

MEMORANDUM



To: Amanda Schmidt, Bldg. & Zoning Services Coordinator
Scott Shumard, City Manager

From: Chris Ball, EIT
Deb Weaver, PE
Dustin Wolff, AICP

Cc:

Date: April 5, 2017

Subject: *Traffic Impact Study at the Lynn Boulevard and LeFevre Road Intersection*

INTRODUCTION

Mead & Hunt, Inc. (Mead & Hunt) was retained by the City of Sterling (City) to conduct a traffic impact study at the intersection of Lynn Boulevard and West LeFevre Road within Meadowlands Business Park, just northwest of downtown Sterling.

Project Background

The new HALO Headquarters site will be constructed in the southeast quadrant of the Lynn Boulevard/LeFevre Road intersection. The existing cul-de-sac of Commerce Drive, north of W. 13th Avenue, will be vacated to accommodate the new facility.

The proposed facility will include 67,500 square feet (SF) of office space and 90,000 SF of warehouse space. The site will have four access points. One entrance will be located on West LeFevre Road, one on South Lynne Boulevard, and two on West 13th Street.

The facility will be constructed in two phases. The first phase, to be completed in 2018, will contain approximately 90,000 SF of office and warehouse space, and will be located at the north end of the site. The second phase, containing approximately 67,000 SF, will be completed within three to five years.

Within six months of opening in 2018, the facility will have approximately 300 employees in the office and an additional 50 employees in the warehouse. Upon full build-out (referenced in the memo as *opening year* or build conditions) the facility will



have 500 employees in the office, and 75 employees are anticipated in the warehouse.

Study Area

The study area is characterized by a variety of land uses. Predominantly office and light industrial, some single-family residential and recreational/open space peppers the area.

Lynn Boulevard is a two-lane, two-way, principal collector road for the City, providing a continuous ring around the north and west edges of the community. This roadway is heavily travelled by commuter traffic and delivery vehicles. Short right turn lanes with concrete islands are located on the north and south legs of the intersection. A multi-use trail crossing is on the north leg of the intersection.

LeFevre Road is a minor east/west collector that runs the length of the City. LeFevre connects the Westwood Center, community parks, the CGH Medical Center, and Sterling public schools (elementary, middle, and high). The roadway is a two-lane, two-way roadway with frequent stop controls. A short right turn lane with a concrete island is on the westbound leg and a generous roadway radius is on the eastbound leg of the intersection.

The intersection is currently stop controlled on S. Lynn Boulevard with W. LeFevre having the unrestricted through movement. The short slip right turn lanes only provide for one vehicle to turn right at the intersection and will not be considered as an exclusive right turn lane in the capacity analysis.

Study Methodology

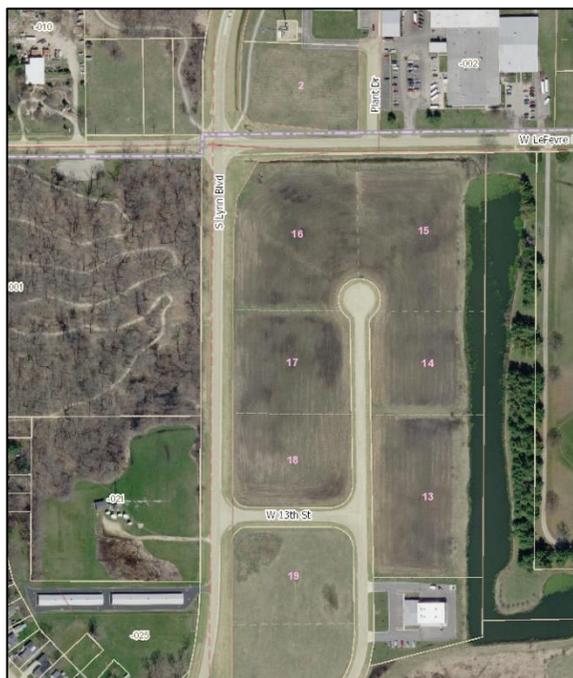
The analysis was conducted to assess the level of service (LOS) of the intersection of Lynn Boulevard and W. LeFevre Road in its current condition, and to determine the impact of the new facility on the intersection. The study will use 2020 as the opening year and 2040 as the design year. The following analyses were completed for the study.

Data Collection

Traffic data was collected using the MioVision *Scout* video collection system. Intersection traffic movement counts were conducted for 12 consecutive hours (6:30am – 6:30pm) at the intersection of Lynn Boulevard and W. LeFevre Road on Thursday, March 9, 2017. The existing traffic data was projected to opening day 2020 and design year 2040 using a 1.5% growth rate as supplied by the City. It should be noted that during peak hours, the intersection volumes are very equal on all legs of the intersection.

Vehicle Trip Generation

The anticipated trips for both the proposed office and warehouse were determined by using the Institute of Transportation Engineers *Trip Generation Manual, 8th Edition* for warehousing and office. The trips were then distributed onto the roadway network using the existing count distribution and the make-up of the surrounding area. The distributed trips were then added to the projected 2020 and 2040 background traffic



volumes to determine the build condition volumes. The trip generation volumes for the opening and design years included the full buildout. Refer to Appendix C for the anticipated trips and the distribution calculations. Peak hour factor and truck percentages were extrapolated from the traffic counts and applied to the opening year and design year volumes.

Signal Warrant Analysis

Using the criteria outlined in the *Manual of Traffic Control Devices* (MUTCD), a signal warrant analysis was completed for the 2017 existing traffic counts and the 2020 opening year condition for the intersection of Lynn Boulevard and W. LeFevre Road. Additionally, the 70% criteria, which may be used when the major-street speed exceeds 40 miles per hour (mph) or in an isolated community with a population of less than 10,000, was used for the signal warrant analysis due to the fact that posted speed limit is 45 mph on N. Lynn Boulevard and 45 mph on W. LeFevre Road. Based on the signal warrant analysis, a signal is not warranted under Warrant #1 and #2 (eight-hour vehicular volume and four-hour vehicular volume). A signal is warranted under Warrant #3 - Peak Hour for both the existing and opening day conditions. However, a signal installed under Warrant #3 should meet the conditions listed in the MUTCD, Section 4C.04, as follows:

This signal warrant shall be applied only in unusual cases, such as office complexes, manufacturing plants, industrial complexes, or high-occupancy vehicle facilities that attract or discharge large numbers of vehicles over a short time.

The need for a traffic control signal shall be considered if an engineering study finds that the criteria in either of the following two categories are met:

- A. If all three of the following conditions exist for the same 1 hour (any four consecutive 15-minute periods) of an average day:
 1. The total stopped time delay experienced by the traffic on one minor-street approach (one direction only) controlled by a STOP sign equals or exceeds: 4 vehicle-hours for a one-lane approach: or 5 vehicle-hours for a two-lane approach: and
 2. The volume on the same minor-street approach (one direction only) equals or exceeds 100 vehicles per hour for one moving lane of traffic or 150 vehicles per hour for two moving lanes; and
 3. The total entering volume serviced during the hour equals 650 vehicles per hour for intersections with three approaches or 800 vehicles per hour for intersections with four or more approaches.
- B. The plotted point representing the vehicles per hour on the major street (total of both approaches) and the corresponding vehicles per hour on the higher-volume minor-street approach (one direction only) for 1 hour (any four consecutive 15 minute periods) of an average day falls above the applicable curve in figure 4C-3 for the existing combination of approach lanes.

According to the signal warrant analysis, the plotted point is above the curve. Note that 70% warrant criteria is met and 4C-3 is used for 100% warrant and 4C-4 is the figure for the 70% warrant. Therefore, the signal is warranted for existing opening year conditions. It should be pointed out that a peak hour warrant is not a very strong warrant and it is preferred that warrants 1 and 2 are met before installing a signal.

Intersection Analysis

The latest version of the Highway Capacity Software was used to determine the necessary lanes needed to achieve an acceptable level of service for the 2040 design year traffic volumes. The following alternatives were analyzed for the intersection of Le Fevre Road and Lynn Boulevard using HCS 7 and Sidra Intersection 7.

- 2020 AM/PM No Build TWSC (two-way stop control)
- 2020 AM/PM Build TWSC
- 2020 AM/PM Build AWSC (all-way stop control)
- 2020 AM/PM Build Signalized
- 2020 AM/PM Build Single Lane Roundabout
- 2040 AM/PM No Build TWSC
- 2040 AM/PM Build TWSC
- 2040 AM/PM Build AWSC
- 2040 AM/PM Build Signalized
- 2040 AM/PM Build Single Lane Roundabout

Existing Operational Performance

The existing intersection was analyzed according to its lane configuration and control, to determine if an acceptable LOS is met. After that, whenever required, the intersection was analyzed under different controls. The initial analysis performed was the existing Two-Way Stop Control (TWSC) with the no build condition, which performed at an unacceptable LOS during the PM peak hour in the design year. The same control with the build condition reached an unacceptable LOS during the PM peak hour in the opening year. Next, the intersection was analyzed as an All-Way Stop Control (AWSC) intersection, which provided a more balanced LOS amongst the four approaches but still reached an unacceptable LOS during the PM peak in the design year. An analysis was performed for the signalized alternative, which indicated the intersection would operate at an acceptable LOS. We also analyzed a single lane roundabout for the intersection. A roundabout produced a better LOS than a signalized intersection control.

We did not evaluate the need for exclusive turn lanes (left or right) at the intersection due to the fact that acceptable levels of service were reached with single lane approaches for the signalized control option. The addition of a left turn lane improves the LOS from an "F" to "E" in the TWSC condition, but the LOS is still unacceptable.

OPENING YEAR (2020) EVALUATION

TWSC No Build Condition

No Build	2020 AM			2020 PM		
	LOS	Delay (s/veh)	Queue Length (ft)	LOS	Delay (s/veh)	Queue Length (ft)
Eastbound	A	4.7	8	A	3.5	8
Westbound	A	2.4	3	A	2.4	3
Northbound	C	17.2	50	D	26.8	65
Southbound	B	14.1	28	C	22.3	95
Overall	C	17.2	N/A	D	26.8	N/A

TWSC Build Condition

TWSC	2020 AM			2020 PM		
	LOS	Delay (s/veh)	Queue Length (ft)	LOS	Delay (s/veh)	Queue Length (ft)
Eastbound	A	3.8	7.5	A	3.4	8
Westbound	A	3.8	3	A	2.7	5
Northbound	C	25.0	88	F	135.7	328
Southbound	C	19.6	52	D	27.7	693
Overall	C	25.0	N/A	F	135.7	N/A

AWSC Build Condition

AWSC	2020 AM			2020 PM		
	LOS	Delay (s/veh)	Queue Length (ft)	LOS	Delay (s/veh)	Queue Length (ft)
Eastbound	B	12.4	58	C	17.9	90
Westbound	B	10.2	20	B	14.5	53
Northbound	B	11.3	40	C	16.9	83
Southbound	B	10.6	28	C	16.0	78
Overall	B	11.4	N/A	C	16.5	N/A

Signalized Build Condition

Signalized	2020 AM			2020 PM		
	LOS	Delay (s/veh)	Queue Length (ft)	LOS	Delay (s/veh)	Queue Length (ft)
Eastbound	B	12.6	112	B	12.6	118
Westbound	B	11.0	39	B	11.6	75
Northbound	B	11.9	80	B	12.4	111
Southbound	B	11.5	60	B	12.5	113
Overall	B	11.9	N/A	B	12.3	N/A

Roundabout Build Condition

Roundabout	2020 AM			2020 PM		
	LOS	Delay (s/veh)	Queue Length (ft)	LOS	Delay (s/veh)	Queue Length (ft)
Eastbound	A	5.8	25	A	6.2	50
Westbound	A	5.4	25	A	6.1	25
Northbound	A	5.0	25	A	6.8	50
Southbound	A	5.0	25	A	6.8	50
Overall	A	5.4	N/A	A	6.5	N/A

Results

In the no build condition, the TWSC intersection will operate at an acceptable LOS as all approaches operate at LOS D or better. For the build condition, the TWSC will not operate at acceptable LOS due to the northbound approach operating at a LOS F during the PM peak hour. The AWSC and Signalized alternatives in the no build condition will both operate at acceptable LOS, as all approaches are expected to operate at LOS C or better. The roundabout option produces the highest LOS for all approaches.

DESIGN YEAR (2040) EVALUATION

TWSC No Build

No Build	2040 AM			2040 PM		
	LOS	Delay (s/veh)	Queue Length (ft)	LOS	Delay (s/veh)	Queue Length (ft)
Eastbound	A	4.8	10	A	3.8	10
Westbound	A	2.6	3	A	2.6	5
Northbound	D	34.7	138	F	209.6	303
Southbound	C	21.3	60	F	103.8	348
Overall	D	34.7	N/A	F	209.6	N/A

TWSC Build Condition

TWSC	2040 AM			2040 PM		
	LOS	Delay (s/veh)	Queue Length (ft)	LOS	Delay (s/veh)	Queue Length (ft)
Eastbound	A	4.2	10	A	3.7	10
Westbound	A	3.7	5	A	2.9	5
Northbound	F	93.6	270	F	1024.4	858
Southbound	E	40.7	133	F	195.7	490
Overall	F	93.6	N/A	F	1024.4	N/A

AWSC Build Condition

AWSC	2040 AM			2040 PM		
	LOS	Delay (s/veh)	Queue Length (ft)	LOS	Delay (s/veh)	Queue Length (ft)
Eastbound	C	18.5	110	F	77.3	320
Westbound	B	12.3	30	D	34.8	150
Northbound	C	15.3	73	E	48.5	220
Southbound	B	13.3	48	F	57.8	265
Overall	C	15.5	N/A	F	57.6	N/A

Signalized Build Condition

Signalized	2040 AM			2040 PM		
	LOS	Delay (s/veh)	Queue Length (ft)	LOS	Delay (s/veh)	Queue Length (ft)
Eastbound	B	13.5	149	B	14.2	170
Westbound	B	11.2	51	B	12.2	101
Northbound	B	12.5	113	B	13.0	137
Southbound	B	11.9	82	B	13.6	159
Overall	B	12.5	N/A	B	13.4	N/A

Roundabout Build Condition

Roundabout	2040 AM			2040 PM		
	LOS	Delay (s/veh)	Queue Length (ft)	LOS	Delay (s/veh)	Queue Length (ft)
Eastbound	A	7.3	50	A	8.0	50
Westbound	A	5.6	25	A	7.8	50
Northbound	A	7.5	50	A	8.6	50
Southbound	A	5.6	25	A	9.2	50
Overall	A	6.8	N/A	A	8.4	N/A

Results

In the no build condition, the TWSC intersection will not operate at an acceptable LOS as both the northbound and southbound legs will operate at LOS F during the PM peak hour. In the build condition, both the TWSC and AWSC do not operate at an acceptable LOS during the PM peak hour. The signalized build condition operates at an acceptable LOS with all approaches maintaining LOS B or better. The roundabout alternative offers the highest intersection level of service as well as the shortest queue lane lengths.

CONCLUSION AND RECOMMENDATIONS

Lynn Boulevard currently operates at an unacceptable LOS during the PM peak hour. As traffic grows, service will further degrade, causing congestion on Lynn Boulevard and may pose potential safety risks. The additional traffic from the proposed development will further contribute to these issues. The intersection satisfies the requirements of a peak hour signal warrant for the existing condition as well as the opening day build condition. The software

analysis showed that the signalized and roundabout alternatives provide the best balance in LOS for all four approaches. The signalized and roundabout alternatives maintain a LOS B or better on all approaches while the TWSC and AWSC alternatives reach LOS F on the minor street during the PM peak hour in 2040 design year. It is therefore recommended to consider installation of a traffic signal or single-lane roundabout at this intersection. The study did not evaluate the existing crash data for this intersection. A roundabout will provide a safer intersection operation as compared to a signalized intersection. A roundabout will also provide a better LOS during off-peak hours by eliminating the wait time for signal phase changes.

As a next step, an Intersection Control Evaluation (ICE) is recommended to provide a detailed evaluation of the signalized and roundabout improvement costs and alternative designs to improve safety and mobility.

