Traffic Impact Study
Indy Tru, LLC
Truck Storage Parking Lot
Shelbyville, Indiana

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Prepared by
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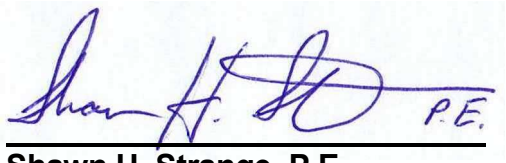
September 5th, 2023

I certify that this TRAFFIC IMPACT ANALYSIS has been prepared by me or under my immediate supervision and that I have experience and training in the field of traffic and transportation engineering.



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Executive Summary

This development is a truck storage facility that is located in Shelbyville, Indiana. This facility has a truck storage area that is on a 42.92-acre lot. This truck storage area will have a storage volume of 1034 total tractor-trailer spaces as well as a trailer repair building and a single entrance road that connects to Enterprise Dr.

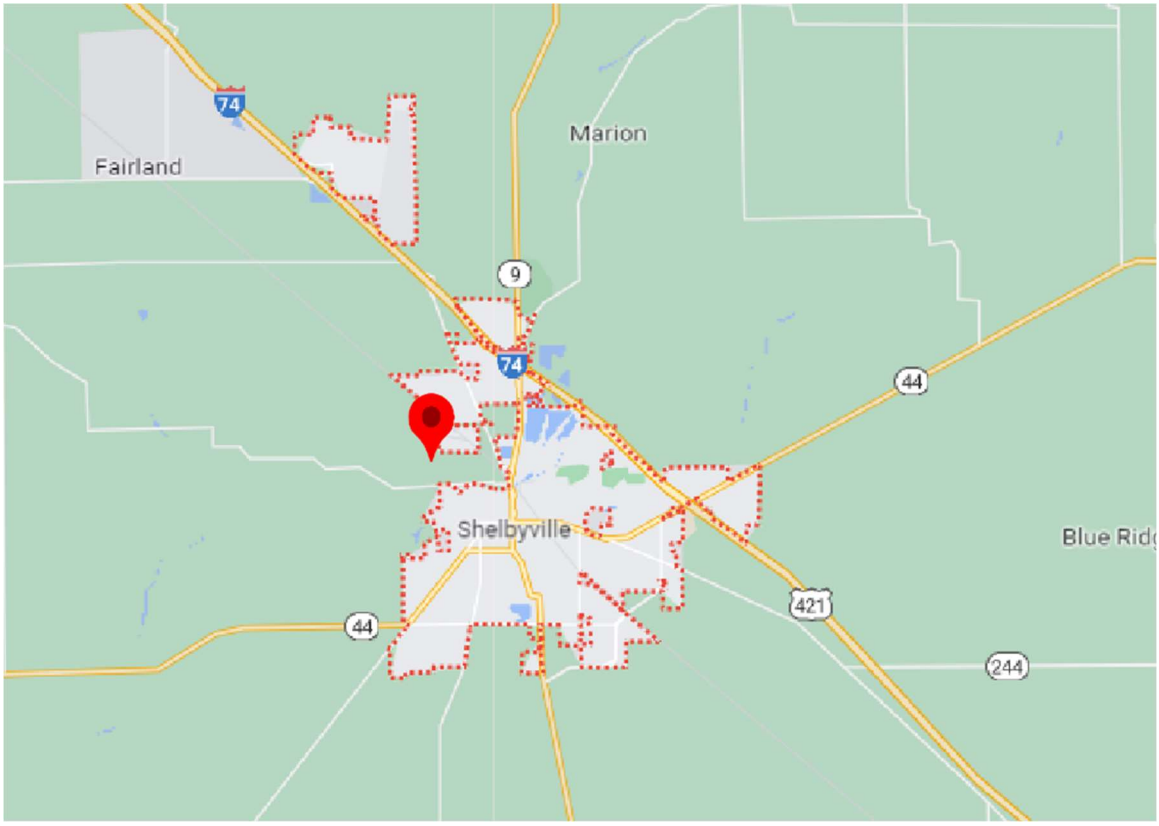


Figure 1. Proposed Development Location

At the time of this traffic study, there is 4 proposed phases for parking lot development. This study is based on the full build out of all 4 phases of the parking lot as well as growth of the existing traffic. Existing traffic counts have been calculated as a growth of 3% per year for 5 years. Under these conditions, this study is to determine the impacts of the storage area on 3 nearby intersections, W. Mausoleum Road and Enterprise Drive, W. Mausoleum Road and N. Michigan Road, and W Rampart Rd and N Michigan Rd.

Traffic counts and generated trips were analyzed using McTrans Highway Capacity Software 2023, and a Level of Service (LOS) was determined for post-development conditions using the existing population of the surrounding area. Future trips were generated using the Trip Generation Manual (11th edition).

The intersection level of service (LOS) is used to grade the level of delay at an intersection with the following conditions:

Level of Service	Unsignalized Control Delay (Seconds/ Vehicle)	Signalized Control Delay (Seconds / Vehicle)
A	< 10	< 10
B	10 - 15	10 - 20
C	16 - 25	21 - 35
D	26 - 35	35 - 55
E	36 - 50	55 - 80
F	>50	>80

A LOS lower than a D is undesirable while a LOS of F is considered a failure and warrants improvements to the capacity of the intersection. INDOT also looks at any level intersection with a level of service of E or lower in need of geometric or traffic control improvements.

The signalized intersection at Michigan Rd currently operates at a LOS of "A" in the AM peak hour and "B" in the PM Peak Hour. While the stop-controlled intersection at Enterprise drive operates at a LOS of "A" in both the AM and PM peak hours. The stop-controlled intersection at Rampart and Michigan will have a LOS of "A" in both the AM and PM peak hours. With no improvements made, under post development conditions the LOS will not change at these intersections.

After the Level of Service analysis, considerations for a geometric change to the studied intersections were made for safety reasons but were found not to be necessary for the projected traffic with the added development. The Indiana Design Manual was referenced for geometric change to the intersections at Enterprise and Mausoleum Dr. as well as Rampart and Michigan Rd and neither an added left turn nor a right turn was warranted for either of the studied intersections/drives.

Indy Tru Truck Parking Traffic Impact Study

Shelbyville, Indiana

Introduction

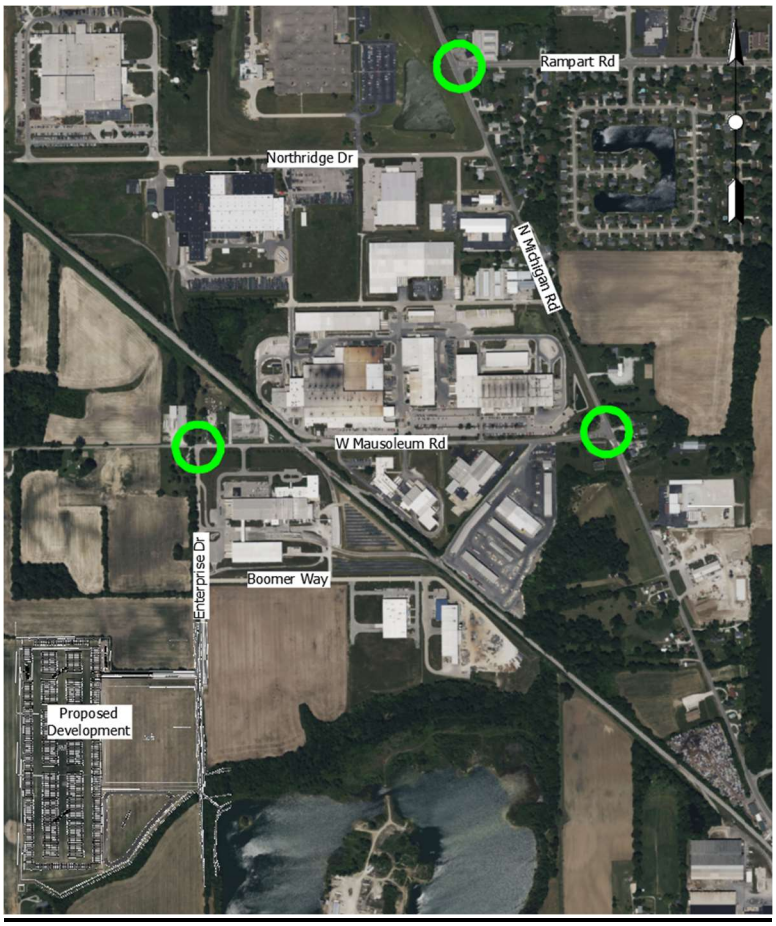


Figure 2. Proposed Development

This traffic impact study will document the changes in the traffic generated by the development of the Indy Tru Parking lot located in Shelbyville, Indiana. The proposed site has allotted 42.92 acres for a 1034 tractor-trailer parking spots. This development is on the north side of Shelbyville and is surrounded by mostly industrial businesses.

There are 3 studied intersections on Mausoleum Rd, at Enterprise Dr and N Michigan Rd. At Michigan Rd, and Rampart Rd at Michigan Rd. At Mausoleum Rd and Michigan Rd there is an existing traffic signal, while Enterprise Dr and Rampart Dr are unsignalized. There is only one outlet point from the proposed development through Enterprise Dr and it is currently being used by other industrial developments.

Traffic counts and generated trips were analyzed using McTrans Highway Capacity Software 2023, and a Level of Service (LOS) was determined for post-development conditions.

Future trips were generated using the Trip Generation Manual (11th edition), as well as using truck turnover rates provided by the owner. The generated traffic was applied to the intersections at the same distribution as the existing intersections, since the area mainly comprises of industrial buildings. Since truck traffic is not allowed on Mausoleum Rd to the west of Enterprise, all of the trucks will be taking right turns at this location, then the existing distribution was used at Michigan Rd.

This traffic study includes:

- Field Data Collection
- Trip Generation Analysis
- Highway Capacity Analysis and Signal Warrant Analysis
- Intersection Evaluation and Recommendations
- Calculations and detailed results are available in the appendix.

The traffic counts for the intersections of Enterprise and Mausoleum, and Mausoleum and Michigan were counted by detection on June 15th, 2023 for the peak hours in the morning and at night. The traffic counts for Rampart and Michigan were counted later on August 29th, 2023 for the morning and evening peak hours as well. These intersections are the closest intersection to the development and will be the only intersections greatly affected by the development. These intersections are important intersections to the traffic flow of the adjacent area and feed major businesses in the area.

Highway capacity and level of service calculations were made based on Highway Capacity Software 2023 (HCS2023) and signal warrant analysis was made utilizing criteria in the Indiana Manual of Uniform Traffic Control Devices (MUTCD).

Intersection evaluation and recommendations were evaluated utilizing output from HCS2023, the Indiana Department of Transportation Design Manual, and the AASHTO Policy on Geometric Design.

Existing Conditions

Michigan Road is classified as a major collector and has 2 lanes, making it 24' wide. Both Mausoleum Rd and Enterprise Rd are classified as local roads and are 24' Wide as well. The intersection at Enterprise Dr a single shared lane on each leg for all movements at the intersection. The intersection at Michigan Rd has 2 lanes going eastbound, a left and a right turn lane. In the northbound direction the intersection has a dedicated left turn lane as well as a through lane, and in the southbound direction it has a single shared lane for all movements. The northbound left turn lane is 225' long. Rampart Rd is classified as a major collector and is 3 lines wide, with a shared turn lane in the middle. The total width of the road is 38' and the westbound left turn lane is 250' long. The northbound right turn lane is 250' long.

The posted speed limit on Michigan Rd, Mausoleum Rd, and Rampart Rd is 30 mph. There is no posted speed limit on Enterprise Rd, but for this study it was assumed to be 30 mph as well.

The traffic counts that were taken show the AM Peak hour was from 7:00 AM – 8:00 AM and the PM peak hour, as well as the overall peak hour, was from 4:00 PM – 5:00 PM. The full traffic count is contained in Appendix pages A1-A6.

Trip Generation

The trip generation for the model was based on a 48 – hour turnover rate for the truck 1034 spot storage area, meaning there will be 517 trucks leaving and entering daily. The FHWA hour truck traffic distribution was used as well to find which hours of the day these trucks are most likely to be coming and going. Using this modeling method, the truck trips were calculated:

	Parking Lot (Trucks)		
	Entering	Exiting	Total
AM Peak	63	11	74
PM Peak	32	49	81

Table 1. Trip Generation

The traffic model used can be found in Appendix A19-A21.

