (P-11)							
S of Loves Lane	8015	10503	12580	15760	13460	5445	40%
N of I-90	10237	11771	12930	13060	11610	1373	12%
W of 7th	9560	10251	11960	12080	13030	3470	27%
W of 5th	4305	4765	5690	6040	5210	905	17%
W of Bennett	2560	3830	2030	2080	2315	-245	-11%
5th Street (U-7403)							
Park to Front	4830	5790	7750	9640	12090	7260	60%
Front Street (U7404)							
E of 5th	1200	1200	1300	1450	1370	170	12%
W of 5th	3000	3095	3380	3550	3690	690	19%
Bennett (U-7405)							
N of Park	2610	3190	2630	3290	2480	-130	-5%
Gallatin (U-7406)							
Park to Front	4050	4260	3810	4150	4080	30	1%
N of Front	3000	3095	3380	3350	3530	530	15%
W of Bennett	1340	1680	1250	1450	980	-360	-37%
Rogers Lane (U-7407)							
W of Park	530	320	470	470	560	30	5%
West Park (U-7408)							
W of Park	3195	3665	4650	4750	4940	1745	35%
Main St (U-7409)							
S of Park	2770	2770	2590	3470	2340	-430	-18%
N of Geyser	1054	1094	1190	980	1080	26	2%
Geyser (U-7410)							
9th to Main	2400	2410	2090	2030	2720	320	12%
Main to H	1210	1290	1140	1120	1260	50	4%
B Street (U-7411)							
S of Park	2050	1970	2810	2790	3200	1150	36%
9th Street (U-7412)							
S of Park	811	811	780	1270	1200	389	32%
Totals =	68727	77760	84410	92780	91145	22418	25%

Calculated Overall Annual Growth = *1.6%*

Capacity

Table 6 presents capacity analysis results for future traffic projections. Capacity calculations can be found in Appendix E of this report. All of the intersections and all of the approaches would operate at LOS "C" except for the westbound approaches at the intersections Park Street and I-90 WB Ramps and the Front Street and 5th Street intersection, which would operate at LOS "F" and "E" respectively.

Table 6. Year 2027 Average Design Hour Intersection Capacity Summary

Intersection	Rank by Delay	Eastbound Delay (s/v)	Eastbound LOS	Westbound Delay (s/v)	Westbound LOS	Northbound Delay (s/v)	Northbound LOS	Southbound Delay (s/v)	Southbound LOS	Intersection Delay (s/v)	Intersection LOS
Park St. & I-90 WB Ramps				155.4	F			12.0	B	169.0	F
Park St.& 7th St.	1	32.1	C	20.3	C	14.0	B	34.7	C	28.1	C
Park St. & B St.	2	15.0	B	30.9	C	30.2	C	28.9	C	24.0	C
Park St.& 5th St.	3	18.4	B	30.6	C	25.8	C	26.2	C	23.4	C
Park St.& Loves Lane	4	15.6	B	15.1	B	18.8	B	17.2	B	17.3	B
Front St. & 5th St.	5	13.2	B	35.9	E	8.2	A	7.8	A	12.6	B
Callander St. & B St.	6	7.6	A	7.4	A	14.2	B	11.9	B	11.4	B
Park St. & 6th St	7			10.2	B	19.7	C			11.1	B
Park St. & 2nd St.	8			9.4	A	20.4	C			10.9	B
Park St. & Main St.	9			9.0	A	20.7	C			10.7	B
Park St. & Rogers St.	10	21.2	C			9.5	A			10.3	B
Chinook St. & 5th St.	11	7.4	A	7.6	A	13.0	B	12.0	B	10.1	B
Callander St. & Main St.	12	10.3	B	10.1	B	10.3	B	9.5	B	9.9	A
Park St. & Geyser St.	13			16.6	C			8.7	A	9.7	A
Park St. & 8th St	14			14.9	B			9.0	A	9.5	A
Callander St. & 2nd St.	15	9.1	A	9.6	A	9.3	A	9.2	A	9.4	A
Chinook St. & Main St.	16	8.3	A	9.5	A	9.2	A	7.9	A	9.3	A
Park St. & Old Clyde Park	17	8.1	A					11.4	C	9.0	A
Clark St. & 5th St.	18	10.0	B	9.7	A	7.3	A	7.3	A	8.7	A
Front St. & Main St.	19	11.6	B			7.6	A			8.2	A
Sun Ave. & Star Road	20	8.6	A			7.4	A			7.7	A
								Average Delay =		20.0	

IMPROVEMENT CONCEPTS

Intersection Efficiency Improvements

Capacity calculations were performed for alternative concepts to improve efficiency of the Front Street and 5th Street intersection. The calculations can be found in Appendix F of this report and a summary of those calculation are presented in Table 7. The intersection of Front Street and 5th Street currently operates below a LOS "C" on the westbound approach with through traffic on 5th Street and stop signs on Front Street. The first improvement that could be considered would be changing the operation to an all-way stop condition. Table 7 indicates that the all-way stop would operate with all movements at LOS "C" or better. However, the maximum vehicle queue on the northbound approach would be approximately 7 vehicles. The separation between the intersection and the railroad tracks is only long enough to store 4 passenger vehicles. Thus, a safety problem would be created.by using all-way stop control.

Table 7. Front Street & 5th Street Improvement Concepts Capacity

Intersection	MOE	EB		WB	NB	SB
Movement Group		*TR*	*R*	*LT*	*L*	*L*
NB Left Turn Lane& EB Right Turn Lane Stop Control on Front Street Peak PM Hour	*Control Delay (s/veh)*	25.7	10.1	33.7	8.2	7.8
	LOS	D	B	D	A	A
	V/C Ratio	0.10	0.18	0.45	0.19	0.00
	Queue Length (95%)	1	1	3	1	0
Movement Group		*LTR*		*LTR*	*LTR*	*LTR*
All-way Stop Control Existing Geometry Peak PM Hour	*Control Delay (s/veh)*	10.6		10.5	23.1	11.0
	LOS	B		B	C	B
	V/C Ratio	0.26		0.18	0.77	0.33
	Queue Length (95%)	2		1	8	2
Movement Group		*LTR*		*LTR*	*LTR*	*LTR*
All-way Stop Control Existing Geometry Peak AM Hour	*Control Delay (s/veh)*	11.2		9.7	11.1	13.3
	LOS	B		A	B	B
	V/C Ratio	0.39		0.13	0.33	0.50
	Queue Length (95%)	2		1	2	3
Movement Group		*LTR*		*LTR*	*LTR*	*LTR*
NB Left Turn Lane& EB Right Turn Lane All-way Stop Control Peak PM Hour	*Control Delay (s/veh)*	9.8		9.0	11.9	9.2
	LOS	A		A	B	A
	V/C Ratio	0.22		0.14	0.42	0.22
	Queue Length (95%)	1		1	3	1

An alternative would involve adding traffic lanes for the highest volume movements in the am and pm hours (westbound right turns and northbound left turns) while keeping stop

control on Front Street. Table 7 indicates that both the eastbound and westbound approach would operate at LOS "D". Thus, the overall delay would not be improved.

It was determined that the combination of the additional turn lanes and the all-way stop control would result in significant efficiency improvements. Table 7 indicates that this concept would result in all movements being at LOS "B" or better and the maximum queue on the northbound approach would be 3 vehicles.

Because of the railroad tracks between Front Street and Park Street on N 5th Street, there is an overlap with safety and efficiency which involves operations at the Park Street and 5th Street Intersection. Table 8 presents capacity calculations for am and pm hour conditions (see Appendix F). It can be seen that during the am hour there would be a maximum queue of 10 vehicles in the southbound lanes, which is substantially more than the 4 vehicle storage available, south of the tracks. A concept that would add a southbound right turn lane on 5th Street at the signalized intersection was investigated. It was determined that the added lane would substantially improve overall operations of the intersection in the am and pm hour and would also reduce the maximum southbound queue to 7 vehicles during the peak am hour. Figure 5 on the following page illustrates the associated concept improvements for both Park Street and Front Street intersections with N 5th Street.

Table 8. Park Street & 5th Street Improvement Concepts Capacity

Intersection	MOE	EB		WB		NB	SB	
Movement Group		*L*	*TR*	*L*	*TR*	*LTR*	*LTR*	
Year 2027 Peak AM Hour Existing Controls	*Control Delay (s/veh)*	17.9	21.5	22.8	34.6	14.0	26.2	
	LOS	B	C	C	C	B	C	
	V/C Ratio	0.30	0.54	0.01	0.67	0.09	0.79	
	Queue Length (95%)	5	8	0	7	1	10	
Movement Group		*L*	*TR*	*L*	*TR*	*LTR*	*LT*	*R*
Year 2027 Peak AM Hour With SB Right Turn Lane Operations	*Control Delay (s/veh)*	9.6	11.4	16.3	23.3	19.7	25.9	10.4
	LOS	A	B	B	C	B	C	B
	V/C Ratio	0.20	0.43	0.01	0.54	0.13	0.64	0.16
	Queue Length (95%)	4	7	0	6	2	7	3
Movement Group		*L*	*TR*	*L*	*TR*	*LTR*	*LT*	*R*
Year 2027 Peak PM Hour With SB Right Turn Lane Operations	*Control Delay (s/veh)*	25.6	15.3	17.3	31.5	22.0	20.6	10.1
	LOS	C	B	B	C	C	C	B
	V/C Ratio	0.77	0.65	0.07	0.78	0.42	0.25	0.11
	Queue Length (95%)	8	10	1	10	4	2	2

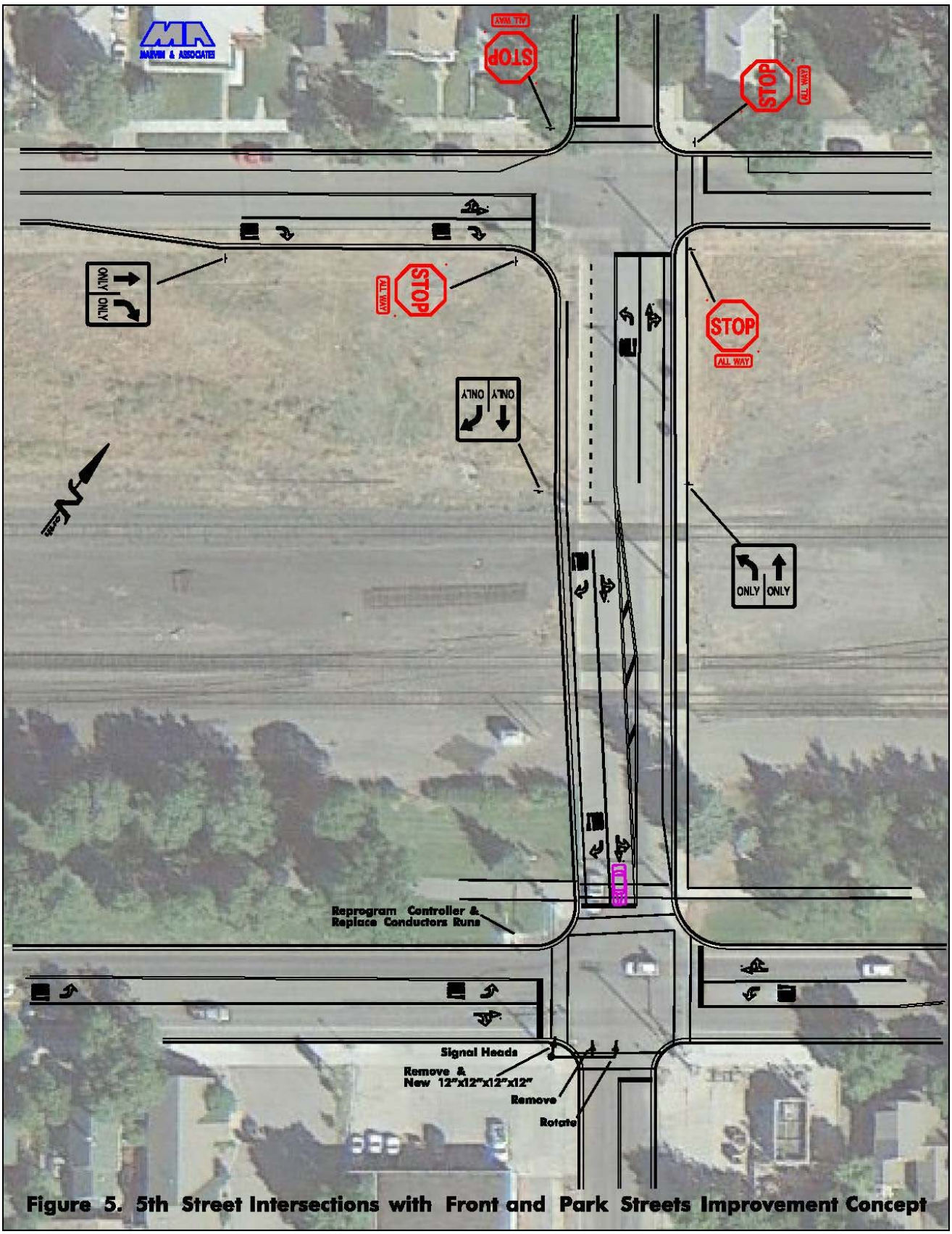


Figure 5. 5th Street Intersections with Front and Park Streets Improvement Concept

Intersection Safety Improvements

Callender & F Street

The intersection of F Street and Callender Street is currently uncontrolled. There were 5 crashes in the reporting period and 3 of them were angle crashes. Callender Street and F Street are relatively equal in terms of traffic volumes, but Callender Street has more extended continuity through the urban area. There are line-of-sight restrictions at the intersection, especially in the northwest corner where there are over-grown trees in the corner. Figure 6 illustrates the recommended safety improvements for this intersection. Stop control should be implemented on F Street and no parking signs should be installed on Callender Street to ensure that vehicles do not block sight distance for stopped vehicles. All trees and shrubbery should be trimmed to ensure clear sight lines on all approaches.

Figure 6. Callender & F Street Improvements

Lewis & Alley Between 2nd & Main Streets

There were 7 crashes recorded at the alley intersection with Lewis Street. Four of the crashes were rear-end crashes, 2 sideswipe crashes, and one angle crash. The one-way alley (northbound) has minimal traffic demand and because it is a one-way movement, there are very few conflicting movements. The visual inventory indicated that there are no permanent sight restrictions to vehicles on the alley approach for eastbound traffic on Lewis Street. A building in the southeast corner of the intersection presents some line of sight restrictions, but a vehicle entering Lewis Avenue should be able to see oncoming westbound traffic from a stopped position. It appears that there are small buses that park on the south side of Lewis near the alley, which severely limits sight distance (see photo).

The bus pictured at right is parked within a signed no parking zone, so it appears that parking enforcement needs to be increased. Also, the no parking zone length needs to be reviewed. Calculations for line of sight at this location indicates that the no parking zone should be at least 50’ from the edge of the alley.

Callender & 8th Street

There were 5 crashes reported at the intersection of Callender Street and 8th Street. Four of the 5 crashes were angle crashes while the remaining incident was a rear-end crash. Currently, 8th Street is stop controlled. The visual inventory indicated that there are two conditions that contribute to the crash experience. The first is related to vegetation in the corners. There are overgrown trees in the northwest corner that restrict southbound traffic's line of sight to the stop sign and to the west when drivers are at the stop sign. The second condition involves cars parked too close to the intersection. It is recommended that over-grown trees be trimmed and curbs painted to delineate no parking zones according to the Montana Motor Vehicle Code.

N Main & Front Street

There were 9 crashes at the intersection of N Main Street and Front Street. There were only 2 angle crashes, 1 sideswipe, and 1 left-turn crash while 5 of the crashes were rear-end crashes. Rear-end crashes are not typically predominant at stop controlled intersections, especially at "T- intersections". When they do occur at T-intersections, it is usually due to limited sight distance or diverted attention. The crash data that was provided did not indicate whether the rear-end crashes occurred on Front Street or on Main Street. If they occurred on Front Street, the visual inventory indicated that there are critical sight distance restrictions in both the northwest and southwest corners of the intersection due to high berms in the corners. If the rear-end crashes occurred on Main Street, the likely cause would be the combination of a sharp horizontal curve in the underpass, prior to the intersection, and speeds too fast for conditions. Figure 7 illustrates recommendations to improve sight distance and provide a left-turn lane for northbound vehicles. Cutting the vertical obstructions down and installing retaining walls out of the clear sight zone would be essential. Because of tight geometrics the left-turn bay would be atypical. An alternative to this concept would be a mini roundabout, which would require more right-of-way and vertical grades may create maintenance concerns.

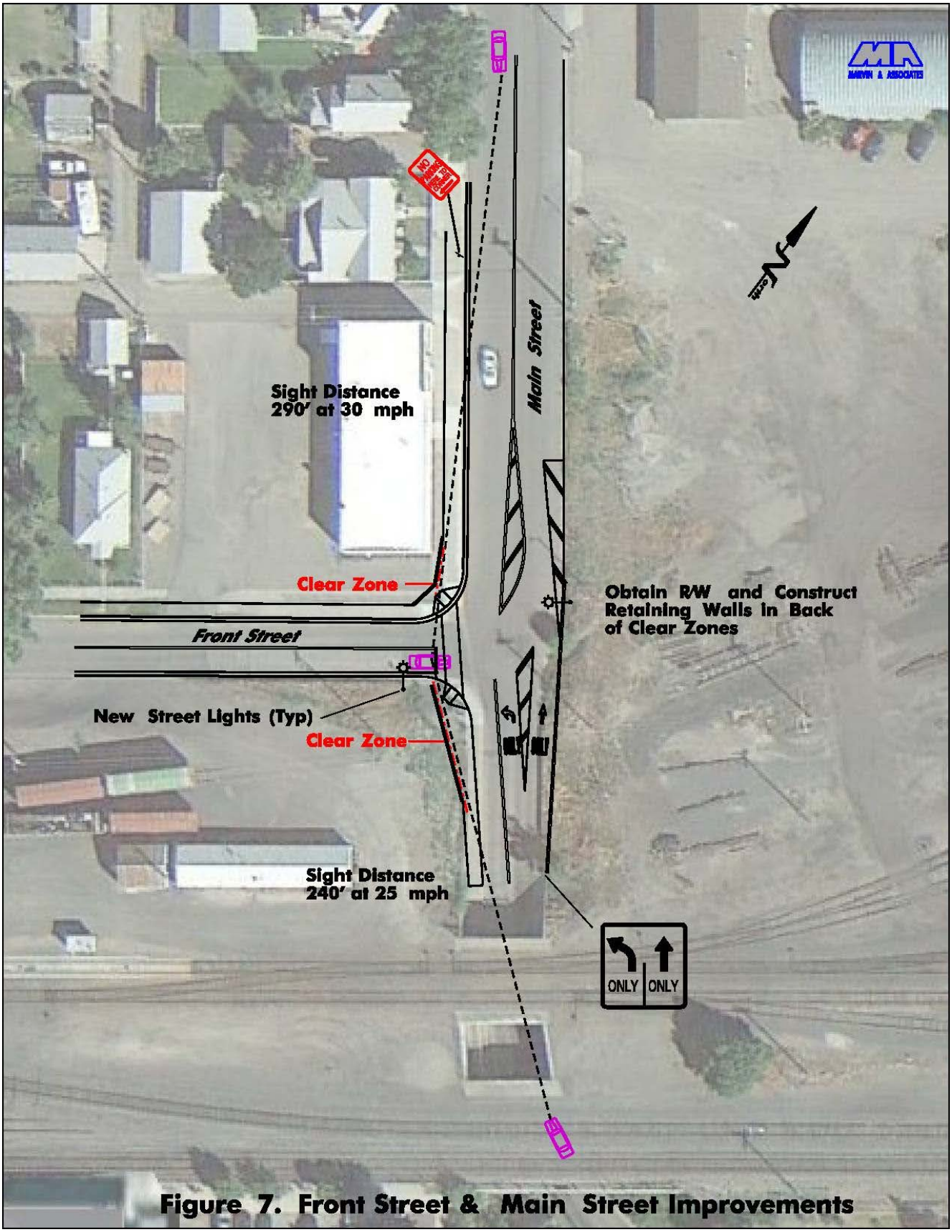


Figure 7. Front Street & Main Street Improvements

C Street & Chinook Street

There were 7 crashes at the intersection of C Street and Chinook Street. Five of the crashes were angle crashes while the remaining crashes were sideswipe crashes. Figure 8 shows the recommended improvements at this intersection and also illustrates the unusual intersection configuration, which is actually a 90-degree curve in the Chinook – C street alignment. An uncontrolled gravel approach enters the curve from the south, which may be a causation factor for the angle crashes.

Several different improvement concepts were evaluated and the improvements shown in Figure 8 were considered to be the most economically viable. Reconstructing the curve by using a 100' curb radius in the northwest corner would allow for operations of a 20 mph curve without needing to super-elevated the roadway. Discouraging left-turn movements into and out of the gravel access by using a painted island would minimize intersection conflicts. A curbed section on the gravel approach would restrict off-angle entries and departures to and from the gravel approach. Curve signing and parking restrictions would command attention to the unusual geometry encountered at this location. A minor amount of new right-of-way would be required along with cooperation from adjacent land owners in order to implement these improvements.

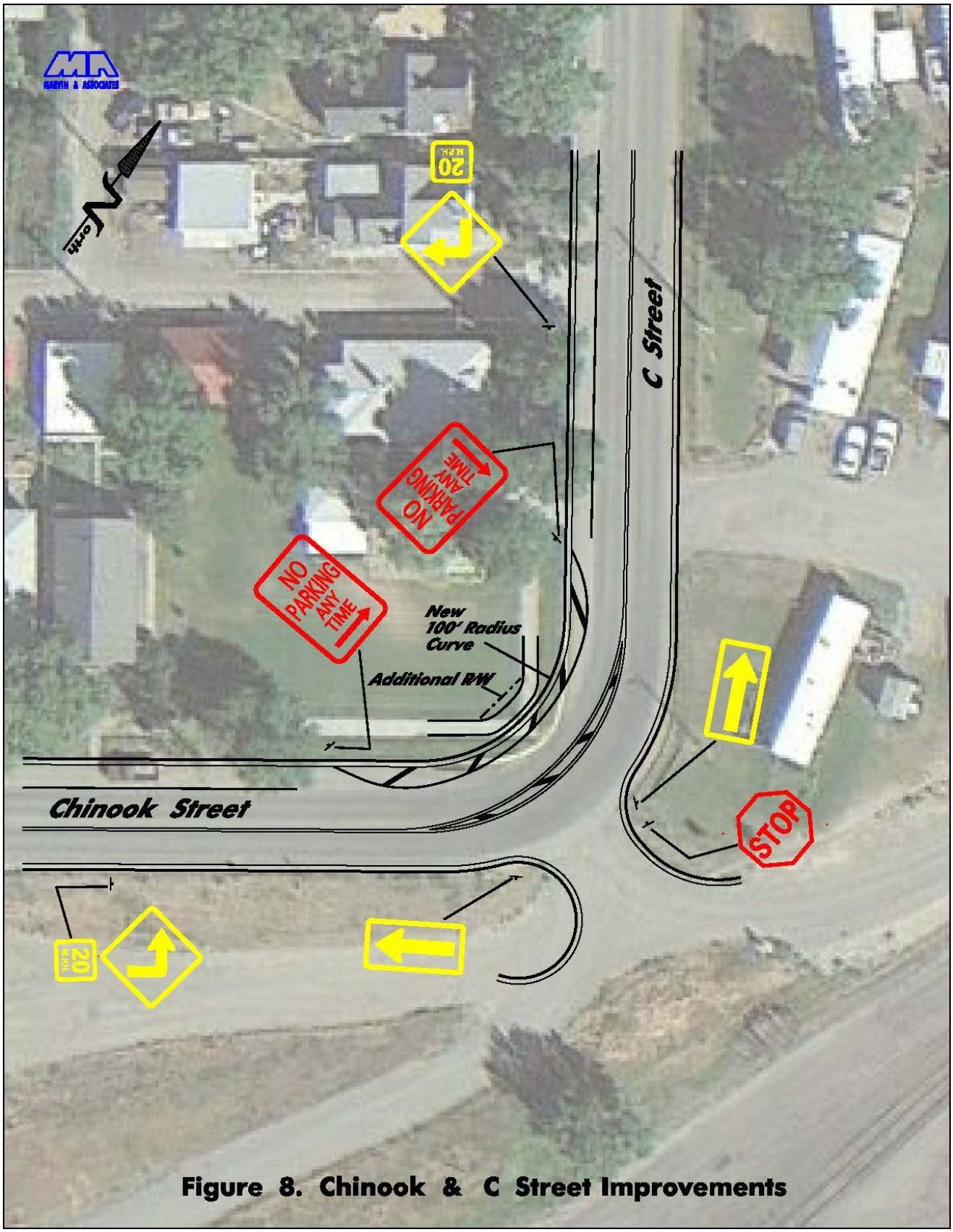


Figure 8. Chinook & C Street Improvements

Callender & 3rd Street

There were 6 crashes at the intersection of Callender Street and 3rd Street. Only 1 crash was an angle crash while 3 were rear-end crashes and 2 were sideswipe crashes. The intersection is currently uncontrolled. There is a bulb-out curb section on the east side of the intersection and a marked cross walk on that side of Callender Street. Buildings located in the southeast corner and northwest corners of the intersection inhibit sight distance sight distance for approach traffic. It is assumed that the resulting rear-end and sideswipe crashes may be related to crosswalk operations when following cars do not see a pedestrian and leading cars stop.

Figure 9 illustrates recommended improvements at this intersection. Since Callender Street has substantially more traffic than 3rd Street, Callender should be the through street and 3rd Street should be strop controlled. Parked cars on the west side of the intersection tend to park too close to the intersection and no parking sigs should be installed to provide adequate lines of sight for the stop controlled operation. Crosswalk warning signs should be installed in advance and at the crosswalk as shown in Figure 9. This would help to alert drivers that a stop condition could occur on Callender Street.

Figure 9. Callender & 3rd Street Improvements

Park Street & I-90 Westbound Ramps

This intersection was not included in the initial traffic counts and intersection study, but was counted in July of 2017 subsequent to a review meeting with City of Livingston staff. The ”T” intersection has raised medians and traffic islands that provide a southbound left-turn bay and short right-turn departure islands for northbound and westbound traffic. Predominant movements at the intersection involve through traffic on Park Street and the northbound right-turn movement from Park Street to westbound I-90. While the westbound left-turn movement from the I-90 westbound exit ramp to southbound Park Street is rather minor in comparison, the continuous flow of traffic and variable vehicle speeds on Park Street creates long delays. Vehicle queues from three to five vehicles are common during most hours of the day. There were 5 crashes at the intersection of Park Street and I-90 Westbound Ramps in the 5 year reporting period, with only one angle type crash.

A preliminary traffic signal warrant study evaluation was performed based on peak hour counts and ADT estimates applied to typical hourly traffic variations at adjacent facilities (see Appendix H). It was determined that2 of the 9 signal warrants would be met at this intersection: Warrant #1 “Eight Hour Traffic Volumes” Condition B and Warrant # 8 “Roadway Network”. Based on the preliminary warrant evaluation the recommended improvement at this intersection would involve installation of a traffic signal. Figure 10 illustrates the preliminary layout for traffic signal construction that would be required. Because of the small area right turn islands westbound and northbound right-turn movements would need to be signalized to accommodate pedestrian movements along the eastside of Park Street. Alternatives to this concept would include geometric modifications to develop westbound and northbound right-turn lanes and eliminate the right-turn islands to improve pedestrian safety. Capacity calculations for the year 2017 indicate that the signalized intersection would operate at a LOS “B” in the year 2027 reducing delay for the westbound movement by 195 seconds per vehicle.

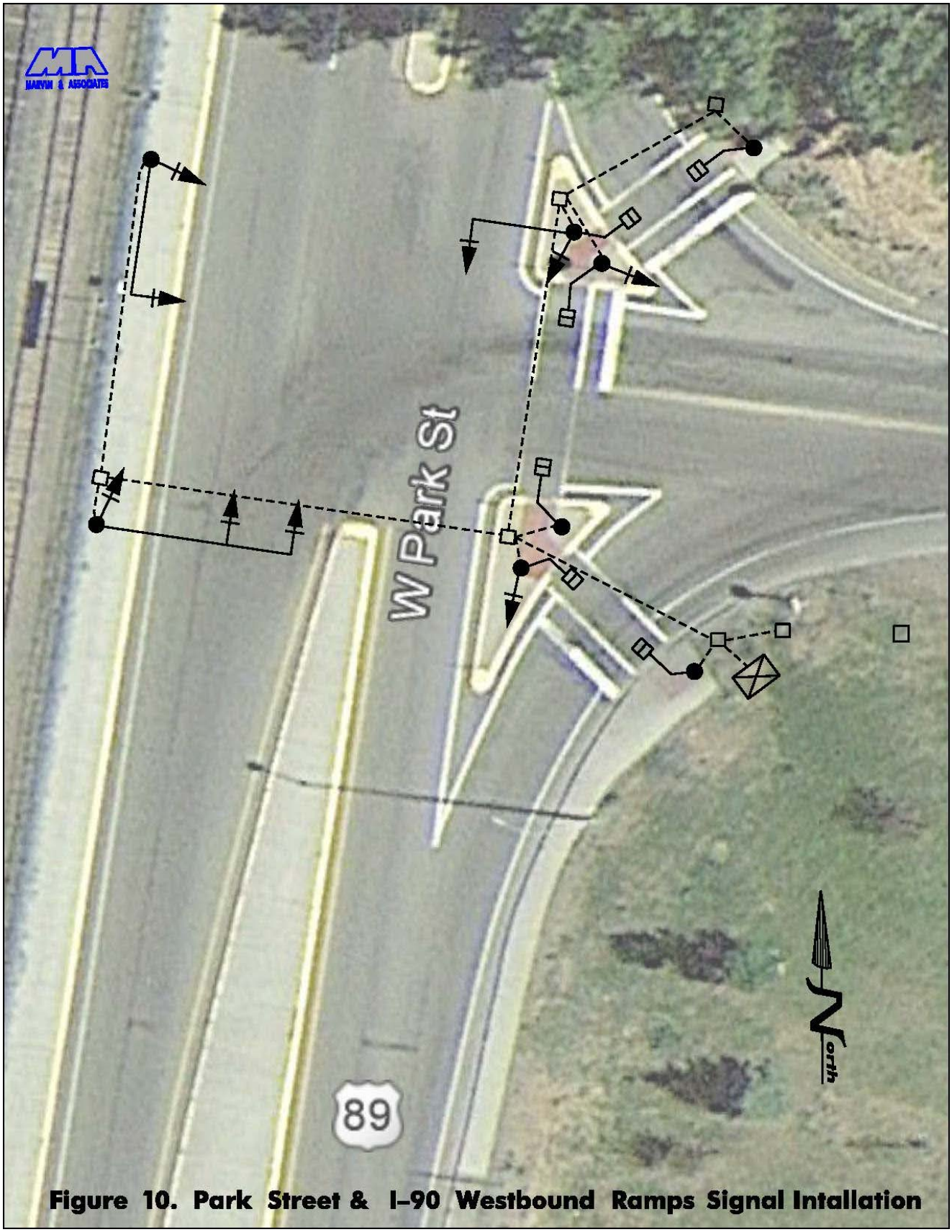


Figure 10. Park Street & I–90 Westbound Ramps Signal Intallation

Corridor Safety Improvements

Callender Street

Callender Street extends from Park Street west of 9th Street to a point east of O Street and runs parallel and adjacent to Park Street, which is the major arterial route through Livingston. Since Park Street is a two lane street from 5th Street to the east and carries in excess of 10,000 AADT, short segments of Callender Street tend to carry some over-flow traffic from Park Street. Even though Callender Street is a local street its continuity allows it to function as a quasi-collector street. For that reason, it would be desirable to designate Callender Street as a through-street from Park Street to 2nd Street and from B Street to H street similar to Lewis Avenue. This would necessitate installing stop signs at several intersections that are currently uncontrolled.

The visual inventory of Callender Street indicates that there are numerous sight distance concerns along the entire length of Callender Street created by overgrown trees, hedges, buildings, and park cars. To improve safety on Callender Street it would be necessary to implement the following improvements:

- Create a maintenance program to check for sight obstructions and to trim trees and other vegetation within the right-of-way at least once per year and notify adjacent land owners of encroachments into clear vision zones.
- Check existing no-parking zones at intersections and alleys to make sure that they meet the minimum distance required in the Montana Motor Vehicle Code.
- Paint curbs yellow within the no-parking zones at all intersections and install signs in critical areas.

Lewis Street

The Lewis Street corridor is similar to Callender Street except that Lewis is already designated as a through Street except in the central city core, where 4-way stop control is used. The same safety recommendations as Callender Street would apply to Lewis Street.

N. Main Street

The N Main corridor is a very short section of street with most of the crashes occurring at the intersections with Park Street and Front Street. Non-junction related crashes have occurred within the difficult geometry encountered in the underpass area. Some short term improvements, as recommended in the original year 2000 study, could be implemented at the intersection with Park Street and B Street, but any improvements to the underpass would be quite expensive and would be considered as a long-term improvement project.

S. Main Street

The majority of crashes on S Main Street are related to mid-block collisions related to angle parking. This trend has continued since the original year 2000 transportation study. It appeared that the original recommendations would still apply, which would convert 2nd Street and Main Street to one-way operations between Park and Callender. In discussions with City of Livingston staff another alternative emerged which was evaluated within this study. The alternative involved converting Main Street to single-lane one-way southbound traffic from Park Street to Clark Street and installing a traffic signal at the intersection of Park Street and 2nd Street to accommodate increased northbound traffic at that intersection. Figure 11 illustrates a detailed layout of the one-way conversion alternative concept.

"B" STREET

"B" STREET

PARK STREET

CALLENDER STREET

LEWIS STREET

CLARK STREET

North

MARVIN & ASSOCIATES

Year 2027 490 35 PM 730 165

Year 2017 420 30 PM 620 140

Year 2027 450 40 PM 115 80

Year 2017 385 780 45 35 PM 100 70 670 40

Required Regulatory Signing At Intersections (Typical)

Approximately 58 Parking Spaces

Approximately 52 Parking Spaces

2nd STREET

MAIN STREET

MAIN STREET

Approximately 50 Parking Spaces

Curb Bulb–outs & ADA Ramps Desireable for Pedestrian Safety and Traffic Calming Effects

Eliminate Parking on Southside of Park Street Install Center Turn Lane

Proposed Changes Intersection Traffic Control (Typical)

2ND STREET

2ND STREET

New Traffic Signal Park & 2nd Street

PARK STREET

CALLENDER STREET

LEWIS STREET

CLARK STREET

Figure 11. Main Street Corridor One–way Conversion

One-way conversion on Main Street would accommodate approximately 160 45-degree angle parking spaces by using a single traffic lane and parking on both sides of the street. The center lane would be approximately 20' wide within a 55' street width and could accommodate shared bicycle operations. Curb bulb-outs are shown in Figure 11to enhance safety at intersections by shortening pedestrian crossings, allowing visibility to and from pedestrians at the curb face, physical restricting parking near intersections.

The traffic signal at Park Street and 2nd Street would provide a signal controlled pedestrian crossing of Park Street at a location with heavy pedestrian demand. A continuous left turn lane would be recommended from 2nd Street to B Street to accommodate left turn movements at both Main Street and 2nd Street. A traffic distribution analysis was completed for this concept and Resulting peak pm traffic demand at both Park Street intersection for year 2017 and 2027 conditions are shown in Figure 11. A preliminary traffic signal warrant analysis for the intersection of Park Street and 2nd Street was completed (see Appendix H) and it was determined that three of the nine warrants would be met with additional northbound traffic added to 2nd Street: Warrant #1 - "Eight Hour Volumes", Warrant #2 – "Four Hour Volumes" and, Warrant #3 – "Peak Hour Volumes".

Capacity calculations for the intersection of Park Street and 2nd Street with existing volumes plus additional northbound traffic indicate that the northbound approach would operate at LOS "E" based on existing geometry. Capacity calculations associated with the signal, as indicated in Figure 11, would result in an overall LOS B (see Appendix F).

Figure 11 also indicates that traffic control changes at 2nd Street intersections with Callender Street, Lewis Street, and Clark Street would be required based on redirected traffic associated with one-way operations on Main Street. It would appear that overall operations in the downtown area could result from implementation of this concept.

COST ESTIMATES

Cost estimates were prepared for the concept intersection and corridor improvement projects recommended within this report using the latest unit process data available (see Appendix I). Table 9 presents a summary of the individual projects construction costs, right-or-way costs, engineering design and construction services, and miscellaneous legal and administrated costs. The estimates are based on assumptions of average conditions without the benefit of surveys, base mapping, utility locations, and other unknown factors that could substantially affect engineering and construction costs. Therefore, project costs in Table 9 should be considered a mid-range estimate of actual cost in 2017 dollars. A wide range of Montana Department of Transportation (MDT) and local funding sources could be used for these projects.

Table 9. Intersection & Corridor Improvement Project Costs

Project Description	Construction	R/W	Engineering Services	Legal & Admin.	Total Project
Main Street One-way Conversion, Angle Parking, 2nd & Park Signal	$ 859,700.00	$ -	$ 171,900.00	$42,985.00	$1,074,585.00
Park Street & I-90 Westbound Traffic Signal Installation	$ 346,000.00	$ -	$ 69,200.00	$17,300.00	$ 432,500.00
5th Street Reconstruction Front Street to Park Street	$ 194,200.00	$ 28,000.00	$ 46,600.00	$ 9,710.00	$ 278,510.00
Front Street & Main Street Retaining Walls & Turn Lane	$ 207,600.00	$ 9,000.00	$ 49,800.00	$10,380.00	$ 276,780.00
Chinook Street & C Street Intersection Reailignment	$ 36,600.00	$ 9,000.00	$ 9,500.00	$ 1,830.00	$ 56,930.00
Callender & 3rd Street Traffic Control Improvements	$ 8,900.00	$ -	$ 1,800.00	$ 445.00	$ 11,145.00
Callender & F Street Traffic Control Change	$ 4,800.00	$ -	$ 1,000.00	$ 240.00	$ 6,040.00
PROJECT TOTALS =	**$ 1,657,800.00**	**$ 46,000.00**	**$ 349,800.00**	**$82,890.00**	**$2,136,490.00**

BICYCLE & PEDESTRIAN FACILITIES

The year 2000 Livingston Transportation Study presented a plan structure for key bicycle routes within the City of Livingston based on connectivity to the existing path located on the north side of Park Street. Since that time, no additional bicycle facilities have been constructed. In reviewing the proposed bike/ped system structure, it appears that the paths and routes would still be viable as the key structure from which a future system can be developed. Subsequent to the year 2000, bicycle and pedestrian facility design has evolved dramatically and facility types have expanded beyond bike/pedestrian paths completely separated from motorized vehicles. Thus, the following narratives attempt to describe the types of bike facilities that could be incorporated in Livingston.

Bike Lanes

Bicycle (bike) lanes are on-street facilities that generally consist of an allocated portion of the roadway surface delineated by longitudinal striping, in-lane pavement markings and roadside signs that all serve to dedicate that space for exclusive use by bicyclists.

There are four common types of modern bike lanes: 1) conventional; 2) buffered; 3) contra-flow; and 4) left-side. Conventional bike lanes are located adjacent to vehicle travel lanes and flow in the same direction as adjacent traffic. They are generally located on the right side of a street. Conventional bike lanes may be installed directly adjacent to curb and gutter or there may be parking or auxiliary right-turn lanes to the outside of the facility.

Buffered bike lanes are similar to conventional bike lanes, but they are paired with a designated buffer space between the bike lane and the adjacent travel lane(s) and/or parking lane. The buffer space provides additional shy distance to aid in safety, comfort and the ability of bicyclists to pass each other without encroaching on an adjacent travel

or parking lane. The buffer or buffers can vary considerably in width depending upon overall availability of right-of-way.

A contra-flow bike lane is configured to promote bicycle travel in the opposite direction of adjacent vehicular traffic. They are often implemented along one-way streets for which bicycle routing is predominantly in the opposite direction. The intent is to reduce the occurrence of wrong-way riding and to decrease trip distance caused by out-of-direction travel for bicyclists.

Left-side bike lanes are conventional bike lanes that are located on the left side of a one-way or two-way, median-divided street. They are advantageous along streets with frequent parking turnover, heavy delivery activity or transit use on the right side of the street.

Cycle Tracks

A cycle track is an exclusive bike facility that combines the user experience of a separated path with the on-street feel of a conventional bike lane. Cycle tracks differ from bike lanes in that they are physically separated from vehicular traffic lanes using a variety of barrier alternatives. They may allow for one-way or two-way bicycle travel, and they may be installed at street level, sidewalk level or at an intermediate level.

There are three common types of modern cycle tracks: 1) one-way protected; 2) raised; and 3) two-way. One-way protected cycle tracks are at street level and use a variety of methods for physical separation from adjacent vehicular traffic, including parking lanes, raised medians or bollards.

Raised cycle tracks are vertically separated from adjacent vehicular traffic. They may be set at the level of adjacent sidewalks or at an intermediate level between the adjacent street and sidewalk. Raised cycle tracks that are at sidewalk level are often distinguished from the adjacent sidewalk through coloration or surface texture/material (such as concrete vs. asphalt). At intersections, raised cycle tracks can be dropped and merged onto the adjacent street to simply intersection operations or the intersection crossings can be facilitated with dedicated bicycle facility signals.

Two-way cycle tracks are physically separated facilities that allow for two-way bicycle traffic flow. They may be at street level or raised and generally share similar characteristics with one-way protected and/or raised cycle tracks.

Bicycle Boulevards

Bicycle boulevards are streets with low motorized vehicle demand that are designated and designed to give travel priority to bicycles. Bicycle boulevards use signs, pavement markings and traffic calming measures to discourage through trips by motorized vehicles, thereby creating a safer and more convenient pathway for bicycling. The routing of these facilities requires careful planning, because their use inherently impacts local access and mobility vehicles. Traffic calming measures on bicycle boulevards typical aim to serve the dual purposes of reducing vehicle speeds and lessening traffic demand. Typical speed reduction measures include vertical deflection installations such as speed humps, cushions or tables, and horizontal deflection measures such as bulb-outs, traffic circles, chicanes and pinch points.

