

2015-2019 CRASH DATA

CRASHES	INJURIES			
	FATALITIES	TYPE A	TYPE B	TYPE C
1 ANGLE	0	1	0	5
1 HEAD-ON				

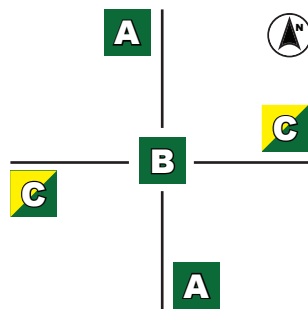
2045 OPERATIONS

LEVEL OF SERVICE

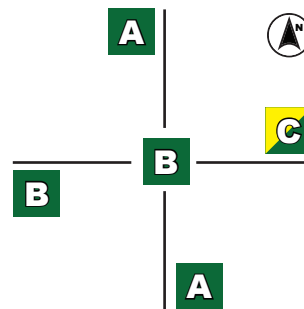
A	B	C	D	E	F
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NO BUILD

AM PEAK

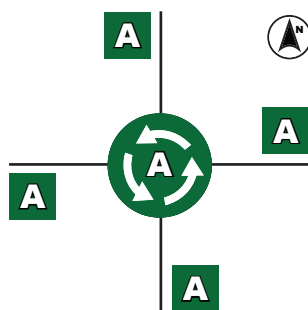


PM PEAK

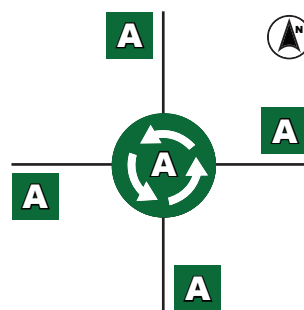


ROUNDBABOUT

AM PEAK



PM PEAK



Opinion of probable cost for single-lane roundabout

\$942,000

M. University Avenue and Chevrolet Avenue

The intersection of University Avenue and Chevrolet Avenue was included in the early preliminary engineering phase with support from the City of Flint due to intersection operations. This intersection is a secondary analysis Tier Three intersection.

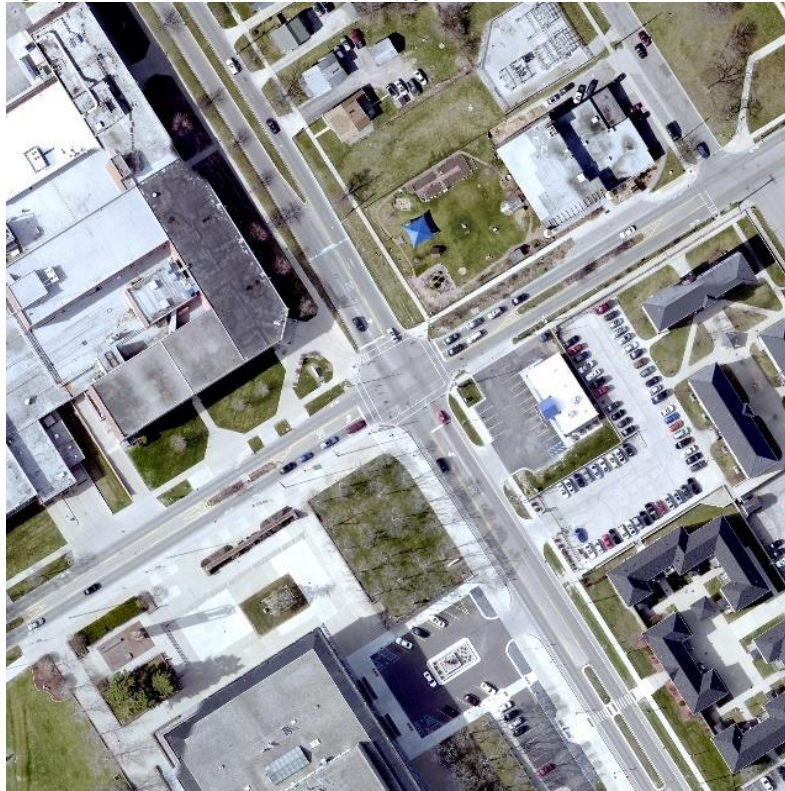
During the skim analysis, it was observed that there was one angle crash and one head on left turn crash over the 5-year period. These crashes resulted in zero fatalities, one type A injury, zero type B injuries, and five type C injuries at the intersection.

No-Build Conditions

The intersection of University Avenue and Chevrolet Avenue is a signalized intersection. University Avenue is an east/west road with a three-lane cross section (one lane in each direction and a center left-turn lane/median). Chevrolet Avenue is a north/south road also with a three-lane cross section (one lane in each direction and a center left-turn lane/median). All approaches have a left-turn only lane and a shared through/right-turn lane. All approaches also have shared bike lanes. There are pedestrian crossing all legs of the intersection. There is an increasing elevation traveling west to east on University Avenue and traveling south to north on Chevrolet Avenue.

In the northwest quadrant is the Kettering University Library. In the southwest quadrant is the Kettering University Bookstore. In the southeast quadrant is Flint Police Service Center and an Einstein Brothers Bagel Restaurant. The northwest quadrant has a fenced-in space from the Flint Children's Museum. There are overhead utilities present on the south and east legs of the intersection.

An aerial of the existing intersection can be seen in Figure 14.

Figure 14: Aerial view of University Avenue and Chevrolet Avenue

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 the future no-build conditions reveals all approaches and movements of the intersection operate at LOS C or better during the AM and PM peak hours.

The 95th percentile queue lengths were reviewed at the intersection and the results showed all approaches experienced a maximum queue length of 140 feet (9 vehicles) during the AM peak hour and 150 feet (9 vehicles) during the PM peak hour.

The operational analysis results for the future no-build conditions are presented in Table 32.

Table 32: Operational Analysis for 2045 No-Build Condition

Intersection	Approach	AM Peak		PM Peak	
		Delay/LOS	Queue (veh)*	Delay/LOS	Queue (veh)*
University Avenue and Chevrolet Avenue	Eastbound	24.4/C	9 (140 ft)	19.7/B	9 (150 ft)
	Westbound	22.7/C	6 (88 ft)	21.0/C	9 (146 ft)
	Northbound	5.4/A	6 (91 ft)	8.8/A	8 (131 ft)
	Southbound	4.9/A	4 (69 ft)	7.6/A	6 (96 ft)
	Overall	12.8/B		13.5/B	

* 95th percentile queue length.

Roundabout Conditions

The proposed roundabout configuration for the intersection of University Avenue and Chevrolet Avenue is a single lane circulating. The proposed single-lane roundabout configuration will not fit

inside the existing right-of-way. Based on the concept design, additional right-of-way may be required in the northwest, southeast, and southwest. The proposed inscribed diameter for the concept roundabout is 100 feet. With pedestrian crossings on all legs, additional equipment/signage should be included to warn drivers. A concept plan for the single-lane roundabout is to follow the recommendations.

An operational analysis for the single-lane roundabout (build) condition was completed for the intersection using 2045 forecast traffic volumes. The results of the analysis for the roundabout (build) condition reveals all approaches and movements of the intersection operate at LOS A during the AM and PM peak hours.