Capacity Analysis – Final Build Out (No Roadway Improvements)

Highway Capacity Analysis

For the capacity analysis, an HCS2023 analysis was run for the intersection of both existing conditions and post-development conditions as well as for each of the proposed intersections. The results can be seen in Table 2. The Level of Service (LOS) of an intersection or an approach is the way the operational condition of the intersection or approach is described. Levels of Service are ranked from A to F, with an A being very good and an F representing failure. Generally, LOS D is the minimum acceptable Level of Service before roadway improvements are warranted.

	Existing LOS		Proposed LOS	
	AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour
Mausoleum Rd & Enterprise Dr	A	A	A	A
Mausoleum Rd & Michigan Rd	A	B	A	B
Rampart Rd & Michigan Rd	A	A	A	A

Table 2. Future Level of Service.

All of the proposed intersection have an LOS of B or higher for the post-development conditions which is desirable and will not cause extended delays. No improvements such as turn lanes are necessary to the existing signalized intersection of Mausoleum Rd and Michigan Rd. No improvements are needed for the unsignalized intersections of Mausoleum Rd and Michigan Rd or Rampart Rd and Michigan Rd as all levels of service outputs indicate desirable operations.

All HCS output can be found in Appendix A7 – A18.

Warrant Analysis

Turn Lane Warrants

Given the projected traffic volumes, right and left turn lanes are checked against turn lane warrants given INDOT figures 46-4a, 46-4b, & 46-4c for intersection safety. There will be no turn lanes warranted on any of the intersections.

All turn lane warrant charts can be found in the Appendix A26 – A27.

Passing Blister Warrant

A passing blister warrant analysis was done at Enterprise Dr and it was found to be warranted. Since Mausoleum Rd has a daily traffic volume of less than 5000 vehicles, INDOT calls for a passing blister to be warranted if there are more than 20 left turning vehicles in the design hour, which at this location there will be 75 during the AM peak hour.

However, during the AM peak hour, the 95% queue length at this location is .3 veh with a delay of just .3 seconds for the westbound through vehicles. Since this scenario has such a low through movement volume, just 4 veh in the AM peak hour, it has been determined that the addition of a passing blister wouldn't be necessary at this location. Although INDOT says it would typically be warranted, in this unique case it isn't necessary at this location, therefore this study does not recommend the passing blister at Enterprise Dr.

Traffic Signal Warrant

A traffic signal warrant analysis was done at the Enterprise Rd and Rampart Rd intersections using HCS2023 to check if the intersections warrant a traffic signal under the MUTCD standards. It was found that a traffic signal is unwarranted at these locations.

The traffic signal warrant analysis can be found in the appendix A22-A25.

Proposed Traffic Design (Geometric) Changes

There are no proposed changes to the traffic design layout of the either of the intersections studied.

Summary

The Indy Tru Truck Parking lot development will consist of a truck staging area with 1034 total tractor trailer parking spots. This staging area will take up a total of 42.92 acres.

The LOS for the 3 intersections shows there will be minimal traffic flow congestion from this new development during both the AM peak hour as well as the PM Peak hour. Under future conditions, the LOS of the intersections will drop to just a LOS of "B" which is considered a well-functioning intersection.

For traffic signal warrants, The MUTCD was referenced and showed that the addition of a traffic signal was not warranted at any of the studied intersection where there is currently no signal. For a geometric change in the intersections, the Indiana Design Manual was referenced and it was found that a passing blister may be warranted at Enterprise Rd. After considering the warrant we find that due to the low volume of through traffic at this location as well as the low queuing done at the location, it is not necessary.

Consideration for a geometric change of the 3 intersections studied to improve the LOS showed it was not necessary to make changes to the current traffic design.

No other improvements are necessary with the addition of this development as described in this report.

APPENDIX

Michigan Road AM PHF 0.674

Leg	Michigan				Michigan				Mausoluem				
Direction	Southbound				Northbound				Eastbound				
Start Time	Right	Thru	U-Turn	**App Total**	Thru	Left	U-Turn	**App Total**	Right	Left	U-Turn	**App Total**	**Int Total**
2023-06-15 07:00:00	41	67	0	**108**	25	23	0	**48**	16	12	0	**28**	**184**
2023-06-15 07:15:00	21	21	0	**42**	30	19	0	**49**	5	3	0	**8**	**99**
2023-06-15 07:30:00	20	19	0	**39**	19	23	0	**42**	8	4	0	**12**	**93**
2023-06-15 07:45:00	24	25	0	**49**	28	23	0	**51**	11	9	0	**20**	**120**
Grand Total	106	132	0	**238**	102	88	0	**190**	40	28	0	**68**	**496**
% Approach	44.5%	55.5%	0.0%		53.7%	46.3%	0.0%		58.8%	41.2%	0.0%		
% Total	21.4%	26.6%	0.0%	**48.0%**	20.6%	17.7%	0.0%	**38.3%**	8.1%	5.6%	0.0%	**13.7%**	
PHF (7 AM - 8 AM)	0.646	0.493	0	**0.551**	0.85	0.957	0	**0.931**	0.625	0.583	0	**0.607**	**0.674**
Lights	100	129	0	**229**	98	84	0	**182**	39	26	0	**65**	**476**
% Lights	94.3%	97.7%	0.0%	**96.2%**	96.1%	95.5%	0.0%	**95.8%**	97.5%	92.9%	0.0%	**95.6%**	**96.0%**
Articulated Trucks	5	0	0	**5**	4	3	0	**7**	1	2	0	**3**	**15**
% Articulated Trucks	4.7%	0.0%	0.0%	**2.1%**	3.9%	3.4%	0.0%	**3.7%**	2.5%	7.1%	0.0%	**4.4%**	**3.0%**
Buses and Single-Unit Trucks	1	3	0	**4**	0	1	0	**1**	0	0	0	**0**	**5**
% Buses and Single-Unit Trucks	0.9%	2.3%	0.0%	**1.7%**	0.0%	1.1%	0.0%	**0.5%**	0.0%	0.0%	0.0%	**0.0%**	**1.0%**

Michigan Road PM PHF 0.689

Leg	Michigan				Michigan				Mausoluem				
Direction	Southbound				Northbound				Eastbound				
Start Time	Right	Thru	U-Turn	**App Total**	Thru	Left	U-Turn	**App Total**	Right	Left	U-Turn	**App Total**	**Int Total**
2023-06-15 16:00:00	5	72	0	**77**	30	4	0	**34**	47	30	0	**77**	**188**
2023-06-15 16:15:00	3	49	0	**52**	23	4	0	**27**	18	21	0	**39**	**118**
2023-06-15 16:30:00	8	37	0	**45**	26	4	0	**30**	23	20	0	**43**	**118**
2023-06-15 16:45:00	1	40	0	**41**	27	3	0	**30**	9	14	0	**23**	**94**
Grand Total	17	198	0	**215**	106	15	0	**121**	97	85	0	**182**	**518**
% Approach	7.9%	92.1%	0.0%		87.6%	12.4%	0.0%		53.3%	46.7%	0.0%		
% Total	3.3%	38.2%	0.0%	**41.5%**	20.5%	2.9%	0.0%	**23.4%**	18.7%	16.4%	0.0%	**35.1%**	
PHF (4 PM - 5 PM)	0.531	0.688	0	**0.698**	0.883	0.938	0	**0.89**	0.516	0.708	0	**0.591**	**0.689**
Lights	15	194	0	**209**	103	13	0	**116**	93	80	0	**173**	**498**
% Lights	88.2%	98.0%	0.0%	**97.2%**	97.2%	86.7%	0.0%	**95.9%**	95.9%	94.1%	0.0%	**95.1%**	**96.1%**
Articulated Trucks	2	0	0	**2**	2	2	0	**4**	3	3	0	**6**	**12**
% Articulated Trucks	11.8%	0.0%	0.0%	**0.9%**	1.9%	13.3%	0.0%	**3.3%**	3.1%	3.5%	0.0%	**3.3%**	**2.3%**
Buses and Single-Unit Trucks	0	4	0	**4**	1	0	0	**1**	1	2	0	**3**	**8**
% Buses and Single-Unit Trucks	0.0%	2.0%	0.0%	**1.9%**	0.9%	0.0%	0.0%	**0.8%**	1.0%	2.4%	0.0%	**1.6%**	**1.5%**

Enterprise Dr AM PHF 0.6

Leg	Mausoleum				Enterprise				Mausoleum				
Direction	Westbound				Northbound				Eastbound				
Start Time	Thru	Left	U-Turn	**App Total**	Right	Left	U-Turn	**App Total**	Right	Thru	U-Turn	**App Total**	**Int Total**
2023-06-15 07:00:00	1	3	0	**4**	1	0	0	**1**	0	2	0	**2**	**7**
2023-06-15 07:15:00	2	3	0	**5**	0	0	0	**0**	1	1	0	**2**	**7**
2023-06-15 07:30:00	1	9	0	**10**	1	0	0	**1**	1	2	0	**3**	**14**
2023-06-15 07:45:00	0	14	0	**14**	2	0	0	**2**	2	2	0	**4**	**20**
Grand Total	4	29	0	**33**	4	0	0	**4**	4	7	0	**11**	**48**
% Approach	12.1%	87.9%	0.0%		100.0%	0.0%	0.0%		36.4%	63.6%	0.0%		
% Total	8.3%	60.4%	0.0%	**68.8%**	8.3%	0.0%	0.0%	**8.3%**	8.3%	14.6%	0.0%	**22.9%**	
PHF (7 AM - 8 AM)	0.5	0.518	0	**0.589**	0.5	0	0	**0.5**	0.5	0.875	0	**0.688**	**0.6**
Lights	4	23	0	**27**	1	0	0	**1**	4	7	0	**11**	**39**
% Lights	100.0%	79.3%	0.0%	**81.8%**	25.0%	0.0%	0.0%	**25.0%**	100.0%	100.0%	0.0%	**100.0%**	**81.3%**
Articulated Trucks	0	4	0	**4**	3	0	0	**3**	0	0	0	**0**	**7**
% Articulated Trucks	0.0%	13.8%	0.0%	**12.1%**	75.0%	0.0%	0.0%	**75.0%**	0.0%	0.0%	0.0%	**0.0%**	**14.6%**
Buses and Single-Unit Trucks	0	2	0	**2**	0	0	0	**0**	0	0	0	**0**	**2**
% Buses and Single-Unit Trucks	0.0%	6.9%	0.0%	**6.1%**	0.0%	0.0%	0.0%	**0.0%**	0.0%	0.0%	0.0%	**0.0%**	**4.2%**

Enterprise Dr PM PHF 0.667

Leg	Mausoleum				Enterprise				Mausoleum				
Direction	Westbound				Northbound				Eastbound				
Start Time	Thru	Left	U-Turn	**App Total**	Right	Left	U-Turn	**App Total**	Right	Thru	U-Turn	**App Total**	**Int Total**
2023-06-15 16:15:00	7	0	0	**7**	2	1	0	**3**	0	3	0	**3**	**13**
2023-06-15 16:30:00	5	2	0	**7**	7	2	0	**9**	0	2	0	**2**	**18**
2023-06-15 16:45:00	3	0	0	**3**	2	0	0	**2**	0	0	0	**0**	**5**
2023-06-15 17:00:00	2	0	0	**2**	9	0	0	**9**	0	1	0	**1**	**12**
Grand Total	17	2	0	**19**	20	3	0	**23**	0	6	0	**6**	**48**
% Approach	89.5%	10.5%	0.0%		87.0%	13.0%	0.0%		0.0%	100.0%	0.0%		
% Total	35.4%	4.2%	0.0%	**39.6%**	41.7%	6.3%	0.0%	**47.9%**	0.0%	12.5%	0.0%	**12.5%**	
PHF (4:15 PM - 5:15 PM)	0.607	0.25	0	**0.679**	0.556	0.375	0	**0.639**	0	0.5	0	**0.5**	**0.667**
Lights	17	1	0	**18**	17	3	0	**20**	0	5	0	**5**	**43**
% Lights	100.0%	50.0%	0.0%	**94.7%**	85.0%	100.0%	0.0%	**87.0%**	0.0%	83.3%	0.0%	**83.3%**	**89.6%**
Articulated Trucks	0	1	0	**1**	3	0	0	**3**	0	0	0	**0**	**4**
% Articulated Trucks	0.0%	50.0%	0.0%	**5.3%**	15.0%	0.0%	0.0%	**13.0%**	0.0%	0.0%	0.0%	**0.0%**	**8.3%**
Buses and Single-Unit Trucks	0	0	0	**0**	0	0	0	**0**	0	1	0	**1**	**1**
% Buses and Single-Unit Trucks	0.0%	0.0%	0.0%	**0.0%**	0.0%	0.0%	0.0%	**0.0%**	0.0%	16.7%	0.0%	**16.7%**	**2.1%**

