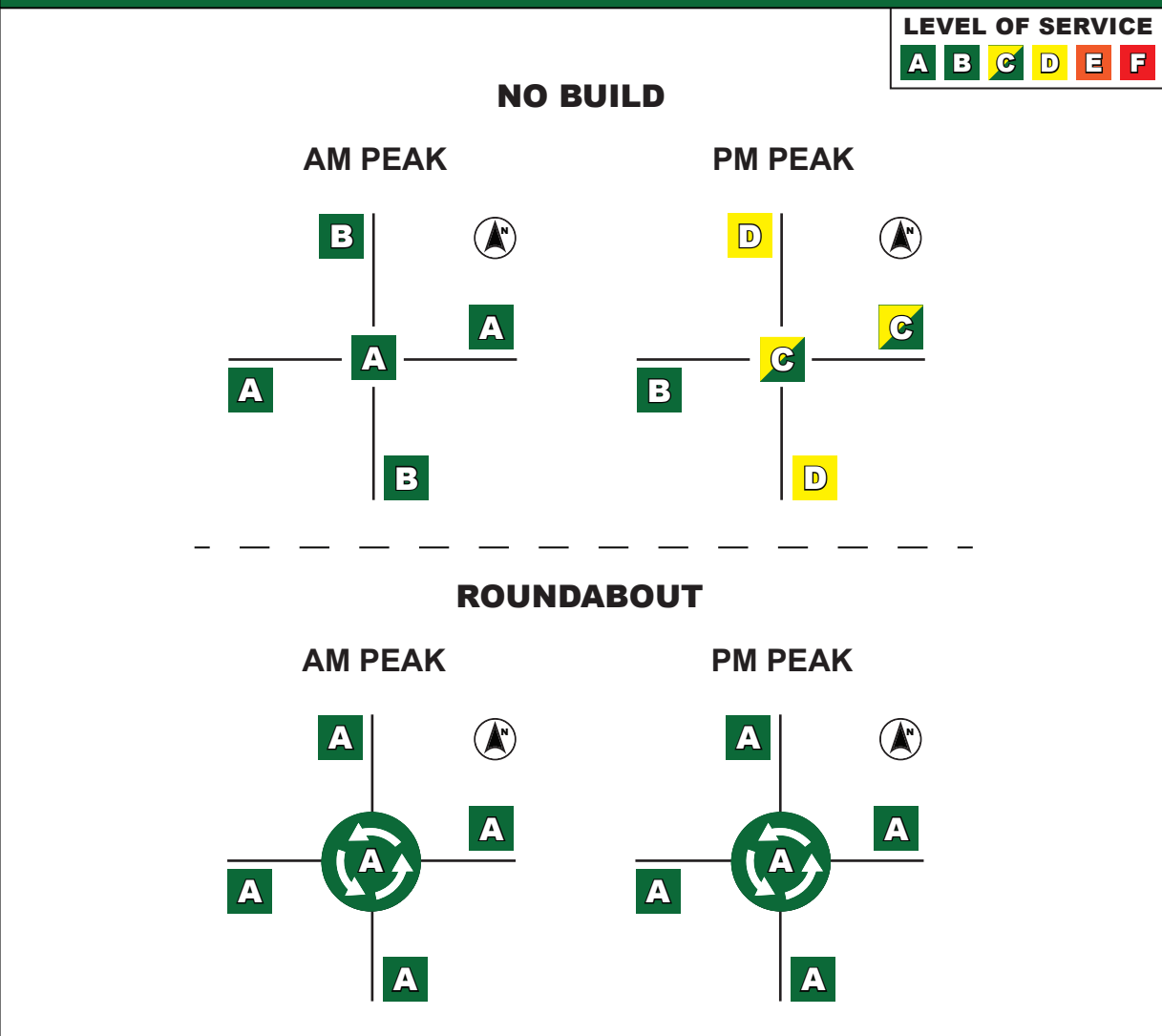


# I. LENNON ROAD & ELMS ROAD

## 2015-2019 CRASH DATA

CRASHES	INJURIES			
	FATALITIES	TYPE A	TYPE B	TYPE C
2 ANGLE	0	0	4	2
3 HEAD-ON				

## 2045 OPERATIONS



Opinion of probable cost for single-lane roundabout

**\$1.36 MILLION**

## I. Lennon Road and Elms Road

The intersection of Lennon Road and Elms Road was included in the early preliminary engineering phase with support from the Genesee County Road Commission due to intersection operations. This intersection is a secondary analysis Tier Three intersection.

During the skim analysis, it was observed that there were two angle crashes and three head on left turn crashes over the 5-year period. These crashes resulted in zero fatalities, zero type A injuries, four type B injuries, and two type C injuries at the intersection.

### **Future No-Build Conditions**

The intersection of Lennon Road and Elms Road is an all-way stop control intersection. Stop signs and overhead flashing beacons are present for all approaches. Lennon Road runs east/west and is a two-lane roadway with one lane in each direction. Elms Road runs north/south and is a two-lane road with one lane in each direction. Lennon Road intersects Elms Road at an approximately 45-degree angle. There is a business in the northwest quadrant. The other three quadrants are vacant immediately adjacent to the intersection. There is a self storage business just to the southeast of the intersection. An aerial of the existing intersection can be seen in Figure 10.

**Figure 10: Aerial view of Lennon Road and Elms Road**



An operational analysis of the no-build condition was completed for the intersection using the 2045 forecast traffic volumes. The results of the analysis for future no-build conditions reveals that all approaches operate at LOS C or better in the AM and PM peak hours, except for the Elms Road approaches in the PM peak hour which are LOS D.

The 95<sup>th</sup> percentile queue lengths were reviewed at the intersection and results showed that the approaches experienced a maximum queue length of 58 feet (3 vehicles) during the AM peak hour and 167 feet (7 vehicles) during the PM peak hour.

The operational results for future no-build conditions are presented in Table 22.

**Table 22: Operational Analysis for 2045 No-Build Conditions**

Intersection	Approach	AM Peak		PM Peak	
		Delay/LOS	Queue (veh)*	Delay/LOS	Queue (veh)*
Lennon Road and Elms Road	Eastbound (NE)	9.2/A	2 (44 ft)	12.6/B	2 (46 ft)
	Westbound (SW)	9.4/A	3 (51 ft)	20.1/C	6 (126 ft)
	Northbound	10.1/B	2 (49 ft)	25.7/D	7 (158 ft)
	Southbound	10.5/B	3 (58 ft)	25.7/D	7 (167 ft)
	<b>Overall</b>	<b>10.0/A</b>		<b>23.3/C</b>	

\* 95<sup>th</sup> percentile queue length

**Roundabout Conditions**

A single-lane roundabout with an oblong shape is proposed at this location. The oblong shape would facilitate speed control at the skewed intersection without needing a large diameter roundabout. The inscribed circle diameter would be approximately 130 feet for the smaller dimension of the oblong shape and approximately 146 feet for the long portion. The roundabout would improve traffic operations and safety at this intersection. It is likely that a small amount of permanent right-of-way acquisition would be needed in the southeast intersection quadrant. A large overhead power pole is located in the northeast quadrant. This pole can most likely be avoided, but overhead power poles in the other quadrants may be affected. A concept design exhibit for this intersection can be found at the end of this section.