Volume demand reduction measures typically consist of physical barriers that restrict vehicle movements or access at targeted intersection or mid-block locations. The barriers are often referred to as “diverters” or diverter islands. A diverter island restricts vehicular access while still allowing for bicycle and pedestrian access through the island. A more drastic volume management tactic would be full closure of a street in a targeted location,

leaving only a pedestrian and bicycle pathway through the closure area. Bicycle boulevards provide the added benefit in a residential neighborhood of calming traffic to create a safer and quieter living environment.

Planning, design, and implementation of the above noted bicycle facilities need to be completed on a case by case basis considering user type in terms of purpose, street operations, and other considerations. Numerous publications on planning, design, and operational guidelines for bicycle and pedestrian facilities can be found at the Institute of Transportation Engineers Web site (ite.org). The MDT web site also provides links to a number of bicycle and pedestrian FHWA publications and guidelines.

SUMMARY & GENERAL RECOMMENDATIONS

This transportation study update identified a number of intersections and street corridors that have the most issues in terms of safety and efficiency. Concept improvement presented herein should be considered priorities to advance the safety and efficiency of the Livingston transportation system.

This study identified issues on street corridors and proposed concepts for improvements to the Livingston street system, which did not include Park Street, which is the major arterial through the City of Livingston. Park Street is classified as a National Highway of Significance (NHS 11) also known as US Highway 89. AS such it is under the jurisdiction of MDT, and MDT is responsible for maintenance and operations. MDT performed an operational study on Park Street in the recent past and recently implemented a project to improve efficiency at the signalized intersections. It is anticipated that MDT will review the concepts presented within this study at intersections with I-90 Westbound Ramps, 5th Street, 2nd Street, and Main Street to determine what future improvements can be made that can enhance the safety and efficiency of the Park Street corridor.

Most of the improvement concepts contained herein are related to vehicular traffic operations simply because the current transportation system is designed to accommodate demand for vehicular travel. However, current transportation trends indicate that pedestrian and bicycle travel demand is increasing rapidly, especially when facilities are available for use. Thus, a concerted effort should be made to accommodate increasing demand for pedestrian and bicycle travel within the City of Livingston. Future improvements could include separate bike/ped paths, bike lanes, shared lanes, and any of the many other bike facilities.

Pedestrian facilities need to be improved especially at intersections where vehicles and pedestrians experience conflicts. Visibility is of paramount importance in the avoidance of pedestrian-vehicle conflicts. Line of sight between pedestrians and drivers can be enhanced by ensuring that conflict points are clear of obstructions. In cases where on-street parking is allowed on wide streets, the use of curb bulb-outs can dramatically reduce conflicts while reducing pedestrian exposure time at crosswalk locations. While capital intensive, curb bulb-outs provide physical barriers to enforce parking restrictions and insure clear lines of sight.

Crash records along all of the study corridors indicate that sight distance obstructions at street and alley intersections have been associated with numerous crashes that include angle and rear-end crashes. It was also noted that many of the sight obstructions are associated with either overgrown vegetation or parking too close to the intersection corners. Many communities in Montana have sight-triangle ordinances that specify line of sight distances along each street and detail enforcement procedures. It is recommended that the City of Livingston investigate model ordinances from other Montana communities to determine what would be appropriate for Livingston.

APPENDIX A

INTERSECTION TRAFFIC COUNTS

Intersection: **Callender & N 3rd** **Date:** **12/1/2017**

Begin Time	Callender						N 3rd Street						Total Vehicles
	Eastbound			Westbound			Northbound			Southbound			
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
7:00	1	3	0	0	3	1	0	1	0	1	0	0	10
7:15	0	2	0	0	5	0	2	1	1	3	0	0	14
7:30	0	10	0	0	20	2	1	1	1	2	2	0	39
7:45	0	14	1	0	14	5	0	3	0	1	1	0	39
8:00	1	16	0	2	17	1	0	4	1	0	0	0	42
8:15	1	9	0	2	10	1	1	3	1	2	2	1	33
8:30	1	9	0	1	18	1	0	0	3	0	2	1	36
8:45	1	9	0	2	11	3	0	2	1	1	1	0	31
Peak AM Hour	**2**	**49**	**1**	**4**	**61**	**9**	**2**	**11**	**3**	**5**	**5**	**1**	**153**
4:00	0	12	1	3	27	4	1	4	3	2	1	1	59
4:15	0	14	0	1	33	6	2	8	5	5	2	0	76
4:30	0	12	1	6	31	0	0	4	4	5	6	4	73
4:45	1	10	1	5	38	3	0	4	5	5	4	4	80
5:00	0	15	0	2	23	3	1	5	3	7	4	1	64
5:15	0	11	3	3	20	5	0	0	3	4	0	2	51
5:30	3	10	0	0	17	0	0	2	1	3	6	0	42
5:45	1	11	0	1	16	3	0	3	2	1	2	2	42
Peak PM Hour	**1**	**51**	**2**	**14**	**125**	**12**	**3**	**21**	**17**	**22**	**16**	**9**	**293**

AM phf = **0.91**
PM phf = **0.92**

Intersection: **Clark & Yellowstone** **Date:** **11/30/2016**

Begin Time	E Clark Street						S Yellowstone Street						Total Vehicles
	Eastbound			Westbound			Northbound			Southbound			
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
7:00	0	1	0	0	0	0	0	1	0	0	1	0	3
7:15	0	5	0	2	4	0	0	0	1	0	0	0	12
7:30	0	6	0	0	4	0	0	3	1	0	0	0	14
7:45	0	10	1	0	7	0	1	3	1	0	3	1	27
8:00	0	13	0	1	10	1	0	4	1	0	2	1	33
8:15	0	14	1	0	6	1	2	3	0	0	3	0	30
8:30	0	7	0	0	7	0	1	1	0	1	3	1	21
8:45	1	2	2	0	5	1	0	0	1	0	4	0	16
Peak AM Hour	**0**	**44**	**2**	**1**	**30**	**2**	**4**	**11**	**2**	**1**	**11**	**3**	**111**
4:00	0	6	2	0	7	1	0	0	0	1	4	1	22
4:15	0	1	0	1	7	1	1	4	0	0	2	0	17
4:30	0	2	1	2	10	1	0	3	0	0	3	0	22
4:45	0	9	0	0	3	0	0	4	0	0	4	2	22
5:00	1	5	1	0	12	1	1	6	1	1	7	2	38
5:15	0	4	1	0	7	0	0	1	2	0	5	2	22
5:30	0	10	0	0	15	1	1	2	1	0	3	1	34
5:45	0	7	0	0	5	4	0	2	1	0	2	0	21
Peak PM Hour	**1**	**28**	**2**	**0**	**37**	**2**	**2**	**13**	**4**	**1**	**19**	**7**	**116**

AM phf = **0.84**
PM phf = **0.76**

Intersection: **Clark & 5th** **Date:** **11/30/2016**

Begin Time	W Clark Street						S 5th Street						Total Vehicles
	Eastbound			Westbound			Northbound			Southbound			
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
7:00	0	3	0	2	6	0	0	0	0	1	0	0	12
7:15	0	3	1	2	10	0	0	4	1	0	2	0	23
7:30	0	5	0	3	21	1	0	3	1	2	3	1	40
7:45	0	9	0	3	40	0	0	4	3	1	4	0	64
8:00	0	20	0	6	11	0	0	10	2	0	9	1	59
8:15	1	12	1	2	4	1	1	5	2	1	12	0	42
8:30	0	4	3	0	2	0	2	1	0	1	3	0	16
8:45	0	4	0	5	6	1	0	4	1	0	2	0	23
Peak AM Hour	**1**	**46**	**1**	**14**	**76**	**2**	**1**	**22**	**8**	**4**	**28**	**2**	**205**
4:00	0	9	2	1	7	1	0	5	3	3	3	0	34
4:15	0	4	0	0	7	1	1	6	0	2	1	1	23
4:30	0	6	0	1	8	0	1	6	5	2	5	0	34
4:45	0	7	0	2	8	0	0	4	1	0	5	0	27
5:00	0	15	0	1	6	3	0	6	4	0	5	0	40
5:15	0	9	1	1	2	1	1	7	4	7	4	1	38
5:30	0	5	0	0	3	0	2	10	3	1	10	0	34
5:45	1	1	0	0	8	1	1	5	1	0	4	0	22
Peak PM Hour	**0**	**36**	**1**	**4**	**19**	**4**	**3**	**27**	**12**	**8**	**24**	**1**	**139**

AM phf = **0.80**
PM phf = **0.87**

Intersection: **Callender & C Street** **Date:** **12/1/2016**

	Callender						C Street						
Begin	Eastbound			Westbound			Northbound			Southbound			Total
Time	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Vehicles
7:00	1	2	0	0	1	0	0	0	0	0	1	0	5
7:15	2	2	0	0	6	0	1	4	0	1	2	0	18
7:30	2	4	0	0	10	1	1	5	0	1	5	3	32
7:45	1	7	2	0	9	1	1	5	0	1	0	1	28
8:00	2	5	1	1	11	3	1	5	0	0	1	1	31
8:15	0	7	2	0	7	0	2	2	0	0	2	3	25
8:30	2	5	1	0	6	0	0	4	0	1	2	0	21
8:45	2	6	0	0	6	0	0	3	1	0	2	2	22
Peak AM Hour	**5**	**23**	**5**	**1**	**37**	**5**	**5**	**17**	**0**	**2**	**8**	**8**	**116**
4:00	2	17	2	0	19	0	2	6	0	1	5	4	58
4:15	3	9	1	1	13	0	1	5	1	1	8	6	49
4:30	2	9	3	1	15	2	4	6	0	1	10	2	55
4:45	3	8	0	0	12	0	1	3	2	2	6	3	40
5:00	2	9	3	0	14	1	2	5	2	2	4	4	48
5:15	6	7	2	1	11	0	1	1	2	0	6	2	39
5:30	2	4	0	0	13	0	1	3	0	0	4	3	30
5:45	1	4	3	1	10	1	3	3	2	0	2	2	32
Peak PM Hour	**10**	**43**	**6**	**2**	**59**	**2**	**8**	**20**	**3**	**5**	**29**	**15**	**202**

AM phf = **0.91**
PM phf = **0.87**

Intersection: **Front Street & 5th Street** **Date:** **11/28/2016**

	Front Street						5th Street						
Begin	Eastbound			Westbound			Northbound			Southbound			Total
Time	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Vehicles
7:00	0	8	19	2	1	0	2	5	2	8	25	0	72
7:15	0	6	21	1	3	0	7	5	1	1	44	2	91
7:30	0	5	43	3	1	0	13	8	1	1	62	1	138
7:45	0	5	43	3	1	0	13	8	1	1	62	1	138
8:00	0	5	42	4	13	0	25	20	3	1	60	0	173
8:15	0	11	24	6	8	3	28	19	3	0	36	0	138
8:30	0	2	34	4	3	0	16	20	5	1	28	0	113
8:45	0	15	20	0	4	0	11	7	1	2	25	0	85
Peak AM Hour	**0**	**26**	**152**	**16**	**23**	**3**	**79**	**55**	**8**	**3**	**220**	**2**	**587**
4:00	0	7	22	6	6	1	27	27	5	1	34	1	137
4:15	0	2	26	3	13	0	40	30	6	0	27	1	148
4:30	0	3	24	3	11	1	31	31	12	0	25	0	141
4:45	1	3	30	4	8	2	44	37	5	0	27	0	161
5:00	0	4	21	2	14	1	52	31	6	0	34	0	165
5:15	0	2	22	2	17	0	47	46	8	0	24	0	168
5:30	3	8	18	2	10	1	29	18	5	7	14	1	116
5:45	0	7	13	2	9	2	29	25	4	1	19	1	112
Peak PM Hour	**1**	**12**	**97**	**11**	**50**	**4**	**174**	**145**	**31**	**0**	**110**	**0**	**635**

AM phf = **0.85**
PM phf = **0.94**

Intersection: **Park & 5th Street** **Date:** **11/28/2016**

	Park Street						5th Street						
Begin	Eastbound			Westbound			Northbound			Southbound			Total
Time	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Vehicles
7:00	6	39	0	1	60	0	2	3	1	7	7	29	155
7:15	8	52	0	0	45	0	2	2	0	13	13	38	173
7:30	14	65	0	0	55	3	2	6	2	31	27	45	250
7:45	21	93	4	0	66	3	3	16	0	36	48	65	355
8:00	37	94	2	0	73	7	4	11	2	26	25	49	330
8:15	5	14	1	1	13	4	0	6	3	7	7	21	82
8:30	30	77	3	1	69	3	9	9	5	19	9	37	271
8:45	15	75	4	0	60	0	7	5	2	11	5	33	217
Peak AM Hour	**80**	**304**	**6**	**0**	**239**	**13**	**11**	**35**	**4**	**106**	**113**	**197**	**1108**
4:00	44	107	0	0	89	4	12	11	1	13	15	26	322
4:15	55	119	1	3	89	8	16	16	3	8	13	29	360
4:30	49	111	1	5	82	2	14	23	1	10	10	30	338
4:45	60	100	0	1	65	8	10	20	1	12	9	34	320
5:00	63	96	1	2	80	2	11	25	1	11	6	34	332
5:15	75	96	0	1	82	4	4	25	0	10	8	39	344
5:30	45	121	1	1	68	2	5	9	4	4	5	24	289
5:45	38	100	2	2	48	2	4	8	2	4	3	24	237
Peak PM Hour	**227**	**426**	**3**	**11**	**316**	**20**	**51**	**84**	**6**	**41**	**38**	**127**	**1350**

AM phf = **0.78**
PM phf = **0.94**

Intersection: **Callender & B Street** **Date:** 1/10/2017

	Callender						B Street						
Begin	Eastbound			Westbound			Northbound			Southbound			Total
Time	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Vehicles
7:00	2	4	1	0	2	3	1	3	0	0	3	4	23
7:15	5	2	4	2	0	1	0	4	0	1	4	6	29
7:30	11	4	3	1	6	1	2	9	0	0	21	9	67
7:45	5	10	2	2	8	1	2	13	0	4	34	8	89
8:00	8	4	4	3	3	6	0	16	1	2	23	1	71
8:15	5	8	6	2	3	3	2	21	0	2	16	11	79
8:30	1	5	2	2	3	5	1	9	1	1	14	9	53
8:45	5	2	3	1	9	2	3	10	1	2	10	3	51
Peak AM Hour	**29**	**26**	**15**	**8**	**20**	**11**	**6**	**59**	**1**	**8**	**94**	**29**	**306**
4:00	18	6	6	3	9	7	4	19	3	3	11	7	96
4:15	12	14	8	0	7	1	6	22	1	2	6	10	89
4:30	13	6	2	1	13	7	2	23	0	2	7	9	85
4:45	17	8	3	1	11	12	3	24	2	3	11	7	102
5:00	16	3	3	0	10	8	1	27	0	4	15	10	97
5:15	9	10	2	1	6	7	2	21	1	3	17	7	86
5:30	4	4	3	1	8	8	0	9	1	0	9	7	54
5:45	10	5	0	1	4	1	0	15	0	2	11	6	55
Peak PM Hour	**58**	**31**	**16**	**2**	**41**	**28**	**12**	**96**	**3**	**11**	**39**	**36**	**373**

AM phf = **0.86**
PM phf = **0.91**

Intersection: **Clark & Main** **Date:** 1/10/2017

	Clark Street						Main Street						
Begin	Eastbound			Westbound			Northbound			Southbound			Total
Time	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Vehicles
7:00	0	1	1	0	1	0	0	9	0	2	19	1	34
7:15	0	2	2	0	1	1	0	7	0	0	20	0	33
7:30	2	2	6	3	1	2	3	32	0	3	39	1	94
7:45	1	6	8	3	4	2	4	39	5	2	61	0	135
8:00	5	5	7	4	2	1	8	42	3	1	39	1	118
8:15	3	3	3	0	3	2	5	27	1	0	16	0	63
8:30	3	1	0	1	1	1	0	7	3	2	9	2	30
8:45	5	4	3	0	4	0	0	11	2	2	14	3	48
Peak AM Hour	**11**	**16**	**24**	**10**	**10**	**7**	**20**	**140**	**9**	**6**	**155**	**2**	**410**
4:00	2	3	1	0	3	5	0	26	2	5	12	3	62
4:15	2	4	2	0	3	3	1	18	1	3	25	4	66
4:30	1	2	1	1	2	4	3	21	0	4	18	5	62
4:45	6	2	2	1	5	2	1	16	1	1	14	3	54
5:00	1	8	1	1	7	4	1	12	1	3	23	2	64
5:15	2	2	2	2	5	0	3	25	1	4	20	3	69
5:30	2	0	1	2	3	1	3	10	1	2	13	1	39
5:45	2	1	4	0	2	1	2	14	1	1	16	1	45
Peak PM Hour	**10**	**14**	**6**	**5**	**19**	**10**	**8**	**74**	**3**	**12**	**75**	**13**	**249**

AM phf = **0.76**
PM phf = **0.90**

Intersection: **Clark & K Street** **Date:** 1/10/2017

	Clark Street						K Street						
Begin	Eastbound			Westbound			Northbound			Southbound			Total
Time	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Vehicles
7:00	0	0	0	0	2	0	0	1	0	0	0	0	3
7:15	0	1	1	0	1	0	0	0	0	0	0	0	3
7:30	0	0	0	0	2	0	0	0	0	0	0	0	2
7:45	0	0	0	0	1	0	0	1	0	0	0	0	2
8:00	0	1	0	0	2	0	1	0	0	0	0	0	4
8:15	0	1	0	0	1	0	0	1	0	0	0	3	6
8:30	1	1	0	0	0	0	0	2	0	0	0	1	5
8:45	0	1	0	0	2	0	0	2	0	0	0	0	5
Peak AM Hour	**1**	**4**	**0**	**0**	**5**	**0**	**1**	**5**	**0**	**0**	**0**	**4**	**20**
4:00	1	0	1	0	3	0	0	1	0	0	0	0	6
4:15	0	1	0	0	0	0	0	4	0	1	1	0	7
4:30	0	0	0	0	1	0	0	0	0	0	0	1	2
4:45	1	1	0	0	0	0	0	0	0	0	1	0	3
5:00	1	3	0	0	0	0	0	1	0	0	2	0	7
5:15	0	2	0	0	1	0	0	1	0	0	1	0	5
5:30	1	1	2	0	2	0	0	0	0	0	0	0	6
5:45	0	2	1	0	1	0	0	0	0	0	0	0	4
Peak PM Hour	**2**	**8**	**3**	**0**	**4**	**0**	**0**	**2**	**0**	**0**	**3**	**0**	**22**

AM phf = **0.83**
PM phf = **0.79**

Intersection: **Callender & 2nd Street** **Date:** **1/11/2017**

	Callender						2nd Street						
Begin	Eastbound			Westbound			Northbound			Southbound			Total
Time	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Vehicles
7:00	1	3	0	0	1	0	0	1	0	1	3	0	10
7:15	0	5	2	0	8	2	0	2	0	1	6	1	27
7:30	1	10	1	3	11	6	3	3	2	4	6	1	51
7:45	3	9	5	4	12	5	0	5	6	5	7	1	62
8:00	0	13	2	0	15	5	4	8	3	3	8	1	62
8:15	2	6	4	2	10	1	0	8	2	3	7	3	48
8:30	1	5	1	2	10	1	3	3	4	2	7	2	41
8:45	0	10	1	2	15	0	2	5	3	5	5	6	54
Peak AM Hour	**6**	**38**	**12**	**9**	**48**	**17**	**7**	**24**	**13**	**15**	**28**	**6**	**223**
4:00	3	12	6	6	17	5	2	10	3	1	12	3	80
4:15	4	14	13	7	11	4	10	18	7	5	7	7	107
4:30	6	13	3	2	20	7	3	11	5	2	10	14	96
4:45	5	15	3	7	22	4	3	19	2	12	6	5	103
5:00	5	15	0	4	29	8	6	8	8	7	11	6	107
5:15	5	9	2	5	20	5	2	4	3	2	7	11	75
5:30	1	10	0	1	16	3	6	3	0	2	8	6	56
5:45	3	7	1	3	8	2	3	1	0	4	6	2	40
Peak PM Hour	**20**	**57**	**19**	**20**	**82**	**23**	**22**	**56**	**22**	**26**	**34**	**32**	**413**

AM phf = **0.90**
PM phf = **0.96**

Intersection: **Chinook & 5th Street** **Date:** **1/11/2017**

	Chinook Street						5th Street						
Begin	Eastbound			Westbound			Northbound			Southbound			Total
Time	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Vehicles
7:00	0	4	18	6	3	0	2	1	3	0	1	0	38
7:15	0	3	27	5	7	0	2	1	3	0	3	0	51
7:30	0	19	47	13	7	0	4	0	3	4	4	0	101
7:45	0	38	64	19	15	0	14	0	3	1	3	0	157
8:00	2	17	44	11	18	0	11	2	4	0	2	0	111
8:15	0	12	27	6	16	0	18	2	6	0	4	0	91
8:30	0	17	18	12	9	1	9	1	1	0	2	0	70
8:45	0	8	16	7	8	0	3	0	5	0	3	0	50
Peak AM Hour	**2**	**86**	**182**	**49**	**56**	**0**	**47**	**4**	**16**	**5**	**13**	**0**	**460**
4:00	0	9	14	6	14	1	14	5	5	1	0	0	69
4:15	1	6	27	5	7	1	28	7	3	0	4	1	90
4:30	0	3	14	17	16	0	14	8	9	1	4	0	86
4:45	0	3	15	14	17	1	19	8	11	0	2	0	90
5:00	0	11	18	9	20	2	18	5	11	0	2	0	96
5:15	0	17	16	8	23	0	31	7	5	0	1	0	108
5:30	0	7	17	8	20	1	14	2	4	1	0	1	75
5:45	0	7	16	7	22	0	24	4	14	0	2	0	96
Peak PM Hour	**0**	**34**	**63**	**48**	**76**	**3**	**82**	**28**	**36**	**1**	**9**	**0**	**380**

AM phf = **0.73**
PM phf = **0.88**

Intersection: **Callender & 9th Street** **Date:** **1/11/2017**

	Callender Street						9th Street						
Begin	Eastbound			Westbound			Northbound			Southbound			Total
Time	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Vehicles
7:00	0	1	0	0	0	1	0	3	0	0	1	0	6
7:15	0	0	0	2	1	0	0	4	0	0	3	0	10
7:30	0	1	2	2	5	0	0	1	0	0	0	0	11
7:45	0	5	0	0	1	1	0	2	0	0	0	0	9
8:00	0	4	0	0	1	0	0	10	1	0	1	0	17
8:15	0	5	0	0	2	1	0	1	0	0	0	0	9
8:30	1	5	0		2	0	0	2	1	0	0	0	11
8:45	0	2	1	2	3	0	0	1	1	0	0	0	10
Peak AM Hour	**0**	**10**	**2**	**4**	**8**	**1**	**0**	**17**	**1**	**0**	**4**	**0**	**47**
4:00	0	10	0	3	2	0	0	1	0	0	1	0	17
4:15	0	5	1	2	3	0	0	0	0	0	2	0	13
4:30	0	7	3	0	6	0	1	2	0	1	1	0	21
4:45	0	4	0	1	12	2	1	1	1	0	1	0	23
5:00	0	5	1	1	7	1	0	1	1	1	2	0	20
5:15	1	7	1	3	7	0	0	2	1	0	0	0	22
5:30	0	4	2	3	4	0	0	3	0	0	2	0	18
5:45	0	6	0	2	2	0	0	0	2	0	2	0	14
Peak PM Hour	**1**	**23**	**5**	**5**	**32**	**3**	**2**	**6**	**3**	**2**	**4**	**0**	**86**

AM phf = **0.69**
PM phf = **0.93**

Intersection: **Chinook & Yellowstone** **Date:** **1/12/2017**

	Chinook Street						Yellowstone Street						
Begin	Eastbound			Westbound			Northbound			Southbound			Total
Time	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Vehicles
7:00	0	18	1	0	10	0	0	0	0	1	0	2	32
7:15	0	6	1	0	18	2	1	0	1	4	0	1	34
7:30	0	21	0	0	16	1	1	0	0	2	0	2	43
7:45	0	39	0	0	27	3	0	0	1	4	0	2	76
8:00	0	21	1	0	15	0	2	0	0	3	0	2	44
8:15	0	14	1	0	23	2	2	0	0	1	1	2	46
8:30	0	8	0	0	14	0	2	0	0	1	0	0	25
8:45	0	12	0	0	17	0	1	0	0	0	0	2	32
Peak AM Hour	**0**	**95**	**2**	**0**	**81**	**6**	**5**	**0**	**1**	**10**	**1**	**8**	**209**
4:00	0	6	0	0	32	2	1	0	0	5	1	0	47
4:15	1	22	0	1	29	2	0	1	2	0	1	0	59
4:30	2	11	2	0	28	2	2	3	1	0	2	0	53
4:45	1	14	1	0	18	1	1	1	0	2	0	0	39
5:00	1	30	0	1	35	4	0	0	1	1	0	0	73
5:15	0	19	1	0	30	2	1	2	0	2	2	0	59
5:30	0	22	0	0	22	6	1	0	2	3	0	1	57
5:45	2	17	0	2	24	2	0	0	1	1	2	0	51
Peak PM Hour	**2**	**85**	**2**	**1**	**105**	**13**	**3**	**3**	**3**	**8**	**2**	**1**	**228**

AM phf = **0.69**
PM phf = **0.78**

Intersection: **Callender & D Street** **Date:** **1/12/2017**

	Callender Street						D Street						
Begin	Eastbound			Westbound			Northbound			Southbound			Total
Time	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Vehicles
7:00	1	1	0	0	3	0	0	2	0	0	4	0	11
7:15	1	2	0	0	1	0	1	2	0	1	2	1	11
7:30	0	3	2	0	4	1	0	3	0	1	4	0	18
7:45	2	9	2	0	3	0	0	3	2	1	5	0	27
8:00	2	5	1	0	8	0	0	1	2	1	0	1	21
8:15	1	1	0	0	3	1	0	5	0	0	0	1	12
8:30	0	3	1	0	7	1	1	1	0	1	3	1	19
8:45	1	7	3	0	9	0	1	2	0	2	1	0	26
Peak AM Hour	**5**	**18**	**4**	**0**	**21**	**2**	**1**	**10**	**4**	**3**	**8**	**3**	**79**
4:00	1	8	1	1	6	0	2	4	0	0	1	1	25
4:15	1	9	0	1	12	3	0	3	1	0	3	0	33
4:30	2	7	0	0	11	0	1	3	0	0	2	1	27
4:45	2	7	0	0	7	0	5	2	1	1	5	0	30
5:00	1	13	2	0	13	1	7	3	0	0	3	0	43
5:15	0	5	2	1	9	0	1	2	0	1	3	0	24
5:30	3	5	1	1	3	0	0	3	0	0	3	2	21
5:45	1	6	1	0	5	1	1	3	0	0	1	1	20
Peak PM Hour	**6**	**36**	**2**	**1**	**43**	**4**	**13**	**11**	**2**	**1**	**13**	**1**	**133**

AM phf = **0.73**
PM phf = **0.77**

Intersection: **Butte & H Street** **Date:** **1/12/2017**

	Butte Street						H Street						
Begin	Eastbound			Westbound			Northbound			Southbound			Total
Time	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Vehicles
7:00	0	0	0	0	0	0	0	0	0	0	8	0	8
7:15	0	0	0	1	0	0	0	6	0	1	14	0	22
7:30	0	0	0	0	0	0	0	7	0	2	25	0	34
7:45	1	0	0	2	0	2	0	14	1	2	52	0	74
8:00	0	0	0	0	0	1	0	20	2	0	28	0	51
8:15	0	0	0	0	0	0	0	4	0	1	7	0	12
8:30	0	0	0	0	0	2	0	1	1	1	4	0	9
8:45	0	0	0	0	0	0	0	4	0	2	2	0	8
Peak AM Hour	**1**	**0**	**0**	**3**	**0**	**3**	**0**	**47**	**3**	**5**	**119**	**0**	**181**
4:00	0	0	0	0	0	1	0	11	0	2	10	0	24
4:15	0	0	0	1	0	1	0	13	1	3	11	0	30
4:30	0	0	0	0	0	1	0	9	0	1	10	0	21
4:45	0	0	0	1	0	3	0	8	1	2	5	0	20
5:00	0	0	0	0	0	1	0	9	2	2	4	1	19
5:15	0	0	0	0	0	2	0	4	0	2	6	1	15
5:30	0	0	0	1	0	1	0	8	1	2	5	0	18
5:45	0	0	0	0	0	0	0	3	0	1	6	0	10
Peak PM Hour	**0**	**0**	**0**	**2**	**0**	**6**	**0**	**41**	**2**	**8**	**36**	**0**	**95**

AM phf = **0.61**
PM phf = **0.79**

Intersection: **Callender & Main** **Date:** **1/13/2017**

	Callender Street						Main Street						
Begin	Eastbound			Westbound			Northbound			Southbound			Total
Time	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Vehicles
7:00	0	1	1	0	7	1	2	5	1	0	5	1	24
7:15	2	5	0	1	3	1	2	8	2	2	21	0	47
7:30	2	7	3	5	12	0	4	9	4	1	22	2	71
7:45	2	5	6	15	12	1	10	12	11	0	34	1	109
8:00	1	11	6	2	4	1	19	12	12	4	18	1	91
8:15	1	4	4	3	5	1	4	19	4	4	15	3	67
8:30	3	9	2	0	3	2	0	9	4	3	14	4	53
8:45	2	10	4	5	5	4	4	9	4	2	12	3	64
Peak AM Hour	**6**	**27**	**19**	**25**	**33**	**3**	**37**	**52**	**31**	**9**	**89**	**7**	**338**
4:00	5	29	4	10	22	2	13	15	13	1	15	8	137
4:15	6	22	5	6	17	8	5	13	11	1	17	5	116
4:30	7	19	8	10	13	8	9	11	7	1	12	6	111
4:45	5	19	5	3	19	8	10	14	14	1	17	8	123
5:00	4	11	8	5	16	6	9	18	14	5	21	6	123
5:15	9	10	6	4	13	6	6	11	6	2	7	6	86
5:30	4	16	4	6	15	7	3	12	6	1	12	10	96
5:45	7	16	4	5	13	5	9	12	6	5	15	7	104
Peak PM Hour	**23**	**89**	**22**	**29**	**71**	**26**	**37**	**53**	**45**	**4**	**61**	**27**	**487**

AM phf = **0.78**
PM phf = **0.89**

Intersection: **Chinook & Main** **Date:** **1/13/2017**

	Chinook Street						Main Street						
Begin	Eastbound			Westbound			Northbound			Southbound			Total
Time	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Vehicles
7:00	2	0	5	0	0	0	17	2	0	0	6	4	36
7:15	2	0	1	0	0	1	22	6	0	0	5	5	42
7:30	6	0	8	0	1	0	25	17	0	0	4	24	85
7:45	8	0	14	0	3	0	35	15	0	0	12	42	129
8:00	10	0	16	0	0	0	12	10	0	0	12	17	77
8:15	9	0	15	0	1	0	9	12	0	0	14	10	70
8:30	8	0	7	0	0	0	14	13	0	0	5	6	53
8:45	6	0	4	1	0	0	12	6	0	1	8	18	56
Peak AM Hour	**33**	**0**	**53**	**0**	**5**	**0**	**81**	**54**	**0**	**0**	**42**	**93**	**361**
4:00	28	1	34	0	1	0	21	17	0	0	5	14	121
4:15	12	2	15	0	0	0	20	11	0	0	17	3	80
4:30	13	1	24	0	1	1	23	15	0	1	12	3	94
4:45	10	4	18	0	2	1	20	12	1	0	13	8	89
5:00	14	2	21	0	0	1	7	12	0	1	11	10	79
5:15	19	1	25	1	2	0	8	11	0	0	7	9	83
5:30	9	0	24	0	1	0	11	10	1	1	9	9	75
5:45	16	0	22	0	0	0	16	12	0	0	6	5	77
Peak PM Hour	**63**	**8**	**91**	**0**	**4**	**2**	**84**	**55**	**1**	**1**	**47**	**28**	**384**

AM phf = **0.70**
PM phf = **0.79**

Intersection: **Chinook & 3rd Street** **Date:** **1/13/2017**

	Chinook Street						3rd Street						
Begin	Eastbound			Westbound			Northbound			Southbound			Total
Time	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Vehicles
7:00	0	11	0	0	6	0	0	0	0	0	0	0	17
7:15	0	10	1	0	8	0	0	0	0	0	0	0	19
7:30	0	26	0	0	26	0	1	0	1	0	0	0	54
7:45	0	47	0	0	22	0	0	0	0	0	0	0	69
8:00	0	32	0	0	18	0	0	0	0	0	0	0	50
8:15	0	21	0	0	21	0	1	0	0	1	0	0	44
8:30	0	6	0	0	20	0	0	0	2	0	0	0	28
8:45	0	25	0	0	11	0	0	0	1	0	0	0	37
Peak AM Hour	**0**	**126**	**0**	**0**	**87**	**0**	**2**	**0**	**1**	**1**	**0**	**0**	**217**
4:00	1	17	0	2	36	0	0	0	0	0	0	0	56
4:15	0	19	0	0	22	0	0	0	0	0	0	1	42
4:30	0	14	1	3	23	0	0	0	0	0	0	0	41
4:45	0	19	2	1	23	0	2	0	2	0	0	0	49
5:00	0	16	3	2	33	0	0	1	1	0	0	0	56
5:15	1	17	0	0	32	0	0	1	0	0	0	0	51
5:30	1	15	0	1	18	0	0	0	0	0	0	1	36
5:45	1	9	0	0	25	0	0	0	0	0	0	0	35
Peak PM Hour	**1**	**66**	**6**	**6**	**111**	**0**	**2**	**2**	**3**	**0**	**0**	**0**	**197**

AM phf = **0.79**
PM phf = **0.88**

Intersection: **Park & Main** **Date:** **1/16/2017**

	Park Street						Main Street						
Begin	Eastbound			Westbound			Northbound			Southbound			Total
Time	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Vehicles
7:00	0	23	13	7	39	0	5	0	4	0	0	0	91
7:15	0	40	12	3	40	0	3	0	1	0	0	0	99
7:30	0	62	24	12	50	0	3	0	7	0	0	0	158
7:45	0	72	30	10	57	0	5	0	7	0	0	0	181
8:00	0	62	27	4	53	0	7	0	8	0	0	0	161
8:15	0	61	16	6	50	0	11	0	6	0	0	0	150
8:30	0	41	13	3	53	0	5	0	2	0	0	0	117
8:45	0	42	13	6	55	0	5	0	3	0	0	0	124
Peak AM Hour	**0**	**257**	**97**	**32**	**210**	**0**	**26**	**0**	**28**	**0**	**0**	**0**	**650**
4:00	0	89	21	7	76	0	9	0	12	0	0	0	214
4:15	0	90	13	7	73	0	6	0	13	0	0	0	202
4:30	0	85	20	7	85	0	6	0	10	0	0	0	213
4:45	0	93	23	4	68	1	6	0	11	0	0	0	206
5:00	0	99	23	5	79	0	11	0	7	0	0	0	224
5:15	0	85	15	4	77	0	8	0	11	0	0	0	200
5:30	0	121	18	5	57	0	9	0	3	0	0	0	213
5:45	0	121	15	9	62	0	7	0	6	0	0	0	220
Peak PM Hour	**0**	**426**	**71**	**23**	**275**	**0**	**35**	**0**	**27**	**0**	**0**	**0**	**857**

AM phf = **0.90**
PM phf = **0.96**

Intersection: **Park & 7th Street** **Date:** **1/16/2017**

	Park Street						7th Street						
Begin	Eastbound			Westbound			Northbound			Southbound			Total
Time	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Vehicles
7:00	5	29	0	0	26	43	2	4	0	14	3	1	127
7:15	3	28	0	1	50	57	1	6	1	11	2	1	161
7:30	9	77	0	1	55	31	2	9	1	18	4	4	211
7:45	7	79	0	1	66	54	4	15	0	22	7	2	257
8:00	2	94	0	0	71	34	2	10	3	25	1	3	245
8:15	12	85	0	1	99	34	3	11	2	12	2	2	263
8:30	7	56	0	0	61	36	6	2	1	18	4	4	195
8:45	8	64	0	0	78	35	8	7	2	26	2	4	234
Peak AM Hour	**30**	**335**	**0**	**3**	**291**	**153**	**11**	**45**	**6**	**77**	**14**	**11**	**976**
4:00	4	112	1	2	105	28	7	6	0	46	6	8	325
4:15	6	91	1	1	89	27	9	2	3	41	8	5	283
4:30	8	96	0	1	105	29	4	3	3	50	6	8	313
4:45	8	129	1	1	87	30	4	6	2	56	8	6	338
5:00	1	109	1	1	98	23	12	2	2	74	10	10	343
5:15	9	114	1	0	104	30	5	4	2	55	8	15	347
5:30	3	114	2	0	72	22	6	4	1	82	5	11	322
5:45	1	96	0	0	47	15	4	0	0	54	77	16	310
Peak PM Hour	**21**	**466**	**5**	**2**	**361**	**105**	**27**	**16**	**7**	**267**	**31**	**42**	**1350**

AM phf = **0.93**
PM phf = **0.97**

Intersection: **Park & Geyser** **Date:** **1/16/2017**

	Geyser Street						Park Street						
Begin	Eastbound			Westbound			Northbound			Southbound			Total
Time	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Vehicles
7:00	0	0	0	5	0	1	0	24	8	0	27	0	65
7:15	0	0	0	10	0	0	0	34	6	0	40	0	90
7:30	0	0	0	7	0	0	0	80	22	0	43	0	152
7:45	0	0	0	9	0	3	0	96	40	0	56	0	204
8:00	0	0	0	21	0	0	0	81	15	0	51	0	168
8:15	0	0	0	10	0	2	0	62	7	0	90	0	171
8:30	0	0	0	9	0	1	0	61	7	0	70	0	148
8:45	0	0	0	9	0	0	0	74	7	1	60	0	151
Peak AM Hour	**0**	**0**	**0**	**47**	**0**	**5**	**0**	**319**	**84**	**0**	**240**	**0**	**695**
4:00	0	0	0	9	0	1	0	92	9	1	83	0	195
4:15	0	0	0	8	0	1	0	77	12	3	74	0	175
4:30	0	0	0	17	0	1	0	76	14	3	103	0	214
4:45	0	0	0	13	0	2	0	109	10	1	88	0	223
5:00	0	0	0	10	0	3	0	111	15	2	98	0	239
5:15	0	0	0	12	0	1	0	109	12	2	99	0	235
5:30	0	0	0	7	0	2	0	89	6	3	71	0	178
5:45	0	0	0	11	0	2	0	82	6	3	62	0	166
Peak PM Hour	**0**	**0**	**0**	**52**	**0**	**7**	**0**	**405**	**51**	**8**	**388**	**0**	**911**

AM phf = **0.85**
PM phf = **0.95**

Intersection: **Star Road & Sun Avenue** **Date:** **1/17/2017**

	Sun Ave.						Star Road						
Begin	Eastbound			Westbound			Northbound			Southbound			Total
Time	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Vehicles
7:00	0	0	18	0	0	0	3	0	0	0	5	0	26
7:15	0	0	19	0	0	0	3	0	0	0	7	0	29
7:30	0	0	35	0	0	0	5	6	0	0	22	0	68
7:45	0	0	39	0	0	0	3	1	0	0	17	0	60
8:00	0	0	16	0	0	0	5	8	0	0	9	0	38
8:15	0	0	10	0	0	0	12	8	0	0	12	0	42
8:30	0	0	6	0	0	0	4	3	0	0	7	0	20
8:45	0	0	17	0	0	0	2	6	0	0	8	0	33
Peak AM Hour	**0**	**0**	**100**	**0**	**0**	**0**	**25**	**23**	**0**	**0**	**60**	**0**	**208**
4:00	0	0	5	0	0	0	12	13	0	0	6	1	37
4:15	0	0	9	0	0	0	22	7	0	0	8	0	46
4:30	0	0	7	0	0	0	14	8	0	0	11	0	40
4:45	0	0	13	0	0	0	16	3	0	0	11	0	43
5:00	0	0	7	0	0	0	31	18	0	0	9	0	65
5:15	0	0	4	0	0	0	20	10	0	0	10	0	44
5:30	0	0	17	0	0	0	24	14	0	0	6	0	61
5:45	0	0	14	0	0	0	26	7	0	0	1	0	48
Peak PM Hour	**0**	**0**	**42**	**0**	**0**	**0**	**101**	**49**	**0**	**0**	**26**	**0**	**218**

AM phf = **0.76**
PM phf = **0.84**

Intersection: **Callender & F Street** **Date:** **1/17/2017**

	Callender Street						F Street						
Begin	Eastbound			Westbound			Northbound			Southbound			Total
Time	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Vehicles
7:00	0	1	0	0	1	0	0	0	0	0	0	0	2
7:15	2	1	0	0	0	0	0	1	0	0	0	0	4
7:30	0	1	0	0	3	1	1	1	0	0	1	0	8
7:45	1	1	0	2	3	2	2	3	3	0	7	0	24
8:00	0	1	1	1	6	1	2	1	1	0	3	0	17
8:15	1	0	0	0	4	1	2	4	0	0	1	1	14
8:30	1	3	2	0	2	0	1	3	0	1	4	0	17
8:45	2	0	1	0	5	2	2	2	0	1	7	1	23
Peak AM Hour	**3**	**5**	**3**	**3**	**15**	**4**	**7**	**11**	**4**	**1**	**15**	**1**	**72**
4:00	0	5	0	0	4	1	0	5	0	0	2	2	19
4:15	0	8	1	0	4	0	0	1	1	0	1	0	16
4:30	1	6	0	0	5	0	0	1	0	1	1	0	15
4:45	0	4	1	1	2	0	1	1	0	0	2	0	12
5:00	0	7	0	0	5	0	0	2	0	0	0	2	16
5:15	1	3	0	0	6	0	0	0	1	2	2	1	16
5:30	1	5	0	0	4	0	0	2	0	1	4	1	18
5:45	0	1	1	1	3	1	0	2	0	2	5	0	16
Peak PM Hour	**2**	**16**	**1**	**1**	**18**	**1**	**0**	**6**	**1**	**5**	**11**	**4**	**66**