Rampart Road AM PHF 0.877

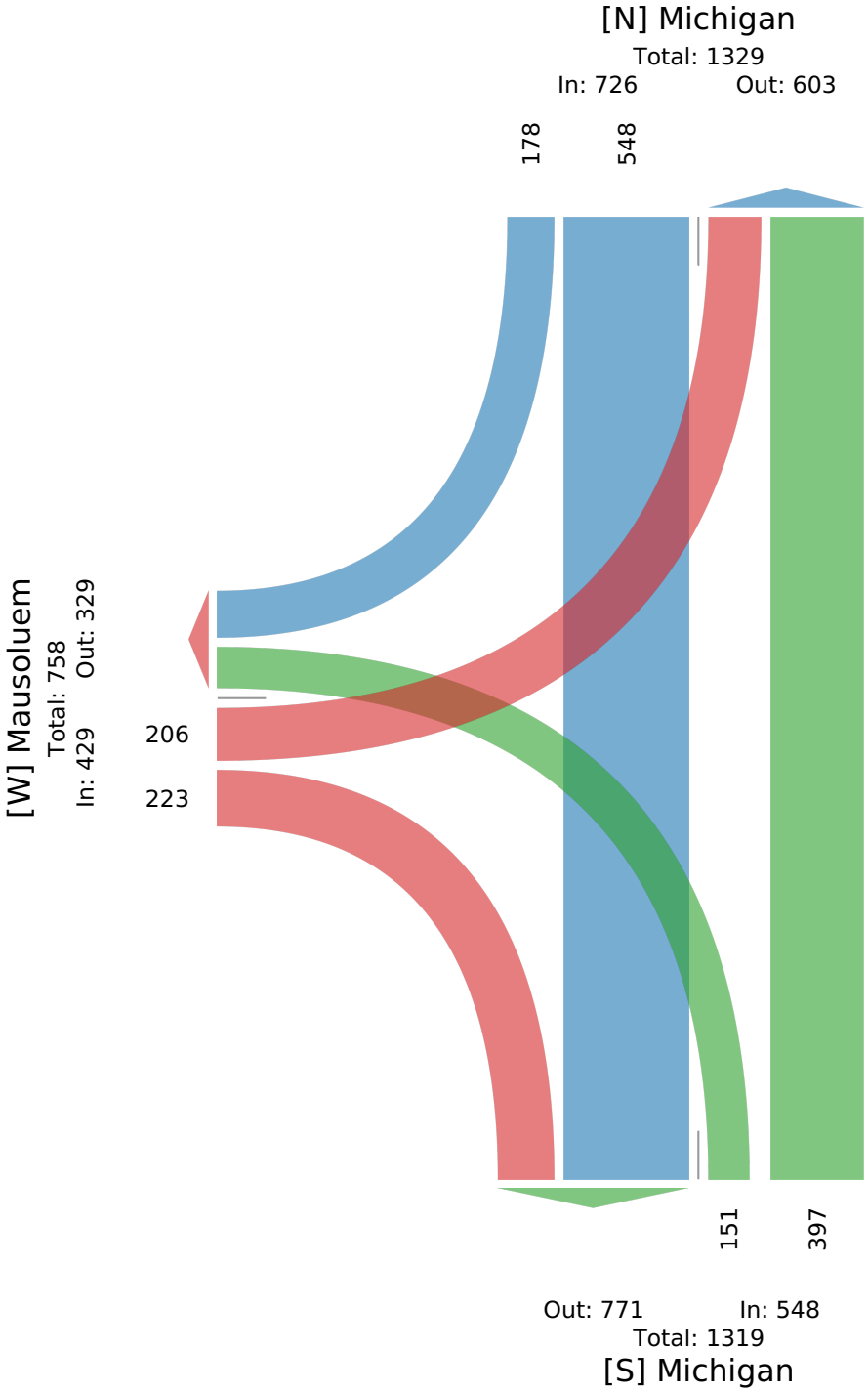
Leg	Michigan				Rampart				Michigan				
Direction	Southbound				Westbound				Northbound				
Start Time	Thru	Left	U-Turn	**App Total**	Right	Left	U-Turn	**App Total**	Right	Thru	U-Turn	**App Total**	**Int Total**
2023-08-29 07:00:00	32	3	0	**35**	19	29	0	**48**	41	30	0	**71**	**154**
2023-08-29 07:15:00	30	4	0	**34**	20	28	0	**48**	12	29	0	**41**	**123**
2023-08-29 07:30:00	38	11	0	**49**	19	30	0	**49**	8	29	0	**37**	**135**
2023-08-29 07:45:00	29	13	0	**42**	8	46	0	**54**	8	24	0	**32**	**128**
Grand Total	129	31	0	**160**	66	133	0	**199**	69	112	0	**181**	**540**
% Approach	80.6%	19.4%	0.0%		33.2%	66.8%	0.0%		38.1%	61.9%	0.0%		
% Total	23.9%	5.7%	0.0%	**29.6%**	12.2%	24.6%	0.0%	**36.9%**	12.8%	20.7%	0.0%	**33.5%**	
PHF (7 AM - 8 AM)	0.849	0.596	0	**0.816**	0.825	0.723	0	**0.921**	0.421	0.933	0	**0.637**	**0.877**
Lights	122	30	0	**152**	63	121	0	**184**	61	104	0	**165**	**501**
% Lights	94.6%	96.8%	0.0%	**95.0%**	95.5%	91.0%	0.0%	**92.5%**	88.4%	92.9%	0.0%	**91.2%**	**92.8%**
Articulated Trucks	0	0	0	**0**	0	10	0	**10**	5	5	0	**10**	**20**
% Articulated Trucks	0.0%	0.0%	0.0%	**0.0%**	0.0%	7.5%	0.0%	**5.0%**	7.2%	4.5%	0.0%	**5.5%**	**3.7%**
Buses and Single-Unit Trucks	7	1	0	**8**	3	2	0	**5**	3	3	0	**6**	**19**
% Buses and Single-Unit Trucks	5.4%	3.2%	0.0%	**5.0%**	4.5%	1.5%	0.0%	**2.5%**	4.3%	2.7%	0.0%	**3.3%**	**3.5%**

Rampart Road PM PHF 0.791

Leg	Michigan				Rampart				Michigan				
Direction	Southbound				Westbound				Northbound				
Start Time	Thru	Left	U-Turn	**App Total**	Right	Left	U-Turn	**App Total**	Right	Thru	U-Turn	**App Total**	**Int Total**
2023-08-29 16:00:00	59	17	0	**76**	16	5	1	**22**	35	52	0	**87**	**185**
2023-08-29 16:15:00	37	10	0	**47**	11	9	0	**20**	35	48	0	**83**	**150**
2023-08-29 16:30:00	38	9	0	**47**	12	8	0	**20**	30	46	0	**76**	**143**
2023-08-29 16:45:00	26	7	0	**33**	14	10	0	**24**	16	34	0	**50**	**107**
Grand Total	160	43	0	**203**	53	32	1	**86**	116	180	0	**296**	**585**
% Approach	78.8%	21.2%	0.0%		61.6%	37.2%	1.2%		39.2%	60.8%	0.0%		
% Total	27.4%	7.4%	0.0%	**34.7%**	9.1%	5.5%	0.2%	**14.7%**	19.8%	30.8%	0.0%	**50.6%**	
PHF (4 PM - 5 PM)	0.678	0.632	0	**0.668**	0.828	0.8	0.25	**0.896**	0.829	0.865	0	**0.851**	**0.791**
Lights	159	41	0	**200**	50	25	1	**76**	109	176	0	**285**	**561**
% Lights	99.4%	95.3%	0.0%	**98.5%**	94.3%	78.1%	100.0%	**88.4%**	94.0%	97.8%	0.0%	**96.3%**	**95.9%**
Articulated Trucks	0	0	0	**0**	3	7	0	**10**	4	2	0	**6**	**16**
% Articulated Trucks	0.0%	0.0%	0.0%	**0.0%**	5.7%	21.9%	0.0%	**11.6%**	3.4%	1.1%	0.0%	**2.0%**	**2.7%**
Buses and Single-Unit Trucks	1	2	0	**3**	0	0	0	**0**	3	2	0	**5**	**8**
% Buses and Single-Unit Trucks	0.6%	4.7%	0.0%	**1.5%**	0.0%	0.0%	0.0%	**0.0%**	2.6%	1.1%	0.0%	**1.7%**	**1.4%**

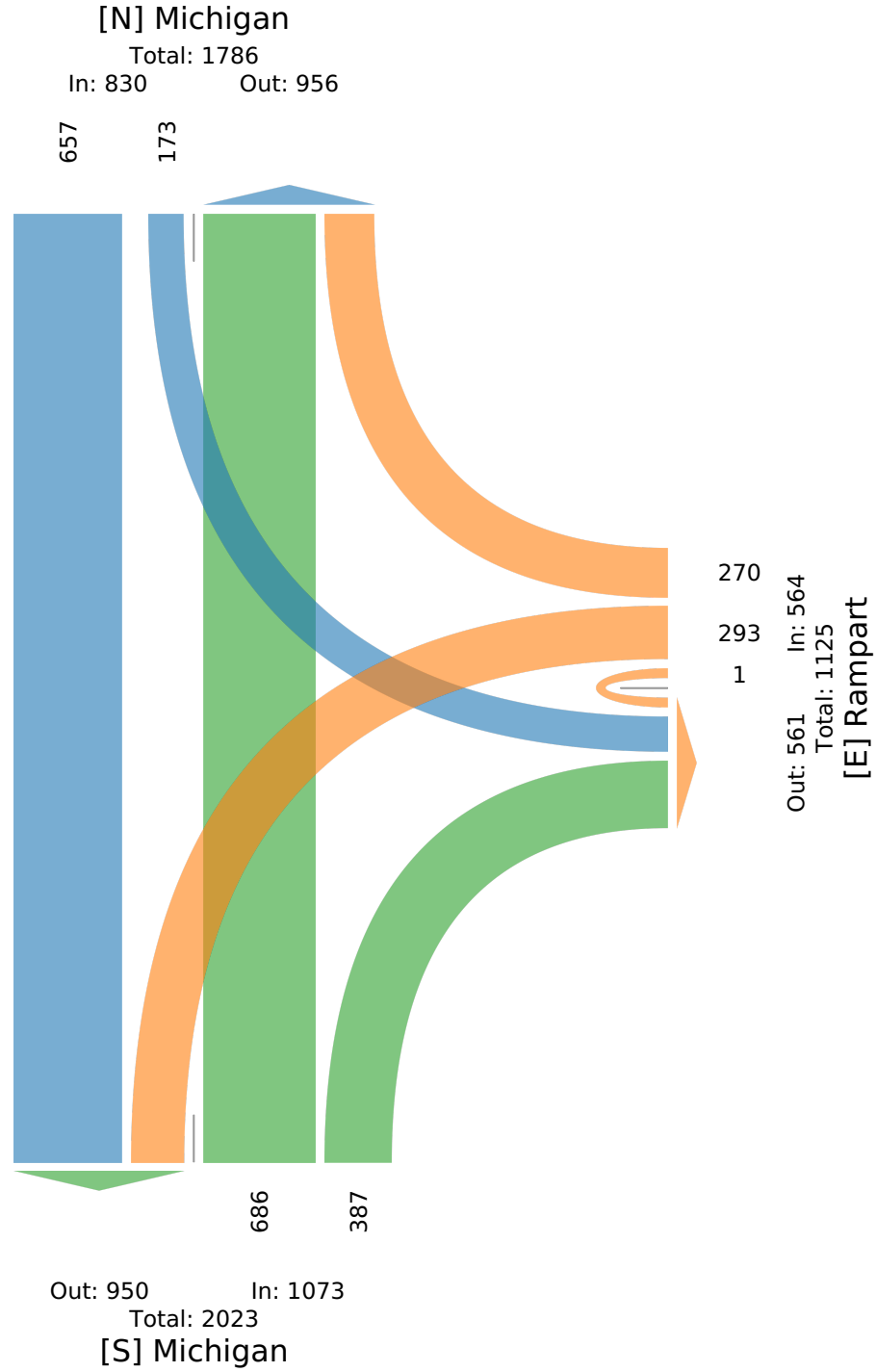
W Mausoleum Rd & N Michigan Rd - TMC
Thu Jun 15, 2023
Full Length (7 AM-9 AM, 4 PM-6 PM)
All Classes (Lights, Articulated Trucks, Buses and Single-Unit Trucks)
All Movements
ID: 1079197, Location: 39.540278, -85.783689