APPENDICES/EXHIBITS

Appendix A – Traffic Counts

Appendix B – Trip Generation

Appendix C – Trip Calculations

Appendix D – Signal Warrant Existing Conditions

Appendix E – Signal Warrant Opening Day

Appendix F – HCS Analysis/Sidra Analysis

Appendix A – Traffic Counts

Memorandum

Leg Direction Start Time	Lynn Blvd Southbound				LeFevre Rd Westbound				Lynn Blvd Northbound				LeFevre Rd Eastbound				App Total	Int Total			
	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn					
	App Total				App Total				App Total				App Total								
2017-03-09 06:30:00	7	11	0	0	18	1	6	4	0	11	5	10	5	0	20	2	9	18	0	29	78
2017-03-09 06:45:00	9	14	0	0	23	0	9	5	0	14	9	12	8	0	29	3	15	26	0	44	110
2017-03-09 07:00:00	16	13	0	0	29	1	10	4	0	15	7	10	3	0	20	4	14	29	0	47	111
2017-03-09 07:15:00	14	9	0	0	23	2	11	6	0	19	18	27	5	0	50	3	23	24	0	50	142
2017-03-09 07:30:00	13	9	1	0	23	0	9	6	0	15	21	24	7	0	52	2	18	39	0	59	149
2017-03-09 07:45:00	15	16	8	0	39	3	19	7	0	29	19	19	7	0	45	1	23	37	0	61	174
2017-03-09 08:00:00	18	16	2	0	36	2	9	5	0	16	11	17	5	0	33	2	10	17	0	29	114
2017-03-09 08:15:00	7	13	2	0	22	3	12	1	0	16	8	16	2	0	26	3	11	14	0	28	92
2017-03-09 08:30:00	9	8	2	0	19	2	7	3	0	12	6	13	4	0	23	1	14	11	0	26	80
2017-03-09 08:45:00	8	11	3	0	22	2	8	2	0	12	8	14	2	0	24	4	13	10	0	27	85
2017-03-09 09:00:00	8	8	3	0	19	5	5	5	0	15	9	10	1	0	20	1	10	11	0	22	76
2017-03-09 09:15:00	13	12	0	0	25	1	7	9	0	17	5	10	1	0	16	5	11	13	0	29	87
2017-03-09 09:30:00	15	2	1	0	18	2	10	5	0	17	6	9	2	0	17	2	15	19	0	36	88
2017-03-09 09:45:00	13	10	2	0	25	1	5	6	0	12	7	10	1	0	18	3	14	14	0	31	86
2017-03-09 10:00:00	11	10	3	0	24	0	8	4	0	12	3	18	2	0	23	2	17	15	0	34	93
2017-03-09 10:15:00	10	12	3	0	25	2	6	2	0	10	3	17	3	0	23	3	10	15	0	28	86
2017-03-09 10:30:00	13	15	1	0	29	2	9	7	0	18	5	9	4	0	18	0	13	16	0	29	94
2017-03-09 10:45:00	14	11	1	0	26	0	12	2	0	14	3	14	5	0	22	4	14	18	0	36	98
2017-03-09 11:00:00	10	19	0	0	29	4	9	10	0	23	5	12	4	0	21	8	10	10	0	28	101
2017-03-09 11:15:00	14	16	3	0	33	2	6	5	0	13	6	18	3	0	27	1	7	10	0	18	91
2017-03-09 11:30:00	12	10	1	0	23	1	15	10	0	26	8	19	5	0	32	7	13	16	0	36	117
2017-03-09 11:45:00	22	20	1	0	43	1	12	8	0	21	8	17	1	0	26	6	8	15	0	29	119
2017-03-09 12:00:00	22	19	1	0	42	2	22	10	0	34	7	21	5	0	33	7	16	15	0	38	147
2017-03-09 12:15:00	23	16	1	0	40	3	7	8	0	18	3	15	4	0	22	4	13	15	0	32	112
2017-03-09 12:30:00	22	22	1	0	45	1	13	5	0	19	10	11	3	0	24	2	7	14	0	23	111
2017-03-09 12:45:00	25	16	0	0	41	1	15	7	0	23	10	13	7	0	30	0	18	17	0	35	129
2017-03-09 13:00:00	26	11	2	0	39	1	16	3	0	20	6	17	2	0	25	3	12	22	0	37	121
2017-03-09 13:15:00	20	15	1	0	36	1	15	6	0	22	6	22	5	0	33	3	11	18	0	32	123
2017-03-09 13:30:00	17	17	1	0	35	1	15	9	0	25	1	15	3	0	19	2	19	18	0	39	118
2017-03-09 13:45:00	19	11	2	0	32	2	14	11	0	27	4	22	5	0	31	2	12	14	0	28	118
2017-03-09 14:00:00	18	17	0	0	35	2	12	7	0	21	5	23	7	0	35	5	14	11	0	30	121
2017-03-09 14:15:00	27	23	2	0	52	1	23	7	0	31	8	8	6	0	22	3	26	13	0	42	147
2017-03-09 14:30:00	22	17	2	0	41	4	14	7	0	25	6	18	4	0	28	20	45	31	0	96	190
2017-03-09 14:45:00	18	11	0	0	29	2	16	4	0	22	11	19	4	0	34	9	19	21	0	49	134
2017-03-09 15:00:00	38	20	3	0	61	1	28	16	0	45	8	21	9	0	38	8	22	21	0	51	195
2017-03-09 15:15:00	43	22	0	0	65	1	27	8	0	36	6	15	1	0	22	8	15	14	0	37	160
2017-03-09 15:30:00	34	39	2	0	75	4	25	10	0	39	10	26	6	0	42	6	26	17	0	49	205
2017-03-09 15:45:00	38	20	3	0	61	1	29	16	0	46	11	14	4	0	29	6	20	23	0	49	185
2017-03-09 16:00:00	39	20	0	0	59	9	25	14	0	48	13	15	5	0	33	14	33	22	0	69	209
2017-03-09 16:15:00	41	19	1	0	61	0	38	11	0	49	4	18	6	0	28	8	47	42	0	97	235
2017-03-09 16:30:00	44	18	0	0	62	0	22	15	0	37	3	15	9	0	27	8	26	26	0	60	186
2017-03-09 16:45:00	26	18	0	0	44	0	38	4	0	42	8	20	7	1	36	2	15	11	0	28	150
2017-03-09 17:00:00	42	27	2	0	71	1	33	13	0	47	5	21	8	0	34	8	41	48	0	97	249
2017-03-09 17:15:00	33	15	0	0	48	1	36	8	0	45	8	14	10	0	32	3	22	18	0	43	168
2017-03-09 17:30:00	30	14	0	0	44	0	29	4	0	33	4	14	3	0	21	5	17	17	0	39	137
2017-03-09 17:45:00	35	12	0	0	47	0	31	6	0	37	8	17	12	0	37	5	36	33	0	74	195
2017-03-09 18:00:00	13	22	0	0	35	3	31	5	0	39	4	8	4	0	16	10	29	17	0	56	146
2017-03-09 18:15:00	18	13	0	0	31	0	9	7	0	16	4	14	2	0	20	4	24	20	0	48	115
Grand Total	1004	739	61	0	1804	79	787	337	0	1203	353	761	221	1	1336	222	877	935	0	2034	6377
% Approach	55.7%	41.0%	3.4%	0.0%	6.6%	65.4%	28.0%	0.0%	0.0%	26.4%	57.0%	16.5%	0.1%		10.9%	43.1%	46.0%	0.0%			
% Total	15.7%	11.6%	1.0%	0.0%	28.3%	1.2%	12.3%	5.3%	0.0%	18.9%	5.5%	11.9%	3.5%	0.0%	21.0%	3.5%	13.8%	14.7%	0.0%	31.9%	
Lights	971	651	50	0	1672	66	772	326	0	1164	331	690	202	1	1224	210	867	906	0	1983	6043
% Lights	96.7%	88.1%	82.0%	0.0%	92.7%	83.5%	98.1%	96.7%	0.0%	96.8%	93.8%	90.7%	91.4%	100.0%	91.6%	94.6%	98.9%	96.9%	0.0%	97.5%	94.8%
Articulated Trucks	9	49	1	0	59	0	3	3	0	6	3	33	10	0	46	6	2	10	0	18	129
% Articulated Trucks	0.9%	6.6%	1.6%	0.0%	3.3%	0.0%	0.4%	0.9%	0.0%	0.5%	0.8%	4.3%	4.5%	0.0%	3.4%	2.7%	0.2%	1.1%	0.0%	0.9%	2.0%
Buses and Single-Unit Trucks	24	39	10	0	73	13	12	8	0	33	19	38	9	0	66	6	8	19	0	33	205
% Buses and Single-Unit Trucks	2.4%	5.3%	16.4%	0.0%	4.0%	16.5%	1.5%	2.4%	0.0%	2.7%	5.4%	5.0%	4.1%	0.0%	4.9%	2.7%	0.9%	2.0%	0.0%	1.6%	3.2%

Appendix B – Trip Generation

Memorandum

Single Tenant Office Building (715)

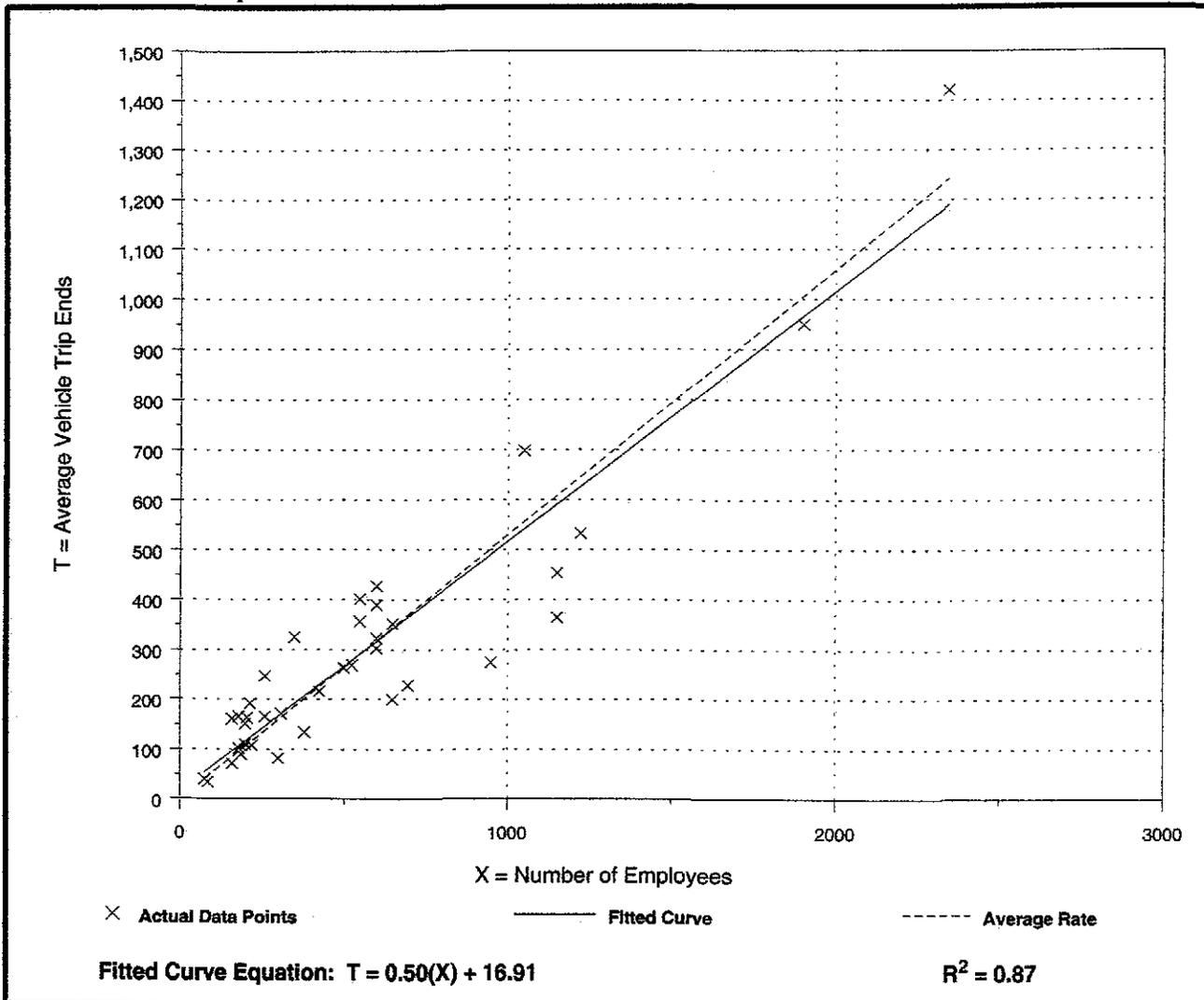
Average Vehicle Trip Ends vs: Employees
On a: Weekday,
A.M. Peak Hour

Number of Studies: 38
 Avg. Number of Employees: 556
 Directional Distribution: 89% entering, 11% exiting

Trip Generation per Employee

Average Rate	Range of Rates	Standard Deviation
0.53	0.27 - 1.01	0.75

Data Plot and Equation



Single Tenant Office Building (715)

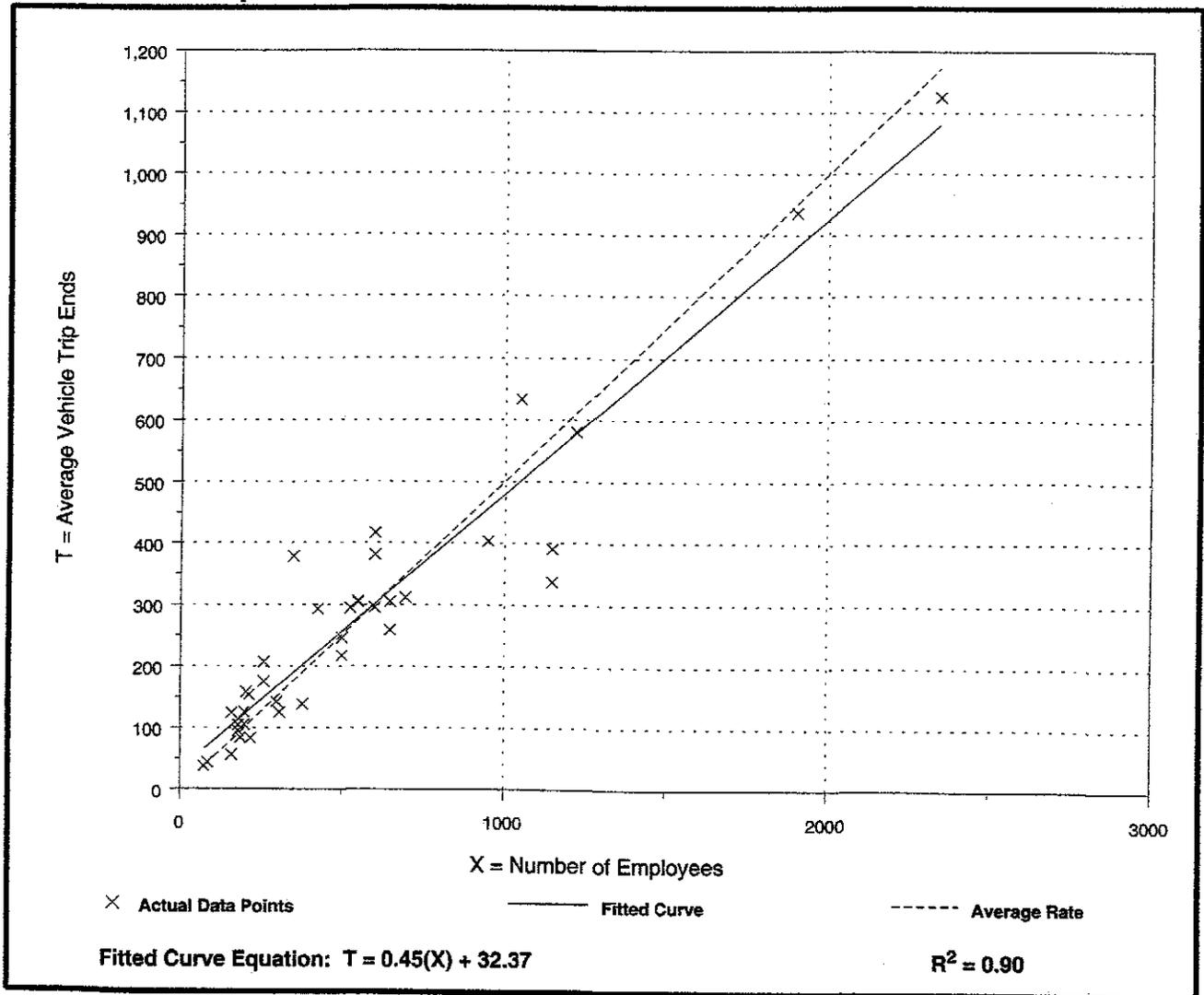
Average Vehicle Trip Ends vs: Employees
On a: Weekday,
P.M. Peak Hour

Number of Studies: 38
 Avg. Number of Employees: 556
 Directional Distribution: 15% entering, 85% exiting

Trip Generation per Employee

Average Rate	Range of Rates	Standard Deviation
0.50	0.29 - 1.08	0.72

Data Plot and Equation



Warehousing (150)

