April 2016

349 Olmstead Street Transportation Brief

Prepared for:

CONSEIL DES ÉCOLES CATHOLIQUES DU CENTRE-EST

Le meilleur conseil qu'on puisse vous donner

Prepared by:

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349 Olmstead Street
Transportation Brief

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1. Introduction

This study has been prepared in support of a Site Plan Application (SPA) for Conseil des Ecoles Catholiques du Centre-Est's (CECCE) redevelopment of 349 Olmstead Street. The existing building has two sections, the north section contains an elementary school and the south section contains a training facility. The proposed redevelopment will rebuild the elementary school portion of the building, while maintaining the training facility. The reconstruction will also improve the on-site parking to better accommodate the current parking demands. The school board currently leases 30 additional parking spaces in a nearby lot (directly across the street from the training facility) to accommodate the current parking demand. Upon completion of the proposed redevelopment the additional off-site parking will no longer be required, and the lease will be terminated.

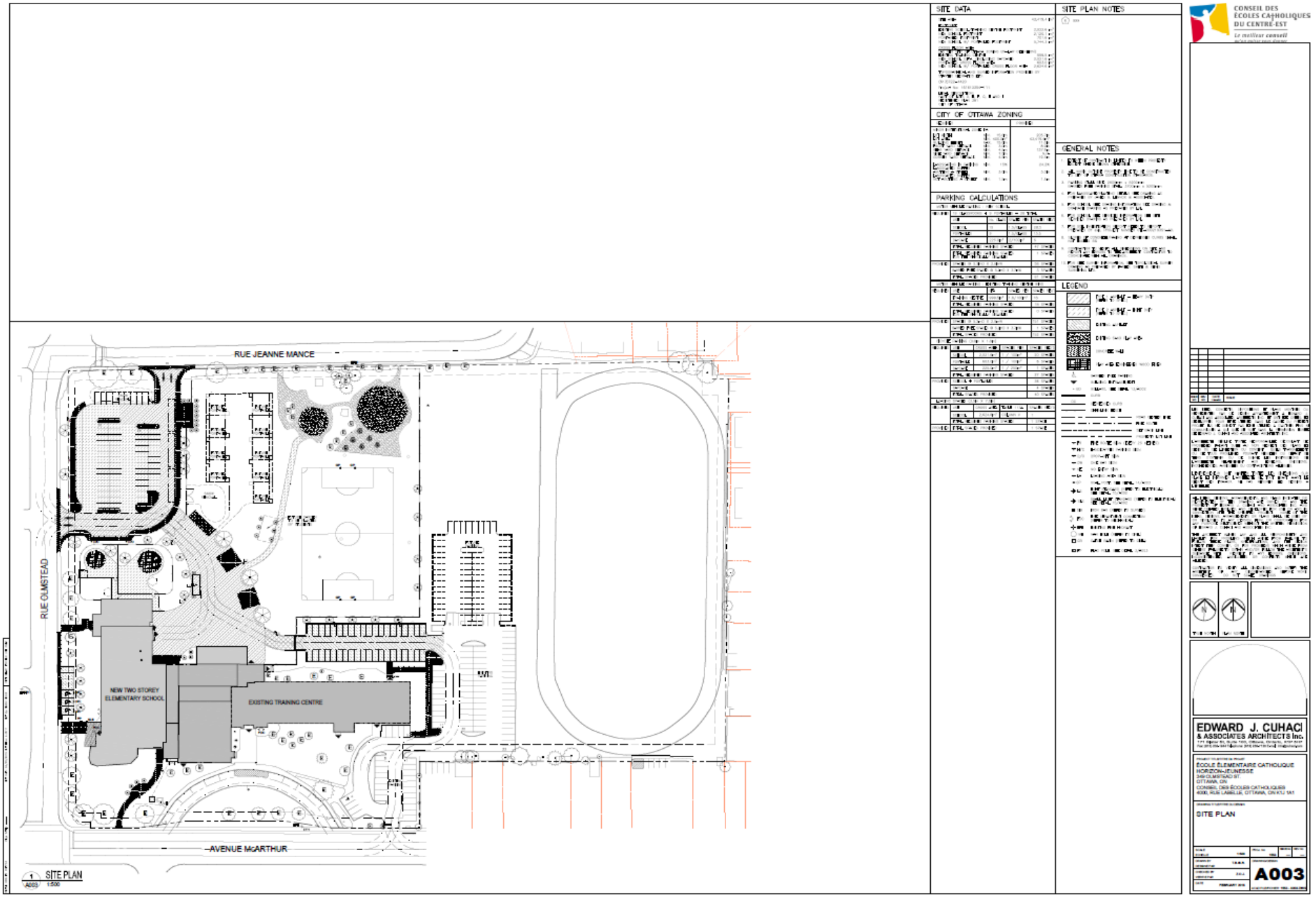
The subject site is located on the northeast corner of the intersection of Olmstead Street at McArthur Avenue. The site accesses will be modified to accommodate the proposed development, but will remain generally in the same location as the existing accesses. There will be two separate parking locations within this site. The first location is a pre-existing parking area that is located at the south side of the site off of McArthur Avenue, this area will retain the original parking area but will be expanded to accommodate more vehicles. The second parking area is being constructed in the northwest corner of the property with access points on Olmstead Street and Jeanne Mance Street. The proposed site plan will accommodate 213 vehicle parking spaces and 40 bicycle parking spaces.

Figure 1 shows the site location and the nearby road network.

Figure 2 shows the proposed site plan.

As per the City of Ottawa's 2006 Transportation Impact Assessment Guidelines (TIA Guidelines) the proposed development application necessitates a Transportation Brief (TB).

Figure 1: Local Site Context



PARSONS

Figure 2: Proposed Site Plan

2. Existing Conditions

2.1 Study Area Road Network

The Study Area road network is summarized below:

McArthur Avenue is an east-west, arterial, four-lane road with a posted (school zone) speed limit of 40 km/h. Sidewalks are provided on both sides of the street. At the intersection with Olmstead Street no auxiliary lanes are provided for either the eastbound or westbound directions.

Olmstead Street is a north-south road, two-lane road with an unposted (school zone) speed limit of 40 km/h. Sidewalks are provided on both sides of the street. At the intersection with Jeanne Mance Street no auxiliary lanes are provided for either the eastbound or westbound directions.

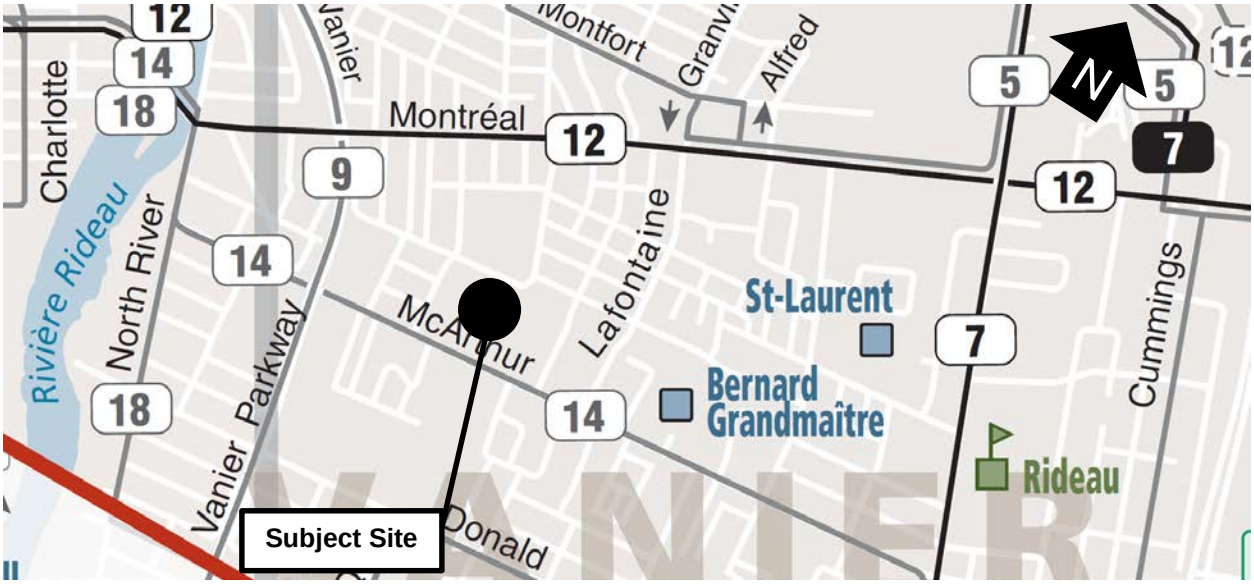
Jeanne Mance Street is an east-west, two-lane road with a posted speed limit of 40km/h. On-street cycling facilities are not provided and a single sidewalk is available on the south side of the road. At the intersection with Jeanne Mance Street / Olmstead Street no auxiliary lanes are provided on the eastbound or westbound approaches.