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



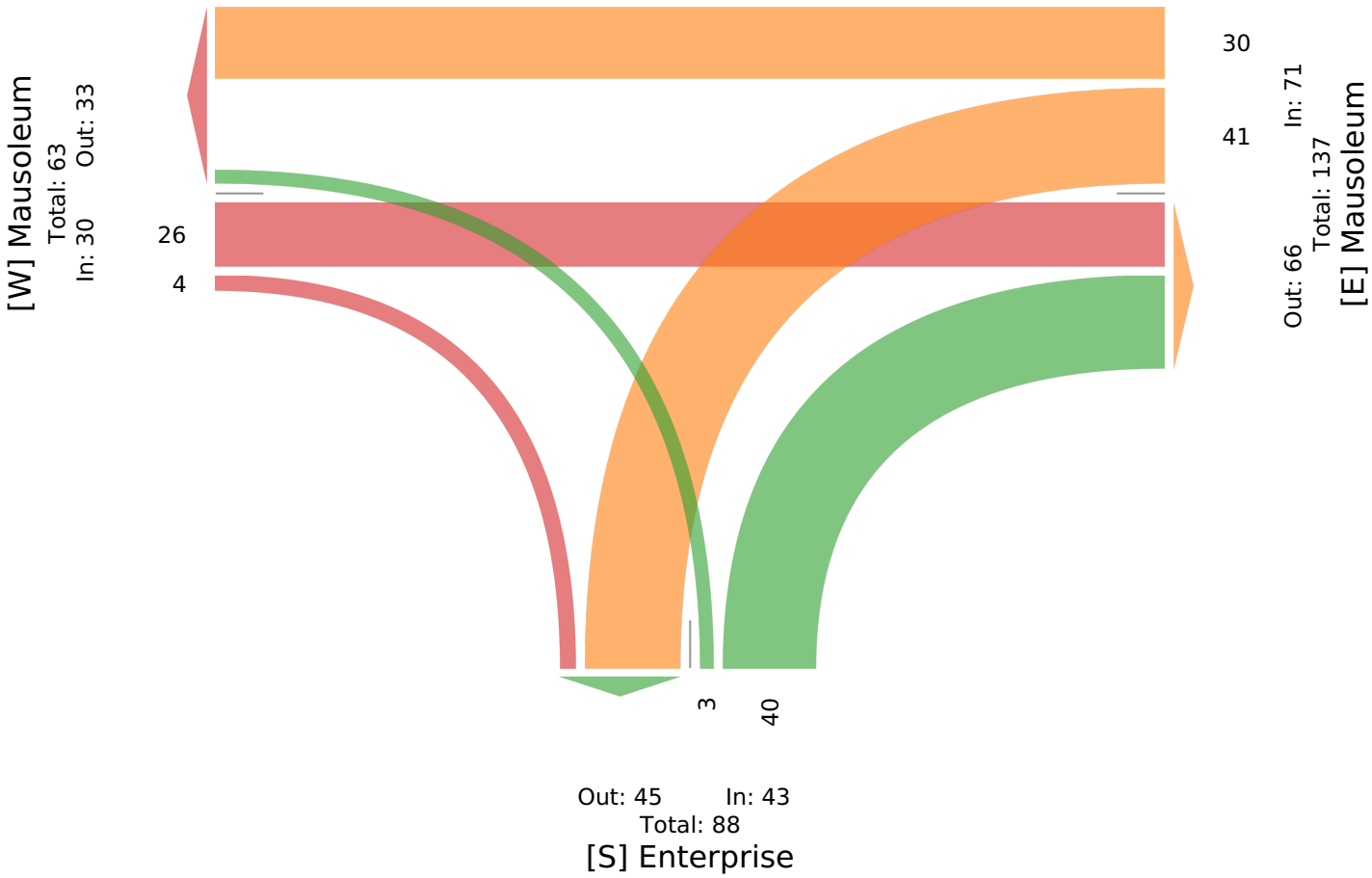
W Rampart Rd & N Michigan Rd - TMC
Tue Aug 29, 2023
Full Length (7 AM-9 AM, 3 PM-6 PM)
All Classes (Lights, Articulated Trucks, Buses and Single-Unit Trucks)
All Movements
ID: 1099590, Location: 39.547419, -85.787582

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



West Mausoleum Road & Enterprise Drive - TMC
Thu Jun 15, 2023
Full Length (7 AM-9 AM, 4 PM-6 PM)
All Classes (Lights, Articulated Trucks, Buses and Single-Unit Trucks)
All Movements
ID: 1079198, Location: 39.539995, -85.794062

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



HCS Two-Way Stop-Control Report

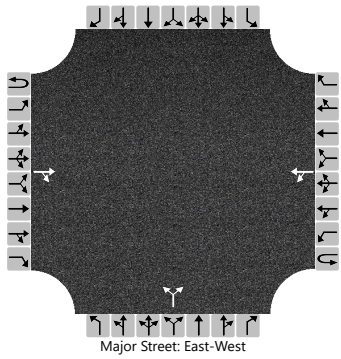
General Information

Analyst	Grant Barker
Agency/Co.	First Group Engineering
Date Performed	6/21/2023
Analysis Year	2023
Time Analyzed	7:00 - 8:00 AM
Intersection Orientation	East-West
Project Description	23-0030 TIS - Truck Parking

Site Information

Intersection	Enterprise Dr and Maursoleum Rd
Jurisdiction	Greenfield
East/West Street	Mausoleum Rd
North/South Street	Enterprise Dr
Peak Hour Factor	0.60
Analysis Time Period (hrs)	1.00

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	1	0		0	0	0
Configuration				TR		LT					LR					
Volume (veh/h)			7	4		29	4			0		4				
Percent Heavy Vehicles (%)						3				0		75				
Proportion Time Blocked																
Percent Grade (%)										0						
Right Turn Channelized																
Median Type | Storage				Undivided												

Critical and Follow-up Headways

Base Critical Headway (sec)						4.1				7.1		6.2				
Critical Headway (sec)						4.13				6.40		6.95				
Base Follow-Up Headway (sec)						2.2				3.5		3.3				
Follow-Up Headway (sec)						2.23				3.50		3.98				

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)						48					7					
Capacity, c (veh/h)						1592					887					
v/c Ratio						0.03					0.01					
95% Queue Length, Q_{95} (veh)						0.1					0.0					
Control Delay (s/veh)						7.3	0.2				9.1					
Level of Service (LOS)						A	A				A					
Approach Delay (s/veh)						6.5				9.1						
Approach LOS						A				A						

HCS Two-Way Stop-Control Report

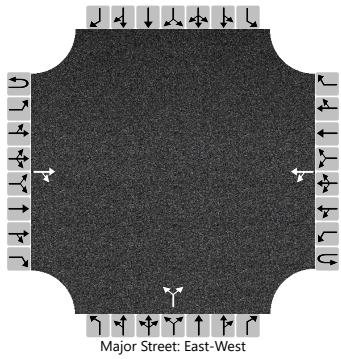
General Information

Analyst	Grant Barker
Agency/Co.	First Group Engineering
Date Performed	6/21/2023
Analysis Year	2023
Time Analyzed	4:15 - 5:15 PM
Intersection Orientation	East-West
Project Description	23-0030 TIS - Truck Parking

Site Information

Intersection	Enterprise Dr and Maursoleum Rd
Jurisdiction	Greenfield
East/West Street	Mausoleum Rd
North/South Street	Enterprise Dr
Peak Hour Factor	0.67
Analysis Time Period (hrs)	1.00

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	1	0		0	0	0
Configuration				TR		LT					LR					
Volume (veh/h)			6	0		2	17			3		20				
Percent Heavy Vehicles (%)						50				0		15				
Proportion Time Blocked																
Percent Grade (%)										0						
Right Turn Channelized																
Median Type | Storage																

Critical and Follow-up Headways

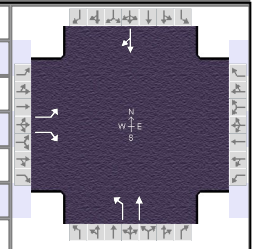
Base Critical Headway (sec)						4.1				7.1		6.2				
Critical Headway (sec)						4.60				6.40		6.35				
Base Follow-Up Headway (sec)						2.2				3.5		3.3				
Follow-Up Headway (sec)						2.65				3.50		3.44				

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)						3					34					
Capacity, c (veh/h)						1347					1177					
v/c Ratio						0.00					0.03					
95% Queue Length, Q_{95} (veh)						0.0					0.1					
Control Delay (s/veh)						7.7	0.0				8.2					
Level of Service (LOS)						A	A				A					
Approach Delay (s/veh)						0.8				8.2						
Approach LOS						A				A						

HCS Signalized Intersection Results Summary

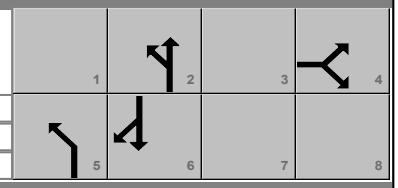
General Information				Intersection Information	
Agency	First Group Engineering			Duration, h	1.000
Analyst	Grant Barker	Analysis Date	6/21/2023	Area Type	Other
Jurisdiction	Greenfield	Time Period	AM Peak	PHF	1.00
Urban Street	Michigan Rd	Analysis Year	2023	Analysis Period	1> 7:00
Intersection	Mausoleum Rd & Michig…	File Name	Michigan Exist AM.xus		
Project Description	23-0030 TIS - Truck Parking				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	28		40				88	102			132	106

Signal Information			
Cycle, s	95.0	Reference Phase	2
Offset, s	0	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	70.9	5.4	6.7	0.0	0.0	0.0						
Yellow	4.0	4.0	4.0	0.0	0.0	0.0						
Red	0.0	0.0	0.0	0.0	0.0	0.0						



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4			5	2		6
Case Number		9.0			1.0	4.0		8.4
Phase Duration, s		10.7			9.4	84.3		74.9
Change Period, (*Y+R c*), s		4.0			4.0	4.0		4.0
Max Allow Headway (*MAH*), s		3.4			3.2	0.0		0.0
Queue Clearance Time (*g s*), s		4.3			2.0			
Green Extension Time (*g e*), s		0.1			0.1	0.0		0.0
Phase Call Probability		0.83			0.90			
Max Out Probability		0.00			0.44			

