

2024-05
Project: (240181)

Aleith Cole
AIM School Inc.
435 King Street North, Unit 2A
Waterloo, ON N2J 1Z5

RE: 145 LINCOLN ROAD, PRIVATE SCHOOL DEVELOPMENT TRANSPORTATION IMPACT STUDY

AIM School Inc. retained Paradigm Transportation Solutions Limited (Paradigm) to conduct this Transportation Impact Study (TIS) for a proposed private school located at 145 Lincoln Road in Waterloo, Ontario.

The existing AIM School is currently operating at 435 King Street North in Waterloo and is proposing to relocate all operations to the 145 Lincoln Road site.

Figure 1 (attached) illustrates the site location.

Scope of Work

This study reviews the forecast impacts of the school generated traffic on the surrounding road network and identifies any required remedial measures. The scope of the study includes:

- ▶ Assessing current traffic and site conditions within the study area;
- ▶ Forecasting future non-development (background) traffic growth;
- ▶ Forecasting school generated traffic;
- ▶ Analysing future traffic impacts on the surrounding road network for five-years after full build-out; and
- ▶ Recommending any necessary mitigation.

The study scope was developed in consultation with the City of Waterloo in April 2024.

Appendix A contains the pre-study consultation material and response from the City

The intersections assessed in this study area include:

- ▶ Weber Street North and Lincoln Road (signalized); and

- ▶ Lincoln Road and the existing Lincoln Road Chapel/Moses Springer Community Centre driveways (unsignalized);

Road Characteristics

The roadways of interest within the study area includes Region of Waterloo governed Weber Street North and City of Waterloo governed¹ Lincoln Road and are described as follows:

- ▶ **Weber Street North** is a four-lane regional arterial within the study area. Sidewalks are provided on both sides of the roadway. North of Allen Street East, the speed limit is 60 km/h. South of Allen Street East, the speed limit is 50 km/h; and
- ▶ **Lincoln Road** is a two-lane, 50 km/h major collector roadway within the study area. Sidewalks are provided on both sides of the roadway.

Development Concept

Development Description

The subject site is proposed to include the existing church facility with a portion of the building allocated to the private school with approximately 75 students. Vehicle access is proposed to be maintained via the existing driveway connection to Lincoln Road.

The development is assumed to occupy space at the existing church facility by September 2024.

School Trip Generation

The Institute of Transportation Engineers (ITE) Trip Generation manual² methods are used to forecast school generated trips. Land Use Code (LUC) 530 (Private School, K-8) was used to estimate the school trip generation. It is assumed that the afternoon dismissal time for the school occurs at 3:30PM which is prior to the peak hour of the adjacent streets. Therefore, trips generated by the school during the afternoon dismissal time will likely arrive and depart prior to the PM peak hour of the adjacent streets. The ITE trip data for LUC 530 is likely generated by school staff and extra curricular activities during the adjacent street PM peak hour.

Table 1 summarizes the forecast school generated trips indicating 42 AM peak hour and 20 PM peak hour trips. No reductions for alternative modes of transportation were used in the calculation.

¹ City of Waterloo, *Official Plan: Schedule E – Road Classification System*, (Waterloo: City of Waterloo, 2018).

² Institute of Transportation Engineers, *Trip Generation Manual*, 11th ed., (Washington DC: ITE, 2021).



TABLE 1: FORECAST SCHOOL GENERATED TRIPS

LUC	Students	AM Peak Hour			PM Peak Hour		
		In	Out	Total	In	Out	Total
530	75	24	18	42	9	11	20

1: $T = 1.11(X) - 40.99$ | 2: Average Rate = 0.26

The trip distribution used for this study was based on anonymized postal code information for students currently enrolled at the existing AIM School at 435 King Street North in Waterloo. The trip distribution is shown in **Table 2**.

Figure 2 (attached) illustrates the AM and PM peak hour trip assignment.

TABLE 2: TRIP DISTRIBUTION

To/From	Percentage
North via Weber Street North	16%
South via Weber Street North	42%
East via Lincoln Road	42%
Total	100%

Traffic Volumes

Paradigm undertook turning movement counts at the study area intersections in April 2024.

Appendix B contains the observed traffic counts for the study area intersections.

Figure 3 (attached) illustrate the base year weekday AM and PM peak hour traffic volumes.

The background traffic volumes reflect an annual growth rate of 1.0% per annum applied to the existing volumes. Although, no growth was applied to traffic leaving/accessing the driveways for the following established developments:

- ▶ The existing traffic for the Lincoln Road Chapel at 145 Lincoln Road (to be shared with the proposed private school);
- ▶ The existing traffic for the Moses Springer Community Centre at 150 Lincoln Road; and
- ▶ The existing traffic for the Bridgeport Plaza opposite of Lincoln Road at Weber Street North.



In addition, the following development was included in the background traffic volumes:

- ▶ 109, 115 & 133 Bridgeport Road East and 30-32 Weber Street North³: The mixed-use development is located southwest of the subject site between Bridgeport Road East and Royal Street along the east side of Weber Street North. 191 and 253 new vehicle trips are forecasted during the AM and PM peak hours, respectively.

Appendix C contains the background development traffic volumes.

Figure 4 (attached) illustrates the forecast background traffic volumes for the weekday AM and PM peak hours.

Figure 5 (attached) illustrates the forecast total (background + school traffic) traffic volumes.

Traffic Operations

The operations of the study intersections were evaluated using the existing lane configurations, traffic controls, and the base year traffic peak hour volumes.

A five-year horizon following the anticipated occupancy (2024) of the private school has been assessed to determine the impact of the subject site.

The level of service conditions on the road network have been assessed using Synchro 11. As noted in the Region of Waterloo TIS guidelines⁴, movements are considered critical under the following conditions:

- ▶ Estimated 95th percentile queue length for an exclusive movement exceeds the available storage space;
- ▶ Exclusive turning lanes are inaccessible because of queue lengths in adjacent through lanes;
- ▶ Estimated 95th percentile queue length for an individual movement will block an existing access; and
- ▶ The average control delay for individual movements is greater than 55 seconds.

Intersections are considered critical under the following conditions:

- ▶ An unsignalized intersection has an average control delay larger than 35 seconds (LOS E or F); and
- ▶ A signalized intersection has an average control delay larger than 55 seconds (LOS E or F).

³ C.F. Crozier & Associates Inc, *Transportation Impact Study & Parking Justification Study 109, 115 & 133 Bridgeport Road East and 30-32 Weber Street North*, (Milton: Crozier, 2023).

⁴ Region of Waterloo, *Transportation Impact Study Guidelines*, (Kitchener: Region of Waterloo, 2014).



Existing Traffic Operations

Table 3 summarizes the existing intersection operations. The entries in the table indicating the AM and PM peak hour level of service (LOS), volume to capacity ratios (V/C), and 95th percentile queues experienced.

All study area intersections are forecast to operate at acceptable levels of service during the AM and PM peak hour with the following critical movements noted at the intersection of Weber Street North and Lincoln Road:

- ▶ The eastbound left-turn movement is forecast to have a 95th percentile queue length surpassing its storage length during the PM peak hour;
- ▶ The eastbound through/right-turn movement is forecast to have a 95th percentile queue length blocking the eastbound left-turn lane during the AM and PM peak hours;
- ▶ The northbound through movement is forecast to have a 95th percentile queue length blocking the northbound left-turn lane during the AM and PM peak hours; and
- ▶ The southbound through movement is forecast to have a 95th percentile queue length blocking the southbound left-turn lane during the PM peak hour.

Appendix D contains the detailed Synchro reports.



TABLE 3: EXISTING OPERATIONS

Analysis Period	Intersection	Control Type	MOE	Direction/Movement/Approach																
				Eastbound				Westbound				Northbound				Southbound				Overall
				Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	
AM Peak Hour	Weber Street North & Lincoln Road	TCS	LOS	C	C	>	C	C	C	>	C	A	B	B	B	A	B	B	B	B
			Delay	24	23	>	23	26	23	>	25	10	14	14	13	10	12	12	12	15
			V/C	0.10	0.22	>		0.24	0.18	>		0.06	0.46	0.46		0.10	0.37	0.37		
			Q	10	21	>		22	18	>		3	67	68		4	52	54		
AM Peak Hour	Site Access & Lincoln Road	TWSC	LOS	A	A	A	A	A	A	A	<	B	>	B	<	A	>	A		
			Delay	8	0	0	0	8	0	0	1	<	10	>	10	<	10	>	10	
			V/C	0.00	0.00	0.00		0.01	0.00	0.00		<	0.06	>		<	0.01	>		
			Q	0	0	0		0	0	0		<	2	>		<	0	>		
PM Peak Hour	Weber Street North & Lincoln Road	TCS	LOS	C	C	>	C	D	C	>	C	B	B	B	B	B	B	B	B	
			Delay	30	30	>	30	36	26	>	30	12	15	16	15	11	18	18	17	19
			V/C	0.28	0.47	>		0.30	0.22	>		0.17	0.49	0.49		0.16	0.61	0.61		
			Q	28	57	>		26	24	>		7	80	80		8	102	104		
PM Peak Hour	Site Access & Lincoln Road	TWSC	Stor.	15	-	>		40	-	>		20	-	-		65	-	-		
			Avail.	-13	-	>		14	-	>		13	-	-		57	-	-		
			LOS	A	A	A	A	A	A	A	A	<	B	>	B	<	B	>	B	
			Delay	8	0	0	0	8	0	0	1	<	11	>	11	<	10	>	10	
PM Peak Hour	Weber Street North & Lincoln Road	TCS	V/C	0.00	0.00	0.00		0.01	0.00	0.00		<	0.08	>		<	0.00	>		
			Q	0	0	0		0	0	0		<	2	>		<	0	>		

MOE - Measure of Effectiveness

LOS - Level of Service

Delay - Average Delay per Vehicle in Seconds

V/C - Volume to Capacity Ratio

Q - 95th Percentile Queue Length (m)

Stor. - Existing Storage (m)

Avail. - Available Storage (m)

TCS - Traffic Control Signal

TWSC - Two-Way Stop Control

</> - Shared Movement

Future Background Traffic Operations

The study area intersection operations analysis for the forecast background traffic scenario followed the same methodology used for the existing traffic conditions. **Table 4** details the level of service conditions.

All study area intersections are forecast to operate at acceptable levels of service during the AM and PM peak hour with the following critical movements noted at the intersection of Weber Street North and Lincoln Road:

- ▶ The eastbound left-turn movement is forecast to have a 95th percentile queue length surpassing its storage length during the PM peak hour;
- ▶ The eastbound through/right-turn movement is forecast to have a 95th percentile queue length blocking the eastbound left-turn lane during the AM and PM peak hours;
- ▶ The northbound through movement is forecast to have a 95th percentile queue length blocking the northbound left-turn lane during the AM and PM peak hours; and



- The southbound through movement is forecast to have a 95th percentile queue length blocking the southbound left-turn lane during the PM peak hour.

Appendix E contains the detailed Synchro reports.

TABLE 4: BACKGROUND OPERATIONS

Analysis Period	Intersection	Control Type	MOE	Direction/Movement/Approach																
				Eastbound				Westbound				Northbound				Southbound				Overall
				Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	
AM Peak Hour	Weber Street North & Lincoln Road	TCS	LOS	C	C	>	C	C	>	C	A	B	B	B	B	B	B	B	B	
			Delay	24	23	>	23	27	23	>	25	10	14	14	14	10	12	13	12	15
			V/C	0.10	0.22	>		0.25	0.18	>		0.06	0.49	0.49		0.11	0.40	0.41		
			Q	10	21	>		24	18	>		3	70	72		4	58	59		
	Stor.	15	-	>		40	-	>		20	-	-		65	-	-				
	Avail.	5	-	>		16	-	>		17	-	-		61	-	-				
Site Access & Lincoln Road	TWSC	LOS	A	A	A	A	A	A	A	A	<	B	>	B	<	A	>	A		
		Delay	8	0	0	0	8	0	0	1	<	10	>	10	<	10	>	10		
		V/C	0.00	0.00	0.00		0.01	0.00	0.00		<	0.06	>		<	0.01	>			
		Q	0	0	0		0	0	0		<	2	>		<	0	>			
PM Peak Hour	Weber Street North & Lincoln Road	TCS	LOS	C	C	>	C	D	C	>	C	B	B	B	B	B	B	B	B	
			Delay	30	30	>	30	35	25	>	30	13	16	17	16	12	19	19	19	20
			V/C	0.27	0.46	>		0.30	0.23	>		0.19	0.53	0.53		0.18	0.65	0.65		
			Q	28	56	>		27	25	>		8	87	88		8	112	115		
	Stor.	15	-	>		40	-	>		20	-	-		65	-	-				
	Avail.	-13	-	>		13	-	>		12	-	-		57	-	-				
Site Access & Lincoln Road	TWSC	LOS	A	A	A	A	A	A	A	A	<	B	>	B	<	B	>	B		
		Delay	8	0	0	0	8	0	0	1	<	11	>	11	<	10	>	10		
		V/C	0.00	0.00	0.00		0.01	0.00	0.00		<	0.08	>		<	0.00	>			
		Q	0	0	0		0	0	0		<	2	>		<	0	>			

MOE - Measure of Effectiveness

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Stor. - Existing Storage (m)

Avail. - Available Storage (m)

TCS - Traffic Control Signal

TWSC - Two-Way Stop Control

</> - Shared Movement

Future Total Traffic Operations

The study area intersection operations analysis for the future total traffic scenario followed the same methodology used for the existing and background traffic conditions. **Table 5** details the level of service conditions for the weekday AM and PM peak hours.

All study area intersections are forecast to operate at acceptable levels of service during the AM and PM peak hour with the following critical movements noted at the intersection of Weber Street North and Lincoln Road:

- The eastbound left-turn movement is forecast to have a 95th percentile queue length surpassing its storage length during the PM peak hour;



- ▶ The eastbound through/right-turn movement is forecast to have a 95th percentile queue length blocking the eastbound left-turn lane during the AM and PM peak hours;
- ▶ The northbound through movement is forecast to have a 95th percentile queue length blocking the northbound left-turn lane during the AM and PM peak hours; and
- ▶ The southbound through movement is forecast to have a 95th percentile queue length blocking the southbound left-turn lane during the PM peak hour.

With the addition of the school generated traffic volumes, the approach delays at the study area intersections increase by one second or less during the AM and PM peak hours.

Appendix F contains the detailed Synchro reports.

TABLE 5: TOTAL OPERATIONS

Analysis Period	Intersection	Control Type	MOE	Direction/Movement/Approach															
				Eastbound				Westbound				Northbound				Southbound			
				Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach
AM Peak Hour	Weber Street North & Lincoln Road	TCS	LOS	C	C	>	C	C	C	>	C	A	B	B	B	B	B	B	B
			Delay	24	23	>	23	27	23	>	25	10	14	14	14	10	12	13	12
			V/C	0.10	0.22	>		0.27	0.19	>		0.06	0.50	0.50		0.12	0.40	0.41	
			Q	10	21	>		26	19	>		3	72	74		4	58	59	
PM Peak Hour	Weber Street North & Lincoln Road	TCS	Stor.	15	-	>		40	-	>		20	-	-		65	-	-	
			Avail.	5	-	>		14	-	>		17	-	-		61	-	-	
	Site Access & Lincoln Road	TWSC	LOS	A	A	A	A	A	A	A	A	<	B	>	B	<	A	>	A
			Delay	8	0	0	0	8	0	0	1	<	11	>	11	<	10	>	10
			V/C	0.00	0.00	0.00		0.02	0.00	0.00		<	0.08	>		<	0.01	>	
			Q	0	0	0		1	0	0		<	2	>		<	0	>	
PM Peak Hour	Weber Street North & Lincoln Road	TCS	LOS	C	C	>	C	D	C	>	C	B	B	B	B	B	B	B	B
			Delay	30	30	>	30	36	26	>	30	13	16	17	16	12	19	19	19
			V/C	0.27	0.46	>		0.32	0.23	>		0.19	0.53	0.53		0.19	0.65	0.65	
			Q	28	56	>		28	26	>		8	88	88		8	112	115	
PM Peak Hour	Site Access & Lincoln Road	TWSC	Stor.	15	-	>		40	-	>		20	-	-		65	-	-	
			Avail.	-13	-	>		12	-	>		12	-	-		57	-	-	
	Site Access & Lincoln Road	TWSC	LOS	A	A	A	A	A	A	A	A	<	B	>	B	<	B	>	B
			Delay	8	0	0	0	8	0	0	1	<	11	>	11	<	10	>	10
			V/C	0.00	0.00	0.00		0.02	0.00	0.00		<	0.10	>		<	0.00	>	
			Q	0	0	0		1	0	0		<	2	>		<	0	>	

MOE - Measure of Effectiveness

LOS - Level of Service

Delay - Average Delay per Vehicle in Seconds

V/C - Volume to Capacity Ratio

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Avail. - Available Storage (m)

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</> - Shared Movement



Remedial Measures

Left-Turn Lane Warrant

The intersection of Lincoln Road at the Site Driveway was assessed to determine if the projected traffic volumes warrant installation of a left-turn lane. The warrants for left-turn lanes follow the requirements in the Ministry of Transportation's (MTO) Geometric Design Standards⁵. A design speed of 60 km/h (10 km/h over the posted speed limit) was used for Lincoln Road.

The percentages of left-turning vehicles in the approaching volume were rounded to the nearest 5%, as nomographs are only provided for 5% increments. This apparent requirement is due to the nature of the warrant procedure that assumes a minimum of 5% of left turning vehicles in the advancing volume. Therefore, left-turn lanes are automatically not warranted for any left turning volume less than 5%.

Table 6 summarizes the left-turn lane warrant for the intersection of Lester Street at the Site Driveway. The warrant analysis suggests that a westbound left-turn lane is not warranted.

TABLE 6: LEFT-TURN WARRANT SUMMARY – LINCOLN ROAD

Roadway	Lincoln Road	
Intersection	Site Driveway	
Approach Direction	Westbound	
Design Speed	60 km/h	
Horizon	Total 2029	
Peak Hour	AM	PM
Advancing Volume	157	167
Opposing Volume	162	231
Left Turning Traffic	27	22
% of Left Turning Traffic	17%	13%
Figure Used*	9A-8	9A-8
Warranted	No	No
Storage Length Required	-	-

*Ontario Ministry of Transportation, *MTO Design Supplement for TAC Geometric Design Guide for Canadian Roads*, (Toronto: Queen's Printer for Ontario, 2020).

Appendix G contains the left-turn lane warrant nomographs.

⁵ Ontario Ministry of Transportation, *MTO Design Supplement for TAC Geometric Design Guide for Canadian Roads*, (Toronto: Queen's Printer for Ontario, 2020).



Transportation Demand Management

The following strategies and tools exist in the surrounding area, including existing pedestrian and transit facilities, or can be implemented into the site design to encourage the use of alternative modes of transportation for staff and students.

Cycling

The City of Waterloo's Zoning By-law 2018-050⁶ indicates parking requirements for bicycles at the following rate:

- ▶ Private School: For every teaching space part of the school, a minimum of two bicycle parking spots are required.

Walking

The pedestrian accessibility of a development is essential in helping to ensure that those that can walk, have access to accessible pedestrian connections.

Sidewalks are provided on both sides of all surrounding roadways along with a pedestrian crossing on Lincoln Road in front of the subject site. In addition, the signalized intersection of Weber Street North and Lincoln Road operates with crosswalks and pedestrian phases on all approaches, making the surrounding municipal sidewalk/multi-use path network accessible from the subject site.

Transit

The availability of convenient and desirable transit options can reduce the number of person automobile trips. Public transportation is provided via the following Grand River Transit Routes⁷:

- ▶ Route 5 (Erb);
- ▶ Route 8 (Weber); and
- ▶ Route 29 (Keats-University).

All bus routes operate with headways not surpassing 30-minutes during the anticipated times staff and students leave and access the school.

The closest transit stops to the subject site are located at or near the intersections of Weber Street North at Lincoln Road and Ellis Crecent North at Lincoln Road (about a 3 to 4 minute walk).

Both seating and shelter is provided at most bus stops in the vicinity of the Weber Street North and Lincoln Road intersection. Although, both bus stops in the vicinity of Ellis Crescent North

⁶ City of Waterloo Zoning By-law 2018-050, Section 6 – Parking, Driveways, Loading

⁷ Grand River Transit System Map," Region of Waterloo, 2023, <https://www.grt.ca/en/schedules-maps/system-map.aspx>.



and Lincoln Road intersection along with the bus stop in the northeast corner of the Weber Street North and Lincoln intersection only consists of a sign and pad with standing room.

Conclusions and Recommendations

Conclusions

Based on the investigations carried out, it is concluded that:

- ▶ **Development Trip Generation:** The private school is forecast to generate approximately 42 and 20 trips during the AM and PM peak hours, respectively.
- ▶ **Existing Traffic Conditions:** All study area intersections are forecast to operate at acceptable levels of service during the AM and PM peak hour with the following critical movements noted at the intersection of Weber Street North and Lincoln Road:
 - The eastbound left-turn movement is forecast to have a 95th percentile queue length surpassing its storage length during the PM peak hour;
 - The eastbound through/right-turn movement is forecast to have a 95th percentile queue length blocking the eastbound left-turn lane during the AM and PM peak hours;
 - The northbound through movement is forecast to have a 95th percentile queue length blocking the northbound left-turn lane during the AM and PM peak hours; and
 - The southbound through movement is forecast to have a 95th percentile queue length blocking the southbound left-turn lane during the PM peak hour.
- ▶ **Future Background and Total Traffic Conditions:** The study area intersections are forecast to operate at acceptable levels of service similar to existing traffic conditions with no additional critical movements noted.
- ▶ **Left-Turn Lane Warrant:** A westbound left-turn lane is not warranted at the intersection of Lincoln Road and the Site Driveway.
- ▶ **Critical Movements:** All critical movements at the intersection of Weber Street North and Lincoln Road operate on approaches governed by private owners or the Region of Waterloo and are present under existing and future traffic conditions.
- ▶ **Transportation Demand Management:** The site is well served by alternate mode infrastructure including:
 - Sidewalks are provided on both sides of all surrounding roadways; and
 - Multiple transit stops close to the subject site are located at a 3-4 minute walking distance.

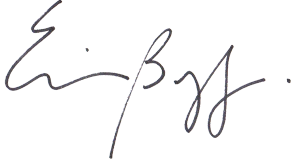


Recommendations

Based on the findings of this study, it is recommended that the existing AIM School operations be transferred to the property at 145 Lincoln Road with no conditions related to off-site transportation improvements.