2.2 Transit Network

OC Transpo Route 14 run east-west along McArthur Avenue. A transit stop is located on the southwest corner of the intersection of Olmstead Street and McArthur Avenue, providing access to the noted route. School busses will also serve the site. The future northwest parking lot also contains the proposed bus drop off / pickup area.

Figure 3 shows the transit routes through the Study Area.

Figure 3: Existing Transit Network



Accessed February 17, 2016. http://www.octranspo1.com/images/files/systemmap/systemmap.pdf

2.3 Pedestrian & Cycling Network

Sidewalks are provided on both sides of McArthur Avenue, both sides of Olmstead Street and a single sidewalk on the south side of Jeanne Mance Street. Additionally, several pedestrian connections are provided on the north, west and south side of the property, allowing pedestrian access from the site to the surrounding residential neighbourhood.

Bike lanes are not provided on McArthur Avenue, Olmstead Street or Jeanne Mance Street. There are no other planned cycling facilities in the vicinity of the subject site.

Figure 4 illustrates the study area, and surrounding area, cycling network.

Figure 4: Cycling Network

2.4 Existing Traffic Operations

To establish the baseline intersection operations an operational analysis of the existing traffic conditions at the intersection of Olmstead Street at McArthur Avenue has been undertaken. The most recent turning movement counts have been obtained from the City of Ottawa. The count was undertaken on Wednesday July 29, 2015 and are shown on **Figure 5.**

Appendix A contains the detailed traffic data sheets.

To assess the peak hour traffic conditions a level of service analysis has been completed using Trafficware Synchro 8.0, which implements the methods of the 2000 Highway Capacity Manual. The key parameters used in the analysis include:

- A saturation flow rate of 1800 (as per the City of Ottawa TIA Guidelines)
- Existing lane arrangements
- Existing signal timing (provided by the City of Ottawa)
- Peak hour factor (derived from the traffic count provided by the City of Ottawa)
- Heavy vehicle percentages (derived from the traffic count provided by the City of Ottawa)
- Heavy vehicle equivalent factor of 1.70 (as per the City of Ottawa TIA Guidelines)

- Default values for all other inputs (as defined by Synchro 8.0)

The results of the operational analysis are summarized in **Table 1**. The existing signal timing information is included in **Appendix A**. The Synchro analysis outputs are provided in **Appendix B**.

Table 1: Intersection Operational Analysis
2016 Existing Traffic Conditions

Intersection	Approach / Movement		AM Peak Hour				PM Peak Hour			
			LOS[1]	V/C	Delay (s)	Queue (m)[2]	LOS[1]	V/C	Delay (s)	Queue (m)[2]
Olmstead Street at McArthur Avenue *Signalized*	EB	L/T	A	0.13	3	7	A	0.32	4	21
	WB	T/R	A	0.21	3	12	A	0.24	4	15
	SB	L	A	0.16	25	9	A	0.24	25	13
		R	A	0.02	24	6	A	0.04	23	8
	Overall		**A**	**0.20**	**5**	**-**	**A**	**0.31**	**5**	**-**

L=Left Turn Movement(s); T=Through Movement(s); R=Right Turn Movement(s)
# - 95TH Percentile volume exceeds capacity, queue may be longer
1 – Level of Service based on v/c ratio as per the City of Ottawa TIA Guidelines
2 – 95th Percentile queue

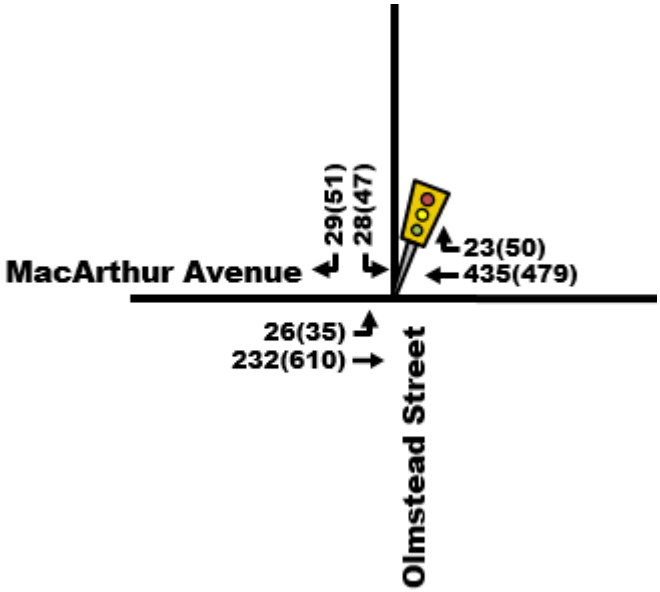
The existing signalized intersection was shown to operate with good overall levels of service and no critical movements. The southbound left-turn lane queue available storage length is approaching the length of the combined storage lengths. Any blockage of the southbound left turn lane would be infrequent, and would clear quickly. As a result no mitigation measures are recommended.

2.5 Future Operations

The subject site is not anticipated to generate any new trips. The total gross floor area of the school is being reduced. While this could be linked to a reduction in trips, the proposed renovations are partially in response to a lower demand at this school location, and as a result the trip generation is not likely to change. The existing training facility is remaining unchanged, but there is an increase in parking spaces provided for this facility. While an increase in parking could lead to more trips, the school board currently leases a nearby parking lot to accommodate overflow parking from the training facility. The school board intends to terminate the lease on these additional parking spaces. The net trips to the area will not increase as a result of the proposed site modifications.

Regardless of any potential minor changes to the traffic patterns as a result of the site modifications, the intersection is operating with LOS A, minimal delays, and no queuing issues. If traffic were slightly redistributed across this intersection to reflect the change in the parking configuration there would be negligible differences in the operational analysis.

Figure 5: Existing Peak Hour Traffic Volumes



3. Site Plan Review

To accommodate overflow parking demand that currently exists at the training facility the school board leases 30 additional parking spaces from a parking lot directly across McArthur Avenue from the training facility. With the construction of additional onsite parking the school board intends to terminate the lease of the additional off-site parking. As mentioned previously this change is not anticipated to increase the number of vehicle trips bound to the area. The site will also have an increase in bicycle racks better accommodating active transportation trips to the site. It is anticipated that the new site plan will generate no additional trips and have similar traffic demands.

The site modifications include a reconstructed parking lot in the northeastern corner of the property and an expansion of the existing parking lot along the southern edge of the property. The access configurations will remain similar to the existing access points. The Olmstead Street access to the north parking lot will be realigned to form the fourth leg of the intersection of Olmstead Street at Maple Street. The access from the north lot to Jeanne Mance Street is near the existing curb cut that provides access to two parking spaces. The northeastern parking lot is planned to expand from 22 to 54 spaces. This parking lot also will accommodate the drop off laybys and the bus staging area.

Access to the existing southern parking lot will be by the existing entrance on McArthur Avenue. This lot will expand from 102 to 141 spaces.

In addition to the two primary parking lots on the site, seven parking spaces are proposed fronting onto Olmstead Street. These parking stalls are proposed to be adjacent to the sidewalk, with vehicles passing over a depressed sidewalk. While a portion of the parking stall would be within the City's right of way the sidewalk would be uninterrupted. The school board would remain responsible for the operation and maintenance of the parking. These spaces are primarily to accommodate the barrier free parking spaces adjacent to the accessible entrance. These parking spaces would replace the existing drop off loop on Olmstead Street.

4. Conclusions

The conclusions of the Transportation Impact Study are as follows:

a) The study area intersection (Olmstead Street /McArthur Avenue) currently operates with LOS A in the AM and PM peak hours. The southbound left-turn queue was shown to approach the limit of available storage length, however, given that this is unlikely to cause a significant interference with the southbound right lane, no mitigation is required at this time.

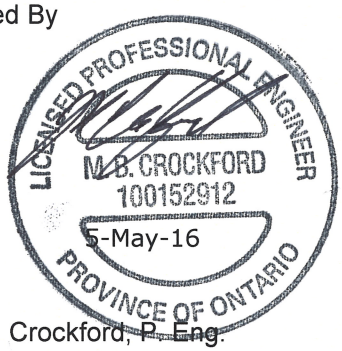
b) The proposed site plan will increase the onsite parking by expanding the existing parking lot, and constructing a new parking lot. While the number of parking spaces on site is increasing, the trip generation to the site will remain unchanged. The future operations at the intersection of Olmstead Street and McArthur Avenue will be unchanged by the proposed development.

c) The proposed access configuration is similar to the existing access configuration. The minor changes to the accesses will not negatively impact the road network.

d) The on street parking stalls along Olmstead Street would be partially on the City's right of way, but would remain the responsibility of the school board. The sidewalk would remain continuous, allowing normal snow clearing and maintenance of the sidewalk by the City. This parking layout will allow barrier free drop offs and pickups near the most suitable entrance to the school.