The 95th percentile queue lengths were reviewed at the intersection and the results showed all approaches experienced a maximum queue length of one (1) vehicle during the AM peak hour and two (2) vehicles during the PM peak hour.

The operation analysis for the future roundabout (build) conditions are presented in Table 33.

Table 33: Operational Analysis for 2045 Roundabout (Build) Condition

Intersection	Approach	AM Peak		PM Peak	
		Delay/LOS	Queue (veh)*	Delay/LOS	Queue (veh)*
University Avenue and Chevrolet Avenue	Eastbound	5.7/A	0.6	6.5/A	0.9
	Westbound	4.7/A	0.4	7.0/A	1.1
	Northbound	6.3/A	1.0	7.9/A	1.9
	Southbound	5.3/A	0.5	6.6/A	0.9
	Overall	5.6/A		7.1/A	

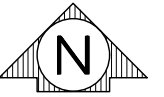
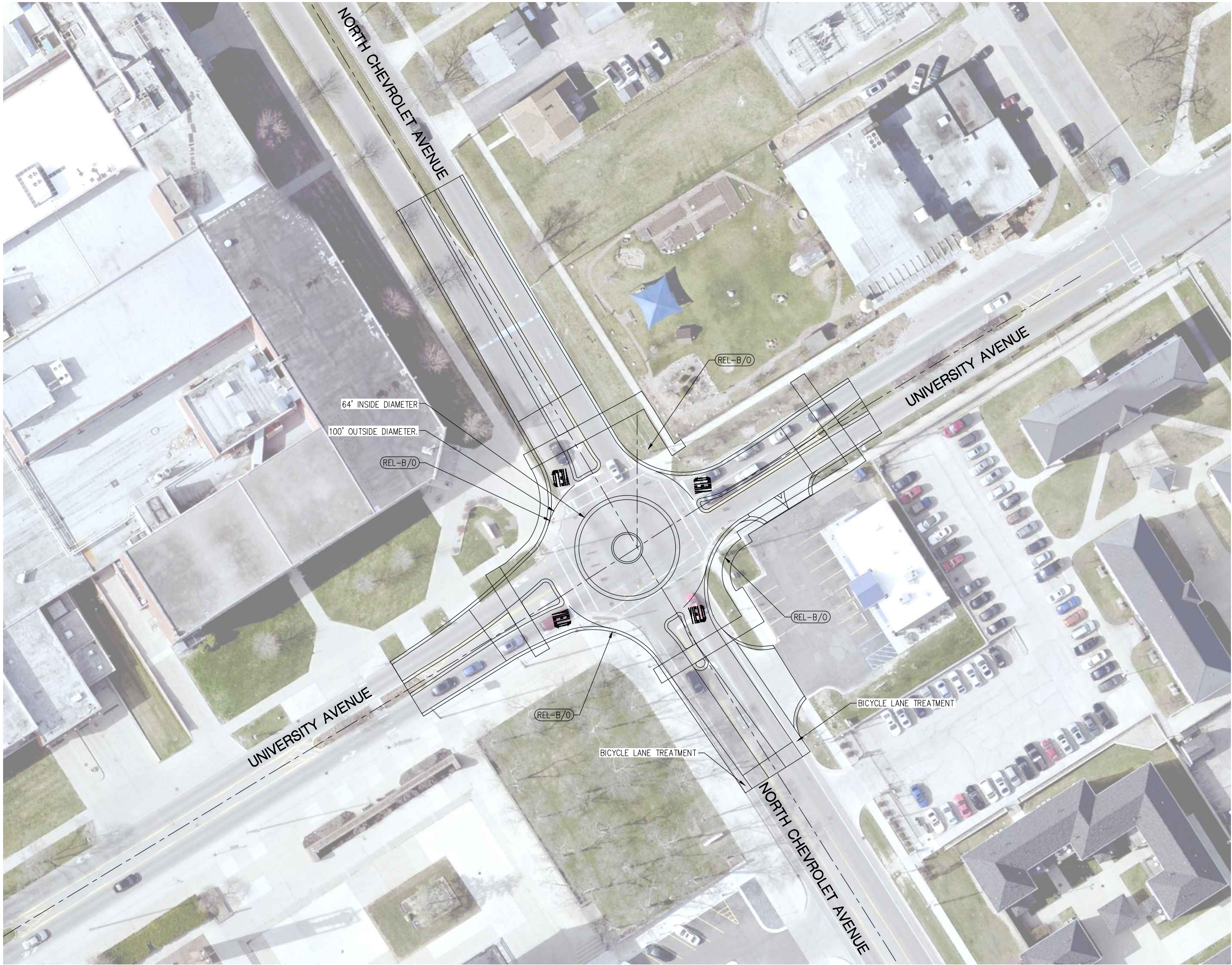
* 95th percentile queue length.

Opinion of probable cost were developed for a single-lane roundabout. The total probable cost is \$942,000 in year 2025 dollars. The probable cost includes a 20 percent contingency and 3 percent inflation. Not included in this fee are the potential costs to relocate any utilities to accommodate the proposed layout. A full breakdown along with all the assumptions can be found in Appendix 3.

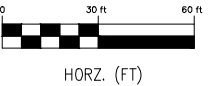
Potential funding for this improvement could be made possible by regular road improvement funding or an earmark. There are no significant crashes of the type that would make the intersections eligible for safety funds and the intersection does not experience enough delay to make it eligible for CMAQ funding.

Recommendation

A roundabout would be feasible at this location.



UNIVERSITY AND NORTH
CHEVROLET AVE
ROUNDAABOUT CONCEPT
SCALE: 1" = 60'



CONCEPT PLAN – FOR DISCUSSION PURPOSES ONLY

PLAN DATE: AUGUST 27, 2021



**ROWE PROFESSIONAL
SERVICES COMPANY**

The Rowe Building
540 S. Saginaw St., Suite 200
Flint, MI 48502

O: (810) 341-7500
F: (810) 341-7573
www.rowepsc.com

PREPARED FOR
GENESEE COUNTY ROAD COMMISSION
ROUNDAABOUT CONCEPTS
UNIVERSITY AVENUE AND NORTH CHEVROLET AVENUE
ROUNDAABOUT CONCEPT

FIGURE NO.
13
JOB No: 19C0262

University Avenue & North Chevrolet Avenue - 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: 817413, Location: 43.013444, -83.712405