Yours very truly,

PARADIGM TRANSPORTATION SOLUTIONS LIMITED



Erica Bayley
P.Eng.
Senior Project Manager, Associate



Jim Mallett
M.A.Sc., P.Eng., PTOE
President and Chief Executive Officer, Principal



Attachments



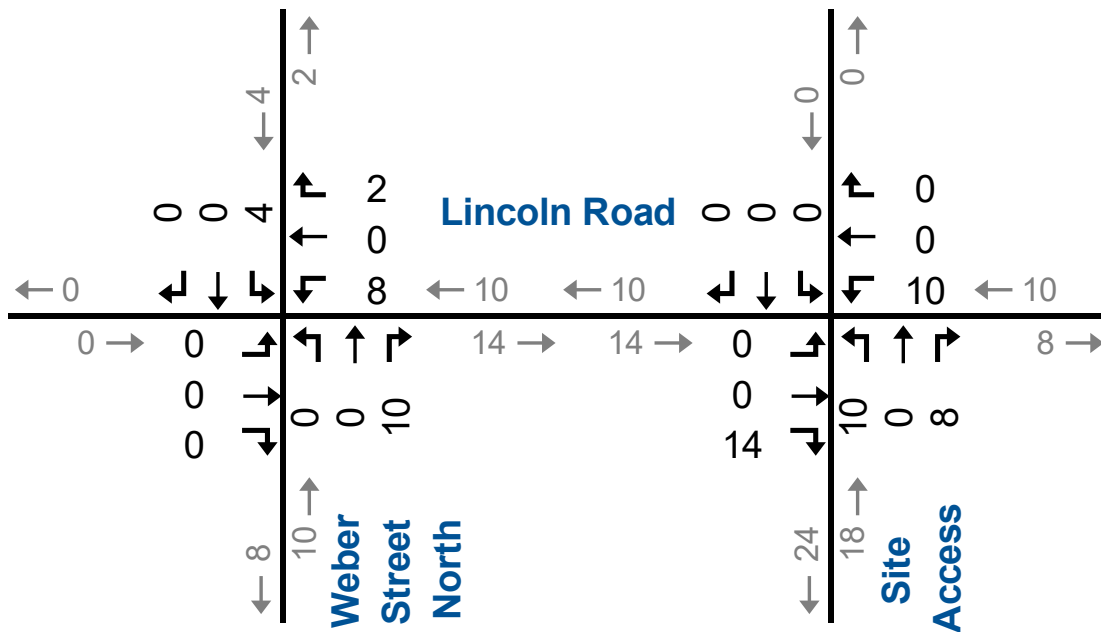


Site Location

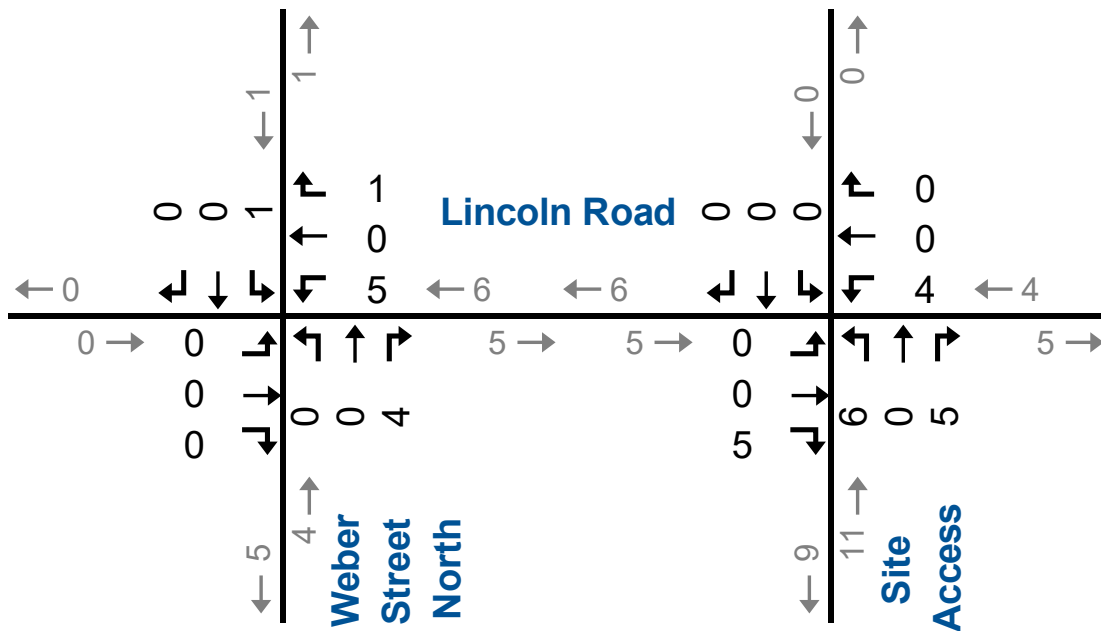
145 Lincoln Road, Waterloo TIS
240181

Figure 1

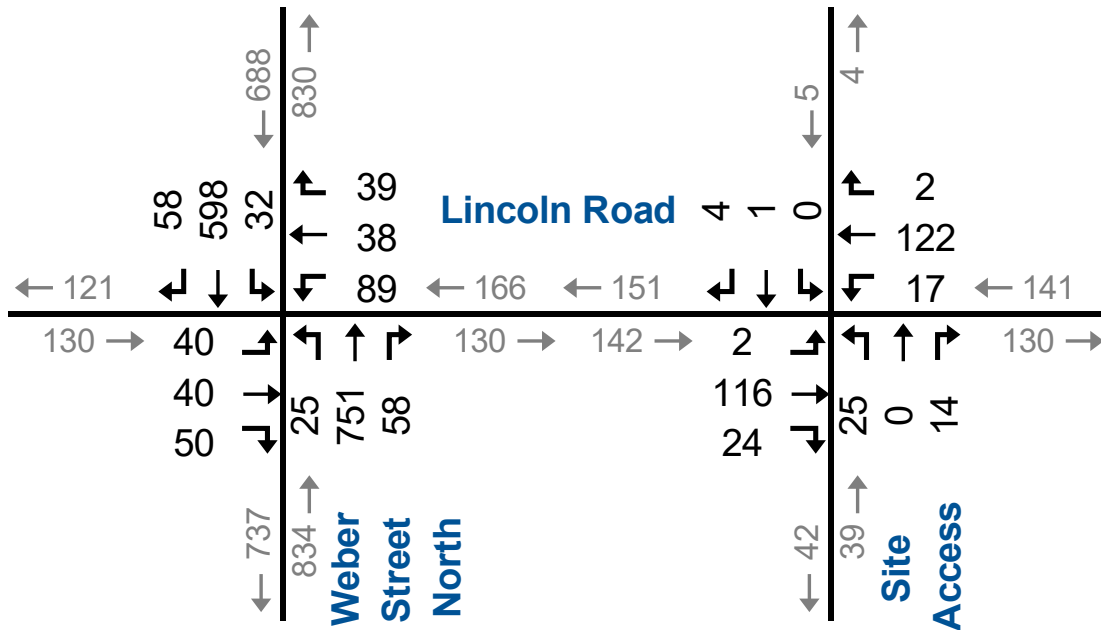
AM Peak Hour



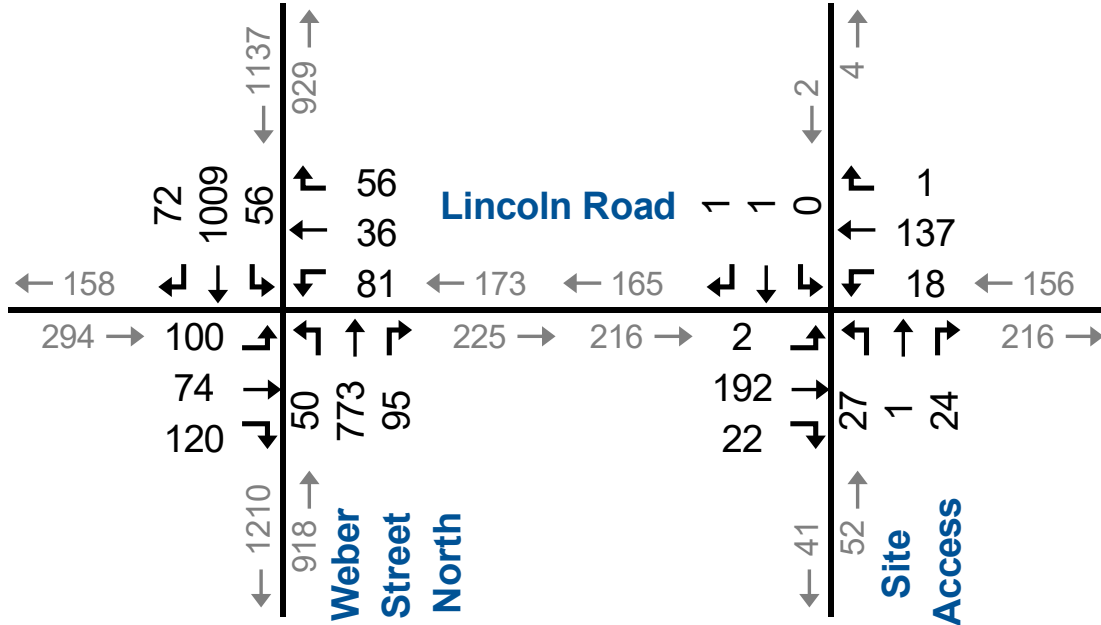
PM Peak Hour



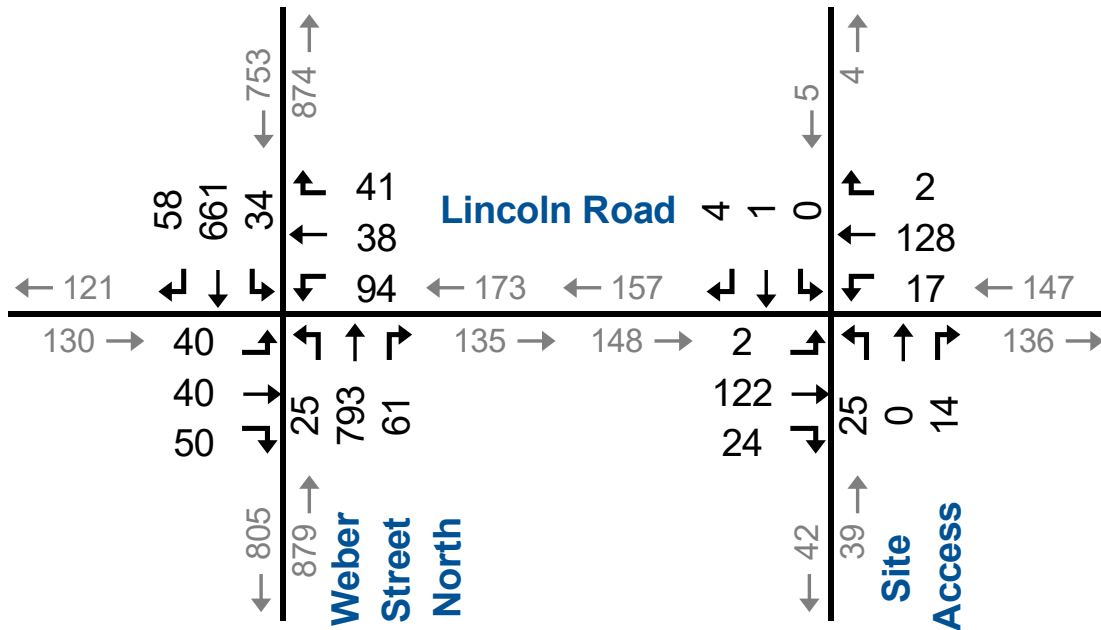
AM Peak Hour



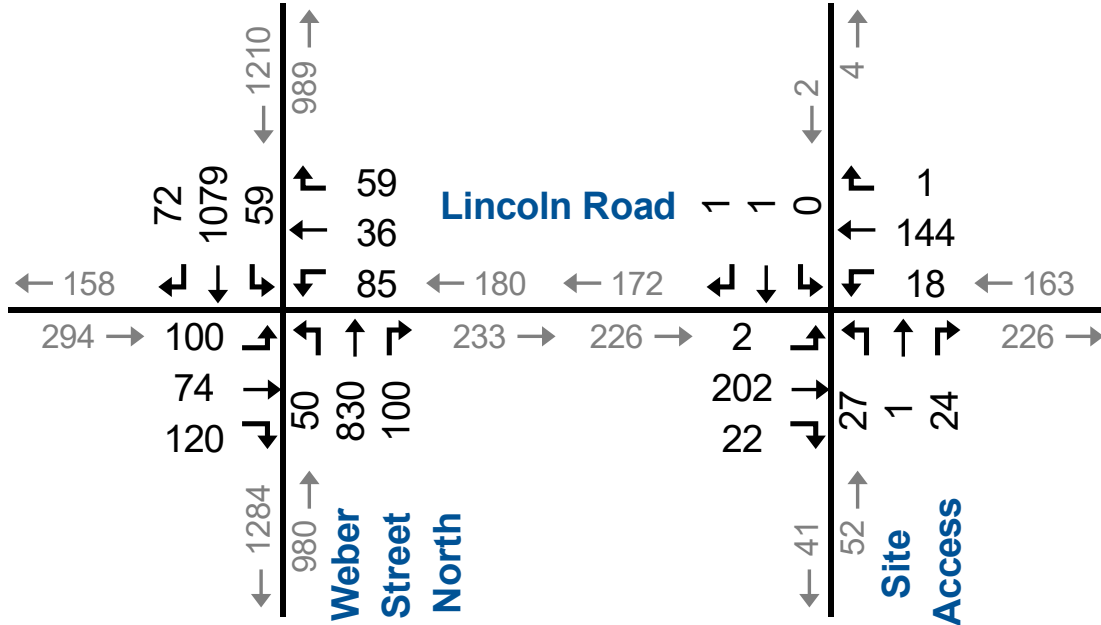
PM Peak Hour



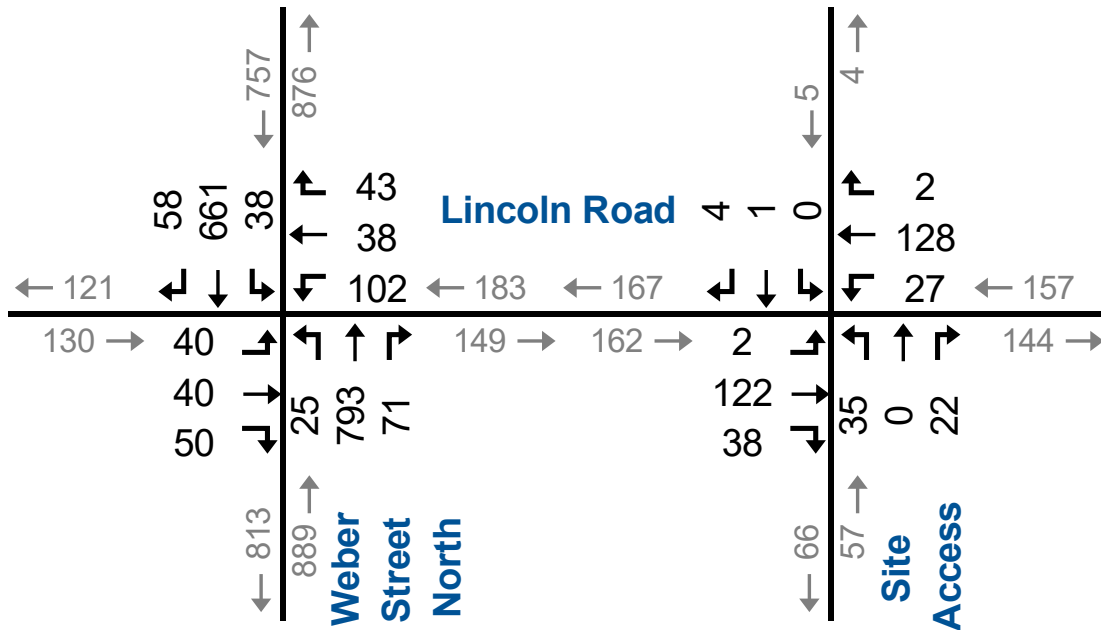
AM Peak Hour



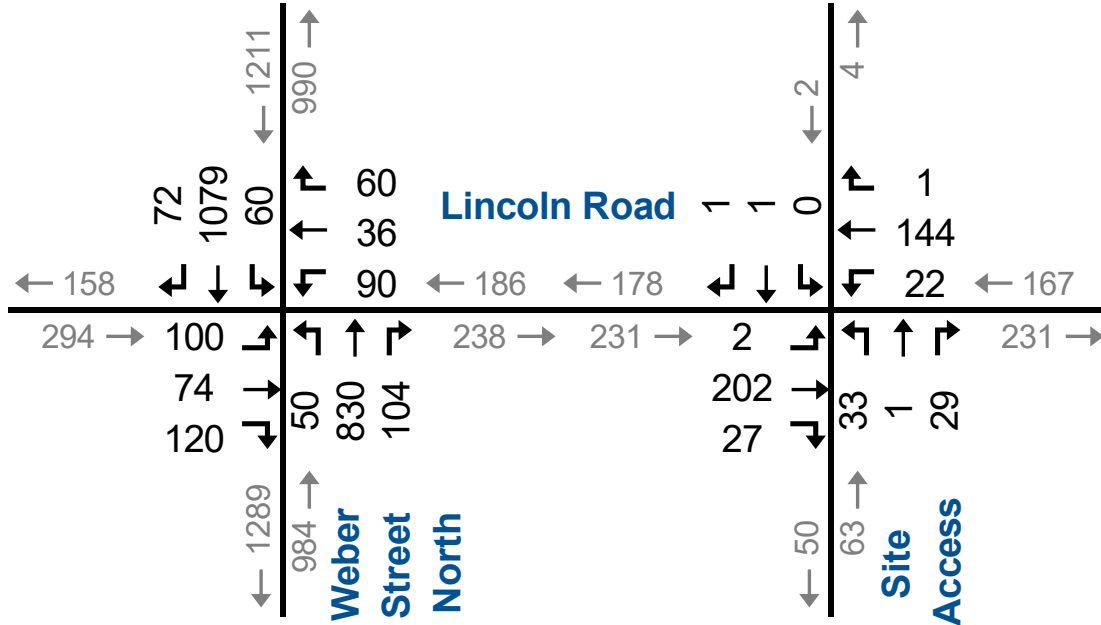
PM Peak Hour



AM Peak Hour



PM Peak Hour



Appendix A: Pre-Study



From: Tanikia Kinear <TKinear@regionofwaterloo.ca>
Sent: April 17, 2024 1:52 PM
To: Andrew Orr; 'Ainsley Rego'
Cc: Erica Bayley
Subject: RE: (240181) 145 Lincoln Road, Waterloo TIS

Hi Andrew,

No need for a Regional TIS.

Thanks,

Tanikia Kinear, C.E.T.
Transportation Planner (Corridor Planning)
Region of Waterloo - Planning, Development and Legislative Services
150 Frederick Street, 8th Floor, Kitchener ON N2G 4J3
519-897-5691
www.regionofwaterloo.ca

From: Andrew Orr <aorr@ptsl.com>
Sent: April 15, 2024 8:27 AM
To: Tanikia Kinear <TKinear@regionofwaterloo.ca>; 'Ainsley Rego' <Ainsley.Rego@waterloo.ca>
Cc: Erica Bayley <ebayley@ptsl.com>
Subject: RE: (240181) 145 Lincoln Road, Waterloo TIS

CAUTION! EXTERNAL SENDER

Were you expecting this email? TAKE A CLOSER LOOK. Is the sender legitimate?
DO NOT click links or open attachments unless you are 100% sure that the email is safe.

Hi Ainsley and Tanikia,

The expected enrollment at the proposed private school is between 60 to 75 students.

Does the Region still remain uninterested in the study and is as traffic brief sufficient for the study or is a full TIS needed?

Best Regards,

Andrew Orr, M.A.Sc., EIT
Transportation Consultant, Associate
(He/Him)



5A-150 Pinebush Road, Cambridge ON, N1R 8J8
p: 519.896.3163 x210
m: 289-808-8997
e: aorr@ptsl.com
w: www.ptsl.com

From: Tanikia Kinear <TKinear@regionofwaterloo.ca>
Sent: Friday, April 12, 2024 3:56 PM
To: 'Ainsley Rego' <Ainsley.Rego@waterloo.ca>; Andrew Orr <aorr@ptsl.com>
Cc: Erica Bayley <ebayley@ptsl.com>
Subject: RE: (240181) 145 Lincoln Road, Waterloo TIS

Seems I received a response sooner than expected.

At this point the Region would not require a TIS, however, it would be dependent on the number of students at the school as this would be used to assess the need for TIS in terms of peak hour trip generation.

Thanks,

Tanikia Kinear, C.E.T.
Transportation Planner (Corridor Planning)
Region of Waterloo - Planning, Development and Legislative Services
150 Frederick Street, 8th Floor, Kitchener ON N2G 4J3
519-897-5691
www.regionofwaterloo.ca

From: Ainsley Rego <Ainsley.Rego@waterloo.ca>
Sent: April 12, 2024 2:57 PM
To: Andrew Orr <aorr@ptsl.com>; Tanikia Kinear <TKinear@regionofwaterloo.ca>
Cc: Erica Bayley <ebayley@ptsl.com>
Subject: RE: (240181) 145 Lincoln Road, Waterloo TIS

CAUTION! EXTERNAL SENDER

Were you expecting this email? TAKE A CLOSER LOOK. Is the sender legitimate?
DO NOT click links or open attachments unless you are 100% sure that the email is safe.

Good afternoon Andrew,

Thank you for providing the below scope of work. Please see my responses below in red.

@Tanikia Kinear – Is a full study required or could we have this information in a letter or brief instead?

Best Regards,



Ainsley Rego, BES, RSP1 (she/her)

Engineering Technologist – Traffic

Transportation Engineering, Integrated Planning & Public Works, City of Waterloo

265 Lexington Court PO Box 337 Station Waterloo Waterloo, ON N2J 4A8

P: 1.519.886.2310 ext. 30336 F: 1.519.886.5788 TTY: 1.866.786.3941 E: ainsley.rego@waterloo.ca

From: Andrew Orr <aorr@ptsl.com>

Sent: Thursday, April 11, 2024 1:54 PM

To: Ainsley Rego <Ainsley.Rego@waterloo.ca>; TKinear@regionofwaterloo.ca

Cc: Erica Bayley <ebayley@ptsl.com>

Subject: [EXTERNAL] (240181) 145 Lincoln Road, Waterloo TIS

Hello Ainsley and Tanikia,

Paradigm Transportation Solutions Limited (Paradigm) has been retained to conduct this Transportation Impact Study (TIS) for a proposed private school located at 145 Lincoln Road in Waterloo, Ontario. The subject site is proposed to include the existing church facility with a portion of the building allocated to the private school. Vehicle access is proposed to be maintained via the existing driveway connection to Lincoln Road. Note that this is the relocation of the existing AIM School currently operating at 435 King Street North.

We'd like to prepare our report based on the following scope, subject to your comments. If the Region of Waterloo has interest in this study, a PSC form will be issued:

PROPOSED TERMS OF REFERENCE

Study Area Intersections:

- Weber Street North and Lincoln Road (signalized); and
- Existing driveway connection to Lincoln Road, opposite Moses Springer Community Centre (unsignalized).

Analysis Periods:

- Weekday AM peak hour
- Weekday PM peak hour

Existing Data:

- Existing 8-hour TMC data to be collected by Paradigm in April/May 2024

Horizon Year

- Five-years from the full build-out

Analysis

- Synchro 11, HCM 6 analysis

Background Traffic

- Background traffic annual growth rate **Please confirm** - 1% growth rate
- Approved developments to include in background. **Please confirm** - 109, 115, 133 Bridgeport Road E and 30 Weber Street N (<https://www.engagewr.ca/bridgeport-and-weber>)

Future Road Improvements:

- **Please confirm** – No identified improvements on City roads.

Trip Generation

- ITE Trip Generation Data 11th Edition with no modal split reductions, based on information from the client re: student numbers and school hours (to be confirmed).

Site Traffic Distribution

- Existing Traffic Patterns, 2016 Transportation Tomorrow Survey (TTS) Data, and information from the client re: school catchment.