From a transportation perspective it is anticipated that the site will operate well and should not cause any adverse impacts to the operation of adjacent roads or the nearby Olmstead Street / McArthur Avenue intersection.

Prepared By



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Reviewed By

Christopher A. Gordon, P. Eng.
Senior Project Manager, Transportation

Appendix A

Traffic Data

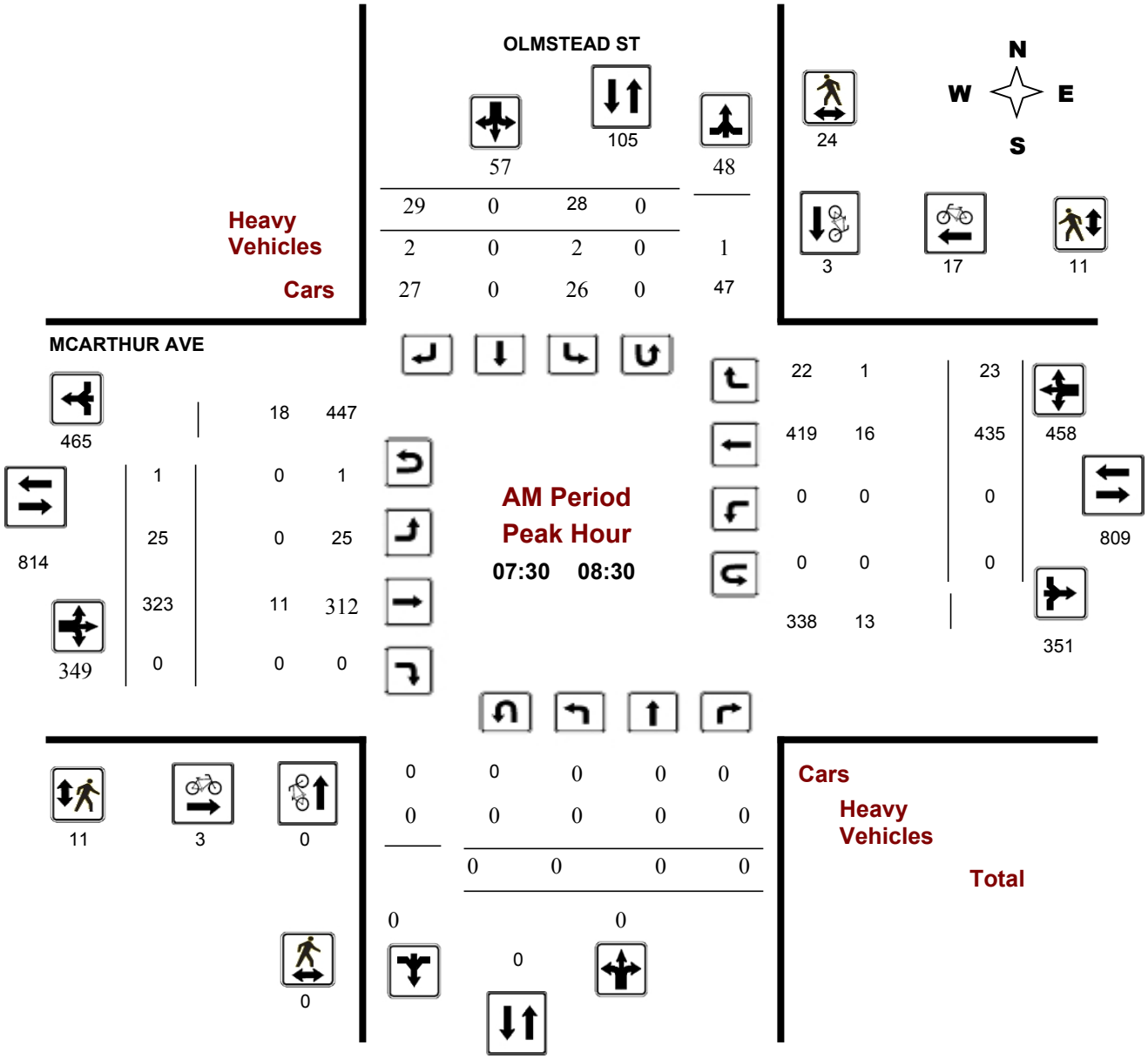
Public Works - Traffic Services

Turning Movement Count - Peak Hour Diagram

MCARTHUR AVE @ OLMSTEAD ST

Survey Date: Wednesday, July 29, 2015 **WO No:** 35153

Start Time: 07:00 **Device:** Miovision



Comments

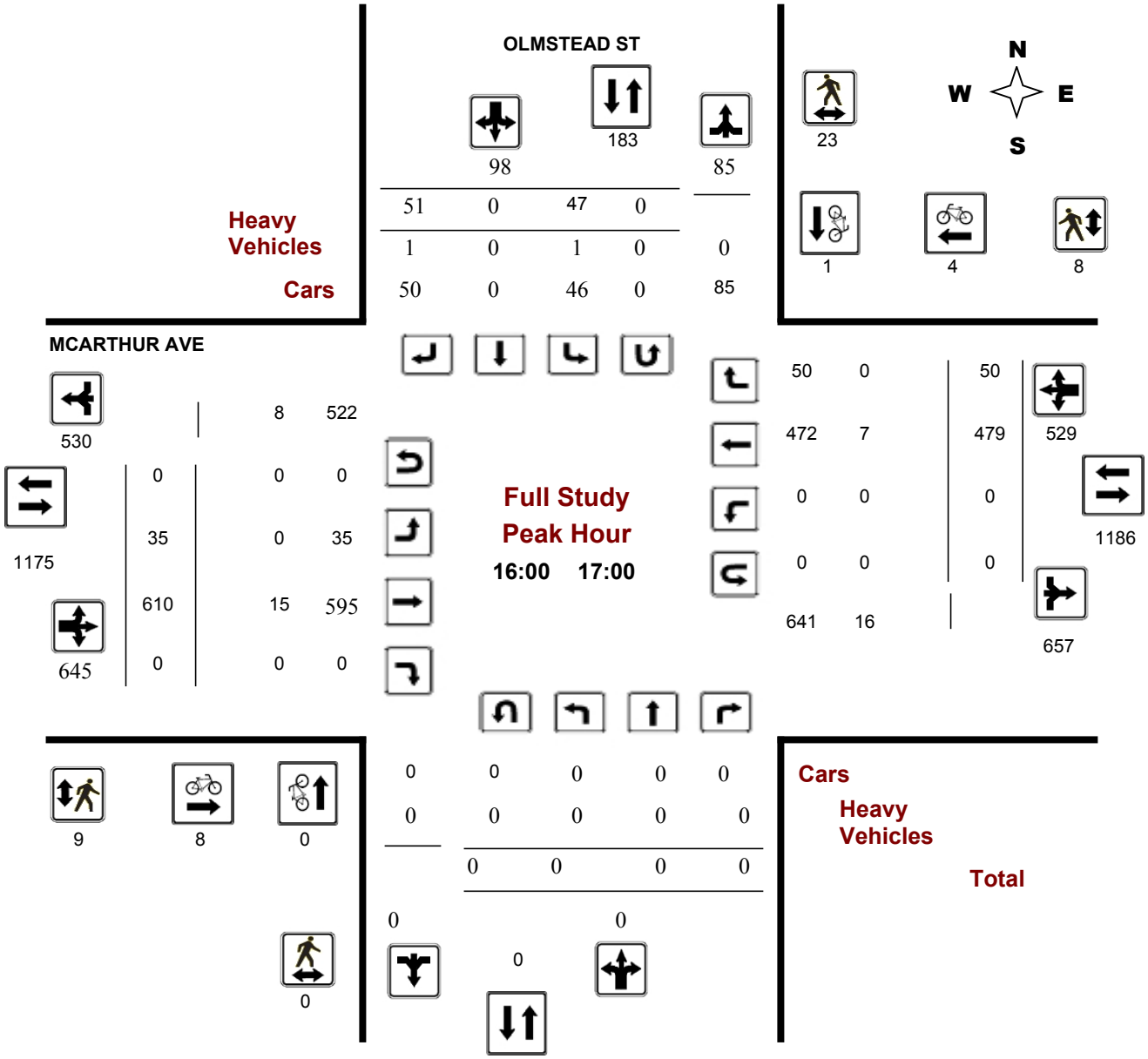
Public Works - Traffic Services

Turning Movement Count - Peak Hour Diagram

MCARTHUR AVE @ OLMSTEAD ST

Survey Date: Wednesday, July 29, 2015 **WO No:** 35153

Start Time: 07:00 **Device:** Miovision



Comments

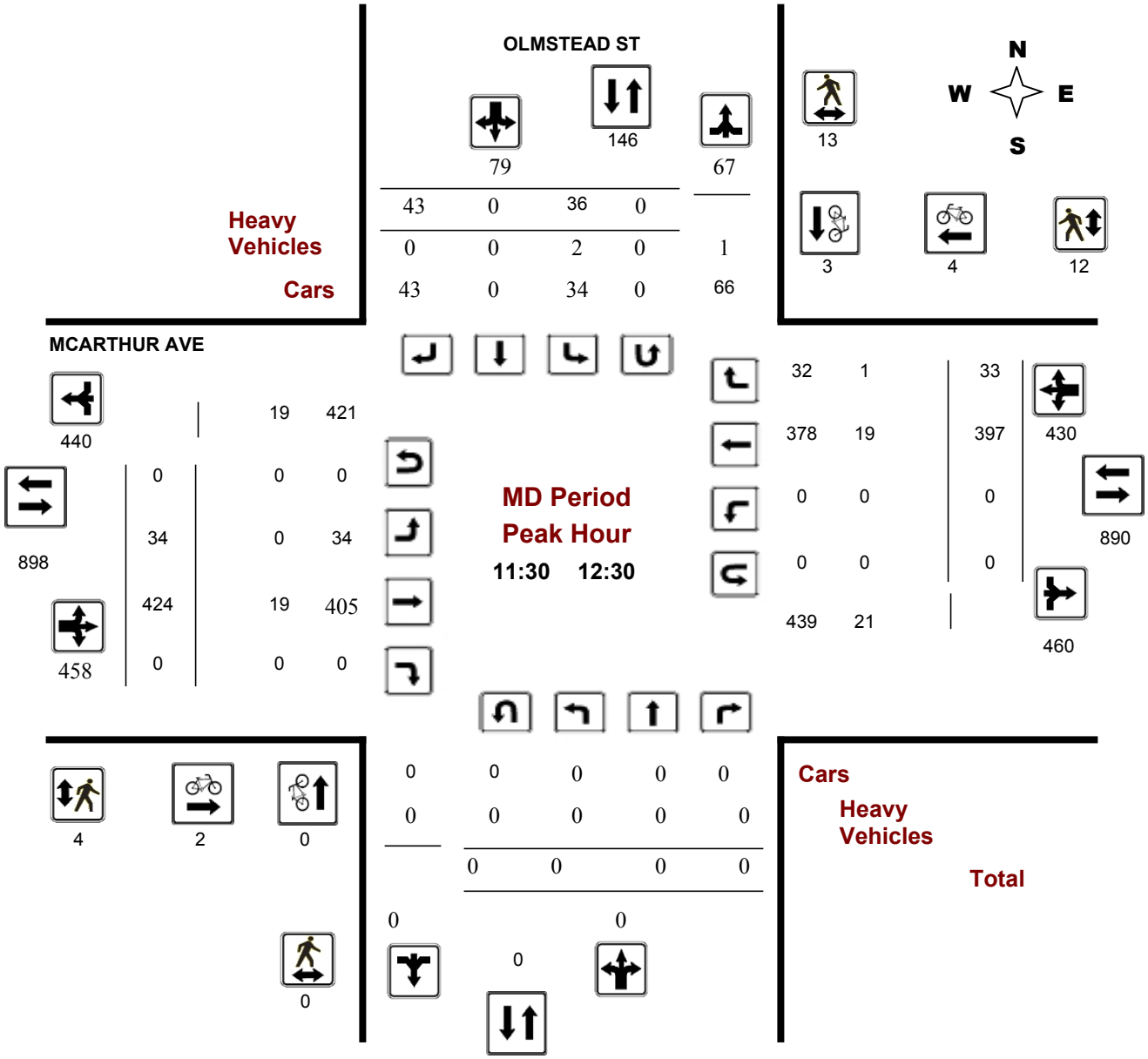
Public Works - Traffic Services

Turning Movement Count - Peak Hour Diagram

MCARTHUR AVE @ OLMSTEAD ST

Survey Date: Wednesday, July 29, 2015 **WO No:** 35153

Start Time: 07:00 **Device:** Miovision



Comments

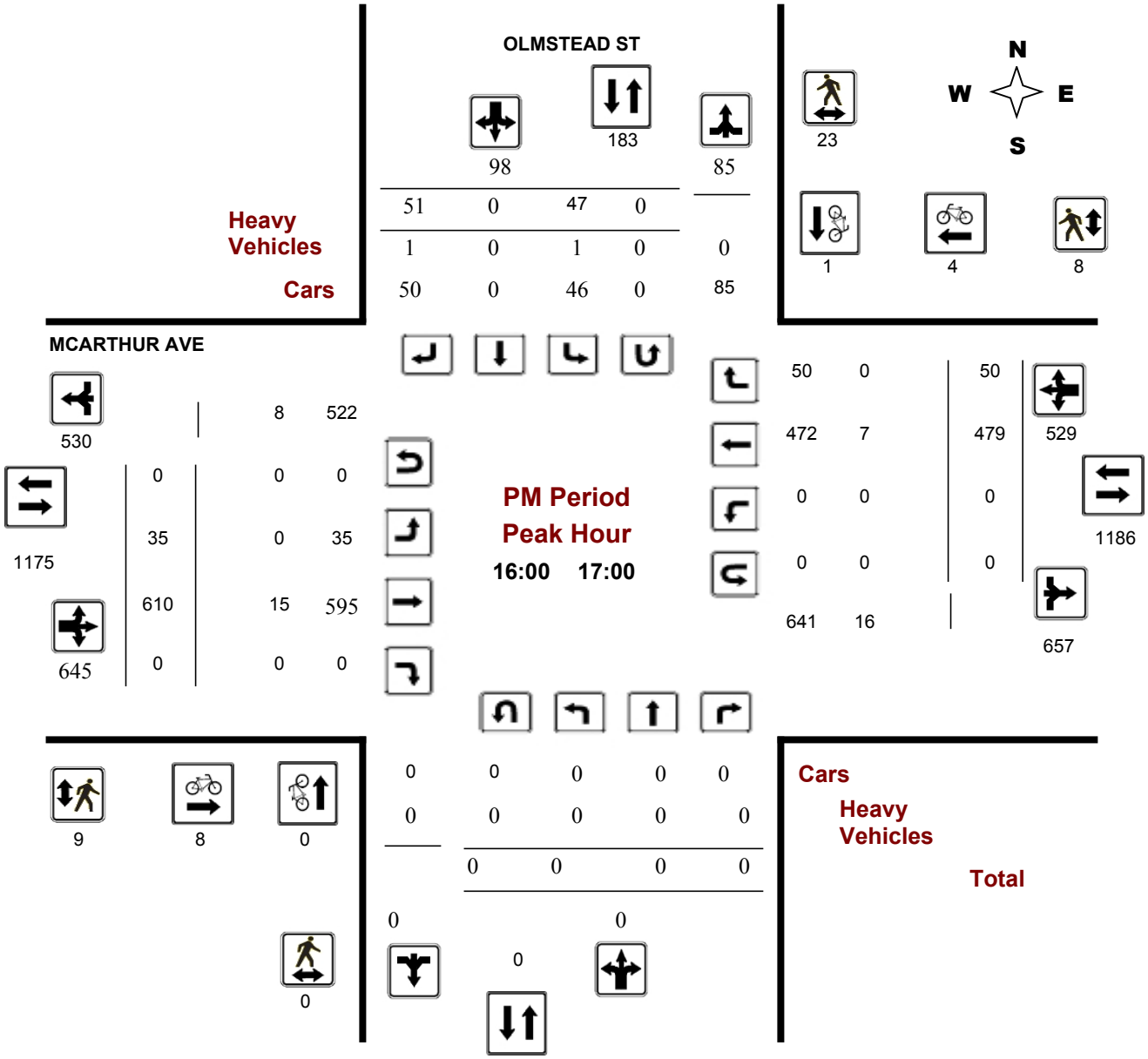
Public Works - Traffic Services

Turning Movement Count - Peak Hour Diagram

MCARTHUR AVE @ OLMSTEAD ST