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

Leg Direction	University Ave Eastbound						University Ave Westbound						N Chevrolet Ave Northbound						N Chevrolet Ave 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 7:00AM	1	12	7	0	20	0	3	9	2	0	14	1	6	13	11	0	30	0	2	12	1	0	15	0	79
7:15AM	2	18	8	0	28	0	3	8	1	0	12	0	10	21	20	0	51	0	2	27	1	0	30	0	121
7:30AM	1	24	20	0	45	0	9	15	3	0	27	0	12	17	18	0	47	0	2	22	0	0	24	0	143
7:45AM	2	27	17	0	46	3	6	15	1	0	22	0	8	24	13	0	45	4	6	28	2	0	36	0	149
Hourly Total	6	81	52	0	139	3	21	47	7	0	75	1	36	75	62	0	173	4	12	89	4	0	105	0	492
8:00AM	1	18	11	0	30	2	9	11	3	0	23	0	13	39	16	0	68	0	4	26	0	0	30	2	151
8:15AM	0	21	8	0	29	0	6	17	3	0	26	1	9	29	19	0	57	0	6	31	0	0	37	1	149
8:30AM	1	17	8	0	26	0	5	14	1	0	20	1	11	19	19	0	49	0	2	22	1	0	25	1	120
8:45AM	2	23	8	0	33	0	1	17	1	0	19	0	5	23	17	0	45	1	3	28	0	0	31	0	128
Hourly Total	4	79	35	0	118	2	21	59	8	0	88	2	38	110	71	0	219	1	15	107	1	0	123	4	548
4:00PM	1	25	26	0	52	1	26	28	7	0	61	0	21	50	17	0	88	2	3	39	2	0	44	0	245
4:15PM	4	21	10	0	35	0	15	27	6	0	48	0	17	45	13	0	75	2	5	40	0	0	45	1	203
4:30PM	2	23	13	0	38	3	19	23	7	0	49	3	20	41	18	0	79	1	1	39	1	0	41	3	207
4:45PM	0	35	16	0	51	1	13	26	3	0	42	2	26	53	18	0	97	6	3	53	0	0	56	1	246
Hourly Total	7	104	65	0	176	5	73	104	23	0	200	5	84	189	66	0	339	11	12	171	3	0	186	5	901
5:00PM	1	24	11	0	36	3	11	29	9	0	49	3	19	47	14	0	80	1	4	50	0	0	54	3	219
5:15PM	0	24	14	0	38	0	11	27	5	0	43	5	20	50	10	0	80	2	4	41	0	0	45	3	206
5:30PM	2	23	18	0	43	2	14	15	4	0	33	2	16	39	9	0	64	1	6	40	1	0	47	4	187
5:45PM	1	15	13	0	29	6	9	19	5	0	33	2	13	47	9	0	69	0	4	40	0	0	44	0	175
Hourly Total	4	86	56	0	146	11	45	90	23	0	158	12	68	183	42	0	293	4	18	171	1	0	190	10	787
Total	21	350	208	0	579	21	160	300	61	0	521	20	226	557	241	0	1024	20	57	538	9	0	604	19	2728
% Approach	3.6%	60.4%	35.9%	0%	-	-	30.7%	57.6%	11.7%	0%	-	-	22.1%	54.4%	23.5%	0%	-	-	9.4%	89.1%	1.5%	0%	-	-	-
% Total	0.8%	12.8%	7.6%	0%	21.2%	-	5.9%	11.0%	2.2%	0%	19.1%	-	8.3%	20.4%	8.8%	0%	37.5%	-	2.1%	19.7%	0.3%	0%	22.1%	-	-
Lights	16	344	205	0	565	-	159	296	52	0	507	-	217	552	240	0	1009	-	47	531	6	0	584	-	2665
% Lights	76.2%	98.3%	98.6%	0%	97.6%	-	99.4%	98.7%	85.2%	0%	97.3%	-	96.0%	99.1%	99.6%	0%	98.5%	-	82.5%	98.7%	66.7%	0%	96.7%	-	97.7%
Single-Unit Trucks	4	3	2	0	9	-	1	4	0	0	5	-	8	3	1	0	12	-	0	3	3	0	6	-	32
% Single-Unit Trucks	19.0%	0.9%	1.0%	0%	1.6%	-	0.6%	1.3%	0%	0%	1.0%	-	3.5%	0.5%	0.4%	0%	1.2%	-	0%	0.6%	33.3%	0%	1.0%	-	1.2%
Articulated Trucks	0	0	1	0	1	-	0	0	0	0	0	-	0	0	0	0	0	-	0	1	0	0	1	-	2
% Articulated Trucks	0%	0%	0.5%	0%	0.2%	-	0%	0%	0%	0%	0%	-	0%	0%	0%	0%	0%	-	0%	0.2%	0%	0%	0.2%	-	0.1%
Buses	1	3	0	0	4	-	0	0	9	0	9	-	1	2	0	0	3	-	9	3	0	0	12	-	28
% Buses	4.8%	0.9%	0%	0%	0.7%	-	0%	0%	14.8%	0%	1.7%	-	0.4%	0.4%	0%	0%	0.3%	-	15.8%	0.6%	0%	0%	2.0%	-	1.0%
Bicycles on Road	0	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	1	0	0	0	1	-	1
% Bicycles on Road	0%	0%	0%	0%	0%	-	0%	0%	0%	0%	0%	-	0%	0%	0%	0%	0%	-	1.8%	0%	0%	0%	0.2%	-	0%
Pedestrians	-	-	-	-	-	15	-	-	-	-	-	18	-	-	-	-	-	20	-	-	-	-	-	19	-
% Pedestrians	-	-	-	-	-	71.4%	-	-	-	-	-	90.0%	-	-	-	-	-	100%	-	-	-	-	-	100%	-
Bicycles on Crosswalk	-	-	-	-	-	6	-	-	-	-	-	2	-	-	-	-	-	0	-	-	-	-	-	0	-
% Bicycles on Crosswalk	-	-	-	-	-	28.6%	-	-	-	-	-	10.0%	-	-	-	-	-	0%	-	-	-	-	-	0%	-

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

University Avenue & North Chevrolet Avenue - TMC

Tue Mar 9, 2021

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

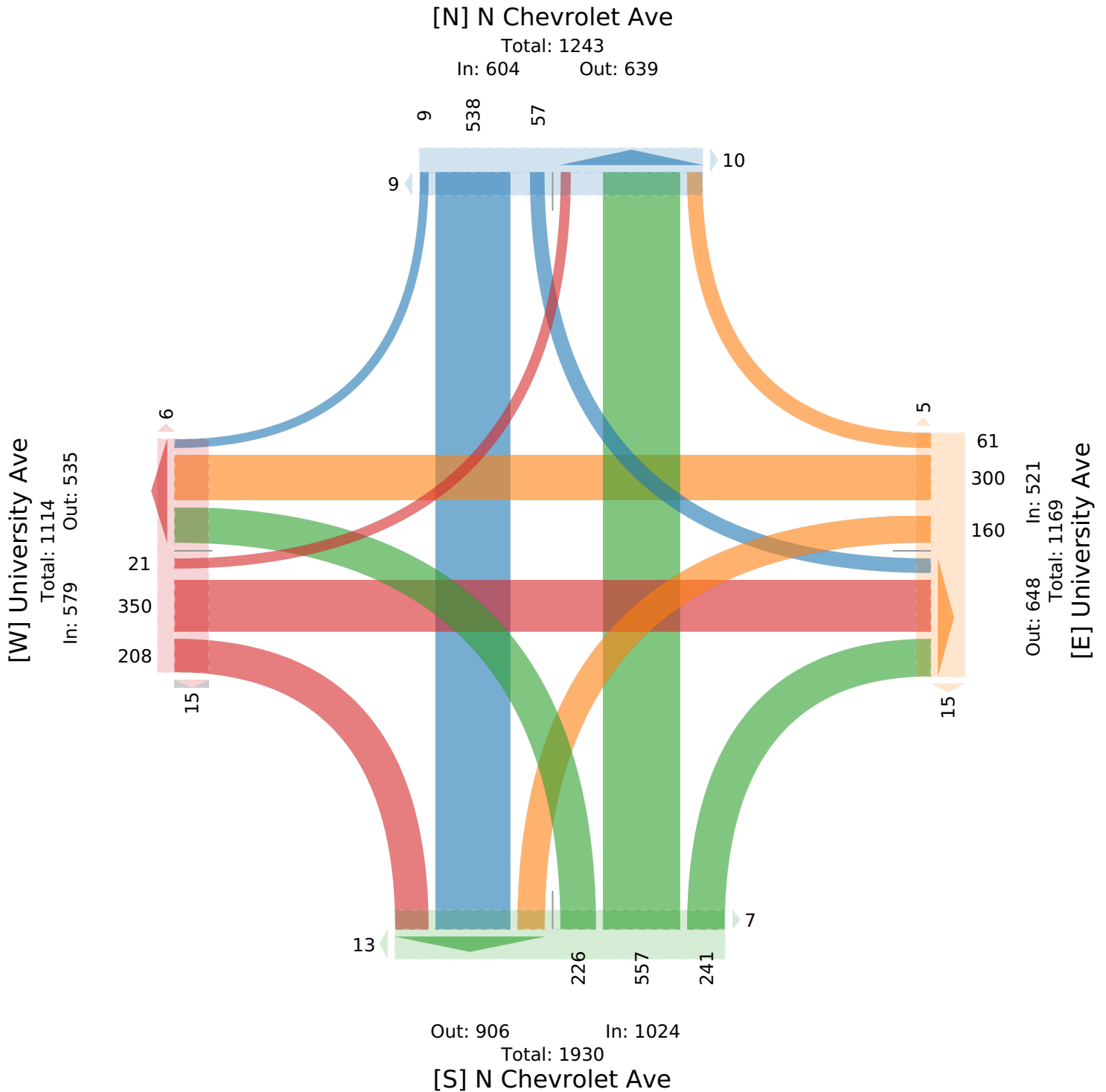
All Classes (Lights, Single-Unit Trucks, Articulated Trucks, Buses,
Pedestrians, Bicycles on Road, Bicycles on Crosswalk)