An operational analysis of the roundabout (build) condition was completed for the intersection using Rodel software and the 2045 forecast traffic volumes. The results of the analysis for roundabout (build) conditions reveal that all approaches and movements at the intersection operate at LOS A during the AM and PM peak hours.

The 95<sup>th</sup> percentile queue lengths were reviewed, and results showed that all approaches would experience a maximum queue length of 0.8 vehicles during the AM peak hour and 1.7 vehicles in the PM peak hour for the single-lane roundabout design.

The operational results for future roundabout (build) conditions are presented in Table 23.

**Table 23: Operational Analysis for 2045 with Roundabout**

Intersection	Approach	AM Peak		PM Peak	
		Delay/LOS	Queue (veh)*	Delay/LOS	Queue (veh)*
Lennon Road and Elms Road	Eastbound (NE)	3.7/A	0.3	3.9/A	0.3
	Westbound (SW)	3.7/A	0.3	4.7/A	1.0
	Northbound	3.9/A	0.7	4.8/A	1.7
	Southbound	4.0/A	0.8	4.9/A	1.7
	<b>Overall</b>	<b>3.9/A</b>		<b>4.8/A</b>	

\* 95<sup>th</sup> percentile queue length

An opinion of probable cost was developed for the single-lane roundabout. The probable cost is \$1.36 million in year 2025 dollars. This cost includes a 20 percent contingency and 3 percent annual inflation. A full breakdown along with all assumptions can be found in Appendix 3.

Potential funding sources for this improvement could include regular road improvement funding or an earmark.

**Recommendation**

A roundabout appears feasible at this location, assuming GCRC can acquire the limited right-of-way that may be needed.

PLOT INFO: Z:\2020\201202\CAD\PRECEDLENNON AND ELMS.DWG LAYOUT: LAYOUT1 DATE: 6/2/2021 TIME: 8:32:37 PM USER: A.LEPPEK

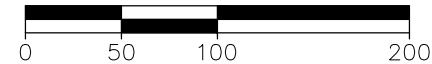
CONCEPT PLAN – FOR DISCUSSION PURPOSES ONLY



NORTH

SINGLE LANE ROUNDABOUT  
LENNON & ELMS

SCALE: 1" = 100'



Hard copy is intended to be 11"x17" when plotted. Scale(s) indicated and graphic quality may not be accurate for any other size.

6/2/2021

PROJECT NO.

FIGURE NO.

45

Lennon Road & Elms Road - TMC

Tue Mar 9, 2021

Full Length (7 AM-9 AM, 4 PM-6 PM)

All Classes (Lights, Single-Unit Trucks, Articulated Trucks, Buses, Pedestrians, Bicycles on Road, Bicycles on Crosswalk)

All Movements

ID: 817405, Location: 42.986615, -83.811726



Provided by: Gewalt Hamilton Associates Inc.  
625 Forest Edge Drive, Vernon Hills, IL, 60061, US

Leg Direction	Lennon Rd Eastbound						Lennon Rd Westbound						Elms Rd Northbound						Elms Rd Southbound						Int
Time	L	T	R	U	App	Ped*	L	T	R	U	App	Ped*	L	T	R	U	App	Ped*	L	T	R	U	App	Ped*	
2021-03-09 7:00AM	1	6	2	0	9	0	1	9	3	0	13	0	3	16	1	0	20	0	6	31	2	0	39	0	81
7:15AM	1	11	4	0	16	0	1	11	7	0	19	0	2	20	3	0	25	0	10	45	4	0	59	0	119
7:30AM	2	15	4	0	21	0	2	4	4	0	10	0	0	28	10	0	38	0	7	32	0	0	39	0	108
7:45AM	1	17	2	0	20	0	3	7	2	0	12	0	1	40	7	0	48	0	19	26	1	0	46	0	126
Hourly Total	5	49	12	0	66	0	7	31	16	0	54	0	6	104	21	0	131	0	42	134	7	0	183	0	434
8:00AM	0	5	4	0	9	0	8	6	4	0	18	0	2	27	7	0	36	0	6	41	5	0	52	0	115
8:15AM	2	10	5	0	17	0	11	6	3	0	20	0	2	29	10	0	41	0	10	35	0	0	45	0	123
8:30AM	3	8	4	0	15	0	6	6	4	0	16	0	1	27	5	0	33	0	10	34	3	0	47	0	111
8:45AM	4	10	2	0	16	0	5	9	4	0	18	0	4	29	5	0	38	0	7	28	1	0	36	0	108
Hourly Total	9	33	15	0	57	0	30	27	15	0	72	0	9	112	27	0	148	0	33	138	9	0	180	0	457
4:00PM	5	12	1	0	18	0	8	25	16	0	49	0	4	61	12	0	77	0	10	42	3	0	55	0	199
4:15PM	4	12	1	0	17	0	5	17	20	0	42	0	5	64	11	0	80	0	11	43	3	0	57	0	196
4:30PM	4	7	3	0	14	0	15	9	19	0	43	0	10	52	7	0	69	0	11	68	2	0	81	0	207
4:45PM	2	13	3	0	18	0	15	21	8	0	44	0	3	72	7	0	82	0	10	49	4	0	63	0	207
Hourly Total	15	44	8	0	67	0	43	72	63	0	178	0	22	249	37	0	308	0	42	202	12	0	256	0	809
5:00PM	5	5	1	0	11	0	12	24	30	0	66	0	6	57	10	0	73	0	10	57	7	0	74	0	224
5:15PM	4	11	1	0	16	0	5	17	14	0	36	0	7	65	9	0	81	0	12	55	8	0	75	0	208
5:30PM	6	11	1	0	18	0	9	19	17	0	45	0	3	53	8	0	64	0	8	45	5	0	58	0	185
5:45PM	3	8	0	0	11	0	8	13	8	0	29	0	3	40	9	0	52	0	11	41	0	0	52	0	144
Hourly Total	18	35	3	0	56	0	34	73	69	0	176	0	19	215	36	0	270	0	41	198	20	0	259	0	761
<b>Total</b>	47	161	38	0	246	0	114	203	163	0	480	0	56	680	121	0	857	0	158	672	48	0	878	0	2461
<b>% Approach</b>	19.1%	65.4%	15.4%	0%	-	-	23.8%	42.3%	34.0%	0%	-	-	6.5%	79.3%	14.1%	0%	-	-	18.0%	76.5%	5.5%	0%	-	-	-
<b>% Total</b>	1.9%	6.5%	1.5%	0%	10.0%	-	4.6%	8.2%	6.6%	0%	19.5%	-	2.3%	27.6%	4.9%	0%	34.8%	-	6.4%	27.3%	2.0%	0%	35.7%	-	-
<b>Lights</b>	47	158	38	0	243	-	111	199	159	0	469	-	55	673	120	0	848	-	155	666	47	0	868	-	2428
<b>% Lights</b>	100%	98.1%	100%	0%	98.8%	-	97.4%	98.0%	97.5%	0%	97.7%	-	98.2%	99.0%	99.2%	0%	98.9%	-	98.1%	99.1%	97.9%	0%	98.9%	-	98.7%
<b>Single-Unit Trucks</b>	0	0	0	0	0	-	1	2	1	0	4	-	1	5	1	0	7	-	0	2	0	0	2	-	13
<b>% Single-Unit Trucks</b>	0%	0%	0%	0%	0%	-	0.9%	1.0%	0.6%	0%	0.8%	-	1.8%	0.7%	0.8%	0%	0.8%	-	0%	0.3%	0%	0%	0.2%	-	0.5%
<b>Articulated Trucks</b>	0	2	0	0	2	-	1	1	1	0	3	-	0	0	0	0	0	-	1	1	0	0	2	-	7
<b>% Articulated Trucks</b>	0%	1.2%	0%	0%	0.8%	-	0.9%	0.5%	0.6%	0%	0.6%	-	0%	0%	0%	0%	0%	-	0.6%	0.1%	0%	0%	0.2%	-	0.3%
<b>Buses</b>	0	1	0	0	1	-	1	1	2	0	4	-	0	2	0	0	2	-	2	3	1	0	6	-	13
<b>% Buses</b>	0%	0.6%	0%	0%	0.4%	-	0.9%	0.5%	1.2%	0%	0.8%	-	0%	0.3%	0%	0%	0.2%	-	1.3%	0.4%	2.1%	0%	0.7%	-	0.5%
<b>Bicycles on Road</b>	0	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0
<b>% Bicycles on Road</b>	0%	0%	0%	0%	0%	-	0%	0%	0%	0%	0%	-	0%	0%	0%	0%	0%	-	0%	0%	0%	0%	0%	-	0%
<b>Pedestrians</b>	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-
<b>% Pedestrians</b>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<b>Bicycles on Crosswalk</b>	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-
<b>% Bicycles on Crosswalk</b>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