AM phf = **0.75**
PM phf = **0.92**

Intersection: **Park & Old Clyde Park Road** **Date:** **1/17/2017**

	Park Street						Old Clyde Park Road						
Begin	Eastbound			Westbound			Northbound			Southbound			Total
Time	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Vehicles
7:00	5	27	0	0	13	0	0	0	0	8	0	19	72
7:15	4	24	0	0	31	1	0	0	0	5	0	37	102
7:30	3	44	0	0	38	2	0	0	0	14	0	48	149
7:45	13	58	0	0	40	3	0	0	0	12	0	55	181
8:00	15	43	0	0	32	3	0	0	0	7	0	30	130
8:15	21	32	0	0	46	2	0	0	0	5	0	17	123
8:30	13	40	0	0	42	1	0	0	0	3	0	35	134
8:45	13	35	0	0	55	2	0	0	0	8	0	27	140
Peak AM Hour	**52**	**177**	**0**	**0**	**156**	**10**	**0**	**0**	**0**	**38**	**0**	**150**	**583**
4:00	28	44	0	0	40	9	0	0	0	7	0	25	153
4:15	36	46	0	0	33	1	0	0	0	5	0	17	138
4:30	21	29	0	0	57	15	0	0	0	0	0	22	144
4:45	35	34	0	0	47	6	0	0	0	8	0	23	153
5:00	27	38	0	0	42	8	0	0	0	0	0	15	130
5:15	19	38	0	0	46	7	0	0	0	5	0	12	127
5:30	19	53	0	0	37	8	0	0	0	5	0	20	142
5:45	23	25	0	0	23	10	0	0	0	1	0	13	95
Peak PM Hour	**120**	**153**	**0**	**0**	**177**	**31**	**0**	**0**	**0**	**20**	**0**	**87**	**588**

AM phf = **0.81**
PM phf = **0.96**

Intersection: **Park & 2nd Street** **Date:** **1/18/2017**

	Park Street						2nd Street						
Begin	Eastbound			Westbound			Northbound			Southbound			Total
Time	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Vehicles
7:00	0	43	2	3	49	0	2	0	2	0	0	0	101
7:15	0	50	5	5	57	0	2	0	2	0	0	0	121
7:30	0	90	12	7	76	0	3	0	2	0	0	0	190
7:45	0	116	17	8	70	0	3	0	6	0	0	0	220
8:00	0	107	6	8	88	0	6	0	7	0	0	0	222
8:15	0	83	7	6	65	0	3	0	3	0	0	0	167
8:30	0	80	18	6	79	0	6	0	3	0	0	0	192
8:45	0	73	12	7	94	0	2	0	4	0	0	0	192
Peak AM Hour	**0**	**386**	**48**	**28**	**302**	**0**	**18**	**0**	**19**	**0**	**0**	**0**	**801**
4:00	0	119	17	6	94	0	5	0	7	0	0	0	248
4:15	0	113	15	11	91	0	5	0	9	0	0	0	244
4:30	0	95	17	6	90	0	7	0	10	0	0	0	225
4:45	0	116	17	7	89	0	1	0	8	0	0	0	238
5:00	0	117	22	10	95	0	8	0	14	0	0	0	266
5:15	0	105	11	6	89	0	4	0	5	0	0	0	220
5:30	0	132	22	4	80	0	2	0	15	0	0	0	255
5:45	0	92	14	8	70	0	4	0	7	0	0	0	195
Peak PM Hour	**0**	**470**	**72**	**27**	**353**	**0**	**15**	**0**	**42**	**0**	**0**	**0**	**979**

AM phf = **0.90**
PM phf = **0.92**

Intersection: **Park & B Street** **Date:** **1/18/2017**

	Park Street						B Street						
Begin	Eastbound			Westbound			Northbound			Southbound			Total
Time	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Vehicles
7:00	4	32	0	1	46	2	1	0	5	8	4	10	113
7:15	2	39	1	1	50	3	2	2	3	13	10	20	146
7:30	10	54	6	0	68	7	5	6	2	19	15	19	211
7:45	13	74	9	7	62	11	5	6	2	33	36	28	286
8:00	11	75	10	2	68	13	10	23	4	25	29	12	282
8:15	8	62	12	2	51	17	8	12	6	18	14	13	223
8:30	6	56	6	1	71	6	7	11	4	12	10	7	197
8:45	7	54	4	10	82	11	5	5	7	18	10	16	229
Peak AM Hour	**29**	**199**	**16**	**9**	**226**	**23**	**13**	**14**	**12**	**73**	**65**	**77**	**756**
4:00	15	95	4	4	75	24	22	20	10	11	20	6	306
4:15	15	85	8	1	69	16	16	17	11	11	11	11	271
4:30	10	68	12	5	71	21	15	18	6	7	15	12	260
4:45	31	91	7	6	67	33	10	30	12	20	16	21	344
5:00	26	79	14	3	73	28	16	40	10	13	5	18	325
5:15	42	63	10	4	69	13	12	25	6	5	9	17	275
5:30	31	81	10	1	60	14	12	19	2	14	12	11	267
5:45	16	67	11	2	62	20	8	18	7	10	7	8	236
Peak PM Hour	**130**	**314**	**41**	**14**	**269**	**88**	**50**	**114**	**30**	**52**	**42**	**67**	**1211**

AM phf = **0.66**
PM phf = **0.88**

Intersection: **Park (US 87) & Loves Lane** **Date:** **1/18/2017**

	Loves Lane						Park Street (US 87)						
Begin	Eastbound			Westbound			Northbound			Southbound			Total
Time	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Vehicles
7:00	9	0	0	9	0	1	0	48	1	1	47	9	125
7:15	10	2	1	9	0	5	2	57	0	2	38	6	132
7:30	10	0	1	13	1	5	1	94	1	1	61	8	196
7:45	32	0	3	9	1	7	2	126	2	1	67	12	262
8:00	23	2	2	13	0	3	4	100	5	0	72	9	233
8:15	13	1	0	12	1	4	1	78	3	3	72	12	200
8:30	11	1	1	8	1	4	2	72	4	4	60	6	174
8:45	10	0	2	23	1	4	2	63	1	2	57	16	181
Peak AM Hour	**78**	**3**	**6**	**47**	**3**	**19**	**8**	**398**	**11**	**5**	**272**	**41**	**891**
4:00	25	2	3	12	10	12	2	85	4	2	83	25	265
4:15	21	2	6	19	2	9	1	80	1	2	87	33	263
4:30	26	4	3	19	3	9	1	81	2	4	89	34	275
4:45	22	1	0	23	5	15	3	100	6	3	82	36	296
5:00	30	0	5	19	1	21	5	113	5	4	115	41	359
5:15	27	4	4	27	8	10	5	84	2	7	72	39	289
5:30	25	3	3	32	5	12	5	81	5	9	71	23	274
5:45	17	0	1	23	9	16	2	51	5	3	56	24	207
Peak PM Hour	**99**	**7**	**14**	**80**	**11**	**54**	**10**	**374**	**14**	**13**	**373**	**144**	**1193**

AM phf = **0.85**
PM phf = **0.83**

ADDITIONAL COUNTS MARCH 2017

Intersection: **Chinook & C Street** **Date:** **3/29/2017**

	Chinook Street						C Street						
Begin	Eastbound			Westbound			Northbound			Southbound			Total
Time	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Vehicles
4:30	57		0				0	0			0	50	107
4:45	57		0				0	0			0	57	114
5:00	35		0				0	0			0	30	65
5:15	46		0				0	0			0	30	76
Peak PM Hour	**138**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**117**	**255**
PM phf =		**0.56**											

Intersection: **Front Street & Main Street** **Date:** **3/29/2017**

	Front Street						Main Street						
Begin	Eastbound			Westbound			Northbound			Southbound			Total
Time	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Vehicles
4:30	5		5				18	53		0	28	2	111
4:45	4		9				9	44		0	33	4	103
5:00	6		3				26	57		0	22	3	117
5:15	7		4				20	56		0	22	1	110
Peak PM Hour	**17**	**0**	**16**	**0**	**0**	**0**	**55**	**157**	**0**	**0**	**77**	**8**	**330**
PM phf =		**0.71**											

Intersection: **Park Street & 6th Street** **Date:** **3/29/2017**

	Park Street						6th Street						
Begin	Eastbound			Westbound			Northbound			Southbound			Total
Time	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Vehicles
4:30	0	167	3	0	125	0	0	0	2	0	0	0	297
4:45	0	189	0	1	130	0	1	0	0	0	0	0	321
5:00	0	190	2	1	156	0	2	0	0	0	0	0	351
5:15	0	220	2	0	190	0	0	0	3	0	0	0	415
Peak PM Hour	**0**	**599**	**4**	**2**	**476**	**0**	**3**	**0**	**3**	**0**	**0**	**0**	**1087**
PM phf =		**0.65**											

Intersection: **Park Street & 8th Street** **Date:** **3/30/2017**

	8th Street						Park Street						
Begin	Eastbound			Westbound			Northbound			Southbound			Total
Time	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Vehicles
4:30	0	0	0	0	0	2	0	111	1	2	130	0	246
4:45	0	0	0	0	0	3	0	124	0	0	142	0	269
5:00	0	0	0	2	0	2	0	147	0	2	155	0	308
5:15	0	0	0	1	0	1	0	144	1	3	174	0	324
Peak PM Hour	**0**	**0**	**0**	**3**	**0**	**6**	**0**	**415**	**1**	**5**	**471**	**0**	**901**
PM phf =		**0.70**											

Intersection: **Park Street & Rogers Street** **Date:** **3/30/2017**

	Rogers Street						Park Street						
Begin	Eastbound			Westbound			Northbound			Southbound			Total
Time	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Vehicles
4:30	1		1				3	85		0	111	3	204
4:45	4		1				5	134		0	130	0	274
5:00	5		1				7	148		0	150	4	315
5:15	1		0				3	132		0	100	3	239
Peak PM Hour	**10**	**0**	**2**	**0**	**0**	**0**	**15**	**414**	**0**	**0**	**380**	**7**	**828**
PM phf =		**0.66**											

ADDITIONAL COUNTS JUNE & JULY 2017

Intersection: **Park Street & 2nd Street** **Date:** **6/29/2017**

	Park Street						2nd Street						
Begin	Eastbound			Westbound			Northbound			Southbound			Total
Time	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Vehicles
7:00		36	5	5	70		0		0				116
7:15		65	7	5	57		1		4				139
7:30		71	14	11	53		2		4				155
7:45		113	13	8	63		4		1				202
8:00		77	11	4	80		2		6				180
8:15		77	14	10	85		3		7				196
8:30		97	13	8	86		2		13				219
8:45		77	15	4	76		4		8				184
Peak AM Hour		**364**	**51**	**30**	**314**		**11**		**27**				**797**
AM phf =		**0.91**											

Intersection: **Park Street & 2nd Street** **Date:** **6/29/2017**

	Park Street						2nd Street						
Begin	Eastbound			Westbound			Northbound			Southbound			Total
Time	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Vehicles
4:00		128	23	11	122		1		14				299
4:15		107	22	9	98		14		9				259
4:30		108	23	8	89		4		7				239
4:45		115	27	2	104		6		5				259
5:00		113	24	6	99		8		7				257
5:15		142	23	8	95		5		8				281
5:30		120	23	6	100		11		6				266
5:45		121	22	1	75		4		4				227
Peak PM Hour		**490**	**97**	**22**	**398**		**30**		**26**				**1063**
PM phf =		**0.95**											

Intersection: **Park Street & I-90 Westbound Ramps** **Date:** **7/6/2017**

	I-90 Westbound Ramps						Park Street						
Begin	Eastbound			Westbound			Northbound			Southbound			Total
Time	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Vehicles
7:00				2		2		44	31	19	47		145
7:15				8		3		57	33	7	53		161
7:30				23		3		86	28	17	89		246
7:45				10		4		122	38	10	63		247
8:00				10		6		99	30	9	81		235
8:15				15		1		73	40	11	90		230
8:30				10		0		92	48	9	75		234
8:45				18		2		99	30	9	60		218
Peak AM Hour				**58**		**14**		**380**	**136**	**47**	**323**		**958**
AM phf =			**0.97**										

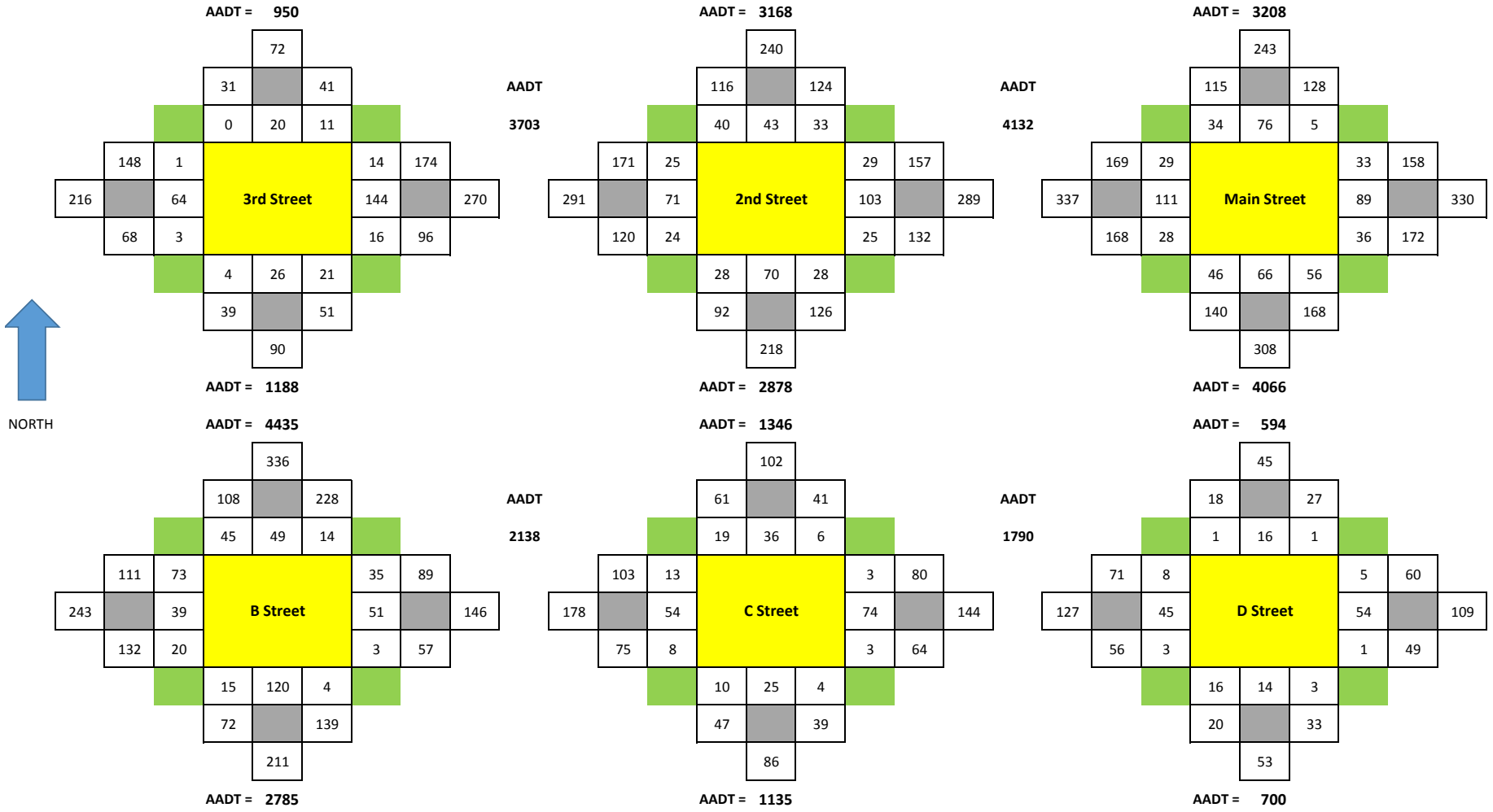
Intersection: **Park Street & I-90 Westbound Ramps** **Date:** **7/6/2017**

	I-90 Westbound Ramps						Park Street						
Begin	Eastbound			Westbound			Northbound			Southbound			Total
Time	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Vehicles
4:00				14		8		148	29	8	102		309
4:15				14		10		150	52	8	100		334
4:30				20		3		142	57	4	130		356
4:45				23		10		175	45	10	111		374
5:00				13		8		168	61	8	135		393
5:15				17		6		150	39	8	80		300
5:30				14		5		165	66	6	90		346
5:45				11		2		151	43	11	92		310
Peak PM Hour				**70**		**31**		**635**	**215**	**30**	**476**		**1457**
PM phf =			**0.93**										

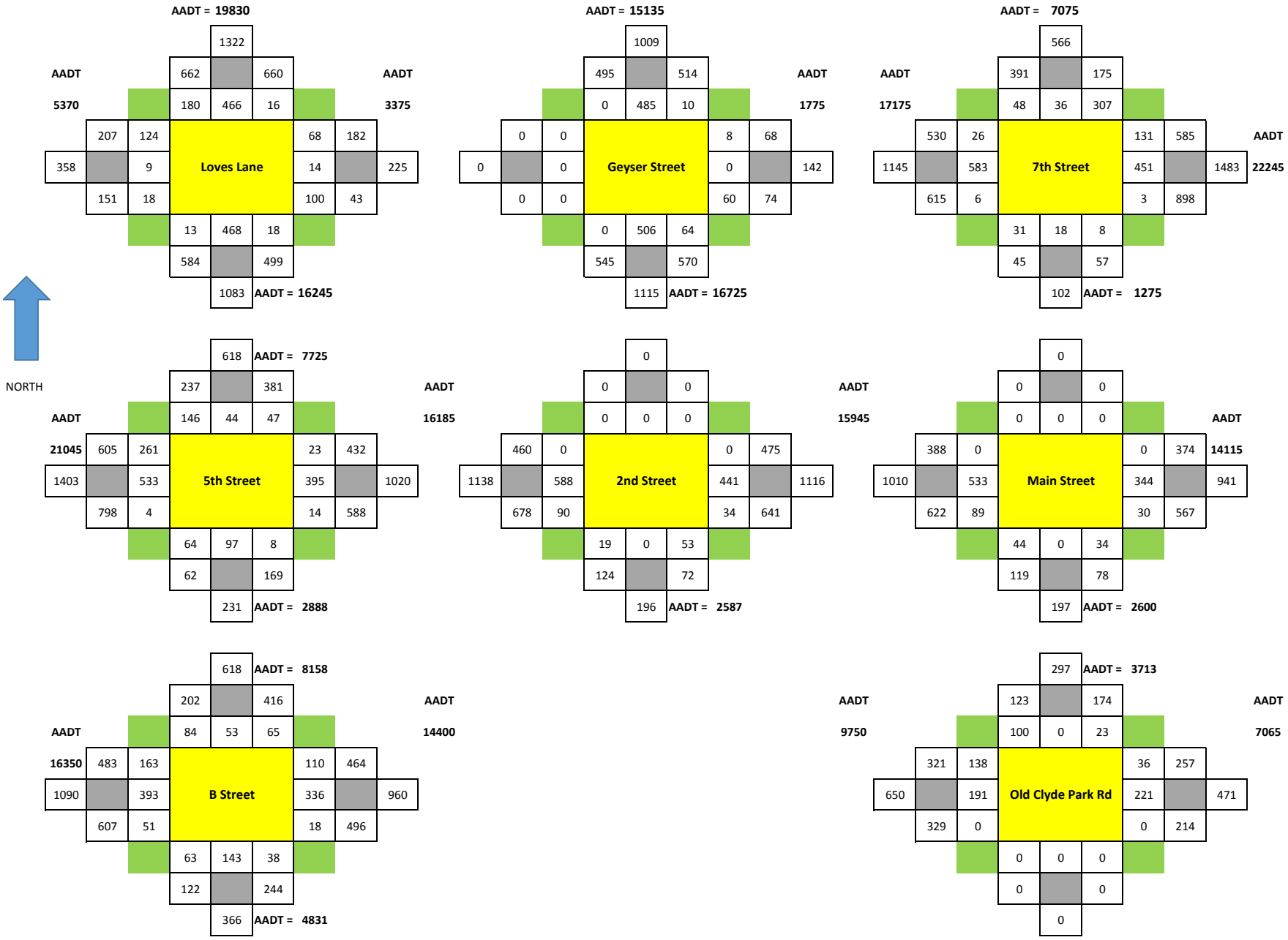
APPENDIX B

2017 DESIGN HOUR TRAFFIC

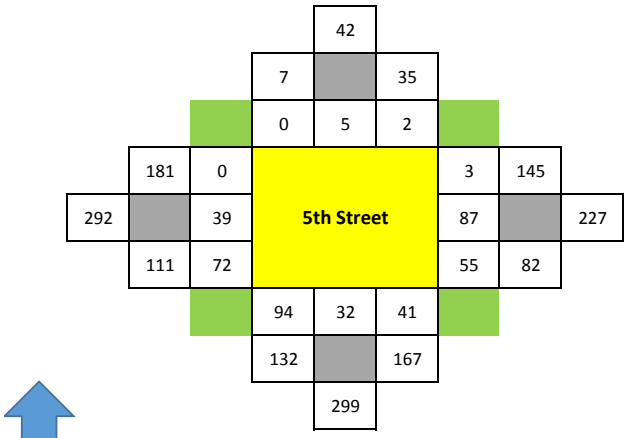
2017 DESIGN PM HOUR TRAFFIC CALLENDER STREET

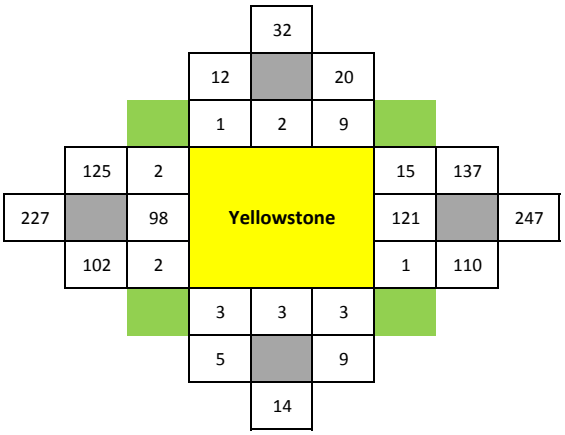


2017 DESIGN PM HOUR TRAFFIC PARK STREET

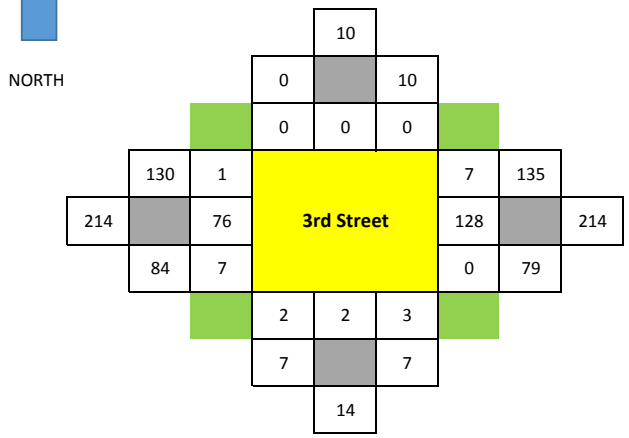


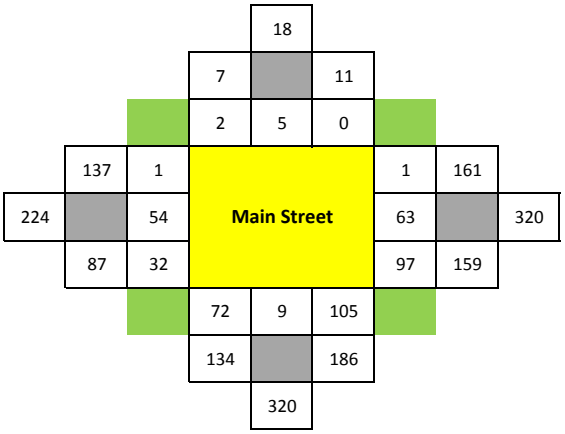
2017 DESIGN PM HOUR TRAFFIC CHINOOK STREET





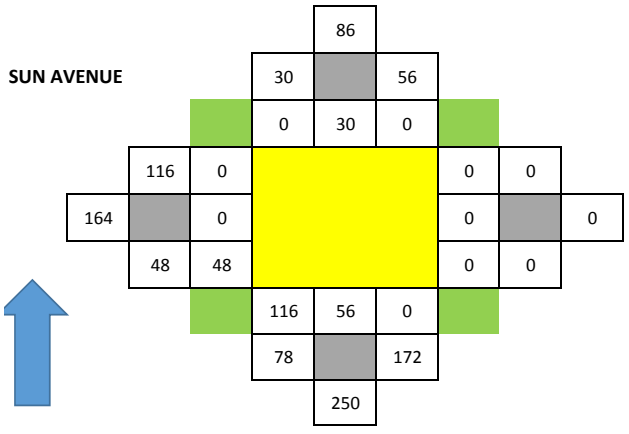
NORTH





STAR AVENUE

SUN AVENUE

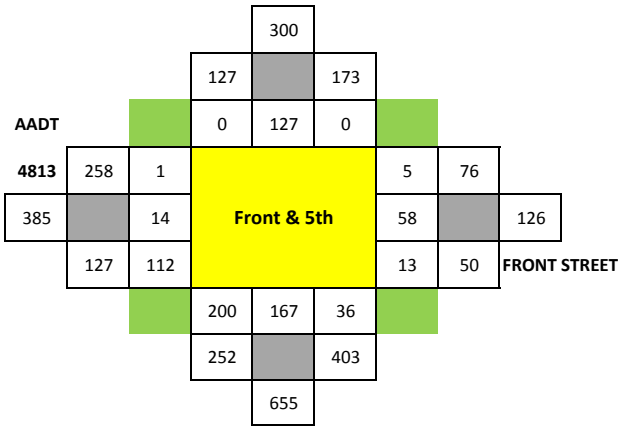


NORTH

5th Street

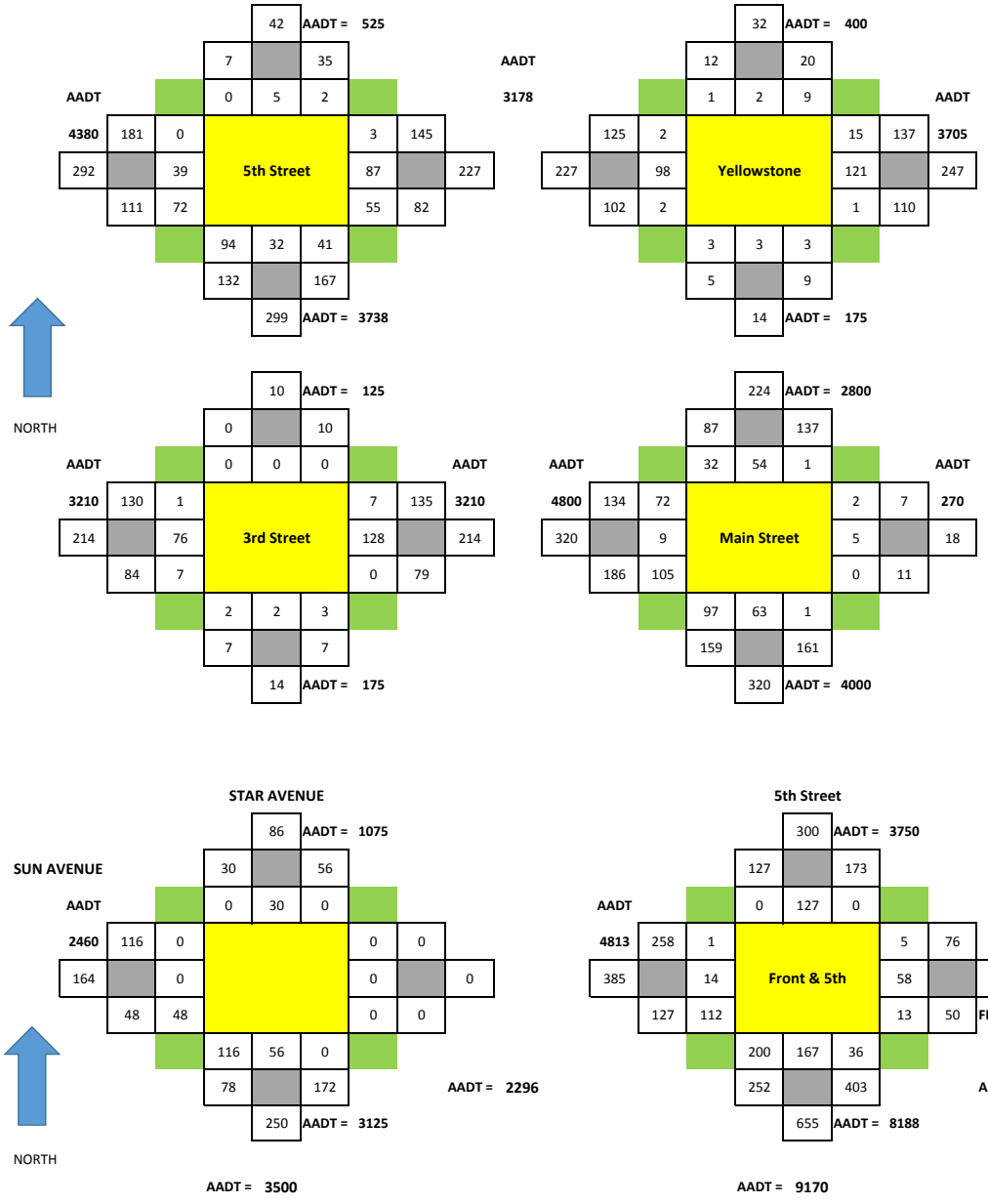
AADT

4813

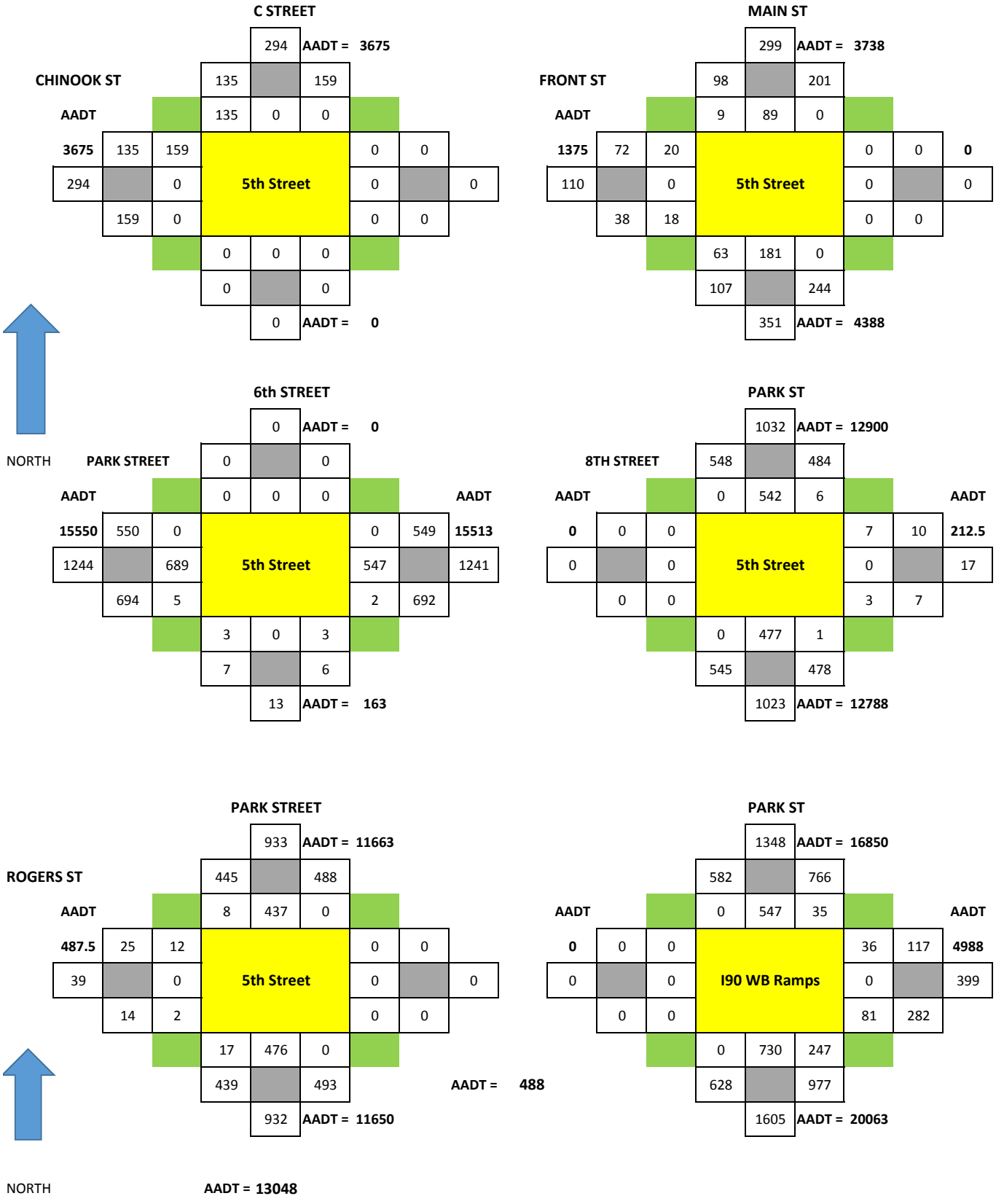


FRONT STREET

2017 DESIGN PM HOUR TRAFFIC CHINOOK STREET



2017 PM DESIGN HOUR ADDITIONAL INTERSECTIONS TRAFFIC

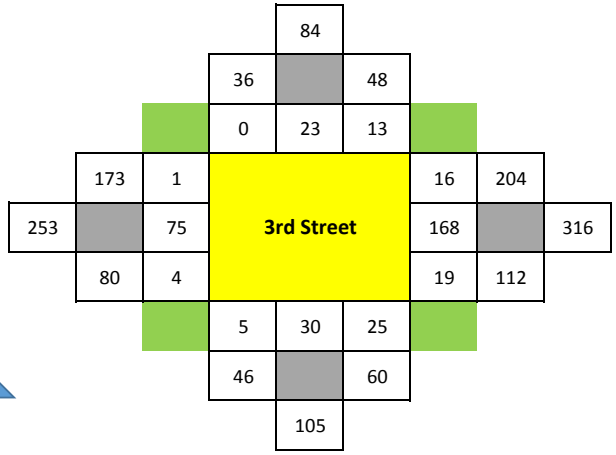


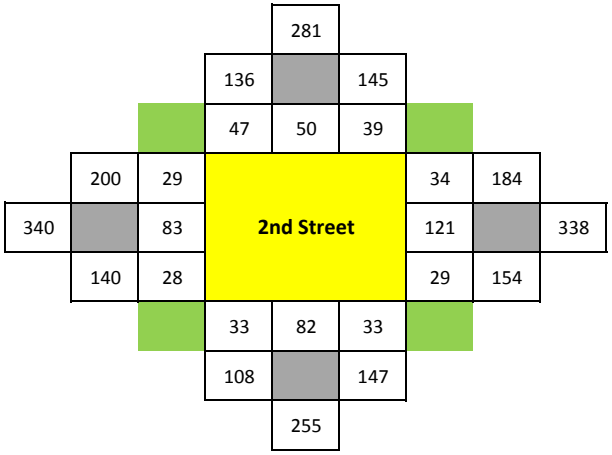
APPENDIX C

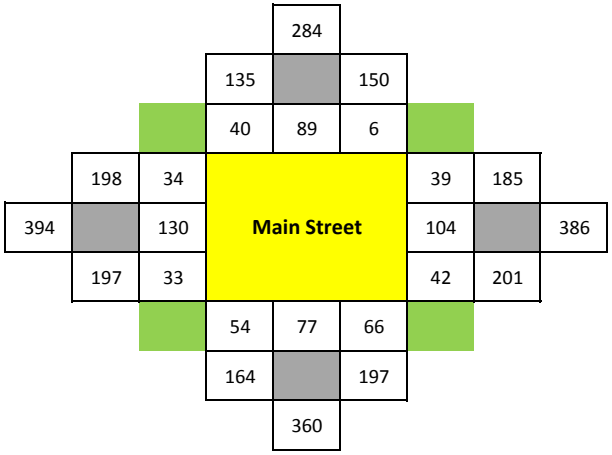
2027 DESIGN HOUR TRAFFIC

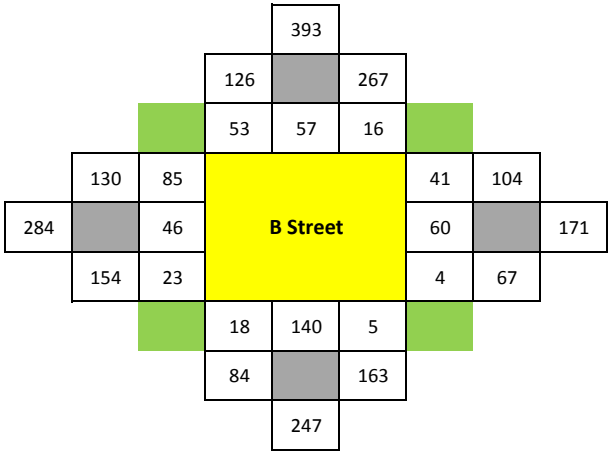
2027 DESIGN PM HOUR TRAFFIC CALLENDER STREET