All Movements

ID: 817413, Location: 43.013444, -83.712405



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



University Avenue & North Chevrolet Avenue - TMC

Tue Mar 9, 2021

AM Peak (7:30 AM - 8:30 AM)

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

All Movements

ID: 817413, Location: 43.013444, -83.712405



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Leg Direction	University Ave Eastbound						University Ave Westbound						N Chevrolet Ave Northbound						N Chevrolet Ave 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 7:30AM	1	24	20	0	45	0	9	15	3	0	27	0	12	17	18	0	47	0	2	22	0	0	24	0	143
7:45AM	2	27	17	0	46	3	6	15	1	0	22	0	8	24	13	0	45	4	6	28	2	0	36	0	149
8:00AM	1	18	11	0	30	2	9	11	3	0	23	0	13	39	16	0	68	0	4	26	0	0	30	2	151
8:15AM	0	21	8	0	29	0	6	17	3	0	26	1	9	29	19	0	57	0	6	31	0	0	37	1	149
Total	4	90	56	0	150	5	30	58	10	0	98	1	42	109	66	0	217	4	18	107	2	0	127	3	592
% Approach	2.7%	60.0%	37.3%	0%	-	-	30.6%	59.2%	10.2%	0%	-	-	19.4%	50.2%	30.4%	0%	-	-	14.2%	84.3%	1.6%	0%	-	-	-
% Total	0.7%	15.2%	9.5%	0%	25.3%	-	5.1%	9.8%	1.7%	0%	16.6%	-	7.1%	18.4%	11.1%	0%	36.7%	-	3.0%	18.1%	0.3%	0%	21.5%	-	-
PHF	0.500	0.833	0.700	-	0.815	-	0.833	0.853	0.833	-	0.907	-	0.808	0.699	0.868	-	0.798	-	0.750	0.863	0.250	-	0.858	-	0.980
Lights	2	89	55	0	146	-	30	58	8	0	96	-	41	108	66	0	215	-	16	105	1	0	122	-	579
% Lights	50.0%	98.9%	98.2%	0%	97.3%	-	100%	100%	80.0%	0%	98.0%	-	97.6%	99.1%	100%	0%	99.1%	-	88.9%	98.1%	50.0%	0%	96.1%	-	97.8%
Single-Unit Trucks	2	0	1	0	3	-	0	0	0	0	0	-	1	1	0	0	2	-	0	0	1	0	1	-	6
% Single-Unit Trucks	50.0%	0%	1.8%	0%	2.0%	-	0%	0%	0%	0%	0%	-	2.4%	0.9%	0%	0%	0.9%	-	0%	0%	50.0%	0%	0.8%	-	1.0%
Articulated Trucks	0	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	1	0	0	1	-	1
% Articulated Trucks	0%	0%	0%	0%	0%	-	0%	0%	0%	0%	0%	-	0%	0%	0%	0%	0%	-	0%	0.9%	0%	0%	0.8%	-	0.2%
Buses	0	1	0	0	1	-	0	0	2	0	2	-	0	0	0	0	0	-	2	1	0	0	3	-	6
% Buses	0%	1.1%	0%	0%	0.7%	-	0%	0%	20.0%	0%	2.0%	-	0%	0%	0%	0%	0%	-	11.1%	0.9%	0%	0%	2.4%	-	1.0%
Bicycles on Road	0	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0
% Bicycles on Road	0%	0%	0%	0%	0%	-	0%	0%	0%	0%	0%	-	0%	0%	0%	0%	0%	-	0%	0%	0%	0%	0%	-	0%
Pedestrians	-	-	-	-	-	5	-	-	-	-	-	1	-	-	-	-	-	4	-	-	-	-	-	3	
% Pedestrians	-	-	-	-	-	100%	-	-	-	-	-	100%	-	-	-	-	-	100%	-	-	-	-	-	-	100%
Bicycles on Crosswalk	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	
% Bicycles on Crosswalk	-	-	-	-	-	0%	-	-	-	-	-	0%	-	-	-	-	-	0%	-	-	-	-	-	0%	-

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

University Avenue & North Chevrolet Avenue - TMC

Tue Mar 9, 2021

AM Peak (7:30 AM - 8:30 AM)