Survey Date: Wednesday, July 29, 2015 **WO No:** 35153

Start Time: 07:00 **Device:** Miovision



Comments

Public Works - Traffic Services

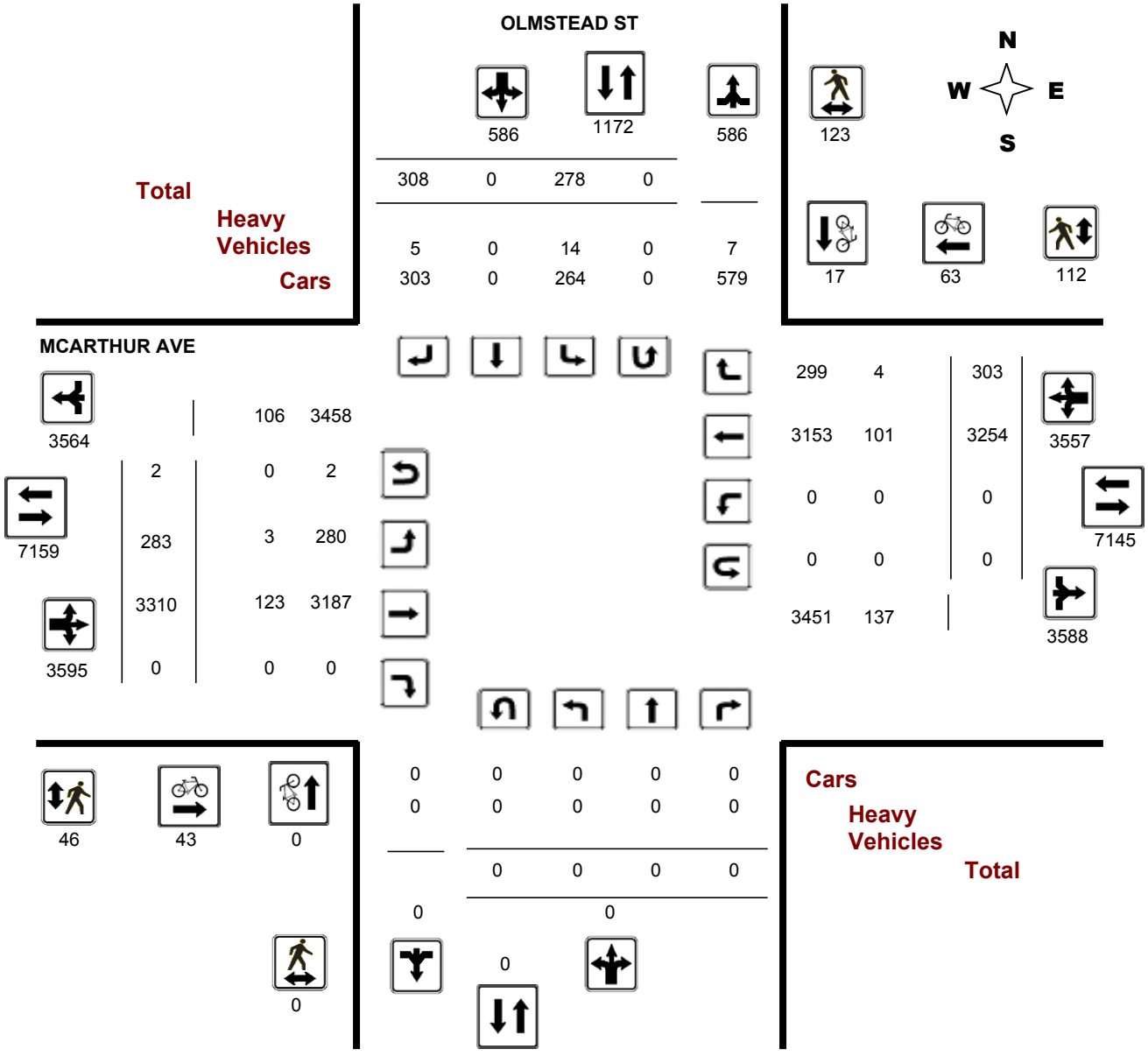
Turning Movement Count - Full Study Diagram

MCARTHUR AVE @ OLMSTEAD ST

Survey Date: Wednesday, July 29, 2015

WO#: 35153

Device: Miovision



Comments

Public Works - Traffic Services

Work Order
35153

Turning Movement Count - Full Study Summary Report

MCARTHUR AVE @ OLMSTEAD ST

Survey Date: Wednesday, July 29, 2015

Total Observed U-Turns

Northbound: 0 Southbound: 0
Eastbound: 2 Westbound: 0

AADT Factor
.90

Full Study

	OLMSTEAD ST									MCARTHUR AVE									
	Northbound				Southbound					Eastbound				Westbound					
Period	LT	ST	RT	**NB TOT**	LT	ST	RT	**SB TOT**	**STR TOT**	LT	ST	RT	**EB TOT**	LT	ST	RT	**WB TOT**	**STR TOT**	**Grand Total**
07:00 08:00	0	0	0	**0**	21	0	26	**47**	**47**	28	301	0	**329**	0	395	16	**411**	**740**	**787**
08:00 09:00	0	0	0	**0**	31	0	20	**51**	**51**	35	319	0	**354**	0	415	33	**448**	**802**	**853**
09:00 10:00	0	0	0	**0**	32	0	39	**71**	**71**	34	335	0	**369**	0	328	37	**365**	**734**	**805**
11:30 12:30	0	0	0	**0**	36	0	43	**79**	**79**	34	424	0	**458**	0	397	33	**430**	**888**	**967**
12:30 13:30	0	0	0	**0**	44	0	40	**84**	**84**	35	390	0	**425**	0	370	49	**419**	**844**	**928**