NORTH

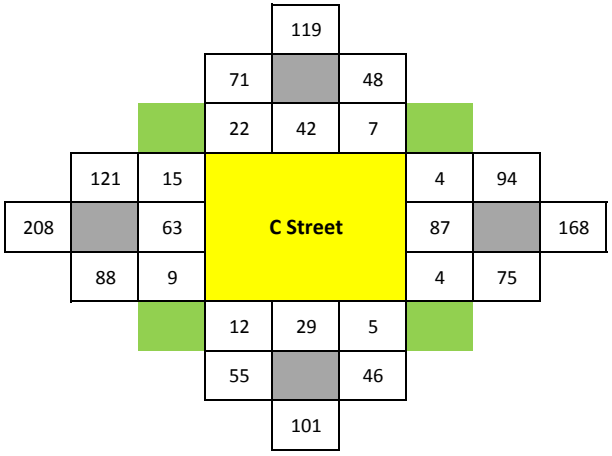




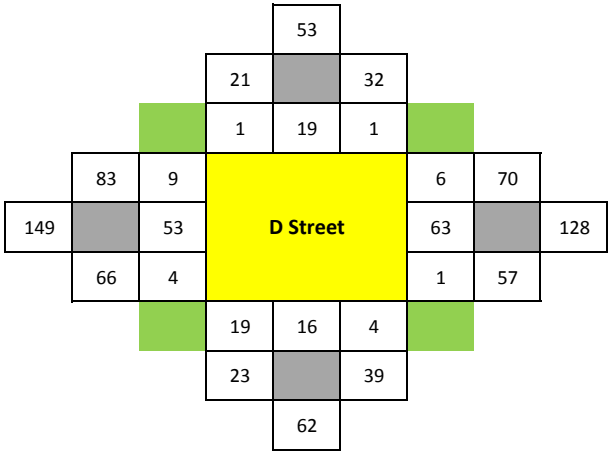




AADT = **3259**

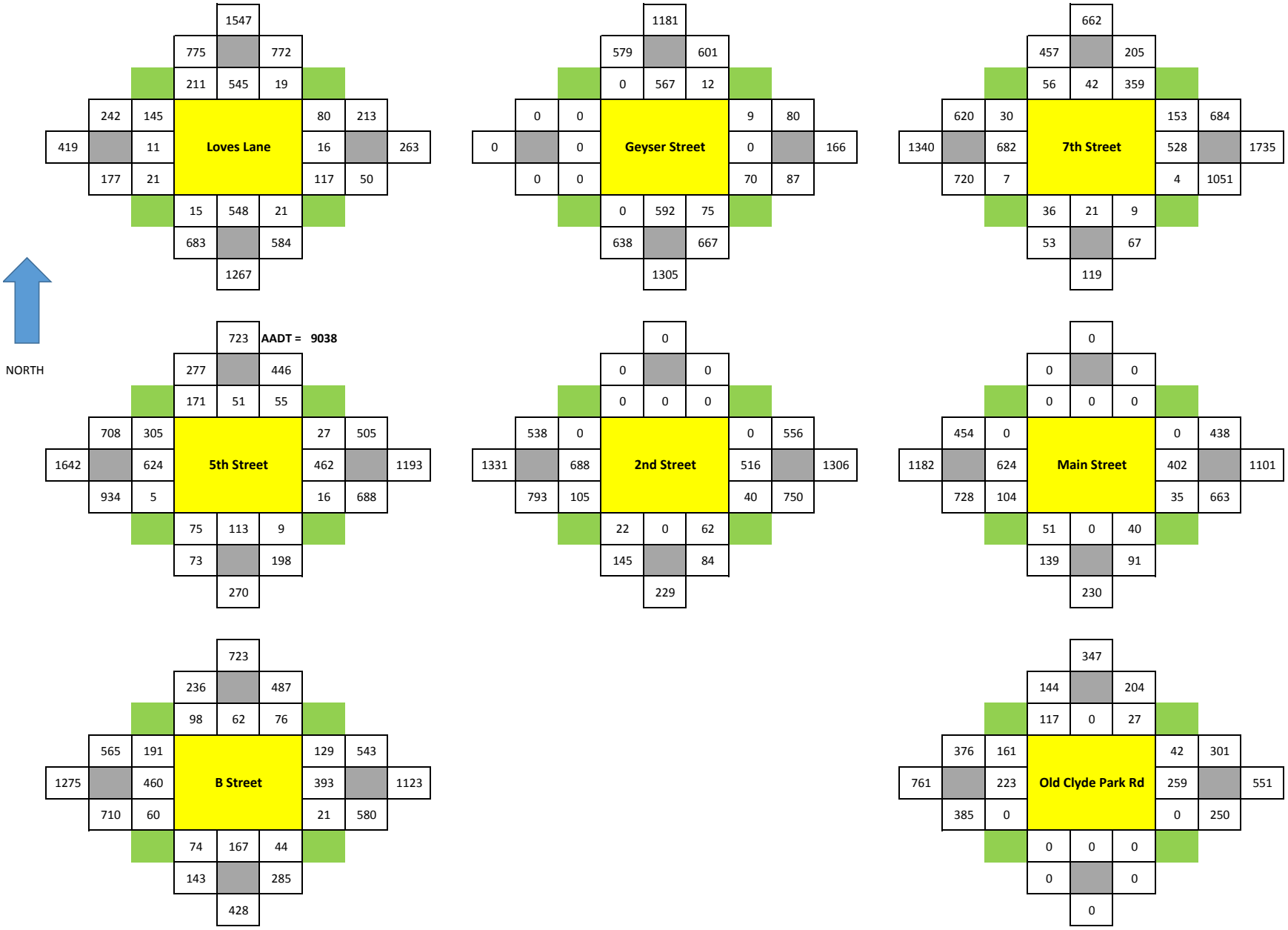


AADT = **1328**

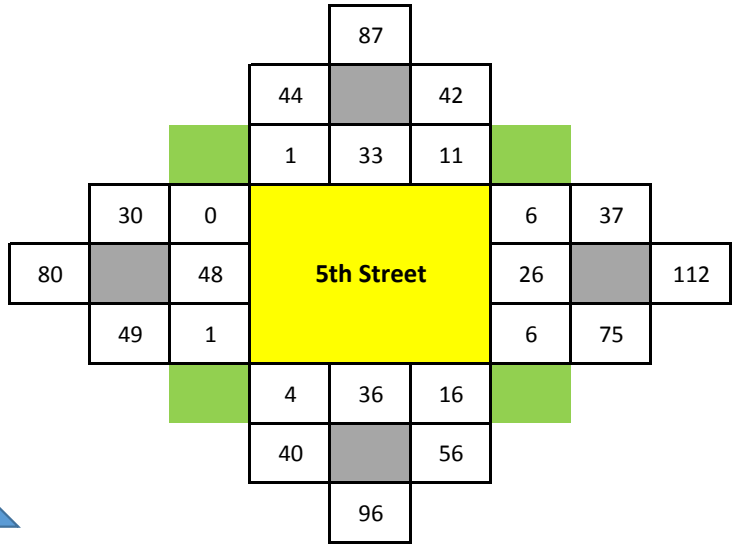


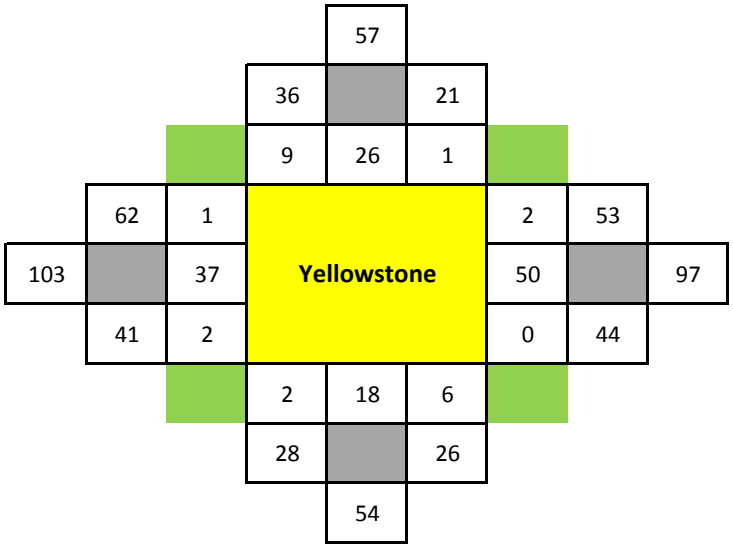
AADT = **819**

2027 DESIGN PM HOUR TRAFFIC PARK STREET

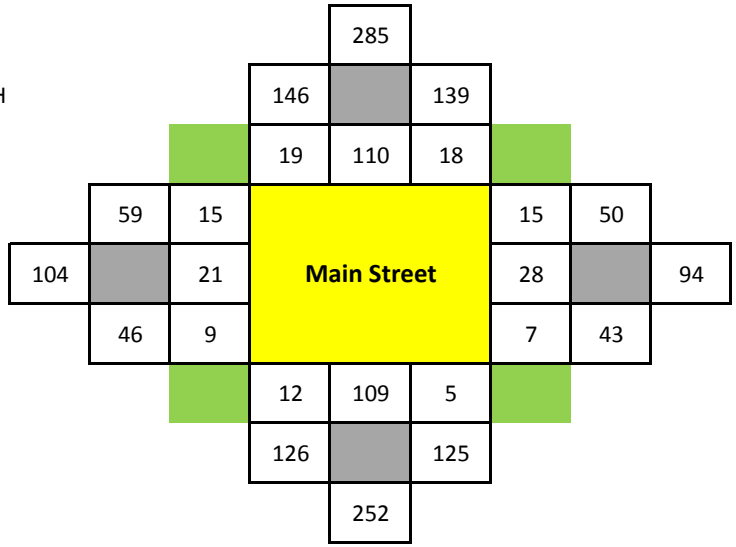


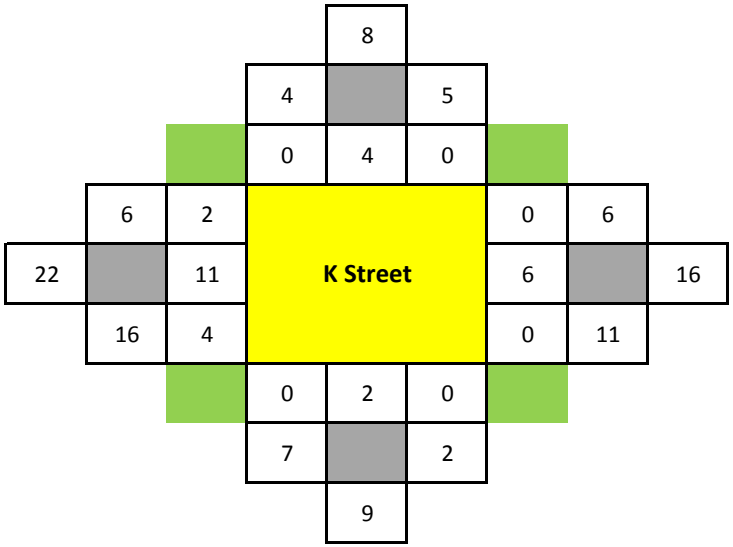
2027 DESIGN PM HOUR TRAFFIC CLARK STREET



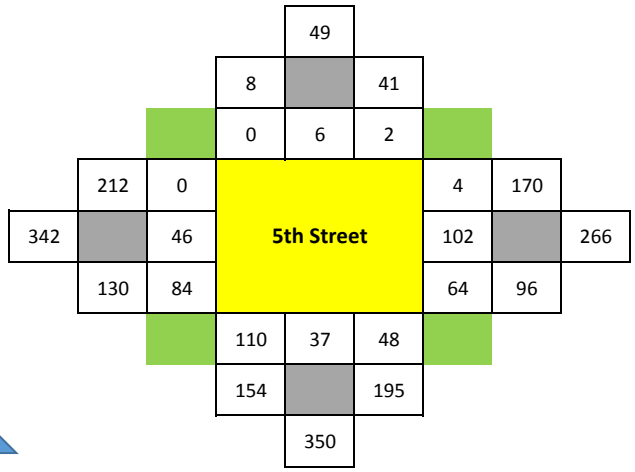


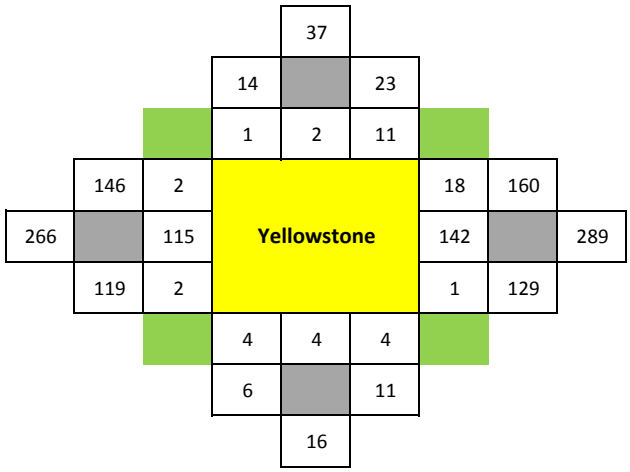
NORTH



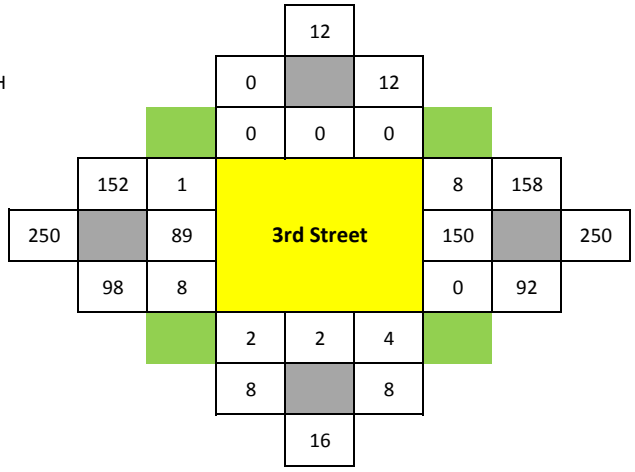


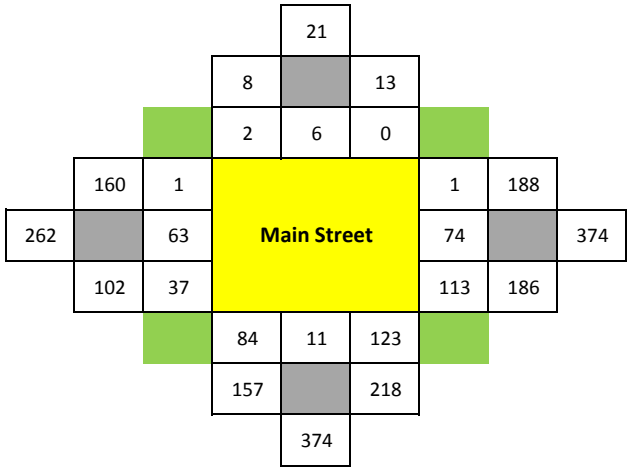
2027 DESIGN PM HOUR TRAFFIC CHINOOK STREET





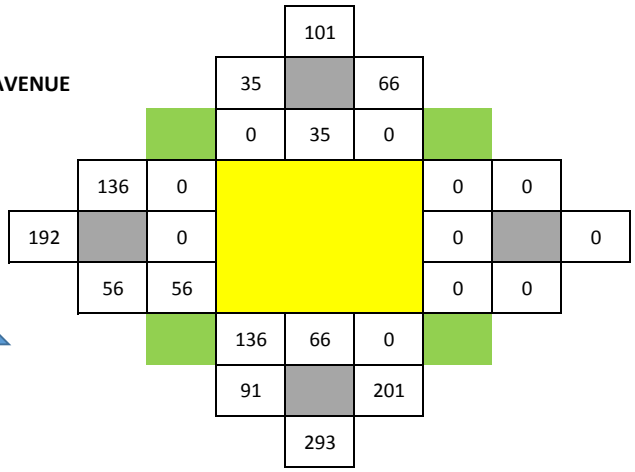
NORTH





STAR AVENUE

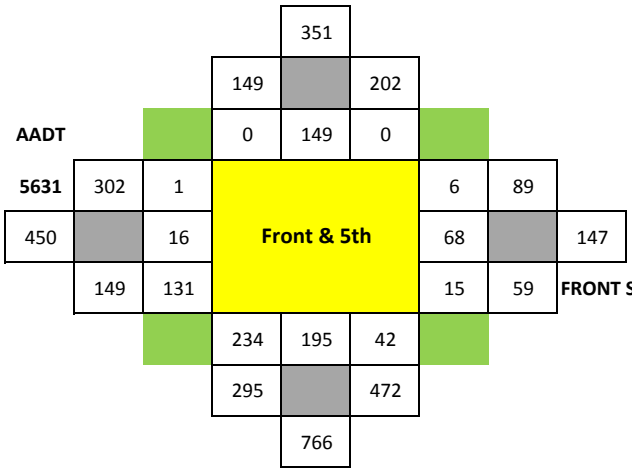
SUN AVENUE



5th Street

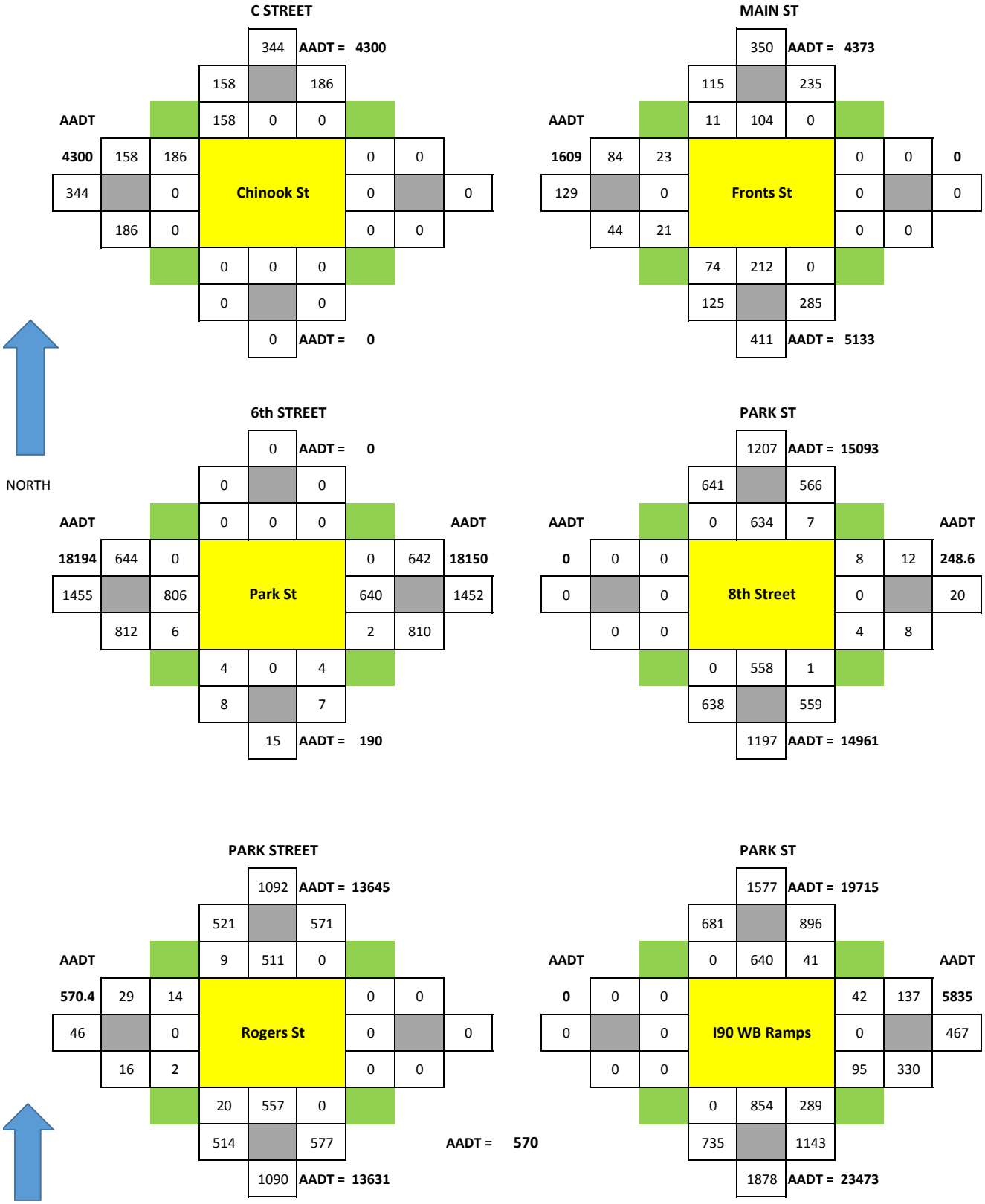
AADT

5631



FRONT STREET

2027 PM DESIGN HOUR ADDITIONAL INTERSECTIONS TRAFFIC



APPENDIX D

2017 INTERSECTION CAPACITY CALCULATIONS

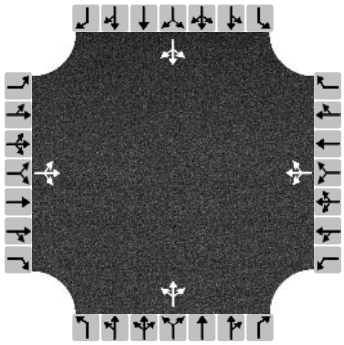
Intersection Capacity Information - 2017 Existing

Intersection	No. Legs	Number of Lanes EB	WB	NB	SB	Control	Stop Leg	Signal Phase	Design PM Enter Vol.	PHF
Callender Street:										
3rd Street	4	1	1	1	1	Uncontrolled				
2nd Street	4	1	1	1	1	4-way Stop			519	0.96
Main Street	4	1	1	1	1	4-way Stop			622	0.79
B Street	4	1	1	1	1	2-way Stop	B St		468	0.91
C Street	4	1	1	1	1	Uncontrolled				
D Street	4	1	1	1	1	Uncontrolled				
Park Street:										
Loves Lane	4	2	3	3	3	Signal		Two Phase	1494	
Geyser Street	3	0	1	1	2	Stop	Geyser		1133	0.95
7th Street	4	2	3	1	1	Signal		Two Phase	1648	0.97
5th Street	4	2	2	1	1	Signal		EB p/p	1636	0.94
2nd Street	3	1	1	1	0	Stop	2nd St		1225	0.92
Main Street	3	1	1	1	0	Stop	Main		1074	0.96
B Street	4	1	1	1	1	Signal		EB p/p	1517	0.83
Old Clyde Park Rd	3	2	1	0	2	Stop	Old C P		709	0.96
Clark Street:										
5th Street	4	1	1	1	1	Stop	Clark		160	0.87
Yellowstone Street	4	1	1	1	1	Uncontrolled				
Main Street	4	1	1	1	1	Uncontrolled				
K Street	4	1	1	1	1	Uncontrolled				
Chinook Street:										
5th Street	4	1	1	1	1	Stop	5th St		304	0.88
Yellowstone Street	4	1	1	1	1	Uncontrolled				
3rd Street	4	1	1	1	1	Uncontrolled				
Main Street	4	1	1	1	1	Uncontrolled				
Sun Avenue:										
Star Avenue	3	1	0	1	1	Stop	Sun Ave		250	0.84
Front Street:										
5th Street	4	1	1	1	1	Stop	Front St		739	0.94

HCS 2010 All-Way Stop-Control Summary Report

General Information		Site Information	
Analyst	R Marvin	Intersection	Callender & 2nd
Agency/Co.	Marvin & Associates	Jurisdiction	Livingston
Date Performed	3/23/2017	East/West Street	Callender Street
Analysis Year	2017	North/South Street	2nd Street
Time Analyzed	0.25	Peak Hour Factor	0.79
Anaylysis Time Period (hrs)	Peak PM		
Project Description	Livingston Trans Plan Update		

Lanes



Vehicle Volume and Adjustments

Approach	Eastbound			Westbound			Northbound			Southbound		
Movement	L	T	R	L	T	R	L	T	R	L	T	R
Volume	25	71	24	25	103	29	28	70	28	33	43	40
% Thrus in Shared Lane												
Lane	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
Configuration	LTR			LTR			LTR			LTR		
Flow Rate, v (veh/h)	152			199			159			147		
Percent Heavy Vehicles	1			1			1			1		

Departure Headway and Service Time

Initial Departure Headway, hd (s)	3.20			3.20			3.20			3.20		
Initial Degree of Utilization, x	0.135			0.177			0.142			0.131		
Final Departure Headway, hd (s)	4.88			4.82			4.91			4.87		
Final Degree of Utilization, x	0.206			0.266			0.217			0.198		
Move-Up Time, m (s)	2.0			2.0			2.0			2.0		
Service Time, ts (s)	2.88			2.82			2.91			2.87		

Capacity, Delay and Level of Service

Flow Rate, v (veh/h)	152			199			159			147		
Capacity	738			747			734			740		
95% Queue Length, Q_{95} (veh)	0.8			1.1			0.8			0.7		
Control Delay (s/veh)	9.1			9.6			9.3			9.1		
Level of Service, LOS	A			A			A			A		
Approach Delay (s/veh)	9.1			9.6			9.3			9.1		
Approach LOS	A			A			A			A		
Intersection Delay, s/veh | LOS	9.3						A					

HCS7 Two-Way Stop-Control Report

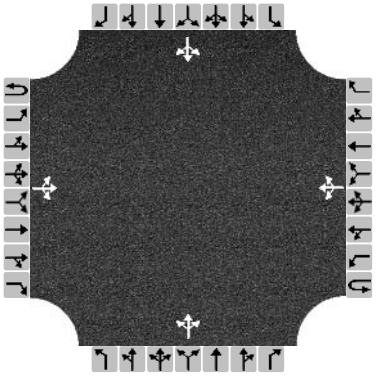
General Information

Analyst	R Marvin
Agency/Co.	Marvin & Associates
Date Performed	3/22/2017
Analysis Year	2017
Time Analyzed	Peak PM
Intersection Orientation	East-West
Project Description	Livingston Trans PLan Update

Site Information

Intersection	Callender & B Street
Jurisdiction	Livingston
East/West Street	Callender St
North/South Street	B Street
Peak Hour Factor	0.91
Analysis Time Period (hrs)	0.25

Lanes



Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	1	0		0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume, V (veh/h)		73	39	20		3	51	35		15	120	4		14	49	45
Percent Heavy Vehicles (%)		0				0				0	0	0		0	0	0
Proportion Time Blocked																
Percent Grade (%)										0				0		
Right Turn Channelized		No				No				No				No		
Median Type/Storage		Undivided														

Critical and Follow-up Headways

Base Critical Headway (sec)		4.1				4.1				7.1	6.5	6.2		7.1	6.5	6.2
Critical Headway (sec)		4.10				4.10				7.10	6.50	6.20		7.10	6.50	6.20
Base Follow-Up Headway (sec)		2.2				2.2				3.5	4.0	3.3		3.5	4.0	3.3
Follow-Up Headway (sec)		2.20				2.20				3.50	4.00	3.30		3.50	4.00	3.30

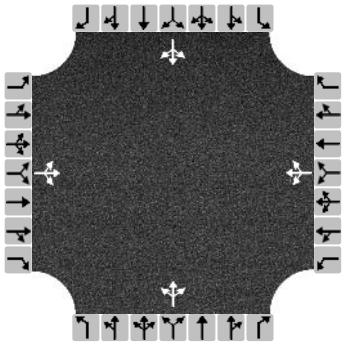
Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		80				3					152				118	
Capacity, c (veh/h)		1486				1523					545				642	
v/c Ratio		0.05				0.00					0.28				0.18	
95% Queue Length, Q_{95} (veh)		0.2				0.0					1.1				0.7	
Control Delay (s/veh)		7.6				7.4					14.2				11.9	
Level of Service, LOS		A				A					B				B	
Approach Delay (s/veh)		4.4				0.2				14.2				11.9		
Approach LOS										B				B		

HCS 2010 All-Way Stop-Control Summary Report

General Information		Site Information	
Analyst	R Marvin	Intersection	Callender & Main
Agency/Co.	Marvin & Associates	Jurisdiction	Livingston
Date Performed	3/23/2017	East/West Street	Callender Street
Analysis Year	2017	North/South Street	Main Street
Time Analyzed	0.25	Peak Hour Factor	0.79
Anaylysis Time Period (hrs)	Peak PM		
Project Description	Livingston Trans Plan Update		

Lanes



Vehicle Volume and Adjustments

Approach	Eastbound			Westbound			Northbound			Southbound		
Movement	L	T	R	L	T	R	L	T	R	L	T	R
Volume	29	111	28	36	89	33	46	66	56	5	76	34
% Thrus in Shared Lane												
Lane	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
Configuration	LTR			LTR			LTR			LTR		
Flow Rate, v (veh/h)	213			200			213			146		
Percent Heavy Vehicles	1			1			1			1		

Departure Headway and Service Time

Initial Departure Headway, hd (s)	3.20			3.20			3.20			3.20		
Initial Degree of Utilization, x	0.189			0.178			0.189			0.129		
Final Departure Headway, hd (s)	5.11			5.11			5.09			5.17		
Final Degree of Utilization, x	0.302			0.284			0.301			0.209		
Move-Up Time, m (s)	2.0			2.0			2.0			2.0		
Service Time, ts (s)	3.11			3.11			3.09			3.17		

Capacity, Delay and Level of Service

Flow Rate, v (veh/h)	213			200			213			146		
Capacity	705			704			707			696		
95% Queue Length, Q_{95} (veh)	1.3			1.2			1.3			0.8		
Control Delay (s/veh)	10.3			10.1			10.3			9.5		
Level of Service, LOS	B			B			B			A		
Approach Delay (s/veh)	10.3			10.1			10.3			9.5		
Approach LOS	B			B			B			A		
Intersection Delay, s/veh | LOS	10.1						B					

HCS7 Two-Way Stop-Control Report

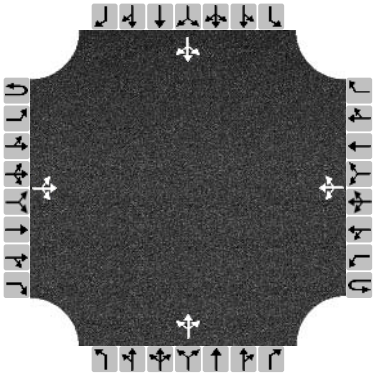
General Information

Analyst	R Marvin
Agency/Co.	Marvin & Associates
Date Performed	3/22/2017
Analysis Year	2017
Time Analyzed	Peak PM
Intersection Orientation	East-West
Project Description	Livingston Trans PLan Update

Site Information

Intersection	Chinook & 5th
Jurisdiction	Livingston
East/West Street	Chinook Street
North/South Street	5th Street
Peak Hour Factor	0.88
Analysis Time Period (hrs)	0.25

Lanes



Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	1	0		0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume, V (veh/h)		0	39	72		55	87	3		94	32	41		2	5	0
Percent Heavy Vehicles (%)		0				0				0	0	0		0	0	0
Proportion Time Blocked																
Percent Grade (%)										0				0		
Right Turn Channelized		No				No				No				No		
Median Type/Storage		Undivided														

Critical and Follow-up Headways

Base Critical Headway (sec)		4.1				4.1				7.1	6.5	6.2		7.1	6.5	6.2
Critical Headway (sec)		4.10				4.10				7.10	6.50	6.20		7.10	6.50	6.20
Base Follow-Up Headway (sec)		2.2				2.2				3.5	4.0	3.3		3.5	4.0	3.3
Follow-Up Headway (sec)		2.20				2.20				3.50	4.00	3.30		3.50	4.00	3.30

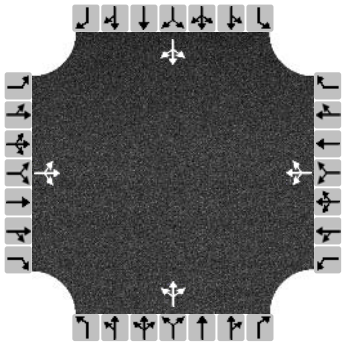
Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		0				62					190				8	
Capacity, c (veh/h)		1476				1447					639				521	
v/c Ratio		0.00				0.04					0.30				0.02	
95% Queue Length, Q_{95} (veh)		0.0				0.1					1.2				0.0	
Control Delay (s/veh)		7.4				7.6					13.0				12.0	
Level of Service, LOS		A				A					B				B	
Approach Delay (s/veh)		0.0				3.1				13.0				12.0		
Approach LOS										B				B		

HCS 2010 All-Way Stop-Control Summary Report

General Information		Site Information	
Analyst	R Marvin	Intersection	Chinook & Main
Agency/Co.	Marvin & Associates	Jurisdiction	Livingston
Date Performed	3/23/2017	East/West Street	Chinook Street
Analysis Year	2017	North/South Street	Main Street
Time Analyzed	0.25	Peak Hour Factor	0.79
Anaylysis Time Period (hrs)	Peak PM		
Project Description	Livingston Trans Plan Update		

Lanes



Vehicle Volume and Adjustments

Approach	Eastbound			Westbound			Northbound			Southbound		
Movement	L	T	R	L	T	R	L	T	R	L	T	R
Volume	1	54	32	97	63	1	72	9	105	0	5	2
% Thrus in Shared Lane												
Lane	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
Configuration	LTR			LTR			LTR			LTR		
Flow Rate, v (veh/h)	110			204			235			9		
Percent Heavy Vehicles	1			3			1			1		

Departure Headway and Service Time

Initial Departure Headway, hd (s)	3.20			3.20			3.20			3.20		
Initial Degree of Utilization, x	0.098			0.181			0.209			0.008		
Final Departure Headway, hd (s)	4.53			4.78			4.43			4.81		
Final Degree of Utilization, x	0.139			0.271			0.290			0.012		
Move-Up Time, m (s)	2.0			2.0			2.0			2.0		
Service Time, ts (s)	2.53			2.78			2.43			2.81		

Capacity, Delay and Level of Service

Flow Rate, v (veh/h)	110			204			235			9		
Capacity	794			753			813			749		
95% Queue Length, Q_{95} (veh)	0.5			1.1			1.2			0.0		
Control Delay (s/veh)	8.3			9.5			9.2			7.9		
Level of Service, LOS	A			A			A			A		
Approach Delay (s/veh)	8.3			9.5			9.2			7.9		
Approach LOS	A			A			A			A		
Intersection Delay, s/veh | LOS	9.1						A					

HCS7 Two-Way Stop-Control Report

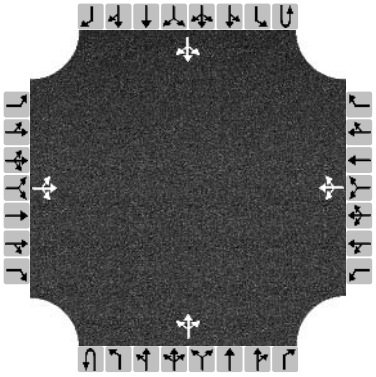
General Information

Analyst	R Marvin
Agency/Co.	Marvin & Associates
Date Performed	3/22/2017
Analysis Year	2017
Time Analyzed	Peak PM
Intersection Orientation	North-South
Project Description	Livingston Trans Plan Update

Site Information

Intersection	Clark & 5th
Jurisdiction	Livingston
East/West Street	Clark Street
North/South Street	5th Street
Peak Hour Factor	0.87
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	1	0	0	0	1	0	0	0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume, V (veh/h)		0	41	1		5	22	5		3	31	14		9	28	1
Percent Heavy Vehicles (%)		0	0	0		0	0	0		0				0		
Proportion Time Blocked																
Percent Grade (%)		0				0										
Right Turn Channelized		No				No				No				No		
Median Type/Storage		Undivided														

Critical and Follow-up Headways

Base Critical Headway (sec)		7.1	6.5	6.2		7.1	6.5	6.2		4.1				4.1		
Critical Headway (sec)		7.10	6.50	6.20		7.10	6.50	6.20		4.10				4.10		
Base Follow-Up Headway (sec)		3.5	4.0	3.3		3.5	4.0	3.3		2.2				2.2		
Follow-Up Headway (sec)		3.50	4.00	3.30		3.50	4.00	3.30		2.20				2.20		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			48				37			3				10		
Capacity, c (veh/h)			764				801			1578				1553		
v/c Ratio			0.06				0.05			0.00				0.01		
95% Queue Length, Q_{95} (veh)			0.2				0.1			0.0				0.0		
Control Delay (s/veh)			10.0				9.7			7.3				7.3		
Level of Service, LOS			B				A			A				A		
Approach Delay (s/veh)		10.0				9.7				0.4				1.7		
Approach LOS		B				A										

HCS7 Two-Way Stop-Control Report

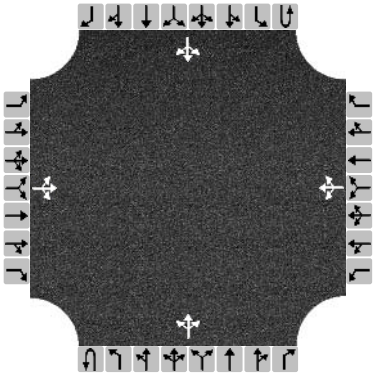
General Information

Analyst	R Marvin
Agency/Co.	Marvin & Associates
Date Performed	3/22/2017
Analysis Year	2017
Time Analyzed	Peak PM
Intersection Orientation	North-South
Project Description	Livingston Trans Plan Update

Site Information

Intersection	Front & 5th
Jurisdiction	Livingston
East/West Street	Front Street
North/South Street	5th Street
Peak Hour Factor	0.87
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	1	0	0	0	1	0	0	0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume, V (veh/h)		1	14	112		13	58	5		200	167	36		0	127	0
Percent Heavy Vehicles (%)		0	0	0		0	0	0		0				0		
Proportion Time Blocked																
Percent Grade (%)		0				0										
Right Turn Channelized		No				No				No				No		
Median Type/Storage		Undivided														

Critical and Follow-up Headways

Base Critical Headway (sec)		7.1	6.5	6.2		7.1	6.5	6.2		4.1				4.1		
Critical Headway (sec)		7.10	6.50	6.20		7.10	6.50	6.20		4.10				4.10		
Base Follow-Up Headway (sec)		3.5	4.0	3.3		3.5	4.0	3.3		2.2				2.2		
Follow-Up Headway (sec)		3.50	4.00	3.30		3.50	4.00	3.30		2.20				2.20		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			146				88			230				0		
Capacity, c (veh/h)			673				245			1436				1335		
v/c Ratio			0.22				0.36			0.16				0.00		
95% Queue Length, Q_{95} (veh)			0.8				1.6			0.6				0.0		
Control Delay (s/veh)			11.8				27.7			8.0				7.7		
Level of Service, LOS			B				D			A				A		
Approach Delay (s/veh)		11.8				27.7				4.7				0.0		
Approach LOS		B				D										

HCS7 Two-Way Stop-Control Report

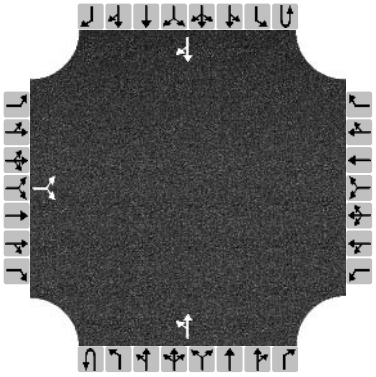
General Information

Analyst	R Marvin
Agency/Co.	Marvin & Associates
Date Performed	4/5/2017
Analysis Year	2017
Time Analyzed	Peak PM
Intersection Orientation	North-South
Project Description	Livingston Trans PLan Update

Site Information

Intersection	Main Street & Front Stree
Jurisdiction	City of Livingston
East/West Street	Front Street
North/South Street	MAin Street
Peak Hour Factor	0.71
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	0	0	0	0	1	0	0	0	1	0
Configuration			LR							LT						TR
Volume, V (veh/h)		20		18						63	181				89	9
Percent Heavy Vehicles (%)		1		1						1						
Proportion Time Blocked																
Percent Grade (%)		0														
Right Turn Channelized		No				No				No				No		
Median Type/Storage		Undivided														

Critical and Follow-up Headways

Base Critical Headway (sec)		7.1		6.2						4.1						
Critical Headway (sec)		6.41		6.21						4.11						
Base Follow-Up Headway (sec)		3.5		3.3						2.2						
Follow-Up Headway (sec)		3.51		3.31						2.21						

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			53							89						
Capacity, c (veh/h)			595							1451						
v/c Ratio			0.09							0.06						
95% Queue Length, Q_{95} (veh)			0.3							0.2						
Control Delay (s/veh)			11.6							7.6						
Level of Service, LOS			B							A						
Approach Delay (s/veh)		11.6								2.4						
Approach LOS		B														

HCS7 Two-Way Stop-Control Report

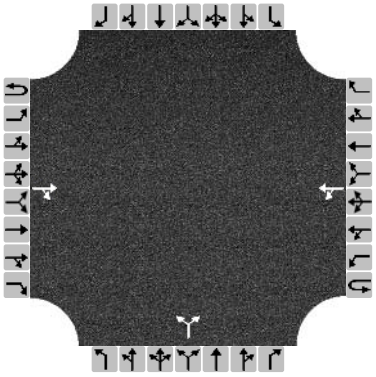
General Information

Analyst	R Marvin
Agency/Co.	Marvin & Associates
Date Performed	3/22/2017
Analysis Year	2017
Time Analyzed	Peak PM
Intersection Orientation	East-West
Project Description	Livingston Trans Plan Update

Site Information

Intersection	Park & 2nd St
Jurisdiction	Livingston
East/West Street	Park Street
North/South Street	2nd Street
Peak Hour Factor	0.92
Analysis Time Period (hrs)	0.25

Lanes



Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	0	0		0	0	0
Configuration				TR		LT					LR					
Volume, V (veh/h)			588	90		34	441			19		53				
Percent Heavy Vehicles (%)						0				0		0				
Proportion Time Blocked																
Percent Grade (%)										0						
Right Turn Channelized		No				No				No				No		
Median Type/Storage			Undivided													

Critical and Follow-up Headways

Base Critical Headway (sec)						4.1				7.1		6.2				
Critical Headway (sec)						4.10				6.40		6.20				
Base Follow-Up Headway (sec)						2.2				3.5		3.3				
Follow-Up Headway (sec)						2.20				3.50		3.30				

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)						37					79					
Capacity, c (veh/h)						862					312					
v/c Ratio						0.04					0.25					
95% Queue Length, Q_{95} (veh)						0.1					1.0					
Control Delay (s/veh)						9.4					20.4					
Level of Service, LOS						A					C					
Approach Delay (s/veh)						1.2					20.4					
Approach LOS											C					

HCS7 Two-Way Stop-Control Report

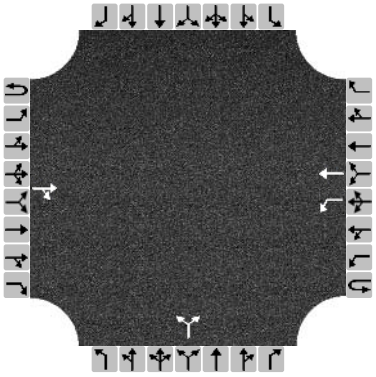
General Information

Analyst	R Marvin
Agency/Co.	Marvin & Associates
Date Performed	3/22/2017
Analysis Year	2017
Time Analyzed	Peak PM
Intersection Orientation	East-West
Project Description	Livingston Trans Plan Update

Site Information

Intersection	Park & 6th
Jurisdiction	Livingston
East/West Street	Park Street
North/South Street	6th Street
Peak Hour Factor	0.70
Analysis Time Period (hrs)	0.25

Lanes



Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	1	1	0		0	0	0		0	0	0
Configuration				TR		L	T				LR					
Volume, V (veh/h)			689	5		2	547			3		3				
Percent Heavy Vehicles (%)						0				0		0				
Proportion Time Blocked																
Percent Grade (%)										0						
Right Turn Channelized		No				No				No				No		
Median Type/Storage		Left Only								1						

Critical and Follow-up Headways

Base Critical Headway (sec)						4.1				7.1		6.2				
Critical Headway (sec)						4.10				6.40		6.20				
Base Follow-Up Headway (sec)						2.2				3.5		3.3				
Follow-Up Headway (sec)						2.20				3.50		3.30				

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)						3					8					
Capacity, c (veh/h)						699					253					
v/c Ratio						0.00					0.03					
95% Queue Length, Q_{95} (veh)						0.0					0.1					
Control Delay (s/veh)						10.2					19.7					
Level of Service, LOS						B					C					
Approach Delay (s/veh)						0.0					19.7					
Approach LOS											C					

HCM Analysis Summary

Lingston Trans Plan Update	Park Street/5th Street	Area Type: Non CBD
R Marvin	3/23/17	Analysis Duration: 15 mins.
Peak PM 2017	Case: 2027 Park and 5th	

Lanes			Geometry: Movements Serviced by Lane and Lane Widths (feet)											
	Approach	Outbound	Lane 1		Lane 2		Lane 3		Lane 4		Lane 5		Lane 6	
EB	2	1	L	12.0	TR	12.0								
WB	2	1	L	12.0	TR	12.0								
NB	1	1	LTR	12.0										
SB	1	1	LTR	12.0										

	East			West			North			South		
Data	L	T	R	L	T	R	L	T	R	L	T	R
Movement Volume (vph)	261	533	4	14	395	23	64	97	8	47	44	146
PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
% Heavy Vehicles	2	2	2	2	2	2	2	2	2	2	2	2
Lane Groups	L	TR		L	TR			LTR			LTR	
Arrival Type	3	3		3	3			3			3	
RTOR Vol (vph)	0			5			0			72		
Peds/Hour	5			5			5			5		
% Grade	0			0			0			0		
Buses/Hour	0			0			0			0		
Parkers/Hour (Left|Right)	---	---		---	---		---	---		---	---	