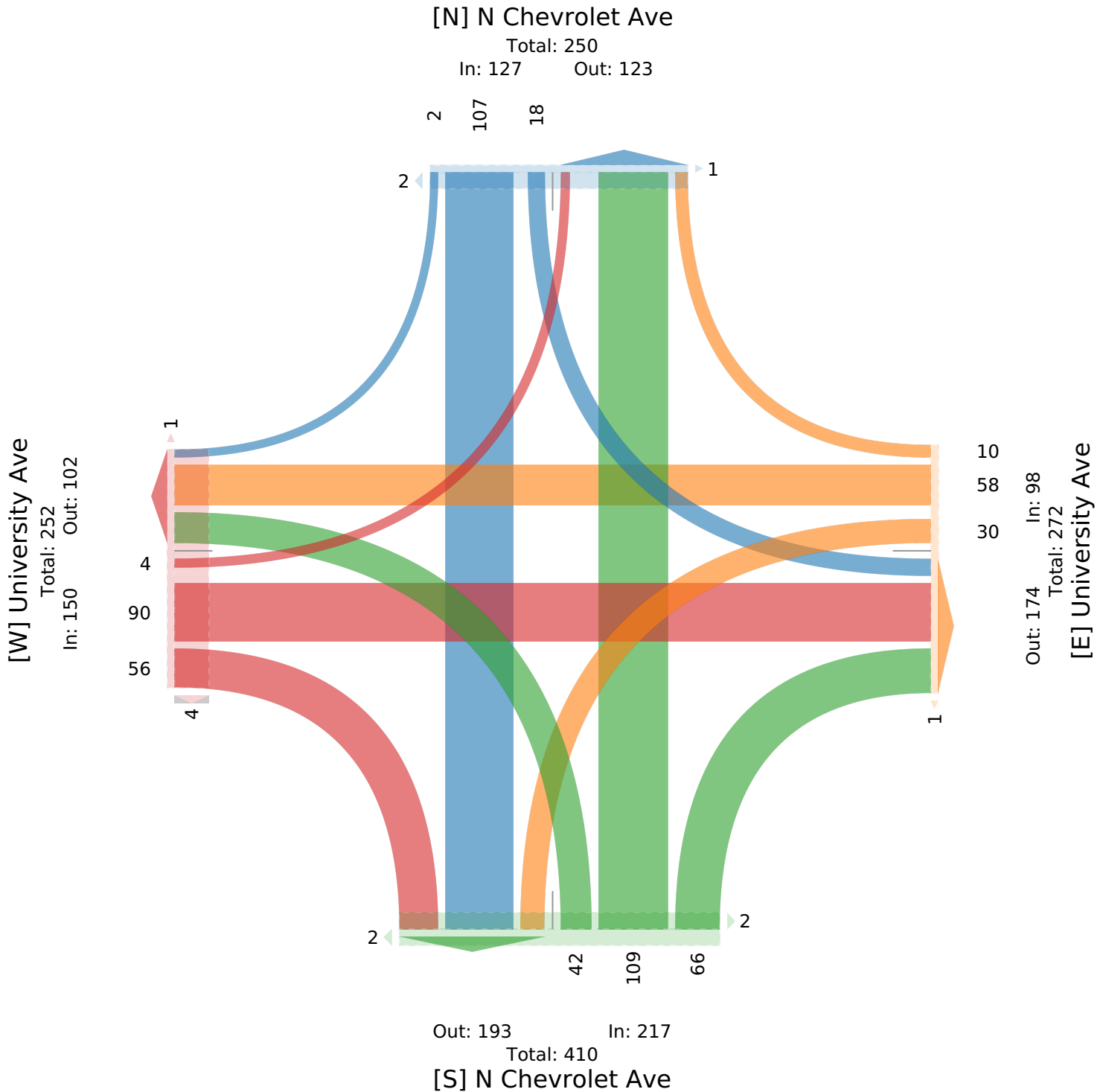
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All Movements

ID: 817413, Location: 43.013444, -83.712405



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625 Forest Edge Drive, Vernon Hills, IL, 60061, US



University Avenue & North Chevrolet Avenue - TMC

Tue Mar 9, 2021

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

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

All Movements

ID: 817413, Location: 43.013444, -83.712405



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

Leg Direction	University Ave Eastbound							University Ave Westbound							N Chevrolet Ave Northbound							N Chevrolet Ave 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 4:00PM	1	25	26	0	52	1		26	28	7	0	61	0		21	50	17	0	88	2		3	39	2	0	44	0	245	
4:15PM	4	21	10	0	35	0		15	27	6	0	48	0		17	45	13	0	75	2		5	40	0	0	45	1	203	
4:30PM	2	23	13	0	38	3		19	23	7	0	49	3		20	41	18	0	79	1		1	39	1	0	41	3	207	
4:45PM	0	35	16	0	51	1		13	26	3	0	42	2		26	53	18	0	97	6		3	53	0	0	56	1	246	
Total	7	104	65	0	176	5		73	104	23	0	200	5		84	189	66	0	339	11		12	171	3	0	186	5	901	
% Approach	4.0%	59.1%	36.9%	0%	-	-		36.5%	52.0%	11.5%	0%	-	-		24.8%	55.8%	19.5%	0%	-	-		6.5%	91.9%	1.6%	0%	-	-	-	
% Total	0.8%	11.5%	7.2%	0%	19.5%	-		8.1%	11.5%	2.6%	0%	22.2%	-		9.3%	21.0%	7.3%	0%	37.6%	-		1.3%	19.0%	0.3%	0%	20.6%	-	-	
PHF	0.438	0.743	0.625	-	0.846	-		0.702	0.929	0.821	-	0.820	-		0.808	0.892	0.917	-	0.874	-		0.600	0.807	0.375	-	0.830	-	0.916	
Lights	7	102	64	0	173	-		73	101	20	0	194	-		82	188	65	0	335	-		9	170	3	0	182	-	884	
% Lights	100%	98.1%	98.5%	0%	98.3%	-		100%	97.1%	87.0%	0%	97.0%	-		97.6%	99.5%	98.5%	0%	98.8%	-		75.0%	99.4%	100%	0%	97.8%	-	98.1%	
Single-Unit Trucks	0	2	0	0	2	-		0	3	0	0	3	-		2	1	1	0	4	-		0	0	0	0	0	-	9	
% Single-Unit Trucks	0%	1.9%	0%	0%	1.1%	-		0%	2.9%	0%	0%	1.5%	-		2.4%	0.5%	1.5%	0%	1.2%	-		0%	0%	0%	0%	0%	-	1.0%	
Articulated Trucks	0	0	1	0	1	-		0	0	0	0	0	-		0	0	0	0	0	-		0	0	0	0	0	-	1	
% Articulated Trucks	0%	0%	1.5%	0%	0.6%	-		0%	0%	0%	0%	0%	-		0%	0%	0%	0%	0%	-		0%	0%	0%	0%	0%	-	0.1%	
Buses	0	0	0	0	0	-		0	0	3	0	3	-		0	0	0	0	0	-		3	1	0	0	4	-	7	
% Buses	0%	0%	0%	0%	0%	-		0%	0%	13.0%	0%	1.5%	-		0%	0%	0%	0%	0%	-		25.0%	0.6%	0%	0%	2.2%	-	0.8%	
Bicycles on Road	0	0	0	0	0	-		0	0	0	0	0	-		0	0	0	0	0	-		0	0	0	0	0	-	0	
% Bicycles on Road	0%	0%	0%	0%	0%	-		0%	0%	0%	0%	0%	-		0%	0%	0%	0%	0%	-		0%	0%	0%	0%	0%	-	0%	
Pedestrians	-	-	-	-	-	4		-	-	-	-	-	5		-	-	-	-	-	11		-	-	-	-	-	5		
% Pedestrians	-	-	-	-	-	80.0%		-	-	-	-	-	100%		-	-	-	-	-	100%		-	-	-	-	-	100%	-	
Bicycles on Crosswalk	-	-	-	-	-	1		-	-	-	-	-	0		-	-	-	-	-	0		-	-	-	-	-	0		
% Bicycles on Crosswalk	-	-	-	-	-	20.0%		-	-	-	-	-	0%		-	-	-	-	-	0%		-	-	-	-	-	0%	-	