\*Pedestrians and Bicycles on Crosswalk. L: Left, R: Right, T: Thru, U: U-Turn

Lennon Road & Elms Road - TMC

Tue Mar 9, 2021

Full Length (7 AM-9 AM, 4 PM-6 PM)

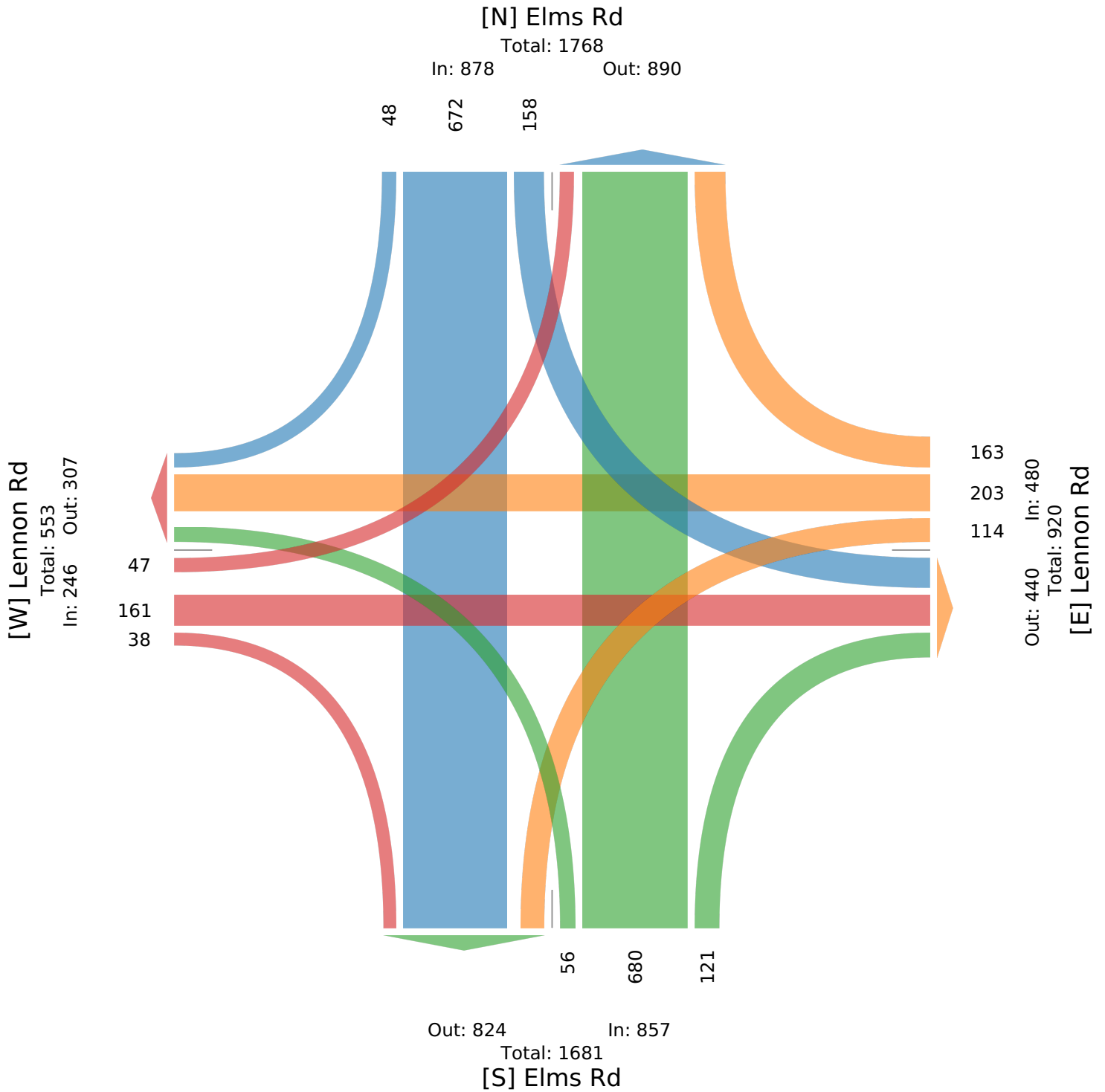
All Classes (Lights, Single-Unit Trucks, Articulated Trucks, Buses, Pedestrians, Bicycles on Road, Bicycles on Crosswalk)

All Movements

ID: 817405, Location: 42.986615, -83.811726



Provided by: Gewalt Hamilton Associates Inc.  
625 Forest Edge Drive, Vernon Hills, IL, 60061, US



Lennon Road & Elms Road - TMC

Tue Mar 9, 2021

AM Peak (7:45 AM - 8:45 AM)

All Classes (Lights, Single-Unit Trucks, Articulated Trucks, Buses, Pedestrians, Bicycles on Road, Bicycles on Crosswalk)

All Movements

ID: 817405, Location: 42.986615, -83.811726



Provided by: Gewalt Hamilton Associates Inc.  
625 Forest Edge Drive, Vernon Hills, IL, 60061, US