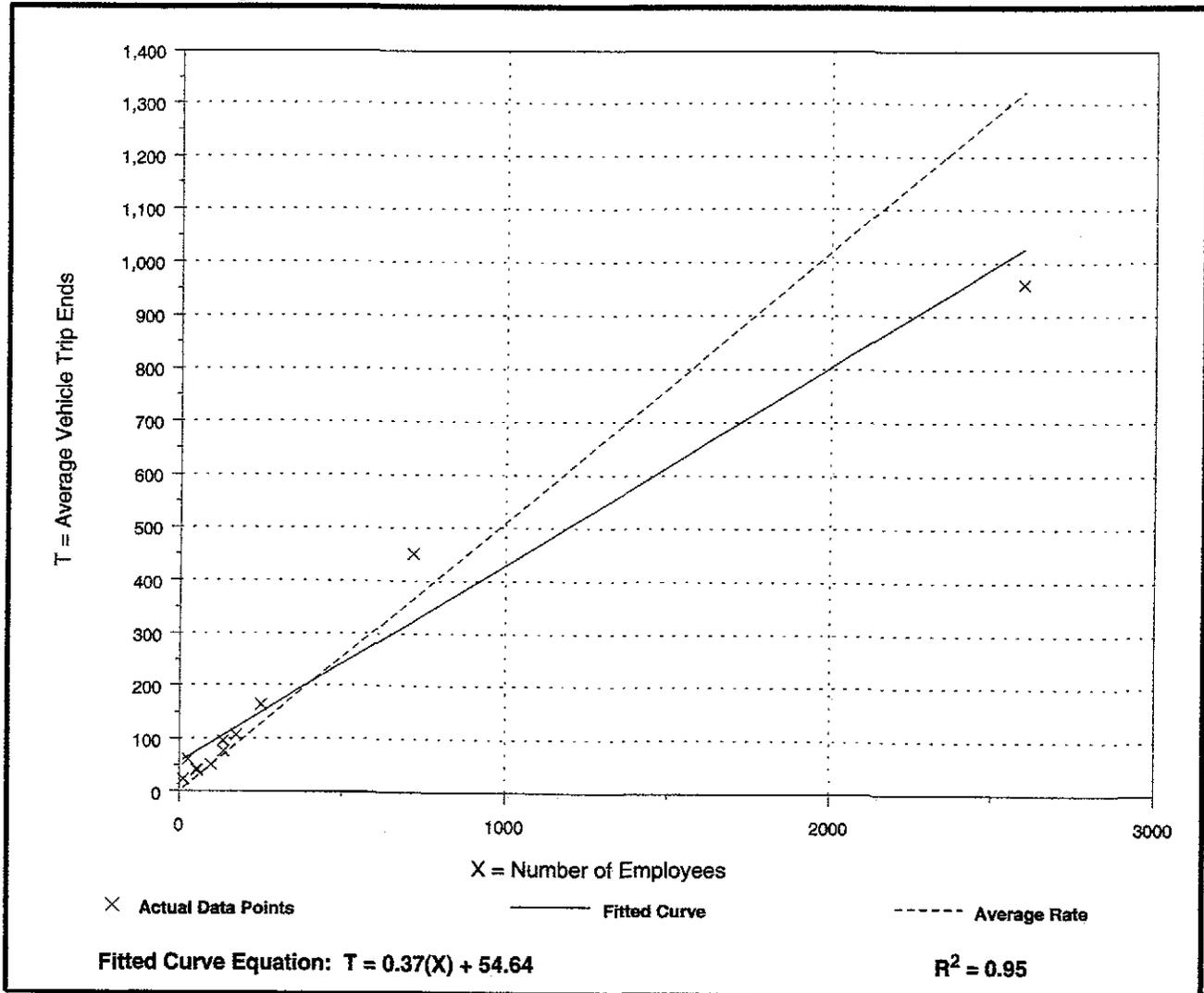
Average Vehicle Trip Ends vs: Employees
On a: Weekday,
Peak Hour of Adjacent Street Traffic,
One Hour Between 7 and 9 a.m.

Number of Studies: 12
 Avg. Number of Employees: 414
 Directional Distribution: 72% entering, 28% exiting

Trip Generation per Employee

Average Rate	Range of Rates	Standard Deviation
0.51	0.37 - 2.14	0.74

Data Plot and Equation



Warehousing (150)

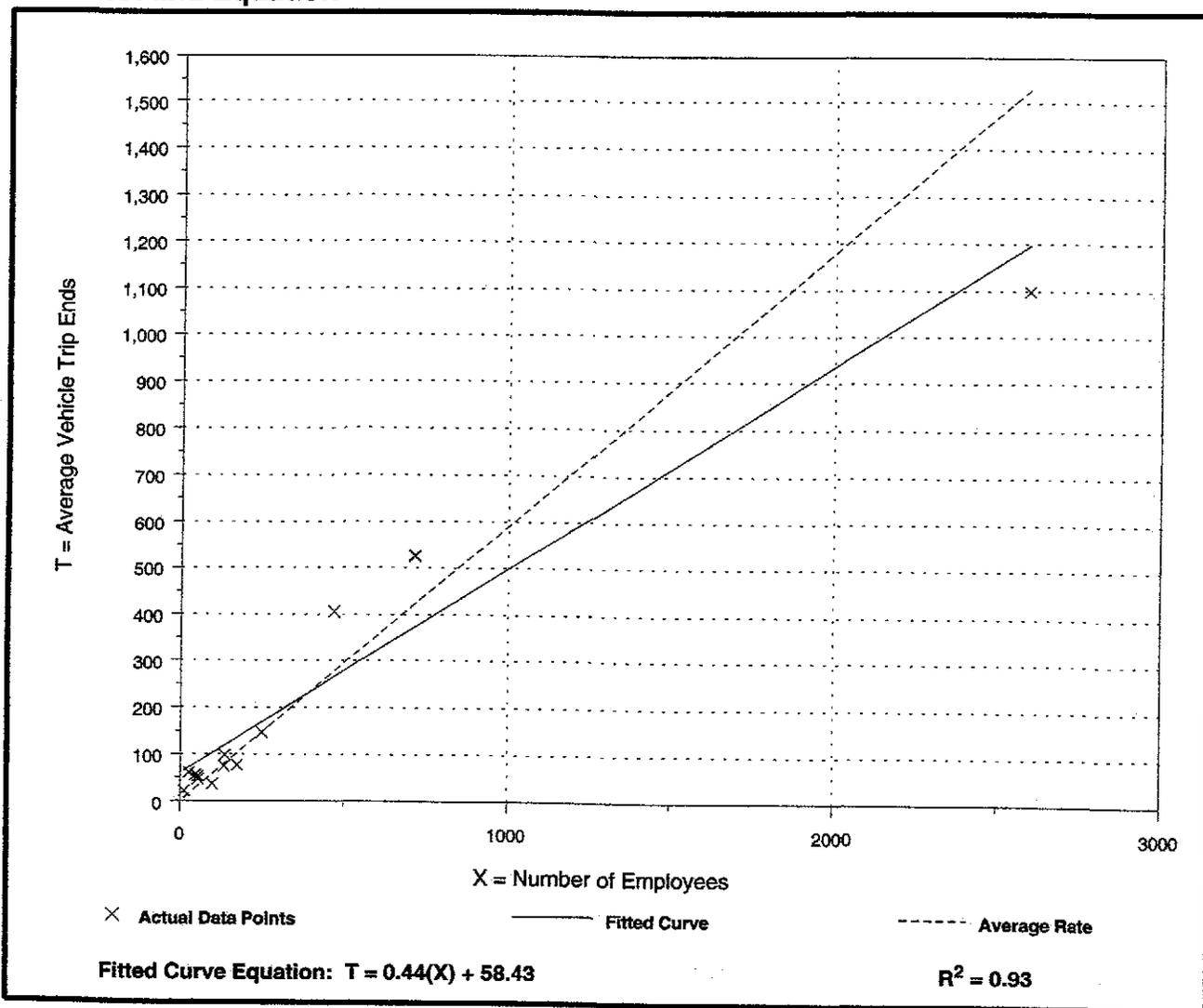
Average Vehicle Trip Ends vs: Employees
On a: Weekday,
Peak Hour of Adjacent Street Traffic,
One Hour Between 4 and 6 p.m.

Number of Studies: 14
 Avg. Number of Employees: 392
 Directional Distribution: 35% entering, 65% exiting

Trip Generation per Employee

Average Rate	Range of Rates	Standard Deviation
0.59	0.37 - 2.22	0.80

Data Plot and Equation



Appendix C – Trip Calculations

Memorandum

	Leg Direction	Lynn Blvd Southbound				LeFevre Rd Westbound				Lynn Blvd Northbound				LeFevre Rd Eastbound				Int Total							
		YEAR	PEAK HOUR	Right	Thru	Left	App Total	Right	Thru	Left	App Total	Right	Thru	Left	App Total	Right	Thru		Left	App Total					
TRIP GEN	AM			36		36			27		27			5		6		11		22			64		149
	PM			11		11			9		9			40		48		48		136			11		167
EXISTING	2017	AM		60	50	11	121		7	48	24	79		69	87	24	180		8	74	117	199		579	
	2017	PM		152	98	6	256		14	117	51	182		38	73	21	132		34	126	104	264		834	
BACKGROUND	2020	AM		64	54	14	132		10	52	28	90		73	93	28	194		12	80	124	216		632	
	2020	PM		160	103	9	272		17	125	55	197		42	78	25	145		38	134	110	282		896	
BACKGROUND	2040	AM		85	72	19	176		14	68	39	121		96	122	38	256		17	106	163	286		839	
	2040	PM		209	136	13	358		23	165	74	262		57	103	35	195		52	176	145	373		1188	
OPENING YEAR	2020	AM		64	90	14	168		10	52	55	117		78	99	39	216		76	80	124	280		781	
	2020	PM		160	114	9	283		17	125	64	206		82	126	73	281		49	134	110	293		1063	
DESIGN YEAR	2040	AM		85	108	19	212		14	68	66	148		101	128	49	278		81	106	163	350		988	
	2040	PM		209	147	13	369		23	165	83	271		97	151	83	331		63	176	145	384		1355	

Appendix D – Signal Warrant Existing Conditions

Memorandum

Traffic Signal Warrant Summary Worksheet

70%

The Worksheet(s) attached are provided as an attachment to the Engineering Investigation Study for:

Intersection: W Le Fevre Rd and S Lynn Blvd

County: Whiteside County

City: Sterling, IL

Major Street: W Le Fevre Road

Minor Street: S Lynn Boulevard

Critical Approach Speed: 45 mph

Critical Approach Speed: 45 mph

Lanes: 1 lane

Lanes: 1 lane

% Right Turns Included

From North (SB) 0%

From East (WB) 0%

From South (NB) 0%

From West (EB) 0%

In built-up area of isolated community of < 10,000 population? No

Total number of approaches at intersection? 4 or more

If it is a "T" intersection, inflate minor threshold to 150%? No

Manually set volume level?

Analysis based on **EXISTING** volume data.

Date	Day of the Week	Time (HH:MM)			
		From	AM / PM	To	AM / PM
3/9/2017	Thursday	6:30	AM	6:30	PM

Warrant Evaluation Summary	Warrant Met:
Warrant 1: Eight - Hour Vehicular Volume	No
Condition A: Minimum Vehicular Volume	No
Condition B: Interruption of Continuous Traffic	No
Condition C: Combination: 80% of A and B	No
Warrant 2: Four-Hour Volume	No
Warrant 3: Peak Hour Volume	Yes
Warrant 4: Pedestrian Volume	N/A
Criterion A: Four-Hour	
Criterion B: Peak-Hour	
Warrant 5: School Crossing	N/A
Warrant 6: Coordinated Signal System	N/A
Warrant 7: Crash Experience	N/A
Warrant 8: Roadway Network	N/A
Warrant 9: Intersection Near a Grade Crossing	N/A

Warrant Analysis Conducted By:

Name: Chris Ball

Agency: Mead & Hunt

Date: 3/29/2017

Warrant 1: Eight - Hour Vehicular Volume

70%

Warrant Evaluated? Yes

Warrant Satisfied? No

Manually Set To: No

Condition A : Min. Veh. Volume		
Volume Level	70%	56%
Major Rd. Req	350	280
Minor Rd. Req	105	84
Number of Hours	1	3

Satisfied? No

Condition B: Interruption of Continuous Traffic		
Volume Level	70%	56%
Major Rd. Req	525	420
Minor Rd. Req	53	42
Number of Hours	0	0

Satisfied? No

Condition C: Combination of A & B at 56%		
---	--	--

Satisfied? No

Time Period	From	To	Enter Start Time (Military Time) (HH:MM)		Major Road: Both App. (VPH)	Minor Road: High App. (VPH)	Total
			6:00 AM				
1	6:00	7:00			213	80	293
2	7:00	8:00			237	97	334
3	8:00	9:00			139	55	194
4	9:00	10:00			165	62	227
5	10:00	11:00			158	69	227
6	11:00	12:00			203	87	290
7	12:00	13:00			199	80	279
8	13:00	14:00			225	89	314
9	14:00	15:00			308	91	399
10	15:00	16:00			398	104	502
11	16:00	17:00			376	105	481
12	17:00	18:00			315	74	389
13	18:00	19:00			0	0	0
14	19:00	20:00			0	0	0
15	20:00	21:00			0	0	0
16	21:00	22:00			0	0	0

Warrant 2: Four-Hour Volume

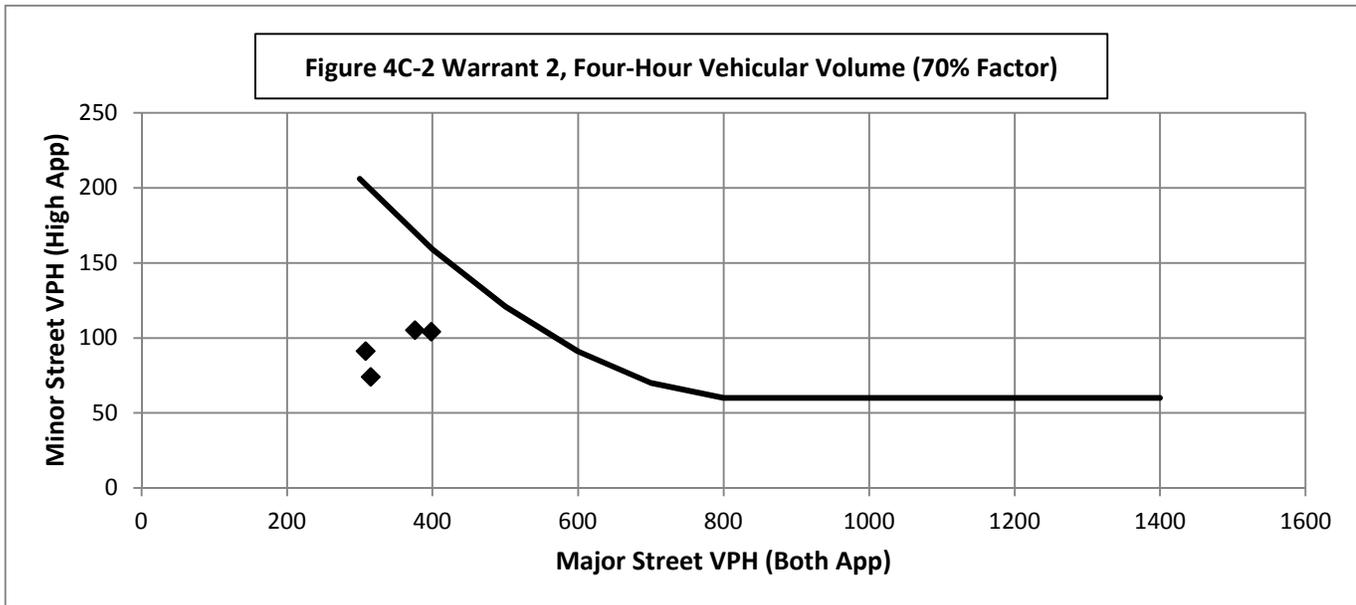
70%

Warrant Evaluated? Yes

Warrant Satisfied? No

Manually Set To:

Hour Start	15:00	16:00	14:00	17:00
Major Road Vol.	398	376	308	315
Minor Road Vol.	104	105	91	74



Warrant 3: Peak Hour Volume

70%

Warrant Evaluated? Yes

Warrant Satisfied? Yes

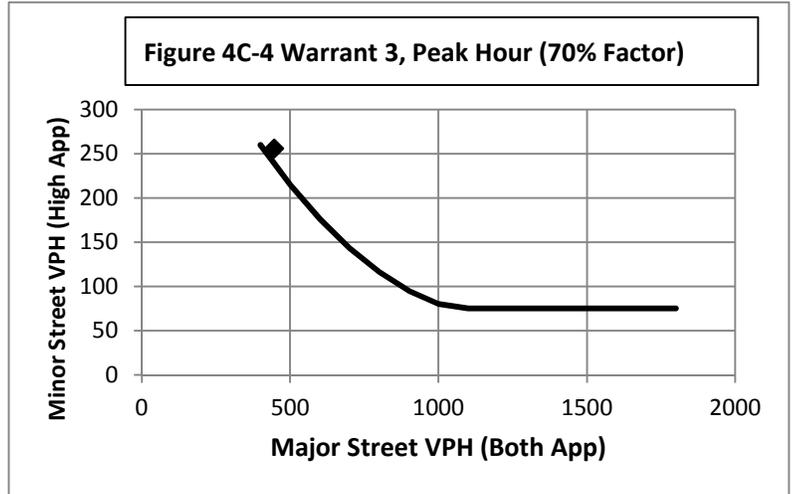
Manually Set To:

Condition justifying use of warrant:

Criteria		Met?
Delay on Minor Approach	4	No
Volume on Minor Approach	100	
Total Entering Volume (veh/h)	800	

Manually Set Peak Hour? Yes

Peak Hour	Major Road Vol. (Both App.)	Minor Road Vol. (High App.)
15:30	446	256
15:30	446	256



Warrant 4: Pedestrian Volume

70%

Warrant Evaluated?