15:00 16:00	0	0	0	**0**	42	0	39	**81**	**81**	42	461	0	**503**	0	461	50	**511**	**1014**	**1095**
16:00 17:00	0	0	0	**0**	47	0	51	**98**	**98**	35	610	0	**645**	0	479	50	**529**	**1174**	**1272**
17:00 18:00	0	0	0	**0**	25	0	50	**75**	**75**	40	470	0	**510**	0	409	35	**444**	**954**	**1029**
Sub Total	0	0	0	**0**	278	0	308	**586**	**586**	283	3310	0	**3593**	0	3254	303	**3557**	**7150**	**7736**
U Turns				**0**				**0**	**0**				**2**				**0**	**2**	**2**
Total	0	0	0	**0**	278	0	308	**586**	**586**	283	3310	0	**3595**	0	3254	303	**3557**	**7152**	**7738**
EQ 12Hr	0	0	0	**0**	386	0	428	**815**	**815**	393	4601	0	**4997**	0	4523	421	**4944**	**9941**	**10756**
Note: These values are calculated by multiplying the totals by the appropriate expansion factor.													**1.39**						
AVG 12Hr	0	0	0	**0**	348	0	385	**733**	**733**	354	4141	0	**4497**	0	4071	379	**4450**	**8947**	**9680**
Note: These volumes are calculated by multiplying the Equivalent 12 hr. totals by the AADT factor.													**.90**						
AVG 24Hr	0	0	0	**0**	456	0	505	**960**	**960**	464	5424	0	**5892**	0	5333	497	**5829**	**11721**	**12681**
Note: These volumes are calculated by multiplying the Average Daily 12 hr. totals by 12 to 24 expansion factor.													**1.31**						

Comments:

Note: U-Turns provided for approach totals. Refer to 'U-Turn' Report for specific breakdown.