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

University Avenue & North Chevrolet Avenue - TMC

Tue Mar 9, 2021

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

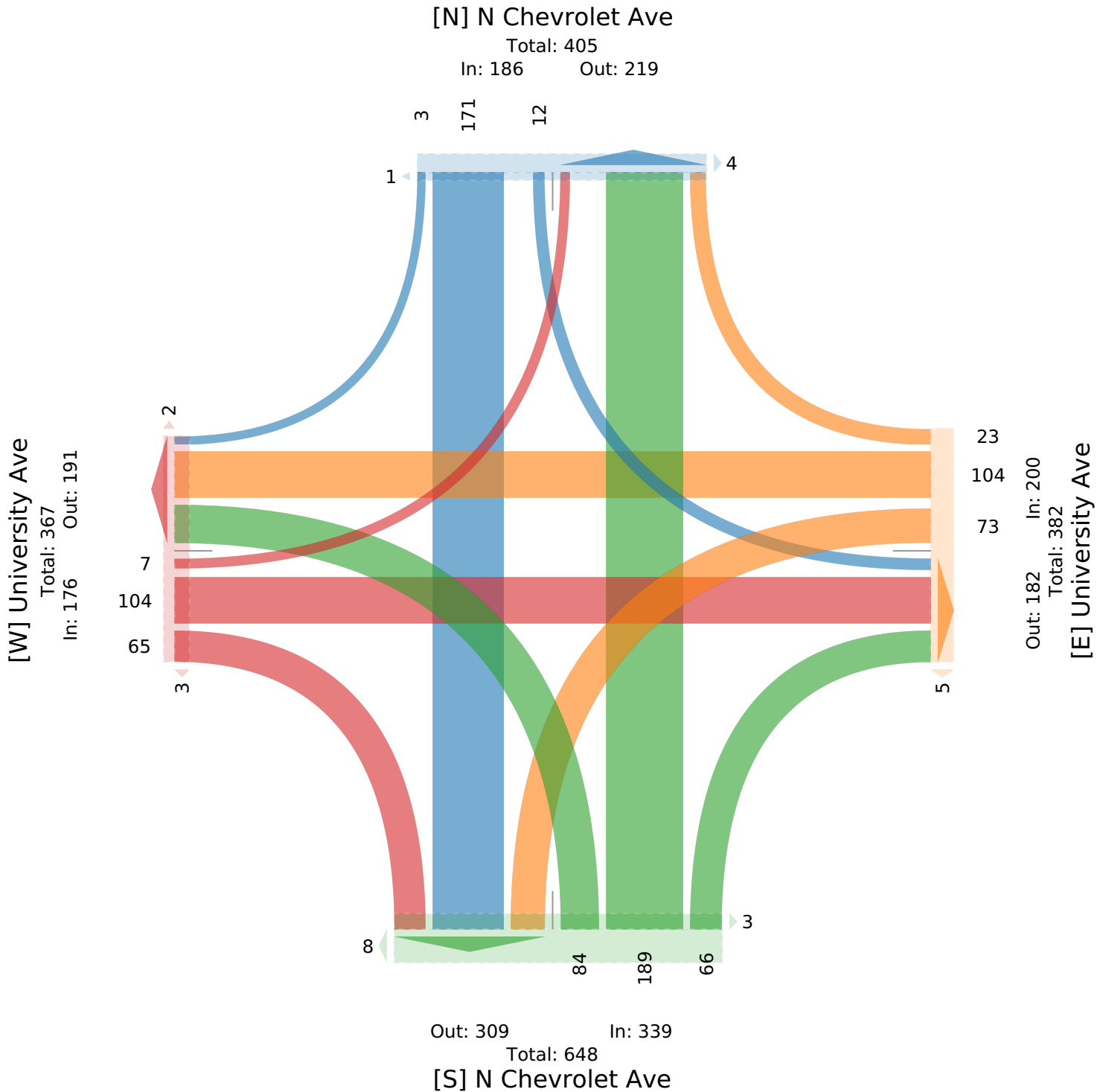
All Classes (Lights, Single-Unit Trucks, Articulated Trucks, Buses,
Pedestrians, Bicycles on Road, Bicycles on Crosswalk)

All Movements

ID: 817413, Location: 43.013444, -83.712405























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



HCM 6th Signalized Intersection Summary

1: Chevrolet Avenue & University Avenue

2045 No Build
AM Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	5	117	73	39	75	13	55	142	86	23	139	3
Future Volume (veh/h)	5	117	73	39	75	13	55	142	86	23	139	3
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No			No			No		
Adj Sat Flow, veh/h/ln	1856	1856	1856	1870	1870	1870	1885	1885	1885	1841	1841	1841
Adj Flow Rate, veh/h	6	143	89	43	82	14	69	178	108	27	162	3
Peak Hour Factor	0.82	0.82	0.82	0.91	0.91	0.91	0.80	0.80	0.80	0.86	0.86	0.86
Percent Heavy Veh, %	3	3	3	2	2	2	1	1	1	4	4	4
Cap, veh/h	319	213	132	207	310	53	852	693	421	722	1137	21
Arrive On Green	0.20	0.20	0.20	0.20	0.20	0.20	0.63	0.63	0.63	0.63	0.63	0.63
Sat Flow, veh/h	1289	1070	666	1148	1557	266	1230	1099	667	1076	1801	33
Grp Volume(v), veh/h	6	0	232	43	0	96	69	0	286	27	0	165
Grp Sat Flow(s),veh/h/ln	1289	0	1736	1148	0	1823	1230	0	1765	1076	0	1835
Q Serve(g_s), s	0.2	0.0	7.4	2.2	0.0	2.7	1.4	0.0	4.3	0.7	0.0	2.2
Cycle Q Clear(g_c), s	2.9	0.0	7.4	9.6	0.0	2.7	3.6	0.0	4.3	5.0	0.0	2.2
Prop In Lane	1.00		0.38	1.00		0.15	1.00		0.38	1.00		0.02
Lane Grp Cap(c), veh/h	319	0	345	207	0	363	852	0	1114	722	0	1158
V/C Ratio(X)	0.02	0.00	0.67	0.21	0.00	0.26	0.08	0.00	0.26	0.04	0.00	0.14
Avail Cap(c_a), veh/h	510	0	602	376	0	632	852	0	1114	722	0	1158
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	21.6	0.0	22.2	26.6	0.0	20.3	5.2	0.0	4.9	6.0	0.0	4.5
Incr Delay (d2), s/veh	0.0	0.0	2.3	0.5	0.0	0.4	0.2	0.0	0.6	0.1	0.0	0.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	0.1	0.0	5.5	1.1	0.0	2.0	0.6	0.0	2.3	0.2	0.0	1.1
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	21.6	0.0	24.5	27.1	0.0	20.7	5.4	0.0	5.4	6.1	0.0	4.7
LnGrp LOS	C	A	C	C	A	C	A	A	A	A	A	A
Approach Vol, veh/h	238			139			355			192		
Approach Delay, s/veh	24.4			22.7			5.4			4.9		
Approach LOS	C			C			A			A		
Timer - Assigned Phs	2			4			6			8		
Phs Duration (G+Y+Rc), s	43.1			16.9			43.1			16.9		
Change Period (Y+Rc), s	5.2			5.0			5.2			5.0		
Max Green Setting (Gmax), s	29.0			20.8			29.0			20.8		
Max Q Clear Time (g_c+I1), s	6.3			9.4			7.0			11.6		
Green Ext Time (p_c), s	2.0			1.0			0.9			0.4		
Intersection Summary												
HCM 6th Ctrl Delay	12.8											
HCM 6th LOS	B											