Warrant Satisfied? N/A

Manually Set To:

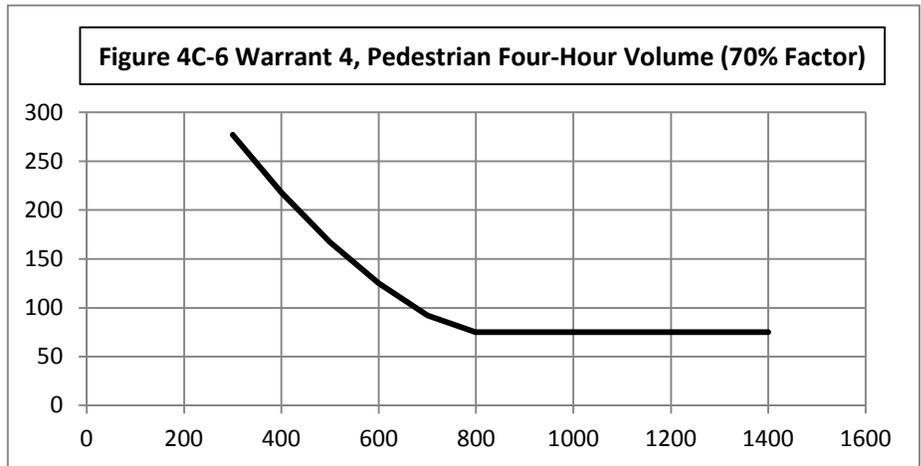
Criterion A: Four Hour

Hour (Start)	Pedestrian Volume	Major Road Vol.
		0
		0
		0
		0

Manually Set Major Rd Vol?

Avg. walk speed less than 3.5 ft/s?

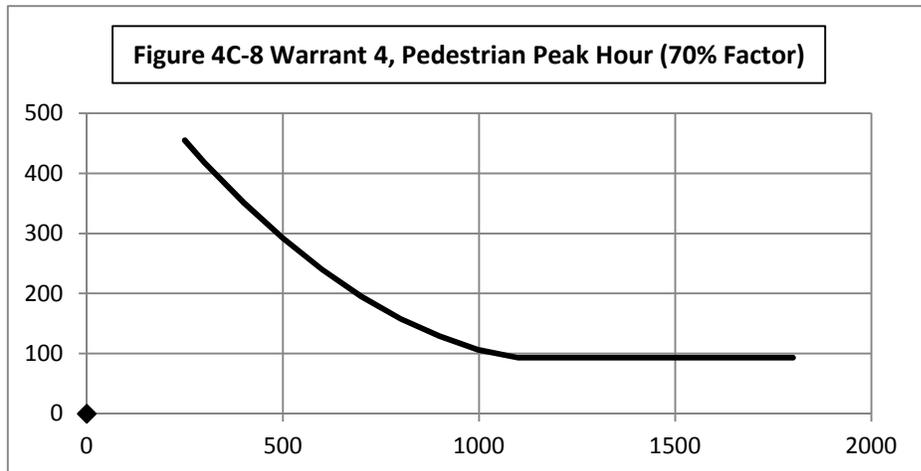
Criterion A Satisfied?



Criterion B: Peak Hour

Peak Hour	Pedestrian Vol.	Major Road Vol.
0:00	0	0

Criterion B Satisfied?



Warrant 5: School Crossing

70%

Warrant Evaluated?

Warrant Satisfied? N/A

Manually Set To:

Criteria		Fulfilled?
1	There are a MINIMUM of 20 school children during the highest crossing hour.	
2	There are fewer adequate gaps in the major road traffic stream during the period when the school children are using the crossing than the number of minutes in the same period.	
3	The nearest traffic signal along the major road is located more than 300 ft away. Or, the nearest traffic signal is within 300 ft but the proposed traffic signal will not restrict the progressive movement of traffic.	

Warrant 6: Coordinated Signal System

70%

Warrant Evaluated?

Warrant Satisfied? N/A

Manually Set To:

Criteria		Fulfilled?
1	Signal spacing > 1000 ft	
2	On a one-way road or a road that has traffic predominantly in one direction, the adjacent signals are so far apart that they do not provide the necessary degree of vehicle platooning.	
3	On a two-way road, adjacent signals do not provide the necessary degree of platooning and the proposed and the adjacent signals will collectively provide a progressive operation.	

Warrant 7: Crash Experience

70%

Warrant Evaluated?

Warrant Satisfied? N/A

Manually Set To:

Criteria		Met?	Fulfilled?
1	Adequate trial of other remedial measures has failed to reduce crash frequency. Measures Tried:		
2	Five or more reported crashes, of types susceptible to correction by signal, have occurred within a 12 month period.	# of crashes per 12 months	
3	Warrant 1, Condition A (80%)	No	No
	Warrant 1, Condition B (80%)	No	
	Warrant 4, Criterion A (80%)	No	
	Warrant 4, Criterion B (80%)	No	

Warrant 8: Roadway Network

70%

Warrant Evaluated?

Warrant Satisfied? N/A

Manually Set To:

Criteria		Met?	Fulfilled?
1	Total entering volume of at least 1,000 veh/h during typical weekday peak hour	702	No
	Five-year projected volumes that satisfy one or more of Warrants 1, 2, or 3.		No
2	Total entering vol. of at least 1,000 veh/h for each of any 5 hrs of non-normal business day (Sat. or Sun.)		
	Hour		
	Volume		

Characteristics of Major Routes - Select yes if all intersecting routes have characteristic		Fulfilled?
1	Part of the road or highway system that serves as the principal roadway network for through traffic flow	
2	Rural or suburban highway outside of, entering, or traversing a city	
3	Appears as a major route on an official plan	

Warrant 9: Intersection Near a Grade Crossing

70%

Warrant Evaluated?

Warrant Satisfied? N/A

Manually Set To:

Adjustment Factors			Manually Set Peak Hour?				
Rail Traffic per Day	% High Occupancy Buses on Minor Road	% Tractor-Trailer Trucks on Minor Road	D	Peak Hour	Major Road Vol.	Minor Road Vol.	Adjusted Minor Vol.
1	0	0% to 2.5%	660	15:30	446	256	85.76

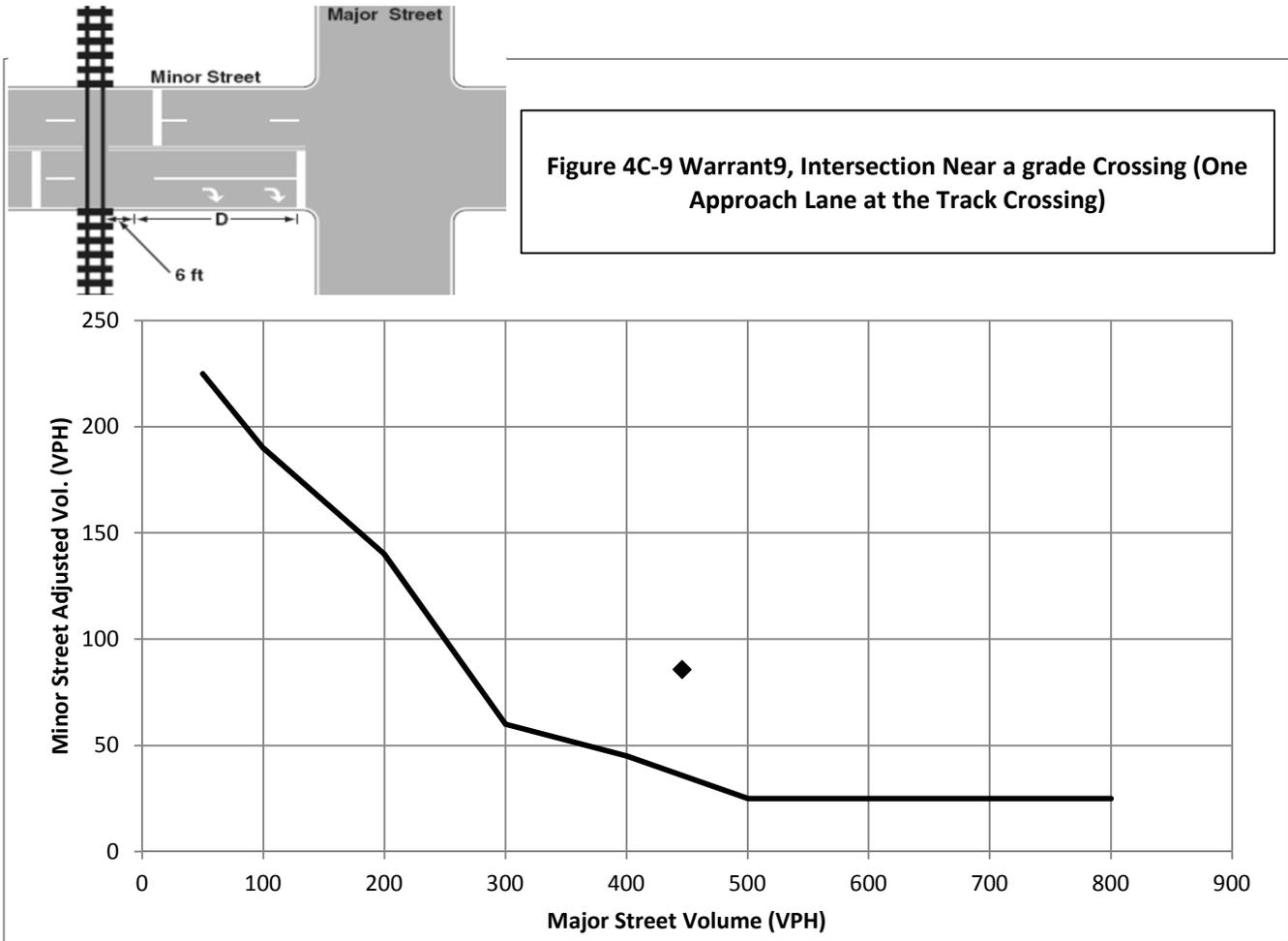


Figure 4C-9 Warrant9, Intersection Near a grade Crossing (One Approach Lane at the Track Crossing)

Conclusions/Comments:
Warrant for Existing Conditions 2017

Updated: 2/18/2016

Appendix E – Signal Warrant Opening Day

Memorandum

Traffic Signal Warrant Summary Worksheet

70%

The Worksheet(s) attached are provided as an attachment to the Engineering Investigation Study for:

Intersection: W Le Fevre Rd and S Lynn Blvd
 County: Whiteside County
 City: Sterling, IL

Major Street: W Le Fevre Rd
 Critical Approach Speed: 45 mph
 Lanes: 1 lane

Minor Street: S Lynn Blvd
 Critical Approach Speed: 45 mph
 Lanes: 1 lane

% Right Turns Included
 From North (SB) 0%
 From East (WB) 0%
 From South (NB) 0%
 From West (EB) 0%

In built-up area of isolated community of < 10,000 population? No
 Total number of approaches at intersection? 4 or more
 If it is a "T" intersection, inflate minor threshold to 150%? No
 Manually set volume level?

Analysis based on **EXISTING** volume data.

Date	Day of the Week	Time (HH:MM)			
		From	AM / PM	To	AM / PM
3/9/2017	Thursday	6:30	AM	6:30	PM

Warrant Evaluation Summary	Warrant Met:
Warrant 1: Eight - Hour Vehicular Volume	N/A
Condition A: Minimum Vehicular Volume Condition B: Interruption of Continuous Traffic Condition C: Combination: 80% of A and B	
Warrant 2: Four-Hour Volume	N/A
Warrant 3: Peak Hour Volume	Yes
Warrant 4: Pedestrian Volume	N/A
Criterion A: Four-Hour Criterion B: Peak-Hour	
Warrant 5: School Crossing	N/A
Warrant 6: Coordinated Signal System	N/A
Warrant 7: Crash Experience	N/A
Warrant 8: Roadway Network	N/A
Warrant 9: Intersection Near a Grade Crossing	N/A

Warrant Analysis Conducted By:

Name: Chris Ball
 Agency: Mead & Hunt
 Date: 3/29/2017

Warrant 1: Eight - Hour Vehicular Volume

70%

Warrant Evaluated? No

Warrant Satisfied? N/A

Manually Set To:

Condition A : Min. Veh. Volume		
Volume Level	70%	56%
Major Rd. Req	350	280
Minor Rd. Req	105	84
Number of Hours	1	2

Satisfied?

Condition B: Interruption of Continuous Traffic		
Volume Level	70%	56%
Major Rd. Req	525	420
Minor Rd. Req	53	42
Number of Hours	0	1

Satisfied?

Condition C: Combination of A & B at 56%		
---	--	--

Satisfied?

Time Period	From	To	Manually Set To:		Total
			Major Road: Both App. (VPH)	Minor Road: High App. (VPH)	
6:00 AM Enter Start Time (Military Time) (HH:MM)					
1	6:00	7:00	0	0	0
2	7:00	8:00	311	138	449
3	8:00	9:00	0	0	0
4	9:00	10:00	0	0	0
5	10:00	11:00	0	0	0
6	11:00	12:00	0	0	0
7	12:00	13:00	0	0	0
8	13:00	14:00	0	0	0
9	14:00	15:00	0	0	0
10	15:00	16:00	433	199	632
11	16:00	17:00	0	0	0
12	17:00	18:00	0	0	0
13	18:00	19:00	0	0	0
14	19:00	20:00	0	0	0
15	20:00	21:00	0	0	0
16	21:00	22:00	0	0	0

Warrant 2: Four-Hour Volume

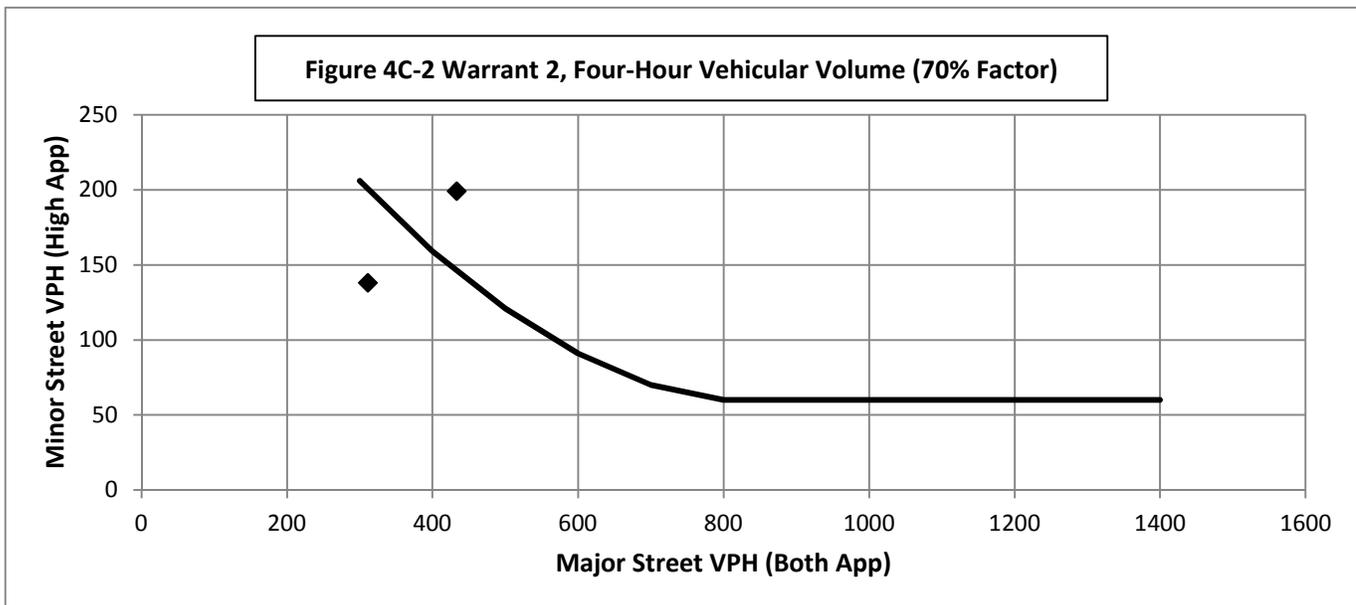
70%

Warrant Evaluated? No

Warrant Satisfied? N/A

Manually Set To:

Hour Start	15:00	7:00	#N/A	#N/A
Major Road Vol.	433	311	#N/A	#N/A
Minor Road Vol.	199	138	#N/A	#N/A



Warrant 3: Peak Hour Volume

70%

Warrant Evaluated? Yes

Warrant Satisfied? Yes

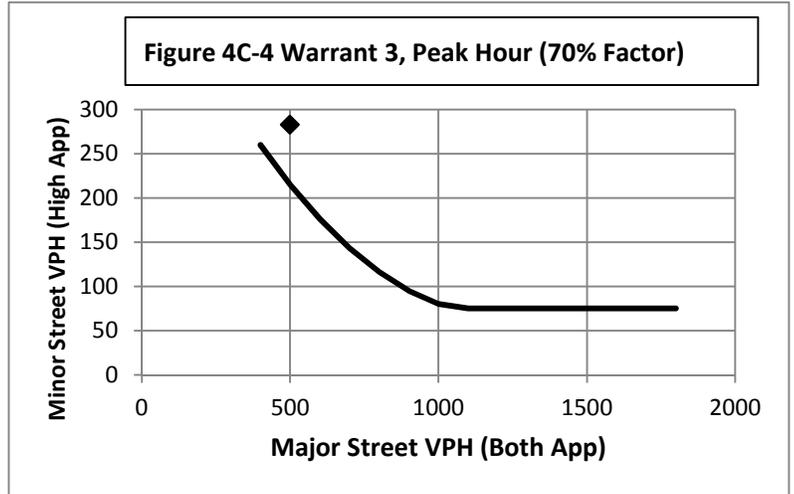
Manually Set To:

Condition justifying use of warrant:

Criteria		Met?
Delay on Minor Approach	4	No
Volume on Minor Approach	100	No
Total Entering Volume (veh/h)	800	

Manually Set Peak Hour? Yes

Peak Hour	Major Road Vol. (Both App.)	Minor Road Vol. (High App.)
7:15	499	283
7:15	499	283



Warrant 4: Pedestrian Volume

70%

Warrant Evaluated?