Best Regards,

Andrew Orr, M.A.Sc., EIT

Transportation Consultant, Associate
(He/Him)



5A-150 Pinebush Road, Cambridge ON, N1R 8J8
p: 519.896.3163 x210
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Appendix B: Traffic Data





Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: 145 Lincoln Road
Site Code: 240181
Start Date: 04/23/2024
Page No: 1

Turning Movement Data

Start Time	Lincoln Road Eastbound						Lincoln Road Westbound						145 Lincoln Road Driveway Northbound						Driveway Southbound						Int. Total
	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	
7:00 AM	1	7	1	0	0	9	1	7	0	0	0	8	1	0	1	0	3	2	0	0	0	0	1	0	19
7:15 AM	1	10	1	0	0	12	1	9	0	0	0	10	2	0	1	0	1	3	0	0	0	0	0	0	25
7:30 AM	0	15	4	0	0	19	3	13	0	1	0	17	3	0	3	0	2	6	0	0	1	0	0	1	43
7:45 AM	0	16	8	1	0	25	4	24	2	0	0	30	4	0	4	0	2	8	0	1	0	0	2	1	64
Hourly Total	2	48	14	1	0	65	9	53	2	1	0	65	10	0	9	0	8	19	0	1	1	0	3	2	151
8:00 AM	0	17	1	0	0	18	9	18	0	0	0	27	7	0	7	0	3	14	0	0	0	0	28	0	59
8:15 AM	1	33	8	0	0	42	6	32	0	0	1	38	6	0	5	0	6	11	0	0	0	0	16	0	91
8:30 AM	0	23	6	0	0	29	3	29	1	0	1	33	8	0	2	0	2	10	0	1	3	0	2	4	76
8:45 AM	1	28	6	0	2	35	7	36	0	0	0	43	6	0	3	0	1	9	0	0	1	0	3	1	88
Hourly Total	2	101	21	0	2	124	25	115	1	0	2	141	27	0	17	0	12	44	0	1	4	0	49	5	314
9:00 AM	0	32	4	0	0	36	1	25	1	0	6	27	5	0	4	0	3	9	0	0	0	0	11	0	72
9:15 AM	0	23	7	0	0	30	3	23	1	0	0	27	1	0	3	0	0	4	0	0	1	0	3	1	62
9:30 AM	0	18	7	0	0	25	2	22	0	0	0	24	5	0	1	0	1	6	1	0	0	0	2	1	56
9:45 AM	0	16	3	0	0	19	6	32	0	0	0	38	3	0	0	0	0	3	0	0	0	0	5	0	60
Hourly Total	0	89	21	0	0	110	12	102	2	0	6	116	14	0	8	0	4	22	1	0	1	0	21	2	250
*** BREAK ***	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11:30 AM	0	35	1	0	0	36	1	16	1	0	2	18	2	0	3	0	1	5	0	0	1	0	4	1	60
11:45 AM	1	45	1	0	1	47	3	23	1	0	2	27	2	0	1	0	2	3	0	0	1	0	2	1	78
Hourly Total	1	80	2	0	1	83	4	39	2	0	4	45	4	0	4	0	3	8	0	0	2	0	6	2	138
12:00 PM	0	34	1	0	0	35	1	29	0	0	0	30	3	0	2	0	0	5	1	0	1	0	1	2	72
12:15 PM	1	39	0	0	0	40	1	18	0	0	0	19	1	0	1	0	3	2	0	0	0	0	0	0	61
12:30 PM	1	34	3	0	2	38	2	21	0	0	0	23	3	0	3	0	3	6	2	0	0	0	1	2	69
12:45 PM	2	35	2	0	3	39	2	16	0	0	0	18	1	0	1	0	0	2	2	0	0	0	1	2	61
Hourly Total	4	142	6	0	5	152	6	84	0	0	0	90	8	0	7	0	6	15	5	0	1	0	3	6	263
1:00 PM	0	25	0	0	1	25	2	24	1	0	0	27	6	0	0	0	0	6	0	0	1	0	4	1	59
1:15 PM	0	31	4	0	0	35	3	27	1	0	0	31	1	0	1	0	0	2	0	0	0	0	0	0	68
*** BREAK ***	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hourly Total	0	56	4	0	1	60	5	51	2	0	0	58	7	0	1	0	0	8	0	0	1	0	4	1	127
3:00 PM	1	34	1	1	1	37	0	35	0	0	1	35	2	0	1	0	9	3	0	0	0	0	15	0	75
3:15 PM	0	48	5	0	0	53	0	30	0	0	0	30	2	0	3	0	2	5	0	0	0	0	32	0	88
3:30 PM	0	40	1	0	1	41	1	34	0	0	0	35	5	0	2	0	3	7	1	0	0	0	4	1	84
3:45 PM	1	43	7	0	0	51	4	27	0	0	0	31	6	0	6	0	3	12	1	0	1	0	2	2	96
Hourly Total	2	165	14	1	2	182	5	126	0	0	1	131	15	0	12	0	17	27	2	0	1	0	53	3	343
4:00 PM	2	39	3	0	1	44	5	32	0	0	0	37	10	0	5	0	4	15	0	0	1	0	1	1	97
4:15 PM	0	49	8	0	0	57	2	45	1	0	0	48	5	0	5	0	5	10	0	0	0	0	2	0	115

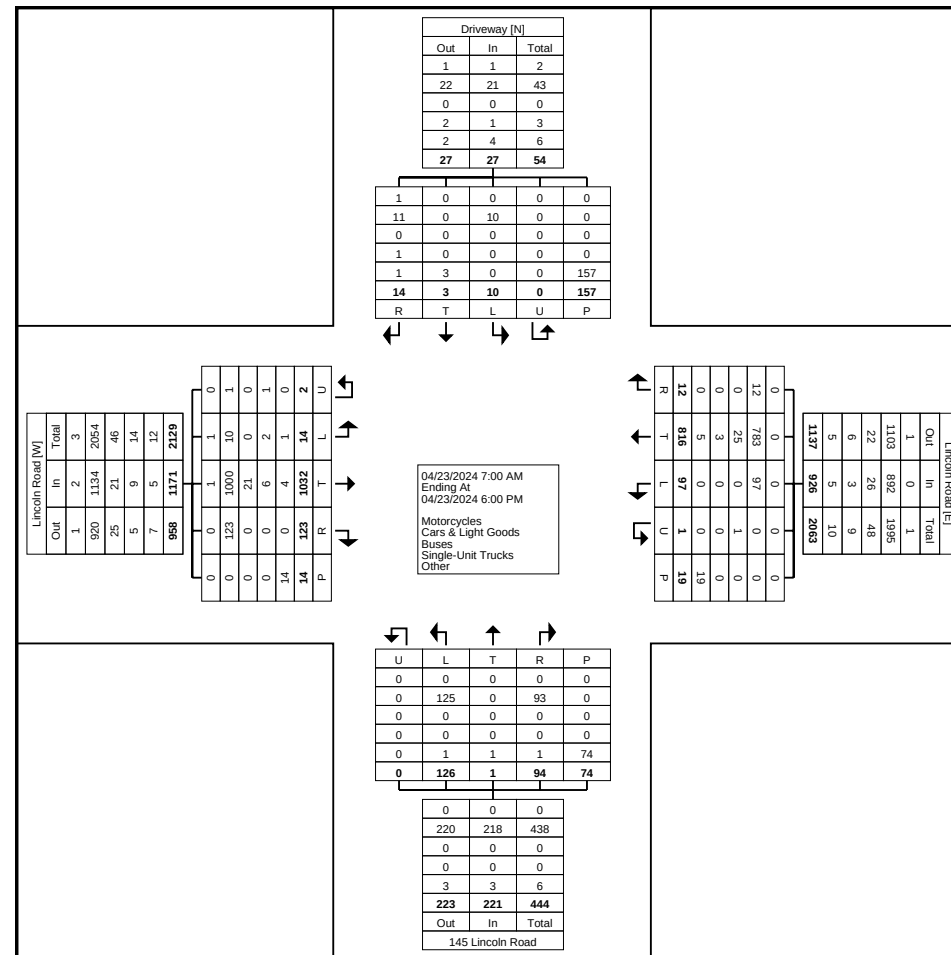
4:30 PM	0	48	4	0	0	52	8	26	0	0	4	34	2	0	6	0	0	8	0	0	0	0	3	0	94
4:45 PM	0	56	7	0	1	63	3	34	0	0	2	37	10	1	8	0	1	19	0	1	0	0	6	1	120
Hourly Total	2	192	22	0	2	216	18	137	1	0	6	156	27	1	24	0	10	52	0	1	1	0	12	2	426
5:00 PM	0	39	5	0	0	44	5	34	0	0	0	39	4	0	4	0	0	8	0	0	0	0	0	0	91
5:15 PM	0	46	6	0	0	52	3	21	1	0	0	25	3	0	4	0	4	7	1	0	1	0	5	2	86
5:30 PM	1	41	6	0	1	48	2	24	1	0	0	27	5	0	1	0	7	6	1	0	0	0	0	1	82
5:45 PM	0	33	2	0	0	35	3	30	0	0	0	33	2	0	3	0	3	5	0	0	1	0	1	1	74
Hourly Total	1	159	19	0	1	179	13	109	2	0	0	124	14	0	12	0	14	26	2	0	2	0	6	4	333
Grand Total	14	1032	123	2	14	1171	97	816	12	1	19	926	126	1	94	0	74	221	10	3	14	0	157	27	2345
Approach %	1.2	88.1	10.5	0.2	-	-	10.5	88.1	1.3	0.1	-	-	57.0	0.5	42.5	0.0	-	-	37.0	11.1	51.9	0.0	-	-	-
Total %	0.6	44.0	5.2	0.1	-	49.9	4.1	34.8	0.5	0.0	-	39.5	5.4	0.0	4.0	0.0	-	9.4	0.4	0.1	0.6	0.0	-	1.2	-
Motorcycles	1	1	0	0	-	2	0	0	0	0	-	0	0	0	0	0	-	0	0	0	1	0	-	1	3
% Motorcycles	7.1	0.1	0.0	0.0	-	0.2	0.0	0.0	0.0	0.0	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	0.0	7.1	-	-	3.7	0.1
Cars & Light Goods	10	1000	123	1	-	1134	97	783	12	0	-	892	125	0	93	0	-	218	10	0	11	0	-	21	2265
% Cars & Light Goods	71.4	96.9	100.0	50.0	-	96.8	100.0	96.0	100.0	0.0	-	96.3	99.2	0.0	98.9	-	-	98.6	100.0	0.0	78.6	-	-	77.8	96.6
Buses	0	21	0	0	-	21	0	25	0	1	-	26	0	0	0	0	-	0	0	0	0	0	-	0	47
% Buses	0.0	2.0	0.0	0.0	-	1.8	0.0	3.1	0.0	100.0	-	2.8	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	2.0
Single-Unit Trucks	2	6	0	1	-	9	0	3	0	0	-	3	0	0	0	0	-	0	0	0	1	0	-	1	13
% Single-Unit Trucks	14.3	0.6	0.0	50.0	-	0.8	0.0	0.4	0.0	0.0	-	0.3	0.0	0.0	0.0	-	-	0.0	0.0	0.0	7.1	-	-	3.7	0.6
Articulated Trucks	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0	0	1	0	-	1	1
% Articulated Trucks	0.0	0.0	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	0.0	7.1	-	-	3.7	0.0
Bicycles on Road	1	4	0	0	-	5	0	5	0	0	-	5	1	1	1	0	-	3	0	3	0	0	-	3	16
% Bicycles on Road	7.1	0.4	0.0	0.0	-	0.4	0.0	0.6	0.0	0.0	-	0.5	0.8	100.0	1.1	-	-	1.4	0.0	100.0	0.0	-	-	11.1	0.7
Bicycles on Crosswalk	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	2	-	-
% Bicycles on Crosswalk	-	-	-	-	0.0	-	-	-	-	-	0.0	-	-	-	-	-	0.0	-	-	-	-	-	1.3	-	-
Pedestrians	-	-	-	-	14	-	-	-	-	-	19	-	-	-	-	-	74	-	-	-	-	-	155	-	-
% Pedestrians	-	-	-	-	100.0	-	-	-	-	-	100.0	-	-	-	-	-	100.0	-	-	-	-	-	98.7	-	-



Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada N1R 8J8
519-896-3163 cbowness@pts1.com

Count Name: 145 Lincoln Road
Site Code: 240181
Start Date: 04/23/2024
Page No: 3



Turning Movement Data Plot



Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: 145 Lincoln Road
Site Code: 240181
Start Date: 04/23/2024
Page No: 4

Turning Movement Peak Hour Data (8:15 AM)

Start Time	Lincoln Road Eastbound						Lincoln Road Westbound						145 Lincoln Road Driveway Northbound						Driveway Southbound						Int. Total
	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	
8:15 AM	1	33	8	0	0	42	6	32	0	0	1	38	6	0	5	0	6	11	0	0	0	0	16	0	91
8:30 AM	0	23	6	0	0	29	3	29	1	0	1	33	8	0	2	0	2	10	0	1	3	0	2	4	76
8:45 AM	1	28	6	0	2	35	7	36	0	0	0	43	6	0	3	0	1	9	0	0	1	0	3	1	88
9:00 AM	0	32	4	0	0	36	1	25	1	0	6	27	5	0	4	0	3	9	0	0	0	0	11	0	72
Total	2	116	24	0	2	142	17	122	2	0	8	141	25	0	14	0	12	39	0	1	4	0	32	5	327
Approach %	1.4	81.7	16.9	0.0	-	-	12.1	86.5	1.4	0.0	-	-	64.1	0.0	35.9	0.0	-	-	0.0	20.0	80.0	0.0	-	-	-
Total %	0.6	35.5	7.3	0.0	-	43.4	5.2	37.3	0.6	0.0	-	43.1	7.6	0.0	4.3	0.0	-	11.9	0.0	0.3	1.2	0.0	-	1.5	-
PHF	0.500	0.879	0.750	0.000	-	0.845	0.607	0.847	0.500	0.000	-	0.820	0.781	0.000	0.700	0.000	-	0.886	0.000	0.250	0.333	0.000	-	0.313	0.898
Motorcycles	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0
% Motorcycles	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	-	0.0	-	-	0.0	-	0.0	0.0	-	-	0.0	0.0
Cars & Light Goods	1	111	24	0	-	136	17	114	2	0	-	133	24	0	14	0	-	38	0	0	3	0	-	3	310
% Cars & Light Goods	50.0	95.7	100.0	-	-	95.8	100.0	93.4	100.0	-	-	94.3	96.0	-	100.0	-	-	97.4	-	0.0	75.0	-	-	60.0	94.8
Buses	0	3	0	0	-	3	0	6	0	0	-	6	0	0	0	0	-	0	0	0	0	0	-	0	9
% Buses	0.0	2.6	0.0	-	-	2.1	0.0	4.9	0.0	-	-	4.3	0.0	-	0.0	-	-	0.0	-	0.0	0.0	-	-	0.0	2.8
Single-Unit Trucks	1	2	0	0	-	3	0	1	0	0	-	1	0	0	0	0	-	0	0	0	1	0	-	1	5
% Single-Unit Trucks	50.0	1.7	0.0	-	-	2.1	0.0	0.8	0.0	-	-	0.7	0.0	-	0.0	-	-	0.0	-	0.0	25.0	-	-	20.0	1.5
Articulated Trucks	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0
% Articulated Trucks	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	-	0.0	-	-	0.0	-	0.0	0.0	-	-	0.0	0.0
Bicycles on Road	0	0	0	0	-	0	0	1	0	0	-	1	1	0	0	0	-	1	0	1	0	0	-	1	3
% Bicycles on Road	0.0	0.0	0.0	-	-	0.0	0.0	0.8	0.0	-	-	0.7	4.0	-	0.0	-	-	2.6	-	100.0	0.0	-	-	20.0	0.9
Bicycles on Crosswalk	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	2	-	-
% Bicycles on Crosswalk	-	-	-	-	0.0	-	-	-	-	-	0.0	-	-	-	-	-	0.0	-	-	-	-	-	6.3	-	-
Pedestrians	-	-	-	-	2	-	-	-	-	-	8	-	-	-	-	-	12	-	-	-	-	-	30	-	-
% Pedestrians	-	-	-	-	100.0	-	-	-	-	-	100.0	-	-	-	-	-	100.0	-	-	-	-	-	93.8	-	-

Turning Movement Peak Hour Data Plot (8:15 AM)



Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada N1R 8J8
519-896-3163 cbowness@ptsll.com

Count Name: 145 Lincoln Road
Site Code: 240181
Start Date: 04/23/2024
Page No: 6

Turning Movement Peak Hour Data (11:45 AM)

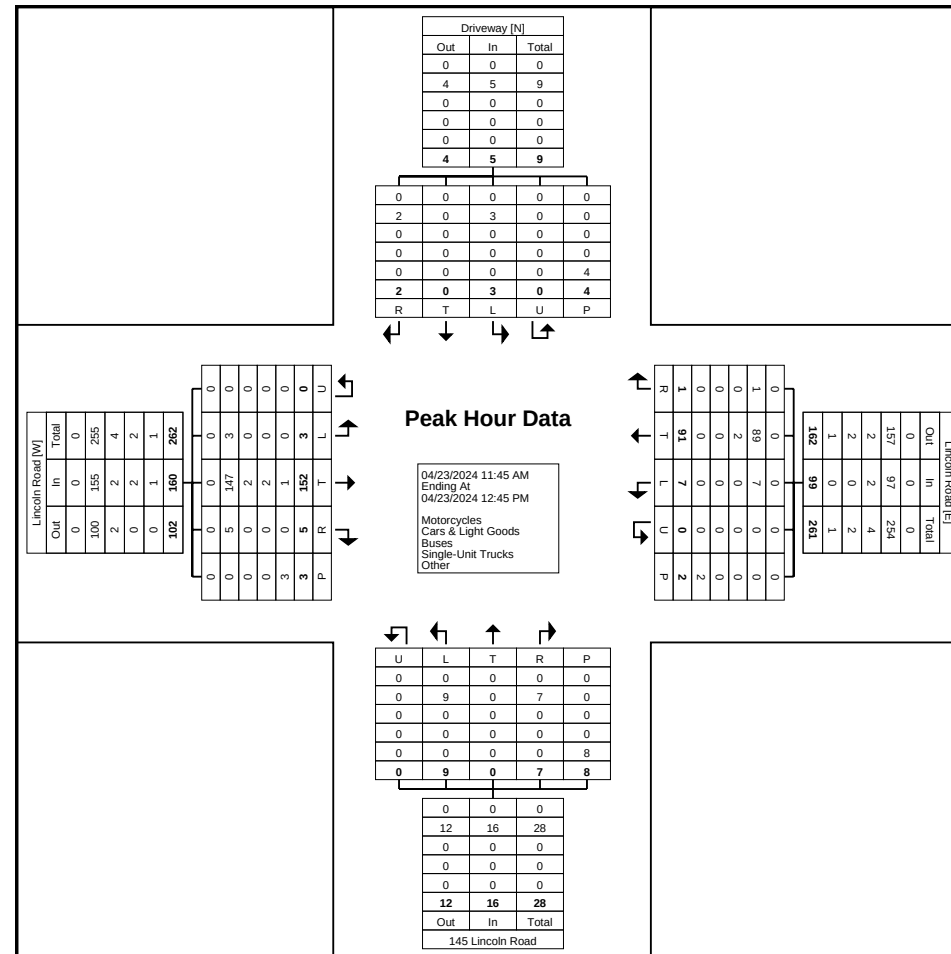
Start Time	Lincoln Road Eastbound						Lincoln Road Westbound						145 Lincoln Road Driveway Northbound						Driveway Southbound						Int. Total
	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	
11:45 AM	1	45	1	0	1	47	3	23	1	0	2	27	2	0	1	0	2	3	0	0	1	0	2	1	78
12:00 PM	0	34	1	0	0	35	1	29	0	0	0	30	3	0	2	0	0	5	1	0	1	0	1	2	72
12:15 PM	1	39	0	0	0	40	1	18	0	0	0	19	1	0	1	0	3	2	0	0	0	0	0	0	61
12:30 PM	1	34	3	0	2	38	2	21	0	0	0	23	3	0	3	0	3	6	2	0	0	0	1	2	69
Total	3	152	5	0	3	160	7	91	1	0	2	99	9	0	7	0	8	16	3	0	2	0	4	5	280
Approach %	1.9	95.0	3.1	0.0	-	-	7.1	91.9	1.0	0.0	-	-	56.3	0.0	43.8	0.0	-	-	60.0	0.0	40.0	0.0	-	-	-
Total %	1.1	54.3	1.8	0.0	-	57.1	2.5	32.5	0.4	0.0	-	35.4	3.2	0.0	2.5	0.0	-	5.7	1.1	0.0	0.7	0.0	-	1.8	-
PHF	0.750	0.844	0.417	0.000	-	0.851	0.583	0.784	0.250	0.000	-	0.825	0.750	0.000	0.583	0.000	-	0.667	0.375	0.000	0.500	0.000	-	0.625	0.897
Motorcycles	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0
% Motorcycles	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	-	0.0	-	-	0.0	0.0	-	0.0	-	-	0.0	0.0
Cars & Light Goods	3	147	5	0	-	155	7	89	1	0	-	97	9	0	7	0	-	16	3	0	2	0	-	5	273
% Cars & Light Goods	100.0	96.7	100.0	-	-	96.9	100.0	97.8	100.0	-	-	98.0	100.0	-	100.0	-	-	100.0	100.0	-	100.0	-	-	100.0	97.5
Buses	0	2	0	0	-	2	0	2	0	0	-	2	0	0	0	0	-	0	0	0	0	0	-	0	4
% Buses	0.0	1.3	0.0	-	-	1.3	0.0	2.2	0.0	-	-	2.0	0.0	-	0.0	-	-	0.0	0.0	-	0.0	-	-	0.0	1.4
Single-Unit Trucks	0	2	0	0	-	2	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	2
% Single-Unit Trucks	0.0	1.3	0.0	-	-	1.3	0.0	0.0	0.0	-	-	0.0	0.0	-	0.0	-	-	0.0	0.0	-	0.0	-	-	0.0	0.7
Articulated Trucks	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0
% Articulated Trucks	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	-	0.0	-	-	0.0	0.0	-	0.0	-	-	0.0	0.0
Bicycles on Road	0	1	0	0	-	1	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	1
% Bicycles on Road	0.0	0.7	0.0	-	-	0.6	0.0	0.0	0.0	-	-	0.0	0.0	-	0.0	-	-	0.0	0.0	-	0.0	-	-	0.0	0.4
Bicycles on Crosswalk	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-
% Bicycles on Crosswalk	-	-	-	-	0.0	-	-	-	-	-	0.0	-	-	-	-	-	0.0	-	-	-	-	-	0.0	-	-
Pedestrians	-	-	-	-	3	-	-	-	-	-	2	-	-	-	-	-	8	-	-	-	-	-	4	-	-
% Pedestrians	-	-	-	-	100.0	-	-	-	-	-	100.0	-	-	-	-	-	100.0	-	-	-	-	-	100.0	-	-



Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada N1R 8J8
519-896-3163 cbowness@ptsI.com

Count Name: 145 Lincoln Road
Site Code: 240181
Start Date: 04/23/2024
Page No: 7



Turning Movement Peak Hour Data Plot (11:45 AM)



Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: 145 Lincoln Road
Site Code: 240181
Start Date: 04/23/2024
Page No: 8

Turning Movement Peak Hour Data (4:00 PM)