Public Works - Traffic Services

W.O. 35153

Turning Movement Count - 15 Minute Summary Report

MCARTHUR AVE @ OLMSTEAD ST

Survey Date: Wednesday, July 29, 2015

Total Observed U-Turns

Northbound: 0 Southbound: 0

Eastbound: 2 Westbound: 0

		OLMSTEAD ST									MCARTHUR AVE									
		Northbound				Southbound					Eastbound				Westbound					
Time Period		LT	ST	RT	N TOT	LT	ST	RT	S TOT	STR TOT	LT	ST	RT	E TOT	LT	ST	RT	W TOT	STR TOT	Grand Total
07:00	07:15	0	0	0	**0**	3	0	5	**8**	**8**	10	64	0	**74**	0	84	1	**85**	**159**	**167**
07:15	07:30	0	0	0	**0**	5	0	5	**10**	**10**	5	71	0	**76**	0	103	5	**108**	**184**	**194**
07:30	07:45	0	0	0	**0**	6	0	7	**13**	**13**	1	79	0	**80**	0	113	4	**117**	**197**	**210**
07:45	08:00	0	0	0	**0**	7	0	9	**16**	**16**	12	87	0	**99**	0	95	6	**101**	**200**	**216**
08:00	08:15	0	0	0	**0**	9	0	4	**13**	**13**	4	77	0	**82**	0	109	6	**115**	**197**	**210**
08:15	08:30	0	0	0	**0**	6	0	9	**15**	**15**	8	80	0	**88**	0	118	7	**125**	**213**	**228**
08:30	08:45	0	0	0	**0**	7	0	2	**9**	**9**	10	77	0	**87**	0	95	8	**103**	**190**	**199**
08:45	09:00	0	0	0	**0**	9	0	5	**14**	**14**	13	85	0	**98**	0	93	12	**105**	**203**	**217**
09:00	09:15	0	0	0	**0**	11	0	5	**16**	**16**	7	78	0	**85**	0	92	10	**102**	**187**	**203**
09:15	09:30	0	0	0	**0**	9	0	13	**22**	**22**	10	80	0	**90**	0	74	7	**81**	**171**	**193**
09:30	09:45	0	0	0	**0**	4	0	9	**13**	**13**	7	95	0	**102**	0	96	11	**107**	**209**	**222**
09:45	10:00	0	0	0	**0**	8	0	12	**20**	**20**	10	82	0	**92**	0	66	9	**75**	**167**	**187**
11:30	11:45	0	0	0	**0**	11	0	11	**22**	**22**	7	104	0	**111**	0	87	6	**93**	**204**	**226**
11:45	12:00	0	0	0	**0**	7	0	9	**16**	**16**	8	104	0	**112**	0	110	10	**120**	**232**	**248**
12:00	12:15	0	0	0	**0**	8	0	13	**21**	**21**	9	120	0	**129**	0	89	8	**97**	**226**	**247**
12:15	12:30	0	0	0	**0**	10	0	10	**20**	**20**	10	96	0	**106**	0	111	9	**120**	**226**	**246**
12:30	12:45	0	0	0	**0**	4	0	10	**14**	**14**	3	98	0	**101**	0	97	13	**110**	**211**	**225**
12:45	13:00	0	0	0	**0**	16	0	3	**19**	**19**	8	105	0	**113**	0	101	9	**110**	**223**	**242**
13:00	13:15	0	0	0	**0**	12	0	10	**22**	**22**	11	90	0	**101**	0	88	12	**100**	**201**	**223**
13:15	13:30	0	0	0	**0**	12	0	17	**29**	**29**	13	97	0	**110**	0	84	15	**99**	**209**	**238**
15:00	15:15	0	0	0	**0**	7	0	13	**20**	**20**	8	129	0	**137**	0	119	9	**128**	**265**	**285**
15:15	15:30	0	0	0	**0**	8	0	8	**16**	**16**	11	97	0	**108**	0	133	13	**146**	**254**	**270**
15:30	15:45	0	0	0	**0**	15	0	9	**24**	**24**	9	111	0	**120**	0	107	17	**124**	**244**	**268**
15:45	16:00	0	0	0	**0**	12	0	9	**21**	**21**	14	124	0	**138**	0	102	11	**113**	**251**	**272**
16:00	16:15	0	0	0	**0**	16	0	14	**30**	**30**	9	136	0	**145**	0	133	14	**147**	**292**	**322**
16:15	16:30	0	0	0	**0**	8	0	14	**22**	**22**	8	162	0	**170**	0	115	10	**125**	**295**	**317**
16:30	16:45	0	0	0	**0**	17	0	8	**25**	**25**	10	168	0	**178**	0	119	17	**136**	**314**	**339**
16:45	17:00	0	0	0	**0**	6	0	15	**21**	**21**	8	144	0	**152**	0	112	9	**121**	**273**	**294**
17:00	17:15	0	0	0	**0**	9	0	14	**23**	**23**	14	113	0	**127**	0	111	8	**119**	**246**	**269**
17:15	17:30	0	0	0	**0**	7	0	11	**18**	**18**	11	127	0	**138**	0	108	14	**122**	**260**	**278**
17:30	17:45	0	0	0	**0**	5	0	11	**16**	**16**	6	127	0	**134**	0	106	4	**110**	**244**	**260**
17:45	18:00	0	0	0	**0**	4	0	14	**18**	**18**	9	103	0	**112**	0	84	9	**93**	**205**	**223**
TOTAL:		0	0	0	**0**	278	0	308	**586**	**586**	283	3310	0	**3595**	0	3254	303	**3557**	**7152**	**7738**

Note: U-Turns are included in Totals.

Comment:

Public Works - Traffic Services

Turning Movement Count - Cyclist Volume Report

Work Order
35153

MCARTHUR AVE @ OLMSTEAD ST

Count Date: Wednesday, July 29, 2015 **Start Time:** 07:00

	OLMSTEAD ST			MCARTHUR AVE			
Time Period	Northbound	Southbound	**Street Total**	Eastbound	Westbound	**Street Total**	**Grand Total**
07:00 08:00	0	2	**2**	4	9	**13**	**15**
08:00 09:00	0	2	**2**	2	20	**22**	**24**
09:00 10:00	0	1	**1**	1	6	**7**	**8**
11:30 12:30	0	3	**3**	2	4	**6**	**9**
12:30 13:30	0	3	**3**	2	4	**6**	**9**
15:00 16:00	0	3	**3**	7	6	**13**	**16**
16:00 17:00	0	1	**1**	8	4	**12**	**13**
17:00 18:00	0	2	**2**	17	10	**27**	**29**
Total	0	17	**17**	43	63	**106**	**123**

Comment:

Note: These volumes consists of bicycles only (no mopeds or motorcycles) and ARE NOT included in the Turning Movement Count Summary.

Public Works - Traffic Services

W.O. 35153

Turning Movement Count - Heavy Vehicle Report

MCARTHUR AVE @ OLMSTEAD ST

Survey Date: Wednesday, July 29, 2015

		OLMSTEAD ST									MCARTHUR AVE									
		Northbound				Southbound					Eastbound				Westbound					
Time Period		LT	ST	RT	N TOT	LT	ST	RT	S TOT	STR TOT	LT	ST	RT	E TOT	LT	ST	RT	W TOT	STR TOT	Grand Total
07:00	08:00	0	0	0	**0**	6	0	0	**6**	**6**	0	11	0	**11**	0	21	1	**22**	**33**	**39**
08:00	09:00	0	0	0	**0**	2	0	2	**4**	**4**	0	10	0	**10**	0	16	0	**16**	**26**	**30**
09:00	10:00	0	0	0	**0**	1	0	0	**1**	**1**	1	16	0	**17**	0	12	1	**13**	**30**	**31**
11:30	12:30	0	0	0	**0**	2	0	0	**2**	**2**	0	19	0	**19**	0	19	1	**20**	**39**	**41**
12:30	13:30	0	0	0	**0**	0	0	1	**1**	**1**	1	21	0	**22**	0	8	1	**9**	**31**	**32**
15:00	16:00	0	0	0	**0**	1	0	0	**1**	**1**	0	21	0	**21**	0	9	0	**9**	**30**	**31**
16:00	17:00	0	0	0	**0**	1	0	1	**2**	**2**	0	15	0	**15**	0	7	0	**7**	**22**	**24**
17:00	18:00	0	0	0	**0**	1	0	1	**2**	**2**	1	10	0	**11**	0	9	0	**9**	**20**	**22**
Sub Total		0	0	0	**0**	14	0	5	**19**	**19**	3	123	0	**126**	0	101	4	**105**	**231**	**250**
U-Turns (Heavy Vehicles)					**0**				**0**	**0**				**0**				**0**	**0**	**0**
Total		0	0	0	**0**	14	0	5	**19**	**19**	3	123	0	**126**	0	101	4	**105**	**231**	**250**

Heavy Vehicles are vehicles having one rear axle with four or more wheels, or having two or more rear axles. These vehicles include most O.C. Transpo, school and inter-city buses. Further, they ARE included in the Turning Movement Count Summary.

Public Works - Traffic Services

Work Order
35153

Turning Movement Count - Pedestrian Volume Report

MCARTHUR AVE @ OLMSTEAD ST

Count Date: Wednesday, July 29, 2015 **Start Time:** 07:00

Time Period	NB Approach (E or W Crossing)	SB Approach (E or W Crossing)	Total	EB Approach (N or S Crossing)	WB Approach (N or S Crossing)	Total	Grand Total
07:00 07:15	0	2	**2**	0	0	**0**	**2**
07:15 07:30	0	5	**5**	1	0	**1**	**6**
07:30 07:45	0	4	**4**	4	0	**4**	**8**
07:45 08:00	0	5	**5**	4	0	**4**	**9**
07:00 08:00	0	16	**16**	9	0	**9**	**25**
08:00 08:15	0	7	**7**	0	9	**9**	**16**
08:15 08:30	0	8	**8**	3	2	**5**	**13**
08:30 08:45	0	2	**2**	0	1	**1**	**3**
08:45 09:00	0	4	**4**	3	2	**5**	**9**
08:00 09:00	0	21	**21**	6	14	**20**	**41**
09:00 09:15	0	0	**0**	4	7	**11**	**11**
09:15 09:30	0	2	**2**	0	3	**3**	**5**
09:30 09:45	0	5	**5**	2	5	**7**	**12**
09:45 10:00	0	2	**2**	2	3	**5**	**7**
09:00 10:00	0	9	**9**	8	18	**26**	**35**
11:30 11:45	0	3	**3**	4	3	**7**	**10**
11:45 12:00	0	2	**2**	0	2	**2**	**4**
12:00 12:15	0	6	**6**	0	3	**3**	**9**
12:15 12:30	0	2	**2**	0	4	**4**	**6**
11:30 12:30	0	13	**13**	4	12	**16**	**29**
12:30 12:45	0	7	**7**	1	4	**5**	**12**
12:45 13:00	0	4	**4**	0	3	**3**	**7**
13:00 13:15	0	1	**1**	0	6	**6**	**7**
13:15 13:30	0	4	**4**	0	2	**2**	**6**
12:30 13:30	0	16	**16**	1	15	**16**	**32**
15:00 15:15	0	0	**0**	1	33	**34**	**34**
15:15 15:30	0	5	**5**	0	4	**4**	**9**
15:30 15:45	0	1	**1**	2	1	**3**	**4**
15:45 16:00	0	3	**3**	5	0	**5**	**8**
15:00 16:00	0	9	**9**	8	38	**46**	**55**
16:00 16:15	0	10	**10**	3	3	**6**	**16**
16:15 16:30	0	2	**2**	2	0	**2**	**4**
16:30 16:45	0	3	**3**	1	3	**4**	**7**
16:45 17:00	0	8	**8**	3	2	**5**	**13**
16:00 17:00	0	23	**23**	9	8	**17**	**40**
17:00 17:15	0	2	**2**	0	1	**1**	**3**
17:15 17:30	0	4	**4**	0	2	**2**	**6**
17:30 17:45	0	6	**6**	0	3	**3**	**9**
17:45 18:00	0	4	**4**	1	1	**2**	**6**
17:00 18:00	0	16	**16**	1	7	**8**	**24**
Total	0	123	**123**	46	112	**158**	**281**