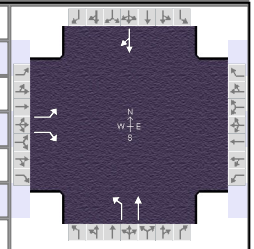
Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7		14				5	2			6	16
Adjusted Flow Rate (*v*), veh/h	28		40				88	102			238	
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1711		1572				1838	1788			1690	
Queue Service Time (*g s*), s	1.5		2.3				0.0	0.9			3.9	
Cycle Queue Clearance Time (*g c*), s	1.5		2.3				0.0	0.9			3.9	
Green Ratio (*g/C*)	0.07		0.07				0.78	0.85			0.75	
Capacity (*c*), veh/h	120		110				986	1512			1262	
Volume-to-Capacity Ratio (*X*)	0.233		0.362				0.089	0.067			0.189	
Back of Queue (*Q*), ft/ln (95 th percentile)	29.9		42				17.5	7.6			54.6	
Back of Queue (*Q*), veh/ln (95 th percentile)	1.1		1.6				0.7	0.3			2.1	
Queue Storage Ratio (*RQ*) (95 th percentile)	0.18		0.00				0.08	0.00			0.00	
Uniform Delay (*d 1*), s/veh	41.7		42.1				3.5	1.2			3.6	
Incremental Delay (*d 2*), s/veh	0.4		0.7				0.0	0.1			0.3	
Initial Queue Delay (*d 3*), s/veh	0.0		0.0				0.0	0.0			0.0	
Control Delay (*d*), s/veh	42.1		42.9				3.5	1.3			3.9	
Level of Service (LOS)	D		D				A	A			A	
Approach Delay, s/veh / LOS	42.6	D		0.0			2.3	A		3.9	A	
Intersection Delay, s/veh / LOS	8.6						A					

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

HCS Signalized Intersection Results Summary

A10

General Information				Intersection Information	
Agency	First Group Engineering			Duration, h	1.000
Analyst	Grant Barker	Analysis Date	6/21/2023	Area Type	Other
Jurisdiction	Greenfield	Time Period	PM Peak	PHF	1.00
Urban Street	Michigan Rd	Analysis Year	2023	Analysis Period	1> 7:00
Intersection	Mausoleum Rd & Michig…	File Name	Michigan Exist PM.xus		
Project Description	23-0030 TIS - Truck Parking				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	85		97				15	106			198	17

Signal Information			
Cycle, s	95.0	Reference Phase	2
Offset, s	0	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

							1	2	3	4		
Green	73.0	2.0	8.1	0.0	0.0	0.0	5	6	7	8		
Yellow	4.0	4.0	4.0	0.0	0.0	0.0						
Red	0.0	0.0	0.0	0.0	0.0	0.0						

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4			5	2		6
Case Number		9.0			1.0	4.0		8.4
Phase Duration, s		12.1			6.0	82.9		77.0
Change Period, ($Y+R_c$), s		4.0			4.0	4.0		4.0
Max Allow Headway (*MAH*), s		3.4			3.2	0.0		0.0
Queue Clearance Time (g_s), s		7.7			2.0			
Green Extension Time (g_e), s		0.4			0.1	0.0		0.0
Phase Call Probability		0.99			0.33			
Max Out Probability		0.00			0.37			

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7		14				5	2			6	16
Adjusted Flow Rate (*v*), veh/h	85		97				15	106			215	
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1753		1566				1691	1817			1873	
Queue Service Time (g_s), s	4.4		5.7				0.0	1.0			2.9	
Cycle Queue Clearance Time (g_c), s	4.4		5.7				0.0	1.0			2.9	
Green Ratio (*g/C*)	0.08		0.08				0.77	0.83			0.77	
Capacity (*c*), veh/h	149		133				904	1510			1439	
Volume-to-Capacity Ratio (*X*)	0.570		0.729				0.017	0.070			0.149	
Back of Queue (*Q*), ft/ln (95 th percentile)	90.7		106.1				3.1	9.8			39.4	
Back of Queue (*Q*), veh/ln (95 th percentile)	3.5		4.1				0.1	0.4			1.6	
Queue Storage Ratio (*RQ*) (95 th percentile)	0.55		0.00				0.01	0.00			0.00	
Uniform Delay (d_1), s/veh	41.8		42.4				3.3	1.4			2.9	
Incremental Delay (d_2), s/veh	1.3		2.9				0.0	0.1			0.2	
Initial Queue Delay (d_3), s/veh	0.0		0.0				0.0	0.0			0.0	
Control Delay (*d*), s/veh	43.1		45.3				3.3	1.5			3.1	
Level of Service (LOS)	D		D				A	A			A	
Approach Delay, s/veh / LOS	44.3	D		0.0			1.8	A		3.1	A	
Intersection Delay, s/veh / LOS	17.2						B					

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

HCS Two-Way Stop-Control Report

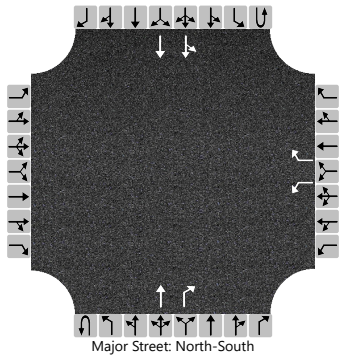
General Information

Analyst	Grant Barker
Agency/Co.	First Group Engineering
Date Performed	08/29/2023
Analysis Year	2023
Time Analyzed	7:00 - 8:00 AM
Intersection Orientation	North-South
Project Description	23-0030 TIS - Truck Parking

Site Information

Intersection	Rampart Rd and Michigan Rd
Jurisdiction	Greenfield
East/West Street	Rampart Rd
North/South Street	Michigan Rd
Peak Hour Factor	0.88
Analysis Time Period (hrs)	1.00

Lanes


Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		1	0	1	0	0	1	1	0	0	2	0
Configuration						L		R			T	R		LT	T	
Volume (veh/h)						133		66			112	69		31	129	
Percent Heavy Vehicles (%)						8		0						0		
Proportion Time Blocked																
Percent Grade (%)						0										
Right Turn Channelized						No					No					
Median Type | Storage						Undivided										

Critical and Follow-up Headways

Base Critical Headway (sec)						7.5		6.2						4.1		
Critical Headway (sec)						6.96		6.20						4.10		
Base Follow-Up Headway (sec)						3.5		3.3						2.2		
Follow-Up Headway (sec)						3.58		3.30						2.20		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)						152		75						35		
Capacity, c (veh/h)						660		928						1377		
v/c Ratio						0.23		0.08						0.03		
95% Queue Length, Q_{95} (veh)						0.9		0.3						0.1		
Control Delay (s/veh)						12.1		9.2						7.7	0.1	
Level of Service (LOS)						B		A						A	A	
Approach Delay (s/veh)						11.1								1.6		
Approach LOS						B								A		

HCS Two-Way Stop-Control Report

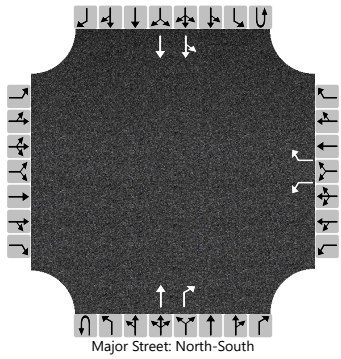
General Information

Analyst	Grant Barker
Agency/Co.	First Group Engineering
Date Performed	08/29/2023
Analysis Year	2023
Time Analyzed	4:00 - 5:00 AM
Intersection Orientation	North-South
Project Description	23-0030 TIS - Truck Parking

Site Information

Intersection	Rampart Rd and Michigan Rd
Jurisdiction	Greenfield
East/West Street	Rampart Rd
North/South Street	Michigan Rd
Peak Hour Factor	0.79
Analysis Time Period (hrs)	1.00

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		1	0	1	0	0	1	1	0	0	2	0
Configuration						L		R			T	R		LT	T	
Volume (veh/h)						32		53			180	116		43	160	
Percent Heavy Vehicles (%)						22		6						0		
Proportion Time Blocked																
Percent Grade (%)						0										
Right Turn Channelized						No					No					
Median Type | Storage						Undivided										

Critical and Follow-up Headways

Base Critical Headway (sec)						7.5		6.2						4.1		
Critical Headway (sec)						7.24		6.32						4.10		
Base Follow-Up Headway (sec)						3.5		3.3						2.2		
Follow-Up Headway (sec)						3.72		3.36						2.20		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)						40		67						54		
Capacity, c (veh/h)						475		798						1195		
v/c Ratio						0.09		0.08						0.05		
95% Queue Length, Q_{95} (veh)						0.3		0.3						0.1		
Control Delay (s/veh)						13.3		9.9						8.2	0.3	
Level of Service (LOS)						B		A						A	A	
Approach Delay (s/veh)						11.2								1.9		
Approach LOS						B								A		

HCS Two-Way Stop-Control Report

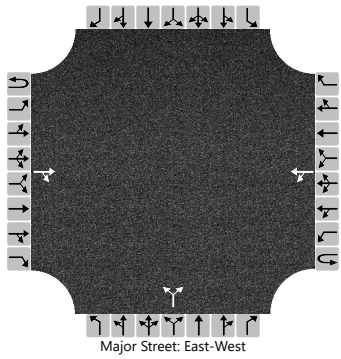
General Information

Analyst	Grant Barker
Agency/Co.	First Group Engineering
Date Performed	6/21/2023
Analysis Year	2023
Time Analyzed	7:00 - 8:00 AM
Intersection Orientation	East-West
Project Description	23-0030 TIS - Truck Parking

Site Information

Intersection	Enterprise Dr and Maursoleum Rd
Jurisdiction	Greenfield
East/West Street	Mausoleum Rd
North/South Street	Enterprise Dr
Peak Hour Factor	0.60
Analysis Time Period (hrs)	1.00

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	1	0		0	0	0
Configuration				TR		LT					LR					
Volume (veh/h)			7	4		75	4			0		12				
Percent Heavy Vehicles (%)						67				0		92				
Proportion Time Blocked																
Percent Grade (%)										0						
Right Turn Channelized																
Median Type | Storage				Undivided												

Critical and Follow-up Headways

Base Critical Headway (sec)						4.1				7.1		6.2				
Critical Headway (sec)						4.77				6.40		7.12				
Base Follow-Up Headway (sec)						2.2				3.5		3.3				
Follow-Up Headway (sec)						2.80				3.50		4.13				

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)						125					20					
Capacity, c (veh/h)						1262					854					
v/c Ratio						0.10					0.02					
95% Queue Length, Q_{95} (veh)						0.3					0.1					
Control Delay (s/veh)						8.2	0.8				9.3					
Level of Service (LOS)						A	A				A					
Approach Delay (s/veh)						7.8				9.3						
Approach LOS						A				A						

HCS Two-Way Stop-Control Report

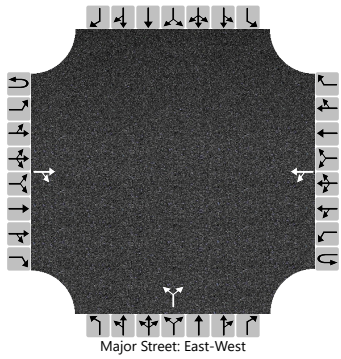
General Information

Analyst	Grant Barker
Agency/Co.	First Group Engineering
Date Performed	6/21/2023
Analysis Year	2023
Time Analyzed	4:15 - 5:15 PM
Intersection Orientation	East-West
Project Description	23-0030 TIS - Truck Parking

Site Information

Intersection	Enterprise Dr and Maursoleum Rd
Jurisdiction	Greenfield
East/West Street	Mausoleum Rd
North/South Street	Enterprise Dr
Peak Hour Factor	0.67
Analysis Time Period (hrs)	1.00

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	1	0		0	0	0
Configuration				TR		LT					LR					
Volume (veh/h)			7	0		26	20			3		59				
Percent Heavy Vehicles (%)						96				0		66				
Proportion Time Blocked																
Percent Grade (%)										0						
Right Turn Channelized																
Median Type | Storage						Undivided										

Critical and Follow-up Headways

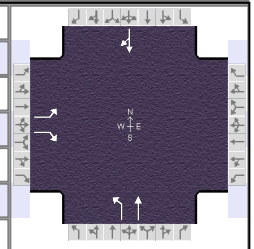
Base Critical Headway (sec)						4.1				7.1		6.2				
Critical Headway (sec)						5.06				6.40		6.86				
Base Follow-Up Headway (sec)						2.2				3.5		3.3				
Follow-Up Headway (sec)						3.06				3.50		3.89				

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)						39					93					
Capacity, c (veh/h)						1163					956					
v/c Ratio						0.03					0.10					
95% Queue Length, Q_{95} (veh)						0.1					0.3					
Control Delay (s/veh)						8.2	0.3				9.2					
Level of Service (LOS)						A	A				A					
Approach Delay (s/veh)						4.8				9.2						
Approach LOS						A				A						