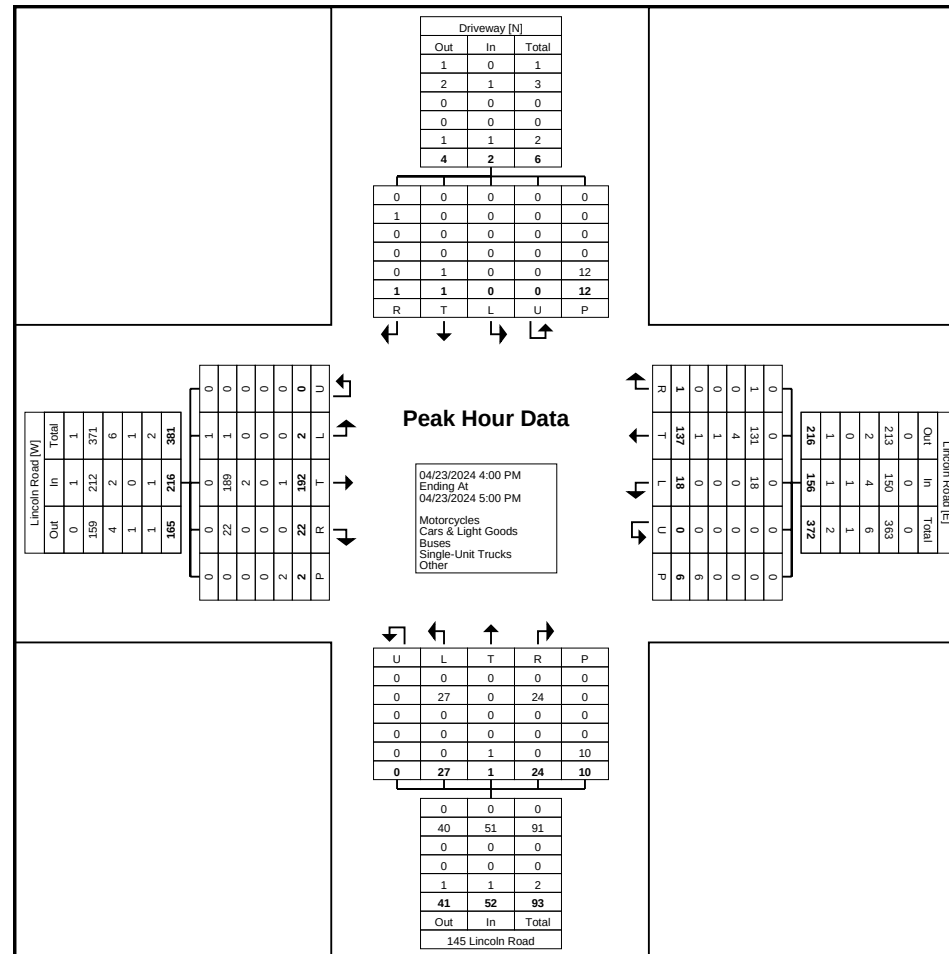
Start Time	Lincoln Road Eastbound						Lincoln Road Westbound						145 Lincoln Road Driveway Northbound						Driveway Southbound						Int. Total
	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	
4:00 PM	2	39	3	0	1	44	5	32	0	0	0	37	10	0	5	0	4	15	0	0	1	0	1	1	97
4:15 PM	0	49	8	0	0	57	2	45	1	0	0	48	5	0	5	0	5	10	0	0	0	0	2	0	115
4:30 PM	0	48	4	0	0	52	8	26	0	0	4	34	2	0	6	0	0	8	0	0	0	0	3	0	94
4:45 PM	0	56	7	0	1	63	3	34	0	0	2	37	10	1	8	0	1	19	0	1	0	0	6	1	120
Total	2	192	22	0	2	216	18	137	1	0	6	156	27	1	24	0	10	52	0	1	1	0	12	2	426
Approach %	0.9	88.9	10.2	0.0	-	-	11.5	87.8	0.6	0.0	-	-	51.9	1.9	46.2	0.0	-	-	0.0	50.0	50.0	0.0	-	-	-
Total %	0.5	45.1	5.2	0.0	-	50.7	4.2	32.2	0.2	0.0	-	36.6	6.3	0.2	5.6	0.0	-	12.2	0.0	0.2	0.2	0.0	-	0.5	-
PHF	0.250	0.857	0.688	0.000	-	0.857	0.563	0.761	0.250	0.000	-	0.813	0.675	0.250	0.750	0.000	-	0.684	0.000	0.250	0.250	0.000	-	0.500	0.888
Motorcycles	1	0	0	0	-	1	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	1
% Motorcycles	50.0	0.0	0.0	-	-	0.5	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	-	0.0	0.0	-	-	0.0	0.2
Cars & Light Goods	1	189	22	0	-	212	18	131	1	0	-	150	27	0	24	0	-	51	0	0	1	0	-	1	414
% Cars & Light Goods	50.0	98.4	100.0	-	-	98.1	100.0	95.6	100.0	-	-	96.2	100.0	0.0	100.0	-	-	98.1	-	0.0	100.0	-	-	50.0	97.2
Buses	0	2	0	0	-	2	0	4	0	0	-	4	0	0	0	0	-	0	0	0	0	0	-	0	6
% Buses	0.0	1.0	0.0	-	-	0.9	0.0	2.9	0.0	-	-	2.6	0.0	0.0	0.0	-	-	0.0	-	0.0	0.0	-	-	0.0	1.4
Single-Unit Trucks	0	0	0	0	-	0	0	1	0	0	-	1	0	0	0	0	-	0	0	0	0	0	-	0	1
% Single-Unit Trucks	0.0	0.0	0.0	-	-	0.0	0.0	0.7	0.0	-	-	0.6	0.0	0.0	0.0	-	-	0.0	-	0.0	0.0	-	-	0.0	0.2
Articulated Trucks	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0
% Articulated Trucks	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	-	0.0	0.0	-	-	0.0	0.0
Bicycles on Road	0	1	0	0	-	1	0	1	0	0	-	1	0	1	0	0	-	1	0	1	0	0	-	1	4
% Bicycles on Road	0.0	0.5	0.0	-	-	0.5	0.0	0.7	0.0	-	-	0.6	0.0	100.0	0.0	-	-	1.9	-	100.0	0.0	-	-	50.0	0.9
Bicycles on Crosswalk	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-
% Bicycles on Crosswalk	-	-	-	-	0.0	-	-	-	-	-	0.0	-	-	-	-	-	0.0	-	-	-	-	-	0.0	-	-
Pedestrians	-	-	-	-	2	-	-	-	-	-	6	-	-	-	-	-	10	-	-	-	-	-	12	-	-
% Pedestrians	-	-	-	-	100.0	-	-	-	-	-	100.0	-	-	-	-	-	100.0	-	-	-	-	-	100.0	-	-



Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada N1R 8J8
519-896-3163 cbowness@pts1.com

Count Name: 145 Lincoln Road
Site Code: 240181
Start Date: 04/23/2024
Page No: 9



Turning Movement Peak Hour Data Plot (4:00 PM)



Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Weber Street & Lincoln Road
Site Code: 240181
Start Date: 04/23/2024
Page No: 1

Turning Movement Data

Start Time	Plaza Driveway Eastbound						Lincoln Road Westbound						Weber Street N Northbound						Weber Street N Southbound						Int. Total
	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	
7:00 AM	2	2	5	0	1	9	5	3	4	0	1	12	2	98	8	0	1	108	2	70	3	0	1	75	204
7:15 AM	5	2	9	0	3	16	4	3	6	0	1	13	4	108	7	0	6	119	2	88	1	0	5	91	239
7:30 AM	7	7	9	0	0	23	12	3	4	0	2	19	4	139	9	0	2	152	1	78	6	0	4	85	279
7:45 AM	7	1	12	0	1	20	22	3	11	0	1	36	0	160	10	0	6	170	11	145	5	0	4	161	387
Hourly Total	21	12	35	0	5	68	43	12	25	0	5	80	10	505	34	0	15	549	16	381	15	0	14	412	1109
8:00 AM	8	4	11	0	1	23	10	3	14	0	2	27	5	176	9	0	7	190	4	123	6	0	3	133	373
8:15 AM	6	5	12	0	2	23	16	9	14	0	6	39	7	183	15	0	7	205	8	151	17	0	8	176	443
8:30 AM	8	8	11	0	1	27	24	13	10	0	3	47	6	197	15	0	3	218	4	164	19	0	5	187	479
8:45 AM	11	11	10	0	1	32	28	9	8	0	2	45	5	206	14	0	9	225	12	147	12	0	6	171	473
Hourly Total	33	28	44	0	5	105	78	34	46	0	13	158	23	762	53	0	26	838	28	585	54	0	22	667	1768
9:00 AM	15	16	17	0	7	48	21	7	7	0	6	35	7	165	14	0	3	186	8	136	10	0	11	154	423
9:15 AM	13	3	13	0	2	29	12	4	10	0	5	26	4	140	20	0	8	164	8	130	12	0	8	150	369
9:30 AM	15	9	15	0	3	39	17	11	7	0	4	35	7	128	15	0	8	150	5	123	10	0	4	138	362
9:45 AM	13	5	10	0	4	28	20	8	9	0	7	37	6	159	17	0	13	182	8	123	13	0	13	144	391
Hourly Total	56	33	55	0	16	144	70	30	33	0	22	133	24	592	66	0	32	682	29	512	45	0	36	586	1545
*** BREAK ***	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11:30 AM	18	15	24	0	3	57	14	6	7	0	2	27	11	153	15	0	11	179	8	134	30	0	11	172	435
11:45 AM	24	19	21	0	3	64	11	8	7	0	3	26	13	167	16	0	10	196	14	148	14	0	6	176	462
Hourly Total	42	34	45	0	6	121	25	14	14	0	5	53	24	320	31	0	21	375	22	282	44	0	17	348	897
12:00 PM	16	14	22	0	6	52	24	8	10	0	3	42	19	161	21	0	7	201	8	133	23	0	9	164	459
12:15 PM	28	17	23	0	4	68	13	9	9	0	3	31	8	150	16	0	16	174	12	139	14	0	9	165	438
12:30 PM	15	11	30	0	4	56	20	4	6	0	9	30	15	152	20	0	13	187	7	160	19	0	4	186	459
12:45 PM	23	21	22	0	0	66	13	8	8	0	5	29	7	175	17	0	14	199	15	165	22	0	5	202	496
Hourly Total	82	63	97	0	14	242	70	29	33	0	20	132	49	638	74	0	50	761	42	597	78	0	27	717	1852
1:00 PM	21	19	21	0	1	61	19	10	12	0	6	41	11	174	7	0	8	192	7	166	22	0	9	195	489
1:15 PM	18	15	22	0	3	55	16	14	8	0	7	38	6	134	16	0	16	156	6	138	18	0	11	162	411
*** BREAK ***	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hourly Total	39	34	43	0	4	116	35	24	20	0	13	79	17	308	23	0	24	348	13	304	40	0	20	357	900
3:00 PM	17	10	19	0	5	46	19	18	3	0	4	40	8	174	17	0	22	199	11	172	20	0	6	203	488
3:15 PM	34	18	17	0	5	69	18	7	14	0	5	39	7	197	29	0	11	233	12	184	26	0	10	222	563
3:30 PM	25	16	33	0	6	74	26	10	8	0	8	44	6	195	27	0	18	228	9	171	21	0	11	201	547
3:45 PM	26	8	27	0	7	61	23	8	9	0	9	40	9	169	26	0	9	204	14	178	22	0	12	214	519
Hourly Total	102	52	96	0	23	250	86	43	34	0	26	163	30	735	99	0	60	864	46	705	89	0	39	840	2117
4:00 PM	23	15	25	0	5	63	23	12	16	0	4	51	18	197	24	0	13	239	13	188	29	0	13	230	583
4:15 PM	18	26	40	0	5	84	24	11	8	0	8	43	8	200	30	0	11	238	9	232	23	0	14	264	629

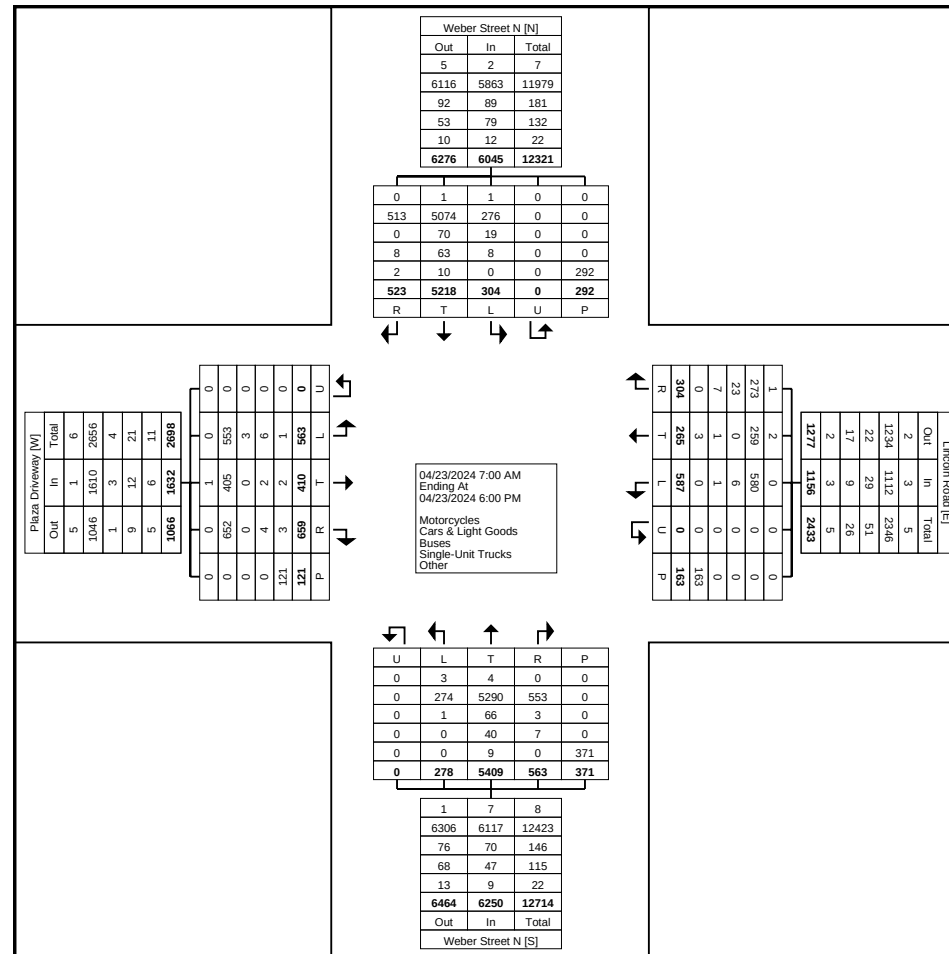
4:30 PM	24	20	25	0	3	69	26	9	8	0	13	43	16	199	19	0	16	234	16	235	14	0	18	265	611
4:45 PM	20	25	28	0	9	73	20	12	16	0	11	48	10	208	31	0	14	249	13	263	14	0	21	290	660
Hourly Total	85	86	118	0	22	289	93	44	48	0	36	185	52	804	104	0	54	960	51	918	80	0	66	1049	2483
5:00 PM	23	17	27	0	13	67	20	12	13	0	3	45	11	174	10	0	21	195	17	254	18	0	13	289	596
5:15 PM	28	16	29	0	7	73	19	8	9	0	5	36	11	211	27	0	32	249	16	250	22	0	7	288	646
5:30 PM	29	16	36	0	2	81	22	4	18	0	8	44	18	180	27	0	16	225	10	242	18	0	15	270	620
5:45 PM	23	19	34	0	4	76	26	11	11	0	7	48	9	180	15	0	20	204	14	188	20	0	16	222	550
Hourly Total	103	68	126	0	26	297	87	35	51	0	23	173	49	745	79	0	89	873	57	934	78	0	51	1069	2412
Grand Total	563	410	659	0	121	1632	587	265	304	0	163	1156	278	5409	563	0	371	6250	304	5218	523	0	292	6045	15083
Approach %	34.5	25.1	40.4	0.0	-	-	50.8	22.9	26.3	0.0	-	-	4.4	86.5	9.0	0.0	-	-	5.0	86.3	8.7	0.0	-	-	-
Total %	3.7	2.7	4.4	0.0	-	10.8	3.9	1.8	2.0	0.0	-	7.7	1.8	35.9	3.7	0.0	-	41.4	2.0	34.6	3.5	0.0	-	40.1	-
Motorcycles	0	1	0	0	-	1	0	2	1	0	-	3	3	4	0	0	-	7	1	1	0	0	-	2	13
% Motorcycles	0.0	0.2	0.0	-	-	0.1	0.0	0.8	0.3	-	-	0.3	1.1	0.1	0.0	-	-	0.1	0.3	0.0	0.0	-	-	0.0	0.1
Cars & Light Goods	553	405	652	0	-	1610	580	259	273	0	-	1112	274	5290	553	0	-	6117	276	5074	513	0	-	5863	14702
% Cars & Light Goods	98.2	98.8	98.9	-	-	98.7	98.8	97.7	89.8	-	-	96.2	98.6	97.8	98.2	-	-	97.9	90.8	97.2	98.1	-	-	97.0	97.5
Buses	3	0	0	0	-	3	6	0	23	0	-	29	1	66	3	0	-	70	19	70	0	0	-	89	191
% Buses	0.5	0.0	0.0	-	-	0.2	1.0	0.0	7.6	-	-	2.5	0.4	1.2	0.5	-	-	1.1	6.3	1.3	0.0	-	-	1.5	1.3
Single-Unit Trucks	6	2	4	0	-	12	1	1	7	0	-	9	0	40	7	0	-	47	8	63	8	0	-	79	147
% Single-Unit Trucks	1.1	0.5	0.6	-	-	0.7	0.2	0.4	2.3	-	-	0.8	0.0	0.7	1.2	-	-	0.8	2.6	1.2	1.5	-	-	1.3	1.0
Articulated Trucks	0	0	3	0	-	3	0	0	0	0	-	0	0	7	0	0	-	7	0	6	1	0	-	7	17
% Articulated Trucks	0.0	0.0	0.5	-	-	0.2	0.0	0.0	0.0	-	-	0.0	0.0	0.1	0.0	-	-	0.1	0.0	0.1	0.2	-	-	0.1	0.1
Bicycles on Road	1	2	0	0	-	3	0	3	0	0	-	3	0	2	0	0	-	2	0	4	1	0	-	5	13
% Bicycles on Road	0.2	0.5	0.0	-	-	0.2	0.0	1.1	0.0	-	-	0.3	0.0	0.0	0.0	-	-	0.0	0.0	0.1	0.2	-	-	0.1	0.1
Bicycles on Crosswalk	-	-	-	-	6	-	-	-	-	-	7	-	-	-	-	-	5	-	-	-	-	-	5	-	-
% Bicycles on Crosswalk	-	-	-	-	5.0	-	-	-	-	-	4.3	-	-	-	-	-	1.3	-	-	-	-	-	1.7	-	-
Pedestrians	-	-	-	-	115	-	-	-	-	-	156	-	-	-	-	-	366	-	-	-	-	-	287	-	-
% Pedestrians	-	-	-	-	95.0	-	-	-	-	-	95.7	-	-	-	-	-	98.7	-	-	-	-	-	98.3	-	-



Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

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Count Name: Weber Street & Lincoln Road
Site Code: 240181
Start Date: 04/23/2024
Page No: 3



Turning Movement Data Plot



Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada N1R 8J8
519-896-3163 cbowness@pts1.com

Count Name: Weber Street & Lincoln Road
Site Code: 240181
Start Date: 04/23/2024
Page No: 4

Turning Movement Peak Hour Data (8:15 AM)

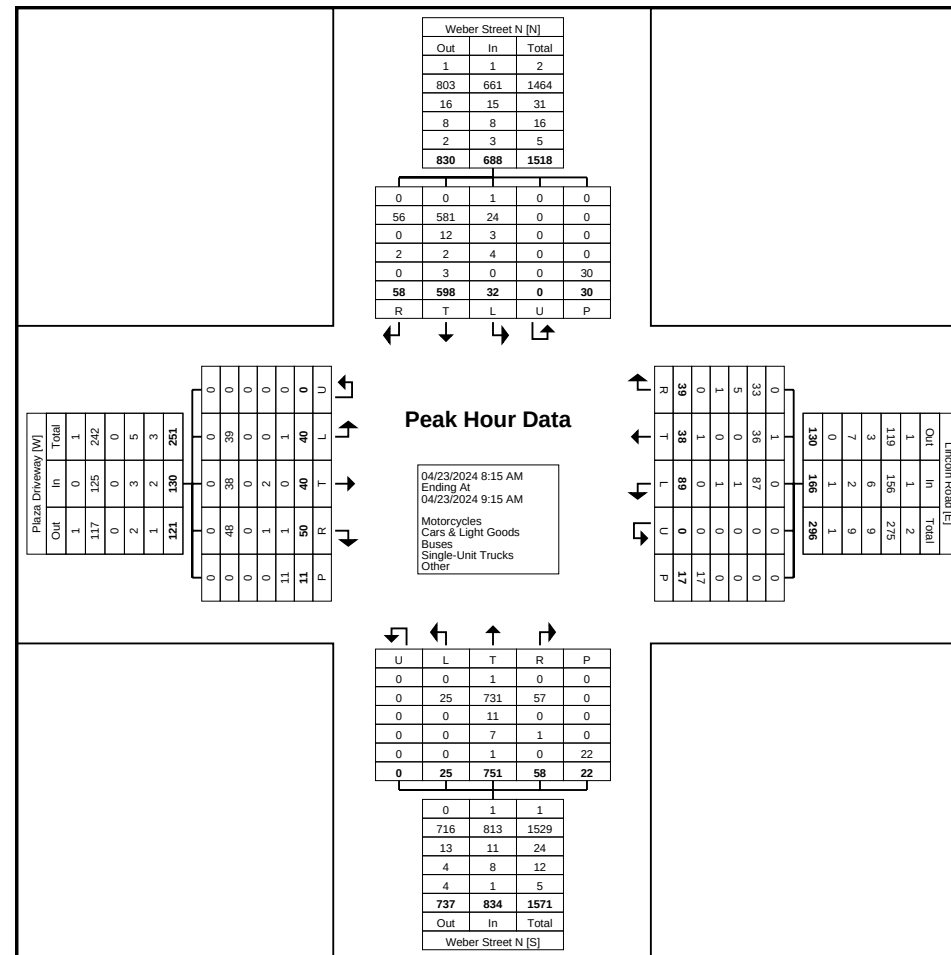
Start Time	Plaza Driveway Eastbound						Lincoln Road Westbound						Weber Street N Northbound						Weber Street N Southbound						Int. Total
	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	
8:15 AM	6	5	12	0	2	23	16	9	14	0	6	39	7	183	15	0	7	205	8	151	17	0	8	176	443
8:30 AM	8	8	11	0	1	27	24	13	10	0	3	47	6	197	15	0	3	218	4	164	19	0	5	187	479
8:45 AM	11	11	10	0	1	32	28	9	8	0	2	45	5	206	14	0	9	225	12	147	12	0	6	171	473
9:00 AM	15	16	17	0	7	48	21	7	7	0	6	35	7	165	14	0	3	186	8	136	10	0	11	154	423
Total	40	40	50	0	11	130	89	38	39	0	17	166	25	751	58	0	22	834	32	598	58	0	30	688	1818
Approach %	30.8	30.8	38.5	0.0	-	-	53.6	22.9	23.5	0.0	-	-	3.0	90.0	7.0	0.0	-	-	4.7	86.9	8.4	0.0	-	-	-
Total %	2.2	2.2	2.8	0.0	-	7.2	4.9	2.1	2.1	0.0	-	9.1	1.4	41.3	3.2	0.0	-	45.9	1.8	32.9	3.2	0.0	-	37.8	-
PHF	0.667	0.625	0.735	0.000	-	0.677	0.795	0.731	0.696	0.000	-	0.883	0.893	0.911	0.967	0.000	-	0.927	0.667	0.912	0.763	0.000	-	0.920	0.949
Motorcycles	0	0	0	0	-	0	0	1	0	0	-	1	0	1	0	0	-	1	1	0	0	0	-	1	3
% Motorcycles	0.0	0.0	0.0	-	-	0.0	0.0	2.6	0.0	-	-	0.6	0.0	0.1	0.0	-	-	0.1	3.1	0.0	0.0	-	-	0.1	0.2
Cars & Light Goods	39	38	48	0	-	125	87	36	33	0	-	156	25	731	57	0	-	813	24	581	56	0	-	661	1755
% Cars & Light Goods	97.5	95.0	96.0	-	-	96.2	97.8	94.7	84.6	-	-	94.0	100.0	97.3	98.3	-	-	97.5	75.0	97.2	96.6	-	-	96.1	96.5
Buses	0	0	0	0	-	0	1	0	5	0	-	6	0	11	0	0	-	11	3	12	0	0	-	15	32
% Buses	0.0	0.0	0.0	-	-	0.0	1.1	0.0	12.8	-	-	3.6	0.0	1.5	0.0	-	-	1.3	9.4	2.0	0.0	-	-	2.2	1.8
Single-Unit Trucks	0	2	1	0	-	3	1	0	1	0	-	2	0	7	1	0	-	8	4	2	2	0	-	8	21
% Single-Unit Trucks	0.0	5.0	2.0	-	-	2.3	1.1	0.0	2.6	-	-	1.2	0.0	0.9	1.7	-	-	1.0	12.5	0.3	3.4	-	-	1.2	1.2
Articulated Trucks	0	0	1	0	-	1	0	0	0	0	-	0	0	1	0	0	-	1	0	2	0	0	-	2	4
% Articulated Trucks	0.0	0.0	2.0	-	-	0.8	0.0	0.0	0.0	-	-	0.0	0.0	0.1	0.0	-	-	0.1	0.0	0.3	0.0	-	-	0.3	0.2
Bicycles on Road	1	0	0	0	-	1	0	1	0	0	-	1	0	0	0	0	-	0	0	1	0	0	-	1	3
% Bicycles on Road	2.5	0.0	0.0	-	-	0.8	0.0	2.6	0.0	-	-	0.6	0.0	0.0	0.0	-	-	0.0	0.0	0.2	0.0	-	-	0.1	0.2
Bicycles on Crosswalk	-	-	-	-	1	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-
% Bicycles on Crosswalk	-	-	-	-	9.1	-	-	-	-	-	0.0	-	-	-	-	-	0.0	-	-	-	-	-	0.0	-	-
Pedestrians	-	-	-	-	10	-	-	-	-	-	17	-	-	-	-	-	22	-	-	-	-	-	30	-	-
% Pedestrians	-	-	-	-	90.9	-	-	-	-	-	100.0	-	-	-	-	-	100.0	-	-	-	-	-	100.0	-	-