Leg Direction	Lennon Rd Eastbound					Lennon Rd Westbound					Elms Rd Northbound					Elms Rd Southbound									
Time	L	T	R	U	App Ped*	L	T	R	U	App Ped*	L	T	R	U	App Ped*	L	T	R	U	App Ped*	Int				
2021-03-09 7:45AM	1	17	2	0	20	0	3	7	2	0	12	0	1	40	7	0	48	0	19	26	1	0	46	0	126
8:00AM	0	5	4	0	9	0	8	6	4	0	18	0	2	27	7	0	36	0	6	41	5	0	52	0	115
8:15AM	2	10	5	0	17	0	11	6	3	0	20	0	2	29	10	0	41	0	10	35	0	0	45	0	123
8:30AM	3	8	4	0	15	0	6	6	4	0	16	0	1	27	5	0	33	0	10	34	3	0	47	0	111
<b>Total</b>	6	40	15	0	61	0	28	25	13	0	66	0	6	123	29	0	158	0	45	136	9	0	190	0	475
<b>% Approach</b>	9.8%	65.6%	24.6%	0%	-	42.4%	37.9%	19.7%	0%	-	3.8%	77.8%	18.4%	0%	-	23.7%	71.6%	4.7%	0%	-	-	-	-	-	-
<b>% Total</b>	1.3%	8.4%	3.2%	0%	12.8%	-	5.9%	5.3%	2.7%	0%	13.9%	-	1.3%	25.9%	6.1%	0%	33.3%	-	9.5%	28.6%	1.9%	0%	40.0%	-	-
<b>PHF</b>	0.500	0.588	0.750	-	0.763	-	0.636	0.893	0.813	-	0.825	-	0.750	0.769	0.725	-	0.823	-	0.592	0.829	0.450	-	0.913	-	0.942
<b>Lights</b>	6	39	15	0	60	-	27	21	13	0	61	-	6	120	29	0	155	-	43	134	9	0	186	-	462
<b>% Lights</b>	100%	97.5%	100%	0%	98.4%	-	96.4%	84.0%	100%	0%	92.4%	-	100%	97.6%	100%	0%	98.1%	-	95.6%	98.5%	100%	0%	97.9%	-	97.3%
<b>Single-Unit Trucks</b>	0	0	0	0	0	-	0	2	0	0	2	-	0	1	0	0	1	-	0	1	0	0	1	-	4
<b>% Single-Unit Trucks</b>	0%	0%	0%	0%	0%	-	0%	8.0%	0%	0%	3.0%	-	0%	0.8%	0%	0%	0.6%	-	0%	0.7%	0%	0%	0.5%	-	0.8%
<b>Articulated Trucks</b>	0	1	0	0	1	-	0	1	0	0	1	-	0	0	0	0	0	-	0	1	0	0	1	-	3
<b>% Articulated Trucks</b>	0%	2.5%	0%	0%	1.6%	-	0%	4.0%	0%	0%	1.5%	-	0%	0%	0%	0%	0%	-	0%	0.7%	0%	0%	0.5%	-	0.6%
<b>Buses</b>	0	0	0	0	0	-	1	1	0	0	2	-	0	2	0	0	2	-	2	0	0	0	2	-	6
<b>% Buses</b>	0%	0%	0%	0%	0%	-	3.6%	4.0%	0%	0%	3.0%	-	0%	1.6%	0%	0%	1.3%	-	4.4%	0%	0%	0%	1.1%	-	1.3%
<b>Bicycles on Road</b>	0	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0
<b>% Bicycles on Road</b>	0%	0%	0%	0%	0%	-	0%	0%	0%	0%	0%	-	0%	0%	0%	0%	0%	-	0%	0%	0%	0%	0%	-	0%
Pedestrians	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	-	0
% Pedestrians	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bicycles on Crosswalk	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	-	0
% Bicycles on Crosswalk	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

\* Pedestrians and Bicycles on Crosswalk. L: Left, R: Right, T: Thru, U: U-Turn



**Lennon Road & Elms Road - TMC**

Tue Mar 9, 2021

AM Peak (7:45 AM - 8:45 AM)

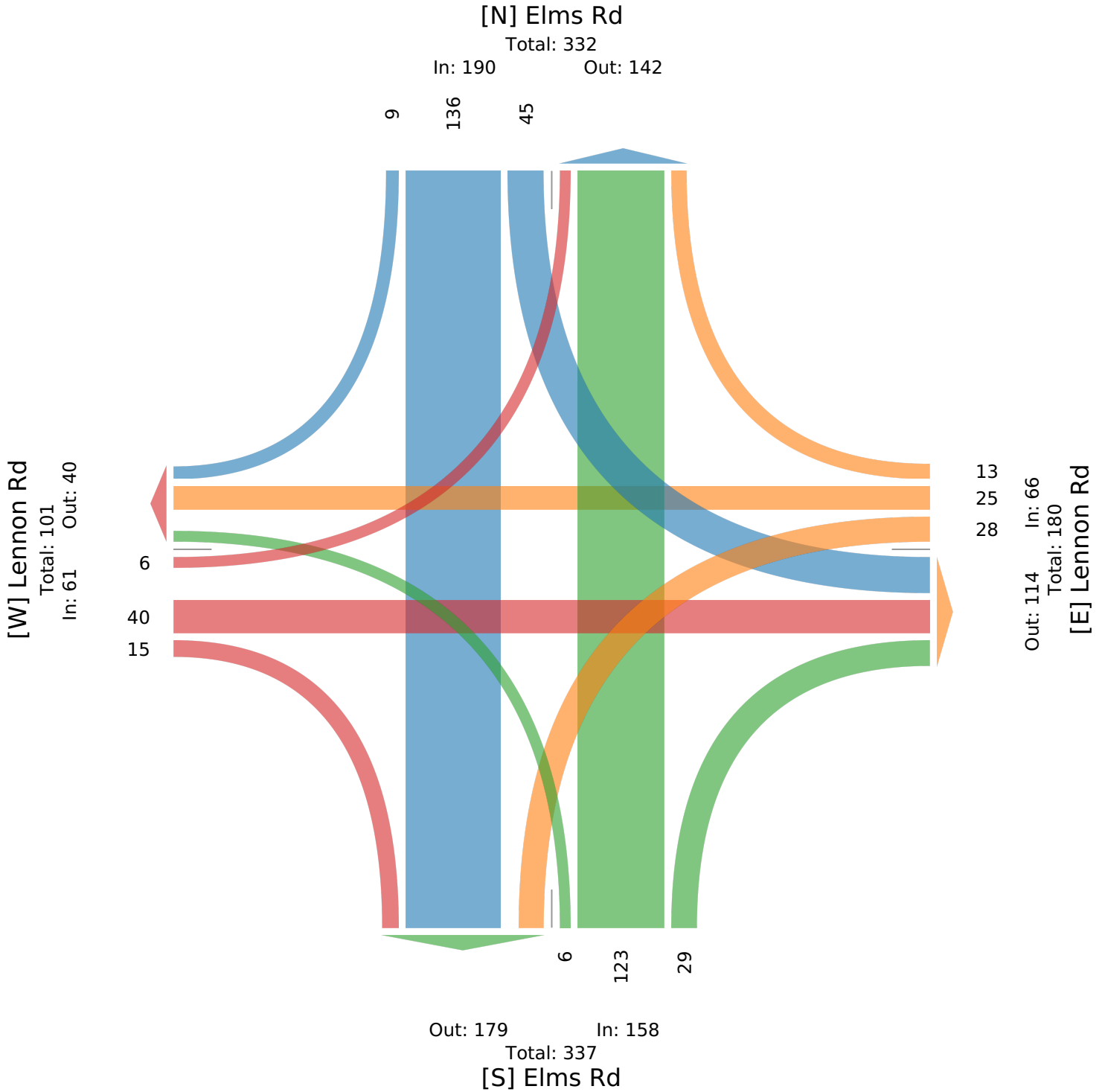
All Classes (Lights, Single-Unit Trucks, Articulated Trucks, Buses, Pedestrians, Bicycles on Road, Bicycles on Crosswalk)