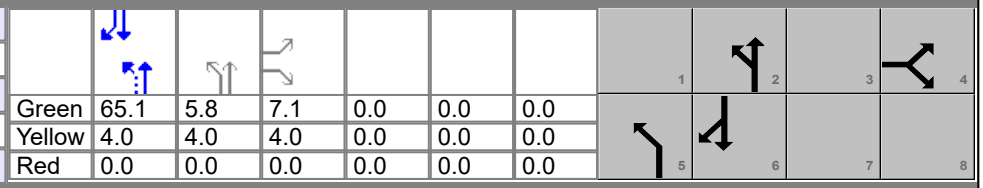
HCS Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	First Group Engineering			Duration, h	1.000
Analyst	Grant Barker	Analysis Date	6/21/2023	Area Type	Other
Jurisdiction	Greenfield	Time Period	AM Peak	PHF	1.00
Urban Street	Michigan Rd	Analysis Year	2023	Analysis Period	1> 7:00
Intersection	Mausoleum Rd & Michig…	File Name	Michigan Prop AM.xus		
Project Description	23-0030 TIS - Truck Parking				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	36		51				136	118			153	134

Signal Information			
Cycle, s	90.0	Reference Phase	2
Offset, s	0	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	65.1	5.8	7.1	0.0	0.0	0.0						
Yellow	4.0	4.0	4.0	0.0	0.0	0.0						
Red	0.0	0.0	0.0	0.0	0.0	0.0						

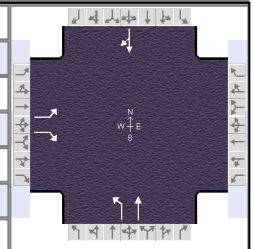
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4			5	2		6
Case Number		9.0			1.0	4.0		8.4
Phase Duration, s		11.1			9.8	78.9		69.1
Change Period, ($Y+R_c$), s		4.0			4.0	4.0		4.0
Max Allow Headway (*MAH*), s		3.4			3.2	0.0		0.0
Queue Clearance Time (g_s), s		5.0			2.0			
Green Extension Time (g_e), s		0.2			0.2	0.0		0.0
Phase Call Probability		0.89			0.97			
Max Out Probability		0.00			0.49			

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7		14				5	2			6	16
Adjusted Flow Rate (*v*), veh/h	36		51				136	118			287	
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1584		1459				1471	1788			1753	
Queue Service Time (g_s), s	1.9		3.0				0.0	1.1			4.9	
Cycle Queue Clearance Time (g_c), s	1.9		3.0				0.0	1.1			4.9	
Green Ratio (*g/C*)	0.08		0.08				0.77	0.83			0.72	
Capacity (*c*), veh/h	125		115				758	1488			1268	
Volume-to-Capacity Ratio (*X*)	0.288		0.443				0.179	0.079			0.226	
Back of Queue (*Q*), ft/ln (95 th percentile)	38.5		54				38.8	9.6			68.6	
Back of Queue (*Q*), veh/ln (95 th percentile)	1.4		2.0				1.3	0.4			2.7	
Queue Storage Ratio (*RQ*) (95 th percentile)	0.23		0.00				0.17	0.00			0.00	
Uniform Delay (d_1), s/veh	39.1		39.6				4.4	1.4			4.1	
Incremental Delay (d_2), s/veh	0.5		1.0				0.0	0.1			0.4	
Initial Queue Delay (d_3), s/veh	0.0		0.0				0.0	0.0			0.0	
Control Delay (*d*), s/veh	39.5		40.6				4.5	1.5			4.5	
Level of Service (LOS)	D		D				A	A			A	
Approach Delay, s/veh / LOS	40.1	D		0.0			3.1	A		4.5	A	
Intersection Delay, s/veh / LOS	8.9						A					

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

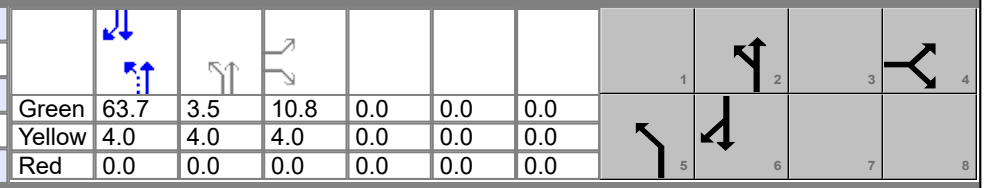
HCS Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	First Group Engineering			Duration, h	1.000
Analyst	Grant Barker	Analysis Date	6/21/2023	Area Type	Other
Jurisdiction	Greenfield	Time Period	PM Peak	PHF	1.00
Urban Street	Michigan Rd	Analysis Year	2023	Analysis Period	1> 7:00
Intersection	Mausoleum Rd & Michig…	File Name	Michigan Prop PM.xus		
Project Description	23-0030 TIS - Truck Parking				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	115		131				35	123			230	20

Signal Information			
Cycle, s	90.0	Reference Phase	2
Offset, s	0	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	63.7	3.5	10.8	0.0	0.0	0.0
Yellow	4.0	4.0	4.0	0.0	0.0	0.0
Red	0.0	0.0	0.0	0.0	0.0	0.0

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4			5	2		6
Case Number		9.0			1.0	4.0		8.4
Phase Duration, s		14.8			7.5	75.2		67.7
Change Period, ($Y+R_c$), s		4.0			4.0	4.0		4.0
Max Allow Headway (*MAH*), s		3.4			3.2	0.0		0.0
Queue Clearance Time (g_s), s		10.2			2.0			
Green Extension Time (g_e), s		0.5			0.1	0.0		0.0
Phase Call Probability		1.00			0.58			
Max Out Probability		0.00			0.41			

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7		14				5	2			6	16
Adjusted Flow Rate (*v*), veh/h	115		131				35	123			250	
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1570		1391				1045	1817			1873	
Queue Service Time (g_s), s	6.3		8.2				0.0	1.4			4.0	
Cycle Queue Clearance Time (g_c), s	6.3		8.2				0.0	1.4			4.0	
Green Ratio (*g/C*)	0.12		0.12				0.72	0.79			0.71	
Capacity (*c*), veh/h	188		166				545	1438			1326	
Volume-to-Capacity Ratio (*X*)	0.613		0.787				0.064	0.086			0.188	
Back of Queue (*Q*), ft/ln (95 th percentile)	124.6		148.8				12.6	16.2			62.4	
Back of Queue (*Q*), veh/ln (95 th percentile)	4.4		5.2				0.3	0.6			2.5	
Queue Storage Ratio (*RQ*) (95 th percentile)	0.75		0.00				0.06	0.00			0.00	
Uniform Delay (d_1), s/veh	37.6		38.5				4.9	2.1			4.4	
Incremental Delay (d_2), s/veh	1.2		3.2				0.0	0.1			0.3	
Initial Queue Delay (d_3), s/veh	0.0		0.0				0.0	0.0			0.0	
Control Delay (*d*), s/veh	38.9		41.7				4.9	2.2			4.7	
Level of Service (LOS)	D		D				A	A			A	
Approach Delay, s/veh / LOS	40.4	D		0.0			2.8	A		4.7	A	
Intersection Delay, s/veh / LOS	17.7						B					

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

HCS Two-Way Stop-Control Report

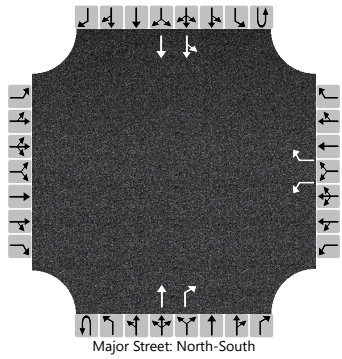
General Information

Analyst	Grant Barker
Agency/Co.	First Group Engineering
Date Performed	08-29-2023
Analysis Year	2023
Time Analyzed	7:00 - 8:00 AM
Intersection Orientation	North-South
Project Description	23-0030 TIS - Truck Parking

Site Information

Intersection	Rampart Rd and Michigan Rd
Jurisdiction	Greenfield
East/West Street	Rampart Rd
North/South Street	Michigan Rd
Peak Hour Factor	0.88
Analysis Time Period (hrs)	1.00

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		1	0	1	0	0	1	1	0	0	2	0
Configuration						L		R			T	R		LT	T	
Volume (veh/h)						158		77			154	88		36	161	
Percent Heavy Vehicles (%)						10		0						0		
Proportion Time Blocked																
Percent Grade (%)						0										
Right Turn Channelized						No					No					
Median Type | Storage						Undivided										

Critical and Follow-up Headways

Base Critical Headway (sec)						7.5		6.2						4.1		
Critical Headway (sec)						7.00		6.20						4.10		
Base Follow-Up Headway (sec)						3.5		3.3						2.2		
Follow-Up Headway (sec)						3.60		3.30						2.20		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)						180		88						41		
Capacity, c (veh/h)						581		873						1299		
v/c Ratio						0.31		0.10						0.03		
95% Queue Length, Q_{95} (veh)						1.3		0.3						0.1		
Control Delay (s/veh)						14.0		9.6						7.9	0.2	
Level of Service (LOS)						B		A						A	A	
Approach Delay (s/veh)						12.5								1.6		
Approach LOS						B								A		

HCS Two-Way Stop-Control Report

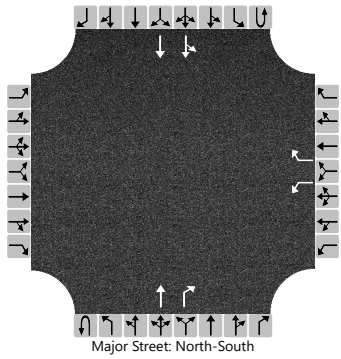
General Information

Analyst	Grant Barker
Agency/Co.	First Group Engineering
Date Performed	08-29-2023
Analysis Year	2023
Time Analyzed	4:00 - 5:00 AM
Intersection Orientation	North-South
Project Description	23-0030 TIS - Truck Parking

Site Information

Intersection	Rampart Rd and Michigan Rd
Jurisdiction	Greenfield
East/West Street	Rampart Rd
North/South Street	Michigan Rd
Peak Hour Factor	0.79
Analysis Time Period (hrs)	1.00

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		1	0	1	0	0	1	1	0	0	2	0
Configuration						L		R			T	R		LT	T	
Volume (veh/h)						39		61			283	159		50	192	
Percent Heavy Vehicles (%)						8		3						3		
Proportion Time Blocked																
Percent Grade (%)						0										
Right Turn Channelized						No					No					
Median Type | Storage			Undivided													

Critical and Follow-up Headways

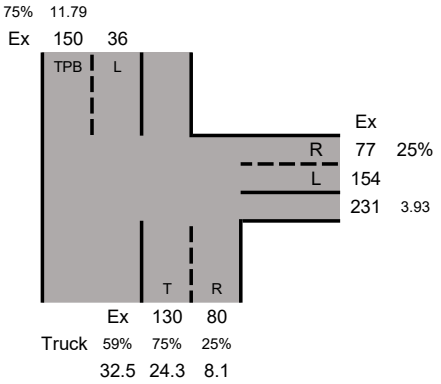
Base Critical Headway (sec)						7.5		6.2						4.1		
Critical Headway (sec)						6.96		6.26						4.16		
Base Follow-Up Headway (sec)						3.5		3.3						2.2		
Follow-Up Headway (sec)						3.58		3.33						2.23		

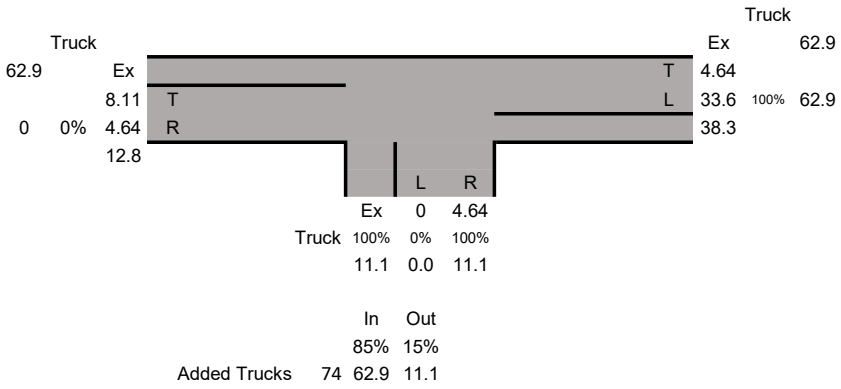
Delay, Queue Length, and Level of Service