Signal Settings: Actuated Operational Analysis Cycle Length: 90.0 Sec Lost Time Per Cycle: 13.0 Sec

Phase:	1	2	3	4	5	6	7	8	Ped Only
EB	LTR	LTP							
WB		LTP							
NB			LTP						
SB			LTP						
Green	12.0	37.0	28.0						0
Yellow / All Red	3.0 / 0.0	3.5 / 1.5	3.5 / 1.5						

		Capacity Analysis Results							Approach:	
App	Lane Group	Cap (vph)	v/s Ratio	g/C Ratio	Lane Group	v/c Ratio	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
EB	Lper	262	0.075	0.467					14.1	B
	* Lpro	236	0.133	0.133	L	0.558	15.3	B		
	TR	1075	0.307	0.578	TR	0.531	13.5	B		
WB										
	L	319	0.019	0.411	L	0.047	16.2	B	23.4	C
	* TR	761	0.237	0.411	TR	0.577	23.6	C		
NB										
	* LTR	482	0.116	0.311	LTR	0.373	24.3	C	24.3	C
SB										
	LTR	473	0.116	0.311	LTR	0.372	24.3	C	24.3	C

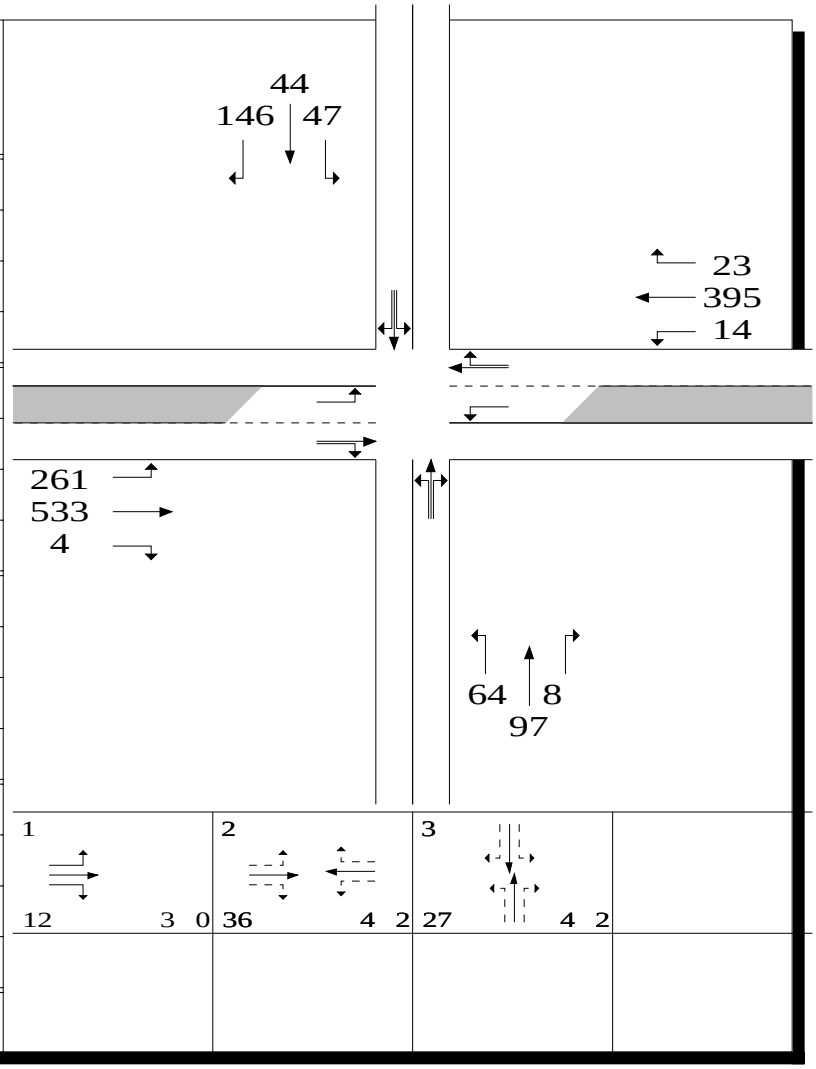
Intersection: Delay = 18.8 sec/veh Int. LOS=B X_c= 0.57 * Critical Lane Group Σ(v/s)Crit= 0.49

NETSIM Summary Results

Lingston Trans Plan Update
R Marvin
Peak PM 2017

Park Street/5th Street
3/23/17
Case: 2027 Park and 5th

App	Lane Group	Queues Per Lane Avg/Max (veh)	Average Speed (mph)	Spillback in Worst Lane (% of Peak Period)
EB	L	8 / 13	3.2	4.7
	TR	8 / 10	15.8	0.0
	All		10.3	4.7
WB	L	0 / 1	6.5	0.0
	TR	6 / 7	11.9	0.0
	All		11.7	0.0
NB	LTR	3 / 4	10.9	0.0
	All		10.9	0.0
SB	LTR	4 / 5	11.7	0.0
	All		11.7	0.0
Intersect.			10.9	



HCM Analysis Summary

Livingston Trans Plan Update	Highway 10 W/Park Street	Area Type: Non CBD
R Marvin	3/23/17	Analysis Duration: 15 mins.
Peak PM 2017	Case: Park & 7th 2017 PM	

Lanes			Geometry: Movements Serviced by Lane and Lane Widths (feet)											
	Approach	Outbound	Lane 1		Lane 2		Lane 3		Lane 4		Lane 5		Lane 6	
EB	2	1	L	12.0	TR	12.0								
WB	3	1	L	12.0	T	12.0	R	12.0						
NB	1	1	LTR	12.0										
SB	1	1	LTR	12.0										

	East			West			North			South		
Data	L	T	R	L	T	R	L	T	R	L	T	R
Movement Volume (vph)	26	583	6	3	451	131	31	18	8	307	36	48
PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
% Heavy Vehicles	4	0	1	0	0	0	1	4	0	0	4	4
Lane Groups	L	TR		L	T	R		LTR			LTR	
Arrival Type	3	3		3	3	3		3			3	
RTOR Vol (vph)	0			48			2			5		
Peds/Hour	5			0			10			5		
% Grade	0			0			0			0		
Buses/Hour	0			0			0			0		
Parkers/Hour (Left|Right)	---	---		---	---		---	---		---	---	

Signal Settings: Actuated Operational Analysis Cycle Length: 75.0 Sec Lost Time Per Cycle: 10.0 Sec

Phase:		1		2		3		4		5		6		7		8		Ped Only
EB		LTP																
WB		LTP																
NB				LTP														
SB				LTP														
Green		35.0		30.0														0
Yellow	All Red	3.5	1.5	3.5	1.5													

		Capacity Analysis Results							Approach:	
App	Lane Group	Cap (vph)	v/s Ratio	g/C Ratio	Lane Group	v/c Ratio	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
EB										
	L	315	0.040	0.467	L	0.086	11.6	B	21.1	C
	* TR	839	0.338	0.467	TR	0.723	21.5	C		
WB										
	L	216	0.006	0.467	L	0.014	10.9	B	16.1	B
	T	840	0.258	0.467	T	0.554	17.0	B		
	R	754	0.053	0.467	R	0.114	11.6	B		
NB										
	LTR	523	0.044	0.400	LTR	0.109	14.1	B	14.1	B
SB										
	* LTR	508	0.312	0.400	LTR	0.781	26.7	C	26.7	C

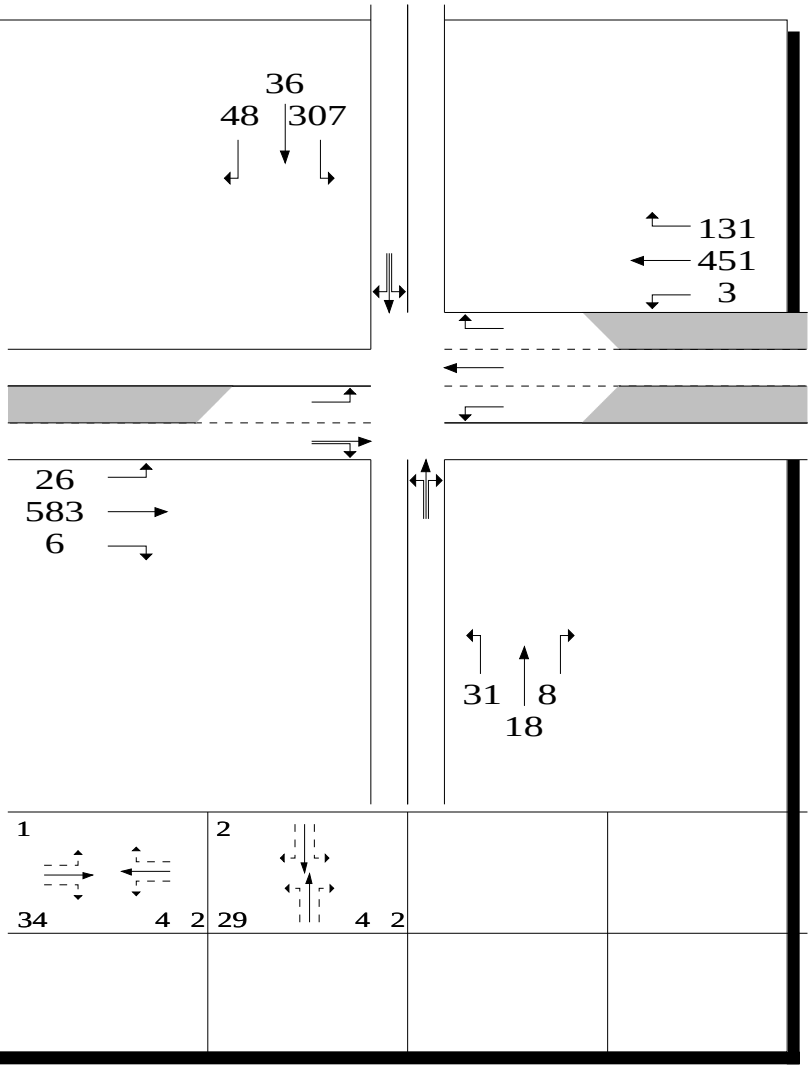
Intersection: Delay = 20.5 sec/veh Int. LOS=C X_c= 0.75 * Critical Lane Group Σ(v/s)Crit= 0.65

NETSIM Summary Results

Livingston Trans Plan Update
R Marvin
Peak PM 2017

Highway 10 W/Park Street
3/23/17
Case: Park & 7th 2017 PM

App	Lane Group	Queues Per Lane Avg/Max (veh)	Average Speed (mph)	Spillback in Worst Lane (% of Peak Period)
EB	L	0 / 1	8.3	0.0
	TR	8 / 9	12.9	0.0
	All		12.7	0.0
WB	L	0 / 0	0.0	0.0
	T	7 / 8	14.1	0.0
	R	1 / 1	21.4	0.0
	All		14.7	0.0
NB	LTR	1 / 1	17.2	0.0
	All		17.2	0.0
SB	LTR	5 / 6	13.0	0.0
	All		13.0	0.0
Intersect.			13.6	



HCS7 Two-Way Stop-Control Report

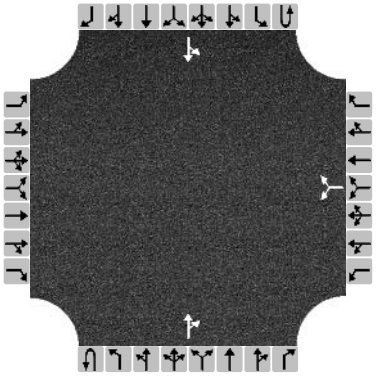
General Information

Analyst	R Marvin
Agency/Co.	Marvin & Associates
Date Performed	4/5/2017
Analysis Year	2017
Time Analyzed	Peak PM
Intersection Orientation	North-South
Project Description	Livingston Trans PLan Update

Site Information

Intersection	Park & 8th
Jurisdiction	City of Livingston
East/West Street	8th Street
North/South Street	Park Street
Peak Hour Factor	0.70
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	0	0	0	0	1	0	0	0	1	0
Configuration							LR					TR		LT		
Volume, V (veh/h)						3		7			477	1		06	542	
Percent Heavy Vehicles (%)						3		3						3		
Proportion Time Blocked																
Percent Grade (%)							0									
Right Turn Channelized			No				No				No				No	
Median Type/Storage			Left Only								1					

Critical and Follow-up Headways

Base Critical Headway (sec)						7.1		6.2						4.1		
Critical Headway (sec)						6.43		6.23						4.13		
Base Follow-Up Headway (sec)						3.5		3.3						2.2		
Follow-Up Headway (sec)						3.53		3.33						2.23		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)							14							9		
Capacity, c (veh/h)							379							905		
v/c Ratio							0.04							0.01		
95% Queue Length, Q_{95} (veh)							0.1							0.0		
Control Delay (s/veh)							14.9							9.0		
Level of Service, LOS							B							A		
Approach Delay (s/veh)						14.9								0.3		
Approach LOS						B										

HCM Analysis Summary

Livingston Trans Plan Update	Park Street/B Street	Area Type: Non CBD
R Marvin	03/23/2017	Analysis Duration: 15 mins.
Peak PM 2017	Case: Park & B 2017 PM	

Lanes			Geometry: Movements Serviced by Lane and Lane Widths (feet)											
	Approach	Outbound	Lane 1		Lane 2		Lane 3		Lane 4		Lane 5		Lane 6	
EB	2	1	L	12.0	TR	12.0								
WB	2	1	L	12.0	TR	12.0								
NB	1	1	LTR	12.0										
SB	1	1	LTR	12.0										

	East			West			North			South		
Data	L	T	R	L	T	R	L	T	R	L	T	R
Movement Volume (vph)	163	393	51	18	336	110	63	143	38	65	53	84
PHF	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
% Heavy Vehicles	2	2	2	2	2	2	2	4	2	2	4	2
Lane Groups	L	TR		L	TR			LTR			LTR	
Arrival Type	3	3		3	3			3			3	
RTOR Vol (vph)	10			20			10			15		
Peds/Hour	5			5			5			0		
% Grade	0			0			0			0		
Buses/Hour	0			0			0			0		
Parkers/Hour (Left|Right)	---	---		---	---		---	---		---	---	

Signal Settings: Actuated Operational Analysis Cycle Length: 80.0 Sec Lost Time Per Cycle: 14.0 Sec

Phase:		1		2		3		4		5		6		7		8		Ped Only
EB		LTP		LTP														
WB				LTP														
NB						LTP												
SB						LTP												
Green		16.0		28.0		22.0												0
Yellow	All Red	4.0	0.0	3.5	1.5	3.5	1.5											

		Capacity Analysis Results							Approach:	
App	Lane Group	Cap (vph)	v/s Ratio	g/C Ratio	Lane Group	v/c Ratio	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
EB	Lper	144	0.000	0.412					10.8	B
	* Lpro	354	0.108	0.200	L	0.386	12.2	B		
	TR	1102	0.278	0.600	TR	0.463	10.3	B		
WB										
	L	309	0.024	0.350	L	0.068	17.7	B	32.8	C
	* TR	630	0.278	0.350	TR	0.795	33.4	C		
NB										
	* LTR	420	0.180	0.275	LTR	0.655	28.6	C	28.6	C
SB										
	LTR	362	0.167	0.275	LTR	0.605	27.3	C	27.3	C

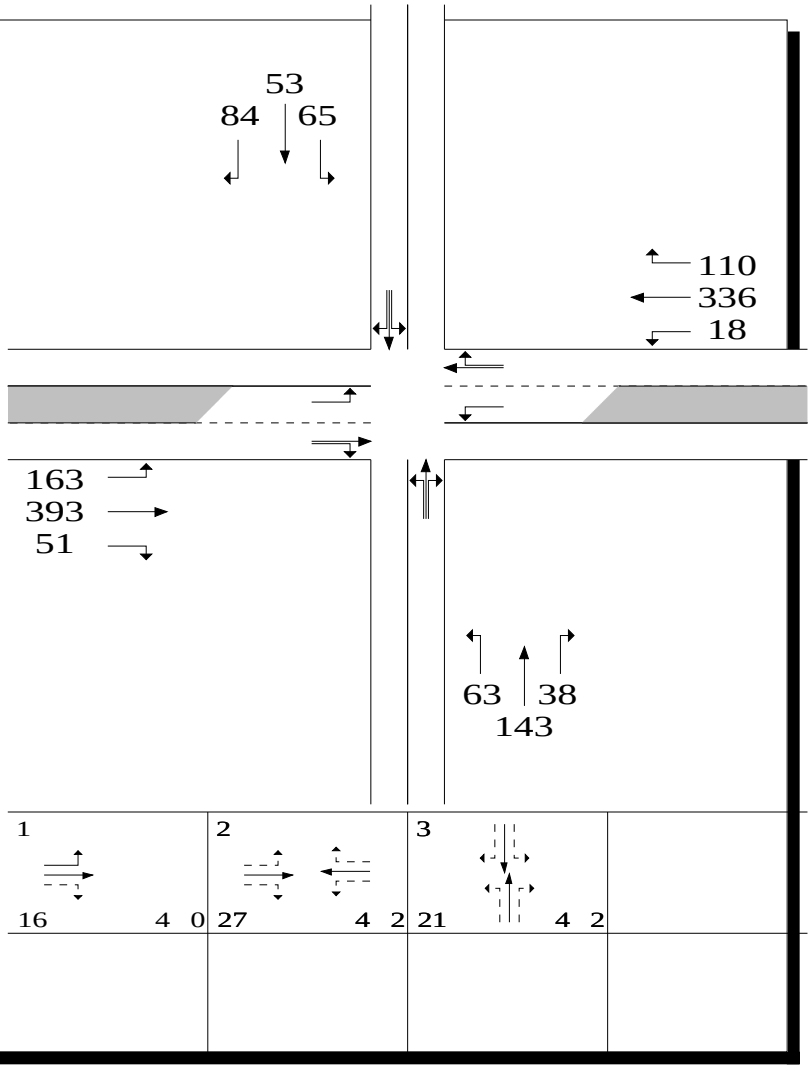
Intersection: Delay = 22.4 sec/veh Int. LOS=C X_c= 0.69 * Critical Lane Group Σ(v/s)Crit= 0.57

NETSIM Summary Results

Livingston Trans Plan Update
R Marvin
Peak PM 2017

Park Street/B Street
03/23/2017
Case: Park & B 2017 PM

App	Lane Group	Queues Per Lane Avg/Max (veh)	Average Speed (mph)	Spillback in Worst Lane (% of Peak Period)
EB	L	4 / 6	9.6	0.0
	TR	6 / 9	18.4	0.0
	All		15.6	0.0
WB	L	1 / 1	9.5	0.0
	TR	8 / 9	10.7	0.0
	All		10.7	0.0
NB	LTR	5 / 6	9.9	0.0
	All		9.9	0.0
SB	LTR	3 / 5	10.2	0.0
	All		10.2	0.0
Intersect.			12.0	



HCS7 Two-Way Stop-Control Report

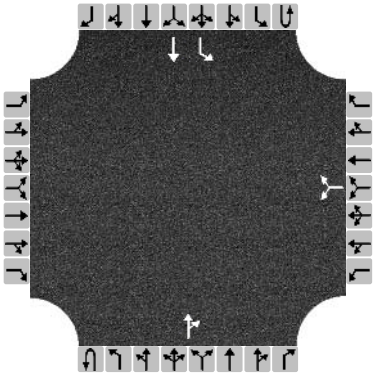
General Information

Analyst	R Marvin
Agency/Co.	Marvin & Associates
Date Performed	3/22/2017
Analysis Year	2017
Time Analyzed	Peak PM
Intersection Orientation	North-South
Project Description	Livingston Trans PLan Update

Site Information

Intersection	Park Street & Geyser St
Jurisdiction	Livingston
East/West Street	Geyser Street
North/South Street	Park Street
Peak Hour Factor	0.95
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	0	0	0	0	1	0	0	1	1	0
Configuration							LR					TR		L	T	
Volume, V (veh/h)						60		8			505	64		10	485	
Percent Heavy Vehicles (%)						0		0						0		
Proportion Time Blocked																
Percent Grade (%)						0										
Right Turn Channelized		No				No				No				No		
Median Type/Storage		Left Only								1						

Critical and Follow-up Headways

Base Critical Headway (sec)						7.1		6.2						4.1		
Critical Headway (sec)						6.40		6.20						4.10		
Base Follow-Up Headway (sec)						3.5		3.3						2.2		
Follow-Up Headway (sec)						3.50		3.30						2.20		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)							71							11		
Capacity, c (veh/h)							382							979		
v/c Ratio							0.19							0.01		
95% Queue Length, Q_{95} (veh)							0.7							0.0		
Control Delay (s/veh)							16.6							8.7		
Level of Service, LOS							C							A		
Approach Delay (s/veh)						16.6								0.2		
Approach LOS						C										

HCM Analysis Summary

Livingston Trans Plan	Loves Lane/Park Street	Area Type: Non CBD
R Marvin	03/23/2017	Analysis Duration: 15 mins.
Peak PM 2017	Case: Park & Loves 2017 PM	

Lanes			Geometry: Movements Serviced by Lane and Lane Widths (feet)											
	Approach	Outbound	Lane 1		Lane 2		Lane 3		Lane 4		Lane 5		Lane 6	
EB	2	1	L	12.0	TR	12.0								
WB	3	1	L	12.0	T	12.0	R	12.0						
NB	3	1	L	12.0	T	12.0	R	12.0						
SB	3	1	L	12.0	T	12.0	R	12.0						

	East			West			North			South		
Data	L	T	R	L	T	R	L	T	R	L	T	R
Movement Volume (vph)	124	9	18	100	14	68	13	468	18	16	466	180
PHF	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
% Heavy Vehicles	2	2	2	2	2	2	2	3	2	2	3	2
Lane Groups	L	TR		L	T	R	L	T	R	L	T	R
Arrival Type	3	3		3	3	3	3	3	3	3	3	3
RTOR Vol (vph)		5			20			8			55	
Peds/Hour		0			0			5			5	
% Grade		0			0			0			0	
Buses/Hour		0			0			0			0	
Parkers/Hour (Left|Right)	---	---		---	---		---	---		---	---	

Signal Settings: Actuated Operational Analysis Cycle Length: 70.0 Sec Lost Time Per Cycle: 10.0 Sec

Phase:		1		2		3		4		5		6		7		8		Ped Only
EB		LTP																
WB		LTP																
NB				LTP														
SB				LTP														
Green		26.0		34.0														0
Yellow	All Red	3.5	1.5	3.5	1.5													

		Capacity Analysis Results							Approach:	
App	Lane Group	Cap (vph)	v/s Ratio	g/C Ratio	Lane Group	v/c Ratio	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
EB										
	* L	517	0.105	0.371	L	0.282	15.6	B	15.3	B
	TR	632	0.015	0.371	TR	0.041	14.1	B		
WB										
	L	512	0.086	0.371	L	0.230	15.2	B	14.9	B
	T	692	0.009	0.371	T	0.023	14.0	B		
	R	588	0.035	0.371	R	0.095	14.4	B		
NB										
	L	284	0.026	0.486	L	0.053	9.9	A	16.0	B
	* T	896	0.299	0.486	T	0.615	16.4	B		
	R	765	0.008	0.486	R	0.016	9.4	A		
SB										
	L	281	0.033	0.486	L	0.068	10.0	B	15.0	B
	T	896	0.297	0.486	T	0.612	16.3	B		
	R	765	0.093	0.486	R	0.192	10.8	B		

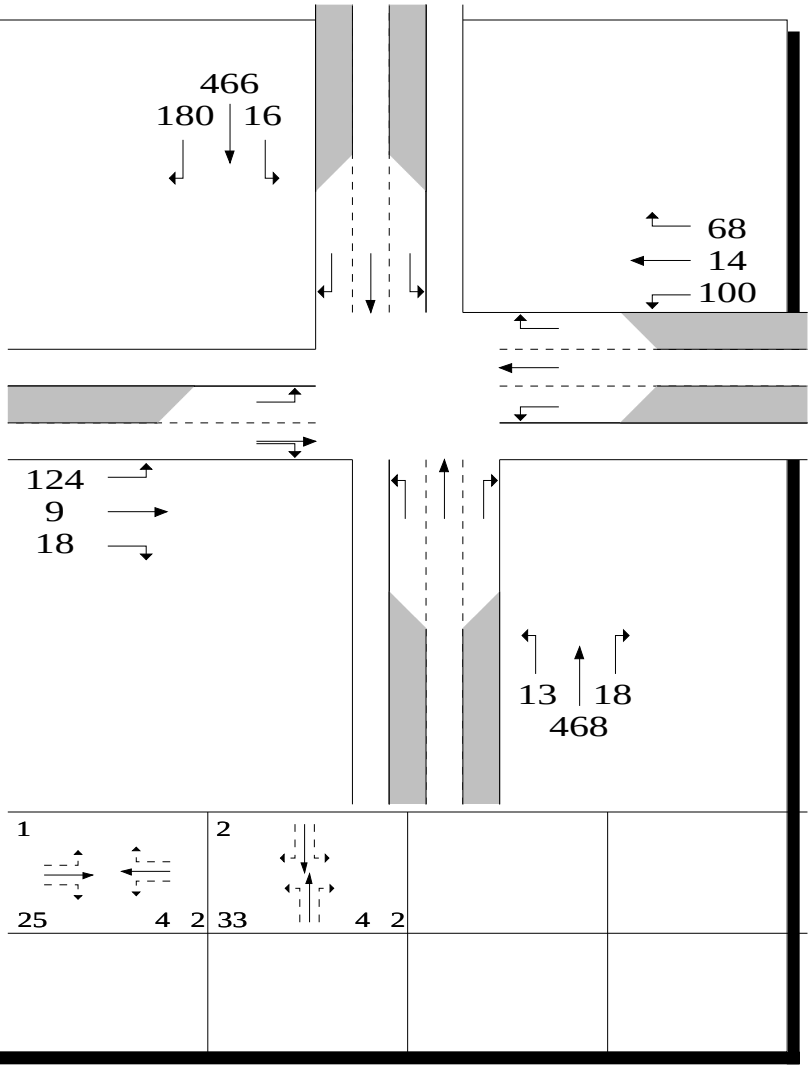
Intersection: Delay = 15.4 sec/veh Int. LOS=B X_c= 0.47 * Critical Lane Group Σ(v/s)Crit= 0.40

NETSIM Summary Results

Livingston Trans Plan
R Marvin
Peak PM 2017

Loves Lane/Park Street
03/23/2017
Case: Park & Loves 2017 PM

App	Lane Group	Queues Per Lane Avg/Max (veh)	Average Speed (mph)	Spillback in Worst Lane (% of Peak Period)
EB	L	2 / 3	10.6	0.0
	TR	0 / 1	21.5	0.0
	All		14.7	0.0
WB	L	2 / 3	9.6	0.0
	T	0 / 2	25.8	0.0
	R	1 / 2	12.8	0.0
	All		15.4	0.0
NB	L	0 / 1	13.4	0.0
	T	6 / 7	14.3	0.0
	R	0 / 1	22.0	0.0
	All		14.3	0.0
SB	L	0 / 1	15.2	0.0
	T	5 / 9	15.6	0.0
	R	1 / 3	20.5	0.0
	All		16.2	0.0
Intersect.			15.3	



HCS7 Two-Way Stop-Control Report

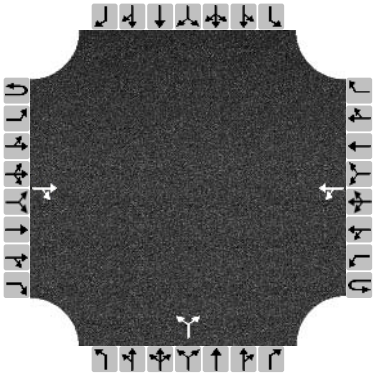
General Information

Analyst	R Marvin
Agency/Co.	Marvin & Associates
Date Performed	3/22/2017
Analysis Year	2017
Time Analyzed	Peak PM
Intersection Orientation	East-West
Project Description	Livingston Trans Plan Update

Site Information

Intersection	Park & Main
Jurisdiction	Livingston
East/West Street	Park Street
North/South Street	Main Street
Peak Hour Factor	0.96
Analysis Time Period (hrs)	0.25

Lanes



Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	0	0		0	0	0
Configuration				TR		LT					LR					
Volume, V (veh/h)			533	89		30	344			44		34				
Percent Heavy Vehicles (%)						0				0		0				
Proportion Time Blocked																
Percent Grade (%)										0						
Right Turn Channelized		No				No				No				No		
Median Type/Storage			Undivided													

Critical and Follow-up Headways

Base Critical Headway (sec)						4.1				7.1		6.2				
Critical Headway (sec)						4.10				6.40		6.20				
Base Follow-Up Headway (sec)						2.2				3.5		3.3				
Follow-Up Headway (sec)						2.20				3.50		3.30				

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)						31					81					
Capacity, c (veh/h)						931					310					
v/c Ratio						0.03					0.26					
95% Queue Length, Q_{95} (veh)						0.1					1.0					
Control Delay (s/veh)						9.0					20.7					
Level of Service, LOS						A					C					
Approach Delay (s/veh)						1.1				20.7						
Approach LOS										C						

HCS7 Two-Way Stop-Control Report

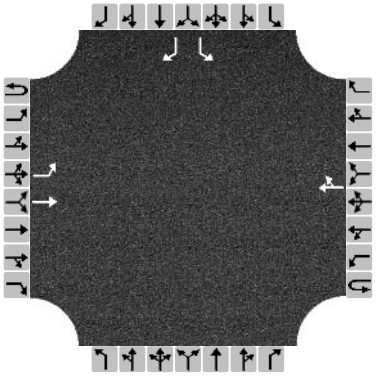
General Information

Analyst	R Marvin
Agency/Co.	Marvin & Associates
Date Performed	3/22/2017
Analysis Year	2017
Time Analyzed	Peak PM
Intersection Orientation	East-West
Project Description	Livingston Trans Plan Update

Site Information

Intersection	Park & Old Clyde Park
Jurisdiction	Livingston
East/West Street	Park Street
North/South Street	Old Clyde Park Road
Peak Hour Factor	0.96
Analysis Time Period (hrs)	0.25

Lanes



Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	1	1	0	0	0	1	0		0	0	0		1	0	1
Configuration		L	T					TR						L		R
Volume, V (veh/h)		138	191				221	36						23		100
Percent Heavy Vehicles (%)		2												2		2
Proportion Time Blocked																
Percent Grade (%)														0		
Right Turn Channelized		No				No				No				No		
Median Type/Storage		Undivided														

Critical and Follow-up Headways

Base Critical Headway (sec)		4.1												7.1		6.2
Critical Headway (sec)		4.12												6.42		6.22
Base Follow-Up Headway (sec)		2.2												3.5		3.3
Follow-Up Headway (sec)		2.22												3.52		3.32

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		144												24		104
Capacity, c (veh/h)		1295												343		789
v/c Ratio		0.11												0.07		0.13
95% Queue Length, Q_{95} (veh)		0.4												0.2		0.5
Control Delay (s/veh)		8.1												16.3		10.3
Level of Service, LOS		A												C		B
Approach Delay (s/veh)		3.4												11.4		
Approach LOS														B		

HCS7 Two-Way Stop-Control Report

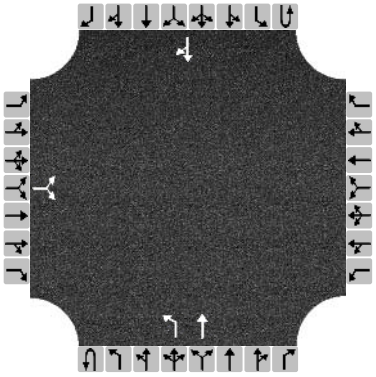
General Information

Analyst	R Marvin
Agency/Co.	Marvin & Associates
Date Performed	4/5/2017
Analysis Year	2017
Time Analyzed	Peak PM
Intersection Orientation	North-South
Project Description	Livingston Trans PLan Update

Site Information

Intersection	Park & Rogers
Jurisdiction	City of Livingston
East/West Street	Rogers Street
North/South Street	Park Street
Peak Hour Factor	0.56
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	0	0	0	1	1	0	0	0	1	0
Configuration			LR							L	T					TR
Volume, V (veh/h)		12		2						17	476				437	8
Percent Heavy Vehicles (%)		1		1						1						
Proportion Time Blocked																
Percent Grade (%)		0														
Right Turn Channelized		No				No				No				No		
Median Type/Storage		Left Only								1						

Critical and Follow-up Headways

Base Critical Headway (sec)		7.1		6.2						4.1						
Critical Headway (sec)		6.41		6.21						4.11						
Base Follow-Up Headway (sec)		3.5		3.3						2.2						
Follow-Up Headway (sec)		3.51		3.31						2.21						

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			25							30						
Capacity, c (veh/h)			247							831						
v/c Ratio			0.10							0.04						
95% Queue Length, Q_{95} (veh)			0.3							0.1						
Control Delay (s/veh)			21.2							9.5						
Level of Service, LOS			C							A						
Approach Delay (s/veh)		21.2								0.3						
Approach LOS		C														

HCS7 Two-Way Stop-Control Report

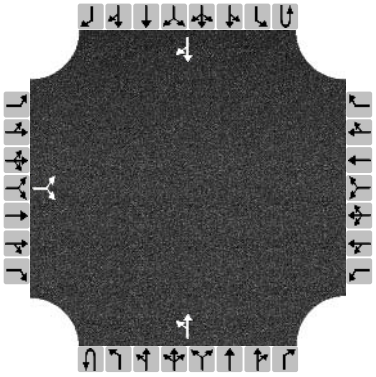
General Information

Analyst	R Marvin
Agency/Co.	Marvin & Associates
Date Performed	3/23/2017
Analysis Year	2017
Time Analyzed	Peak PM
Intersection Orientation	North-South
Project Description	Livingston Trans Plan Update

Site Information

Intersection	Sun & Star
Jurisdiction	Livingston
East/West Street	Sun Avenue
North/South Street	Star Avenue
Peak Hour Factor	0.94
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	0	0	0	0	1	0	0	0	1	0
Configuration			LR							LT						TR
Volume, V (veh/h)		0		48						116	56				30	0
Percent Heavy Vehicles (%)		0		0						0						
Proportion Time Blocked																
Percent Grade (%)		0														
Right Turn Channelized		No				No				No				No		
Median Type/Storage		Undivided														

Critical and Follow-up Headways

Base Critical Headway (sec)		7.1		6.2						4.1						
Critical Headway (sec)		6.40		6.20						4.10						
Base Follow-Up Headway (sec)		3.5		3.3						2.2						
Follow-Up Headway (sec)		3.50		3.30						2.20						

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			51							123						
Capacity, c (veh/h)			1048							1593						
v/c Ratio			0.05							0.08						
95% Queue Length, Q_{95} (veh)			0.2							0.3						
Control Delay (s/veh)			8.6							7.4						
Level of Service, LOS			A							A						
Approach Delay (s/veh)		8.6								5.2						
Approach LOS		A														

HCS7 Two-Way Stop-Control Report

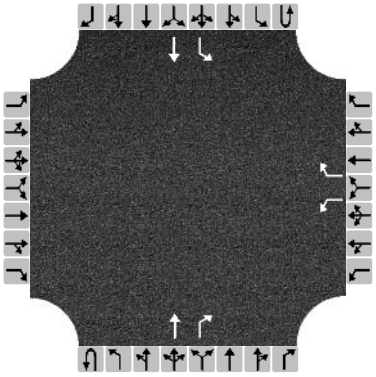
General Information

Analyst	R Marvin
Agency/Co.	Marvin Associates
Date Performed	8/25/2017
Analysis Year	2017
Time Analyzed	Peak PM Existing
Intersection Orientation	North-South
Project Description	Livingston Transportation Update

Site Information

Intersection	I-90 WB Ramps & Park St
Jurisdiction	City of Livingston
East/West Street	I-90 WB Ramps
North/South Street	Park Street
Peak Hour Factor	0.93
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		1	0	1	0	0	1	1	0	1	1	0
Configuration						L		R			T	R		L	T	
Volume, V (veh/h)						81		36			730	247		35	547	
Percent Heavy Vehicles (%)						8		8						5		
Proportion Time Blocked																
Percent Grade (%)						0										
Right Turn Channelized		No				No				No				No		
Median Type/Storage		Undivided														

Critical and Follow-up Headways

Base Critical Headway (sec)						7.1		6.2						4.1		
Critical Headway (sec)						6.48		6.28						4.15		
Base Follow-Up Headway (sec)						3.5		3.3						2.2		
Follow-Up Headway (sec)						3.57		3.37						2.24		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)						87		39						38		
Capacity, c (veh/h)						132		384						652		
v/c Ratio						0.66		0.10						0.06		
95% Queue Length, Q_{95} (veh)						3.6		0.3						0.2		
Control Delay (s/veh)						73.9		15.4						10.9		
Level of Service, LOS						F		C						B		
Approach Delay (s/veh)						55.8								0.7		
Approach LOS						F										

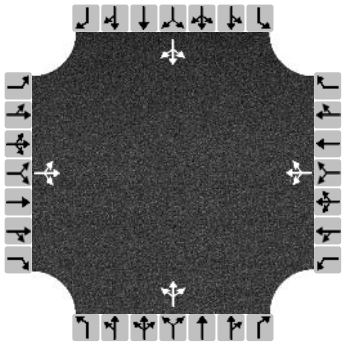
APPENDIX E

2027 INTERSECTION CAPACITY CALCULATIONS

HCS7 All-Way Stop Control Report

General Information		Site Information	
Analyst	R Marvin	Intersection	Callender & 2nd
Agency/Co.	Marvin & Associates	Jurisdiction	Livingston
Date Performed	3/23/2017	East/West Street	Callender Street
Analysis Year	2027	North/South Street	2nd Street
Analysis Time Period (hrs)	0.25	Peak Hour Factor	0.96
Time Analyzed	Peak PM Future		
Project Description	Livingston Trans Plan Update		

Lanes



Vehicle Volume and Adjustments

Approach	Eastbound			Westbound			Northbound			Southbound		
Movement	L	T	R	L	T	R	L	T	R	L	T	R
Volume	29	83	28	29	121	34	33	82	33	39	50	47
% Thrus in Shared Lane												
Lane	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
Configuration	LTR			LTR			LTR			LTR		
Flow Rate, v (veh/h)	146			192			154			142		
Percent Heavy Vehicles	1			1			1			1		

Departure Headway and Service Time

Initial Departure Headway, hd (s)	3.20			3.20			3.20			3.20		
Initial Degree of Utilization, x	0.130			0.170			0.137			0.126		
Final Departure Headway, hd (s)	4.85			4.79			4.87			4.83		
Final Degree of Utilization, x	0.196			0.255			0.209			0.190		
Move-Up Time, m (s)	2.0			2.0			2.0			2.0		
Service Time, ts (s)	2.85			2.79			2.87			2.83		

Capacity, Delay and Level of Service

Flow Rate, v (veh/h)	146			192			154			142		
Capacity	742			752			739			745		
95% Queue Length, Q_{95} (veh)	0.7			1.0			0.8			0.7		
Control Delay (s/veh)	9.0			9.4			9.2			9.0		
Level of Service, LOS	A			A			A			A		
Approach Delay (s/veh)	9.0			9.4			9.2			9.0		
Approach LOS	A			A			A			A		
Intersection Delay, s/veh | LOS	9.2						A					

HCS7 Two-Way Stop-Control Report

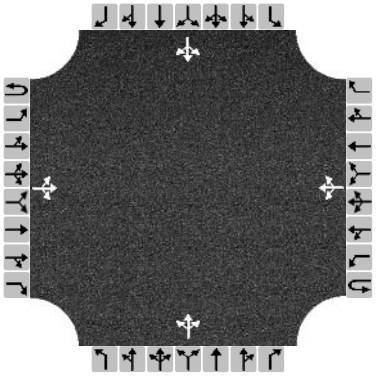
General Information

Analyst	R Marvin
Agency/Co.	Marvin & Associates
Date Performed	3/22/2017
Analysis Year	2027
Time Analyzed	Peak PM Future
Intersection Orientation	East-West
Project Description	Livingston Trans PLan Update

Site Information

Intersection	Callender & B Street
Jurisdiction	Livingston
East/West Street	Callender St
North/South Street	B Street
Peak Hour Factor	0.91
Analysis Time Period (hrs)	0.25

Lanes



Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	1	0		0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume, V (veh/h)		85	46	23		4	60	41		18	140	5		16	57	53
Percent Heavy Vehicles (%)		0				0				0	0	0		0	0	0
Proportion Time Blocked																
Percent Grade (%)										0				0		
Right Turn Channelized		No				No				No				No		
Median Type/Storage		Undivided														

Critical and Follow-up Headways

Base Critical Headway (sec)		4.1				4.1				7.1	6.5	6.2		7.1	6.5	6.2
Critical Headway (sec)		4.10				4.10				7.10	6.50	6.20		7.10	6.50	6.20
Base Follow-Up Headway (sec)		2.2				2.2				3.5	4.0	3.3		3.5	4.0	3.3
Follow-Up Headway (sec)		2.20				2.20				3.50	4.00	3.30		3.50	4.00	3.30

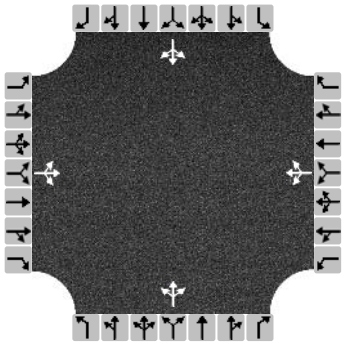
Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		93				4					179				139	
Capacity, c (veh/h)		1465				1509					499				593	
v/c Ratio		0.06				0.00					0.36				0.23	
95% Queue Length, Q_{95} (veh)		0.2				0.0					1.6				0.9	
Control Delay (s/veh)		7.6				7.4					16.2				12.9	
Level of Service, LOS		A				A					C				B	
Approach Delay (s/veh)		4.4				0.3				16.2				12.9		
Approach LOS										C				B		