All Movements

ID: 817405, Location: 42.986615, -83.811726



Provided by: Gewalt Hamilton Associates Inc.  
625 Forest Edge Drive, Vernon Hills, IL, 60061, US



Lennon Road & Elms Road - TMC

Tue Mar 9, 2021

PM Peak (4:30 PM - 5:30 PM) - Overall Peak Hour

All Classes (Lights, Single-Unit Trucks, Articulated Trucks, Buses, Pedestrians, Bicycles on Road, Bicycles on Crosswalk)

All Movements

ID: 817405, Location: 42.986615, -83.811726



Provided by: Gewalt Hamilton Associates Inc.  
625 Forest Edge Drive, Vernon Hills, IL, 60061, US

Leg Direction	Lennon Rd Eastbound					Lennon Rd Westbound					Elms Rd Northbound					Elms Rd Southbound									
Time	L	T	R	U	App Ped*	L	T	R	U	App Ped*	L	T	R	U	App Ped*	L	T	R	U	App Ped*	Int				
2021-03-09 4:30PM	4	7	3	0	14	0	15	9	19	0	43	0	10	52	7	0	69	0	11	68	2	0	81	0	207
4:45PM	2	13	3	0	18	0	15	21	8	0	44	0	3	72	7	0	82	0	10	49	4	0	63	0	207
5:00PM	5	5	1	0	11	0	12	24	30	0	66	0	6	57	10	0	73	0	10	57	7	0	74	0	224
5:15PM	4	11	1	0	16	0	5	17	14	0	36	0	7	65	9	0	81	0	12	55	8	0	75	0	208
<b>Total</b>	15	36	8	0	59	0	47	71	71	0	189	0	26	246	33	0	305	0	43	229	21	0	293	0	846
<b>% Approach</b>	25.4%	61.0%	13.6%	0%	-	-	24.9%	37.6%	37.6%	0%	-	-	8.5%	80.7%	10.8%	0%	-	-	14.7%	78.2%	7.2%	0%	-	-	-
<b>% Total</b>	1.8%	4.3%	0.9%	0%	7.0%	-	5.6%	8.4%	8.4%	0%	22.3%	-	3.1%	29.1%	3.9%	0%	36.1%	-	5.1%	27.1%	2.5%	0%	34.6%	-	-
<b>PHF</b>	0.750	0.692	0.667	-	0.819	-	0.783	0.740	0.592	-	0.716	-	0.650	0.854	0.825	-	0.930	-	0.896	0.842	0.656	-	0.904	-	0.944
<b>Lights</b>	15	36	8	0	59	-	47	71	70	0	188	-	26	244	32	0	302	-	42	227	21	0	290	-	839
<b>% Lights</b>	100%	100%	100%	0%	100%	-	100%	100%	98.6%	0%	99.5%	-	100%	99.2%	97.0%	0%	99.0%	-	97.7%	99.1%	100%	0%	99.0%	-	99.2%
<b>Single-Unit Trucks</b>	0	0	0	0	0	-	0	0	1	0	1	-	0	2	1	0	3	-	0	1	0	0	1	-	5
<b>% Single-Unit Trucks</b>	0%	0%	0%	0%	0%	-	0%	0%	1.4%	0%	0.5%	-	0%	0.8%	3.0%	0%	1.0%	-	0%	0.4%	0%	0%	0.3%	-	0.6%
<b>Articulated Trucks</b>	0	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	1	0	0	0	1	-	1
<b>% Articulated Trucks</b>	0%	0%	0%	0%	0%	-	0%	0%	0%	0%	0%	-	0%	0%	0%	0%	0%	-	2.3%	0%	0%	0%	0.3%	-	0.1%
<b>Buses</b>	0	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	1	0	0	1	-	1
<b>% Buses</b>	0%	0%	0%	0%	0%	-	0%	0%	0%	0%	0%	-	0%	0%	0%	0%	0%	-	0%	0.4%	0%	0%	0.3%	-	0.1%
<b>Bicycles on Road</b>	0	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0
<b>% Bicycles on Road</b>	0%	0%	0%	0%	0%	-	0%	0%	0%	0%	0%	-	0%	0%	0%	0%	0%	-	0%	0%	0%	0%	0%	-	0%
<b>Pedestrians</b>	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-
<b>% Pedestrians</b>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<b>Bicycles on Crosswalk</b>	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-
<b>% Bicycles on Crosswalk</b>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