Warrant Satisfied? N/A

Manually Set To:

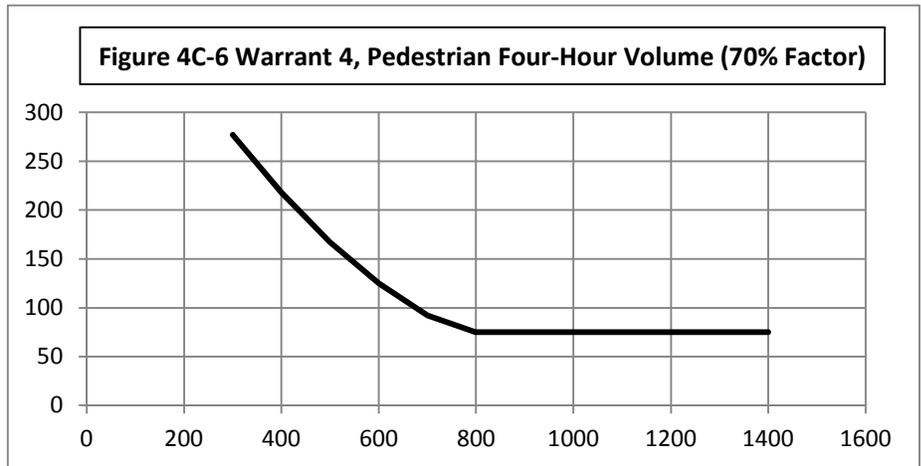
Criterion A: Four Hour

Hour (Start)	Pedestrian Volume	Major Road Vol.
		0
		0
		0
		0

Manually Set Major Rd Vol?

Avg. walk speed less than 3.5 ft/s?

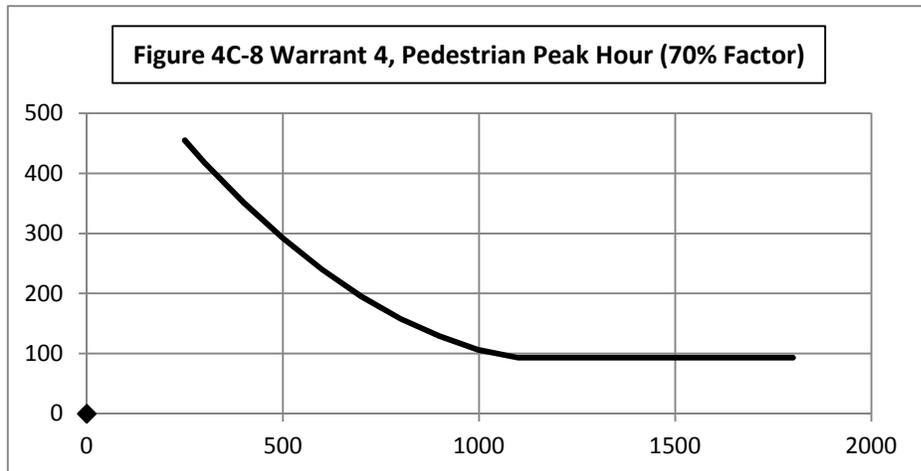
Criterion A Satisfied?



Criterion B: Peak Hour

Peak Hour	Pedestrian Vol.	Major Road Vol.
0:00	0	0

Criterion B Satisfied?



Warrant 5: School Crossing

70%

Warrant Evaluated?

Warrant Satisfied? N/A

Manually Set To:

Criteria		Fulfilled?
1	There are a MINIMUM of 20 school children during the highest crossing hour.	
2	There are fewer adequate gaps in the major road traffic stream during the period when the school children are using the crossing than the number of minutes in the same period.	
3	The nearest traffic signal along the major road is located more than 300 ft away. Or, the nearest traffic signal is within 300 ft but the proposed traffic signal will not restrict the progressive movement of traffic.	

Warrant 6: Coordinated Signal System

70%

Warrant Evaluated?

Warrant Satisfied? N/A

Manually Set To:

Criteria		Fulfilled?
1	Signal spacing > 1000 ft	
2	On a one-way road or a road that has traffic predominantly in one direction, the adjacent signals are so far apart that they do not provide the necessary degree of vehicle platooning.	
3	On a two-way road, adjacent signals do not provide the necessary degree of platooning and the proposed and the adjacent signals will collectively provide a progressive operation.	

Warrant 7: Crash Experience

70%

Warrant Evaluated?

Warrant Satisfied? N/A

Manually Set To:

Criteria		Met?	Fulfilled?
1	Adequate trial of other remedial measures has failed to reduce crash frequency. Measures Tried:		
2	Five or more reported crashes, of types susceptible to correction by signal, have occurred within a 12 month period.	# of crashes per 12 months	
3	Warrant 1, Condition A (80%)	No	No
	Warrant 1, Condition B (80%)	No	
	Warrant 4, Criterion A (80%)	No	
	Warrant 4, Criterion B (80%)	No	

Warrant 8: Roadway Network

70%

Warrant Evaluated?

Warrant Satisfied? N/A

Manually Set To:

Criteria		Met?	Fulfilled?
1	Total entering volume of at least 1,000 veh/h during typical weekday peak hour	782	No
	Five-year projected volumes that satisfy one or more of Warrants 1, 2, or 3.		No
2	Total entering vol. of at least 1,000 veh/h for each of any 5 hrs of non-normal business day (Sat. or Sun.)		
	Hour		
	Volume		

Characteristics of Major Routes - Select yes if all intersecting routes have characteristic		Fulfilled?
1	Part of the road or highway system that serves as the principal roadway network for through traffic flow	
2	Rural or suburban highway outside of, entering, or traversing a city	
3	Appears as a major route on an official plan	

Warrant 9: Intersection Near a Grade Crossing

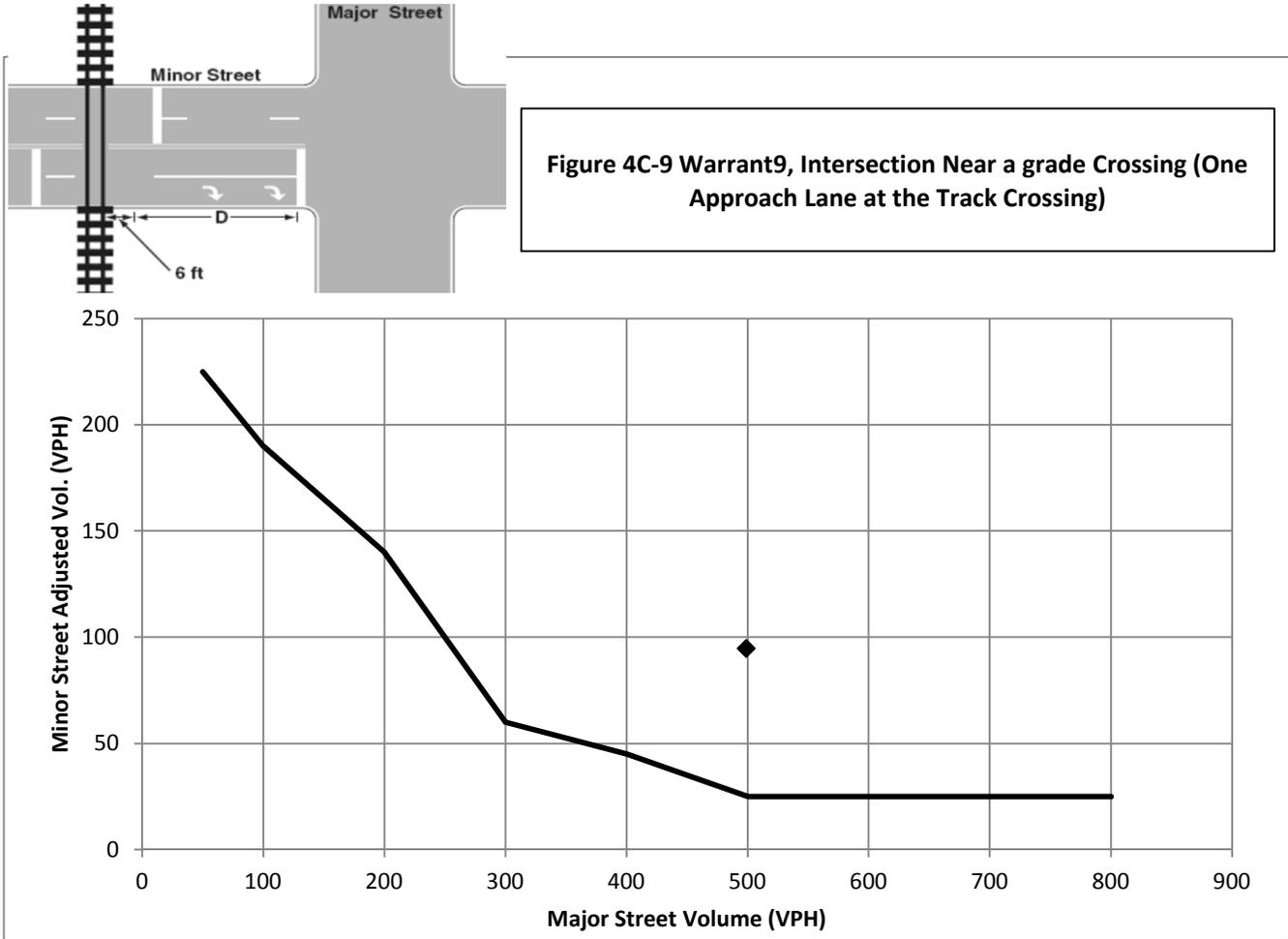
70%

Warrant Evaluated?

Warrant Satisfied? N/A

Manually Set To:

Adjustment Factors			Manually Set Peak Hour?				
Rail Traffic per Day	% High Occupancy Buses on Minor Road	% Tractor-Trailer Trucks on Minor Road	D	Peak Hour	Major Road Vol.	Minor Road Vol.	Adjusted Minor Vol.
1	0	0% to 2.5%	660	7:15	499	283	94.805



Conclusions/Comments:

Warrant for Opening Day 2020 Build Condition

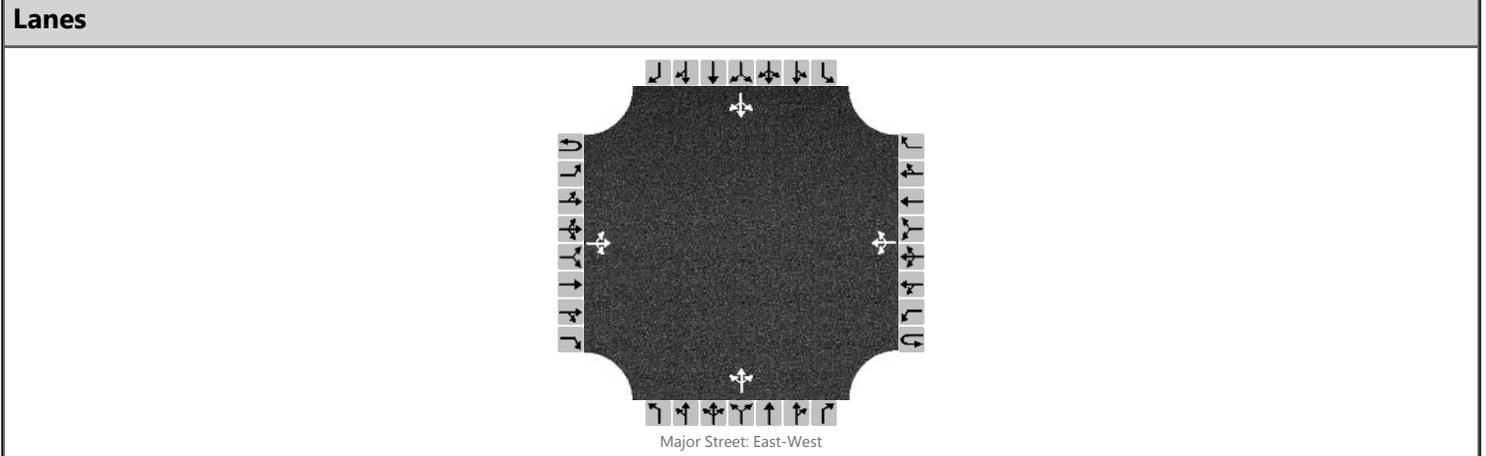
Updated: 2/18/2016

Appendix F – HCS Analysis/Sidra Analysis

Memorandum

HCS7 Two-Way Stop-Control Report

General Information				Site Information			
Analyst	Chris Ball			Intersection	Le Fevre Rd & Lynn Blvd		
Agency/Co.	Mead & Hunt			Jurisdiction	City of Sterling, IL		
Date Performed	3/17/2017			East/West Street	W Le Fevre Rd		
Analysis Year	2020			North/South Street	Lynn Blvd		
Time Analyzed	AM			Peak Hour Factor	0.92		
Intersection Orientation	East-West			Analysis Time Period (hrs)	0.25		
Project Description	No Build Condition						



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Movement	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Priority																
Number of Lanes	0	0	1	0	0	0	1	0		0	1	0		0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume, V (veh/h)		124	80	12		28	52	10		28	93	73		14	54	64
Percent Heavy Vehicles (%)		3				6				8	8	8		10	10	10
Proportion Time Blocked																
Percent Grade (%)									0				0			
Right Turn Channelized	No				No				No				No			
Median Type/Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)																
Critical Headway (sec)																
Base Follow-Up Headway (sec)																
Follow-Up Headway (sec)																

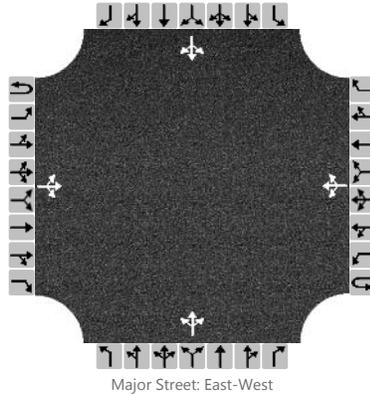
Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		135				30					210					144		
Capacity, c (veh/h)		1525				1471					504					540		
v/c Ratio		0.09				0.02					0.42					0.27		
95% Queue Length, Q ₉₅ (veh)		0.3				0.1					2.0					1.1		
Control Delay (s/veh)		7.6				7.5					17.2					14.1		
Level of Service, LOS		A				A					C					B		
Approach Delay (s/veh)		4.7				2.4					17.2				14.1			
Approach LOS											C				B			

HCS7 Two-Way Stop-Control Report

General Information				Site Information			
Analyst	Chris Ball			Intersection	Le Fevre Rd & Lynn Blvd		
Agency/Co.	Mead & Hunt			Jurisdiction	City of Sterling, IL		
Date Performed	3/17/2017			East/West Street	W Le Fevre Rd		
Analysis Year	2020			North/South Street	Lynn Blvd		
Time Analyzed	PM			Peak Hour Factor	0.92		
Intersection Orientation	East-West			Analysis Time Period (hrs)	0.25		
Project Description	No Build Condition						

