



TRAFFIC IMPACT STUDY MILLBROOK HOUSING DEVELOPMENT MARSHALL, MICHIGAN

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EXECUTIVE SUMMARY

Introduction

GCC 550 Hughes, LLC is working to construct a housing development on a vacant parcel of land, located on the northwest corner of Hughes Street and Kalamazoo Avenue, in Marshall, Michigan, as shown in Figure 1. This development will have access to A Drive via three (3) new driveways and a connection to Kalamazoo Avenue to the east via one (1) new driveway. The dog park will also have an access drive to A Drive, but is not connected to site circulation.

The purpose of this traffic impact study was to analyze the potential impacts of the multifamily development, as defined by the Marshall Zoning Ordinance, and identify what physical and/or operational roadway system improvements may be necessary to mitigate existing or anticipated background issues and/or impacts created by this development's traffic.

Pre-study coordination was completed with the City of Marshall staff to help identify the required study area, study parameters, and any specific areas of concern. The following chapters outline the results of analyses completed during the study process.

Study Area

The study area includes four (4) existing stop-controlled intersections, as listed below:

- Kalamazoo Avenue (M-227) / Industrial Road (M-227) (One-Way Stop)
- Kalamazoo Avenue (M-227) / Crary Street (One-Way Stop)
- Kalamazoo Avenue (M-227) / Hughes Street / A Drive (Two-Way Stop)
- Hughes Street / A Drive / 15 Mile Road (All-Way Stop)

Data Collection

Morning (7:00 to 9:00 a.m.) and evening (4:00 to 6:00 p.m.) peak hour turning movement counts at the study area intersections were collected in June 2025 on a typical weekday. These counts indicated that the typical weekday morning peak hour generally occurs between 7:00 a.m. to 8:00 a.m. and the typical afternoon peak hour occurs between 4:00 p.m. to 5:00 p.m.

Analysis

Three (3) analysis scenarios were completed for the weekday morning and afternoon peak hours as part of the study, as follows:

- Existing Conditions
- Future (2027) Conditions
- Future (2033) Conditions

An annual background traffic growth rate of 0.5% (zero point five percent) was applied to the existing volumes to help reflect anticipated non-development traffic increases by the 2027 and 2033 horizon years. This background growth rate was discussed and agreed upon with Southcentral Michigan Planning Council.

Trip generation for the site was calculated for the typical weekday morning and afternoon peak hours based on the methods of the Institute of Transportation Engineers (ITE) *Trip Generation Manual*, Eleventh Edition. Phase I of the site is expected to generate approximately 127 weekday morning peak hour vehicle trips (31 inbound, 96 outbound) and approximately 164 weekday afternoon peak hour trips (102 inbound, 62 outbound) onto the street system. Full build-out of the development is expected to generate approximately 404 weekday morning peak hour vehicle trips (98 inbound, 306 outbound) and approximately 516 afternoon peak hour trips (323 inbound, 193 outbound).

Conclusions

Based on the analyses performed as part of this study, the proposed development will have some impact to the surrounding roadway network. The findings of this study are as follows:

Existing Conditions

Based on the existing conditions analysis, it appears that all intersections in the study area currently operate at a level of service (LOS) "C" or better besides the left-turning movement for eastbound Hughes Street at Kalamazoo Avenue, which is currently at a LOS "F." This failing level of service is likely due to a lack of gaps in traffic on Kalamazoo Avenue. Additionally, 95th percentile queue lengths for the eastbound approach were projected to be 4.5 vehicles long for the afternoon peak period.

Turn lanes on Hughes Street/A Drive and Kalamazoo Avenue are recommended to reduce the delay at this intersection. These turn lanes can likely be created with pavement markings since the existing pavement flares to roughly 36 feet at the intersection. Turn lanes on Kalamazoo Avenue may need additional pavement and should be constructed to Michigan Department of Transportation (MDOT) standards. These turn lanes are recommended to be striped/constructed to address the existing condition poor traffic conditions.

Crash Analysis

Crash information for the most recent five (5) years available (2019–2023) was reviewed, based on information available on the *Michigan Traffic Crash Facts* website. The crash analysis was completed for each intersection in the stud area.

Kalamazoo Avenue and Hughes Street/A Drive

There was a total of 12 crashes at the Kalamazoo Avenue (M-227) and Hughes Street/A Drive intersection over the last five (5) years. Of these crashes, one (1) crash resulted in an "A" serious injury, one (1) crash resulted in a "C" possible injury, and the remaining crashes resulted in no injury. Additionally, seven (7) of the 12 crashes were angle crashes, including the two (2) injury crashes. The remaining crashes were single vehicle or rear end crashes. These crashes suggest a pattern of angle crashes, which could be a result of limited sight distance or excessive delay on A Drive/Hughes Street.