\*Pedestrians and Bicycles on Crosswalk. L: Left, R: Right, T: Thru, U: U-Turn

**Lennon Road & Elms Road - TMC**

Tue Mar 9, 2021

PM Peak (4:30 PM - 5:30 PM) - Overall Peak Hour

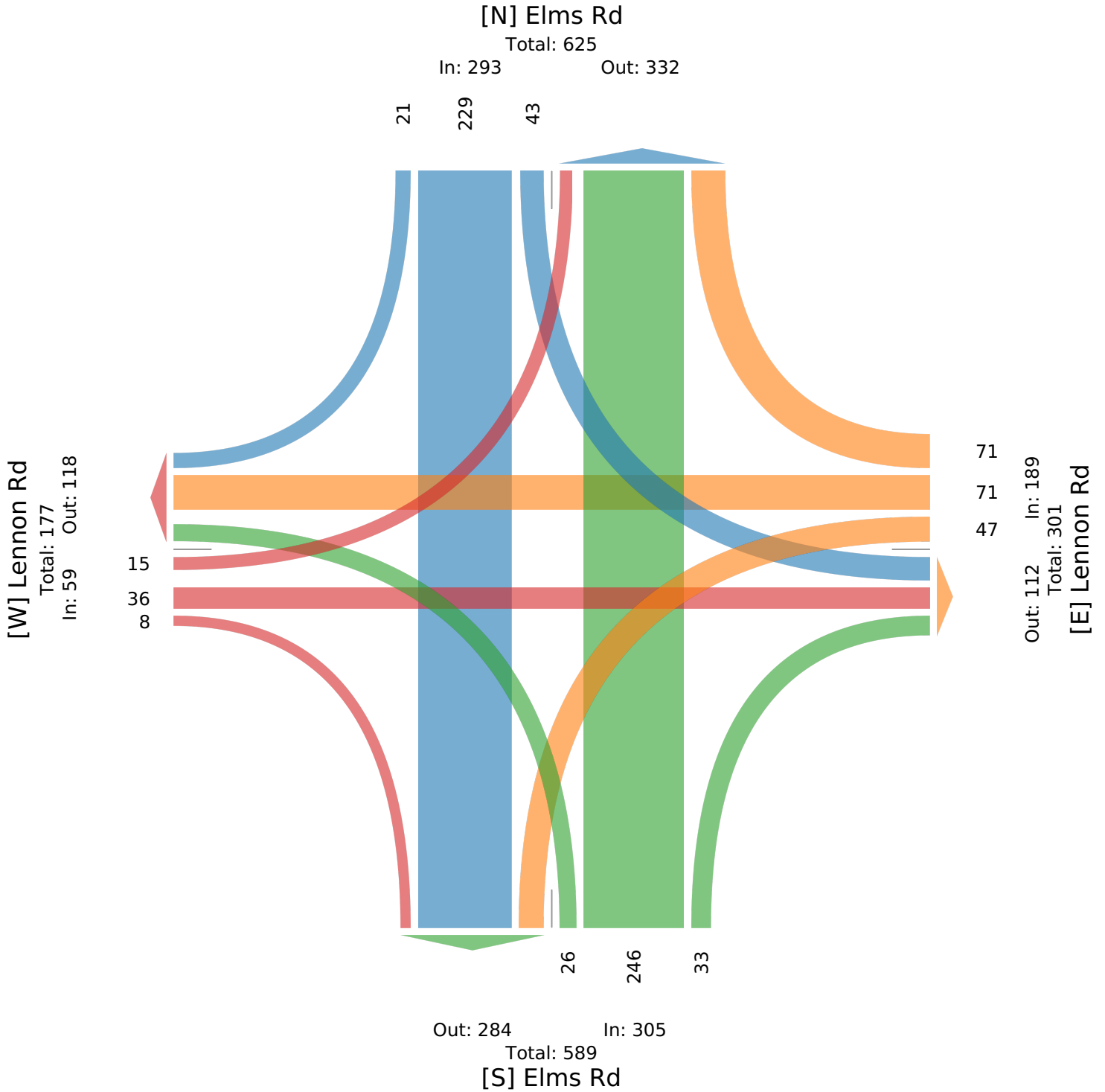
All Classes (Lights, Single-Unit Trucks, Articulated Trucks, Buses, Pedestrians, Bicycles on Road, Bicycles on Crosswalk)

All Movements

ID: 817405, Location: 42.986615, -83.811726



Provided by: Gewalt Hamilton Associates Inc.  
625 Forest Edge Drive, Vernon Hills, IL, 60061, US



Intersection	
Intersection Delay, s/veh	10
Intersection LOS	A

Movement	NBL	NBT	NBR	SBL	SBT	SBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	8	160	38	59	177	12	8	52	20	36	33	17
Future Vol, veh/h	8	160	38	59	177	12	8	52	20	36	33	17
Peak Hour Factor	0.82	0.82	0.82	0.94	0.94	0.94	0.76	0.76	0.76	0.82	0.82	0.82
Heavy Vehicles, %	2	2	2	3	3	3	2	2	2	8	8	8
Mvmt Flow	10	195	46	63	188	13	11	68	26	44	40	21
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	NB	SB	NE	SW
Opposing Approach	SB	NB	SW	NE
Opposing Lanes	1	1	1	1
Conflicting Approach Left	NE	SW	SB	NB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	SW	NE	NB	SB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	10.1	10.5	9.2	9.4
HCM LOS	B	B	A	A

Lane	NELn1	NBLn1	SBLn1	SWLn1
Vol Left, %	10%	4%	24%	42%
Vol Thru, %	65%	78%	71%	38%
Vol Right, %	25%	18%	5%	20%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	80	206	248	86
LT Vol	8	8	59	36
Through Vol	52	160	177	33
RT Vol	20	38	12	17
Lane Flow Rate	105	251	264	105
Geometry Grp	1	1	1	1
Degree of Util (X)	0.151	0.328	0.353	0.156
Departure Headway (Hd)	5.162	4.697	4.813	5.354
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	687	759	741	663
Service Time	3.251	2.765	2.88	3.445
HCM Lane V/C Ratio	0.153	0.331	0.356	0.158
HCM Control Delay	9.2	10.1	10.5	9.4
HCM Lane LOS	A	B	B	A
HCM 95th-tile Q	0.5	1.4	1.6	0.6

Intersection: 9004: Lennon Rd & Elms Rd

Movement	NB	SB	NE	SW
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (ft)	63	71	56	65
Average Queue (ft)	21	28	24	26
95th Queue (ft)	49	58	44	51
Link Distance (ft)	564	556	570	578
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Network Summary

Network wide Queuing Penalty: 0

Intersection	
Intersection Delay, s/veh	23.3
Intersection LOS	C

Movement	NBL	NBT	NBR	SBL	SBT	SBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	34	320	43	56	298	27	20	47	10	61	92	92
Future Vol, veh/h	34	320	43	56	298	27	20	47	10	61	92	92
Peak Hour Factor	0.93	0.93	0.93	0.90	0.90	0.90	0.82	0.82	0.82	0.72	0.72	0.72
Heavy Vehicles, %	1	1	1	1	1	1	0	0	0	1	1	1
Mvmt Flow	37	344	46	62	331	30	24	57	12	85	128	128
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	NB	SB	NE	SW
Opposing Approach	SB	NB	SW	NE
Opposing Lanes	1	1	1	1
Conflicting Approach Left	NE	SW	SB	NB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	SW	NE	NB	SB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	25.7	25.7	12.6	20.1
HCM LOS	D	D	B	C

Lane	NELn1	NBLn1	SBLn1	SWLn1
Vol Left, %	26%	9%	15%	25%
Vol Thru, %	61%	81%	78%	38%
Vol Right, %	13%	11%	7%	38%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	77	397	381	245
LT Vol	20	34	56	61
Through Vol	47	320	298	92
RT Vol	10	43	27	92
Lane Flow Rate	94	427	423	340
Geometry Grp	1	1	1	1
Degree of Util (X)	0.2	0.746	0.744	0.623
Departure Headway (Hd)	7.665	6.292	6.33	6.596
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	471	572	567	544
Service Time	5.665	4.371	4.409	4.677
HCM Lane V/C Ratio	0.2	0.747	0.746	0.625
HCM Control Delay	12.6	25.7	25.7	20.1
HCM Lane LOS	B	D	D	C
HCM 95th-tile Q	0.7	6.5	6.4	4.2

Intersection: 9005: Lennon Rd & Elms Rd

Movement	NB	SB	NE	SW
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (ft)	224	210	54	169
Average Queue (ft)	74	73	26	62
95th Queue (ft)	158	167	46	126
Link Distance (ft)	564	556	569	578
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Network Summary