Comment:

Turning Movement Count - 15 Min U-Turn Total Report

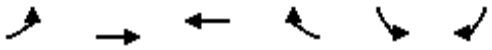
MCARTHUR AVE @ OLMSTEAD ST

Survey Date: Wednesday, July 29, 2015

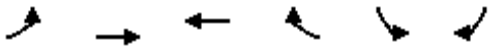
Time Period		Northbound U-Turn Total	Southbound U-Turn Total	Eastbound U-Turn Total	Westbound U-Turn Total	Total
07:00	07:15	0	0	0	0	0
07:15	07:30	0	0	0	0	0
07:30	07:45	0	0	0	0	0
07:45	08:00	0	0	0	0	0
08:00	08:15	0	0	1	0	1
08:15	08:30	0	0	0	0	0
08:30	08:45	0	0	0	0	0
08:45	09:00	0	0	0	0	0
09:00	09:15	0	0	0	0	0
09:15	09:30	0	0	0	0	0
09:30	09:45	0	0	0	0	0
09:45	10:00	0	0	0	0	0
11:30	11:45	0	0	0	0	0
11:45	12:00	0	0	0	0	0
12:00	12:15	0	0	0	0	0
12:15	12:30	0	0	0	0	0
12:30	12:45	0	0	0	0	0
12:45	13:00	0	0	0	0	0
13:00	13:15	0	0	0	0	0
13:15	13:30	0	0	0	0	0
15:00	15:15	0	0	0	0	0
15:15	15:30	0	0	0	0	0
15:30	15:45	0	0	0	0	0
15:45	16:00	0	0	0	0	0
16:00	16:15	0	0	0	0	0
16:15	16:30	0	0	0	0	0
16:30	16:45	0	0	0	0	0
16:45	17:00	0	0	0	0	0
17:00	17:15	0	0	0	0	0
17:15	17:30	0	0	0	0	0
17:30	17:45	0	0	1	0	1
17:45	18:00	0	0	0	0	0
Total		0	0	2	0	2

Appendix B

Synchro Worksheets



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	26	232	435	23	28	29
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Storage Length (m)	0.0			0.0	0.0	15.0
Storage Lanes	0			0	1	1
Taper Length (m)	2.5				2.5	
Lane Util. Factor	0.95	0.95	0.95	0.95	1.00	1.00
Ped Bike Factor		1.00	1.00		0.99	0.97
Frt			0.993			0.850
Flt Protected		0.995			0.950	
Satd. Flow (prot)	0	3344	3291	0	1616	1446
Flt Permitted		0.896			0.950	
Satd. Flow (perm)	0	3006	3291	0	1598	1396
Right Turn on Red				Yes		Yes
Satd. Flow (RTOR)			13			31
Link Speed (k/h)		40	40		40	
Link Distance (m)		244.9	466.4		221.3	
Travel Time (s)		22.0	42.0		19.9	
Confl. Peds. (#/hr)	24			24	11	11
Confl. Bikes (#/hr)				17		17
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Heavy Vehicles (%)	2%	3%	4%	4%	7%	7%
Adj. Flow (vph)	27	244	458	24	29	31
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	271	482	0	29	31
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(m)		0.0	0.0		3.7	
Link Offset(m)		0.0	0.0		0.0	
Crosswalk Width(m)		1.6	1.6		1.6	
Two way Left Turn Lane						
Headway Factor	1.06	1.06	1.06	1.06	1.06	1.06
Turning Speed (k/h)	24			14	24	14
Number of Detectors	1	2	2		1	1
Detector Template	Left	Thru	Thru		Left	Right
Leading Detector (m)	6.1	30.5	30.5		6.1	6.1
Trailing Detector (m)	0.0	0.0	0.0		0.0	0.0
Detector 1 Position(m)	0.0	0.0	0.0		0.0	0.0
Detector 1 Size(m)	6.1	1.8	1.8		6.1	6.1
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex
Detector 1 Channel						
Detector 1 Extend (s)	0.0	0.0	0.0		0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0		0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0		0.0	0.0
Detector 2 Position(m)		28.7	28.7			
Detector 2 Size(m)		1.8	1.8			
Detector 2 Type		Cl+Ex	Cl+Ex			
Detector 2 Channel						
Detector 2 Extend (s)		0.0	0.0			

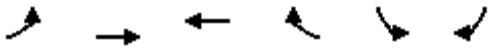


Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Turn Type	Perm	NA	NA		Prot	Perm
Protected Phases		2	6		4	
Permitted Phases	2					4
Detector Phase	2	2	6		4	4
Switch Phase						
Minimum Initial (s)	5.0	5.0	5.0		5.0	5.0
Minimum Split (s)	23.4	23.4	25.4		23.4	23.4
Total Split (s)	36.0	36.0	36.0		24.0	24.0
Total Split (%)	60.0%	60.0%	60.0%		40.0%	40.0%
Maximum Green (s)	30.6	30.6	30.6		18.6	18.6
Yellow Time (s)	3.3	3.3	3.3		3.3	3.3
All-Red Time (s)	2.1	2.1	2.1		2.1	2.1
Lost Time Adjust (s)		0.0	0.0		0.0	0.0
Total Lost Time (s)		5.4	5.4		5.4	5.4
Lead/Lag						
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Recall Mode	C-Max	C-Max	C-Max		Min	Min
Walk Time (s)	7.0	7.0	7.0		7.0	7.0
Flash Dont Walk (s)	11.0	11.0	13.0		11.0	11.0
Pedestrian Calls (#/hr)	0	0	0		0	0
Act Effct Green (s)		42.5	42.5		6.7	6.7
Actuated g/C Ratio		0.71	0.71		0.11	0.11
v/c Ratio		0.13	0.21		0.16	0.17
Control Delay		3.1	3.3		25.6	12.1
Queue Delay		0.0	0.0		0.0	0.0
Total Delay		3.1	3.3		25.6	12.1
LOS		A	A		C	B
Approach Delay		3.1	3.3		18.7	
Approach LOS		A	A		B	
Queue Length 50th (m)		3.7	6.8		3.0	0.0
Queue Length 95th (m)		7.4	12.4		9.0	6.2
Internal Link Dist (m)		220.9	442.4		197.3	
Turn Bay Length (m)						15.0
Base Capacity (vph)		2130	2336		500	454
Starvation Cap Reductn		0	0		0	0
Spillback Cap Reductn		0	0		0	0
Storage Cap Reductn		0	0		0	0
Reduced v/c Ratio		0.13	0.21		0.06	0.07

Intersection Summary	
Area Type:	Other
Cycle Length: 60	
Actuated Cycle Length: 60	
Offset: 2 (3%), Referenced to phase 2:EBTL and 6:WBT, Start of Green	
Natural Cycle: 50	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.21	
Intersection Signal Delay: 4.4	Intersection LOS: A

Intersection Capacity Utilization 44.7% ICU Level of Service A
Analysis Period (min) 15

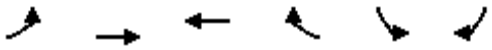
Splits and Phases: 1: MacArthur Avenue & Olmstead Street