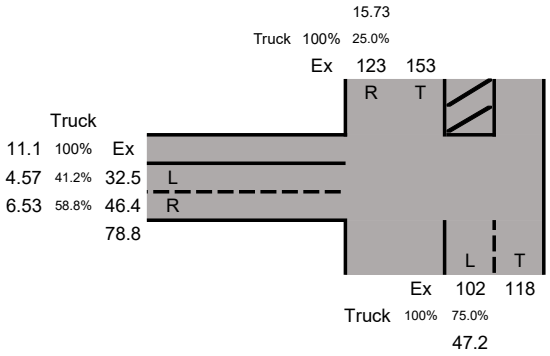
Flow Rate, v (veh/h)						49		77						63		
Capacity, c (veh/h)						387		682						1001		
v/c Ratio						0.13		0.11						0.06		
95% Queue Length, Q_{95} (veh)						0.4		0.4						0.2		
Control Delay (s/veh)						15.7		11.0						8.8	0.4	
Level of Service (LOS)						C		B						A	A	
Approach Delay (s/veh)						12.8								2.1		
Approach LOS						B								A		

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
AM Enterprise Ex + Growth	0	8	5	34	5	0	0	0	5	0	0	0
AM Michigan Ex + Growth	32	0	46	0	0	0	102	118	0	0	153	123
AM Rampart Ex + Growth	0	0	0	154	0	77	0	130	80	36	150	0

AM Peak Hour

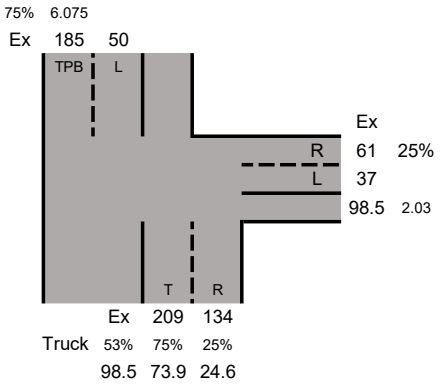


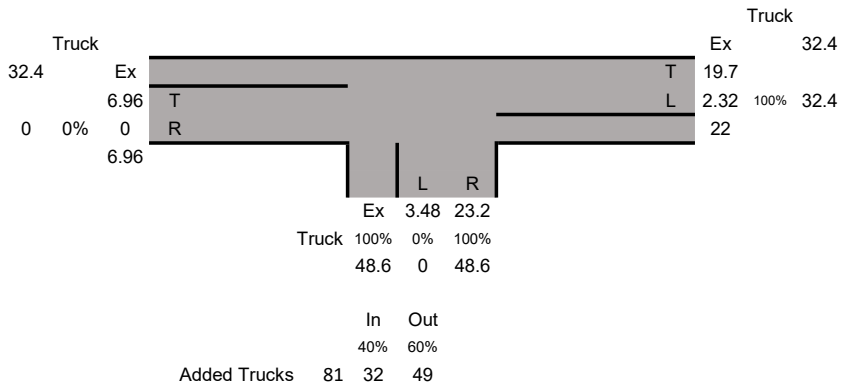


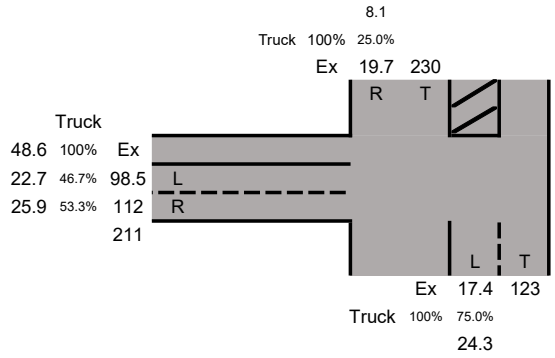


	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
PM Enterprise Ex + Growth	0	7	0	2	20	0	3	0	23	0	0	0
PM Michigan Ex + Growth	99	0	112	0	0	0	17	123	0	0	230	20
PM Rampart Ex + Growth	0	0	0	37	0	61	0	209	134	50	185	0

PM Peak Hour







AM Peak Hour

PHF 0.60	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Enterprise Car	0	7	4	25	4	0	0	0	1	0	0	0
Enterprise Truck	0	0	0	4	0	0	0	0	3	0	0	0
Added Truck			0	63			0		11			
Total Veh	0	7	4	92	4	0	0	0	15	0	0	0
Round	0	7	4	92	4	0	0	0	15	0	0	0
% Truck		0%	0%	73%	0%				93%			

PHF 0.67	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Michigan Car	30	0	45	0	0	0	99	114	0	0	153	117
Michigan Truck	2	0	1	0	0	0	3	5	0	0	0	6
Added Truck	5		7				47					16
Total Veh	37	0	53	0	0	0	149	118	0	0	153	139
Round	37	0	53	0	0	0	149	118	0	0	153	139
% Truck	19%		15%				34%	4%			0%	16%

PHF 0.88	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Rampart Car	0	0	0	143	0	77	0	124	74	36	150	0
Rampart Truck	0	0	0	12	0	0	0	6	6	0	0	0
Added Truck				4		0		24	8	0	12	
Total Veh	0	0	0	158	0	77	0	154	88	36	161	0
Round	0	0	0	158	0	77	0	154	88	36	161	0
% Truck				10%		0%		20%	16%	0%	7%	

PM Peak Hour

PHF 0.67	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Enterprise Car	0	7	0	1	20	0	3	0	20	0	0	0
Enterprise Truck	0	0	0	1	0	0	0	0	3	0	0	0
Added Truck			0	32			0		49			
Total Veh	0	7	0	35	20	0	3	0	72	0	0	0
Round	0	7	0	35	20	0	3	0	72	0	0	0
% Truck		0%		97%	0%		0%		73%			

PHF 0.69	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Michigan Car	95	0	109	0	0	0	15	121	0	0	230	17
Michigan Truck	3	0	3	0	0	0	2	2	0	0	0	2
Added Truck	23		26				24					0
Total Veh	121	0	138	0	0	0	42	123	0	0	230	20
Round	121	0	138	0	0	0	42	123	0	0	230	20
% Truck	22%		21%				64%	2%			0%	12%

PHF 0.79	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Rampart Car	0	0	0	36	0	60	0	202	130	48	180	0
Rampart Truck	0	0	0	1	0	2	0	6	4	1	6	0
Added Truck				2		0		74	25	0	6	
Total Veh	0	0	0	39	0	61	0	283	159	50	192	0
Round	0	0	0	39	0	61	0	283	159	50	192	0
% Truck				8%		3%		28%	18%	3%	6%	

HCS Warrants Report

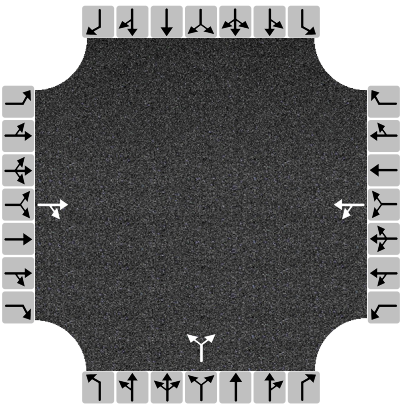
Project Information

Analyst	Grant Barker	Date	6/23/2023
Agency	First Group Engineering	Analysis Year	2023
Jurisdiction	Greenfield	Time Period Analyzed	PM Peak Hour
Project Description	23-0030 Trinity Alloy Truck Parking		

General

Major Street Direction	East-West	Population < 10,000	No
Starting Time Interval	7	Coordinated Signal System	No
Median Type	Undivided	Crashes (crashes/year)	0
Major Street Speed (mi/h)	30	Adequate Trials of Crash Exp. Alt.	No
Nearest Signal (ft)	2900		

Geometry and Traffic



Approach	Eastbound			Westbound			Northbound			Southbound		
Movement	L	T	R	L	T	R	L	T	R	L	T	R
Number of Lanes, N	0	1	0	0	1	0	0	0	0	0	0	0
Lane Usage		TR			LT			LR				
Vehicle Volumes Averages (veh/h)	0	5	8	36	10	0	3	0	30	0	0	0
Pedestrian Averages (peds/h)	0			0			0			0		
Gap Averages (gaps/h)	0			0			0			0		
Delay (s/veh)	0.7			0.4			0.0			0.0		
Delay (veh-hrs)	0.1			0.2			0.0			0.0		

School Crossing and Roadway Network

Number of Students in Highest Hour	0	Two or More Major Routes	No
Number of Adequate Gaps in Period	0	Weekend Counts	No
Number of Minutes in Period	0	5-year Growth Factor (%)	0

Railroad Crossing

Grade Crossing Approach	None	Rail Traffic (trains/day)	4
Highest Volume Hour with Trains	Unknown	High Occupancy Buses (%)	0
Distance to Stop Line (ft)	-	Tractor-Trailer Trucks (%)	10

Volume Summary

A23

Hour	Major Volume	Minor Volume	Total Volume	Peds/h	Gaps/h	1A (100%)	1A (80%)	1B (100%)	1B (80%)	2 (100%)	3A (100%)	3B (80%)	4A (100%)	4B (80%)
07 - 08	101	12	113	0	0	No	No	No	No	No	No	No	No	No
08 - 09	87	11	98	0	0	No	No	No	No	No	No	No	No	No
09 - 10	60	28	88	0	0	No	No	No	No	No	No	No	No	No
10 - 11	54	25	79	0	0	No	No	No	No	No	No	No	No	No
11 - 12	54	25	79	0	0	No	No	No	No	No	No	No	No	No
12 - 13	53	25	78	0	0	No	No	No	No	No	No	No	No	No
13 - 14	56	27	83	0	0	No	No	No	No	No	No	No	No	No
14 - 15	67	30	97	0	0	No	No	No	No	No	No	No	No	No
15 - 16	53	60	113	0	0	No	No	No	No	No	No	No	No	No
16 - 17	57	63	120	0	0	No	No	No	No	No	No	No	No	No
17 - 18	50	57	107	0	0	No	No	No	No	No	No	No	No	No
18 - 19	42	47	89	0	0	No	No	No	No	No	No	No	No	No
Total	734	410	1144	0	0	0	0	0	0	0	0	0	0	0

Warrants

Warrant 1: Eight-Hour Vehicular Volume	
A. Minimum Vehicular Volumes (Both major approaches --and-- higher minor approach) --or--	
B. Interruption of Continuous Traffic (Both major approaches --and-- higher minor approach) --or--	
80% Vehicular --and-- Interruption Volumes (Both major approaches --and-- higher minor approach)	
Warrant 2: Four-Hour Vehicular Volume	
Four-Hour Vehicular Volume (Both major approaches --and-- higher minor approach)	
Warrant 3: Peak Hour	
A. Peak-Hour Conditions (Minor delay -- and-- minor volume --and-- total volume) --or--	
B. Peak-Hour Vehicular Volumes (Both major approaches --and-- higher minor approach)	
Warrant 4: Pedestrian Volume	
A. Four Hour Volumes --or--	
B. One-Hour Volumes	
Warrant 5: School Crossing	
Gaps Same Period --and--	
Student Volumes	
Nearest Traffic Control Signal (optional)	✓
Warrant 6: Coordinated Signal System	
Degree of Platooning (Predominant direction or both directions)	
Warrant 7: Crash Experience	
A. Adequate trials of alternatives, observance and enforcement failed --and--	
B. Reported crashes susceptible to correction by signal (12-month period) --and--	
C. 80% Volumes for Warrants 1A, 1B, --or-- 4 are satisfied	
Warrant 8: Roadway Network	
A. Weekday Volume (Peak hour total --and-- projected warrants 1, 2, or 3) --or--	
B. Weekend Volume (Five hours total)	
Warrant 9: Grade Crossing	
A. Grade Crossing within 140 ft --and--	
B. Peak-Hour Vehicular Volumes	