Network wide Queuing Penalty: 0

# Lennon & Elms AM Peak

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File View Help



Project: Lennon & Elms    Date: 21-May-2021    Model: Rodel 2017    Timeslice: 7.5    Full Geometry    Peak: AM    Feet: RHD  
 Name: Standard Roundabout    Flows: 2045    Delay: Queuing    Results: Veh    Peak60/15m    Synthetic Flow Profile    Conf: 50    Light: 58

Approach Geometry					Entry Geometry					Circ Geom			Exit Geometry				Entry Capacity Mods	
Leg Name	Bearing	G	V	n	E	n	L'	R	Φ	D	C	n	Ex	n	Vx	n	→ Cap (v/h)	Xwalk Fact
1 SB Elms	Y	0	0	11.00	18.00	1	30.00	75.00	30.00	140.00	20.00	1	18.00	1	11.00	1	0	1.000
2 EB Lennon	Y	90	0	11.00	18.00	1	30.00	75.00	30.00	140.00	20.00	1	18.00	1	11.00	1	0	1.000
3 NB Elms	Y	180	0	11.00	18.00	1	30.00	75.00	30.00	140.00	20.00	1	18.00	1	11.00	1	0	1.000
4 WB Lennon	Y	270	0	11.00	18.00	1	30.00	75.00	30.00	140.00	20.00	1	18.00	1	11.00	1	0	1.000

Volume Modifiers			Turning Volumes (veh/hr)						Arrival Volume Ratios			Arrival Volume Times (min)			PHF
Leg Name	%Truck	Factor	U-Turn	Exit-3	Exit-2	Exit-1	Bypass	Ratio1	Ratio2	Ratio3	Time1	Time2	Time3		
1 SB Elms	2.1	1.00	0	59	177	12	0	0.750	1.125	0.750	0	30	60		
2 EB Lennon	1.6	1.00	0	8	52	20	0	0.750	1.125	0.750	0	30	60		
3 NB Elms	1.9	1.00	0	8	160	38	0	0.750	1.125	0.750	0	30	60		
4 WB Lennon	7.6	1.00	0	36	33	17	0	0.750	1.125	0.750	0	30	60		

Calibration     Accidents     Economics     Bypass    Run

	Peak 60min Results	Bypass Type	Flow Rate (veh/hr)		Opp Rate (veh/hr)		Capacity (veh/hr)		Ave VCR		Ave Del (sec/veh)		Max Q (veh)		Max Q95% (veh)		LOS A-F		
			Entry	Bypass	Entry	Bypass	Entry	Bypass	Entry	Bypass	Entry	Bypass	Leg	Entry	Bypass	Entry	Bypass	Entry	By
1	SB Elms	None	248		77		1143		0.2169		3.95		3.95	0.32		0.84		A	A
2	EB Lennon	None	80		272		1050		0.0762		3.68		3.68	0.09		0.25		A	A
3	NB Elms	None	206		119		1127		0.1828		3.85		3.85	0.26		0.68		A	A
4	WB Lennon	None	86		176		983		0.0875		3.73		3.73	0.10		0.27		A	A
All	Intersection										3.85								A

Results 60     Results 15     Int / Slope - 60     Int / Slope - 15     Economics     Global Results

# Lennon & Elms PM Peak

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File View Help



Project: Lennon & Elms    Date: 21-May-2021    Model: Rodel 2017    Timeslice: 7.5    Full Geometry    Peak: PM    Feet: RHD  
 Name: Standard Roundabout    Flows: 2045    Delay: Queuing    Results: Veh    Peak60/15m    Synthetic Flow Profile    Conf: 50    Light: 60

Approach Geometry					Entry Geometry					Circ Geom			Exit Geometry				Entry Capacity Mods	
Leg Name	Bearing	G	V	n	E	n	L'	R	Φ	D	C	n	Ex	n	Vx	n	→ Cap (v/h)	Xwalk Fact
1 SB Elms	Y	0	0	11.00	18.00	1	30.00	75.00	30.00	140.00	20.00	1	18.00	1	11.00	1	0	1.000
2 EB Lennon	Y	90	0	11.00	18.00	1	30.00	75.00	30.00	140.00	20.00	1	18.00	1	11.00	1	0	1.000
3 NB Elms	Y	180	0	11.00	18.00	1	30.00	75.00	30.00	140.00	20.00	1	18.00	1	11.00	1	0	1.000
4 WB Lennon	Y	270	0	11.00	18.00	1	30.00	75.00	30.00	140.00	20.00	1	18.00	1	11.00	1	0	1.000

Volume Modifiers			Turning Volumes (veh/hr)						Arrival Volume Ratios			Arrival Volume Times (min)			PHF
Leg Name	%Truck	Factor	U-Turn	Exit-3	Exit-2	Exit-1	Bypass	Ratio1	Ratio2	Ratio3	Time1	Time2	Time3		
1 SB Elms	1.0	1.00	0	56	298	27	0	0.750	1.125	0.750	0	30	60		
2 EB Lennon	0.0	1.00	0	20	47	10	0	0.750	1.125	0.750	0	30	60		
3 NB Elms	1.0	1.00	0	34	320	43	0	0.750	1.125	0.750	0	30	60		
4 WB Lennon	0.5	1.00	0	61	92	92	0	0.750	1.125	0.750	0	30	60		

Calibration     Accidents     Economics     Bypass    Run

	Peak 60min Results	Bypass Type	Flow Rate (veh/hr)		Opp Rate (veh/hr)		Capacity (veh/hr)		Ave VCR		Ave Del (sec/veh)		Max Q (veh)		Max Q95% (veh)		LOS A-F		
			Entry	Bypass	Entry	Bypass	Entry	Bypass	Entry	Bypass	Entry	Bypass	Leg	Entry	Bypass	Entry	Bypass	Entry	By
1	SB Elms	None	381		187		1111		0.3428		4.92		4.92	0.63		1.65		A	A
2	EB Lennon	None	77		415		1007		0.0765		3.91		3.91	0.10		0.26		A	A
3	NB Elms	None	397		123		1146		0.3464		4.80		4.80	0.64		1.66		A	A
4	WB Lennon	None	245		374		1019		0.2403		4.68		4.68	0.38		1.01		A	A
All	Intersection										4.75								A

Results 60     Results 15     Int / Slope - 60     Int / Slope - 15     Economics     Global Results