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Turning Movement Peak Hour Data (12:15 PM)

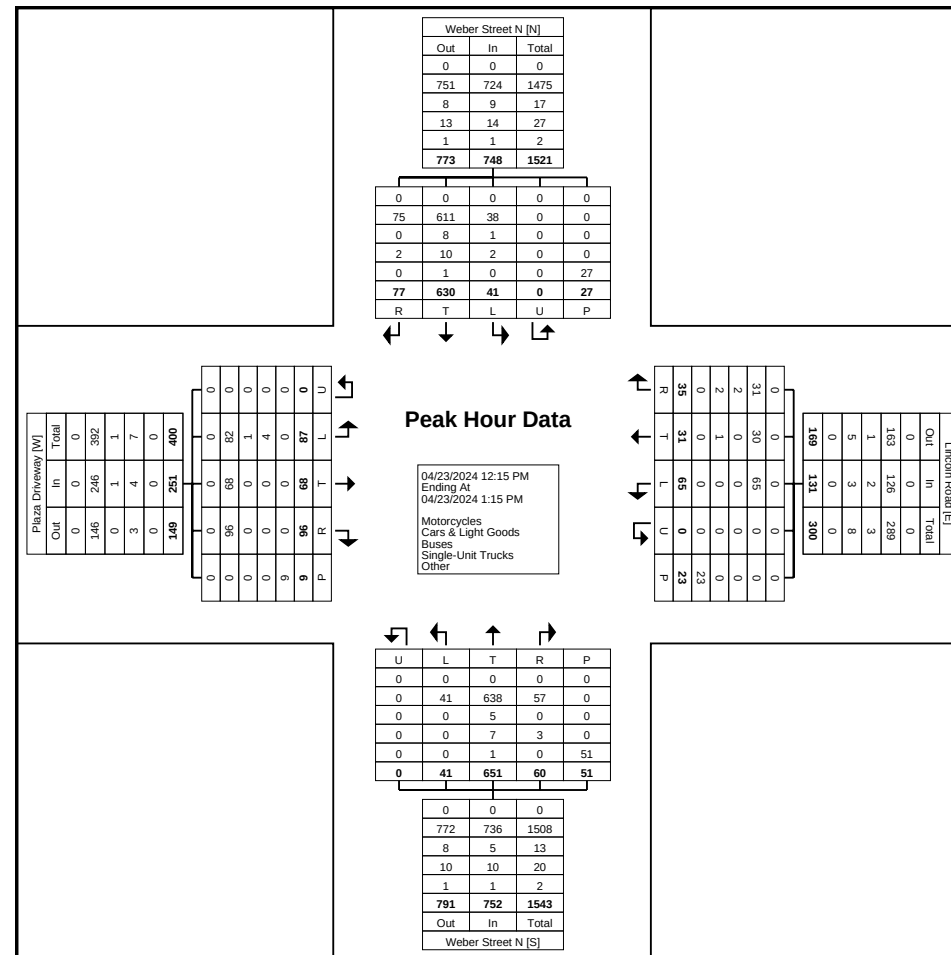
Start Time	Plaza Driveway Eastbound						Lincoln Road Westbound						Weber Street N Northbound						Weber Street N Southbound						Int. Total
	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	
12:15 PM	28	17	23	0	4	68	13	9	9	0	3	31	8	150	16	0	16	174	12	139	14	0	9	165	438
12:30 PM	15	11	30	0	4	56	20	4	6	0	9	30	15	152	20	0	13	187	7	160	19	0	4	186	459
12:45 PM	23	21	22	0	0	66	13	8	8	0	5	29	7	175	17	0	14	199	15	165	22	0	5	202	496
1:00 PM	21	19	21	0	1	61	19	10	12	0	6	41	11	174	7	0	8	192	7	166	22	0	9	195	489
Total	87	68	96	0	9	251	65	31	35	0	23	131	41	651	60	0	51	752	41	630	77	0	27	748	1882
Approach %	34.7	27.1	38.2	0.0	-	-	49.6	23.7	26.7	0.0	-	-	5.5	86.6	8.0	0.0	-	-	5.5	84.2	10.3	0.0	-	-	-
Total %	4.6	3.6	5.1	0.0	-	13.3	3.5	1.6	1.9	0.0	-	7.0	2.2	34.6	3.2	0.0	-	40.0	2.2	33.5	4.1	0.0	-	39.7	-
PHF	0.777	0.810	0.800	0.000	-	0.923	0.813	0.775	0.729	0.000	-	0.799	0.683	0.930	0.750	0.000	-	0.945	0.683	0.949	0.875	0.000	-	0.926	0.949
Motorcycles	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0
% Motorcycles	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0
Cars & Light Goods	82	68	96	0	-	246	65	30	31	0	-	126	41	638	57	0	-	736	38	611	75	0	-	724	1832
% Cars & Light Goods	94.3	100.0	100.0	-	-	98.0	100.0	96.8	88.6	-	-	96.2	100.0	98.0	95.0	-	-	97.9	92.7	97.0	97.4	-	-	96.8	97.3
Buses	1	0	0	0	-	1	0	0	2	0	-	2	0	5	0	0	-	5	1	8	0	0	-	9	17
% Buses	1.1	0.0	0.0	-	-	0.4	0.0	0.0	5.7	-	-	1.5	0.0	0.8	0.0	-	-	0.7	2.4	1.3	0.0	-	-	1.2	0.9
Single-Unit Trucks	4	0	0	0	-	4	0	1	2	0	-	3	0	7	3	0	-	10	2	10	2	0	-	14	31
% Single-Unit Trucks	4.6	0.0	0.0	-	-	1.6	0.0	3.2	5.7	-	-	2.3	0.0	1.1	5.0	-	-	1.3	4.9	1.6	2.6	-	-	1.9	1.6
Articulated Trucks	0	0	0	0	-	0	0	0	0	0	-	0	0	1	0	0	-	1	0	1	0	0	-	1	2
% Articulated Trucks	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	0.2	0.0	-	-	0.1	0.0	0.2	0.0	-	-	0.1	0.1
Bicycles on Road	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0
% Bicycles on Road	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0
Bicycles on Crosswalk	-	-	-	-	0	-	-	-	-	-	1	-	-	-	-	-	0	-	-	-	-	-	0	-	-
% Bicycles on Crosswalk	-	-	-	-	0.0	-	-	-	-	-	4.3	-	-	-	-	-	0.0	-	-	-	-	-	0.0	-	-
Pedestrians	-	-	-	-	9	-	-	-	-	-	22	-	-	-	-	-	51	-	-	-	-	-	27	-	-
% Pedestrians	-	-	-	-	100.0	-	-	-	-	-	95.7	-	-	-	-	-	100.0	-	-	-	-	-	100.0	-	-



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Turning Movement Peak Hour Data Plot (12:15 PM)



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Turning Movement Peak Hour Data (4:45 PM)

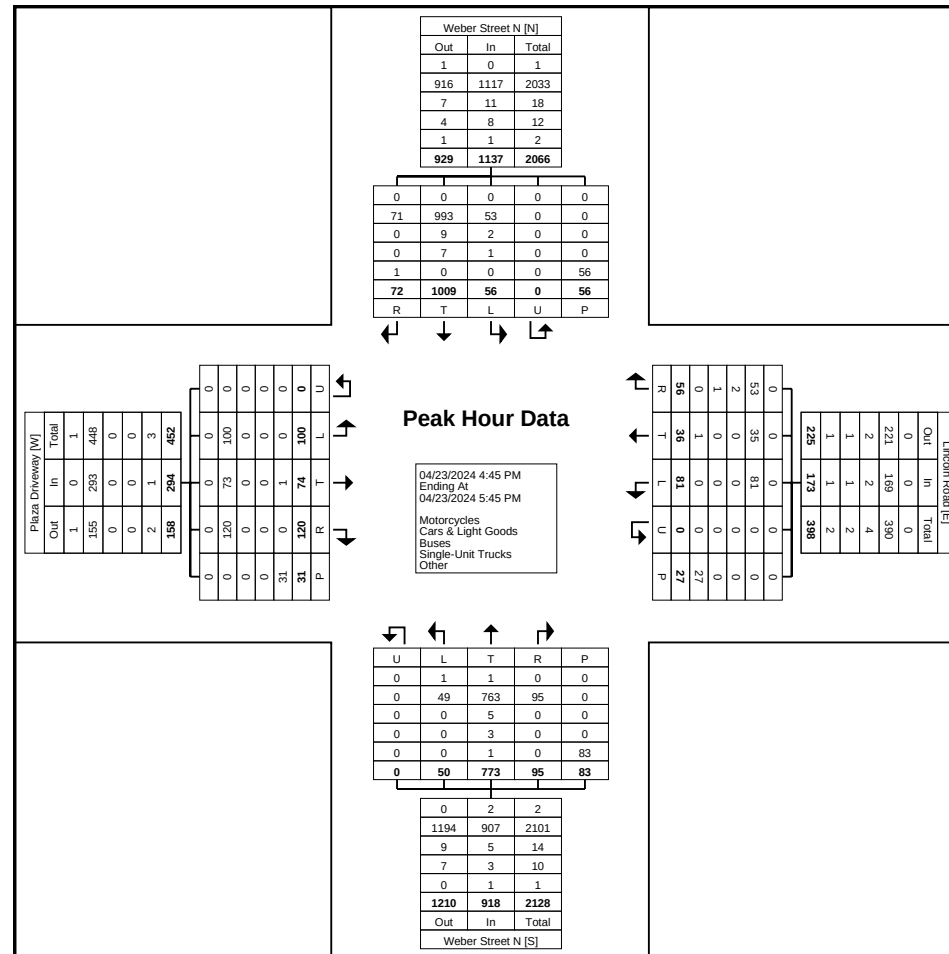
Start Time	Plaza Driveway Eastbound						Lincoln Road Westbound						Weber Street N Northbound						Weber Street N Southbound						Int. Total
	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	
4:45 PM	20	25	28	0	9	73	20	12	16	0	11	48	10	208	31	0	14	249	13	263	14	0	21	290	660
5:00 PM	23	17	27	0	13	67	20	12	13	0	3	45	11	174	10	0	21	195	17	254	18	0	13	289	596
5:15 PM	28	16	29	0	7	73	19	8	9	0	5	36	11	211	27	0	32	249	16	250	22	0	7	288	646
5:30 PM	29	16	36	0	2	81	22	4	18	0	8	44	18	180	27	0	16	225	10	242	18	0	15	270	620
Total	100	74	120	0	31	294	81	36	56	0	27	173	50	773	95	0	83	918	56	1009	72	0	56	1137	2522
Approach %	34.0	25.2	40.8	0.0	-	-	46.8	20.8	32.4	0.0	-	-	5.4	84.2	10.3	0.0	-	-	4.9	88.7	6.3	0.0	-	-	-
Total %	4.0	2.9	4.8	0.0	-	11.7	3.2	1.4	2.2	0.0	-	6.9	2.0	30.7	3.8	0.0	-	36.4	2.2	40.0	2.9	0.0	-	45.1	-
PHF	0.862	0.740	0.833	0.000	-	0.907	0.920	0.750	0.778	0.000	-	0.901	0.694	0.916	0.766	0.000	-	0.922	0.824	0.959	0.818	0.000	-	0.980	0.955
Motorcycles	0	0	0	0	-	0	0	0	0	0	-	0	1	1	0	0	-	2	0	0	0	0	-	0	2
% Motorcycles	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	2.0	0.1	0.0	-	-	0.2	0.0	0.0	0.0	-	-	0.0	0.1
Cars & Light Goods	100	73	120	0	-	293	81	35	53	0	-	169	49	763	95	0	-	907	53	993	71	0	-	1117	2486
% Cars & Light Goods	100.0	98.6	100.0	-	-	99.7	100.0	97.2	94.6	-	-	97.7	98.0	98.7	100.0	-	-	98.8	94.6	98.4	98.6	-	-	98.2	98.6
Buses	0	0	0	0	-	0	0	0	2	0	-	2	0	5	0	0	-	5	2	9	0	0	-	11	18
% Buses	0.0	0.0	0.0	-	-	0.0	0.0	0.0	3.6	-	-	1.2	0.0	0.6	0.0	-	-	0.5	3.6	0.9	0.0	-	-	1.0	0.7
Single-Unit Trucks	0	0	0	0	-	0	0	0	1	0	-	1	0	3	0	0	-	3	1	7	0	0	-	8	12
% Single-Unit Trucks	0.0	0.0	0.0	-	-	0.0	0.0	0.0	1.8	-	-	0.6	0.0	0.4	0.0	-	-	0.3	1.8	0.7	0.0	-	-	0.7	0.5
Articulated Trucks	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0
% Articulated Trucks	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0
Bicycles on Road	0	1	0	0	-	1	0	1	0	0	-	1	0	1	0	0	-	1	0	0	1	0	-	1	4
% Bicycles on Road	0.0	1.4	0.0	-	-	0.3	0.0	2.8	0.0	-	-	0.6	0.0	0.1	0.0	-	-	0.1	0.0	0.0	1.4	-	-	0.1	0.2
Bicycles on Crosswalk	-	-	-	-	1	-	-	-	-	-	1	-	-	-	-	-	0	-	-	-	-	-	3	-	-
% Bicycles on Crosswalk	-	-	-	-	3.2	-	-	-	-	-	3.7	-	-	-	-	-	0.0	-	-	-	-	-	5.4	-	-
Pedestrians	-	-	-	-	30	-	-	-	-	-	26	-	-	-	-	-	83	-	-	-	-	-	53	-	-
% Pedestrians	-	-	-	-	96.8	-	-	-	-	-	96.3	-	-	-	-	-	100.0	-	-	-	-	-	94.6	-	-



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Turning Movement Peak Hour Data Plot (4:45 PM)



CURRENT TRAFFIC SIGNAL TIMING

INT #	54	WEBER STREET @ Lincoln Road	T08-50/ 32W
-------	----	-----------------------------	-------------

Date Prepared: April 12, 2024

Mode of Control Pre-timed running FIXED TIME

<u>Left Info</u>	Actuated	NB	LT	-	WEBER STREET
	Actuated	SB	LT	-	WEBER STREET

*Offsets are a percentage of the cycle length and refers to the beginning of Main Street green

Pattern 1									
7:00-10:00 Monday to Friday									
WEBER STREET									
SBL	Green Arrow	Min	5.0	seconds	NBL	Green Arrow	OFFSET		94%
		Ext	3.0	seconds			Min	5.0	seconds
		Max	6.4	seconds			Ext	3.0	seconds
SBL	Amber Arrow		3.0	seconds	NBL	Amber Arrow	Max	6.4	seconds
			1.0	seconds				3.0	seconds
			36.4	seconds				1.0	seconds
All Red			4.0	seconds	All Red				
Green			2.0	seconds					
Amber					Walk		23.4	seconds	
All Red					FDW		13.0	seconds	

Lincoln Road									
Green			21.2	seconds					
Amber			4.0	seconds	Walk		7.2	seconds	
All Red			2.0	seconds	FDW		14.0	seconds	
TOTAL			80.0	seconds					

Pattern 2									
10:00-14:00 Monday to Friday									
WEBER STREET									
SBL	Green Arrow	Min	5.0	seconds	NBL	Green Arrow	OFFSET		24%
		Ext	3.0	seconds			Min	5.0	seconds
		Max	6.8	seconds			Ext	3.0	seconds
SBL	Amber Arrow		3.0	seconds	NBL	Amber Arrow	Max	8.6	seconds
			1.0	seconds				3.0	seconds
			34.5	seconds				1.0	seconds
All Red			4.0	seconds	All Red				
Green			2.0	seconds					
Amber					Walk		21.5	seconds	
All Red					FDW		13.0	seconds	

Lincoln Road									
Green			30.9	seconds					
Amber			4.0	seconds	Walk		16.9	seconds	
All Red			2.0	seconds	FDW		14.0	seconds	
TOTAL			90.0	seconds					

Min=Minimum Time
Ext=Extension Time
Max=Maximum Time

**This signal timing cannot be
presented as evidence in a court of law.**

Pattern 3

14:00-19:00 Mon to Fri, 08:30-19:00, Sat 11:00-18:00 Sun

WEBER STREET

							OFFSET			4%
SBL	Green Arrow	Min	5.0	seconds	NBL	Green Arrow	Min	5.0	seconds	
		Ext	3.0	seconds			Ext	3.0	seconds	
		Max	7.7	seconds			Max	7.7	seconds	
SBL	Amber Arrow		3.0	seconds	NBL	Amber Arrow		3.0	seconds	
All Red			1.0	seconds	All Red			1.0	seconds	
Green			41.7	seconds						
Amber			4.0	seconds	Walk			28.7	seconds	
All Red			2.0	seconds	FDW			13.0	seconds	

Lincoln Road

Green			24.6	seconds						
Amber			4.0	seconds	Walk			10.6	seconds	
All Red			2.0	seconds	FDW			14.0	seconds	
TOTAL			90.0	seconds						

Pattern 4

All Other Times

WEBER STREET

							OFFSET			24%
Green			35.3	seconds						
Amber			4.0	seconds	Walk			22.3	seconds	
All Red			2.0	seconds	FDW			13.0	seconds	

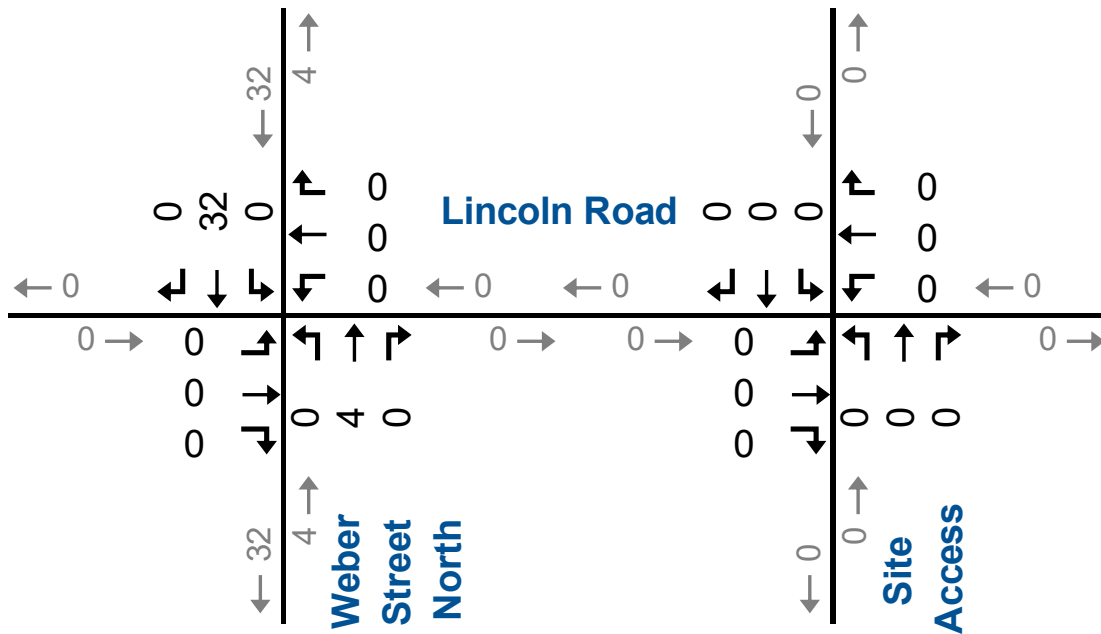
Lincoln Road

Green			22.7	seconds						
Amber			4.0	seconds	Walk			8.7	seconds	
All Red			2.0	seconds	FDW			14.0	seconds	
TOTAL			70.0	seconds						

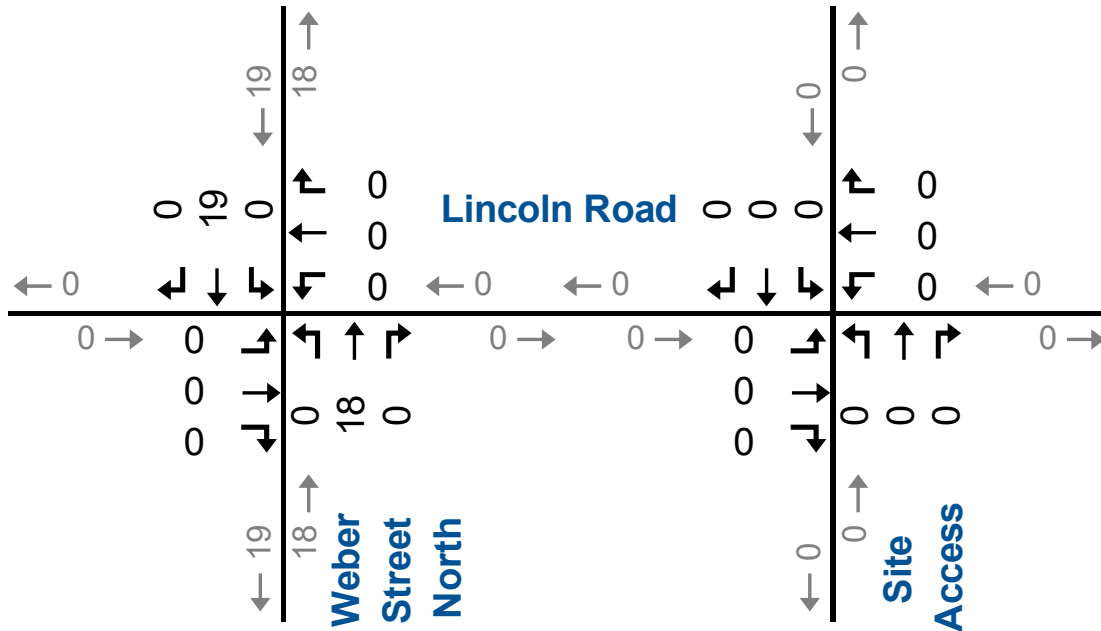
Appendix C: Background Development Traffic Volumes