HCS Warrants Report

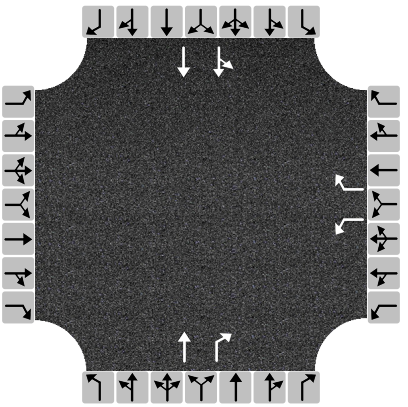
Project Information

Analyst	Grant Barker	Date	8/29/23
Agency	First Group Engineering	Analysis Year	2023
Jurisdiction	Greenfield	Time Period Analyzed	PM Peak Hour
Project Description	23-0030 TIS - Truck Parking		

General

Major Street Direction	North-South	Population < 10,000	No
Starting Time Interval	7	Coordinated Signal System	No
Median Type	Undivided	Crashes (crashes/year)	0
Major Street Speed (mi/h)	30	Adequate Trials of Crash Exp. Alt.	No
Nearest Signal (ft)	2900		

Geometry and Traffic



Approach	Eastbound			Westbound			Northbound			Southbound		
Movement	L	T	R	L	T	R	L	T	R	L	T	R
Number of Lanes, N	0	0	0	1	0	1	0	1	1	0	2	0
Lane Usage				L		R		T	R		LT	
Vehicle Volumes Averages (veh/h)	0	5	8	70	10	54	3	201	104	35	145	0
Pedestrian Averages (peds/h)	0			0			0			0		
Gap Averages (gaps/h)	0			0			0			0		
Delay (s/veh)	0.7			0.4			0.0			0.0		
Delay (veh-hrs)	0.1			0.2			0.0			0.0		

School Crossing and Roadway Network

Number of Students in Highest Hour	0	Two or More Major Routes	No
Number of Adequate Gaps in Period	0	Weekend Counts	No
Number of Minutes in Period	0	5-year Growth Factor (%)	0

Railroad Crossing

Grade Crossing Approach	None	Rail Traffic (trains/day)	4
Highest Volume Hour with Trains	Unknown	High Occupancy Buses (%)	0
Distance to Stop Line (ft)	-	Tractor-Trailer Trucks (%)	10

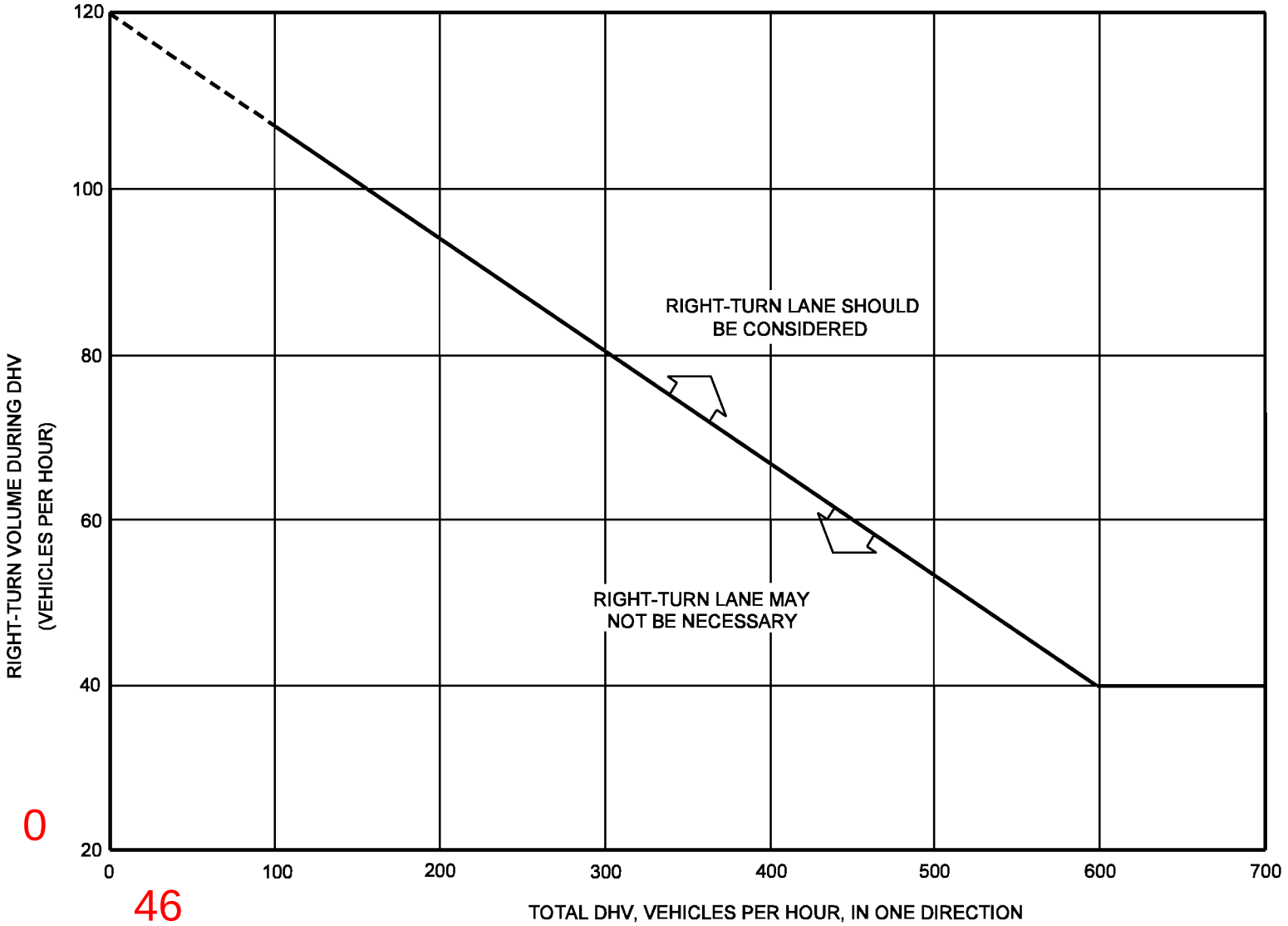
Volume Summary

A25

Hour	Major Volume	Minor Volume	Total Volume	Peds/h	Gaps/h	1A (100%)	1A (80%)	1B (100%)	1B (80%)	2 (100%)	3A (100%)	3B (80%)	4A (100%)	4B (80%)
07 - 08	440	239	703	0	0	No	No	No	No	No	No	No	No	No
08 - 09	375	199	595	0	0	No	No	No	No	No	No	No	No	No
09 - 10	412	131	557	0	0	No	No	No	No	No	No	No	No	No
10 - 11	372	119	504	0	0	No	No	No	No	No	No	No	No	No
11 - 12	368	117	498	0	0	No	No	No	No	No	No	No	No	No
12 - 13	383	115	511	0	0	No	No	No	No	No	No	No	No	No
13 - 14	696	125	834	0	0	No	No	No	No	No	No	No	No	No
14 - 15	452	144	612	0	0	No	No	No	No	No	No	No	No	No
15 - 16	549	113	674	0	0	No	No	No	No	No	No	No	No	No
16 - 17	691	120	824	0	0	No	No	No	No	No	No	No	No	No
17 - 18	621	108	740	0	0	No	No	No	No	No	No	No	No	No
18 - 19	518	90	617	0	0	No	No	No	No	No	No	No	No	No
Total	5877	1620	7669	0	0	0	0	0	0	0	0	0	0	0

Warrants

Warrant 1: Eight-Hour Vehicular Volume	
A. Minimum Vehicular Volumes (Both major approaches --and-- higher minor approach) --or--	
B. Interruption of Continuous Traffic (Both major approaches --and-- higher minor approach) --or--	
80% Vehicular --and-- Interruption Volumes (Both major approaches --and-- higher minor approach)	
Warrant 2: Four-Hour Vehicular Volume	
Four-Hour Vehicular Volume (Both major approaches --and-- higher minor approach)	
Warrant 3: Peak Hour	
A. Peak-Hour Conditions (Minor delay -- and-- minor volume --and-- total volume) --or--	
B. Peak-Hour Vehicular Volumes (Both major approaches --and-- higher minor approach)	
Warrant 4: Pedestrian Volume	
A. Four Hour Volumes --or--	
B. One-Hour Volumes	
Warrant 5: School Crossing	
Gaps Same Period --and--	
Student Volumes	
Nearest Traffic Control Signal (optional)	✓
Warrant 6: Coordinated Signal System	
Degree of Platooning (Predominant direction or both directions)	
Warrant 7: Crash Experience	
A. Adequate trials of alternatives, observance and enforcement failed --and--	
B. Reported crashes susceptible to correction by signal (12-month period) --and--	
C. 80% Volumes for Warrants 1A, 1B, --or-- 4 are satisfied	
Warrant 8: Roadway Network	
A. Weekday Volume (Peak hour total --and-- projected warrants 1, 2, or 3) --or--	
B. Weekend Volume (Five hours total)	
Warrant 9: Grade Crossing	
A. Grade Crossing within 140 ft --and--	
B. Peak-Hour Vehicular Volumes	



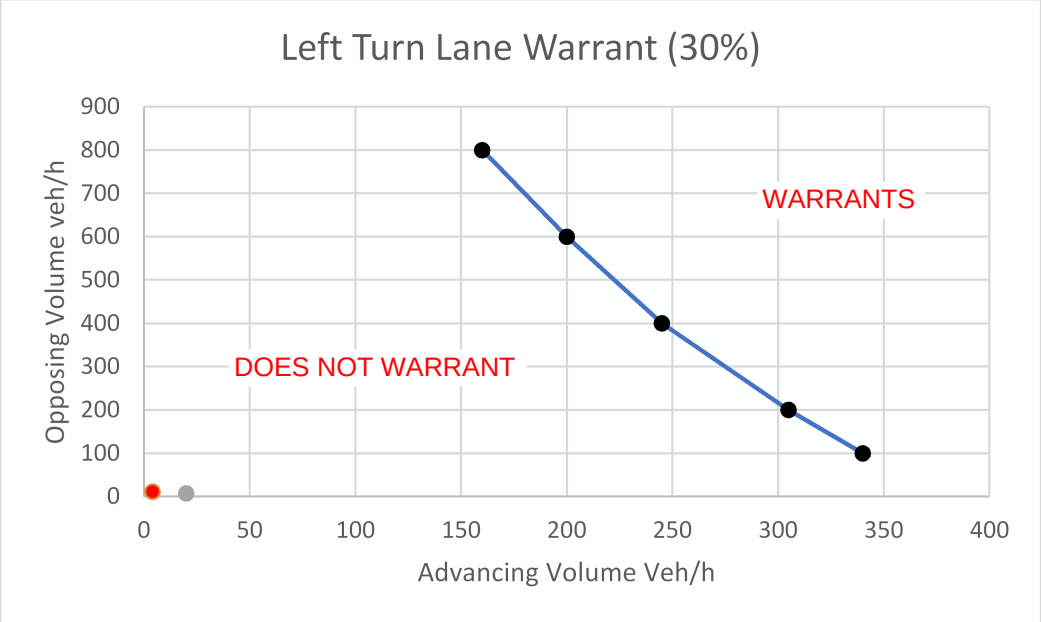
GUIDELINES FOR RIGHT-TURN LANES AT UNSIGNALIZED INTERSECTIONS
ON 2-LANE HIGHWAYS

Figure 46-4A

Operating Speed (mph)	Opposing Volume (veh/h)	Advancing Volume (veh/h)			
		5% Left Turns	10% Left Turns	20% Left Turns	30% Left Turns
40	800	330	240	180	160
	600	410	305	225	200
	400	510	380	275	245
	200	640	470	350	305
	100	720	515	390	340
50	800	280	210	165	135
	600	350	260	195	170
	400	430	320	240	210
	200	550	400	300	270
	100	615	445	335	295
60	800	230	170	125	115
	600	290	210	160	140
	400	365	270	200	175
	200	450	330	250	215
	100	505	370	275	240

VOLUME GUIDELINES FOR LEFT-TURN LANE ON TWO-LANE HIGHWAY

Figure 46-4C



LEFT TURN LANE NOT WARRANTED