Intersection: 1: Chevrolet Avenue & University Avenue

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	TR
Maximum Queue (ft)	68	177	72	115	60	108	40	83
Average Queue (ft)	6	80	29	45	20	45	11	29
95th Queue (ft)	35	140	64	88	52	91	34	69
Link Distance (ft)		497		465		370		384
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)	50		50		80		100	
Storage Blk Time (%)	0	22	5	8	0	1		0
Queuing Penalty (veh)	0	1	5	3	0	1		0

Network Summary





















Network wide Queuing Penalty: 10

HCM 6th Signalized Intersection Summary

1: Chevrolet Avenue & University Avenue

2045 Existing Configuration

PM Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	9	135	85	95	135	30	109	246	86	16	222	4
Future Volume (veh/h)	9	135	85	95	135	30	109	246	86	16	222	4
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No			No			No		
Adj Sat Flow, veh/h/ln	1870	1870	1870	1856	1856	1856	1885	1885	1885	1870	1870	1870
Adj Flow Rate, veh/h	11	159	100	116	165	37	125	283	99	19	267	5
Peak Hour Factor	0.85	0.85	0.85	0.82	0.82	0.82	0.87	0.87	0.87	0.83	0.83	0.83
Percent Heavy Veh, %	2	2	2	3	3	3	1	1	1	2	2	2
Cap, veh/h	332	292	184	282	399	90	658	744	260	559	1021	19
Arrive On Green	0.27	0.27	0.27	0.27	0.27	0.27	0.56	0.56	0.56	0.56	0.56	0.56
Sat Flow, veh/h	1180	1074	675	1112	1467	329	1116	1334	467	1001	1830	34
Grp Volume(v), veh/h	11	0	259	116	0	202	125	0	382	19	0	272
Grp Sat Flow(s),veh/h/ln	1180	0	1749	1112	0	1796	1116	0	1801	1001	0	1864
Q Serve(g_s), s	0.5	0.0	7.6	6.0	0.0	5.5	3.9	0.0	7.1	0.7	0.0	4.5
Cycle Q Clear(g_c), s	6.0	0.0	7.6	13.6	0.0	5.5	8.4	0.0	7.1	7.8	0.0	4.5
Prop In Lane	1.00		0.39	1.00		0.18	1.00		0.26	1.00		0.02
Lane Grp Cap(c), veh/h	332	0	476	282	0	489	658	0	1005	559	0	1040
V/C Ratio(X)	0.03	0.00	0.54	0.41	0.00	0.41	0.19	0.00	0.38	0.03	0.00	0.26
Avail Cap(c_a), veh/h	420	0	606	365	0	623	658	0	1005	559	0	1040
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	20.4	0.0	18.7	24.5	0.0	17.9	9.1	0.0	7.4	9.6	0.0	6.9
Incr Delay (d2), s/veh	0.0	0.0	1.0	1.0	0.0	0.6	0.6	0.0	1.1	0.1	0.0	0.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	0.2	0.0	5.4	2.8	0.0	4.0	1.7	0.0	4.5	0.2	0.0	2.8
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	20.4	0.0	19.6	25.4	0.0	18.5	9.7	0.0	8.5	9.7	0.0	7.5
LnGrp LOS	C	A	B	C	A	B	A	A	A	A	A	A
Approach Vol, veh/h	270			318			507			291		
Approach Delay, s/veh	19.7			21.0			8.8			7.6		
Approach LOS	B			C			A			A		
Timer - Assigned Phs	2			4			6			8		
Phs Duration (G+Y+Rc), s	38.7			21.3			38.7			21.3		
Change Period (Y+Rc), s	5.2			5.0			5.2			5.0		
Max Green Setting (Gmax), s	29.0			20.8			29.0			20.8		
Max Q Clear Time (g_c+l1), s	10.4			9.6			9.8			15.6		
Green Ext Time (p_c), s	2.8			1.2			1.5			0.8		
Intersection Summary												
HCM 6th Ctrl Delay	13.5											
HCM 6th LOS	B											

Intersection: 1: Chevrolet Avenue & University Avenue

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	TR
Maximum Queue (ft)	57	184	83	172	108	166	36	111
Average Queue (ft)	7	87	51	78	42	74	11	50
95th Queue (ft)	32	150	86	146	80	131	35	96
Link Distance (ft)		497		465		370		384
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)	50		50		80		100	
Storage Blk Time (%)	0	23	20	16	1	4		1
Queuing Penalty (veh)	1	2	35	16	3	5		0

Network Summary

Network wide Queuing Penalty: 61

University Avenue and N. Chevrolet Avenue – AM Peak

Model - C:\Users\902JAM\OneDrive - ROWE PSC\19C0262_GeneseeCountyRAB\RODEL\University_Chevrolet.rod

File View Help



Project: University Avenue and N. Chev. Date: 4-Jun-2021 Model: Rodel 2017 Timeslice: 7.5 Full Geometry: Peak: AM Feet: RHD
 Name: 2045 Flows: 2045 Delay: Control Results: Veh Peak60/15m Synthetic Flow Profile Conf: 50 Light: 164

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 (w/h)	Xwalk Fact
1 -Chevrolet Avenue	Y	31	0	15.00	1	15.00	1	200.00	50.00	28.00	100.00	18.00	1	15.00	1	15.00	1	0	1.000
2 EB-University Av...	Y	121	0	12.00	1	15.00	1	110.00	50.00	26.00	100.00	18.00	1	15.00	1	12.00	1	0	1.000
3 NB-Chevrolet Av...	Y	211	0	12.00	1	15.00	1	115.00	50.00	26.00	100.00	18.00	1	15.00	1	12.00	1	0	1.000
4 WB-University Av...	Y	301	0	12.00	1	15.00	1	120.00	50.00	26.00	100.00	18.00	1	15.00	1	12.00	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-Chevrolet Ave	4.0	1.00		0	23	139	3	0	0.750	1.125	0.750	0	30	60	
2 EB-University Av...	3.0	1.00		0	5	117	73	0	0.750	1.125	0.750	0	30	60	
3 NB-Chevrolet Av...	1.0	1.00		0	55	142	86	0	0.750	1.125	0.750	0	30	60	
4 WB-University Av...	2.0	1.00		0	39	75	13	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	Byp	Leg
1	SB-Chevrolet Aven	None	165		169		1069		0.1544		5.25		5.25	0.20		0.52		A		A
2	EB-University Ave...	None	195		201		1071		0.1820		5.68		5.68	0.24		0.64		A		A
3	NB-Chevrolet Ave...	None	283		145		1147		0.2467		6.25		6.25	0.37		0.97		A		A
4	WB-University Ave...	None	127		202		1095		0.1159		4.72		4.72	0.14		0.38		A		A
All	Intersection												5.64							A

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

University Avenue and N. Chevrolet Avenue – PM Peak

Model - C:\Users\902JAM\OneDrive - ROWE PSC\19C0262_GeneseCountyRAB\RODEL\University_Chevrolet.rod