AM Peak Hour



PM Peak Hour



Appendix D: Existing Traffic Operations



Lanes, Volumes, Timings

1: Weber Street North & Lincoln Road

145 Lincoln Road, Waterloo TIS

Base Year AM

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↰	↰	↰	↰	↰	↰	↰	↰	↰	↰	↰
Traffic Volume (vph)	40	40	50	89	38	39	25	751	58	32	598	58
Future Volume (vph)	40	40	50	89	38	39	25	751	58	32	598	58
Ideal Flow (vphpl)	1775	1650	1650	1775	1650	1650	1775	1775	1775	1775	1775	1775
Storage Length (m)	15.0		0.0	40.0		0.0	20.0		0.0	65.0		0.0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	1.00	0.95	0.95
Ped Bike Factor	0.97	0.98		0.98	0.98		1.00	1.00		0.99	1.00	
Frt		0.917			0.924			0.989			0.987	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1668	1404	0	1635	1369	0	1668	3196	0	1367	3187	0
Flt Permitted	0.707			0.699			0.354			0.279		
Satd. Flow (perm)	1203	1404	0	1176	1369	0	619	3196	0	399	3187	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		50			39			14			17	
Link Speed (k/h)		50			50			60			60	
Link Distance (m)		108.2			216.9			122.4			157.7	
Travel Time (s)		7.8			15.6			7.3			9.5	
Confl. Peds. (#/hr)	30		22	22		30	11		17	17		11
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	0%	5%	4%	2%	0%	15%	0%	3%	2%	22%	3%	3%
Adj. Flow (vph)	40	40	50	89	38	39	25	751	58	32	598	58
Shared Lane Traffic (%)												
Lane Group Flow (vph)	40	90	0	89	77	0	25	809	0	32	656	0
Turn Type	Perm	NA		Perm	NA		pm+pt	NA		pm+pt	NA	
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8			2			6		
Detector Phase	4	4		8	8		5	2		1	6	
Switch Phase												
Minimum Initial (s)	21.2	21.2		21.2	21.2		5.0	36.4		5.0	36.4	
Minimum Split (s)	27.2	27.2		27.2	27.2		9.0	42.4		9.0	42.4	
Total Split (s)	27.2	27.2		27.2	27.2		10.4	42.4		10.4	42.4	
Total Split (%)	34.0%	34.0%		34.0%	34.0%		13.0%	53.0%		13.0%	53.0%	
Maximum Green (s)	21.2	21.2		21.2	21.2		6.4	36.4		6.4	36.4	
Yellow Time (s)	4.0	4.0		4.0	4.0		3.0	4.0		3.0	4.0	
All-Red Time (s)	2.0	2.0		2.0	2.0		1.0	2.0		1.0	2.0	
Lost Time Adjust (s)	-2.0	-2.0		-2.0	-2.0		0.0	-2.0		0.0	-2.0	
Total Lost Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lead/Lag							Lead	Lag		Lead	Lag	
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	Max	Max		Max	Max		None	C-Max		None	C-Max	
Walk Time (s)	7.2	7.2		7.2	7.2			23.4			23.4	
Flash Dont Walk (s)	14.0	14.0		14.0	14.0			13.0			13.0	
Pedestrian Calls (#/hr)	0	0		0	0			0			0	
Act Effct Green (s)	23.2	23.2		23.2	23.2		47.2	44.6		47.2	44.7	
Actuated g/C Ratio	0.29	0.29		0.29	0.29		0.59	0.56		0.59	0.56	
v/c Ratio	0.11	0.20		0.26	0.18		0.06	0.45		0.10	0.37	

PTSL (240181)

Synchro 11 Report
Page 1

Lanes, Volumes, Timings

1: Weber Street North & Lincoln Road

145 Lincoln Road, Waterloo TIS

Base Year AM

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Control Delay	22.1	12.7		24.4	13.6		6.6	12.2		7.1	11.2	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	22.1	12.7		24.4	13.6		6.6	12.2		7.1	11.2	
LOS	C	B		C	B		A	B		A	B	
Approach Delay		15.6			19.4			12.0			11.0	
Approach LOS		B			B			B			B	
Queue Length 50th (m)	4.4	4.4		10.2	4.1		1.3	29.2		1.7	22.1	
Queue Length 95th (m)	11.4	14.7		21.6	13.7		4.0	56.8		4.8	43.9	
Internal Link Dist (m)		84.2			192.9			98.4			133.7	
Turn Bay Length (m)	15.0			40.0			20.0			65.0		
Base Capacity (vph)	348	442		341	424		449	1789		312	1786	
Starvation Cap Reductn	0	0		0	0		0	0		0	0	
Spillback Cap Reductn	0	0		0	0		0	0		0	0	
Storage Cap Reductn	0	0		0	0		0	0		0	0	
Reduced v/c Ratio	0.11	0.20		0.26	0.18		0.06	0.45		0.10	0.37	

Intersection Summary

Area Type: Other

Cycle Length: 80

Actuated Cycle Length: 80

Offset: 75.2 (94%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green

Natural Cycle: 80

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.45

Intersection Signal Delay: 12.6

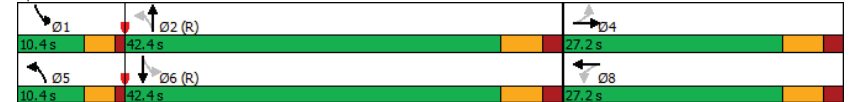
Intersection LOS: B

Intersection Capacity Utilization 54.7%

ICU Level of Service A

Analysis Period (min) 15

Splits and Phases: 1: Weber Street North & Lincoln Road



PTSL (240181)

Synchro 11 Report
Page 2

HCM 6th Signalized Intersection Summary
1: Weber Street North & Lincoln Road

145 Lincoln Road, Waterloo TIS
Base Year AM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↱		↰	↱		↰	↱		↰	↱	
Traffic Volume (veh/h)	40	40	50	89	38	39	25	751	58	32	598	58
Future Volume (veh/h)	40	40	50	89	38	39	25	751	58	32	598	58
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.97		0.97	0.98		0.97	0.99		0.98	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No		No		No		No		No		No	
Adj Sat Flow, veh/h/ln	1775	1586	1599	1747	1650	1457	1775	1733	1747	1470	1733	1733
Adj Flow Rate, veh/h	40	40	50	89	38	39	25	751	58	32	598	58
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Percent Heavy Veh, %	0	5	4	2	0	15	0	3	2	22	3	3
Cap, veh/h	396	182	227	377	212	218	423	1634	126	320	1615	156
Arrive On Green	0.29	0.29	0.27	0.29	0.29	0.27	0.03	0.53	0.50	0.03	0.53	0.51
Sat Flow, veh/h	1223	628	784	1191	732	751	1690	3094	239	1400	3028	293
Grp Volume(v), veh/h	40	0	90	89	0	77	25	400	409	32	325	331
Grp Sat Flow(s), veh/h/ln	1223	0	1412	1191	0	1484	1690	1647	1686	1400	1647	1675
Q Serve(g_s), s	2.0	0.0	3.9	4.9	0.0	3.2	0.6	12.1	12.2	0.9	9.2	9.3
Cycle Q Clear(g_c), s	5.2	0.0	3.9	8.8	0.0	3.2	0.6	12.1	12.2	0.9	9.2	9.3
Prop In Lane	1.00		0.56	1.00		0.51	1.00		0.14	1.00		0.18
Lane Grp Cap(c), veh/h	396	0	409	377	0	430	423	870	890	320	878	893
V/C Ratio(X)	0.10	0.00	0.22	0.24	0.00	0.18	0.06	0.46	0.46	0.10	0.37	0.37
Avail Cap(c_a), veh/h	396	0	409	377	0	430	513	870	890	387	878	893
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	23.2	0.0	22.0	24.9	0.0	21.7	9.5	11.8	11.9	9.8	10.8	11.0
Incr Delay (d2), s/veh	0.5	0.0	1.2	1.5	0.0	0.9	0.1	1.7	1.7	0.1	1.2	1.2
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%), veh/ln	1.3	0.0	2.8	3.0	0.0	2.4	0.4	8.9	9.1	0.5	7.0	7.2
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	23.7	0.0	23.2	26.4	0.0	22.6	9.5	13.5	13.6	10.0	12.0	12.2
LnGrp LOS	C	A	C	C	A	C	A	B	B	A	B	B
Approach Vol, veh/h		130			166			834			688	
Approach Delay, s/veh		23.4			24.6			13.4			12.0	
Approach LOS		C			C			B			B	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	6.5	46.3		27.2	6.1	46.7		27.2				
Change Period (Y+Rc), s	4.0	6.0		6.0	4.0	6.0		6.0				
Max Green Setting (Gmax), s	6.4	36.4		21.2	6.4	36.4		21.2				
Max Q Clear Time (g_c+I1), s	2.9	14.2		7.2	2.6	11.3		10.8				
Green Ext Time (p_c), s	0.0	6.0		0.6	0.0	4.9		0.6				
Intersection Summary												
HCM 6th Ctrl Delay				14.6								
HCM 6th LOS				B								

Lanes, Volumes, Timings
2: Site Access & Lincoln Road

145 Lincoln Road, Waterloo TIS
Base Year AM

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↰			↰			↰			↰	
Traffic Volume (vph)	2	116	24	17	122	2	25	0	14	0	1	4
Future Volume (vph)	2	116	24	17	122	2	25	0	14	0	1	4
Ideal Flow (vphpl)	1550	1550	1550	1550	1550	1550	1550	1550	1550	1550	1550	1550
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor												
Frt		0.977			0.998			0.952			0.892	
Flt Protected		0.999			0.994			0.969				
Satd. Flow (prot)	0	1439	0	0	1445	0	0	1414	0	0	1139	0
Flt Permitted		0.999			0.994			0.969				
Satd. Flow (perm)	0	1439	0	0	1445	0	0	1414	0	0	1139	0
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		216.9			108.2			32.4			83.3	
Travel Time (s)		15.6			7.8			2.3			6.0	
Confl. Peds. (#/hr)	32		12	12		32	2		8	8		2
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	50%	4%	0%	0%	6%	0%	0%	0%	0%	0%	0%	25%
Adj. Flow (vph)	2	116	24	17	122	2	25	0	14	0	1	4
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	142	0	0	141	0	0	39	0	0	5	0
Sign Control		Free			Free			Stop			Stop	
Intersection Summary												
Area Type:	Other											
Control Type:	Unsignalized											
Intersection Capacity Utilization	38.1%											
ICU Level of Service A												
Analysis Period (min)	15											

HCM 6th TWSC
2: Site Access & Lincoln Road

145 Lincoln Road, Waterloo TIS
Base Year AM

Intersection												
Int Delay, s/veh	1.8											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	2	116	24	17	122	2	25	0	14	0	1	4
Future Vol, veh/h	2	116	24	17	122	2	25	0	14	0	1	4
Conflicting Peds, #/hr	32	0	12	12	0	32	2	0	8	8	0	2
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	50	4	0	0	6	0	0	0	0	0	0	25
Mvmt Flow	2	116	24	17	122	2	25	0	14	0	1	4
Major/Minor	Major1	Major2		Minor1		Minor2						
Conflicting Flow All	156	0	0	152	0	0	306	334	148	336	345	157
Stage 1	-	-	-	-	-	-	144	144	-	189	189	-
Stage 2	-	-	-	-	-	-	162	190	-	147	156	-
Critical Hdwy	4.6	-	-	4.1	-	-	7.1	6.5	6.2	7.1	6.5	6.45
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.65	-	-	2.2	-	-	3.5	4	3.3	3.5	4	3.525
Pot Cap-1 Maneuver	1178	-	-	1441	-	-	650	589	904	622	581	832
Stage 1	-	-	-	-	-	-	864	782	-	817	748	-
Stage 2	-	-	-	-	-	-	845	747	-	860	772	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	1149	-	-	1428	-	-	632	561	890	587	553	810
Mov Cap-2 Maneuver	-	-	-	-	-	-	632	561	-	587	553	-
Stage 1	-	-	-	-	-	-	854	773	-	795	720	-
Stage 2	-	-	-	-	-	-	827	719	-	840	764	-
Approach	EB	WB		NB		SB						
HCM Control Delay, s	0.1	0.9		10.4		9.9						
HCM LOS			B		A							
Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1				
Capacity (veh/h)	705	1149	-	-	1428	-	-	741				
HCM Lane V/C Ratio	0.055	0.002	-	-	0.012	-	-	0.007				
HCM Control Delay (s)	10.4	8.1	0	-	7.6	0	-	9.9				
HCM Lane LOS	B	A	A	-	A	A	-	A				
HCM 95th %tile Q(veh)	0.2	0	-	-	0	-	-	0				

Lanes, Volumes, Timings
1: Weber Street North & Lincoln Road

145 Lincoln Road, Waterloo TIS
Base Year PM

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	100	74	120	81	36	56	50	773	95	56	1009	72
Future Volume (vph)	100	74	120	81	36	56	50	773	95	56	1009	72
Ideal Flow (vphpl)	1775	1650	1650	1775	1650	1650	1775	1775	1775	1775	1775	1775
Storage Length (m)	15.0	0.0	40.0	0.0	20.0	0.0	20.0	0.0	65.0	0.0	65.0	0.0
Storage Lanes	1	0	1	0	1	0	1	0	1	0	1	0
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	1.00	0.95	0.95
Ped Bike Factor	0.95	0.94		0.94	0.96		0.99	0.99		0.99	1.00	
Frt		0.907			0.909			0.984			0.990	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1668	1387	0	1668	1376	0	1668	3235	0	1588	3230	0
Flt Permitted	0.697			0.548			0.178			0.237		
Satd. Flow (perm)	1157	1387	0	900	1376	0	311	3235	0	393	3230	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		92			56			20			11	
Link Speed (k/h)		50			50			60			60	
Link Distance (m)		108.2			216.9			122.4			157.7	
Travel Time (s)		7.8			15.6			7.3			9.5	
Confl. Peds. (#/hr)	56		83	83		56	31		27	27		31
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	0%	0%	0%	0%	0%	5%	0%	1%	0%	5%	2%	0%
Adj. Flow (vph)	100	74	120	81	36	56	50	773	95	56	1009	72
Shared Lane Traffic (%)												
Lane Group Flow (vph)	100	194	0	81	92	0	50	868	0	56	1081	0
Turn Type	Perm	NA		Perm	NA		pm+pt	NA		pm+pt	NA	
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8			2			6		
Detector Phase	4	4		8	8		5	2		1	6	
Switch Phase												
Minimum Initial (s)	24.6	24.6		24.6	24.6		5.0	41.7		5.0	41.7	
Minimum Split (s)	30.6	30.6		30.6	30.6		9.0	47.7		9.0	47.7	
Total Split (s)	30.6	30.6		30.6	30.6		11.7	47.7		11.7	47.7	
Total Split (%)	34.0%	34.0%		34.0%	34.0%		13.0%	53.0%		13.0%	53.0%	
Maximum Green (s)	24.6	24.6		24.6	24.6		7.7	41.7		7.7	41.7	
Yellow Time (s)	4.0	4.0		4.0	4.0		3.0	4.0		3.0	4.0	
All-Red Time (s)	2.0	2.0		2.0	2.0		1.0	2.0		1.0	2.0	
Lost Time Adjust (s)	-2.0	-2.0		-2.0	-2.0		0.0	-2.0		0.0	-2.0	
Total Lost Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lead/Lag							Lead	Lag		Lead	Lag	
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	Max	Max		Max	Max		None	C-Max		None	C-Max	
Walk Time (s)	10.6	10.6		10.6	10.6		28.7			28.7		
Flash Dont Walk (s)	14.0	14.0		14.0	14.0		13.0			13.0		
Pedestrian Calls (#/hr)	0	0		0	0		0			0		
Act Effct Green (s)	26.6	26.6		26.6	26.6		52.1	46.6		53.1	48.8	
Actuated g/C Ratio	0.30	0.30		0.30	0.30		0.58	0.52		0.59	0.54	
v/c Ratio	0.29	0.41		0.30	0.21		0.18	0.51		0.17	0.62	

Lanes, Volumes, Timings
1: Weber Street North & Lincoln Road

145 Lincoln Road, Waterloo TIS
Base Year PM

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Control Delay	27.4	16.3		28.5	12.6		8.5	15.9		8.3	17.0	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	27.4	16.3		28.5	12.6		8.5	15.9		8.3	17.0	
LOS	C	B		C	B		A	B		A	B	
Approach Delay	20.1			20.0			15.5			16.6		
Approach LOS	C			C			B			B		
Queue Length 50th (m)	13.1	13.2		10.6	4.4		3.1	49.7		3.5	68.8	
Queue Length 95th (m)	26.2	31.2		22.9	15.3		7.2	67.9		7.8	92.9	
Internal Link Dist (m)	84.2			192.9			98.4			133.7		
Turn Bay Length (m)	15.0			40.0			20.0			65.0		
Base Capacity (vph)	341	474		266	446		298	1686		335	1755	
Starvation Cap Reductn	0	0		0	0		0	0		0	0	
Spillback Cap Reductn	0	0		0	0		0	0		0	0	
Storage Cap Reductn	0	0		0	0		0	0		0	0	
Reduced v/c Ratio	0.29	0.41		0.30	0.21		0.17	0.51		0.17	0.62	

Intersection Summary

Area Type: Other

Cycle Length: 90

Actuated Cycle Length: 90

Offset: 3.6 (4%), Referenced to phase 2:NBT and 6:SBTL, Start of Green

Natural Cycle: 90

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.62

Intersection Signal Delay: 16.8

Intersection LOS: B

Intersection Capacity Utilization 93.3%

ICU Level of Service F

Analysis Period (min) 15

Splits and Phases: 1: Weber Street North & Lincoln Road

Ø1	Ø2 (R)	Ø4
11.7 s	47.7 s	30.6 s
Ø5	Ø6 (R)	Ø8
11.7 s	47.7 s	30.6 s

HCM 6th Signalized Intersection Summary
1: Weber Street North & Lincoln Road

145 Lincoln Road, Waterloo TIS
Base Year PM

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Movement												
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Traffic Volume (veh/h)	100	74	120	81	36	56	50	773	95	56	1009	72
Future Volume (veh/h)	100	74	120	81	36	56	50	773	95	56	1009	72
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.93		0.91	0.95		0.91	1.00		0.97	0.99		0.97
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No		No		No		No		No		No	
Adj Sat Flow, veh/h/ln	1775	1650	1650	1775	1650	1586	1775	1761	1775	1706	1747	1775
Adj Flow Rate, veh/h	100	74	120	81	36	56	50	773	95	56	1009	72
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Percent Heavy Veh, %	0	0	0	0	0	5	0	1	0	5	2	0
Cap, veh/h	363	157	255	274	162	251	288	1581	194	345	1666	119
Arrive On Green	0.30	0.30	0.27	0.30	0.30	0.27	0.04	0.53	0.51	0.04	0.53	0.51
Sat Flow, veh/h	1156	531	862	1074	546	850	1690	2987	367	1625	3135	224
Grp Volume(v), veh/h	100	0	194	81	0	92	50	433	435	56	534	547
Grp Sat Flow(s),veh/h/ln	1156	0	1393	1074	0	1396	1690	1673	1681	1625	1660	1699
Q Serve(g_s), s	6.4	0.0	10.4	6.0	0.0	4.5	1.2	14.8	14.9	1.4	20.0	20.1
Cycle Q Clear(g_c), s	11.0	0.0	10.4	16.4	0.0	4.5	1.2	14.8	14.9	1.4	20.0	20.1
Prop In Lane	1.00		0.62	1.00		0.61	1.00		0.22	1.00		0.13
Lane Grp Cap(c), veh/h	363	0	412	274	0	413	288	885	890	345	882	903
V/C Ratio(X)	0.28	0.00	0.47	0.30	0.00	0.22	0.17	0.49	0.49	0.16	0.61	0.61
Avail Cap(c_a), veh/h	363	0	412	274	0	413	366	885	890	416	882	903
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	28.1	0.0	26.5	32.7	0.0	24.4	12.0	13.5	13.6	10.9	14.6	14.7
Incr Delay (d2), s/veh	1.9	0.0	3.8	2.7	0.0	1.2	0.3	1.9	1.9	0.2	3.1	3.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	3.8	0.0	7.6	3.4	0.0	3.2	0.9	10.6	10.7	1.0	13.6	13.9
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	29.9	0.0	30.3	35.5	0.0	25.6	12.3	15.4	15.5	11.1	17.6	17.7
LnGrp LOS	C	A	C	D	A	C	B	B	B	B	B	B
Approach Vol, veh/h	294		173		918		1137					
Approach Delay, s/veh	30.2		30.2		15.3		17.3					
Approach LOS	C		C		B		B					
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	7.8	51.6		30.6	7.6	51.8		30.6				
Change Period (Y+Rc), s	4.0	6.0		6.0	4.0	6.0		6.0				
Max Green Setting (Gmax), s	7.7	41.7		24.6	7.7	41.7		24.6				
Max Q Clear Time (g_c+1), s	3.4	16.9		13.0	3.2	22.1		18.4				
Green Ext Time (p_c), s	0.0	6.8		1.4	0.0	8.1		0.5				
Intersection Summary												
HCM 6th Ctrl Delay	19.0											
HCM 6th LOS	B											

Lanes, Volumes, Timings
2: Site Access & Lincoln Road

145 Lincoln Road, Waterloo TIS
Base Year PM

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔			↔			↔	
Traffic Volume (vph)	2	192	22	18	137	1	27	1	24	0	1	1
Future Volume (vph)	2	192	22	18	137	1	27	1	24	0	1	1
Ideal Flow (vphpl)	1550	1550	1550	1550	1550	1550	1550	1550	1550	1550	1550	1550
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.986			0.999			0.938			0.932	
Flt Protected					0.994			0.975				
Satd. Flow (prot)	0	1498	0	0	1470	0	0	1402	0	0	1429	0
Flt Permitted					0.994			0.975				
Satd. Flow (perm)	0	1498	0	0	1470	0	0	1402	0	0	1429	0
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		216.9			108.2			32.4			83.3	
Travel Time (s)		15.6			7.8			2.3			6.0	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	0%	1%	0%	0%	4%	0%	0%	0%	0%	0%	0%	0%
Adj. Flow (vph)	2	192	22	18	137	1	27	1	24	0	1	1
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	216	0	0	156	0	0	52	0	0	2	0
Sign Control		Free			Free			Stop			Stop	

Intersection Summary

Area Type: Other

Control Type: Unsignalized

Intersection Capacity Utilization 40.8%

ICU Level of Service A

Analysis Period (min) 15

HCM 6th TWSC
2: Site Access & Lincoln Road

145 Lincoln Road, Waterloo TIS
Base Year PM

Intersection												
Int Delay, s/veh	1.7											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔			↔			↔	
Traffic Vol, veh/h	2	192	22	18	137	1	27	1	24	0	1	1
Future Vol, veh/h	2	192	22	18	137	1	27	1	24	0	1	1
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	0	1	0	0	4	0	0	0	0	0	0	0
Mvmt Flow	2	192	22	18	137	1	27	1	24	0	1	1

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	138	0	0	214	0	0	382	381	203	394	392	138
Stage 1	-	-	-	-	-	-	207	207	-	174	174	-
Stage 2	-	-	-	-	-	-	175	174	-	220	218	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.1	6.5	6.2	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4	3.3	3.5	4	3.3
Pot Cap-1 Maneuver	1458	-	-	1368	-	-	580	555	843	569	547	916
Stage 1	-	-	-	-	-	-	800	734	-	833	759	-
Stage 2	-	-	-	-	-	-	832	759	-	787	726	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	1458	-	-	1368	-	-	571	546	843	545	538	916
Mov Cap-2 Maneuver	-	-	-	-	-	-	571	546	-	545	538	-
Stage 1	-	-	-	-	-	-	798	733	-	831	748	-
Stage 2	-	-	-	-	-	-	818	748	-	762	725	-

Approach	EB		WB		NB		SB	
HCM Control Delay, s	0.1		0.9		10.8		10.3	
HCM LOS					B		B	

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	670	1458	-	-	1368	-	-	678
HCM Lane V/C Ratio	0.078	0.001	-	-	0.013	-	-	0.003
HCM Control Delay (s)	10.8	7.5	0	-	7.7	0	-	10.3
HCM Lane LOS	B	A	A	-	A	A	-	B
HCM 95th %tile Q(veh)	0.3	0	-	-	0	-	-	0