**Intersection**

Lennon Road &amp; Elms Road

Opinion of Probable Cost

By: Fishbeck  
Date: 5/21/2021

PAY ITEM DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	AMOUNT
Mobilization (10%)	1	LSUM	\$91,500.00	\$91,500.00
Pavt, Rem	6140	Syd	\$10.00	\$61,400.00
Curb and Gutter, Rem	80	Ft	\$10.00	\$800.00
Embankment, CIP	1200	Cyd	\$15.00	\$18,000.00
Excavation, Earth	1750	Cyd	\$10.00	\$17,500.00
Aggregate Base	3110	Ton	\$21.00	\$65,310.00
Shoulder, CI II	155	Ton	\$25.00	\$3,875.00
HMA Approach	65	Ton	\$50.00	\$3,250.00
Conc Pavt, Nonreinf, 8 inch	6315	Syd	\$45.00	\$284,175.00
Joint, Contraction, Cp	4475	Ft	\$10.00	\$44,750.00
Joint, Expansion, E3	175	Ft	\$15.00	\$2,625.00
Driveway, Nonreinf Conc, 9 inch	120	Syd	\$50.00	\$6,000.00
Curb and Gutter, Conc, Det B1	1895	Ft	\$25.00	\$47,375.00
Curb and Gutter, Conc, Det D1	1445	Ft	\$25.00	\$36,125.00
Curb and Gutter, Conc, Det E1	170	Ft	\$20.00	\$3,400.00
Driveway Opening, Conc, Det M	85	Ft	\$22.00	\$1,870.00
Conc Pavt, Decorative Colored, 9 inch	7050	Sft	\$12.50	\$88,125.00
Turf Establishment, Performance	6550	Syd	\$5.00	\$32,750.00
Signal Removal	1	LSUM	\$2,000.00	\$2,000.00
Drainage	1	LSUM	\$90,000.00	\$90,000.00
MOT	1	LSUM	\$68,000.00	\$68,000.00
Pavement Markings	1	LSUM	\$17,500.00	\$17,500.00
Signing	1	LSUM	\$20,000.00	\$20,000.00
<b>ESTIMATED CONSTRUCTION COST</b>				<b>\$1,006,330</b>

	<i>CONTINGENCY (20%)</i>	\$201,266.0
<b>ESTIMATED TOTAL CONSTRUCTION COST (YEAR 2021)</b>		<b>\$1,207,596.0</b>
	<i>3% ANNUAL INFLATION 2021 TO 2025</i>	\$151,563.94
<b>ESTIMATED TOTAL CONSTRUCTION COST (YEAR 2025)</b>		<b>\$1,359,159.94</b>

**Assumptions:**

Full Depth Reconstruct assumed for all pavements (HMA base crushing and shaping or cold milling and overlay could be utilized as a cost savings)

Pavement section assumed to be 8" Nonreinforced Concrete over 6" Aggregate Base for roadway

HMA Driveway section assumed to be 3" HMA over 6" Aggregate Base

Existing Gravel Drives paved with HMA to ROW or 20', whichever comes first

HMA and Concrete removal incorporated under Pavt, Rem

Joints assumed for central island/splitter islands

Drainage includes enclosed storm for all curbed areas, spillways, and underdrain.

MOT taken as approximately ~8% of total before mobilization; based on previous roundabout projects

ROW acquisition costs not included

**NUMBER OF CRASHES OR INJURED PERSONS.**

	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
	2015	2016	2017	2018	2019

<b>Fatal and A-Injury Reduction</b>	%REDUCTION	78%	Roundabout		
Number of Crashes	0	0	0	0	0

A-Injured or Killed Persons	0	0	0	0	0
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<b>Minor Crash Reduction</b>	%REDUCTION	57%	0		
Number of Crashes	0	0	0	0	15
	0	0	0	0	12
	0	0	0	0	4

	%REDUCTION	0%			
Number of Crashes	0	0	0	0	0
	0	0	0	0	0
	0	0	0	0	0
A-Injured or Killed Persons	0	0	0	0	0

	%REDUCTION	0%			
Number of Crashes	0	0	0	0	0
	0	0	0	0	0
	0	0	0	0	0
A-Injured or Killed Persons	0	0	0	0	0

	%REDUCTION	0%			
Number of Crashes	0	0	0	0	0
	0	0	0	0	0
	0	0	0	0	0
A-Injured or Killed Persons	0	0	0	0	0

# of A-injuries: 0 For reference only  
 # of Fatalities: 0 For reference only; "Q" accounts

PROJECT COST ESTIMATE : \$1,359,160 for the risk of a fatality. If unknown, enter "0" (zero).  
 ADTb (before-volume) 1.0 You may change these  
 ADTa (after-volume) 1.1 default ADT values.  
 # OF YEARS OF DATA: 5.00 3 to 5 years should be used.  
 RATE OF INFLATION: 2.50%  
 AREA TYPE: Urban "Rural", "Urban", or "Between"

**REMARKS:**

Lennon Road and Elms Road  
 Genesee County Roundabout Study  
 1494105, 1523901  
 5.9280097, 5.0555258  
 Roundabout

**COMPUTED BENEFITS DERIVED THROUGH CRASH REDUCTION**

**TOR 2021**

Date **9-Jul-21**

Project: **Lennon Road and Elms Road**

City/Twp. **Flint Township**

Prepared By: **ROWE Professional Services Company**

County **Genesee County**

PR: **1494105, 1523901**

PR MP Range: **5.9280097, 5.0555258**

The method of evaluating crash costs, used below, is given on page 67 of Roy Jorgensen's report of Highway Safety Improvement Criteria, 1966 edition. This same method is given in the Bureau of Public Roads IM21-3-67. In 1994 we have adapted the Q formula to blend Fatalities and A-injuries only.

In the following analysis the costs provided by the National Safety Council are :

**2019 NSC VALUES:**

Death	\$1,659,000	=FATCOST
Disabling (A) injury:	\$96,200	=ACOST
B-injury:	\$27,800	=BCOST
PDO and/or Minor Injury Crash:	\$12,200	=PDOCOST

$BTOTAL = ADTa / ADTb \times [(Q \times R1) + (BCOST \times R2) + (PDOCOST \times R3)]$

WHERE:

BTOTAL =	Total Benefit in Dollars Over Years Used	\$161,515
ADTa =	Average traffic volume after the improvement	1.1
ADTb =	Average traffic volume before the improvement	1.0
R1 =	Reduction in fatalities and A-Injuries Combined.	0.0
R2 =	Reduction in B-Injury crashes:	2.3
R3 =	Reduction in PDO and C-injury crashes:	6.8
Q =	$[FATCOST + ((I/F) \times INJCOST)] / [1 + (I/F)]$	
=	$[1,659,000 + (6.10 \times 96,200)] / [1 + 6.10]$	\$316,400
	for AREA TYPE "Urban"	
I/F =		6.10

Q-Reference	Q	A-Inuries	Fatalities	I/F
RURAL	\$363,900	6,072	1,255	4.84
URBAN	\$316,400	9,902	1,624	6.10
BETWEEN	\$334,900	15,974	2,879	5.55

Data from Safety Programs Unit  
 5-Year Statewide Non-Trunkline Crash Figures Used.  
 (\*From 1-1-2015 Through 12-31-2019).

Time of Return (T.O.R.) is based on .... 5 years of data.

NOINFB =No-Inflation Annual Benefit=BTOTAL/years \$32,303

With an inflation rate of ..... 2.50%

B=Annual Benefit=Present Value (with Inflation) \$41,351

C = Project Cost \$1,359,160

TOR=C/B=COST/ANNUAL BENEFIT= **32.87**

I. Lennon and Elms

1. [2045 AM Peak Hour No Build](#)
2. [2045 PM Peak Hour No Build](#)
3. [2045 AM Peak Hour Roundabout](#)
4. [2045 PM Peak Hour Roundabout](#)