File View Help

Project University Avenue and N. Chev Date 4-Jun-2021 Model Model 2017 Timeslice 7.5 Full Geometry Peak PM Feet RHD

Name 2045 Flows 2045 Delay Control Results Veh Peak60/15m Synthetic Flow Profile Conf 50 Light 165

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 (w/h)	Xwalk Fact
1	SB-ChevroletAver	Y	31	0	15.00	1	15.00	1	200.00	50.00	28.00	100.00	18.00	1	15.00	1	15.00	1	0	1.000
2	EB-University Av...	Y	121	0	12.00	1	15.00	1	110.00	50.00	26.00	100.00	18.00	1	15.00	1	12.00	1	0	1.000
3	NB-Chevrolet Av...	Y	211	0	12.00	1	15.00	1	115.00	50.00	26.00	100.00	18.00	1	15.00	1	12.00	1	0	1.000
4	WB-University Av...	Y	301	0	12.00	1	15.00	1	120.00	50.00	26.00	100.00	18.00	1	15.00	1	12.00	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-ChevroletAver	2.0	1.00		0	16	222	4	0	0.750	1.125	0.750	0	30	60	
2 EB-University Av...	2.0	1.00		0	9	135	85	0	0.750	1.125	0.750	0	30	60	
3 NB-Chevrolet Av...	1.0	1.00		0	109	246	86	0	0.750	1.125	0.750	0	30	60	
4 WB-University Av...	3.0	1.00		0	95	135	30	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	Leg
1	SB-ChevroletAver	None	242		339		1016		0.2381		6.61		6.61	0.35		0.93		A		A
2	EB-University Ave...	None	229		333		1021		0.2244		6.45		6.45	0.33		0.86		A		A
3	NB-Chevrolet Ave...	None	441		160		1140		0.3870		7.90		7.90	0.74		1.91		A		A
4	WB-University Ave...	None	260		364		987		0.2634		6.95		6.95	0.40		1.05		A		A
All	Intersection												7.14							A

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

Intersection				
University and N. Chevrolet Street				
Opinion of Probable Cost			By: Rowe PSC Date: 5/27/2021	
PAY ITEM DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	AMOUNT
Mobilization (10%)	1	LSUM	\$64,000.00	\$64,000.00
Sidewalk, Rem	320	Syd	\$10.00	\$3,200.00
Pavt, Rem	3500	Syd	\$10.00	\$35,000.00
Curb and Gutter, Rem	1600	Ft	\$10.00	\$16,000.00
Embankment, CIP	3000	Cyd	\$15.00	\$45,000.00
Excavation, Earth	2000	Cyd	\$10.00	\$20,000.00
Aggregate Base	1500	Ton	\$21.00	\$31,500.00
Shoulder, CI II	0	Ton	\$25.00	\$0.00
Approach, CI II	0	Ton	\$25.00	\$0.00
HMA, 4E10	410	Ton	\$85.00	\$34,850.00
HMA Approach	0	Ton	\$50.00	\$0.00
Conc Pavt, Nonreinf, 9 inch	1650	Syd	\$45.00	\$74,250.00
Joint, Contraction, Cp	2400	Ft	\$10.00	\$24,000.00
Joint, Expansion, E2	320	Ft	\$25.00	\$8,000.00
Joint, Expansion, E3	1400	Ft	\$15.00	\$21,000.00
Driveway, Nonreinf Conc, 9 inch	130	Syd	\$50.00	\$6,500.00
Curb and Gutter, Conc, Det B1	2100	Ft	\$25.00	\$52,500.00
Curb and Gutter, Conc, Det D1	190	Ft	\$25.00	\$4,750.00
Curb, Conc. Det E1	55	Ft	\$25.00	\$1,375.00
Driveway Opening, Conc, Det M	140	Ft	\$22.00	\$3,080.00
Detectable Warning Surface	40	Ft	\$40.00	\$1,600.00
Curb Ramp Opening, Conc	56	Ft	\$25.00	\$1,400.00
Sidewalk, Conc, 4 inch	2100	Sft	\$5.00	\$10,500.00
Sidewalk Ramp, Conc, 6 inch	450	Sft	\$10.00	\$4,500.00
Conc Pavt, Decorative Colored, 9 inch	3800	Sft	\$12.50	\$47,500.00
Turf Establishment, Performance	950	Syd	\$5.00	\$4,750.00
MOT	1	LSUM	\$47,000.00	\$47,000.00
Pavement Markings	1	LSUM	\$15,000.00	\$15,000.00
Signing	1	LSUM	\$20,000.00	\$20,000.00
Drainage	1	LSUM	\$100,000	\$100,000.00
TOTAL				\$697,255

CONTINGENCY (20%)	\$139,451.0
ESTIMATED TOTAL CONSTRUCTION COST (YEAR 2021)	\$836,706.0
3% ANNUAL INFLATION 2021 TO 2025	\$105,013.97
ESTIMATED TOTAL CONSTRUCTION COST (YEAR 2025)	\$941,719.97

* Notes

6" Agg base used for driveways and shoulders, 8" used for roadway, 12" used for islands (10% of total added)

Asphalt shoulder gravel thickness was calculated using a 5" depth

Assumed 5" HMA thickness for approach and 8" thick for HMA roadway

B1 curb was calculated by adding the splitter islands along with the roadways, minus the radius for the roundabout

E1 curb was calculated for the inner roundabout curb

E2 joint expansion was calculated for the outer radius of the roundabout

E3 joint expansion was calculated using the radius of curves from the B/C of the roundabout and splitter islands

D1 curb was calculated for the truck apron

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

Joints assumed for central island/splitter islands

NUMBER OF CRASHES OR INJURED PERSONS.

	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
	2015	2016	2017	2018	2019
Fatal and A-Injury Reduction	%REDUCTION	78%	Roundabout		
Number of Crashes	0	0	0	0	1
A-Injured or Killed Persons	0	0	0	0	1
Minor Crash Reduction	%REDUCTION	57%	0		
Number of Crashes	0	0	0	0	15
	0	0	0	0	14
	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
	%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:	1	For reference only
# of Fatalities:	0	For reference only; "Q" accounts

		for the risk of a fatality.
PROJECT COST ESTIMATE :	\$941,720	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:

	University Avenue and Chevrolet Avenue Genesee County Roundabout Study 1499504, 1524409 1.2529561, 0.4625946 Roundabout
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COMPUTED BENEFITS DERIVED THROUGH CRASH REDUCTION

TOR 2021

Date 9-Jul-21

Project: University Avenue and Chevrolet Avenue

City/Twp. City of Flint

Prepared By: ROWE Professional Services Company

County Genesee County

PR: 1499504, 1524409

PR MP Range: 1.2529561, 0.4625946

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	\$378,563
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.	0.8
R2 =	Reduction in B-Injury crashes:	0.0
R3 =	Reduction in PDO and C-injury crashes:	8.0
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-Injuries	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 \$75,713

With an inflation rate of 2.50%

B=Annual Benefit=Present Value (with Inflation) \$96,918

C = Project Cost \$941,720

TOR=C/B=COST/ANNUAL BENEFIT= 9.72

M. University and Chevrolet

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](#)