HCS7 All-Way Stop Control Report

General Information		Site Information	
Analyst	R Marvin	Intersection	Callender & Main
Agency/Co.	Marvin & Associates	Jurisdiction	Livingston
Date Performed	3/23/2017	East/West Street	Callender Street
Analysis Year	2027	North/South Street	Main Street
Analysis Time Period (hrs)	0.25	Peak Hour Factor	0.96
Time Analyzed	Peak PM Future		
Project Description	Livingston Trans Plan Update		

Lanes



Vehicle Volume and Adjustments

Approach	Eastbound			Westbound			Northbound			Southbound		
Movement	L	T	R	L	T	R	L	T	R	L	T	R
Volume	34	130	33	42	104	39	54	77	66	6	89	40
% Thrus in Shared Lane												
Lane	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
Configuration	LTR			LTR			LTR			LTR		
Flow Rate, v (veh/h)	205			193			205			141		
Percent Heavy Vehicles	1			1			1			1		

Departure Headway and Service Time

Initial Departure Headway, hd (s)	3.20			3.20			3.20			3.20		
Initial Degree of Utilization, x	0.182			0.171			0.182			0.125		
Final Departure Headway, hd (s)	5.05			5.05			5.03			5.11		
Final Degree of Utilization, x	0.288			0.271			0.287			0.199		
Move-Up Time, m (s)	2.0			2.0			2.0			2.0		
Service Time, ts (s)	3.05			3.05			3.03			3.11		

Capacity, Delay and Level of Service

Flow Rate, v (veh/h)	205			193			205			141		
Capacity	713			712			716			705		
95% Queue Length, Q_{95} (veh)	1.2			1.1			1.2			0.7		
Control Delay (s/veh)	10.1			9.9			10.0			9.4		
Level of Service, LOS	B			A			B			A		
Approach Delay (s/veh)	10.1			9.9			10.0			9.4		
Approach LOS	B			A			B			A		
Intersection Delay, s/veh | LOS	9.9						A					

HCS7 Two-Way Stop-Control Report

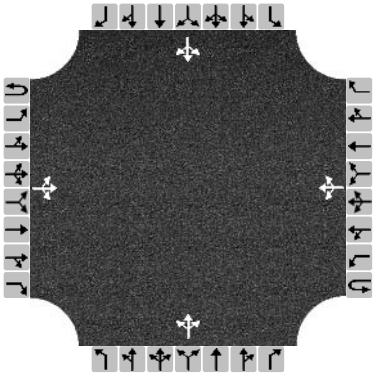
General Information

Analyst	R Marvin
Agency/Co.	Marvin & Associates
Date Performed	3/22/2017
Analysis Year	2027
Time Analyzed	Peak PM Future
Intersection Orientation	East-West
Project Description	Livingston Trans PLan Update

Site Information

Intersection	Chinook & 5th
Jurisdiction	Livingston
East/West Street	Chinook Street
North/South Street	5th Street
Peak Hour Factor	0.88
Analysis Time Period (hrs)	0.25

Lanes



Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	1	0		0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume, V (veh/h)		0	46	84		64	102	4		110	37	48		2	6	0
Percent Heavy Vehicles (%)		0				0				0	0	0		0	0	0
Proportion Time Blocked																
Percent Grade (%)										0				0		
Right Turn Channelized		No				No				No				No		
Median Type/Storage		Undivided														

Critical and Follow-up Headways

Base Critical Headway (sec)		4.1				4.1				7.1	6.5	6.2		7.1	6.5	6.2
Critical Headway (sec)		4.10				4.10				7.10	6.50	6.20		7.10	6.50	6.20
Base Follow-Up Headway (sec)		2.2				2.2				3.5	4.0	3.3		3.5	4.0	3.3
Follow-Up Headway (sec)		2.20				2.20				3.50	4.00	3.30		3.50	4.00	3.30

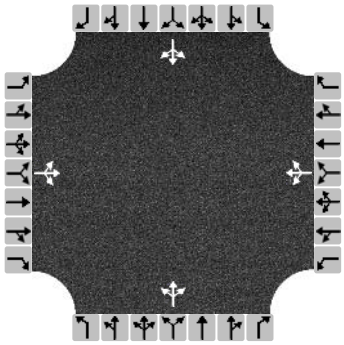
Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		0				73					222				9	
Capacity, c (veh/h)		1453				1422					590				473	
v/c Ratio		0.00				0.05					0.38				0.02	
95% Queue Length, Q_{95} (veh)		0.0				0.2					1.7				0.1	
Control Delay (s/veh)		7.5				7.7					14.7				12.8	
Level of Service, LOS		A				A					B				B	
Approach Delay (s/veh)		0.0				3.1				14.7				12.8		
Approach LOS										B				B		

HCS7 All-Way Stop Control Report

General Information		Site Information	
Analyst	R Marvin	Intersection	Chinook & Main
Agency/Co.	Marvin & Associates	Jurisdiction	Livingston
Date Performed	3/23/2017	East/West Street	Chinook Street
Analysis Year	2027	North/South Street	Main Street
Analysis Time Period (hrs)	0.25	Peak Hour Factor	0.79
Time Analyzed	Peak PM Future		
Project Description	Livingston Trans Plan Update		

Lanes



Vehicle Volume and Adjustments

Approach	Eastbound			Westbound			Northbound			Southbound		
Movement	L	T	R	L	T	R	L	T	R	L	T	R
Volume	1	63	37	113	74	1	84	11	123	0	6	2
% Thrus in Shared Lane												
Lane	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
Configuration	LTR			LTR			LTR			LTR		
Flow Rate, v (veh/h)	128			238			276			10		
Percent Heavy Vehicles	1			3			1			1		

Departure Headway and Service Time

Initial Departure Headway, hd (s)	3.20			3.20			3.20			3.20		
Initial Degree of Utilization, x	0.114			0.212			0.245			0.009		
Final Departure Headway, hd (s)	4.73			4.94			4.59			5.08		
Final Degree of Utilization, x	0.168			0.327			0.352			0.014		
Move-Up Time, m (s)	2.0			2.0			2.0			2.0		
Service Time, ts (s)	2.73			2.94			2.59			3.08		

Capacity, Delay and Level of Service

Flow Rate, v (veh/h)	128			238			276			10		
Capacity	761			728			784			709		
95% Queue Length, Q_{95} (veh)	0.6			1.4			1.6			0.0		
Control Delay (s/veh)	8.7			10.3			10.1			8.1		
Level of Service, LOS	A			B			B			A		
Approach Delay (s/veh)	8.7			10.3			10.1			8.1		
Approach LOS	A			B			B			A		
Intersection Delay, s/veh | LOS	9.9						A					

HCS7 Two-Way Stop-Control Report

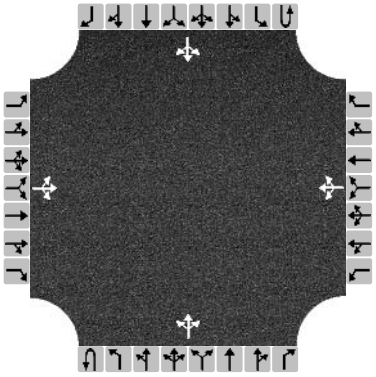
General Information

Analyst	R Marvin
Agency/Co.	Marvin & Associates
Date Performed	3/22/2017
Analysis Year	2027
Time Analyzed	Peak PM Future
Intersection Orientation	North-South
Project Description	Livingston Trans Plan Update

Site Information

Intersection	Clark & 5th
Jurisdiction	Livingston
East/West Street	Clark Street
North/South Street	5th Street
Peak Hour Factor	0.87
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	1	0	0	0	1	0	0	0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume, V (veh/h)		0	48	1		6	26	6		4	36	16		11	33	1
Percent Heavy Vehicles (%)		0	0	0		0	0	0		0				0		
Proportion Time Blocked																
Percent Grade (%)		0				0										
Right Turn Channelized		No				No				No				No		
Median Type/Storage		Undivided														

Critical and Follow-up Headways

Base Critical Headway (sec)		7.1	6.5	6.2		7.1	6.5	6.2		4.1				4.1		
Critical Headway (sec)		7.10	6.50	6.20		7.10	6.50	6.20		4.10				4.10		
Base Follow-Up Headway (sec)		3.5	4.0	3.3		3.5	4.0	3.3		2.2				2.2		
Follow-Up Headway (sec)		3.50	4.00	3.30		3.50	4.00	3.30		2.20				2.20		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			56				44			5				13		
Capacity, c (veh/h)			739				776			1570				1544		
v/c Ratio			0.08				0.06			0.00				0.01		
95% Queue Length, Q_{95} (veh)			0.2				0.2			0.0				0.0		
Control Delay (s/veh)			10.3				9.9			7.3				7.4		
Level of Service, LOS			B				A			A				A		
Approach Delay (s/veh)		10.3				9.9				0.6				1.9		
Approach LOS		B				A										

HCS7 Two-Way Stop-Control Report

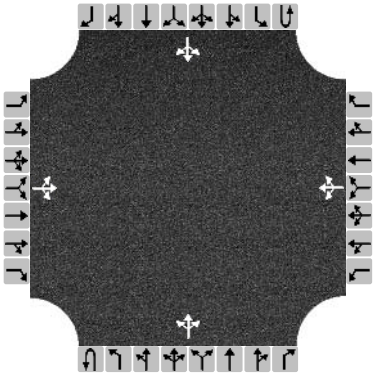
General Information

Analyst	R Marvin
Agency/Co.	Marvin & Associates
Date Performed	3/22/2017
Analysis Year	2027
Time Analyzed	Peak PM Future
Intersection Orientation	North-South
Project Description	Livingston Trans Plan Update

Site Information

Intersection	Front & 5th
Jurisdiction	Livingston
East/West Street	Front Street
North/South Street	5th Street
Peak Hour Factor	0.87
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	1	0	0	0	1	0	0	0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume, V (veh/h)		1	16	131		6	68	15		234	195	42		0	149	0
Percent Heavy Vehicles (%)		0	0	0		0	0	0		0				0		
Proportion Time Blocked																
Percent Grade (%)		0				0										
Right Turn Channelized		No				No				No				No		
Median Type/Storage		Undivided														

Critical and Follow-up Headways

Base Critical Headway (sec)		7.1	6.5	6.2		7.1	6.5	6.2		4.1				4.1		
Critical Headway (sec)		7.10	6.50	6.20		7.10	6.50	6.20		4.10				4.10		
Base Follow-Up Headway (sec)		3.5	4.0	3.3		3.5	4.0	3.3		2.2				2.2		
Follow-Up Headway (sec)		3.50	4.00	3.30		3.50	4.00	3.30		2.20				2.20		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			170				102			269				0		
Capacity, c (veh/h)			610				215			1406				1291		
v/c Ratio			0.28				0.47			0.19				0.00		
95% Queue Length, Q_{95} (veh)			1.1				2.3			0.7				0.0		
Control Delay (s/veh)			13.2				35.9			8.2				7.8		
Level of Service, LOS			B				E			A				A		
Approach Delay (s/veh)		13.2				35.9				5.0				0.0		
Approach LOS		B				E										

HCS7 Two-Way Stop-Control Report

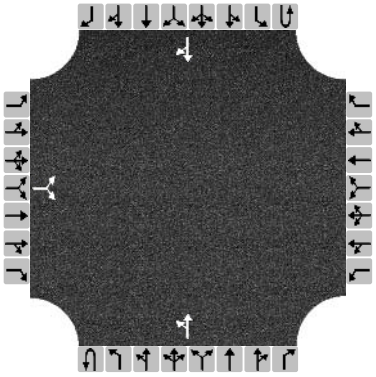
General Information

Analyst	R Marvin
Agency/Co.	Marvin & Associates
Date Performed	4/5/2017
Analysis Year	2027
Time Analyzed	Peak PM Future
Intersection Orientation	North-South
Project Description	Livingston Trans PLan Update

Site Information

Intersection	Main Street & Front Stree
Jurisdiction	City of Livingston
East/West Street	Front Street
North/South Street	MAin Street
Peak Hour Factor	0.71
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	0	0	0	0	1	0	0	0	1	0
Configuration			LR							LT						TR
Volume, V (veh/h)		23		21						74	212				104	11
Percent Heavy Vehicles (%)		1		1						1						
Proportion Time Blocked																
Percent Grade (%)		0														
Right Turn Channelized		No				No				No				No		
Median Type/Storage		Undivided														

Critical and Follow-up Headways

Base Critical Headway (sec)		7.1		6.2						4.1						
Critical Headway (sec)		6.41		6.21						4.11						
Base Follow-Up Headway (sec)		3.5		3.3						2.2						
Follow-Up Headway (sec)		3.51		3.31						2.21						

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			62							104						
Capacity, c (veh/h)			539							1424						
v/c Ratio			0.11							0.07						
95% Queue Length, Q_{95} (veh)			0.4							0.2						
Control Delay (s/veh)			12.5							7.7						
Level of Service, LOS			B							A						
Approach Delay (s/veh)		12.5								2.5						
Approach LOS		B														

HCS7 Two-Way Stop-Control Report

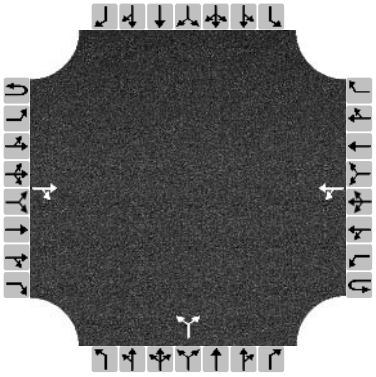
General Information

Analyst	R Marvin
Agency/Co.	Marvin & Associates
Date Performed	3/22/2017
Analysis Year	2027
Time Analyzed	Peak PM Future
Intersection Orientation	East-West
Project Description	Livingston Trans Plan Update

Site Information

Intersection	Park & 2nd St
Jurisdiction	Livingston
East/West Street	Park Street
North/South Street	2nd Street
Peak Hour Factor	0.92
Analysis Time Period (hrs)	0.25

Lanes



Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	0	0		0	0	0
Configuration				TR		LT					LR					
Volume, V (veh/h)			688	105		40	516			22		62				
Percent Heavy Vehicles (%)						0				0		0				
Proportion Time Blocked																
Percent Grade (%)										0						
Right Turn Channelized		No				No				No				No		
Median Type/Storage			Undivided													

Critical and Follow-up Headways

Base Critical Headway (sec)						4.1				7.1		6.2				
Critical Headway (sec)						4.10				6.40		6.20				
Base Follow-Up Headway (sec)						2.2				3.5		3.3				
Follow-Up Headway (sec)						2.20				3.50		3.30				

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)						43					91					
Capacity, c (veh/h)						775					249					
v/c Ratio						0.06					0.37					
95% Queue Length, Q_{95} (veh)						0.2					1.6					
Control Delay (s/veh)						9.9					27.5					
Level of Service, LOS						A					D					
Approach Delay (s/veh)						1.4					27.5					
Approach LOS											D					

HCS7 Two-Way Stop-Control Report

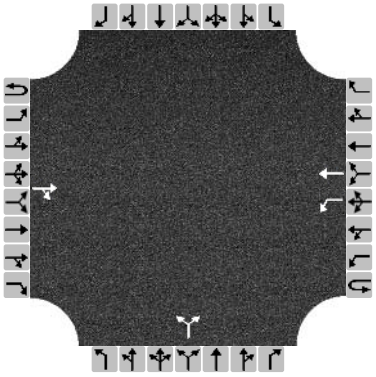
General Information

Analyst	R Marvin
Agency/Co.	Marvin & Associates
Date Performed	3/22/2017
Analysis Year	2027
Time Analyzed	Peak PM Future
Intersection Orientation	East-West
Project Description	Livingston Trans Plan Update

Site Information

Intersection	Park & 6th
Jurisdiction	Livingston
East/West Street	Park Street
North/South Street	6th Street
Peak Hour Factor	0.70
Analysis Time Period (hrs)	0.25

Lanes



Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	1	1	0		0	0	0		0	0	0
Configuration				TR		L	T				LR					
Volume, V (veh/h)			806	6		2	640			4		4				
Percent Heavy Vehicles (%)						0				0		0				
Proportion Time Blocked																
Percent Grade (%)										0						
Right Turn Channelized		No				No				No				No		
Median Type/Storage		Left Only								1						

Critical and Follow-up Headways

Base Critical Headway (sec)						4.1				7.1		6.2				
Critical Headway (sec)						4.10				6.40		6.20				
Base Follow-Up Headway (sec)						2.2				3.5		3.3				
Follow-Up Headway (sec)						2.20				3.50		3.30				

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)						3					12					
Capacity, c (veh/h)						604					204					
v/c Ratio						0.00					0.06					
95% Queue Length, Q_{95} (veh)						0.0					0.2					
Control Delay (s/veh)						11.0					23.7					
Level of Service, LOS						B					C					
Approach Delay (s/veh)						0.0				23.7						
Approach LOS										C						

HCM Analysis Summary

Lingston Trans Plan Update	Park Street/5th Street	Area Type: Non CBD
R Marvin	3/23/17	Analysis Duration: 15 mins.
Peak PM 2027	Case: 2027 Park and 5th	

Lanes			Geometry: Movements Serviced by Lane and Lane Widths (feet)											
	Approach	Outbound	Lane 1		Lane 2		Lane 3		Lane 4		Lane 5		Lane 6	
EB	2	1	L	12.0	TR	12.0								
WB	2	1	L	12.0	TR	12.0								
NB	1	1	LTR	12.0										
SB	1	1	LTR	12.0										

	East			West			North			South		
Data	L	T	R	L	T	R	L	T	R	L	T	R
Movement Volume (vph)	305	624	5	16	462	27	75	113	9	55	51	171
PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
% Heavy Vehicles	2	2	2	2	2	2	2	2	2	2	2	2
Lane Groups	L	TR		L	TR			LTR			LTR	
Arrival Type	3	3		3	3			3			3	
RTOR Vol (vph)	0			7			0			50		
Peds/Hour	5			5			5			5		
% Grade	0			0			0			0		
Buses/Hour	0			0			0			0		
Parkers/Hour (Left|Right)	---	---		---	---		---	---		---	---	

Signal Settings: Actuated Operational Analysis Cycle Length: 94.0 Sec Lost Time Per Cycle: 13.0 Sec

Phase:	1	2	3	4	5	6	7	8	Ped Only
EB	LTR	LTP							
WB		LTP							
NB			LTP						
SB			LTP						
Green	15.0	36.0	30.0						0
Yellow / All Red	3.0 / 0.0	3.5 / 1.5	3.5 / 1.5						

		Capacity Analysis Results							Approach:	
App	Lane Group	Cap (vph)	v/s Ratio	g/C Ratio	Lane Group	v/c Ratio	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
EB	Lper	169	0.109	0.436					18.4	B
	* Lpro	282	0.159	0.160	L	0.718	23.3	C		
	TR	1069	0.359	0.574	TR	0.626	16.1	B		
WB										
	L	246	0.026	0.383	L	0.069	18.9	B	30.6	C
	* TR	709	0.277	0.383	TR	0.722	31.0	C		
NB										
	LTR	456	0.147	0.319	LTR	0.461	25.8	C	25.8	C
SB										
	* LTR	485	0.159	0.319	LTR	0.499	26.2	C	26.2	C

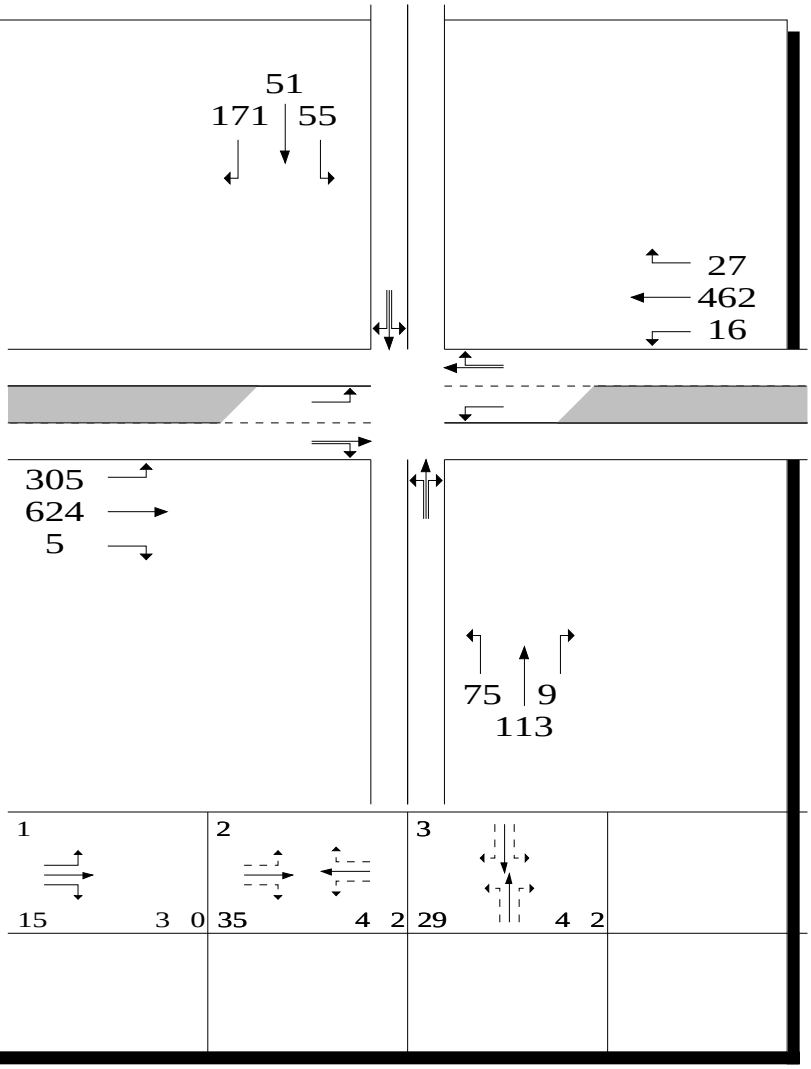
Intersection: Delay = 23.4 sec/veh Int. LOS=C X_c= 0.69 * Critical Lane Group Σ(v/s)Crit= 0.60

NETSIM Summary Results

Lingston Trans Plan Update
R Marvin
Peak PM 2027

Park Street/5th Street
3/23/17
Case: 2027 Park and 5th

App	Lane Group	Queues Per Lane Avg/Max (veh)	Average Speed (mph)	Spillback in Worst Lane (% of Peak Period)
EB	L	12 / 16	2.2	28.0
	TR	8 / 12	11.3	1.3
	All		7.4	28.0
WB	L	1 / 2	5.1	0.0
	TR	9 / 11	10.0	0.0
	All		9.8	0.0
NB	LTR	4 / 5	10.0	0.0
	All		10.0	0.0
SB	LTR	4 / 6	11.2	0.0
	All		11.2	0.0
Intersect.			8.6	



HCM Analysis Summary

Livingston Trans Plan Update	Highway 10 W/Park Street	Area Type: Non CBD
R Marvin	3/23/17	Analysis Duration: 15 mins.
Peak PM 2027	Case: Park & 7th 2027 PM	

Lanes			Geometry: Movements Serviced by Lane and Lane Widths (feet)											
	Approach	Outbound	Lane 1		Lane 2		Lane 3		Lane 4		Lane 5		Lane 6	
EB	2	1	L	12.0	TR	12.0								
WB	3	1	L	12.0	T	12.0	R	12.0						
NB	1	1	LTR	12.0										
SB	1	1	LTR	12.0										

	East			West			North			South		
Data	L	T	R	L	T	R	L	T	R	L	T	R
Movement Volume (vph)	30	682	7	4	528	153	36	21	9	359	42	56
PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
% Heavy Vehicles	4	0	1	0	0	0	1	4	0	0	4	4
Lane Groups	L	TR		L	T	R		LTR			LTR	
Arrival Type	3	3		3	3	3		3			3	
RTOR Vol (vph)	0			50			2			5		
Peds/Hour	5			0			10			5		
% Grade	0			0			0			0		
Buses/Hour	0			0			0			0		
Parkers/Hour (Left|Right)	---	---		---	---		---	---		---	---	

Signal Settings: Actuated Operational Analysis Cycle Length: 80.0 Sec Lost Time Per Cycle: 10.0 Sec

Phase:	1	2	3	4	5	6	7	8	Ped Only
EB	LTP								
WB	LTP								
NB		LTP							
SB		LTP							
Green	36.0	34.0							0
Yellow / All Red	3.5 / 1.5	3.5 / 1.5							

Capacity Analysis Results									Approach:	
App	Lane Group	Cap (vph)	v/s Ratio	g/C Ratio	Lane Group	v/c Ratio	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
EB										
	L	231	0.060	0.450	L	0.134	14.1	B	32.1	C
	* TR	809	0.395	0.450	TR	0.878	32.9	C		
WB										
	L	116	0.016	0.450	L	0.034	12.8	B	20.3	C
	T	810	0.302	0.450	T	0.672	21.8	C		
	R	727	0.066	0.450	R	0.146	13.4	B		
NB										
	LTR	537	0.052	0.425	LTR	0.123	14.0	B	14.0	B
SB										
	* LTR	536	0.369	0.425	LTR	0.869	34.7	C	34.7	C

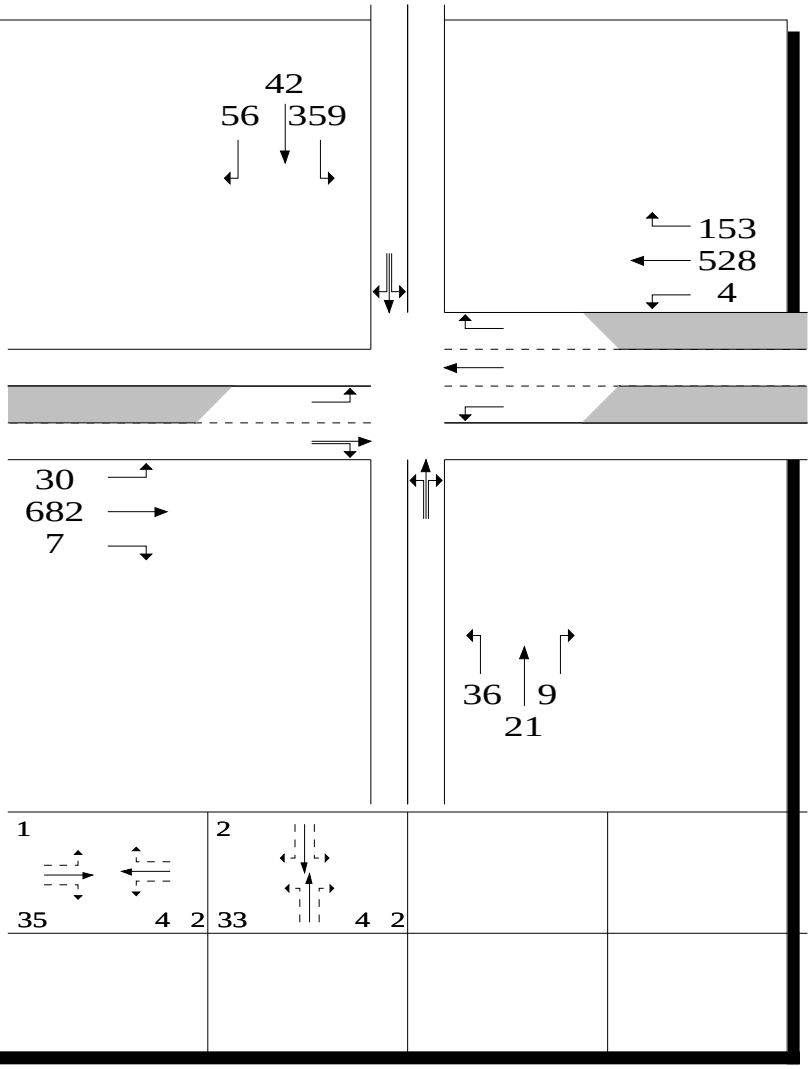
Intersection: Delay = 28.1 sec/veh Int. LOS=C X_c= 0.87 * Critical Lane Group Σ(v/s)Crit= 0.76

NETSIM Summary Results

Livingston Trans Plan Update
R Marvin
Peak PM 2027

Highway 10 W/Park Street
3/23/17
Case: Park & 7th 2027 PM

App	Lane Group	Queues Per Lane Avg/Max (veh)	Average Speed (mph)	Spillback in Worst Lane (% of Peak Period)
EB	L	1 / 2	7.7	0.0
	TR	10 / 12	11.0	0.0
	All		10.9	0.0
WB	L	0 / 1	9.8	0.0
	T	8 / 10	12.7	0.0
	R	1 / 1	22.5	0.0
	All		13.2	0.0
NB	LTR	1 / 1	14.9	0.0
	All		14.9	0.0
SB	LTR	6 / 7	12.3	0.0
	All		12.3	0.0
Intersect.			12.1	



HCS7 Two-Way Stop-Control Report

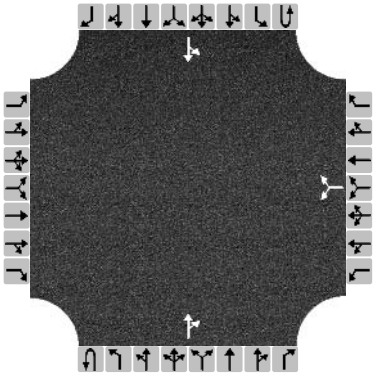
General Information

Analyst	R Marvin
Agency/Co.	Marvin & Associates
Date Performed	4/5/2017
Analysis Year	2027
Time Analyzed	Peak PM Future
Intersection Orientation	North-South
Project Description	Livingston Trans PLan Update

Site Information

Intersection	Park & 8th
Jurisdiction	City of Livingston
East/West Street	8th Street
North/South Street	Park Street
Peak Hour Factor	0.70
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	0	0	0	0	1	0	0	0	1	0
Configuration							LR					TR		LT		
Volume, V (veh/h)						4		8			558	1		7	634	
Percent Heavy Vehicles (%)						3		3						3		
Proportion Time Blocked																
Percent Grade (%)						0										
Right Turn Channelized		No				No				No				No		
Median Type/Storage		Left Only								1						

Critical and Follow-up Headways

Base Critical Headway (sec)						7.1		6.2						4.1		
Critical Headway (sec)						6.43		6.23						4.13		
Base Follow-Up Headway (sec)						3.5		3.3						2.2		
Follow-Up Headway (sec)						3.53		3.33						2.23		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)							17							10		
Capacity, c (veh/h)							310							819		
v/c Ratio							0.05							0.01		
95% Queue Length, Q_{95} (veh)							0.2							0.0		
Control Delay (s/veh)							17.3							9.4		
Level of Service, LOS							C							A		
Approach Delay (s/veh)						17.3								0.3		
Approach LOS						C										

HCM Analysis Summary

Livingston Trans Plan Update	Park Street/B Street	Area Type: Non CBD
R Marvin	03/23/2017	Analysis Duration: 15 mins.
Peak PM 2027	Case: Park & B 2027 PM	

Lanes			Geometry: Movements Serviced by Lane and Lane Widths (feet)											
	Approach	Outbound	Lane 1		Lane 2		Lane 3		Lane 4		Lane 5		Lane 6	
EB	2	1	L	12.0	TR	12.0								
WB	2	1	L	12.0	TR	12.0								
NB	1	1	LTR	12.0										
SB	1	1	LTR	12.0										

	East			West			North			South		
Data	L	T	R	L	T	R	L	T	R	L	T	R
Movement Volume (vph)	191	460	60	21	393	129	74	167	44	76	62	98
PHF	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
% Heavy Vehicles	2	2	2	2	2	2	2	4	2	2	4	2
Lane Groups	L	TR		L	TR			LTR			LTR	
Arrival Type	3	3		3	3			3			3	
RTOR Vol (vph)	10			20			10			15		
Peds/Hour	5			5			5			0		
% Grade	0			0			0			0		
Buses/Hour	0			0			0			0		
Parkers/Hour (Left|Right)	---	---		---	---		---	---		---	---	

Signal Settings: Actuated Operational Analysis Cycle Length: 80.0 Sec Lost Time Per Cycle: 14.0 Sec

Phase:		1		2		3		4		5		6		7		8		Ped Only
EB		LTP		LTP														
WB				LTP														
NB						LTP												
SB						LTP												
Green		10.0		32.0		24.0												0
Yellow	All Red	4.0	0.0	3.5	1.5	3.5	1.5											

		Capacity Analysis Results							Approach:	
App	Lane Group	Cap (vph)	v/s Ratio	g/C Ratio	Lane Group	v/c Ratio	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
EB	Lper	140	0.013	0.463					15.0	B
	* Lpro	221	0.125	0.125	L	0.623	20.4	C		
	TR	1055	0.327	0.575	TR	0.569	13.0	B		
WB										
	L	295	0.034	0.400	L	0.085	15.5	B	30.9	C
	* TR	720	0.328	0.400	TR	0.819	31.5	C		
NB										
	* LTR	444	0.218	0.300	LTR	0.727	30.2	C	30.2	C
SB										
	LTR	379	0.206	0.300	LTR	0.686	28.9	C	28.9	C

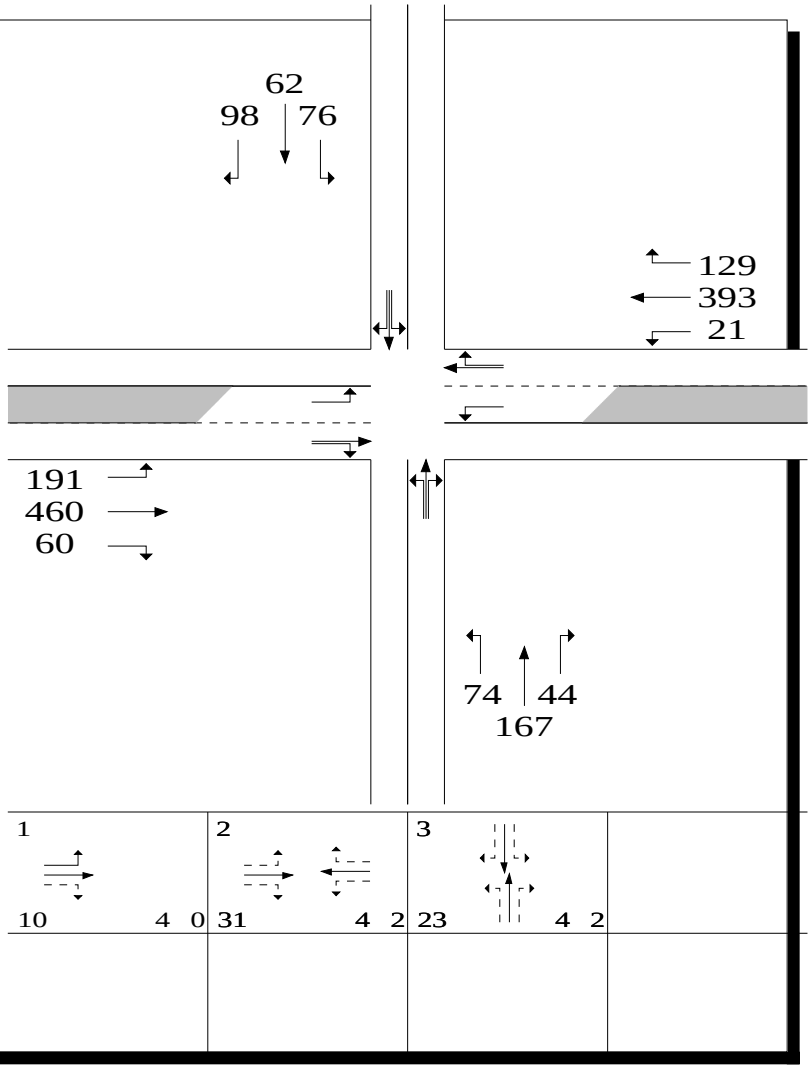
Intersection: Delay = 24.0 sec/veh Int. LOS=C X_c= 0.81 * Critical Lane Group Σ(v/s)Crit= 0.67

NETSIM Summary Results

Livingston Trans Plan Update
R Marvin
Peak PM 2027

Park Street/B Street
03/23/2017
Case: Park & B 2027 PM

App	Lane Group	Queues Per Lane Avg/Max (veh)	Average Speed (mph)	Spillback in Worst Lane (% of Peak Period)
EB	L	6 / 11	4.5	0.0
	TR	7 / 9	16.6	0.0
	All		11.5	0.0
WB	L	0 / 1	11.1	0.0
	TR	9 / 12	10.6	0.0
	All		10.6	0.0
NB	LTR	6 / 10	8.6	0.0
	All		8.6	0.0
SB	LTR	6 / 10	6.8	0.0
	All		6.8	0.0
Intersect.			9.8	



HCS7 Two-Way Stop-Control Report

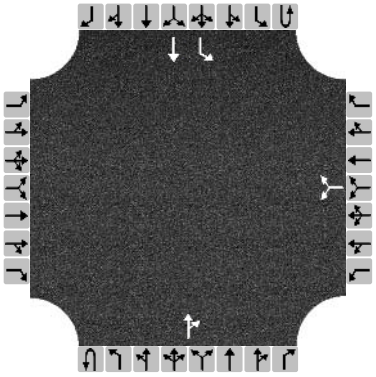
General Information

Analyst	R Marvin
Agency/Co.	Marvin & Associates
Date Performed	3/22/2017
Analysis Year	2027
Time Analyzed	Peak PM Future
Intersection Orientation	North-South
Project Description	Livingston Trans PLan Update

Site Information

Intersection	Park Street & Geyser St
Jurisdiction	Livingston
East/West Street	Geyser Street
North/South Street	Park Street
Peak Hour Factor	0.95
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	0	0	0	0	1	0	0	1	1	0
Configuration							LR					TR		L	T	
Volume, V (veh/h)						70		9			592	75		12	567	
Percent Heavy Vehicles (%)						0		0						0		
Proportion Time Blocked																
Percent Grade (%)						0										
Right Turn Channelized		No				No				No				No		
Median Type/Storage		Left Only								1						

Critical and Follow-up Headways

Base Critical Headway (sec)						7.1		6.2						4.1		
Critical Headway (sec)						6.40		6.20						4.10		
Base Follow-Up Headway (sec)						3.5		3.3						2.2		
Follow-Up Headway (sec)						3.50		3.30						2.20		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)							83							13		
Capacity, c (veh/h)							330							897		
v/c Ratio							0.25							0.01		
95% Queue Length, Q_{95} (veh)							1.0							0.0		
Control Delay (s/veh)							19.5							9.1		
Level of Service, LOS							C							A		
Approach Delay (s/veh)						19.5								0.2		
Approach LOS						C										

HCM Analysis Summary

Livingston Trans Plan	Loves Lane/Park Street	Area Type: Non CBD
R Marvin	03/23/2017	Analysis Duration: 15 mins.
Peak PM 2027	Case: Park & Loves 2027 PM	

Lanes			Geometry: Movements Serviced by Lane and Lane Widths (feet)											
	Approach	Outbound	Lane 1		Lane 2		Lane 3		Lane 4		Lane 5		Lane 6	
EB	2	1	L	12.0	TR	12.0								
WB	3	1	L	12.0	T	12.0	R	12.0						
NB	3	1	L	12.0	T	12.0	R	12.0						
SB	3	1	L	12.0	T	12.0	R	12.0						

	East			West			North			South		
Data	L	T	R	L	T	R	L	T	R	L	T	R
Movement Volume (vph)	145	11	21	117	16	80	15	548	21	19	545	211
PHF	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
% Heavy Vehicles	2	2	2	2	2	2	2	3	2	2	3	2
Lane Groups	L	TR		L	T	R	L	T	R	L	T	R
Arrival Type	3	3		3	3	3	3	3	3	3	3	3
RTOR Vol (vph)	5			20			8			60		
Peds/Hour	0			0			5			5		
% Grade	0			0			0			0		
Buses/Hour	0			0			0			0		
Parkers/Hour (Left|Right)	---	---		---	---		---	---		---	---	

Signal Settings: Actuated Operational Analysis Cycle Length: 70.0 Sec Lost Time Per Cycle: 10.0 Sec

Phase:		1		2		3		4		5		6		7		8		Ped Only
EB		LTP																
WB		LTP																
NB				LTP														
SB				LTP														
Green		26.0		34.0														0
Yellow	All Red	3.5	1.5	3.5	1.5													

		Capacity Analysis Results							Approach:	
App	Lane Group	Cap (vph)	v/s Ratio	g/C Ratio	Lane Group	v/c Ratio	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
EB										
	* L	516	0.123	0.371	L	0.331	15.9	B	15.6	B
	TR	630	0.019	0.371	TR	0.051	14.1	B		
WB										
	L	510	0.101	0.371	L	0.271	15.5	B	15.1	B
	T	692	0.010	0.371	T	0.027	14.0	B		
	R	588	0.045	0.371	R	0.121	14.5	B		
NB										
	L	214	0.041	0.486	L	0.084	10.4	B	18.8	B
	* T	896	0.350	0.486	T	0.720	19.2	B		
	R	765	0.010	0.486	R	0.020	9.4	A		
SB										
	L	211	0.051	0.486	L	0.104	10.7	B	17.2	B
	T	896	0.347	0.486	T	0.715	19.1	B		
	R	765	0.113	0.486	R	0.233	11.1	B		