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Movement	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Priority																
Number of Lanes	0	0	1	0	0	0	1	0		0	1	0		0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume, V (veh/h)		110	134	38		55	125	17		25	78	42		9	103	160
Percent Heavy Vehicles (%)		3				1				5	5	5		4	4	4
Proportion Time Blocked																
Percent Grade (%)									0				0			
Right Turn Channelized	No				No				No				No			
Median Type/Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)																
Critical Headway (sec)																
Base Follow-Up Headway (sec)																
Follow-Up Headway (sec)																

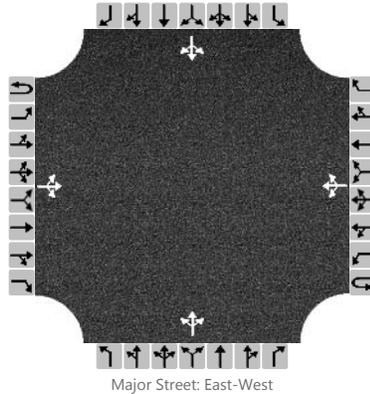
Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		120				60					158					296	
Capacity, c (veh/h)		1419				1393					320					498	
v/c Ratio		0.08				0.04					0.49					0.59	
95% Queue Length, Q ₉₅ (veh)		0.3				0.1					2.6					3.8	
Control Delay (s/veh)		7.8				7.7					26.8					22.3	
Level of Service, LOS		A				A					D					C	
Approach Delay (s/veh)		3.5				2.4				26.8				22.3			
Approach LOS										D				C			

HCS7 Two-Way Stop-Control Report

General Information				Site Information			
Analyst	Chris Ball			Intersection	Le Fevre Rd & Lynn Blvd		
Agency/Co.	Mead & Hunt			Jurisdiction	City of Sterling, IL		
Date Performed	3/29/2017			East/West Street	W Le Fevre Rd		
Analysis Year	2040			North/South Street	Lynn Blvd		
Time Analyzed	AM			Peak Hour Factor	0.92		
Intersection Orientation	East-West			Analysis Time Period (hrs)	0.25		
Project Description	No Build Condition						

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Movement	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Priority																
Number of Lanes	0	0	1	0	0	0	1	0		0	1	0		0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume, V (veh/h)		163	106	17		39	68	14		38	122	96		19	72	85
Percent Heavy Vehicles (%)		3				6				8	8	8		10	10	10
Proportion Time Blocked																
Percent Grade (%)									0				0			
Right Turn Channelized	No				No				No				No			
Median Type/Storage	Undivided															

Critical and Follow-up Headways

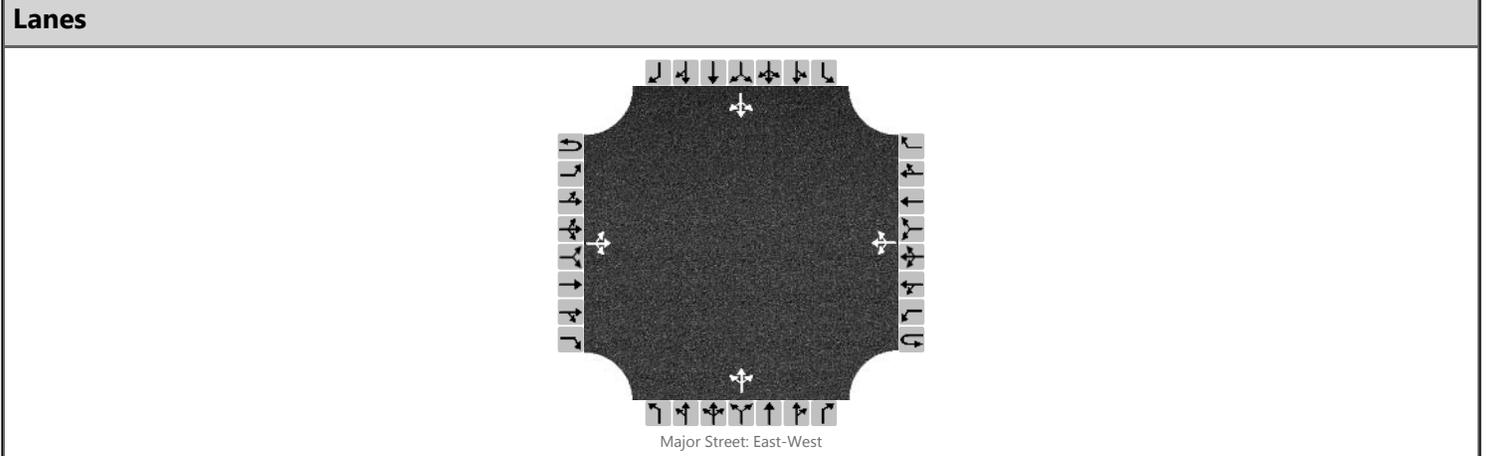
Base Critical Headway (sec)																
Critical Headway (sec)																
Base Follow-Up Headway (sec)																
Follow-Up Headway (sec)																

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		177				42					278					191
Capacity, c (veh/h)		1498				1430					387					409
v/c Ratio		0.12				0.03					0.72					0.47
95% Queue Length, Q ₉₅ (veh)		0.4				0.1					5.5					2.4
Control Delay (s/veh)		7.7				7.6					34.7					21.3
Level of Service, LOS		A				A					D					C
Approach Delay (s/veh)	4.8				2.6				34.7				21.3			
Approach LOS									D				C			

HCS7 Two-Way Stop-Control Report

General Information				Site Information			
Analyst	Chris Ball			Intersection	Le Fevre Rd & Lynn Blvd		
Agency/Co.	Mead & Hunt			Jurisdiction	City of Sterling, IL		
Date Performed	3/29/2017			East/West Street	W Le Fevre Rd		
Analysis Year	2040			North/South Street	Lynn Blvd		
Time Analyzed	PM			Peak Hour Factor	0.92		
Intersection Orientation	East-West			Analysis Time Period (hrs)	0.25		
Project Description	No Build Condition						



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Movement	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Priority																
Number of Lanes	0	0	1	0	0	0	1	0		0	1	0		0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume, V (veh/h)		145	176	52		74	165	23		35	103	57		13	136	209
Percent Heavy Vehicles (%)		3				1				5	5	5		4	4	4
Proportion Time Blocked																
Percent Grade (%)									0				0			
Right Turn Channelized	No				No				No				No			
Median Type/Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)																
Critical Headway (sec)																
Base Follow-Up Headway (sec)																
Follow-Up Headway (sec)																

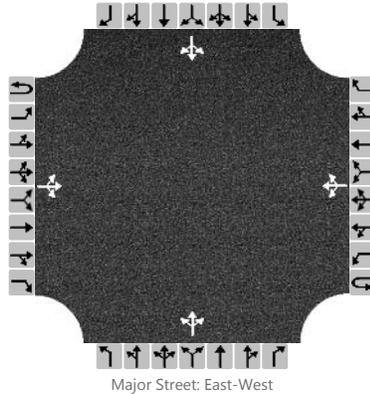
Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		158				80					212					389	
Capacity, c (veh/h)		1360				1323					168					361	
v/c Ratio		0.12				0.06					1.26					1.08	
95% Queue Length, Q ₉₅ (veh)		0.4				0.2					12.1					13.9	
Control Delay (s/veh)		8.0				7.9					209.6					103.8	
Level of Service, LOS		A				A					F					F	
Approach Delay (s/veh)		3.8				2.6				209.6				103.8			
Approach LOS										F				F			

HCS7 Two-Way Stop-Control Report

General Information				Site Information			
Analyst	Chris Ball			Intersection	Le Fevre Rd & Lynn Blvd		
Agency/Co.	Mead & Hunt			Jurisdiction	City of Sterling, IL		
Date Performed	3/17/2017			East/West Street	W Le Fevre Rd		
Analysis Year	2020			North/South Street	Lynn Blvd		
Time Analyzed	AM			Peak Hour Factor	0.92		
Intersection Orientation	East-West			Analysis Time Period (hrs)	0.25		
Project Description	Build Condition						

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Movement	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Priority																
Number of Lanes	0	0	1	0	0	0	1	0		0	1	0		0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume, V (veh/h)		124	80	76		55	52	10		39	99	78		14	90	64
Percent Heavy Vehicles (%)		3				6				8	8	8		10	10	10
Proportion Time Blocked																
Percent Grade (%)									0				0			
Right Turn Channelized	No				No				No				No			
Median Type/Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)																
Critical Headway (sec)																
Base Follow-Up Headway (sec)																
Follow-Up Headway (sec)																

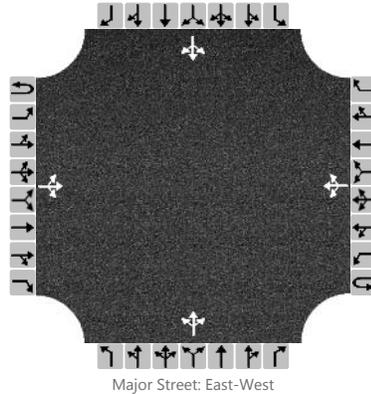
Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		135				60					235					183	
Capacity, c (veh/h)		1525				1386					409					426	
v/c Ratio		0.09				0.04					0.57					0.43	
95% Queue Length, Q ₉₅ (veh)		0.3				0.1					3.5					2.1	
Control Delay (s/veh)		7.6				7.7					25.0					19.6	
Level of Service, LOS		A				A					C					C	
Approach Delay (s/veh)		3.8				3.8				25.0				19.6			
Approach LOS		A				A				C				C			

HCS7 Two-Way Stop-Control Report

General Information				Site Information			
Analyst	Chris Ball			Intersection	Le Fevre Rd & Lynn Blvd		
Agency/Co.	Mead & Hunt			Jurisdiction	City of Sterling, IL		
Date Performed	3/17/2017			East/West Street	W Le Fevre Rd		
Analysis Year	2020			North/South Street	Lynn Blvd		
Time Analyzed	PM			Peak Hour Factor	0.92		
Intersection Orientation	East-West			Analysis Time Period (hrs)	0.25		
Project Description	Build Condition						

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Movement	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Priority																
Number of Lanes	0	0	1	0	0	0	1	0		0	1	0		0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume, V (veh/h)		110	134	49		64	125	17		73	126	82		9	114	160
Percent Heavy Vehicles (%)		3				1				5	5	5		4	4	4
Proportion Time Blocked																
Percent Grade (%)									0				0			
Right Turn Channelized	No				No				No				No			
Median Type/Storage	Undivided															

Critical and Follow-up Headways

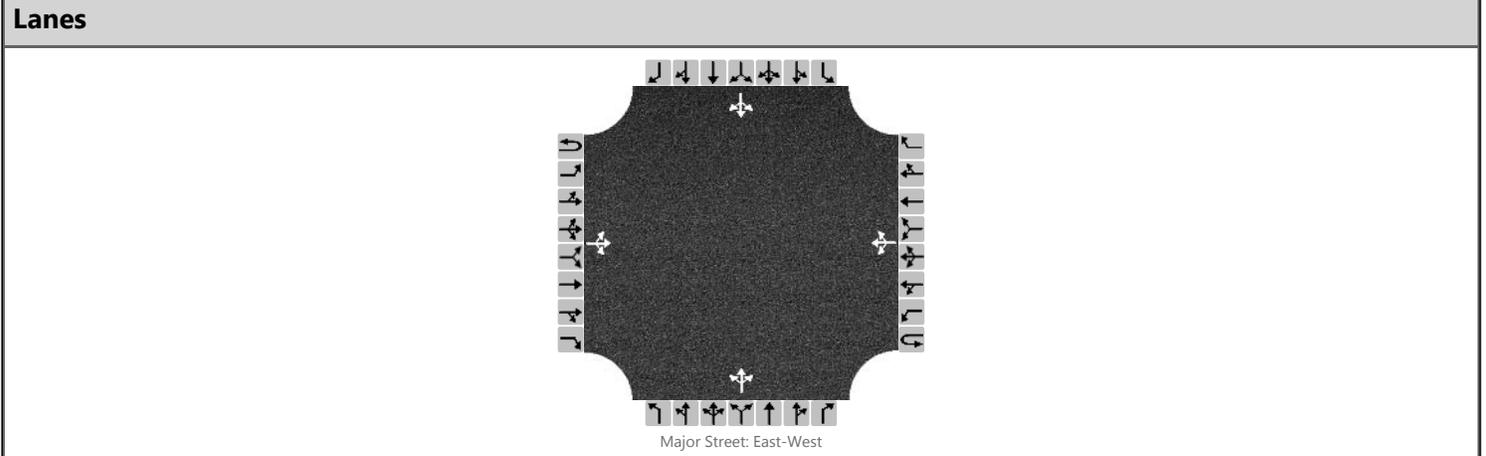
Base Critical Headway (sec)																
Critical Headway (sec)																
Base Follow-Up Headway (sec)																
Follow-Up Headway (sec)																

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		120				70					305					308	
Capacity, c (veh/h)		1419				1379					269					457	
v/c Ratio		0.08				0.05					1.13					0.67	
95% Queue Length, Q ₉₅ (veh)		0.3				0.2					13.1					4.9	
Control Delay (s/veh)		7.8				7.8					135.7					27.7	
Level of Service, LOS		A				A					F					D	
Approach Delay (s/veh)		3.4				2.7				135.7				27.7			
Approach LOS										F				D			

HCS7 Two-Way Stop-Control Report

General Information				Site Information			
Analyst	Chris Ball			Intersection	Le Fevre Rd & Lynn Blvd		
Agency/Co.	Mead & Hunt			Jurisdiction	City of Sterling, IL		
Date Performed	3/17/2017			East/West Street	W Le Fevre Rd		
Analysis Year	2040			North/South Street	Lynn Blvd		
Time Analyzed	AM			Peak Hour Factor	0.92		
Intersection Orientation	East-West			Analysis Time Period (hrs)	0.25		
Project Description	Build Condition						



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Movement	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Priority																
Number of Lanes	0	0	1	0	0	0	1	0		0	1	0		0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume, V (veh/h)		163	106	81		66	68	14		49	128	101		19	108	85
Percent Heavy Vehicles (%)		3				6				8	8	8		10	10	10
Proportion Time Blocked																
Percent Grade (%)									0				0			
Right Turn Channelized	No				No				No				No			
Median Type/Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)																
Critical Headway (sec)																
Base Follow-Up Headway (sec)																
Follow-Up Headway (sec)																

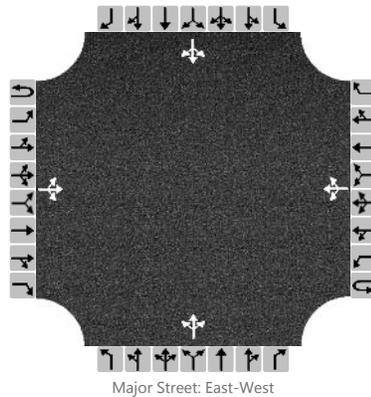
Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		177				72					302				230			
Capacity, c (veh/h)		1498				1348					299				319			
v/c Ratio		0.12				0.05					1.01				0.72			
95% Queue Length, Q ₉₅ (veh)		0.4				0.2					10.8				5.3			
Control Delay (s/veh)		7.7				7.8					93.6				40.7			
Level of Service, LOS		A				A					F				E			
Approach Delay (s/veh)		4.2				3.7					93.6				40.7			
Approach LOS											F				E			

HCS7 Two-Way Stop-Control Report

General Information				Site Information			
Analyst	Chris Ball			Intersection	Le Fevre Rd & Lynn Blvd		
Agency/Co.	Mead & Hunt			Jurisdiction	City of Sterling, IL		
Date Performed	3/17/2017			East/West Street	W Le Fevre Rd		
Analysis Year	2040			North/South Street	Lynn Blvd		
Time Analyzed	PM			Peak Hour Factor	0.92		
Intersection Orientation	East-West			Analysis Time Period (hrs)	0.25		
Project Description	Build Condition						

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Movement	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Priority																
Number of Lanes	0	0	1	0	0	0	1	0		0	1	0		0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume, V (veh/h)		145	176	63		86	165	23		83	151	97		13	147	209
Percent Heavy Vehicles (%)		3				1				5	5	5		4	4	4
Proportion Time Blocked																
Percent Grade (%)									0				0			
Right Turn Channelized	No				No				No				No			
Median Type/Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)																
Critical Headway (sec)																
Base Follow-Up Headway (sec)																
Follow-Up Headway (sec)																