Appendix E: Background Traffic Operations



Lanes, Volumes, Timings
1: Weber Street North & Lincoln Road

145 Lincoln Road, Waterloo TIS
Background AM

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↰	↰	↰	↰	↰	↰	↰	↰	↰	↰	↰
Traffic Volume (vph)	40	40	50	94	38	41	25	793	61	34	661	58
Future Volume (vph)	40	40	50	94	38	41	25	793	61	34	661	58
Ideal Flow (vphpl)	1775	1650	1650	1775	1650	1650	1775	1775	1775	1775	1775	1775
Storage Length (m)	15.0		0.0	40.0		0.0	20.0		0.0	65.0		0.0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	1.00	0.95	0.95
Ped Bike Factor	0.97	0.98		0.98	0.98		1.00	1.00		1.00	1.00	
Frt		0.917			0.922			0.989			0.988	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1668	1404	0	1635	1363	0	1668	3196	0	1367	3191	0
Flt Permitted	0.706			0.699			0.332			0.252		
Satd. Flow (perm)	1202	1404	0	1176	1363	0	580	3196	0	361	3191	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		50			41			14			16	
Link Speed (k/h)		50			50			60			60	
Link Distance (m)		108.2			216.9			122.4			157.7	
Travel Time (s)		7.8			15.6			7.3			9.5	
Confl. Peds. (#/hr)	30		22	22		30	11		17	17		11
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	0%	5%	4%	2%	0%	15%	0%	3%	2%	22%	3%	3%
Adj. Flow (vph)	40	40	50	94	38	41	25	793	61	34	661	58
Shared Lane Traffic (%)												
Lane Group Flow (vph)	40	90	0	94	79	0	25	854	0	34	719	0
Turn Type	Perm	NA		Perm	NA		pm+pt	NA		pm+pt	NA	
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8			2			6		
Detector Phase	4	4		8	8		5	2		1	6	
Switch Phase												
Minimum Initial (s)	21.2	21.2		21.2	21.2		5.0	36.4		5.0	36.4	
Minimum Split (s)	27.2	27.2		27.2	27.2		9.0	42.4		9.0	42.4	
Total Split (s)	27.2	27.2		27.2	27.2		9.0	43.8		9.0	43.8	
Total Split (%)	34.0%	34.0%		34.0%	34.0%		11.3%	54.8%		11.3%	54.8%	
Maximum Green (s)	21.2	21.2		21.2	21.2		5.0	37.8		5.0	37.8	
Yellow Time (s)	4.0	4.0		4.0	4.0		3.0	4.0		3.0	4.0	
All-Red Time (s)	2.0	2.0		2.0	2.0		1.0	2.0		1.0	2.0	
Lost Time Adjust (s)	-2.0	-2.0		-2.0	-2.0		0.0	-2.0		0.0	-2.0	
Total Lost Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lead/Lag							Lead	Lag		Lead	Lag	
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	Max	Max		Max	Max		None	C-Max		None	C-Max	
Walk Time (s)	7.2	7.2		7.2	7.2			23.4			23.4	
Flash Dont Walk (s)	14.0	14.0		14.0	14.0			13.0			13.0	
Pedestrian Calls (#/hr)	0	0		0	0			0			0	
Act Effct Green (s)	23.2	23.2		23.2	23.2		46.4	43.4		47.2	45.2	
Actuated g/C Ratio	0.29	0.29		0.29	0.29		0.58	0.54		0.59	0.56	
v/c Ratio	0.11	0.20		0.28	0.19		0.06	0.49		0.12	0.40	

PTSL (240181)

Synchro 11 Report
Page 1

Lanes, Volumes, Timings
1: Weber Street North & Lincoln Road

145 Lincoln Road, Waterloo TIS
Background AM

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Control Delay	22.1	12.7		24.6	13.4		6.7	13.2		7.4	11.1	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	22.1	12.7		24.6	13.4		6.7	13.2		7.4	11.1	
LOS	C	B		C	B		A	B		A	B	
Approach Delay		15.6			19.5			13.0			10.9	
Approach LOS		B			B			B			B	
Queue Length 50th (m)	4.4	4.4		10.8	4.2		1.3	42.8		1.8	24.9	
Queue Length 95th (m)	11.4	14.7		22.7	13.7		4.0	58.4		5.0	47.0	
Internal Link Dist (m)		84.2			192.9			98.4			133.7	
Turn Bay Length (m)	15.0			40.0			20.0			65.0		
Base Capacity (vph)	348	442		341	424		404	1740		276	1809	
Starvation Cap Reductn	0	0		0	0		0	0		0	0	
Spillback Cap Reductn	0	0		0	0		0	0		0	0	
Storage Cap Reductn	0	0		0	0		0	0		0	0	
Reduced v/c Ratio	0.11	0.20		0.28	0.19		0.06	0.49		0.12	0.40	

Intersection Summary

Area Type: Other

Cycle Length: 80

Actuated Cycle Length: 80

Offset: 75.2 (94%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green

Natural Cycle: 80

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.49

Intersection Signal Delay: 12.9

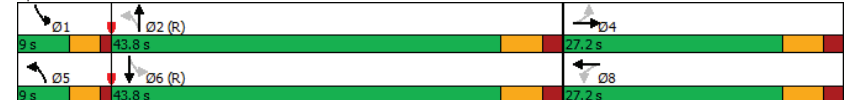
Intersection LOS: B

Intersection Capacity Utilization 54.7%

ICU Level of Service A

Analysis Period (min) 15

Splits and Phases: 1: Weber Street North & Lincoln Road



PTSL (240181)

Synchro 11 Report
Page 2

HCM 6th Signalized Intersection Summary
1: Weber Street North & Lincoln Road

145 Lincoln Road, Waterloo TIS
Background AM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↱		↰	↱		↰	↱		↰	↱	
Traffic Volume (veh/h)	40	40	50	94	38	41	25	793	61	34	661	58
Future Volume (veh/h)	40	40	50	94	38	41	25	793	61	34	661	58
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.97		0.97	0.98		0.97	0.99		0.98	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No		No		No		No		No		No	
Adj Sat Flow, veh/h/ln	1775	1586	1599	1747	1650	1457	1775	1733	1747	1470	1733	1733
Adj Flow Rate, veh/h	40	40	50	94	38	41	25	793	61	34	661	58
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Percent Heavy Veh, %	0	5	4	2	0	15	0	3	2	22	3	3
Cap, veh/h	394	182	227	377	206	223	397	1630	125	307	1631	143
Arrive On Green	0.29	0.29	0.27	0.29	0.29	0.27	0.03	0.53	0.50	0.03	0.53	0.51
Sat Flow, veh/h	1221	628	784	1191	712	768	1690	3095	238	1400	3059	268
Grp Volume(v), veh/h	40	0	90	94	0	79	25	422	432	34	356	363
Grp Sat Flow(s), veh/h/ln	1221	0	1412	1191	0	1480	1690	1647	1686	1400	1647	1680
Q Serve(g_s), s	2.0	0.0	3.9	5.2	0.0	3.3	0.6	13.0	13.1	0.9	10.3	10.4
Cycle Q Clear(g_c), s	5.3	0.0	3.9	9.1	0.0	3.3	0.6	13.0	13.1	0.9	10.3	10.4
Prop In Lane	1.00		0.56	1.00		0.52	1.00		0.14	1.00		0.16
Lane Grp Cap(c), veh/h	394	0	409	377	0	429	397	868	888	307	878	896
V/C Ratio(X)	0.10	0.00	0.22	0.25	0.00	0.18	0.06	0.49	0.49	0.11	0.40	0.41
Avail Cap(c_a), veh/h	394	0	409	377	0	429	458	868	888	349	878	896
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	23.3	0.0	22.0	25.0	0.0	21.7	9.7	12.0	12.1	10.0	11.1	11.2
Incr Delay (d2), s/veh	0.5	0.0	1.2	1.6	0.0	0.9	0.1	1.9	1.9	0.2	1.4	1.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	1.3	0.0	2.8	3.2	0.0	2.4	0.4	9.4	9.6	0.6	7.8	7.9
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	23.8	0.0	23.2	26.6	0.0	22.7	9.7	14.0	14.1	10.2	12.5	12.6
LnGrp LOS	C	A	C	C	A	C	A	B	B	B	B	B
Approach Vol, veh/h	130			173			879			753		
Approach Delay, s/veh	23.4			24.8			13.9			12.4		
Approach LOS	C			C			B			B		
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	6.7	46.1		27.2	6.1	46.7		27.2				
Change Period (Y+Rc), s	4.0	6.0		6.0	4.0	6.0		6.0				
Max Green Setting (Gmax), s	5.0	37.8		21.2	5.0	37.8		21.2				
Max Q Clear Time (g_c+I), s	2.9	15.1		7.3	2.6	12.4		11.1				
Green Ext Time (p_c), s	0.0	6.5		0.6	0.0	5.5		0.6				
Intersection Summary												
HCM 6th Ctrl Delay	14.9											
HCM 6th LOS	B											

Lanes, Volumes, Timings
2: Site Access & Lincoln Road

145 Lincoln Road, Waterloo TIS
Background AM

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	2	122	24	17	128	2	25	0	14	0	1	4
Future Volume (vph)	2	122	24	17	128	2	25	0	14	0	1	4
Ideal Flow (vphpl)	1550	1550	1550	1550	1550	1550	1550	1550	1550	1550	1550	1550
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor												
Frt		0.978			0.998			0.952			0.892	
Flt Protected		0.999			0.994			0.969				
Satd. Flow (prot)	0	1440	0	0	1445	0	0	1414	0	0	1139	0
Flt Permitted		0.999			0.994			0.969				
Satd. Flow (perm)	0	1440	0	0	1445	0	0	1414	0	0	1139	0
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		216.9			108.2			32.4			83.3	
Travel Time (s)		15.6			7.8			2.3			6.0	
Confl. Peds. (#/hr)	32		12	12		32	2		8	8		2
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	50%	4%	0%	0%	6%	0%	0%	0%	0%	0%	0%	25%
Adj. Flow (vph)	2	122	24	17	128	2	25	0	14	0	1	4
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	148	0	0	147	0	0	39	0	0	5	0
Sign Control		Free			Free			Stop			Stop	
Intersection Summary												
Area Type:	Other											
Control Type:	Unsignalized											
Intersection Capacity Utilization	38.6%				ICU Level of Service A							
Analysis Period (min)	15											

HCM 6th TWSC
2: Site Access & Lincoln Road

145 Lincoln Road, Waterloo TIS
Background AM

Intersection												
Int Delay, s/veh	1.8											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔			↔			↔			↔		
Traffic Vol, veh/h	2	122	24	17	128	2	25	0	14	0	1	4
Future Vol, veh/h	2	122	24	17	128	2	25	0	14	0	1	4
Conflicting Peds, #/hr	32	0	12	12	0	32	2	0	8	8	0	2
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	50	4	0	0	6	0	0	0	0	0	0	25
Mvmt Flow	2	122	24	17	128	2	25	0	14	0	1	4
Major/Minor	Major1	Major2		Minor1		Minor2						
Conflicting Flow All	162	0	0	158	0	0	318	346	154	348	357	163
Stage 1	-	-	-	-	-	-	150	150	-	195	195	-
Stage 2	-	-	-	-	-	-	168	196	-	153	162	-
Critical Hdwy	4.6	-	-	4.1	-	-	7.1	6.5	6.2	7.1	6.5	6.45
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.65	-	-	2.2	-	-	3.5	4	3.3	3.5	4	3.525
Pot Cap-1 Maneuver	1172	-	-	1434	-	-	639	580	897	610	572	825
Stage 1	-	-	-	-	-	-	857	777	-	811	743	-
Stage 2	-	-	-	-	-	-	839	742	-	854	768	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	1143	-	-	1421	-	-	621	552	883	575	545	803
Mov Cap-2 Maneuver	-	-	-	-	-	-	621	552	-	575	545	-
Stage 1	-	-	-	-	-	-	848	768	-	789	715	-
Stage 2	-	-	-	-	-	-	822	714	-	834	760	-
Approach	EB	WB		NB		SB						
HCM Control Delay, s	0.1	0.9		10.5		9.9						
HCM LOS				B		A						
Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1				
Capacity (veh/h)	695	1143	-	-	1421	-	-	734				
HCM Lane V/C Ratio	0.056	0.002	-	-	0.012	-	-	0.007				
HCM Control Delay (s)	10.5	8.2	0	-	7.6	0	-	9.9				
HCM Lane LOS	B	A	A	-	A	A	-	A				
HCM 95th %tile Q(veh)	0.2	0	-	-	0	-	-	0				

Lanes, Volumes, Timings
1: Weber Street North & Lincoln Road

145 Lincoln Road, Waterloo TIS
Background PM

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔		↔	↔		↔	↔		↔	↔	
Traffic Volume (vph)	100	74	120	85	36	59	50	830	100	59	1079	72
Future Volume (vph)	100	74	120	85	36	59	50	830	100	59	1079	72
Ideal Flow (vphpl)	1775	1650	1650	1775	1650	1650	1775	1775	1775	1775	1775	1775
Storage Length (m)	15.0	0.0	40.0	0.0	20.0	0.0	20.0	0.0	65.0	0.0	65.0	0.0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	1.00	0.95	0.95
Ped Bike Factor	0.95	0.94		0.94	0.96		0.99	0.99		0.99	1.00	
Frt	0.907				0.907				0.984		0.991	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1668	1387	0	1668	1371	0	1668	3236	0	1588	3233	0
Flt Permitted	0.695			0.551			0.157			0.220		
Satd. Flow (perm)	1154	1387	0	905	1371	0	274	3236	0	365	3233	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)	93				59				21		11	
Link Speed (k/h)	50				50				60		60	
Link Distance (m)	108.2				216.9				122.4		157.7	
Travel Time (s)	7.8				15.6				7.3		9.5	
Confl. Peds. (#/hr)	56		83	83		56	31		27	27		31
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	0%	0%	0%	0%	0%	5%	0%	1%	0%	5%	2%	0%
Adj. Flow (vph)	100	74	120	85	36	59	50	830	100	59	1079	72
Shared Lane Traffic (%)												
Lane Group Flow (vph)	100	194	0	85	95	0	50	930	0	59	1151	0
Turn Type	Perm	NA		Perm	NA		pm+pt	NA		pm+pt	NA	
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8			2			6		
Detector Phase	4	4		8	8		5	2		1	6	
Switch Phase												
Minimum Initial (s)	24.6	24.6		24.6	24.6		5.0	41.7		5.0	41.7	
Minimum Split (s)	30.6	30.6		30.6	30.6		9.0	47.7		9.0	47.7	
Total Split (s)	31.0	31.0		31.0	31.0		9.0	50.0		9.0	50.0	
Total Split (%)	34.4%	34.4%		34.4%	34.4%		10.0%	55.6%		10.0%	55.6%	
Maximum Green (s)	25.0	25.0		25.0	25.0		5.0	44.0		5.0	44.0	
Yellow Time (s)	4.0	4.0		4.0	4.0		3.0	4.0		3.0	4.0	
All-Red Time (s)	2.0	2.0		2.0	2.0		1.0	2.0		1.0	2.0	
Lost Time Adjust (s)	-2.0	-2.0		-2.0	-2.0		0.0	-2.0		0.0	-2.0	
Total Lost Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lead/Lag							Lead	Lag		Lead	Lag	
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	Max	Max		Max	Max		None	C-Max		None	C-Max	
Walk Time (s)	10.6	10.6		10.6	10.6			28.7			28.7	
Flash Dont Walk (s)	14.0	14.0		14.0	14.0			13.0			13.0	
Pedestrian Calls (#/hr)	0	0		0	0			0			0	
Act Effct Green (s)	27.0	27.0		27.0	27.0		51.8	47.8		52.6	49.6	
Actuated g/C Ratio	0.30	0.30		0.30	0.30		0.58	0.53		0.58	0.55	
v/c Ratio	0.29	0.40		0.31	0.21		0.21	0.54		0.21	0.64	

Lanes, Volumes, Timings
1: Weber Street North & Lincoln Road

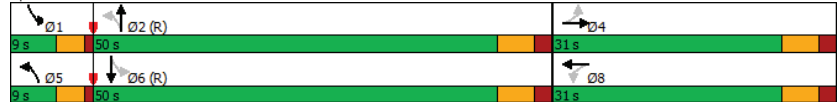
145 Lincoln Road, Waterloo TIS
Background PM

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Control Delay	27.0	15.9		28.4	12.1		9.3	15.4		9.0	16.8	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	27.0	15.9		28.4	12.1		9.3	15.4		9.0	16.8	
LOS	C	B		C	B		A	B		A	B	
Approach Delay		19.7			19.8			15.1			16.4	
Approach LOS		B			B			B			B	
Queue Length 50th (m)	13.0	13.0		11.2	4.4		3.1	53.0		3.7	73.6	
Queue Length 95th (m)	26.0	30.8		23.6	15.2		7.3	70.0		8.2	96.2	
Internal Link Dist (m)		84.2			192.9			98.4			133.7	
Turn Bay Length (m)	15.0			40.0			20.0			65.0		
Base Capacity (vph)	346	481		271	452		234	1728		281	1786	
Starvation Cap Reductn	0	0		0	0		0	0		0	0	
Spillback Cap Reductn	0	0		0	0		0	0		0	0	
Storage Cap Reductn	0	0		0	0		0	0		0	0	
Reduced v/c Ratio	0.29	0.40		0.31	0.21		0.21	0.54		0.21	0.64	

Intersection Summary

Area Type:	Other
Cycle Length: 90	
Actuated Cycle Length: 90	
Offset: 3.6 (4%), Referenced to phase 2:NBT and 6:SBTL, Start of Green	
Natural Cycle: 90	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.64	
Intersection Signal Delay: 16.5	Intersection LOS: B
Intersection Capacity Utilization 93.3%	ICU Level of Service F
Analysis Period (min) 15	

Spills and Phases: 1: Weber Street North & Lincoln Road



HCM 6th Signalized Intersection Summary
1: Weber Street North & Lincoln Road

145 Lincoln Road, Waterloo TIS
Background PM

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Traffic Volume (veh/h)	100	74	120	85	36	59	50	830	100	59	1079	72
Future Volume (veh/h)	100	74	120	85	36	59	50	830	100	59	1079	72
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.94		0.91	0.95		0.91	1.00		0.97	0.99		0.97
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No		No		No		No		No		No	
Adj Sat Flow, veh/h/ln	1775	1650	1650	1775	1650	1586	1775	1761	1775	1706	1747	1775
Adj Flow Rate, veh/h	100	74	120	85	36	59	50	830	100	59	1079	72
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Percent Heavy Veh, %	0	0	0	0	0	5	0	1	0	5	2	0
Cap, veh/h	366	160	259	279	158	260	266	1569	189	323	1661	111
Arrive On Green	0.30	0.30	0.28	0.30	0.30	0.28	0.04	0.52	0.50	0.04	0.53	0.50
Sat Flow, veh/h	1155	532	863	1075	528	866	1690	2995	361	1625	3151	210
Grp Volume(v), veh/h	100	0	194	85	0	95	50	464	466	59	568	583
Grp Sat Flow(s),veh/h/ln	1155	0	1395	1075	0	1394	1690	1673	1683	1625	1660	1702
Q Serve(g_s), s	6.4	0.0	10.3	6.3	0.0	4.7	1.3	16.4	16.5	1.5	22.1	22.2
Cycle Q Clear(g_c), s	11.1	0.0	10.3	16.6	0.0	4.7	1.3	16.4	16.5	1.5	22.1	22.2
Prop In Lane	1.00		0.62	1.00		0.62	1.00		0.21	1.00		0.12
Lane Grp Cap(c), veh/h	366	0	418	279	0	418	266	876	881	323	875	897
V/C Ratio(X)	0.27	0.00	0.46	0.30	0.00	0.23	0.19	0.53	0.53	0.18	0.65	0.65
Avail Cap(c_a), veh/h	366	0	418	279	0	418	293	876	881	344	875	897
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	27.9	0.0	26.2	32.4	0.0	24.2	12.8	14.1	14.3	11.4	15.3	15.4
Incr Delay (d2), s/veh	1.8	0.0	3.7	2.8	0.0	1.3	0.3	2.3	2.3	0.3	3.7	3.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	3.8	0.0	7.5	3.6	0.0	3.3	1.0	11.6	11.7	1.1	14.9	15.3
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	29.7	0.0	29.8	35.2	0.0	25.4	13.1	16.4	16.6	11.7	19.0	19.1
LnGrp LOS	C	A	C	D	A	C	B	B	B	B	B	B
Approach Vol, veh/h		294			180			980			1210	
Approach Delay, s/veh		29.8			30.0			16.3			18.7	
Approach LOS		C			C			B			B	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	7.9	51.1		31.0	7.6	51.4		31.0				
Change Period (Y+Rc), s	4.0	6.0		6.0	4.0	6.0		6.0				
Max Green Setting (Gmax), s	5.0	44.0		25.0	5.0	44.0		25.0				
Max Q Clear Time (g_c+I), s	3.5	18.5		13.1	3.3	24.2		18.6				
Green Ext Time (p_c), s	0.0	7.5		1.4	0.0	8.8		0.5				

Intersection Summary

HCM 6th Ctrl Delay	19.8
HCM 6th LOS	B

Lanes, Volumes, Timings
2: Site Access & Lincoln Road

145 Lincoln Road, Waterloo TIS
Background PM

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔			↔			↔	
Traffic Volume (vph)	2	202	22	18	144	1	27	1	24	0	1	1
Future Volume (vph)	2	202	22	18	144	1	27	1	24	0	1	1
Ideal Flow (vphpl)	1550	1550	1550	1550	1550	1550	1550	1550	1550	1550	1550	1550
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.987			0.999			0.938			0.932	
Flt Protected					0.995			0.975				
Satd. Flow (prot)	0	1499	0	0	1472	0	0	1402	0	0	1429	0
Flt Permitted					0.995			0.975				
Satd. Flow (perm)	0	1499	0	0	1472	0	0	1402	0	0	1429	0
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		216.9			108.2			32.4			83.3	
Travel Time (s)		15.6			7.8			2.3			6.0	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	0%	1%	0%	0%	4%	0%	0%	0%	0%	0%	0%	0%
Adj. Flow (vph)	2	202	22	18	144	1	27	1	24	0	1	1
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	226	0	0	163	0	0	52	0	0	2	0
Sign Control		Free			Free			Stop			Stop	

Intersection Summary

Area Type: Other

Control Type: Unsignalized

Intersection Capacity Utilization 41.3%

ICU Level of Service A

Analysis Period (min) 15

HCM 6th TWSC
2: Site Access & Lincoln Road

145 Lincoln Road, Waterloo TIS
Background PM

Intersection

Int Delay, s/veh 1.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔			↔			↔	
Traffic Vol, veh/h	2	202	22	18	144	1	27	1	24	0	1	1
Future Vol, veh/h	2	202	22	18	144	1	27	1	24	0	1	1
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	0	1	0	0	4	0	0	0	0	0	0	0
Mvmt Flow	2	202	22	18	144	1	27	1	24	0	1	1

Major/Minor	Major1		Major2		Minor1		Minor2					
Conflicting Flow All	145	0	0	224	0	0	399	398	213	411	409	145
Stage 1	-	-	-	-	-	217	217	-	181	181	-	-
Stage 2	-	-	-	-	-	182	181	-	230	228	-	-
Critical Hdwy	4.1	-	-	4.1	-	7.1	6.5	6.2	7.1	6.5	6.2	-
Critical Hdwy Stg 1	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-	-
Critical Hdwy Stg 2	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-	-
Follow-up Hdwy	2.2	-	-	2.2	-	3.5	4	3.3	3.5	4	3.3	-
Pot Cap-1 Maneuver	1450	-	-	1357	-	565	543	832	555	535	908	-
Stage 1	-	-	-	-	-	790	727	-	825	754	-	-
Stage 2	-	-	-	-	-	824	754	-	777	719	-	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	1450	-	-	1357	-	557	534	832	532	526	908	-
Mov Cap-2 Maneuver	-	-	-	-	-	557	534	-	532	526	-	-
Stage 1	-	-	-	-	-	788	726	-	823	743	-	-
Stage 2	-	-	-	-	-	810	743	-	752	718	-	-

Approach	EB		WB		NB		SB
HCM Control Delay, s	0.1		0.8		11		10.4
HCM LOS					B		B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	657	1450	-	-	1357	-	-	666
HCM Lane V/C Ratio	0.079	0.001	-	-	0.013	-	-	0.003
HCM Control Delay (s)	11	7.5	0	-	7.7	0	-	10.4
HCM Lane LOS	B	A	A	-	A	A	-	B
HCM 95th %tile Q(veh)	0.3	0	-	-	0	-	-	0