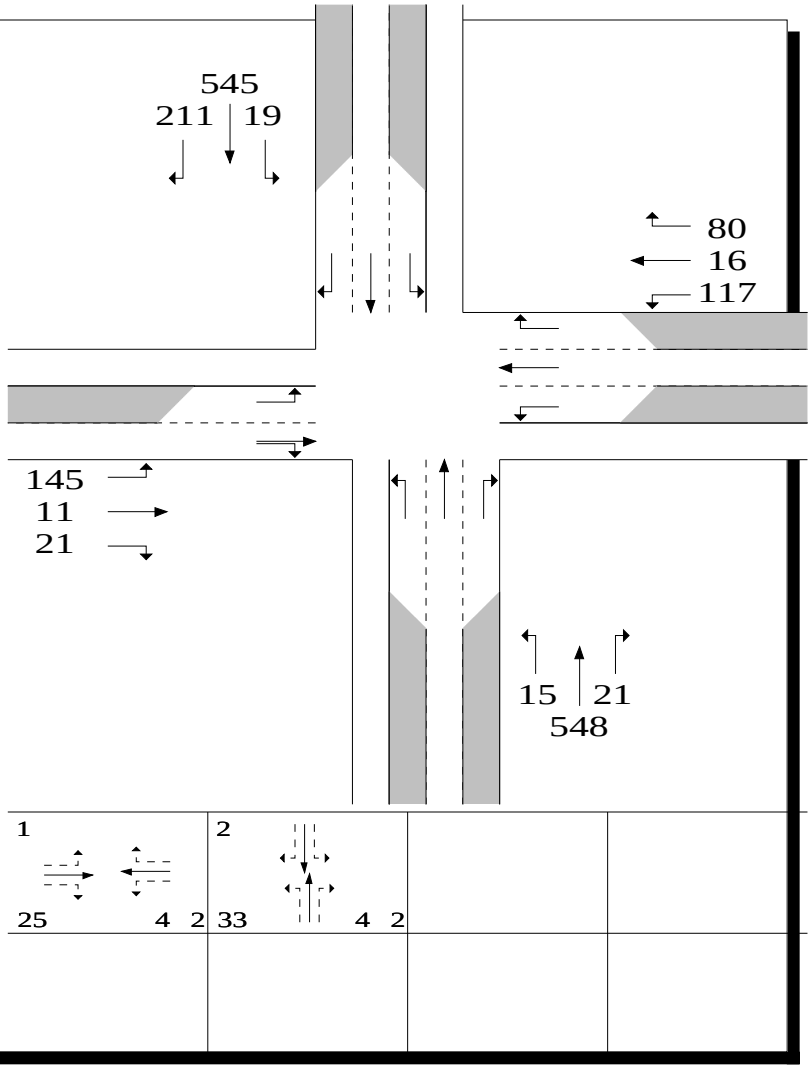
Intersection: Delay = 17.3 sec/veh Int. LOS=B X_c= 0.55 * Critical Lane Group Σ(v/s)Crit= 0.47

NETSIM Summary Results

Livingston Trans Plan
R Marvin
Peak PM 2027

Loves Lane/Park Street
03/23/2017
Case: Park & Loves 2027 PM

App	Lane Group	Queues Per Lane Avg/Max (veh)	Average Speed (mph)	Spillback in Worst Lane (% of Peak Period)
EB	L	2 / 3	9.5	0.0
	TR	0 / 1	22.1	0.0
	All		14.0	0.0
WB	L	2 / 3	10.2	0.0
	T	1 / 2	23.4	0.0
	R	1 / 2	10.6	0.0
	All		14.6	0.0
NB	L	0 / 2	6.8	0.0
	T	6 / 8	14.7	0.0
	R	0 / 1	21.7	0.0
	All		14.5	0.0
SB	L	0 / 1	10.7	0.0
	T	7 / 11	14.5	0.0
	R	1 / 2	20.7	0.0
	All		15.1	0.0
Intersect.			14.7	



HCS7 Two-Way Stop-Control Report

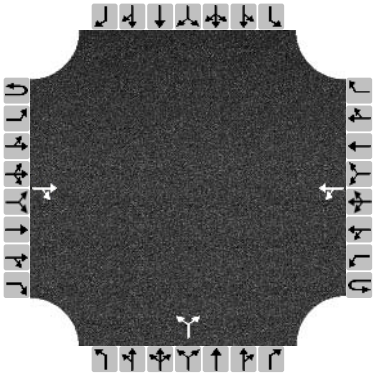
General Information

Analyst	R Marvin
Agency/Co.	Marvin & Associates
Date Performed	3/22/2017
Analysis Year	2027
Time Analyzed	Peak PM Future
Intersection Orientation	East-West
Project Description	Livingston Trans Plan Update

Site Information

Intersection	Park & Main
Jurisdiction	Livingston
East/West Street	Park Street
North/South Street	Main Street
Peak Hour Factor	0.96
Analysis Time Period (hrs)	0.25

Lanes



Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	0	0		0	0	0
Configuration				TR		LT					LR					
Volume, V (veh/h)			624	104		35	402			51		40				
Percent Heavy Vehicles (%)						0				0		0				
Proportion Time Blocked																
Percent Grade (%)										0						
Right Turn Channelized		No				No				No				No		
Median Type/Storage			Undivided													

Critical and Follow-up Headways

Base Critical Headway (sec)						4.1				7.1		6.2				
Critical Headway (sec)						4.10				6.40		6.20				
Base Follow-Up Headway (sec)						2.2				3.5		3.3				
Follow-Up Headway (sec)						2.20				3.50		3.30				

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)						36					95					
Capacity, c (veh/h)						847					251					
v/c Ratio						0.04					0.38					
95% Queue Length, Q_{95} (veh)						0.1					1.7					
Control Delay (s/veh)						9.4					27.8					
Level of Service, LOS						A					D					
Approach Delay (s/veh)						1.2					27.8					
Approach LOS											D					

HCS7 Two-Way Stop-Control Report

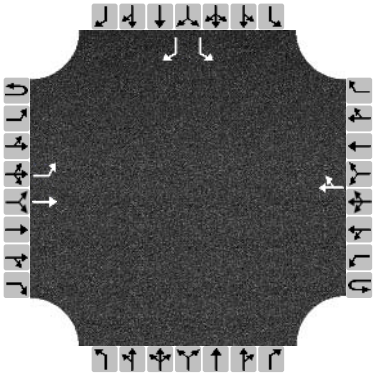
General Information

Analyst	R Marvin
Agency/Co.	Marvin & Associates
Date Performed	3/22/2017
Analysis Year	2027
Time Analyzed	Peak PM Future
Intersection Orientation	East-West
Project Description	Livingston Trans Plan Update

Site Information

Intersection	Park & Old Clyde Park
Jurisdiction	Livingston
East/West Street	Park Street
North/South Street	Old Clyde Park Road
Peak Hour Factor	0.96
Analysis Time Period (hrs)	0.25

Lanes



Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	1	1	0	0	0	1	0		0	0	0		1	0	1
Configuration		L	T					TR						L		R
Volume, V (veh/h)		161	223				259	42						27		117
Percent Heavy Vehicles (%)		2												2		2
Proportion Time Blocked																
Percent Grade (%)														0		
Right Turn Channelized		No				No				No				No		
Median Type/Storage		Undivided														

Critical and Follow-up Headways

Base Critical Headway (sec)		4.1												7.1		6.2
Critical Headway (sec)		4.12												6.42		6.22
Base Follow-Up Headway (sec)		2.2												3.5		3.3
Follow-Up Headway (sec)		2.22												3.52		3.32

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		168												28		122
Capacity, c (veh/h)		1245												282		747
v/c Ratio		0.13												0.10		0.16
95% Queue Length, Q_{95} (veh)		0.5												0.3		0.6
Control Delay (s/veh)		8.3												19.2		10.8
Level of Service, LOS		A												C		B
Approach Delay (s/veh)		3.5												12.3		
Approach LOS														B		

HCS7 Two-Way Stop-Control Report

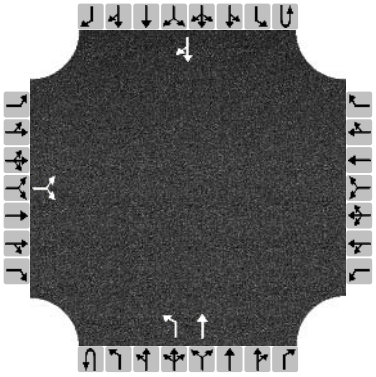
General Information

Analyst	R Marvin
Agency/Co.	Marvin & Associates
Date Performed	4/5/2017
Analysis Year	2027
Time Analyzed	Peak PM Future
Intersection Orientation	North-South
Project Description	Livingston Trans PLan Update

Site Information

Intersection	Park & Rogers
Jurisdiction	City of Livingston
East/West Street	Rogers Street
North/South Street	Park Street
Peak Hour Factor	0.56
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	0	0	0	1	1	0	0	0	1	0
Configuration			LR							L	T					TR
Volume, V (veh/h)		14		2						20	557				511	9
Percent Heavy Vehicles (%)		1		1						1						
Proportion Time Blocked																
Percent Grade (%)		0														
Right Turn Channelized		No				No				No				No		
Median Type/Storage		Left Only								1						

Critical and Follow-up Headways

Base Critical Headway (sec)		7.1		6.2						4.1						
Critical Headway (sec)		6.41		6.21						4.11						
Base Follow-Up Headway (sec)		3.5		3.3						2.2						
Follow-Up Headway (sec)		3.51		3.31						2.21						

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			29							36						
Capacity, c (veh/h)			199							741						
v/c Ratio			0.15							0.05						
95% Queue Length, Q_{95} (veh)			0.5							0.2						
Control Delay (s/veh)			26.2							10.1						
Level of Service, LOS			D							B						
Approach Delay (s/veh)		26.2								0.4						
Approach LOS		D														

HCS7 Two-Way Stop-Control Report

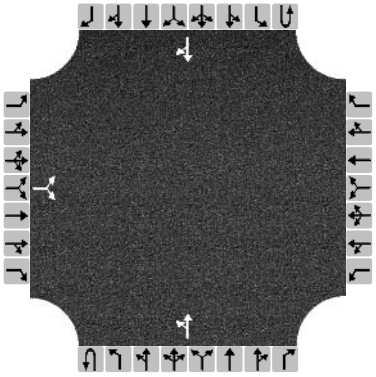
General Information

Analyst	R Marvin
Agency/Co.	Marvin & Associates
Date Performed	3/23/2017
Analysis Year	2027
Time Analyzed	Peak PM Future
Intersection Orientation	North-South
Project Description	Livingston Trans Plan Update

Site Information

Intersection	Sun & Star
Jurisdiction	Livingston
East/West Street	Sun Avenue
North/South Street	Star Avenue
Peak Hour Factor	0.94
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	0	0	0	0	1	0	0	0	1	0
Configuration			LR							LT						TR
Volume, V (veh/h)		0		56						136	66				35	0
Percent Heavy Vehicles (%)		0		0						0						
Proportion Time Blocked																
Percent Grade (%)		0														
Right Turn Channelized		No				No				No				No		
Median Type/Storage		Undivided														

Critical and Follow-up Headways

Base Critical Headway (sec)		7.1		6.2						4.1						
Critical Headway (sec)		6.40		6.20						4.10						
Base Follow-Up Headway (sec)		3.5		3.3						2.2						
Follow-Up Headway (sec)		3.50		3.30						2.20						

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			60							145						
Capacity, c (veh/h)			1041							1587						
v/c Ratio			0.06							0.09						
95% Queue Length, Q_{95} (veh)			0.2							0.3						
Control Delay (s/veh)			8.7							7.5						
Level of Service, LOS			A							A						
Approach Delay (s/veh)		8.7								5.3						
Approach LOS		A														

HCS7 Two-Way Stop-Control Report

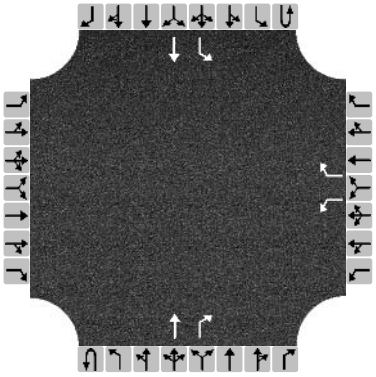
General Information

Analyst	R Marvin
Agency/Co.	Marvin Associates
Date Performed	8/25/2017
Analysis Year	2027
Time Analyzed	Peak PM Existing
Intersection Orientation	North-South
Project Description	Livingston Transportation Update

Site Information

Intersection	I-90 WB Ramps & Park St
Jurisdiction	City of Livingston
East/West Street	I-90 WB Ramps
North/South Street	Park Street
Peak Hour Factor	0.93
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		1	0	1	0	0	1	1	0	1	1	0
Configuration						L		R			T	R		L	T	
Volume, V (veh/h)						95		42			854	289		41	640	
Percent Heavy Vehicles (%)						8		8						5		
Proportion Time Blocked																
Percent Grade (%)						0										
Right Turn Channelized		No				No				No				No		
Median Type/Storage		Undivided														

Critical and Follow-up Headways

Base Critical Headway (sec)						7.1		6.2						4.1		
Critical Headway (sec)						6.48		6.28						4.15		
Base Follow-Up Headway (sec)						3.5		3.3						2.2		
Follow-Up Headway (sec)						3.57		3.37						2.24		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)						102		45						44		
Capacity, c (veh/h)						91		321						558		
v/c Ratio						1.12		0.14						0.08		
95% Queue Length, Q_{95} (veh)						6.9		0.5						0.3		
Control Delay (s/veh)						216.0		18.0						12.0		
Level of Service, LOS						F		C						B		
Approach Delay (s/veh)						155.4								0.7		
Approach LOS						F										

APPENDIX F

2027 INTERSECTION IMPROVEMENT CONCEPTS CAPACITY CALCULATIONS

HCS7 Two-Way Stop-Control Report

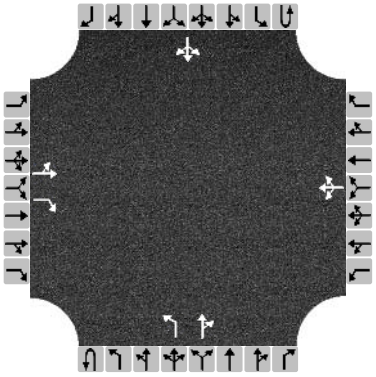
General Information

Analyst	R Marvin
Agency/Co.	Marvin & Associates
Date Performed	3/22/2017
Analysis Year	2027
Time Analyzed	Peak PM with NB LT Lane
Intersection Orientation	North-South
Project Description	Livingston Trans Plan Update

Site Information

Intersection	Front & 5th
Jurisdiction	Livingston
East/West Street	Front Street
North/South Street	5th Street
Peak Hour Factor	0.87
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	1		0	1	0	0	1	1	0	0	0	1	0
Configuration		LT		R			LTR			L		TR			LTR	
Volume, V (veh/h)		1	16	131		6	68	15		234	195	42		0	149	0
Percent Heavy Vehicles (%)		0	0	0		0	0	0		0				0		
Proportion Time Blocked																
Percent Grade (%)	0				0											
Right Turn Channelized	No				No				No				No			
Median Type/Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		7.1	6.5	6.2		7.1	6.5	6.2		4.1				4.1		
Critical Headway (sec)		7.10	6.50	6.20		7.10	6.50	6.20		4.10				4.10		
Base Follow-Up Headway (sec)		3.5	4.0	3.3		3.5	4.0	3.3		2.2				2.2		
Follow-Up Headway (sec)		3.50	4.00	3.30		3.50	4.00	3.30		2.20				2.20		

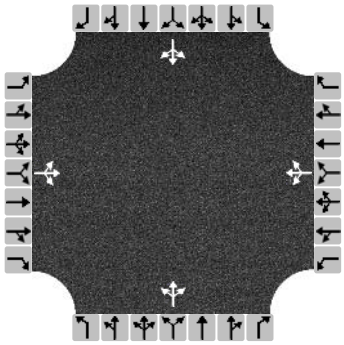
Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		19		151			102			269				0		
Capacity, c (veh/h)		193		859			225			1406				1291		
v/c Ratio		0.10		0.18			0.45			0.19				0.00		
95% Queue Length, Q_{95} (veh)		0.3		0.6			2.2			0.7				0.0		
Control Delay (s/veh)		25.7		10.1			33.7			8.2				7.8		
Level of Service, LOS		D		B			D			A				A		
Approach Delay (s/veh)	11.8				33.7				4.1				0.0			
Approach LOS	B				D											

HCS 2010 All-Way Stop-Control Summary Report

General Information		Site Information	
Analyst	R Marvin	Intersection	Front & 5th
Agency/Co.	Marvin & Associates	Jurisdiction	Livingston
Date Performed	3/23/2017	East/West Street	Front Street
Analysis Year	2027	North/South Street	5th Street
Time Analyzed	0.25	Peak Hour Factor	0.87
Anaylysis Time Period (hrs)	Peak PM Future 4-WaY Stop		
Project Description	Livingston Trans Plan Update		

Lanes



Vehicle Volume and Adjustments

Approach	Eastbound			Westbound			Northbound			Southbound		
Movement	L	T	R	L	T	R	L	T	R	L	T	R
Volume	1	16	131	6	68	15	234	195	42	0	149	40
% Thrus in Shared Lane												
Lane	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
Configuration	LTR			LTR			LTR			LTR		
Flow Rate, v (veh/h)	170			102			541			217		
Percent Heavy Vehicles	1			1			1			1		

Departure Headway and Service Time

Initial Departure Headway, hd (s)	3.20			3.20			3.20			3.20		
Initial Degree of Utilization, x	0.151			0.091			0.481			0.193		
Final Departure Headway, hd (s)	5.59			6.18			5.12			5.42		
Final Degree of Utilization, x	0.264			0.176			0.770			0.327		
Move-Up Time, m (s)	2.0			2.0			2.0			2.0		
Service Time, ts (s)	3.59			4.18			3.12			3.42		

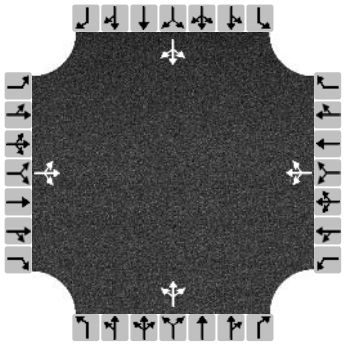
Capacity, Delay and Level of Service

Flow Rate, v (veh/h)	170			102			541			217		
Capacity	644			582			703			665		
95% Queue Length, Q_{95} (veh)	1.1			0.6			7.4			1.4		
Control Delay (s/veh)	10.6			10.5			23.1			11.0		
Level of Service, LOS	B			B			C			B		
Approach Delay (s/veh)	10.6			10.5			23.1			11.0		
Approach LOS	B			B			C			B		
Intersection Delay, s/veh | LOS	17.3						C					

HCS 2010 All-Way Stop-Control Summary Report

General Information		Site Information	
Analyst	R Marvin	Intersection	Front & 5th
Agency/Co.	Marvin & Associates	Jurisdiction	Livingston
Date Performed	3/23/2017	East/West Street	Front Street
Analysis Year	2027	North/South Street	5th Street
Time Analyzed	0.25	Peak Hour Factor	0.87
Anaylysis Time Period (hrs)	Peak AM Future 4-Way Stop		
Project Description	Livingston Trans Plan Update		

Lanes



Vehicle Volume and Adjustments

Approach	Eastbound			Westbound			Northbound			Southbound		
Movement	L	T	R	L	T	R	L	T	R	L	T	R
Volume	1	35	203	21	30	21	102	72	12	4	290	3
% Thrus in Shared Lane												
Lane	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
Configuration	LTR			LTR			LTR			LTR		
Flow Rate, v (veh/h)	275			83			214			341		
Percent Heavy Vehicles	1			1			1			1		

Departure Headway and Service Time

Initial Departure Headway, hd (s)	3.20			3.20			3.20			3.20		
Initial Degree of Utilization, x	0.244			0.074			0.190			0.303		
Final Departure Headway, hd (s)	5.06			5.79			5.50			5.24		
Final Degree of Utilization, x	0.386			0.133			0.327			0.497		
Move-Up Time, m (s)	2.0			2.0			2.0			2.0		
Service Time, ts (s)	3.06			3.79			3.50			3.24		

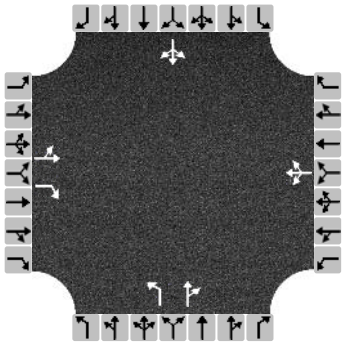
Capacity, Delay and Level of Service

Flow Rate, v (veh/h)	275			83			214			341		
Capacity	712			621			655			687		
95% Queue Length, Q_{95} (veh)	1.8			0.5			1.4			2.8		
Control Delay (s/veh)	11.2			9.7			11.1			13.3		
Level of Service, LOS	B			A			B			B		
Approach Delay (s/veh)	11.2			9.7			11.1			13.3		
Approach LOS	B			A			B			B		
Intersection Delay, s/veh | LOS	11.8						B					

HCS 2010 All-Way Stop-Control Summary Report

General Information		Site Information	
Analyst	R Marvin	Intersection	Front & 5th Street
Agency/Co.	Marvin & Associates	Jurisdiction	Livingston
Date Performed	5/13/2017	East/West Street	Front Street
Analysis Year	2027	North/South Street	5th Street
Time Analyzed	0.25	Peak Hour Factor	0.92
Anaylysis Time Period (hrs)	Peak PM NB LT 4 Way Stop		
Project Description	Livingston Trans Study Update		

Lanes



Vehicle Volume and Adjustments

Approach	Eastbound			Westbound			Northbound			Southbound		
Movement	L	T	R	L	T	R	L	T	R	L	T	R
Volume	1	16	131	6	68	15	234	195	42	0	149	0
% Thrus in Shared Lane												
Lane	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
Configuration	LT	R		LTR			L	TR		LTR		
Flow Rate, v (veh/h)	18	142		97			254	258		162		
Percent Heavy Vehicles	1	1		1			1	0		0		

Departure Headway and Service Time

Initial Departure Headway, hd (s)	3.20	3.20		3.20			3.20	3.20		3.20		
Initial Degree of Utilization, x	0.016	0.127		0.086			0.226	0.229		0.144		
Final Departure Headway, hd (s)	6.33	5.59		5.18			5.91	5.27		4.87		
Final Degree of Utilization, x	0.032	0.221		0.139			0.418	0.377		0.219		
Move-Up Time, m (s)	2.3	2.3		2.0			2.3	2.3		2.0		
Service Time, ts (s)	4.03	3.29		3.18			3.61	2.97		2.87		

Capacity, Delay and Level of Service

Flow Rate, v (veh/h)	18	142		97			254	258		162		
Capacity	569	643		695			609	684		740		
95% Queue Length, Q_{95} (veh)	0.1	0.8		0.5			2.1	1.8		0.8		
Control Delay (s/veh)	9.2	9.9		9.0			12.8	11.1		9.2		
Level of Service, LOS	A	A		A			B	B		A		
Approach Delay (s/veh)	9.8			9.0			11.9			9.2		
Approach LOS	A			A			B			A		
Intersection Delay, s/veh | LOS	10.8						B					

HCM Analysis Summary

Lingston Trans Plan Update	Park Street/5th Street	Area Type: Non CBD
R Marvin	3/23/17	Analysis Duration: 15 mins.
Peak AM 2027	Case: 2027 PARK AND 5TH AM	

Lanes			Geometry: Movements Serviced by Lane and Lane Widths (feet)											
	Approach	Outbound	Lane 1		Lane 2		Lane 3		Lane 4		Lane 5		Lane 6	
EB	2	1	L	12.0	TR	12.0								
WB	2	1	L	12.0	TR	12.0								
NB	1	1	LTR	12.0										
SB	1	1	LTR	12.0										

	East			West			North			South		
Data	L	T	R	L	T	R	L	T	R	L	T	R
Movement Volume (vph)	104	405	6	1	320	17	14	45	6	142	146	263
PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
% Heavy Vehicles	2	2	2	2	2	2	2	2	2	2	2	2
Lane Groups	L	TR		L	TR			LTR			LTR	
Arrival Type	3	3		3	3			3			3	
RTOR Vol (vph)	0			2			0			30		
Peds/Hour	5			5			5			5		
% Grade	0			0			0			0		
Buses/Hour	0			0			0			0		
Parkers/Hour (Left|Right)	---	---		---	---		---	---		---	---	

Signal Settings: Actuated Operational Analysis Cycle Length: 90.0 Sec Lost Time Per Cycle: 13.0 Sec

Phase:	1	2	3	4	5	6	7	8	Ped Only
EB	LTR	LTP							
WB		LTP							
NB			LTP						
SB			LTP						
Green	10.0	26.0	41.0						0
Yellow / All Red	3.0 / 0.0	3.5 / 1.5	3.5 / 1.5						

		Capacity Analysis Results							Approach:	
App	Lane Group	Cap (vph)	v/s Ratio	g/C Ratio	Lane Group	v/c Ratio	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
EB	Lper	173	0.000	0.344					20.8	C
	* Lpro	197	0.063	0.111	L	0.300	17.9	B		
	TR	806	0.235	0.433	TR	0.542	21.5	C		
WB										
	L	238	0.001	0.289	L	0.004	22.8	C	34.6	C
	* TR	534	0.193	0.289	TR	0.667	34.6	C		
NB										
	LTR	740	0.042	0.456	LTR	0.093	14.0	B	14.0	B
SB										
	* LTR	704	0.359	0.456	LTR	0.787	26.2	C	26.2	C

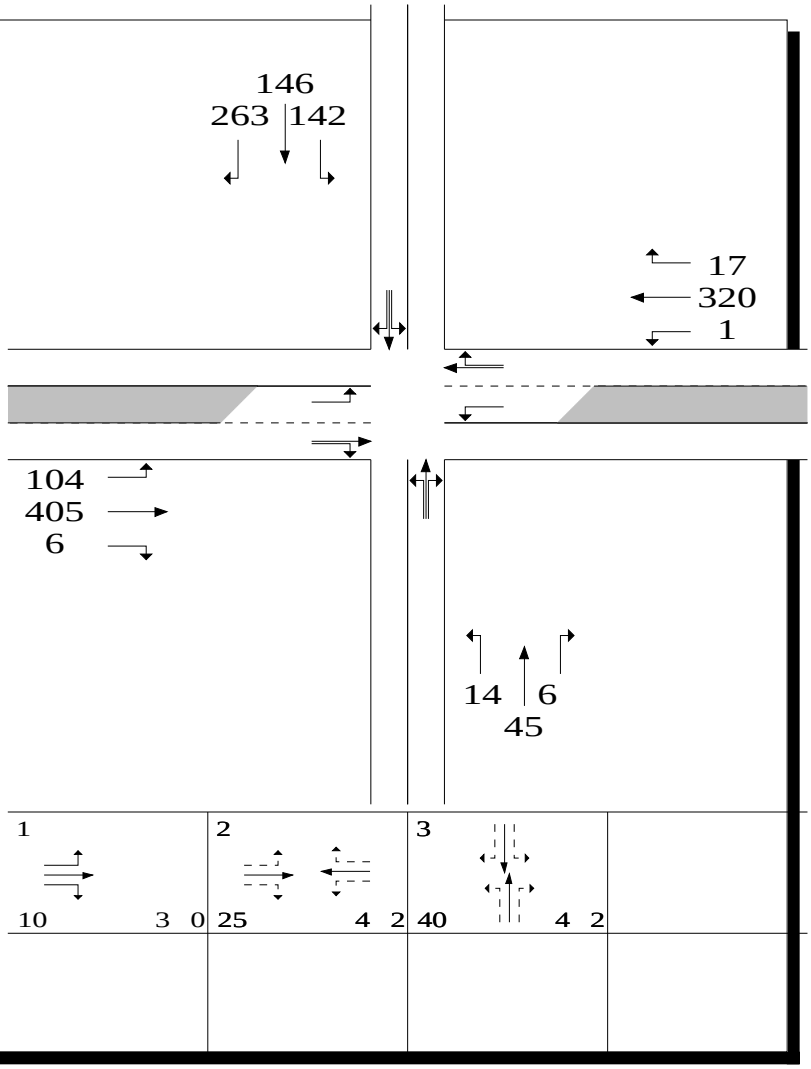
Intersection: Delay = 25.7 sec/veh Int. LOS=C X_c= 0.72 * Critical Lane Group Σ(v/s)Crit= 0.61

NETSIM Summary Results

Lingston Trans Plan Update
R Marvin
Peak AM 2027

Park Street/5th Street
3/23/17
Case: 2027 PARK AND 5TH AM

App	Lane Group	Queues Per Lane Avg/Max (veh)	Average Speed (mph)	Spillback in Worst Lane (% of Peak Period)
EB	L	3 / 5	4.5	0.0
	TR	7 / 8	14.0	0.0
	All		11.7	0.0
WB	L	0 / 0	0.0	0.0
	TR	6 / 7	10.2	0.0
	All		10.2	0.0
NB	LTR	1 / 1	15.6	0.0
	All		15.6	0.0
SB	LTR	9 / 10	10.8	0.0
	All		10.8	0.0
Intersect.			11.1	



HCM Analysis Summary

Livingston Trans Plan Update	Park Street/5th Street	Area Type: Non CBD
R Marvin	3/23/17	Analysis Duration: 15 mins.
Peak AM 2027 SB RT Lane	Case: 2027 Park and 5th SB RT Ln AM	

Lanes			Geometry: Movements Serviced by Lane and Lane Widths (feet)											
	Approach	Outbound	Lane 1		Lane 2		Lane 3		Lane 4		Lane 5		Lane 6	
EB	2	1	L	12.0	TR	12.0								
WB	2	1	L	12.0	TR	12.0								
NB	1	1	LTR	12.0										
SB	2	1	LT	12.0	R	12.0								

	East			West			North			South		
Data	L	T	R	L	T	R	L	T	R	L	T	R
Movement Volume (vph)	104	405	6	1	320	17	14	45	6	142	146	263
PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
% Heavy Vehicles	1	4	0	0	4	1	0	0	0	1	0	1
Lane Groups	L	TR		L	TR			LTR			LT	R
Arrival Type	3	3		3	3			3			3	3
RTOR Vol (vph)	0			5			0			140		
Peds/Hour	5			5			5			5		
% Grade	0			0			0			0		
Buses/Hour	0			0			0			0		
Parkers/Hour (Left|Right)	---	---		---	---		---	---		---	---	

Signal Settings: Actuated Operational Analysis Cycle Length: 80.0 Sec Lost Time Per Cycle: 14.0 Sec

Phase:	1	2	3	4	5	6	7	8	Ped Only
EB	LTP	LTP							
WB		LTP							
NB			LTP						
SB	R		LTP						
Green	12.0	29.0	25.0						0
Yellow / All Red	4.0 / 0.0	3.5 / 1.5	3.5 / 1.5						

		Capacity Analysis Results							Approach:	
App	Lane Group	Cap (vph)	v/s Ratio	g/C Ratio	Lane Group	v/c Ratio	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
EB	Lper	278	0.000	0.425					11.0	B
	* Lpro	268	0.062	0.150	L	0.203	9.6	A		
	TR	1025	0.240	0.563	TR	0.426	11.4	B		
WB										
	L	350	0.001	0.363	L	0.003	16.3	B	23.3	C
	* TR	658	0.194	0.363	TR	0.536	23.3	C		
NB										
	LTR	533	0.040	0.313	LTR	0.129	19.7	B	19.7	B
SB										
	* LT	478	0.200	0.313	LT	0.640	25.9	C	21.2	C
	R	815	0.082	0.512	R	0.161	10.4	B		

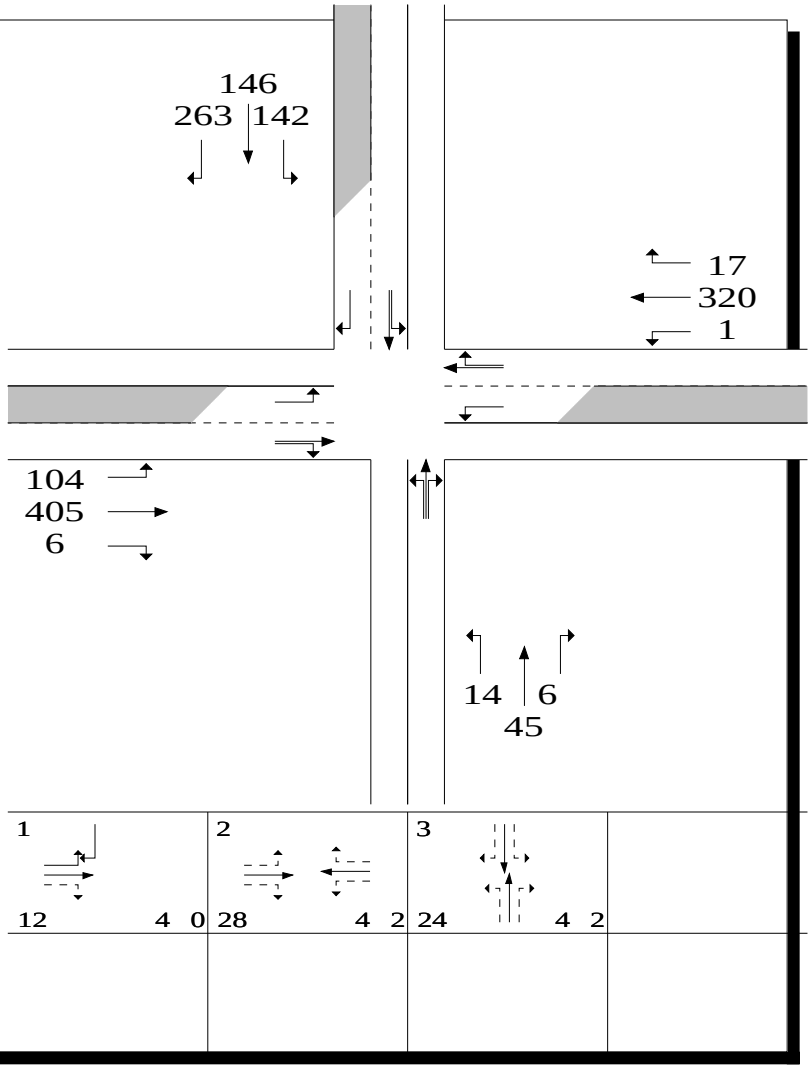
Intersection: Delay = 17.7 sec/veh Int. LOS=B X_c= 0.55 * Critical Lane Group Σ(v/s)Crit= 0.46

NETSIM Summary Results

Livingston Trans Plan Update
R Marvin
Peak AM 2027 SB RT Lane

Park Street/5th Street
3/23/17
Case: 2027 Park and 5th SB RT Ln AM

App	Lane Group	Queues Per Lane Avg/Max (veh)	Average Speed (mph)	Spillback in Worst Lane (% of Peak Period)
EB	L	2 / 4	8.3	0.0
	TR	5 / 7	17.5	0.0
	All		16.0	0.0
WB	L	0 / 0	0.0	0.0
	TR	5 / 6	11.4	0.0
	All		11.4	0.0
NB	LTR	1 / 2	11.2	0.0
	All		11.2	0.0
SB	LT	5 / 7	12.9	0.0
	R	2 / 3	15.7	0.0
	All		13.5	0.0
Intersect.			13.6	



HCM Analysis Summary

Lingston Trans Plan Update	Park Street/5th Street	Area Type: Non CBD
R Marvin	3/23/17	Analysis Duration: 15 mins.
Peak PM 2027 SB RT Lane	Case: 2027 Park and 5th SB RT Ln	

Lanes			Geometry: Movements Serviced by Lane and Lane Widths (feet)											
	Approach	Outbound	Lane 1		Lane 2		Lane 3		Lane 4		Lane 5		Lane 6	
EB	2	1	L	12.0	TR	12.0								
WB	2	1	L	12.0	TR	12.0								
NB	1	1	LTR	12.0										
SB	2	1	LT	12.0	R	12.0								

	East			West			North			South		
Data	L	T	R	L	T	R	L	T	R	L	T	R
Movement Volume (vph)	305	624	5	16	462	27	75	113	9	55	51	171
PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
% Heavy Vehicles	1	4	0	0	4	1	0	0	0	1	0	1
Lane Groups	L	TR		L	TR			LTR			LT	R
Arrival Type	3	3		3	3			3			3	3
RTOR Vol (vph)	0			7			0			85		
Peds/Hour	5			5			5			5		
% Grade	0			0			0			0		
Buses/Hour	0			0			0			0		
Parkers/Hour (Left|Right)	---	---		---	---		---	---		---	---	

Signal Settings: Actuated Operational Analysis Cycle Length: 80.0 Sec Lost Time Per Cycle: 14.0 Sec

Phase:		1		2		3		4		5		6		7		8		Ped Only
EB		LTP		LTP														
WB				LTP														
NB						LTP												
SB		R				LTP												
Green		12.0		29.0		25.0												0
Yellow	All Red	4.0	0.0	3.5	1.5	3.5	1.5											

		Capacity Analysis Results							Approach:	
App	Lane Group	Cap (vph)	v/s Ratio	g/C Ratio	Lane Group	v/c Ratio	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
EB	Lper	153	0.155	0.425					18.6	B
	* Lpro	268	0.150	0.150	L	0.770	25.6	C		
	TR	1027	0.367	0.563	TR	0.651	15.3	B		
WB										
	L	237	0.026	0.363	L	0.072	17.3	B	31.0	C
	* TR	658	0.282	0.363	TR	0.778	31.5	C		
NB										
	* LTR	496	0.132	0.313	LTR	0.423	22.0	C	22.0	C
SB										
	LT	462	0.077	0.313	LT	0.245	20.6	C	15.9	B
	R	815	0.057	0.512	R	0.112	10.1	B		

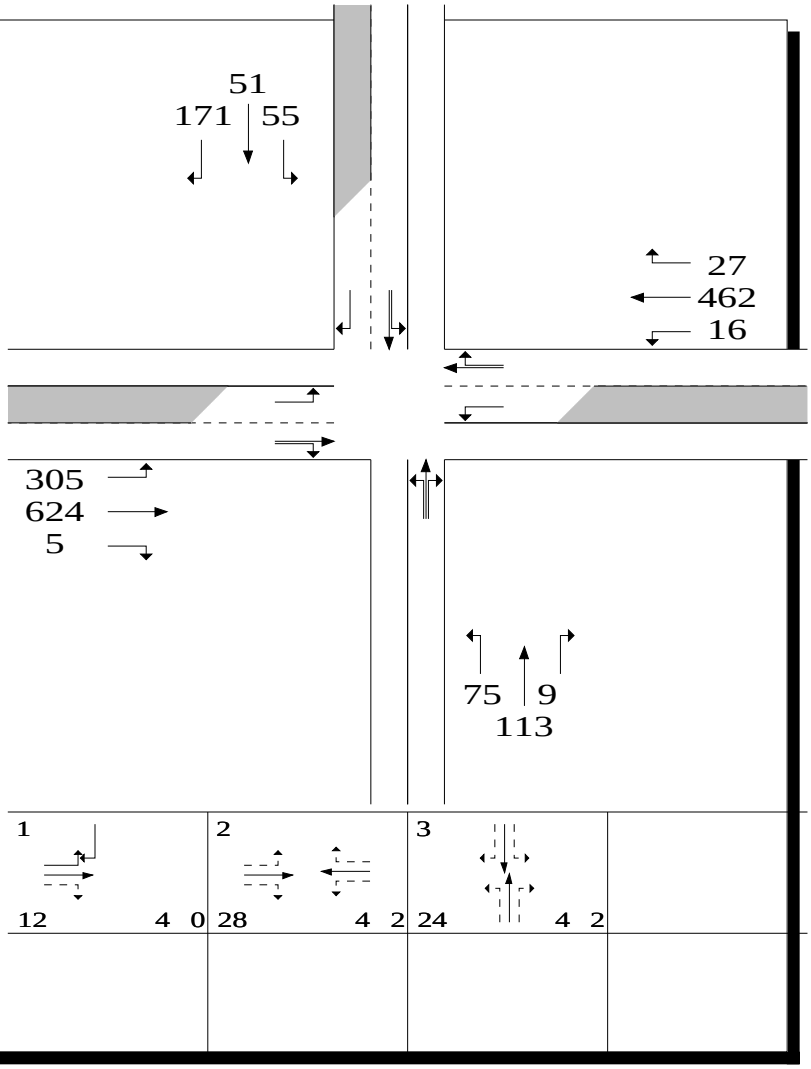
Intersection: Delay = 22.1 sec/veh Int. LOS=C X_c= 0.68 * Critical Lane Group Σ(v/s)Crit= 0.56

NETSIM Summary Results

Lingston Trans Plan Update
R Marvin
Peak PM 2027 SB RT Lane

Park Street/5th Street
3/23/17
Case: 2027 Park and 5th SB RT Ln

App	Lane Group	Queues Per Lane Avg/Max (veh)	Average Speed (mph)	Spillback in Worst Lane (% of Peak Period)
EB	L	5 / 8	5.9	0.0
	TR	8 / 10	16.1	0.0
	All		13.2	0.0
WB	L	0 / 1	7.3	0.0
	TR	8 / 10	10.3	0.0
	All		10.2	0.0
NB	LTR	3 / 4	10.7	0.0
	All		10.7	0.0
SB	LT	1 / 2	16.6	0.0
	R	1 / 2	15.6	0.0
	All		16.2	0.0
Intersect.			12.3	



HCS7 Two-Way Stop-Control Report

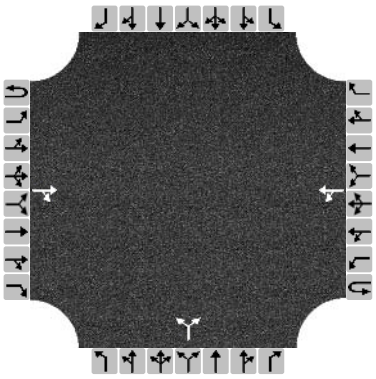
General Information

Analyst	R Marvin
Agency/Co.	Marvin & Associates
Date Performed	3/22/2017
Analysis Year	2017
Time Analyzed	Peak PM Main St One-way
Intersection Orientation	East-West
Project Description	Livingston Trans Plan Update

Site Information

Intersection	Park & 2nd St
Jurisdiction	Livingston
East/West Street	Park Street
North/South Street	2nd Street
Peak Hour Factor	0.92
Analysis Time Period (hrs)	0.25

Lanes



Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	1	0		0	0	0
Configuration				TR		LT					LR					
Volume, V (veh/h)			670	40		35	385			70		100				
Percent Heavy Vehicles (%)						0				0		0				
Proportion Time Blocked																
Percent Grade (%)										0						
Right Turn Channelized		No				No				No				No		
Median Type/Storage			Undivided													