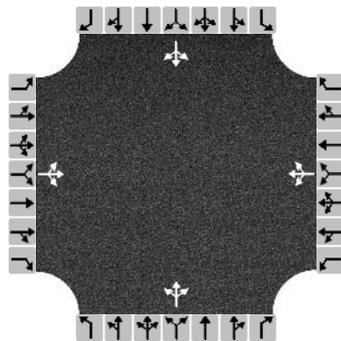
Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		158				93					359					401
Capacity, c (veh/h)		1360				1311					116					306
v/c Ratio		0.12				0.07					3.10					1.31
95% Queue Length, Q ₉₅ (veh)		0.4				0.2					34.3					19.6
Control Delay (s/veh)		8.0				8.0					1024.4					195.7
Level of Service, LOS		A				A					F					F
Approach Delay (s/veh)		3.7				2.9				1024.4				195.7		
Approach LOS										F				F		

HCS7 All-Way Stop Control Report

General Information		Site Information	
Analyst	Chris Ball	Intersection	Le Fevre and Lynn
Agency/Co.	Mead & Hunt	Jurisdiction	City of Sterling
Date Performed	3/29/2017	East/West Street	W Le Fevre Rd
Analysis Year	2020	North/South Street	Lynn Blvd
Analysis Time Period (hrs)	0.25	Peak Hour Factor	0.92
Time Analyzed	AM		
Project Description	Build Condition		

Lanes



Vehicle Volume and Adjustments

Approach	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Movement												
Volume	124	80	76	55	52	10	39	99	78	14	90	64
% Thrus in Shared Lane												
Lane	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
Configuration	LTR			LTR			LTR			LTR		
Flow Rate, v (veh/h)	304			127			235			183		
Percent Heavy Vehicles	3			6			8			10		

Departure Headway and Service Time

Initial Departure Headway, hd (s)	3.20			3.20			3.20			3.20		
Initial Degree of Utilization, x	0.271			0.113			0.209			0.162		
Final Departure Headway, hd (s)	5.27			5.74			5.39			5.48		
Final Degree of Utilization, x	0.446			0.203			0.351			0.278		
Move-Up Time, m (s)	2.0			2.0			2.0			2.0		
Service Time, ts (s)	3.27			3.74			3.39			3.48		

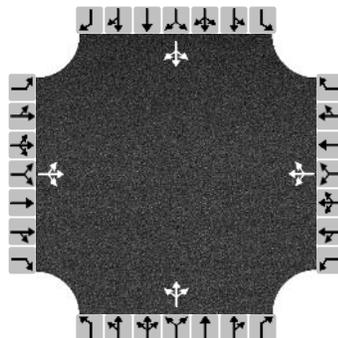
Capacity, Delay and Level of Service

Flow Rate, v (veh/h)	304			127			235			183		
Capacity	683			627			668			657		
95% Queue Length, Q ₉₅ (veh)	2.3			0.8			1.6			1.1		
Control Delay (s/veh)	12.4			10.2			11.3			10.6		
Level of Service, LOS	B			B			B			B		
Approach Delay (s/veh)	12.4			10.2			11.3			10.6		
Approach LOS	B			B			B			B		
Intersection Delay, s/veh LOS	11.4						B					

HCS7 All-Way Stop Control Report

General Information		Site Information	
Analyst	Chris Ball	Intersection	Le Fevre and Lynn
Agency/Co.	Mead & Hunt	Jurisdiction	City of Sterling
Date Performed	3/29/2017	East/West Street	W Le Fevre Rd
Analysis Year	2020	North/South Street	Lynn Blvd
Analysis Time Period (hrs)	0.25	Peak Hour Factor	0.92
Time Analyzed	PM		
Project Description	Build Condition		

Lanes



Vehicle Volume and Adjustments

Approach	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Movement												
Volume	110	134	49	64	125	17	73	126	82	9	114	160
% Thrus in Shared Lane												
Lane	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
Configuration	LTR			LTR			LTR			LTR		
Flow Rate, v (veh/h)	318			224			305			308		
Percent Heavy Vehicles	3			1			5			4		

Departure Headway and Service Time

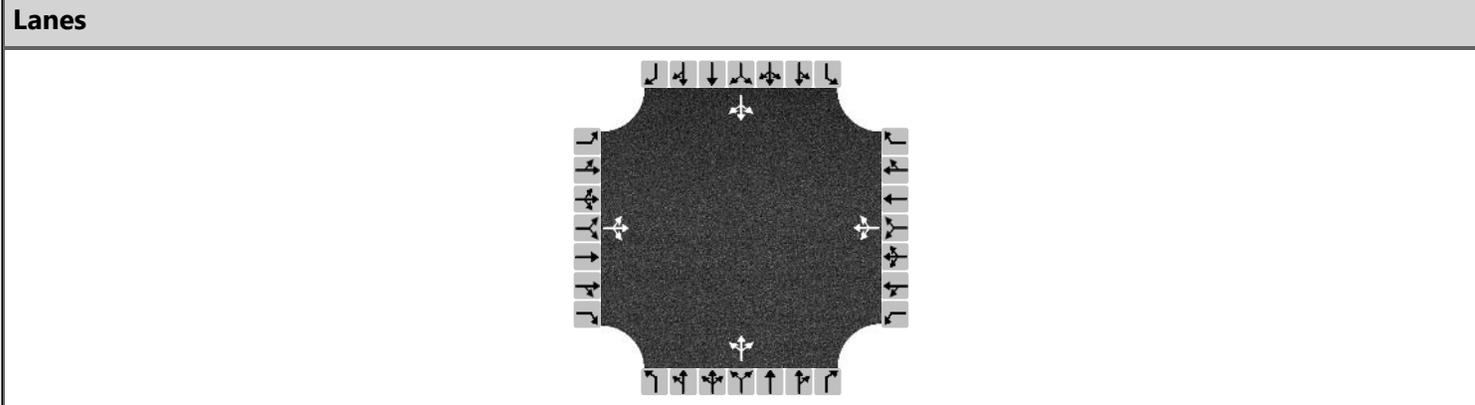
Initial Departure Headway, hd (s)	3.20			3.20			3.20			3.20		
Initial Degree of Utilization, x	0.283			0.199			0.271			0.273		
Final Departure Headway, hd (s)	6.49			6.74			6.42			6.21		
Final Degree of Utilization, x	0.574			0.419			0.545			0.531		
Move-Up Time, m (s)	2.0			2.0			2.0			2.0		
Service Time, ts (s)	4.49			4.74			4.42			4.21		

Capacity, Delay and Level of Service

Flow Rate, v (veh/h)	318			224			305			308		
Capacity	555			534			560			579		
95% Queue Length, Q ₉₅ (veh)	3.6			2.1			3.3			3.1		
Control Delay (s/veh)	17.9			14.5			16.9			16.0		
Level of Service, LOS	C			B			C			C		
Approach Delay (s/veh)	17.9			14.5			16.9			16.0		
Approach LOS	C			B			C			C		
Intersection Delay, s/veh LOS	16.5						C					

HCS7 All-Way Stop Control Report

General Information		Site Information	
Analyst	Chris Ball	Intersection	Le Fevre and Lynn
Agency/Co.	Mead & Hunt	Jurisdiction	City of Sterling
Date Performed	3/29/2017	East/West Street	W Le Fevre Rd
Analysis Year	2040	North/South Street	Lynn Blvd
Analysis Time Period (hrs)	0.25	Peak Hour Factor	0.92
Time Analyzed	AM		
Project Description	Build Condition		



Vehicle Volume and Adjustments

Approach	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Movement												
Volume	163	106	81	66	68	14	49	128	101	19	108	85
% Thrus in Shared Lane												
Lane	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
Configuration	LTR			LTR			LTR			LTR		
Flow Rate, v (veh/h)	380			161			302			230		
Percent Heavy Vehicles	3			6			8			10		

Departure Headway and Service Time

Initial Departure Headway, hd (s)	3.20			3.20			3.20			3.20		
Initial Degree of Utilization, x	0.338			0.143			0.269			0.205		
Final Departure Headway, hd (s)	5.95			6.57			6.08			6.24		
Final Degree of Utilization, x	0.629			0.293			0.511			0.399		
Move-Up Time, m (s)	2.0			2.0			2.0			2.0		
Service Time, ts (s)	3.95			4.57			4.08			4.24		

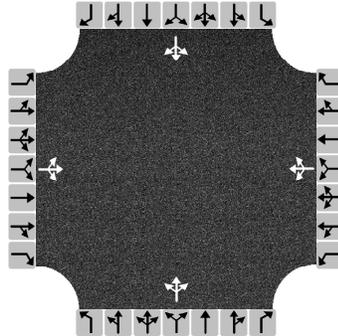
Capacity, Delay and Level of Service

Flow Rate, v (veh/h)	380			161			302			230		
Capacity	605			548			592			577		
95% Queue Length, Q ₉₅ (veh)	4.4			1.2			2.9			1.9		
Control Delay (s/veh)	18.5			12.3			15.3			13.3		
Level of Service, LOS	C			B			C			B		
Approach Delay (s/veh)	18.5			12.3			15.3			13.3		
Approach LOS	C			B			C			B		
Intersection Delay, s/veh LOS	15.5						C					

HCS7 All-Way Stop Control Report

General Information		Site Information	
Analyst	Chris Ball	Intersection	Le Fevre and Lynn
Agency/Co.	Mead & Hunt	Jurisdiction	City of Sterling
Date Performed	3/29/2017	East/West Street	W Le Fevre Rd
Analysis Year	2040	North/South Street	Lynn Blvd
Analysis Time Period (hrs)	0.25	Peak Hour Factor	0.92
Time Analyzed	PM		
Project Description	Build Condition		

Lanes



Vehicle Volume and Adjustments

Approach	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Movement												
Volume	145	176	63	83	165	23	83	151	97	13	147	209
% Thrus in Shared Lane												
Lane	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
Configuration	LTR			LTR			LTR			LTR		
Flow Rate, v (veh/h)	417			295			360			401		
Percent Heavy Vehicles	3			1			5			4		

Departure Headway and Service Time

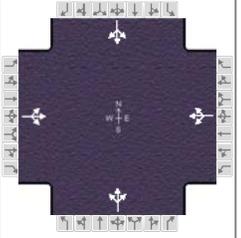
Initial Departure Headway, hd (s)	3.20			3.20			3.20			3.20		
Initial Degree of Utilization, x	0.371			0.262			0.320			0.357		
Final Departure Headway, hd (s)	8.72			9.15			8.75			8.39		
Final Degree of Utilization, x	1.011			0.748			0.874			0.934		
Move-Up Time, m (s)	2.0			2.0			2.0			2.0		
Service Time, ts (s)	6.72			7.15			6.75			6.39		

Capacity, Delay and Level of Service

Flow Rate, v (veh/h)	417			295			360			401		
Capacity	413			394			412			429		
95% Queue Length, Q ₉₅ (veh)	12.8			6.0			8.8			10.6		
Control Delay (s/veh)	77.3			34.8			48.5			57.8		
Level of Service, LOS	F			D			E			F		
Approach Delay (s/veh)	77.3			34.8			48.5			57.8		
Approach LOS	F			D			E			F		
Intersection Delay, s/veh LOS	56.5						F					

HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Mead & Hunt			Duration, h	0.25
Analyst	Chris Ball	Analysis Date	Mar 30, 2017	Area Type	Other
Jurisdiction	City of Sterling	Time Period	AM	PHF	0.92
Urban Street		Analysis Year	2020	Analysis Period	1 > 7:00
Intersection	Lynn and Le Fevre	File Name	13 2020 AM Peak - Opening Year.xus		
Project Description	Build Condition				



Demand Information	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Approach Movement												
Demand (v), veh/h	124	80	76	55	52	10	39	99	78	14	90	64

Signal Information													
Cycle, s	60.0	Reference Phase	2										
Offset, s	0	Reference Point	End										
Uncoordinated	Yes	Simult. Gap E/W	On	Green	25.0	25.0	0.0	0.0	0.0	0.0			
Force Mode	Fixed	Simult. Gap N/S	On	Yellow	3.0	3.0	0.0	0.0	0.0	0.0			
				Red	2.0	2.0	0.0	0.0	0.0	0.0			

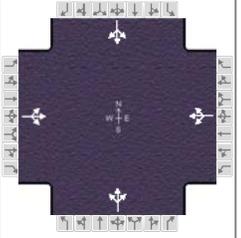
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2		6		8		4
Case Number		8.0		8.0		8.0		8.0
Phase Duration, s		30.0		30.0		30.0		30.0
Change Period, ($Y+R_c$), s		5.0		5.0		5.0		5.0
Max Allow Headway (MAH), s		3.2		3.2		3.2		3.2
Queue Clearance Time (g_s), s		9.9		4.6		7.4		6.1
Green Extension Time (g_e), s		0.7		0.8		0.7		0.7
Phase Call Probability		1.00		1.00		1.00		1.00
Max Out Probability		0.00		0.00		0.00		0.00

Movement Group Results	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Approach Movement												
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (v), veh/h	293			116			224			172		
Adjusted Saturation Flow Rate (s), veh/h/ln	1543			1456			1584			1618		
Queue Service Time (g_s), s	5.3			0.0			0.0			0.0		
Cycle Queue Clearance Time (g_c), s	7.9			2.6			5.4			4.1		
Green Ratio (g/C)	0.42			0.42			0.42			0.42		
Capacity (c), veh/h	730			698			731			740		
Volume-to-Capacity Ratio (X)	0.402			0.167			0.306			0.232		
Back of Queue (Q), ft/ln (95 th percentile)	109.8			39.1			82.4			62		
Back of Queue (Q), veh/ln (95 th percentile)	4.3			1.5			3.1			2.3		
Queue Storage Ratio (RQ) (95 th percentile)	0.00			0.00			0.00			0.00		
Uniform Delay (d_1), s/veh	12.4			10.9			11.8			11.4		
Incremental Delay (d_2), s/veh	0.1			0.0			0.1			0.1		
Initial Queue Delay (d_3), s/veh	0.0			0.0			0.0			0.0		
Control Delay (d), s/veh	12.5			11.0			11.9			11.5		
Level of Service (LOS)	B			B			B			B		
Approach Delay, s/veh / LOS	12.5	B		11.0	B		11.9	B		11.5	B	
Intersection Delay, s/veh / LOS	11.9						B					

Multimodal Results	EB	WB	NB	SB
Pedestrian LOS Score / LOS				
Bicycle LOS Score / LOS				

HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Mead & Hunt			Duration, h	0.25
Analyst	Chris Ball	Analysis Date	Mar 30, 2017	Area Type	Other
Jurisdiction	City of Sterling	Time Period	PM	PHF	0.92
Urban Street		Analysis Year	2020	Analysis Period	1 > 7:00
Intersection	Lynn and Le Fevre	File Name	14 2020 PM Peak - Opening Year.xus		
Project Description	Build Condition				



Demand Information	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Approach Movement												
Demand (v), veh/h	110	134	49	64	125	17	73	126	82	9	114	160

Signal Information													
Cycle, s	60.0	Reference Phase	2										
Offset, s	0	Reference Point	End										
Uncoordinated	Yes	Simult. Gap E/W	On	Green	25.0	25.0	0.0	0.0	0.0	0.0			
Force Mode	Fixed	Simult. Gap N/S	On	Yellow	3.0	3.0	0.0	0.0	0.0	0.0			
				Red	2.0	2.0	0.0	0.0	0.0	0.0			

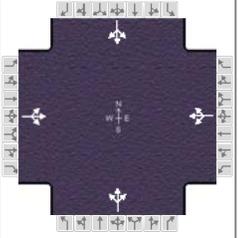
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2		6		8		4
Case Number		8.0		8.0		8.0		8.0
Phase Duration, s		30.0		30.0		30.0		30.0
Change Period, ($Y+R_c$), s		5.0		5.0		5.0		5.0
Max Allow Headway (MAH), s		3.2		3.2		3.3		3.3
Queue Clearance Time (g_s), s		10.1		6.6		9.4		9.5
Green Extension Time (g_e), s		1.0		1.0		1.2		1.2
Phase Call Probability		1.00		1.00		1.00		1.00
Max Out Probability		0.00		0.00		0.00		0.00

Movement Group Results	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (v), veh/h	308			213			295			297		
Adjusted Saturation Flow Rate (s), veh/h/ln	1559			1632			1535			1666		
Queue Service Time (g_s), s	3.5			0.0			0.0			0.0		
Cycle Queue Clearance Time (g_c), s	8.1			4.6			7.4			7.5		
Green Ratio (g/C)	0.42			0.42			0.42			0.42		
Capacity (c), veh/h	733			760			716			756		
Volume-to-Capacity Ratio (X)	0.420			0.280			0.411			0.393		
Back of Queue (Q), ft/ln (95 th percentile)	115.5			72.6			110.8			111.8		
Back of Queue (Q), veh/ln (95 th percentile)	4.5			2.9			4.3			4.3		
Queue Storage Ratio (RQ) (95 th percentile)	0.00			0.00			0.00			0.00		
Uniform Delay (d_1), s/veh	12.4			11.5			12.3			12.4		
Incremental Delay (d_2), s/veh	0.1			0.1			0.1			0.1		
Initial Queue Delay (d_3), s/veh	0.0			0.0			0.0			0.0		
Control Delay (d), s/veh	12.6			11.6			12.4			12.5		
Level of Service (LOS)	B			B			B			B		
Approach Delay, s/veh / LOS	12.6	B		11.6	B		12.4	B		12.5	B	
Intersection Delay, s/veh / LOS	12.3						B					