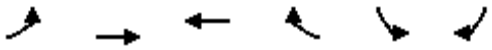
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	26	232	435	23	28	29
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Total Lost time (s)		5.4	5.4		5.4	5.4
Lane Util. Factor		0.95	0.95		1.00	1.00
Frpb, ped/bikes		1.00	1.00		1.00	0.94
Flpb, ped/bikes		1.00	1.00		1.00	1.00
Frt		1.00	0.99		1.00	0.85
Flt Protected		1.00	1.00		0.95	1.00
Satd. Flow (prot)		3338	3290		1616	1365
Flt Permitted		0.90	1.00		0.95	1.00
Satd. Flow (perm)		3006	3290		1616	1365
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	27	244	458	24	29	31
RTOR Reduction (vph)	0	0	4	0	0	28
Lane Group Flow (vph)	0	271	478	0	29	3
Confl. Peds. (#/hr)	24			24	11	11
Confl. Bikes (#/hr)				17		17
Heavy Vehicles (%)	2%	3%	4%	4%	7%	7%
Turn Type	Perm	NA	NA		Prot	Perm
Protected Phases		2	6		4	
Permitted Phases	2					4
Actuated Green, G (s)		42.5	42.5		6.7	6.7
Effective Green, g (s)		42.5	42.5		6.7	6.7
Actuated g/C Ratio		0.71	0.71		0.11	0.11
Clearance Time (s)		5.4	5.4		5.4	5.4
Vehicle Extension (s)		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)		2129	2330		180	152
v/s Ratio Prot			c0.15		c0.02	
v/s Ratio Perm		0.09				0.00
v/c Ratio		0.13	0.21		0.16	0.02
Uniform Delay, d1		2.8	3.0		24.1	23.7
Progression Factor		1.00	1.00		1.00	1.00
Incremental Delay, d2		0.1	0.2		0.4	0.1
Delay (s)		2.9	3.2		24.5	23.8
Level of Service		A	A		C	C
Approach Delay (s)		2.9	3.2		24.2	
Approach LOS		A	A		C	

Intersection Summary			
HCM 2000 Control Delay	4.6	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.20		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	10.8
Intersection Capacity Utilization	44.7%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	35	610	479	50	47	51
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Storage Length (m)	0.0			0.0	0.0	15.0
Storage Lanes	0			0	1	1
Taper Length (m)	2.5				2.5	
Lane Util. Factor	0.95	0.95	0.95	0.95	1.00	1.00
Ped Bike Factor		1.00	0.99		0.99	0.98
Frt			0.986			0.850
Flt Protected		0.997			0.950	
Satd. Flow (prot)	0	3380	3361	0	1695	1517
Flt Permitted		0.907			0.950	
Satd. Flow (perm)	0	3072	3361	0	1682	1484
Right Turn on Red				Yes		Yes
Satd. Flow (RTOR)			27			54
Link Speed (k/h)		40	40		40	
Link Distance (m)		244.9	466.4		221.3	
Travel Time (s)		22.0	42.0		19.9	
Confl. Peds. (#/hr)	23			23	8	9
Confl. Bikes (#/hr)				4		1
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94
Heavy Vehicles (%)	2%	2%	1%	0%	2%	2%
Adj. Flow (vph)	37	649	510	53	50	54
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	686	563	0	50	54
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(m)		0.0	0.0		3.7	
Link Offset(m)		0.0	0.0		0.0	
Crosswalk Width(m)		1.6	1.6		1.6	
Two way Left Turn Lane						
Headway Factor	1.06	1.06	1.06	1.06	1.06	1.06
Turning Speed (k/h)	24			14	24	14
Number of Detectors	1	2	2		1	1
Detector Template	Left	Thru	Thru		Left	Right
Leading Detector (m)	6.1	30.5	30.5		6.1	6.1
Trailing Detector (m)	0.0	0.0	0.0		0.0	0.0
Detector 1 Position(m)	0.0	0.0	0.0		0.0	0.0
Detector 1 Size(m)	6.1	1.8	1.8		6.1	6.1
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex
Detector 1 Channel						
Detector 1 Extend (s)	0.0	0.0	0.0		0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0		0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0		0.0	0.0
Detector 2 Position(m)		28.7	28.7			
Detector 2 Size(m)		1.8	1.8			
Detector 2 Type		Cl+Ex	Cl+Ex			
Detector 2 Channel						
Detector 2 Extend (s)		0.0	0.0			

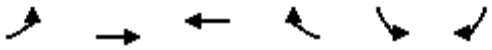


Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Turn Type	Perm	NA	NA		Prot	Perm
Protected Phases		2	6		4	
Permitted Phases	2					4
Detector Phase	2	2	6		4	4
Switch Phase						
Minimum Initial (s)	5.0	5.0	5.0		5.0	5.0
Minimum Split (s)	23.4	23.4	25.4		23.4	23.4
Total Split (s)	36.0	36.0	36.0		24.0	24.0
Total Split (%)	60.0%	60.0%	60.0%		40.0%	40.0%
Maximum Green (s)	30.6	30.6	30.6		18.6	18.6
Yellow Time (s)	3.3	3.3	3.3		3.3	3.3
All-Red Time (s)	2.1	2.1	2.1		2.1	2.1
Lost Time Adjust (s)		0.0	0.0		0.0	0.0
Total Lost Time (s)		5.4	5.4		5.4	5.4
Lead/Lag						
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Recall Mode	C-Max	C-Max	C-Max		Min	Min
Walk Time (s)	7.0	7.0	7.0		7.0	7.0
Flash Dont Walk (s)	11.0	11.0	13.0		11.0	11.0
Pedestrian Calls (#/hr)	0	0	0		0	0
Act Effct Green (s)		41.9	41.9		7.3	7.3
Actuated g/C Ratio		0.70	0.70		0.12	0.12
v/c Ratio		0.32	0.24		0.24	0.24
Control Delay		4.2	3.6		26.2	10.5
Queue Delay		0.0	0.0		0.0	0.0
Total Delay		4.2	3.6		26.2	10.5
LOS		A	A		C	B
Approach Delay		4.2	3.6		18.0	
Approach LOS		A	A		B	
Queue Length 50th (m)		11.6	8.4		5.1	0.0
Queue Length 95th (m)		20.8	15.4		12.8	7.9
Internal Link Dist (m)		220.9	442.4		197.3	
Turn Bay Length (m)						15.0
Base Capacity (vph)		2146	2356		525	497
Starvation Cap Reductn		0	0		0	0
Spillback Cap Reductn		0	0		0	0
Storage Cap Reductn		0	0		0	0
Reduced v/c Ratio		0.32	0.24		0.10	0.11

Intersection Summary	
Area Type:	Other
Cycle Length: 60	
Actuated Cycle Length: 60	
Offset: 59 (98%), Referenced to phase 2:EBTL and 6:WBT, Start of Green	
Natural Cycle: 50	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.32	
Intersection Signal Delay: 5.0	Intersection LOS: A

Intersection Capacity Utilization 56.0% ICU Level of Service B
Analysis Period (min) 15

Splits and Phases: 1: MacArthur Avenue & Olmstead Street



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	35	610	479	50	47	51
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Total Lost time (s)		5.4	5.4		5.4	5.4
Lane Util. Factor		0.95	0.95		1.00	1.00
Frpb, ped/bikes		1.00	0.99		1.00	0.98
Flpb, ped/bikes		1.00	1.00		1.00	1.00
Frt		1.00	0.99		1.00	0.85
Flt Protected		1.00	1.00		0.95	1.00
Satd. Flow (prot)		3378	3361		1695	1482
Flt Permitted		0.91	1.00		0.95	1.00
Satd. Flow (perm)		3073	3361		1695	1482
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	37	649	510	53	50	54
RTOR Reduction (vph)	0	0	8	0	0	47
Lane Group Flow (vph)	0	686	555	0	50	7
Confl. Peds. (#/hr)	23			23	8	9
Confl. Bikes (#/hr)				4		1
Heavy Vehicles (%)	2%	2%	1%	0%	2%	2%
Turn Type	Perm	NA	NA		Prot	Perm
Protected Phases		2	6		4	
Permitted Phases	2					4
Actuated Green, G (s)		41.9	41.9		7.3	7.3
Effective Green, g (s)		41.9	41.9		7.3	7.3
Actuated g/C Ratio		0.70	0.70		0.12	0.12
Clearance Time (s)		5.4	5.4		5.4	5.4
Vehicle Extension (s)		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)		2145	2347		206	180
v/s Ratio Prot			0.17		c0.03	
v/s Ratio Perm		c0.22				0.00
v/c Ratio		0.32	0.24		0.24	0.04
Uniform Delay, d1		3.5	3.3		23.8	23.2
Progression Factor		1.00	1.00		1.00	1.00
Incremental Delay, d2		0.4	0.2		0.6	0.1
Delay (s)		3.9	3.5		24.5	23.3
Level of Service		A	A		C	C
Approach Delay (s)		3.9	3.5		23.9	
Approach LOS		A	A		C	

Intersection Summary			
HCM 2000 Control Delay	5.3	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.31		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	10.8
Intersection Capacity Utilization	56.0%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group