Critical and Follow-up Headways

Base Critical Headway (sec)						4.1				7.1		6.2				
Critical Headway (sec)						4.10				6.40		6.20				
Base Follow-Up Headway (sec)						2.2				3.5		3.3				
Follow-Up Headway (sec)						2.20				3.50		3.30				

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)						38					185					
Capacity, c (veh/h)						838					263					
v/c Ratio						0.05					0.70					
95% Queue Length, Q_{95} (veh)						0.1					4.8					
Control Delay (s/veh)						9.5					45.9					
Level of Service, LOS						A					E					
Approach Delay (s/veh)						1.3					45.9					
Approach LOS											E					

HCM Analysis Summary

Main St One-way Concept Signal@ 2nd	Park Street/2nd Street	Area Type: Non CBD
R Marvin	08/31/2017	Analysis Duration: 15 mins.
Peak PM 2027	Case: Park & 2nd Main St Oneway 2027 PM	

Lanes			Geometry: Movements Serviced by Lane and Lane Widths (feet)											
	Approach	Outbound	Lane 1		Lane 2		Lane 3		Lane 4		Lane 5		Lane 6	
EB	1	1	TR	12.0										
WB	2	1	L	12.0	T	12.0								
NB	1	0	LR	12.0										
SB	0	1												

	East			West			North			South		
Data	L	T	R	L	T	R	L	T	R	L	T	R
Movement Volume (vph)	0	780	45	40	450	0	80	0	115	0	0	0
PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
% Heavy Vehicles	2	4	0	0	4	2	1	2	1	2	2	2
Lane Groups		TR		L	T			LR				
Arrival Type		3		3	3			3				
RTOR Vol (vph)		5			0			15			0	
Peds/Hour		10			5			20			5	
% Grade		0			0			0			0	
Buses/Hour		0			0			0			0	
Parkers/Hour (Left|Right)	---	---		---	---		---	---		---	---	

Signal Settings: Actuated Operational Analysis Cycle Length: 80.0 Sec Lost Time Per Cycle: 10.0 Sec

Phase:		1		2		3		4		5		6		7		8		Ped Only
EB		TP																
WB		LT																
NB				L P														
SB																		
Green		55.0		15.0														0
Yellow	All Red	3.5	1.5	3.5	1.5													

		Capacity Analysis Results							Approach:	
App	Lane Group	Cap (vph)	v/s Ratio	g/C Ratio	Lane Group	v/c Ratio	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
EB										
	* TR	1247	0.502	0.688	TR	0.731	11.6	B	11.6	B
WB										
	L	355	0.085	0.688	L	0.124	5.0	A	6.2	A
	T	1256	0.274	0.688	T	0.398	6.3	A		
NB										
	* LR	308	0.122	0.188	LR	0.649	33.8	C	33.8	C

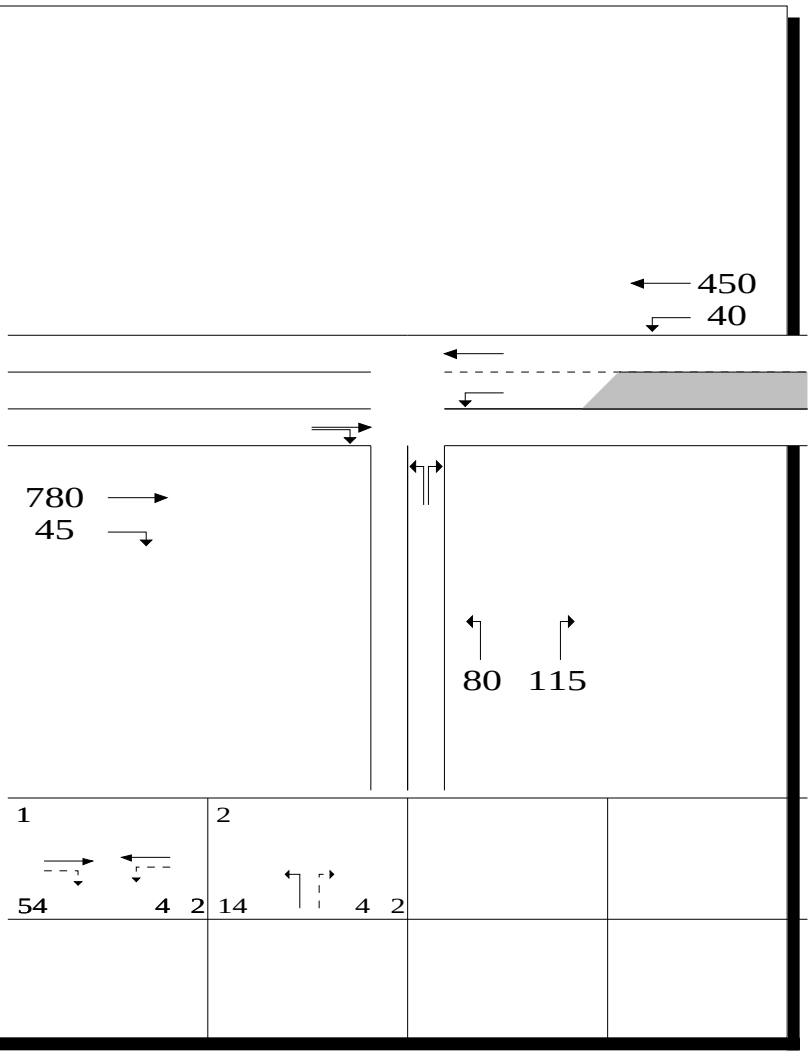
Intersection: Delay = 12.5 sec/veh Int. LOS=B X_c= 0.71 * Critical Lane Group Σ(v/s)Crit= 0.62

NETSIM Summary Results

Main St One-way Concept Signal@ 2nd
R Marvin
Peak PM 2027

Park Street/2nd Street
08/31/2017
Case: Park & 2nd Main St Oneway 2027 PM

App	Lane Group	Queues Per Lane Avg/Max (veh)	Average Speed (mph)	Spillback in Worst Lane (% of Peak Period)
EB	TR	8 / 10	16.8	0.0
	All		16.8	0.0
WB	L	0 / 1	13.5	0.0
	T	4 / 6	19.7	0.0
	All		19.4	0.0
NB	LR	4 / 5	9.4	0.0
	All		9.4	0.0
Intersect.			15.9	



HCM Analysis Summary

Improvement Concept Year 2027	/Park Street	Area Type: Non CBD
R Marvin	09/02/2017	Analysis Duration: 15 mins.
Peak PM Hour	Case: Park & I90 WB 2027 PM	

Lanes			Geometry: Movements Serviced by Lane and Lane Widths (feet)											
	Approach	Outbound	Lane 1		Lane 2		Lane 3		Lane 4		Lane 5		Lane 6	
EB	0	1												
WB	2	0	L	12.0	R	12.0								
NB	2	1	T	12.0	R	12.0								
SB	2	1	L	12.0	T	12.0								

	East			West			North			South		
Data	L	T	R	L	T	R	L	T	R	L	T	R
Movement Volume (vph)	0	0	0	95	0	42	0	854	289	41	640	0
PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
% Heavy Vehicles	2	2	2	5	2	3	2	3	5	3	3	2
Lane Groups				L		R		T	R	L	T	
Arrival Type				3		3		3	3	3	3	
RTOR Vol (vph)		0			0			50			0	
Peds/Hour		5			0			10			5	
% Grade		0			0			0			0	
Buses/Hour		0			0			0			0	
Parkers/Hour (Left|Right)	---	---		---	---		---	---		---	---	

Signal Settings: Actuated Operational Analysis Cycle Length: 75.0 Sec Lost Time Per Cycle: 11.0 Sec

Phase:	1	2	3	4	5	6	7	8	Ped Only
EB									
WB	L R								
NB		TP							
SB		LT							
Green	20.0	44.0							0
Yellow / All Red	3.5 / 1.5	4.0 / 2.0							

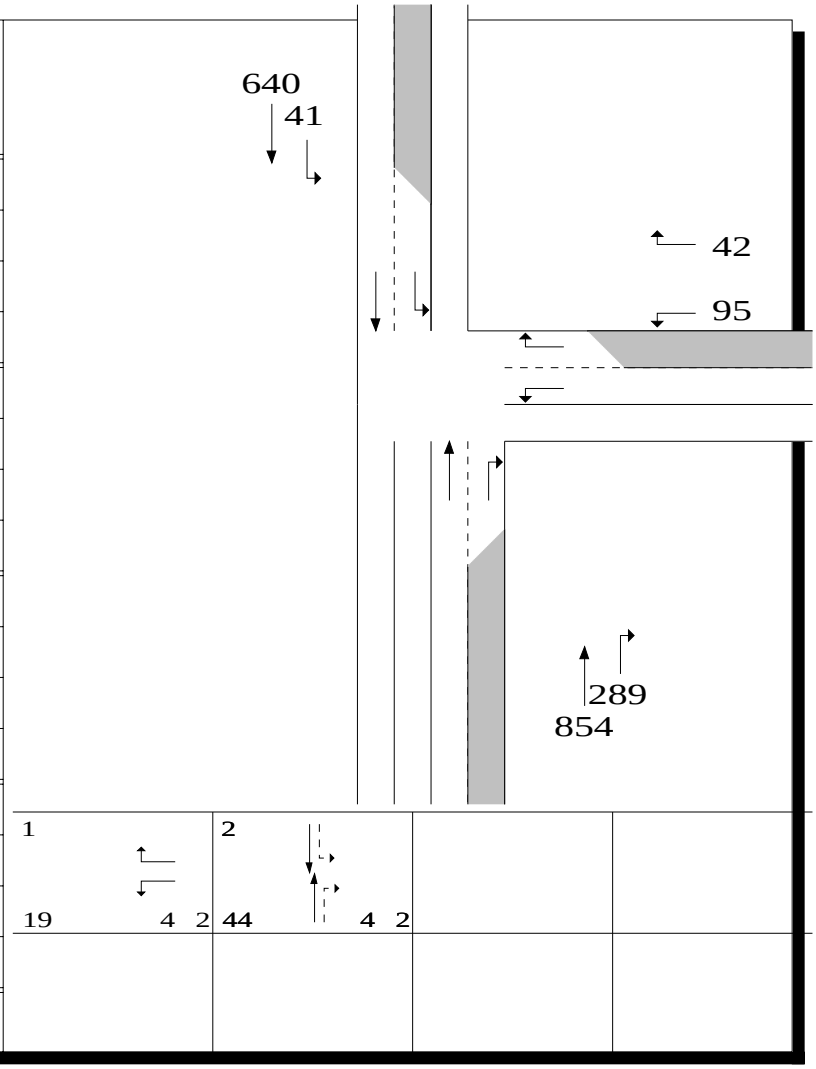
		Capacity Analysis Results							Approach:	
App	Lane Group	Cap (vph)	v/s Ratio	g/C Ratio	Lane Group	v/c Ratio	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
WB										
	* L	458	0.062	0.267	L	0.231	21.6	C	21.4	C
	R	418	0.030	0.267	R	0.112	20.8	C		
NB										
	* T	1082	0.514	0.587	T	0.877	23.2	C	20.0	C
	R	895	0.174	0.587	R	0.297	8.6	A		
SB										
	L	120	0.225	0.587	L	0.383	17.3	B	13.8	B
	T	1082	0.385	0.587	T	0.657	13.6	B		

Intersection: Delay = 17.9 sec/veh Int. LOS=B X_c= 0.68 * Critical Lane Group Σ(v/s)Crit= 0.58

NETSIM Summary Results

Improvement Concept Year 2027 /Park Street
R Marvin 09/02/2017
Peak PM Hour Case: Park & I90 WB 2027 PM

App	Lane Group	Queues Per Lane Avg/Max (veh)	Average Speed (mph)	Spillback in Worst Lane (% of Peak Period)
	All		10.9	0.0
WB	L	2 / 3	12.7	0.0
	R	1 / 2	2.6	0.0
	All		7.0	11.1
NB	T	19 / 25	6.8	11.1
	R	5 / 8	14.1	0.0
	All		9.3	0.0
SB	L	5 / 8	1.0	0.0
	T	7 / 10	15.5	0.0
Intersect.			7.9	



APPENDIX G

2017 OPERATIONAL INVEMTORY OF COORIDOR CRASH LOCATIONS

Callender Street Corridor - Operational Inventory of Crash Locations

Intersection	No. of Crashes	Controls	Parking Occupancy Low	Med	High	Sight Restrictions	Comments
Park Street	NA	Stop on Callender		X		None	
9th Street	4	Uncontrolled		X		Trees NW Corner	
8th Street	5	Stop on 8th Street		X		Trees NE Corner	
7th Street	4	Stop on 7th Street		X		Trees NW Corner	No Stop Sign on NB Approach
6th Street	4	Uncontrolled		X		Hedge NE Corner	
Alley	2		X			Fence & Trees E Side	
5th Street	2	Stop on Callender		X		None	
Yellowstone	3	Uncontrolled	X			None	
3rd Street	5	Uncontrolled		X		Buildings in SE & NW Corners	Should have stop control on 3rd
Alley	4				X	Wall NW Corner	
2nd Street	0	4-Way Stop			X	Buildings in NE, SE, SW Corners	
Alley	2				X	Buildings & Cars	
Main Street	6	4-Way Stop			X	Buildings All Corners	
Alley	4				X	Buildings & Cars	
B Street	3	Stop on B			X	Buildings All Corners	
C Street	2	Uncontrolled		X		Buildings West Side	
D Street	1	Uncontrolled			X	Trees N Side, Park ed Cars S Side	
E Street	0	Uncontrolled			X	None	
Alley	1			X		Trees & Cars	
F Street	0	Uncontrolled		X		Trees NW Corner	
G Street	1	Uncontrolled		X		Trees Sw & House SE Corners	
H Street	3	Stop on Callender	X			House & Trees S\NW Corner	
I Street	0	Uncontrolled	X			None	
K Street	0	Uncontrolled		X		Wall & Trees SE & Hedge SW	
Alley	3		X			Trees All Corners	
L Street	0	Uncontrolled	X			Hedge SE & Houses W Side	
Alley	1		X			Steep Alley Approach	
M Street	0	Uncontrolled	X			Trees W Side	

Lewis Street Corridor - Operational Inventory of Crash Locations

Intersection		Controls	Parking Occupancy Low	Med	High	Sight Restrictions	Comments
8th Street	2	Stop on 8th Street		X		Trees W Side	
Alley	2		X			Trees & Walls	
6th Street	2	Stop on 6th		X		Trees NW Corner	
Alley	2				X	Trees	
5th Street	1	Stop on 5th	X			Trees SW Corner	Camper parked near intersection
Alley Yell & 3rd	3				X	Building & Fences	
3rd Street	2	Stop on 3rd			X	Building SW Corner	Cars Parked near intersection
Alley	2			X		Buidlings & Fence	
2nd Street	2	4-Way Stop	X			Buildings in NW Corner	
Alley	7				X	Buildings Parked Cars	Buses parked along S side
Main Street	3	4-Way Stop			X	Buildings & Parked Cars	
Alley	1				X	Buildings & Parked Cars	
B Street	1	Stop on B			X	Buildings on S Side Cars	
Alley	2				X	Trees SW Corner	
C Street	2	Uncontrolled		X		House NE Corner	
D Street	1	Stop on D		X		Parked Cars E Side	
Alley E & F	1			X		Parked Cars & Trees	
G Street	1	Stop on G Street	X			Parked Van	
H Street	3	Stop on Lewis		X		Buildings & Walls 4 Corners	
Alley	1		X			Trees NW Corner	
Alley K & L	3		X			Fence & Wall N Side	
Alley L & M	1		X			Fench NW Corner	

South Main Street Corridor - Operational Inventory of Crash Locations

Intersection		Controls	Parking Occupancy Low	Med	High	Sight Restrictions	Comments
River Drive	2	Stop on River Road	X			Trees East Side	Trees Obscure SD in Curve
Geyser Street	4	4-Way Stop		X		Buildings in NW & SW Corners	
Clark Street	2	4-way Stop	X			Buildings W Side & NE Corner	
Alley	1				X	Angle Parking & Buildings	Angle Parking East Side
Lewis Street	3	4-Way Stop			X	Buildings & Parked Cars	Angle Parking East Side
Midblock	9				X	Buildings & Parked Cars	Angle Parking East Side
Callender Street	6	4-Way Stop			X	Buildings & Parked Cars	Angle Parking East Side
Midblock to Park	10				X	Parked Cars	Drive-in Bankk Access West Side

North Main Street Corridor - Operational Inventory of Crash Locations

Intersection		Controls	Parking Occupancy Low	Med	High	Sight Restrictions	Comments
Park-Front	21	Stop on River Road	NP			Combination of Underpass and reverse Curves	
Geyser Street	9	4-Way Stop	NP			Beram SW & Wall NW Corners	

APPENDIX H

TRAFFIC SIGNAL WARRANTS

Traffic Signal Warrant Analysis Worksheet

Intersection:	**Park Street and 2nd Street**
Case:	Existing Conditions
Date:	June 12, 2014

Major Street:	Park Street	**Minor Street 1:**		**Minor Street 2:**	2nd Street
Major Street Dir. (N-S or E-W):	E-W	**Minor Street 1 Dir. (N-S or E-W):**		**Minor Street 2 Dir. (N-S or E-W):**	N-S
		Approach Dir. (EB or WB)		**Approach Dir. (NB or SB)**	WB

Major Street Speed Limit:	25 mph	***Major Street 85th % Speed:***	25 mph	***Total Intersection Approaches:*** 3

Hour Beginning		**7 am**	**8am**	**9am**	**10am**	**11am**	**12pm**	**1pm**	**2pm**	**3pm**	**4pm**	**5pm**	**6pm**
Park Street	**EB**	179	263	329	382	464	525	525	495	500	677	585	437
Park Street	**WB**	269	395	455	486	502	525	525	457	480	415	423	403
0	**0**	0	0	0	0	0	0	0	0	0	0	0	0
2nd Street	**NB**	130	159	162	194	194	205	203	197	208	211	194	162
Major Approach Totals		**448**	**658**	**784**	**868**	**966**	**1050**	**1050**	**952**	**980**	**1092**	**1008**	**840**
Max Minor Approach Vol.		**130**	**159**	**162**	**194**	**194**	**205**	**203**	**197**	**208**	**211**	**194**	**162**
Total Entering Volume		**784**	**817**	**946**	**1062**	**1160**	**1255**	**1253**	**1149**	**1188**	**1303**	**1202**	**1002**
Entering Hour Ranks		**12**	**11**	**10**	**7**	**2**	**3**	**4**	**8**	**6**	**1**	**5**	**9**

Volume Warrants	**Condition A**				**Condition B**			
	Values		**Minimums**		**Values**		**Minimums**	
	Major (Total Entering)	*Minor*	*Major (Total Entering)*	*Minor*	*Major*	*Minor*	*Major*	*Minor*
8th Hour Vehicular Volume Warrant	952	197	***500***	***150***	952	197	***750***	***75***
4th Hour Vehicular Volume Warrant	1050	203	***1050***	***90***				
Peak Hour Vehicular Volume Warrant	1092	211	***800***	***150***	1092	211	***1092***	***178***
Crash Experience Warrant	952	197	***400***	***120***	952	197	***600***	***60***
Roadway Network Warrant	1303		***1000***					

Warrant # 1 - Eight-hour Vehicular Volume

Warrant 1 Condition A Met	YES	131.3%
Warrant 1 Condition B Met	YES	262.7%

Warrant # 2 - Four-hour Vehicular Volume

Warrant 2 Conditions Met	YES	225.6%

Warrant # 3 - Peak Hour

Warrant 3 Condtion A.1 Met	NO	35.0%
Warrant 3 Condtion A.2 Met	YES	140.7%
Warrant 3 Condtion A.3 Met	YES	136.5%
Warrant 3 Condtion B Met	YES	118.5%

Warrant # 4 - Pedestrian Volumes

Warrant 4 Condtion A Met	NO	20.0%
Warrant 4 Condition B Met	NO	20.0%

Warrant # 5 - School Crossing

Warrant 5 Condtions Met	NA	NA

Warrant # 6 - Coordinated Signal System

Warrant 6 Condtions Met	NO	N/A

Warrant # 7 - Crash Experience

Warrant 7 Condtion A Met	YES	164.2%
Warrant 7 Condtion B Met	Yes	158.7%
Warrant 7 Condtion C Met	NO	33.0%

Warrant # 8 - Roadway Network

Warrant 8 Condtions Met	NO	130.3%

Warrant # 9 - Intersection Near Grade Crossing

Warrant 9 Condtions Met	NO	N/A

Warrant Number and Title		***Met***	***Percent Met***
1	**Eight-hour Vehicular Volume**	**YES**	**262.7%**
2	**Four-hour Vehicular Volume**	**YES**	**225.6%**
3	**Peak Hour**	**YES**	**118.5%**
4	**Pedestrian Volumes**	**NO**	**20.0%**
5	**School Crossing**	**N/A**	**N/A**
6	**Coordinated Signal System**	**N/A**	**N/A**
7	**Crash Experience**	**NO**	**164.2%**
8	**Roadway Network**	**NO**	**130.3%**
9	**Intersection Near Grade Crossing**	**N/A**	**N/A**
Total Number of Warrants Met			**3**

Traffic Signal Warrant Analysis Worksheet

Intersection:	**Park Street and I-90 WB Ramps**
Case:	Existing Conditions
Date:	June 12, 2014

Major Street:	Park Street	**Minor Street 1:**		**Minor Street 2:**	I-90 WB Ramps
Major Street Dir. (N-S or E-W):	N-S	**Minor Street 1 Dir. (N-S or E-W):**		**Minor Street 2 Dir. (N-S or E-W):**	E-W
		Approach Dir. (EB or WB)		**Approach Dir. (EB or WB)**	WB

Major Street Speed Limit:	35 mph	***Major Street 85th % Speed:***	25 mph	***Total Intersection Approaches:*** 3

Hour Beginning		**7 am**	**8am**	**9am**	**10am**	**11am**	**12pm**	**1pm**	**2pm**	**3pm**	**4pm**	**5pm**	**6pm**
Park Street	**NB**	269	395	494	573	696	798	803	743	750	855	958	677
Park Street	**SB**	346	508	585	625	646	684	662	588	617	599	547	536
0	**0**	0	0	0	0	0	0	0	0	0	0	0	0
I-90 WB Ramps	**WB**	72	89	90	108	108	116	108	110	116	123	113	77
Major Approach Totals		**615**	**903**	**1079**	**1198**	**1342**	**1482**	**1465**	**1331**	**1367**	**1454**	**1505**	**1213**
Max Minor Approach Vol.		**72**	**89**	**90**	**108**	**108**	**116**	**108**	**110**	**116**	**123**	**113**	**77**
Total Entering Volume		**784**	**992**	**1169**	**1306**	**1450**	**1598**	**1573**	**1441**	**1483**	**1577**	**1618**	**1290**
Entering Hour Ranks		**12**	**11**	**10**	**8**	**6**	**2**	**4**	**7**	**5**	**3**	**1**	**9**

Volume Warrants	**Condition A**				**Condition B**			
	Values		**Minimums**		**Values**		**Minimums**	
	Major (Total Entering)	*Minor*	*Major (Total Entering)*	*Minor*	*Major*	*Minor*	*Major*	*Minor*
8th Hour Vehicular Volume Warrant	1198	108	***500***	***200***	1198	108	***750***	***100***
4th Hour Vehicular Volume Warrant	1465	108	***1465***	***115***				
Peak Hour Vehicular Volume Warrant	1505	113	***800***	***150***	1505	113	***1505***	***150***
Crash Experience Warrant	1198	108	***400***	***160***	1198	108	***600***	***80***
Roadway Network Warrant	1618		***1000***					

Warrant # 1 - Eight-hour Vehicular Volume

Warrant 1 Condition A Met	NO	54.0%
Warrant 1 Condition B Met	YES	108.0%

Warrant # 2 - Four-hour Vehicular Volume

Warrant 2 Conditions Met	NO	93.9%

Warrant # 3 - Peak Hour

Warrant 3 Condtion A.1 Met	NO	35.0%
Warrant 3 Condtion A.2 Met	NO	75.3%
Warrant 3 Condtion A.3 Met	YES	188.1%
Warrant 3 Condtion B Met	NO	75.3%

Warrant # 4 - Pedestrian Volumes

Warrant 4 Condtion A Met	NO	10.0%
Warrant 4 Condition B Met	NO	10.0%

Warrant # 5 - School Crossing

Warrant 5 Condtions Met	NA	NA

Warrant # 6 - Coordinated Signal System

Warrant 6 Condtions Met	NO	N/A

Warrant # 7 - Crash Experience

Warrant 7 Condtion A Met	NO	67.5%
Warrant 7 Condtion B Met	Yes	199.7%
Warrant 7 Condtion C Met	NO	N/A

Warrant # 8 - Roadway Network

Warrant 8 Condtions Met	NO	161.8%

Warrant # 9 - Intersection Near Grade Crossing

Warrant 9 Condtions Met	NO	N/A

Warrant Number and Title		***Met***	***Percent Met***
1	**Eight-hour Vehicular Volume**	**YES**	**108.0%**
2	**Four-hour Vehicular Volume**	**NO**	**93.9%**
3	**Peak Hour**	**NO**	**75.3%**
4	**Pedestrian Volumes**	**NO**	**10.0%**
5	**School Crossing**	**N/A**	**N/A**
6	**Coordinated Signal System**	**N/A**	**N/A**
7	**Crash Experience**	**NO**	**67.5%**
8	**Roadway Network**	**YES**	**161.8%**
9	**Intersection Near Grade Crossing**	**N/A**	**N/A**
Total Number of Warrants Met			**2**

APPENDIX I

PROJECT COST ESTIMATES

Construction Estimate - Main Street One-way Conversion Concept with Signal at 2nd St.

8/30/2017

Item No.	Est. Qty.	Unit	Description	Unit Price	Total Price
101	1	LS	Mobilization & Insurance	$ 38,000.00	$ 38,000.00
102	1040	LF	Remove & Dispose Curb & Gutter	$ 12.00	$ 12,480.00
103	5000	SF	Remove & Dispose Concrete Sidewalk	$ 3.00	$ 15,000.00
104	14500	SF	Remove & Dispose Asphalt	$ 2.00	$ 29,000.00
105	500	CY	Unclassified Excavation	$ 12.00	$ 6,000.00
106	500	CY	1.5" Base Course Gravel	$ 21.00	$ 10,500.00
107	1500	LF	Concrete Curb & Gutter	$ 14.00	$ 21,000.00
108	400	SF	Concrete Double Gutter	$ 9.00	$ 3,600.00
109	960	SF	Concrete Accessibility Ramp 6" Concrete	$ 9.00	$ 8,640.00
110	16	EA	Truncated Dome Panel	$ 165.00	$ 2,640.00
111	9600	SF	Concrete Sidewalk - 4" Thick	$ 4.50	$ 43,200.00
112	450	SY	Asphalt Surface Course (4" Section)	$ 17.00	$ 7,650.00
113	500	SY	Asphalt Surface Course (6" Section)	$ 30.00	$ 15,000.00
114	16	EA	Remove Existing Storm Drain Inlets	$ 1,500.00	$ 24,000.00
115	32	EA	New Storm Drain Inlets	$ 3,000.00	$ 96,000.00
116	6	EA	New Storm Drain Manholes	$ 3,500.00	$ 21,000.00
117	1250	LF	12" RCP Storm Drain Lateral Pipe	$ 70.00	$ 87,500.00
118	1	LS	Miscelleanous Utility Adjustments	$ 7,000.00	$ 7,000.00
119	1	LS	Miscellaneous Removals	$ 4,500.00	$ 4,500.00
120	1	LS	New Landscaping	$ 12,000.00	$ 12,000.00
121	138	GL	Epoxy Pavement Markings	$ 220.00	$ 30,360.00
122	40	GL	Curb Paint (Yellow)	$ 130.00	$ 5,200.00
123	11	EA	New Ground Mount Regulatory Signs	$ 520.00	$ 5,720.00
124	4	EA	New Overhead Signs	$ 350.00	$ 1,400.00
125	24	EA	Remove Signs	$ 90.00	$ 2,160.00
126	7	CY	Structural Concrete Pole Foundations	$ 1,200.00	$ 8,400.00
127	100	LF	Conduit - Var Sizes - Push	$ 17.00	$ 1,700.00
128	250	LF	Conduit - Var Sizes - Trench	$ 13.00	$ 3,250.00
129	620	LF	Cable #14 AWG Var Sizes	$ 3.50	$ 2,170.00
130	800	LF	Conductors - Var Sizes	$ 1.50	$ 1,200.00
131	5	EA	Composite Pull Boxes	$ 700.00	$ 3,500.00
132	1	EA	New Concrete Controller Cabinet Pedstal	$ 1,400.00	$ 1,400.00
133	1	EA	New Controller Cabinet	$ 16,000.00	$ 16,000.00
134	1	EA	New MDT Standard Controller	$ 8,000.00	$ 8,000.00
135	1	LS	New Emergency Preemption System	$ 16,000.00	$ 16,000.00
136	2	Ea	New Radar Detectors	$ 10,500.00	$ 21,000.00
137	3	EA	New Signal Standards & Lum Extension	$ 9,000.00	$ 27,000.00
138	2	EA	New Pedestrian Standards	$ 1,700.00	$ 3,400.00
139	2	EA	New LED Luminaires	$ 1,200.00	$ 2,400.00
140	7	EA	New Signal Indications (12x12x12)	$ 1,200.00	$ 8,400.00
141	4	EA	New Count-down Pedestrian Signals	$ 1,100.00	$ 4,400.00
142	4	EA	New Tactile Push Buttons	$ 1,300.00	$ 5,200.00
143	1	LS	Remove & Salvage Misc. Electrical Equipment	$ 2,000.00	$ 2,000.00
144	1	LS	New Electrical Service Assembly	$ 2,600.00	$ 2,600.00
145	1	LS	Traffic Control	$ 100,000.00	$ 100,000.00
			Total Prices =		**$ 747,570.00**
			Contingency @ 15% =		**$ 112,135.50**
			Total Estimated Construction Cost =		**$ 859,705.50**
			Engineering Design & Construction Service =		**$ 171,941.10**
			TOTAL PROJECT COSTS =		**$ 1,031,646.60**

Construction Estimate - Park Street & I-90 WB Ramp Signal Installation.

8/30/2017

Item No.	Est. Qty.	Unit	Description	Unit Price	Total Price
101	1	LS	Mobilization & Insurance	$ 16,000.00	$ 16,000.00
102	128	SF	Remove & Dispose Concrete Sidewalk	$ 3.00	$ 384.00
103	68	SF	Concrete Sidewalk - 4" Thick	$ 4.50	$ 306.00
104	138	GL	Epoxy Pavement Markings	$ 220.00	$ 30,360.00
105	4	EA	New Overhead Signs	$ 400.00	$ 1,600.00
106	3	EA	Remove Signs	$ 100.00	$ 300.00
107	4	CY	Structural Concrete Pole Foundations	$ 1,200.00	$ 4,800.00
108	210	LF	Conduit - Var Sizes - Push	$ 17.00	$ 3,570.00
109	390	LF	Conduit - Var Sizes - Trench	$ 13.00	$ 5,070.00
110	600	LF	Cable #14 AWG Var Sizes	$ 3.50	$ 2,100.00
111	1200	LF	Conductors - Var Sizes	$ 1.50	$ 1,800.00
112	6	EA	Composite Pull Boxes	$ 750.00	$ 4,500.00
113	1	EA	New Concrete Controller Cabinet Pedstal	$ 1,400.00	$ 1,400.00
114	1	EA	New Controller Cabinet	$ 16,000.00	$ 16,000.00
115	1	EA	New MDT Standard Controller	$ 8,000.00	$ 8,000.00
116	1	LS	New Emergency Preemption System	$ 16,000.00	$ 16,000.00
117	2	Ea	New Radar Detectors	$ 10,500.00	$ 21,000.00
118	3	EA	New Signal Standards & Lum Extension	$ 9,000.00	$ 27,000.00
119	5	EA	New Pedestrian Standards	$ 1,700.00	$ 8,500.00
120	2	EA	New LED Luminaires	$ 1,200.00	$ 2,400.00
121	8	EA	New Signal Indications (12x12x12)	$ 1,200.00	$ 9,600.00
122	1	EA	New Signal Indications (12x12x12x12)	$ 1,200.00	$ 1,200.00
123	6	EA	New Count-down Pedestrian Signals	$ 1,100.00	$ 6,600.00
124	6	EA	New Tactile Push Buttons	$ 1,300.00	$ 7,800.00
125	1	LS	Remove & Salvage Misc. Electrical Equipment	$ 2,000.00	$ 2,000.00
126	1	LS	New Electrical Service Assembly	$ 2,600.00	$ 2,600.00
127	1	LS	Traffic Control	$ 100,000.00	$ 100,000.00
			Total Prices =		**$ 300,890.00**
			Contingency @ 15% =		**$ 45,133.50**
			Total Estimated Construction Cost =		**$ 346,023.50**
			Engineering Design & Construction Service =		**$ 69,204.70**
			TOTAL PROJECT COSTS =		**$ 415,228.20**

Construction Estimate - 5th Street / Front Street - Park Street Concept

8/30/2017

Item No.	Est. Qty.	Unit	Description	Unit Price	Total Price
101	1	LS	Mobilization & Insurance	$ 9,000.00	$ 9,000.00
102	625	LF	Remove & Dispose Curb & Gutter	$ 12.00	$ 7,500.00
103	40	SF	Remove & Dispose Concrete Sidewalk	$ 3.00	$ 120.00
104	1200	SF	Remove & Dispose Asphalt	$ 2.00	$ 2,400.00
105	600	CY	Unclassified Excavation	$ 12.00	$ 7,200.00
106	500	CY	1.5" Base Course Gravel	$ 21.00	$ 10,500.00
107	650	LF	Concrete Curb & Gutter	$ 14.00	$ 9,100.00
108	720	SF	Concrete Accessibility Ramp 6" Concrete	$ 9.00	$ 6,480.00
109	2	EA	Truncated Dome Panel	$ 165.00	$ 330.00
110	450	SY	Asphalt Surface Course (4" Section)	$ 17.00	$ 7,650.00
111	480	SY	Asphalt Surface Course (6" Section)	$ 30.00	$ 14,400.00
112	1	LS	Miscelleanous Utility Adjustments	$ 7,000.00	$ 7,000.00
113	1	LS	Miscellaneous Removals	$ 4,500.00	$ 4,500.00
114	58	GL	Epoxy Pavement Markings	$ 220.00	$ 12,760.00
115	4	GL	Curb Paint (Yellow)	$ 130.00	$ 520.00
116	8	EA	New Ground Mount Regulatory Signs	$ 520.00	$ 4,160.00
117	1	EA	New Overhead Signs	$ 350.00	$ 350.00
118	2	EA	Remove Signs	$ 90.00	$ 180.00
119	200	LF	Cable #14 AWG Var Sizes	$ 3.50	$ 700.00
120	1	LS	Reprogram Controller	$ 2,000.00	$ 2,000.00
121	1	LS	Remove & Salvage Misc. Electrical Equipment	$ 2,000.00	$ 2,000.00
122	1	LS	Traffic Control	$ 60,000.00	$ 60,000.00
			Total Prices =		**$ 168,850.00**
			Contingency @ 15% =		**$ 25,327.50**
			Total Estimated Construction Cost =		**$ 194,177.50**
			Right-of-way Acquistion (5,600 s.f.) =		**$ 28,000.00**
			Engineering Design & Construction Service =		**$ 46,602.60**
			TOTAL PROJECT COSTS =		**$ 268,780.10**

Construction Estimate - Front & Main Street Improvement Concept

8/30/2017

Item No.	Est. Qty.	Unit	Description	Unit Price	Total Price
101	1	LS	Mobilization & Insurance	$ 10,000.00	$ 10,000.00
102	180	LF	Remove & Dispose Curb & Gutter	$ 12.00	$ 2,160.00
103	945	SF	Remove & Dispose Concrete Sidewalk	$ 3.00	$ 2,835.00
104	80	SF	Remove & Dispose Asphalt	$ 2.00	$ 160.00
105	300	CY	Unclassified Excavation	$ 12.00	$ 3,600.00
106	95	CY	1.5" Base Course Gravel	$ 21.00	$ 1,995.00
107	165	LF	Concrete Curb & Gutter	$ 14.00	$ 2,310.00
108	1200	SF	Concrete Sidewalk - 4" Thick	$ 4.50	$ 5,400.00
109	250	SF	Concrete Accessibility Ramp 6" Concrete	$ 9.00	$ 2,250.00
110	2	EA	Truncated Dome Panel	$ 165.00	$ 330.00
111	105	LF	New Retaining Walls	$ 300.00	$ 31,500.00
112	170	SY	Asphalt Surface Course (4" Section)	$ 17.00	$ 2,890.00
113	1	LS	Miscelleanous Utility Adjustments	$ 5,000.00	$ 5,000.00
114	1	LS	Miscellaneous Removals	$ 5,000.00	$ 5,000.00
115	1.5	CY	Structural Concrete Pole Foundations	$ 1,200.00	$ 1,800.00
116	70	LF	Conduit - Var Sizes - Push	$ 17.00	$ 1,190.00
117	200	LF	Conduit - Var Sizes - Trench	$ 13.00	$ 2,600.00
118	800	LF	Conductors - Var Sizes	$ 1.50	$ 1,200.00
119	2	EA	Composite Pull Boxes	$ 700.00	$ 1,400.00
120	2	EA	New Lightiing Standards	$ 2,000.00	$ 4,000.00
121	2	EA	New LED Luminaires	$ 1,200.00	$ 2,400.00
122	1	LS	New Electrical Service Assembly	$ 2,600.00	$ 2,600.00
123	25	GL	Epoxy Pavement Markings	$ 220.00	$ 5,500.00
124	2	GL	Curb Paint (Yellow)	$ 130.00	$ 260.00
125	4	EA	New Ground Mount Regulatory Signs	$ 520.00	$ 2,080.00
126	1	EA	Remove Signs	$ 90.00	$ 90.00
127	1	LS	Traffic Control	$ 80,000.00	$ 80,000.00
			Total Prices =		**$ 180,550.00**
			Contingency @ 15% =		**$ 27,082.50**
			Total Estimated Construction Cost =		**$ 207,632.50**
			Right-of-way Acquistion (900 s.f.) =		**$ 9,000.00**
			Engineering Design & Construction Service =		**$ 49,831.80**
			TOTAL PROJECT COSTS =		**$ 266,464.30**

Construction Estimate - Chinook and C Street Improvement Concept

8/30/2017

Item No.	Est. Qty.	Unit	Description	Unit Price	Total Price
101	1	LS	Mobilization & Insurance	$ 2,000.00	$ 2,000.00
102	95	LF	Remove & Dispose Curb & Gutter	$ 12.00	$ 1,140.00
103	40	SF	Remove & Dispose Concrete Sidewalk	$ 3.00	$ 120.00
104	190	SF	Remove & Dispose Asphalt	$ 2.00	$ 380.00
105	200	CY	Unclassified Excavation	$ 12.00	$ 2,400.00
106	100	CY	1.5" Base Course Gravel	$ 21.00	$ 2,100.00
107	550	LF	Concrete Curb & Gutter	$ 14.00	$ 7,700.00
108	160	SF	Concrete Sidewalk - 4" Thick	$ 4.50	$ 720.00
109	100	SY	Asphalt Surface Course (4" Section)	$ 17.00	$ 1,700.00
110	1	LS	Miscellaneous Removals	$ 1,000.00	$ 1,000.00
111	16	GL	Epoxy Pavement Markings	$ 220.00	$ 3,520.00
112	3	GL	Curb Paint (Yellow)	$ 130.00	$ 390.00
113	7	EA	New Ground Mount Regulatory Signs	$ 520.00	$ 3,640.00
114	1	LS	Traffic Control	$ 5,000.00	$ 5,000.00
			Total Prices =		**$ 31,810.00**
			Contingency @ 15% =		**$ 4,771.50**
			Total Estimated Construction Cost =		**$ 36,581.50**
			Right-of-way Acquistion (900 s.f.) =		**$ 9,000.00**
			Engineering Design & Construction Service =		**$ 9,511.19**
			TOTAL PROJECT COSTS =		**$ 55,092.69**

Construction Estimate - Callender and Third Street Improvement Concept

8/30/2017

Item No.	Est. Qty.	Unit	Description	Unit Price	Total Price
101	1	LS	Mobilization & Insurance	$ 1,000.00	$ 1,000.00
102	5	GL	Epoxy Pavement Markings	$ 220.00	$ 1,100.00
103	4	GL	Curb Paint (Yellow)	$ 130.00	$ 520.00
104	8	EA	New Ground Mount Regulatory Signs	$ 520.00	$ 4,160.00
105	1	LS	Traffic Control	$ 1,000.00	$ 1,000.00
			Total Prices =		**$ 7,780.00**
			Contingency @ 15% =		**$ 1,167.00**
			Total Estimated Construction Cost =		**$ 8,947.00**
			Engineering Design & Construction Service =		**$ 1,789.40**
			TOTAL PROJECT COSTS =		**$ 10,736.40**

Construction Estimate - Callender and F Street Improvement Concept

8/30/2017

Item No.	Est. Qty.	Unit	Description	Unit Price	Total Price
101	1	LS	Mobilization & Insurance	$ 300.00	$ 300.00
102	4	GL	Curb Paint (Yellow)	$ 130.00	$ 520.00
103	6	EA	New Ground Mount Regulatory Signs	$ 520.00	$ 3,120.00
104	1	LS	Traffic Control	$ 200.00	$ 200.00
			Total Prices =		**$ 4,140.00**
			Contingency @ 15% =		**$ 621.00**
			Total Estimated Construction Cost =		**$ 4,761.00**
			Engineering Design & Construction Service =		**$ 952.20**
			TOTAL PROJECT COSTS =		**$ 5,713.20**