Appendix F: Total Traffic Operations



Lanes, Volumes, Timings

1: Weber Street North & Lincoln Road

145 Lincoln Road, Waterloo TIS

Total AM

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↰	↰	↰	↰	↰	↰	↰	↰	↰	↰	↰
Traffic Volume (vph)	40	40	50	102	38	43	25	793	71	38	661	58
Future Volume (vph)	40	40	50	102	38	43	25	793	71	38	661	58
Ideal Flow (vphpl)	1775	1650	1650	1775	1650	1650	1775	1775	1775	1775	1775	1775
Storage Length (m)	15.0		0.0	40.0		0.0	20.0		0.0	65.0		0.0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	1.00	0.95	0.95
Ped Bike Factor	0.97	0.98		0.98	0.98		1.00	1.00		1.00	1.00	
Frt		0.917			0.920			0.988			0.988	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1668	1404	0	1635	1357	0	1668	3192	0	1367	3191	0
Flt Permitted	0.704			0.699			0.332			0.248		
Satd. Flow (perm)	1198	1404	0	1176	1357	0	580	3192	0	355	3191	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		50			43			17			16	
Link Speed (k/h)		50			50			60			60	
Link Distance (m)		108.2			216.9			122.4			157.7	
Travel Time (s)		7.8			15.6			7.3			9.5	
Confl. Peds. (#/hr)	30		22	22		30	11		17	17		11
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	0%	5%	4%	2%	0%	15%	0%	3%	2%	22%	3%	3%
Adj. Flow (vph)	40	40	50	102	38	43	25	793	71	38	661	58
Shared Lane Traffic (%)												
Lane Group Flow (vph)	40	90	0	102	81	0	25	864	0	38	719	0
Turn Type	Perm	NA		Perm	NA		pm+pt	NA		pm+pt	NA	
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8			2			6		
Detector Phase	4	4		8	8		5	2		1	6	
Switch Phase												
Minimum Initial (s)	21.2	21.2		21.2	21.2		5.0	36.4		5.0	36.4	
Minimum Split (s)	27.2	27.2		27.2	27.2		9.0	42.4		9.0	42.4	
Total Split (s)	27.2	27.2		27.2	27.2		9.0	43.8		9.0	43.8	
Total Split (%)	34.0%	34.0%		34.0%	34.0%		11.3%	54.8%		11.3%	54.8%	
Maximum Green (s)	21.2	21.2		21.2	21.2		5.0	37.8		5.0	37.8	
Yellow Time (s)	4.0	4.0		4.0	4.0		3.0	4.0		3.0	4.0	
All-Red Time (s)	2.0	2.0		2.0	2.0		1.0	2.0		1.0	2.0	
Lost Time Adjust (s)	-2.0	-2.0		-2.0	-2.0		0.0	-2.0		0.0	-2.0	
Total Lost Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lead/Lag							Lead	Lag		Lead	Lag	
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	Max	Max		Max	Max		None	C-Max		None	C-Max	
Walk Time (s)	7.2	7.2		7.2	7.2			23.4			23.4	
Flash Dont Walk (s)	14.0	14.0		14.0	14.0			13.0			13.0	
Pedestrian Calls (#/hr)	0	0		0	0			0			0	
Act Effct Green (s)	23.2	23.2		23.2	23.2		46.4	43.4		47.2	45.2	
Actuated g/C Ratio	0.29	0.29		0.29	0.29		0.58	0.54		0.59	0.56	
v/c Ratio	0.12	0.20		0.30	0.19		0.06	0.50		0.14	0.40	

PTSL (240181)

Synchro 11 Report
Page 1

Lanes, Volumes, Timings

1: Weber Street North & Lincoln Road

145 Lincoln Road, Waterloo TIS

Total AM

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Control Delay	22.1	12.7		25.1	13.2		6.7	13.2		7.6	11.1	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	22.1	12.7		25.1	13.2		6.7	13.2		7.6	11.1	
LOS	C	B		C	B		A	B		A	B	
Approach Delay		15.6			19.8			13.0			10.9	
Approach LOS		B			B			B			B	
Queue Length 50th (m)	4.4	4.4		11.8	4.1		1.3	43.4		2.1	24.9	
Queue Length 95th (m)	11.5	14.7		24.3	13.8		4.0	59.2		5.4	47.0	
Internal Link Dist (m)		84.2			192.9			98.4			133.7	
Turn Bay Length (m)	15.0			40.0			20.0			65.0		
Base Capacity (vph)	347	442		341	424		404	1739		272	1809	
Starvation Cap Reductn	0	0		0	0		0	0		0	0	
Spillback Cap Reductn	0	0		0	0		0	0		0	0	
Storage Cap Reductn	0	0		0	0		0	0		0	0	
Reduced v/c Ratio	0.12	0.20		0.30	0.19		0.06	0.50		0.14	0.40	

Intersection Summary

Area Type: Other

Cycle Length: 80

Actuated Cycle Length: 80

Offset: 75.2 (94%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green

Natural Cycle: 80

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.50

Intersection Signal Delay: 13.0

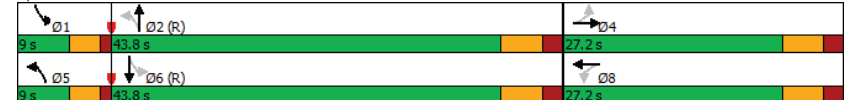
Intersection LOS: B

Intersection Capacity Utilization 58.1%

ICU Level of Service B

Analysis Period (min) 15

Splits and Phases: 1: Weber Street North & Lincoln Road



PTSL (240181)

Synchro 11 Report
Page 2

HCM 6th Signalized Intersection Summary
1: Weber Street North & Lincoln Road

145 Lincoln Road, Waterloo TIS
Total AM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↱		↰	↱		↰	↱		↰	↱	
Traffic Volume (veh/h)	40	40	50	102	38	43	25	793	71	38	661	58
Future Volume (veh/h)	40	40	50	102	38	43	25	793	71	38	661	58
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.97		0.97	0.98		0.97	0.99		0.98	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No		No		No		No		No		No	
Adj Sat Flow, veh/h/ln	1775	1586	1599	1747	1650	1457	1775	1733	1747	1470	1733	1733
Adj Flow Rate, veh/h	40	40	50	102	38	43	25	793	71	38	661	58
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Percent Heavy Veh, %	0	5	4	2	0	15	0	3	2	22	3	3
Cap, veh/h	392	182	227	377	201	227	397	1600	143	306	1631	143
Arrive On Green	0.29	0.29	0.27	0.29	0.29	0.27	0.03	0.52	0.50	0.04	0.53	0.51
Sat Flow, veh/h	1219	628	784	1191	693	784	1690	3052	273	1400	3059	268
Grp Volume(v), veh/h	40	0	90	102	0	81	25	428	436	38	356	363
Grp Sat Flow(s), veh/h/ln	1219	0	1412	1191	0	1476	1690	1647	1679	1400	1647	1680
Q Serve(g_s), s	2.0	0.0	3.9	5.7	0.0	3.3	0.6	13.4	13.4	1.0	10.3	10.4
Cycle Q Clear(g_c), s	5.4	0.0	3.9	9.6	0.0	3.3	0.6	13.4	13.4	1.0	10.3	10.4
Prop In Lane	1.00		0.56	1.00		0.53	1.00		0.16	1.00		0.16
Lane Grp Cap(c), veh/h	392	0	409	377	0	428	397	864	880	306	878	896
V/C Ratio(X)	0.10	0.00	0.22	0.27	0.00	0.19	0.06	0.50	0.50	0.12	0.40	0.41
Avail Cap(c_a), veh/h	392	0	409	377	0	428	458	864	880	344	878	896
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	23.4	0.0	22.0	25.2	0.0	21.8	9.7	12.2	12.3	10.1	11.1	11.2
Incr Delay (d2), s/veh	0.5	0.0	1.2	1.8	0.0	1.0	0.1	2.0	2.0	0.2	1.4	1.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	1.3	0.0	2.8	3.5	0.0	2.5	0.4	9.6	9.8	0.6	7.8	7.9
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	23.9	0.0	23.2	27.0	0.0	22.7	9.8	14.3	14.3	10.3	12.5	12.6
LnGrp LOS	C	A	C	C	A	C	A	B	B	B	B	B
Approach Vol, veh/h		130			183			889			757	
Approach Delay, s/veh		23.4			25.1			14.2			12.4	
Approach LOS		C			C			B			B	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	6.9	45.9		27.2	6.1	46.7		27.2				
Change Period (Y+Rc), s	4.0	6.0		6.0	4.0	6.0		6.0				
Max Green Setting (Gmax), s	5.0	37.8		21.2	5.0	37.8		21.2				
Max Q Clear Time (g_c+I1), s	3.0	15.4		7.4	2.6	12.4		11.6				
Green Ext Time (p_c), s	0.0	6.6		0.5	0.0	5.5		0.6				
Intersection Summary												
HCM 6th Ctrl Delay				15.1								
HCM 6th LOS				B								

Lanes, Volumes, Timings
2: Site Access & Lincoln Road

145 Lincoln Road, Waterloo TIS
Total AM

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↰			↰			↰			↰	
Traffic Volume (vph)	2	122	38	27	128	2	35	0	22	0	1	4
Future Volume (vph)	2	122	38	27	128	2	35	0	22	0	1	4
Ideal Flow (vphpl)	1550	1550	1550	1550	1550	1550	1550	1550	1550	1550	1550	1550
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor												
Frt		0.968			0.998			0.948			0.892	
Flt Protected		0.999			0.991			0.970				
Satd. Flow (prot)	0	1430	0	0	1445	0	0	1409	0	0	1139	0
Flt Permitted		0.999			0.991			0.970				
Satd. Flow (perm)	0	1430	0	0	1445	0	0	1409	0	0	1139	0
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		216.9			108.2			32.4			83.3	
Travel Time (s)		15.6			7.8			2.3			6.0	
Confl. Peds. (#/hr)	32		12	12		32	2		8	8		2
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	50%	4%	0%	0%	6%	0%	0%	0%	0%	0%	0%	25%
Adj. Flow (vph)	2	122	38	27	128	2	35	0	22	0	1	4
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	162	0	0	157	0	0	57	0	0	5	0
Sign Control		Free			Free			Stop			Stop	
Intersection Summary												
Area Type:	Other											
Control Type:	Unsignalized											
Intersection Capacity Utilization 45.7%	ICU Level of Service A											
Analysis Period (min) 15												

HCM 6th TWSC
2: Site Access & Lincoln Road

145 Lincoln Road, Waterloo TIS
Total AM

Intersection												
Int Delay, s/veh	2.3											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	2	122	38	27	128	2	35	0	22	0	1	4
Future Vol, veh/h	2	122	38	27	128	2	35	0	22	0	1	4
Conflicting Peds, #/hr	32	0	12	12	0	32	2	0	8	8	0	2
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	50	4	0	0	6	0	0	0	0	0	0	25
Mvmt Flow	2	122	38	27	128	2	35	0	22	0	1	4

Major/Minor	Major1		Major2		Minor1		Minor2					
Conflicting Flow All	162	0	0	172	0	0	345	373	161	379	391	163
Stage 1	-	-	-	-	-	-	157	157	-	215	215	-
Stage 2	-	-	-	-	-	-	188	216	-	164	176	-
Critical Hdwy	4.6	-	-	4.1	-	-	7.1	6.5	6.2	7.1	6.5	6.45
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.65	-	-	2.2	-	-	3.5	4	3.3	3.5	4	3.525
Pot Cap-1 Maneuver	1172	-	-	1417	-	-	613	561	889	582	548	825
Stage 1	-	-	-	-	-	-	850	772	-	792	729	-
Stage 2	-	-	-	-	-	-	818	728	-	843	757	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	1143	-	-	1404	-	-	592	530	875	540	517	803
Mov Cap-2 Maneuver	-	-	-	-	-	-	592	530	-	540	517	-
Stage 1	-	-	-	-	-	-	841	764	-	771	696	-
Stage 2	-	-	-	-	-	-	794	695	-	815	749	-

Approach	EB		WB		NB		SB
HCM Control Delay, s	0.1		1.3		10.8		10
HCM LOS					B		B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	676	1143	-	-	1404	-	-	723
HCM Lane V/C Ratio	0.084	0.002	-	-	0.019	-	-	0.007
HCM Control Delay (s)	10.8	8.2	0	-	7.6	0	-	10
HCM Lane LOS	B	A	A	-	A	A	-	B
HCM 95th %tile Q(veh)	0.3	0	-	-	0.1	-	-	0

Lanes, Volumes, Timings
1: Weber Street North & Lincoln Road

145 Lincoln Road, Waterloo TIS
Total PM

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	100	74	120	90	36	60	50	830	104	60	1079	72
Future Volume (vph)	100	74	120	90	36	60	50	830	104	60	1079	72
Ideal Flow (vphpl)	1775	1650	1650	1775	1650	1650	1775	1775	1775	1775	1775	1775
Storage Length (m)	15.0		0.0	40.0		0.0	20.0		0.0	65.0		0.0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	1.00	0.95	0.95
Ped Bike Factor	0.95	0.94		0.94	0.95		0.99	0.99		0.99	1.00	
Frt		0.907			0.906			0.983			0.991	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1668	1387	0	1668	1369	0	1668	3232	0	1588	3233	0
Flt Permitted	0.695			0.551			0.160			0.211		
Satd. Flow (perm)	1154	1387	0	905	1369	0	279	3232	0	350	3233	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		93			60			21			11	
Link Speed (k/h)		50			50			60			60	
Link Distance (m)		108.2			216.9			122.4			157.7	
Travel Time (s)		7.8			15.6			7.3			9.5	
Confl. Peds. (#/hr)	56		83	83		56	31		27	27		31
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	0%	0%	0%	0%	0%	5%	0%	1%	0%	5%	2%	0%
Adj. Flow (vph)	100	74	120	90	36	60	50	830	104	60	1079	72
Shared Lane Traffic (%)												
Lane Group Flow (vph)	100	194	0	90	96	0	50	934	0	60	1151	0
Turn Type	Perm	NA		Perm	NA		pm+pt	NA		pm+pt	NA	
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8			2			6		
Detector Phase	4	4		8	8		5	2		1	6	
Switch Phase												
Minimum Initial (s)	24.6	24.6		24.6	24.6		5.0	41.7		5.0	41.7	
Minimum Split (s)	30.6	30.6		30.6	30.6		9.0	47.7		9.0	47.7	
Total Split (s)	31.0	31.0		31.0	31.0		9.0	49.0		10.0	50.0	
Total Split (%)	34.4%	34.4%		34.4%	34.4%		10.0%	54.4%		11.1%	55.6%	
Maximum Green (s)	25.0	25.0		25.0	25.0		5.0	43.0		6.0	44.0	
Yellow Time (s)	4.0	4.0		4.0	4.0		3.0	4.0		3.0	4.0	
All-Red Time (s)	2.0	2.0		2.0	2.0		1.0	2.0		1.0	2.0	
Lost Time Adjust (s)	-2.0	-2.0		-2.0	-2.0		0.0	-2.0		0.0	-2.0	
Total Lost Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lead/Lag							Lead	Lag		Lead	Lag	
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	Max	Max		Max	Max		None	C-Max		None	C-Max	
Walk Time (s)	10.6	10.6		10.6	10.6			28.7			28.7	
Flash Dont Walk (s)	14.0	14.0		14.0	14.0			13.0			13.0	
Pedestrian Calls (#/hr)	0	0		0	0			0			0	
Act Effct Green (s)	27.0	27.0		27.0	27.0		51.0	47.0		53.2	49.6	
Actuated g/C Ratio	0.30	0.30		0.30	0.30		0.57	0.52		0.59	0.55	
v/c Ratio	0.29	0.40		0.33	0.21		0.21	0.55		0.21	0.64	

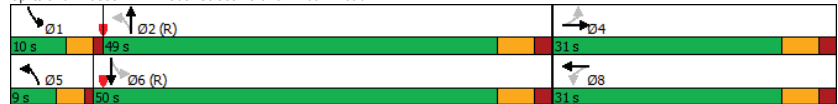
Lanes, Volumes, Timings
1: Weber Street North & Lincoln Road

145 Lincoln Road, Waterloo TIS
Total PM

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Control Delay	27.0	15.9		28.8	12.0		9.4	16.1		8.9	16.8	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	27.0	15.9		28.8	12.0		9.4	16.1		8.9	16.8	
LOS	C	B		C	B		A	B		A	B	
Approach Delay	19.7			20.1			15.8			16.4		
Approach LOS	B			C			B			B		
Queue Length 50th (m)	13.0	13.0		11.9	4.4		3.1	54.7		3.8	73.6	
Queue Length 95th (m)	26.0	30.8		24.9	15.4		7.3	72.4		8.4	96.2	
Internal Link Dist (m)	84.2			192.9			98.4			133.7		
Turn Bay Length (m)	15.0			40.0			20.0			65.0		
Base Capacity (vph)	346	481		271	452		235	1697		289	1786	
Starvation Cap Reductn	0	0		0	0		0	0		0	0	
Spillback Cap Reductn	0	0		0	0		0	0		0	0	
Storage Cap Reductn	0	0		0	0		0	0		0	0	
Reduced v/c Ratio	0.29	0.40		0.33	0.21		0.21	0.55		0.21	0.64	

Intersection Summary	
Area Type:	Other
Cycle Length: 90	
Actuated Cycle Length: 90	
Offset: 3.6 (4%), Referenced to phase 2:NBT and 6:SBTL, Start of Green	
Natural Cycle: 90	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.64	
Intersection Signal Delay: 16.8	Intersection LOS: B
Intersection Capacity Utilization 93.3%	ICU Level of Service F
Analysis Period (min) 15	

Spills and Phases: 1: Weber Street North & Lincoln Road



HCM 6th Signalized Intersection Summary
1: Weber Street North & Lincoln Road

145 Lincoln Road, Waterloo TIS
Total PM

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Traffic Volume (veh/h)	100	74	120	90	36	60	50	830	104	60	1079	72
Future Volume (veh/h)	100	74	120	90	36	60	50	830	104	60	1079	72
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.94		0.91	0.95		0.91	1.00		0.97	0.99		0.97
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No		No		No		No		No		No	
Adj Sat Flow, veh/h/ln	1775	1650	1650	1775	1650	1586	1775	1761	1775	1706	1747	1775
Adj Flow Rate, veh/h	100	74	120	90	36	60	50	830	104	60	1079	72
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Percent Heavy Veh, %	0	0	0	0	0	5	0	1	0	5	2	0
Cap, veh/h	365	160	259	279	157	261	266	1560	195	322	1661	111
Arrive On Green	0.30	0.30	0.28	0.30	0.30	0.28	0.04	0.52	0.50	0.04	0.53	0.50
Sat Flow, veh/h	1154	532	863	1075	522	870	1690	2980	373	1625	3151	210
Grp Volume(v), veh/h	100	0	194	90	0	96	50	466	468	60	568	583
Grp Sat Flow(s),veh/h/ln	1154	0	1395	1075	0	1392	1690	1673	1680	1625	1660	1702
Q Serve(g_s), s	6.4	0.0	10.3	6.7	0.0	4.7	1.3	16.6	16.7	1.6	22.1	22.2
Cycle Q Clear(g_c), s	11.2	0.0	10.3	17.0	0.0	4.7	1.3	16.6	16.7	1.6	22.1	22.2
Prop In Lane	1.00		0.62	1.00		0.63	1.00		0.22	1.00		0.12
Lane Grp Cap(c), veh/h	365	0	418	279	0	418	266	876	879	322	875	897
V/C Ratio(X)	0.27	0.00	0.46	0.32	0.00	0.23	0.19	0.53	0.53	0.19	0.65	0.65
Avail Cap(c_a), veh/h	365	0	418	279	0	418	293	876	879	360	875	897
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	27.9	0.0	26.2	32.6	0.0	24.2	12.8	14.2	14.3	11.4	15.3	15.4
Incr Delay (d2), s/veh	1.8	0.0	3.7	3.0	0.0	1.3	0.3	2.3	2.3	0.3	3.7	3.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	3.8	0.0	7.5	3.8	0.0	3.4	1.0	11.7	11.8	1.1	14.9	15.3
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	29.8	0.0	29.8	35.6	0.0	25.5	13.1	16.5	16.6	11.7	19.0	19.1
LnGrp LOS	C	A	C	D	A	C	B	B	B	B	B	B
Approach Vol, veh/h	294			186			984			1211		
Approach Delay, s/veh	29.8			30.4			16.4			18.7		
Approach LOS	C			C			B			B		
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	7.9	51.1		31.0	7.6	51.4		31.0				
Change Period (Y+Rc), s	4.0	6.0		6.0	4.0	6.0		6.0				
Max Green Setting (Gmax), s	6.0	43.0		25.0	5.0	44.0		25.0				
Max Q Clear Time (g_c+1), s	3.6	18.7		13.2	3.3	24.2		19.0				
Green Ext Time (p_c), s	0.0	7.5		1.4	0.0	8.8		0.5				

Intersection Summary	
HCM 6th Ctrl Delay	19.9
HCM 6th LOS	B

Lanes, Volumes, Timings
2: Site Access & Lincoln Road

145 Lincoln Road, Waterloo TIS
Total PM

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔			↔			↔	
Traffic Volume (vph)	2	202	27	22	144	1	33	1	29	0	1	1
Future Volume (vph)	2	202	27	22	144	1	33	1	29	0	1	1
Ideal Flow (vphpl)	1550	1550	1550	1550	1550	1550	1550	1550	1550	1550	1550	1550
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.984			0.999			0.938			0.932	
Flt Protected					0.993			0.974				
Satd. Flow (prot)	0	1495	0	0	1470	0	0	1400	0	0	1429	0
Flt Permitted					0.993			0.974				
Satd. Flow (perm)	0	1495	0	0	1470	0	0	1400	0	0	1429	0
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		216.9			108.2			32.4			83.3	
Travel Time (s)		15.6			7.8			2.3			6.0	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	0%	1%	0%	0%	4%	0%	0%	0%	0%	0%	0%	0%
Adj. Flow (vph)	2	202	27	22	144	1	33	1	29	0	1	1
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	231	0	0	167	0	0	63	0	0	2	0
Sign Control		Free			Free			Stop			Stop	

Intersection Summary

Area Type: Other

Control Type: Unsignalized

Intersection Capacity Utilization 45.7%

ICU Level of Service A

Analysis Period (min) 15

HCM 6th TWSC
2: Site Access & Lincoln Road

145 Lincoln Road, Waterloo TIS
Total PM

Intersection												
Int Delay, s/veh	2											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔			↔			↔	
Traffic Vol, veh/h	2	202	27	22	144	1	33	1	29	0	1	1
Future Vol, veh/h	2	202	27	22	144	1	33	1	29	0	1	1
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	0	1	0	0	4	0	0	0	0	0	0	0
Mvmt Flow	2	202	27	22	144	1	33	1	29	0	1	1

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	145	0	0	229	0	0	410	409	216	424	422	145
Stage 1	-	-	-	-	-	-	220	220	-	189	189	-
Stage 2	-	-	-	-	-	-	190	189	-	235	233	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.1	6.5	6.2	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4	3.3	3.5	4	3.3
Pot Cap-1 Maneuver	1450	-	-	1351	-	-	556	535	829	544	526	908
Stage 1	-	-	-	-	-	-	787	725	-	817	748	-
Stage 2	-	-	-	-	-	-	816	748	-	773	716	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	1450	-	-	1351	-	-	546	524	829	516	515	908
Mov Cap-2 Maneuver	-	-	-	-	-	-	546	524	-	516	515	-
Stage 1	-	-	-	-	-	-	785	724	-	815	735	-
Stage 2	-	-	-	-	-	-	799	735	-	743	715	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.1	1	11.2	10.5
HCM LOS			B	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	647	1450	-	-	1351	-	-	657
HCM Lane V/C Ratio	0.097	0.001	-	-	0.016	-	-	0.003
HCM Control Delay (s)	11.2	7.5	0	-	7.7	0	-	10.5
HCM Lane LOS	B	A	A	-	A	A	-	B
HCM 95th %tile Q(veh)	0.3	0	-	-	0.1	-	-	0

Appendix G: Left-Turn Lane Warrant