Multimodal Results	EB	WB	NB	SB
Pedestrian LOS Score / LOS				
Bicycle LOS Score / LOS				

HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Mead & Hunt			Duration, h	0.25
Analyst	Chris Ball	Analysis Date	Mar 30, 2017	Area Type	Other
Jurisdiction	City of Sterling	Time Period	AM	PHF	0.92
Urban Street		Analysis Year	2040	Analysis Period	1 > 7:00
Intersection	Lynn and Le Fevre	File Name	15 2040 AM Peak - Design Year.xus		
Project Description	Build Condition				



Demand Information	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Approach Movement												
Demand (v), veh/h	163	106	81	66	68	14	49	128	101	19	108	85

Signal Information													
Cycle, s	60.0	Reference Phase	2										
Offset, s	0	Reference Point	End										
Uncoordinated	Yes	Simult. Gap E/W	On	Green	25.0	25.0	0.0	0.0	0.0	0.0			
Force Mode	Fixed	Simult. Gap N/S	On	Yellow	3.0	3.0	0.0	0.0	0.0	0.0			
				Red	2.0	2.0	0.0	0.0	0.0	0.0			

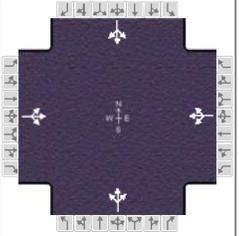
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2		6		8		4
Case Number		8.0		8.0		8.0		8.0
Phase Duration, s		30.0		30.0		30.0		30.0
Change Period, ($Y+R_c$), s		5.0		5.0		5.0		5.0
Max Allow Headway (MAH), s		3.2		3.2		3.2		3.2
Queue Clearance Time (g_s), s		12.8		5.5		9.3		7.4
Green Extension Time (g_e), s		0.9		1.0		1.0		1.0
Phase Call Probability		1.00		1.00		1.00		1.00
Max Out Probability		0.01		0.00		0.00		0.00

Movement Group Results	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (v), veh/h	370			150			291			220		
Adjusted Saturation Flow Rate (s), veh/h/ln	1527			1438			1576			1602		
Queue Service Time (g_s), s	7.3			0.0			0.0			0.0		
Cycle Queue Clearance Time (g_c), s	10.8			3.5			7.3			5.4		
Green Ratio (g/C)	0.42			0.42			0.42			0.42		
Capacity (c), veh/h	725			688			728			733		
Volume-to-Capacity Ratio (X)	0.510			0.218			0.400			0.299		
Back of Queue (Q), ft/ln (95 th percentile)	148.5			51.4			112.5			82.1		
Back of Queue (Q), veh/ln (95 th percentile)	5.8			2.0			4.2			3.0		
Queue Storage Ratio (RQ) (95 th percentile)	0.00			0.00			0.00			0.00		
Uniform Delay (d_1), s/veh	13.2			11.2			12.4			11.8		
Incremental Delay (d_2), s/veh	0.3			0.1			0.1			0.1		
Initial Queue Delay (d_3), s/veh	0.0			0.0			0.0			0.0		
Control Delay (d), s/veh	13.5			11.2			12.5			11.9		
Level of Service (LOS)	B			B			B			B		
Approach Delay, s/veh / LOS	13.5	B		11.2	B		12.5	B		11.9	B	
Intersection Delay, s/veh / LOS	12.5						B					

Multimodal Results	EB	WB	NB	SB
Pedestrian LOS Score / LOS				
Bicycle LOS Score / LOS				

HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Mead & Hunt			Duration, h	0.25
Analyst	Chris Ball	Analysis Date	Mar 30, 2017	Area Type	Other
Jurisdiction	City of Sterling	Time Period	PM	PHF	0.92
Urban Street		Analysis Year	2040	Analysis Period	1 > 7:00
Intersection	Lynn and Le Fevre	File Name	16 2040 PM Peak - Design Year.xus		
Project Description	Build Condition				



Demand Information	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Approach Movement												
Demand (v), veh/h	145	176	63	83	165	23	83	151	97	13	147	209

Signal Information													
Cycle, s	60.0	Reference Phase	2										
Offset, s	0	Reference Point	End										
Uncoordinated	Yes	Simult. Gap E/W	On	Green	25.0	25.0	0.0	0.0	0.0	0.0			
Force Mode	Fixed	Simult. Gap N/S	On	Yellow	3.0	3.0	0.0	0.0	0.0	0.0			
				Red	2.0	2.0	0.0	0.0	0.0	0.0			

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2		6		8		4
Case Number		8.0		8.0		8.0		8.0
Phase Duration, s		30.0		30.0		30.0		30.0
Change Period, ($Y+R_c$), s		5.0		5.0		5.0		5.0
Max Allow Headway (MAH), s		3.3		3.3		3.3		3.3
Queue Clearance Time (g_s), s		14.1		8.8		11.5		12.6
Green Extension Time (g_e), s		1.3		1.4		1.5		1.5
Phase Call Probability		1.00		1.00		1.00		1.00
Max Out Probability		0.04		0.00		0.02		0.03

Movement Group Results	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Approach Movement												
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (v), veh/h	407			284			349			390		
Adjusted Saturation Flow Rate (s), veh/h/ln	1533			1602			1517			1660		
Queue Service Time (g_s), s	5.3			0.0			0.0			0.0		
Cycle Queue Clearance Time (g_c), s	12.1			6.8			9.5			10.6		
Green Ratio (g/C)	0.42			0.42			0.42			0.42		
Capacity (c), veh/h	722			746			707			754		
Volume-to-Capacity Ratio (X)	0.563			0.380			0.493			0.518		
Back of Queue (Q), ft/ln (95 th percentile)	170.2			101.2			137			158.8		
Back of Queue (Q), veh/ln (95 th percentile)	6.7			4.0			5.3			6.2		
Queue Storage Ratio (RQ) (95 th percentile)	0.00			0.00			0.00			0.00		
Uniform Delay (d_1), s/veh	13.6			12.1			12.8			13.3		
Incremental Delay (d_2), s/veh	0.6			0.1			0.2			0.3		
Initial Queue Delay (d_3), s/veh	0.0			0.0			0.0			0.0		
Control Delay (d), s/veh	14.2			12.2			13.0			13.6		
Level of Service (LOS)	B			B			B			B		
Approach Delay, s/veh / LOS	14.2		B	12.2		B	13.0		B	13.6		B
Intersection Delay, s/veh / LOS	13.4						B					

Multimodal Results	EB	WB	NB	SB
Pedestrian LOS Score / LOS				
Bicycle LOS Score / LOS				

MOVEMENT SUMMARY

 Site: 101 [Lynn Blvd & LeFevre Road]

2020 AM Peak
Roundabout

Movement Performance - Vehicles												
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance ft	Prop. Queued	Effective Stop Rate per veh	Average Speed mph	
South: Lynn blvd												
3	L2	42	8.0	0.193	5.4	LOS A	0.8	22.4	0.42	0.29	34.2	
8	T1	108	8.0	0.193	5.4	LOS A	0.8	22.4	0.42	0.29	34.2	
18	R2	42	8.0	0.193	5.4	LOS A	0.8	22.4	0.42	0.29	33.2	
Approach		192	8.0	0.193	5.4	LOS A	0.8	22.4	0.42	0.29	34.0	
East: LeFevre RdRoadName												
1	L2	60	6.0	0.133	5.0	LOS A	0.6	14.5	0.44	0.32	33.8	
6	T1	57	6.0	0.133	5.0	LOS A	0.6	14.5	0.44	0.32	33.8	
16	R2	11	6.0	0.133	5.0	LOS A	0.6	14.5	0.44	0.32	32.8	
Approach		127	6.0	0.133	5.0	LOS A	0.6	14.5	0.44	0.32	33.7	
North: Lynn Blvd												
7	L2	15	10.0	0.172	5.0	LOS A	0.7	20.1	0.34	0.21	34.8	
4	T1	98	10.0	0.172	5.0	LOS A	0.7	20.1	0.34	0.21	34.8	
14	R2	70	10.0	0.172	5.0	LOS A	0.7	20.1	0.34	0.21	33.8	
Approach		183	10.0	0.172	5.0	LOS A	0.7	20.1	0.34	0.21	34.4	
West: LeFevre Rd												
5	L2	135	3.0	0.274	5.8	LOS A	1.4	35.8	0.40	0.26	33.5	
2	T1	87	3.0	0.274	5.8	LOS A	1.4	35.8	0.40	0.26	33.5	
12	R2	83	3.0	0.274	5.8	LOS A	1.4	35.8	0.40	0.26	32.5	
Approach		304	3.0	0.274	5.8	LOS A	1.4	35.8	0.40	0.26	33.2	
All Vehicles		807	6.3	0.274	5.4	LOS A	1.4	35.8	0.39	0.27	33.8	

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Roundabout LOS Method: Same as Sign Control.

Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.

LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).

Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).

Roundabout Capacity Model: US HCM 2010.

HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.

Gap-Acceptance Capacity: Traditional M1.

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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Organisation: MEAD & HUNT | Processed: Monday, April 03, 2017 5:49:56 PM

Project: C:\Users\11670DLW\Desktop\2020 AM Peak.sip7

MOVEMENT SUMMARY

 Site: 101 [Lynn Blvd & LeFevre Road]

2020 PM Peak
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance ft	Prop. Queued	Effective Stop Rate per veh	Average Speed mph
South: Lynn blvd											
3	L2	79	5.0	0.309	6.8	LOS A	1.5	39.7	0.49	0.38	33.5
8	T1	137	5.0	0.309	6.8	LOS A	1.5	39.7	0.49	0.38	33.5
18	R2	89	5.0	0.309	6.8	LOS A	1.5	39.7	0.49	0.38	32.5
Approach		305	5.0	0.309	6.8	LOS A	1.5	39.7	0.49	0.38	33.2
East: LeFevre RdRoadName											
1	L2	70	1.0	0.234	6.1	LOS A	1.1	27.8	0.51	0.42	33.9
6	T1	136	1.0	0.234	6.1	LOS A	1.1	27.8	0.51	0.42	33.8
16	R2	18	1.0	0.234	6.1	LOS A	1.1	27.8	0.51	0.42	32.9
Approach		224	1.0	0.234	6.1	LOS A	1.1	27.8	0.51	0.42	33.7
North: Lynn Blvd											
7	L2	10	4.0	0.311	6.8	LOS A	1.6	40.0	0.50	0.39	34.1
4	T1	124	4.0	0.311	6.8	LOS A	1.6	40.0	0.50	0.39	34.1
14	R2	174	4.0	0.311	6.8	LOS A	1.6	40.0	0.50	0.39	33.1
Approach		308	4.0	0.311	6.8	LOS A	1.6	40.0	0.50	0.39	33.5
West: LeFevre Rd											
5	L2	120	3.0	0.293	6.2	LOS A	1.5	38.7	0.43	0.30	33.6
2	T1	146	3.0	0.293	6.2	LOS A	1.5	38.7	0.43	0.30	33.5
12	R2	53	3.0	0.293	6.2	LOS A	1.5	38.7	0.43	0.30	32.6
Approach		318	3.0	0.293	6.2	LOS A	1.5	38.7	0.43	0.30	33.4
All Vehicles		1155	3.4	0.311	6.5	LOS A	1.6	40.0	0.48	0.37	33.4

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Roundabout LOS Method: Same as Sign Control.

Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.

LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).

Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).

Roundabout Capacity Model: US HCM 2010.

HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.

Gap-Acceptance Capacity: Traditional M1.

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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Organisation: MEAD & HUNT | Processed: Monday, April 03, 2017 5:51:38 PM

Project: C:\Users\1670DLW\Desktop\2020 PM Peak.sip7

MOVEMENT SUMMARY

 Site: 101 [Lynn Blvd & LeFevre Road]

2040 AM Peak
Roundabout

Movement Performance - Vehicles												
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance ft	Prop. Queued	Effective Stop Rate per veh	Average Speed mph	
South: Lynn blvd												
3	L2	53	8.0	0.331	7.5	LOS A	1.6	41.8	0.53	0.44	33.3	
8	T1	139	8.0	0.331	7.5	LOS A	1.6	41.8	0.53	0.44	33.3	
18	R2	110	8.0	0.331	7.5	LOS A	1.6	41.8	0.53	0.44	32.3	
Approach		302	8.0	0.331	7.5	LOS A	1.6	41.8	0.53	0.44	32.9	
East: LeFevre RdRoadName												
1	L2	74	3.0	0.162	5.6	LOS A	0.7	17.9	0.50	0.42	33.5	
6	T1	57	3.0	0.162	5.6	LOS A	0.7	17.9	0.50	0.42	33.4	
16	R2	15	3.0	0.162	5.6	LOS A	0.7	17.9	0.50	0.42	32.5	
Approach		146	3.0	0.162	5.6	LOS A	0.7	17.9	0.50	0.42	33.4	
North: Lynn Blvd												
7	L2	21	10.0	0.223	5.6	LOS A	1.0	26.9	0.38	0.25	34.4	
4	T1	117	10.0	0.223	5.6	LOS A	1.0	26.9	0.38	0.25	34.5	
14	R2	92	10.0	0.223	5.6	LOS A	1.0	26.9	0.38	0.25	33.4	
Approach		230	10.0	0.223	5.6	LOS A	1.0	26.9	0.38	0.25	34.1	
West: LeFevre Rd												
5	L2	177	6.0	0.368	7.3	LOS A	1.9	51.1	0.47	0.35	32.7	
2	T1	115	6.0	0.368	7.3	LOS A	1.9	51.1	0.47	0.35	32.7	
12	R2	88	6.0	0.368	7.3	LOS A	1.9	51.1	0.47	0.35	31.8	
Approach		380	6.0	0.368	7.3	LOS A	1.9	51.1	0.47	0.35	32.5	
All Vehicles		1059	7.0	0.368	6.8	LOS A	1.9	51.1	0.47	0.36	33.1	

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Roundabout LOS Method: Same as Sign Control.

Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.

LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).

Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).

Roundabout Capacity Model: US HCM 2010.

HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.

Gap-Acceptance Capacity: Traditional M1.

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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Project: C:\Users\1670DLW\Desktop\2040 AM Peak.sip7

MOVEMENT SUMMARY

 Site: 101 [Lynn Blvd & LeFevre Road]

2040 PM Peak
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance ft	Prop. Queued	Effective Stop Rate per veh	Average Speed mph
South: Lynn blvd											
3	L2	90	5.0	0.400	8.6	LOS A	2.0	53.3	0.59	0.53	32.6
8	T1	164	5.0	0.400	8.6	LOS A	2.0	53.3	0.59	0.53	32.6
18	R2	105	5.0	0.400	8.6	LOS A	2.0	53.3	0.59	0.53	31.7
Approach		360	5.0	0.400	8.6	LOS A	2.0	53.3	0.59	0.53	32.4
East: LeFevre RdRoadName											
1	L2	90	1.0	0.334	7.8	LOS A	1.7	41.7	0.60	0.54	33.1
6	T1	179	1.0	0.334	7.8	LOS A	1.7	41.7	0.60	0.54	33.0
16	R2	25	1.0	0.334	7.8	LOS A	1.7	41.7	0.60	0.54	32.1
Approach		295	1.0	0.334	7.8	LOS A	1.7	41.7	0.60	0.54	32.9
North: Lynn Blvd											
7	L2	14	4.0	0.438	9.2	LOS A	2.4	61.6	0.61	0.55	33.0
4	T1	160	4.0	0.438	9.2	LOS A	2.4	61.6	0.61	0.55	32.9
14	R2	227	4.0	0.438	9.2	LOS A	2.4	61.6	0.61	0.55	32.0
Approach		401	4.0	0.438	9.2	LOS A	2.4	61.6	0.61	0.55	32.4
West: LeFevre Rd											
5	L2	158	3.0	0.410	8.0	LOS A	2.3	59.0	0.54	0.43	32.7
2	T1	191	3.0	0.410	8.0	LOS A	2.3	59.0	0.54	0.43	32.6
12	R2	68	3.0	0.410	8.0	LOS A	2.3	59.0	0.54	0.43	31.7
Approach		417	3.0	0.410	8.0	LOS A	2.3	59.0	0.54	0.43	32.5
All Vehicles		1473	3.4	0.438	8.4	LOS A	2.4	61.6	0.58	0.51	32.5

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Roundabout LOS Method: Same as Sign Control.

Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.

LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).

Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).

Roundabout Capacity Model: US HCM 2010.

HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.

Gap-Acceptance Capacity: Traditional M1.

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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