The remaining intersections in the study area did not show any crash patterns.

Future Phase I (2027) Conditions

Intersection level of service calculations were completed to evaluate the Phase I future (2027) morning and afternoon peak hour conditions at the site access driveways and study area intersections, assuming the completion of the proposed development. This analysis also included the turn lanes that were recommended for the existing conditions at the Kalamazoo Avenue and Hughes Street/A Drive intersection.

The 2027 future analysis showed an increase in delay at most study intersections, with the worst delay occurring for the eastbound approach on A Drive/Hughes Street and Kalamazoo Avenue. During the afternoon peak, delay increased 69.9 seconds for the eastbound approach. 95th percentile queues also increased to 5.8 vehicles.

Since the eastbound A Drive approach has a failing LOS for the afternoon peak period, a signal warrant for peak hours was conducted to determine if a traffic signal should be recommended at this intersection with the new traffic volumes. While the intersection did not meet warrant 3A or 3B for either morning or afternoon peak hours, this intersection should be monitored after Phase I is constructed to see if the new traffic volumes warrant a traffic signal.

Phase I Driveway Turn Lanes

While the Phase I traffic model showed acceptable levels of service at each proposed driveway, MDOT's turn lane guidance was used for each driveway to determine if a right turn or left turn lane was warranted on A Drive or Kalamazoo Avenue. The only driveway that warranted a turn lane was the driveway on Kalamazoo Avenue at Crary Street. The projected traffic volumes met the full width right-turn lane warrant for southbound Kalamazoo Avenue for the afternoon peak only.

Future Phase IV (2033) Conditions

To ensure that the study area intersections will operate acceptably after the entire four (4) phases are built, a separate analysis was conducted using the full trip generation. This analysis also grew existing traffic with the same 0.5% (zero point five percent) background growth rate to 2033, when the full development is anticipated to be completed. Improvements that were recommended with existing conditions or Phase I conditions, such as the right turn-lane for southbound Kalamazoo Avenue at the Crary Street driveway and left-turn lanes at the Kalamazoo Avenue and Hughes Street/A Drive intersection, were also included in this analysis.

Compared to the 2027 levels of service, delay increased significantly for the intersections of Kalamazoo Avenue/Industrial Drive, Kalamazoo Avenue/Crary Street, and Kalamazoo Avenue/Crary Street/north driveway in the afternoon peak period. 95th percentile queues at the Kalamazoo Avenue/Industrial Drive intersection increased to 5.5 vehicles. Queues at the north driveway and Crary Street intersection increased to 2.1 vehicles and queues at the Hughes Street/A Drive increased to 11.3 vehicles.

Future Phase IV (2033) Roadway Improvements

The delay and queue length at the Hughes Street/A Drive and Kalamazoo Avenue intersection are projected to be unacceptable and the 2033 projected traffic volumes were used with the MDOT peak hour traffic signal warrant. With the projected 2033 traffic volumes, peak hour traffic signal warrants are met and it is likely that a traffic signal will be warranted at this intersection.

To address the poor LOS and queue length projected at Industrial Drive, a right-turn lane was added on the eastbound approach at Kalamazoo Avenue. This turn lane creates a dedicated left-turn and right-turn lane for this approach.

Lastly, although the north driveway is projected to operate at a LOS "F" in the afternoon peak, 95th percentile queue lengths are projected to be 2.1 vehicles. Since Kalamazoo Avenue carries much more traffic and the queue lengths on the north site driveway are not significant, this LOS for one (1) peak hour should be considered acceptable.

Driveway Turn Lane Analysis

The driveways that did not warrant a right-turn or left-turn lane with Phase I traffic were re-evaluated with Phase IV traffic to determine if any turn lanes will be warranted for full build-out conditions. This evaluation determined that a right-turn lane is warranted for the center site driveway on A Drive.

A final traffic model, with the improvements discussed in the previous section, was created to quantify how they will improve traffic conditions in the study area. The future Phase IV (2033) analysis with the roadway improvements, discussed above, projected that all intersections will operate at an acceptable LOS, besides the Kalamazoo Avenue and Crary Street/north driveway intersection; however, this LOS "F" at the Kalamazoo Avenue and Crary Street/north driveway intersection should still be considered acceptable due to the short 95th percentile queue lengths projected. This analysis included the addition of a turn lane on Industrial Drive, the center site driveway on A Drive, and a traffic signal at the Hughes Street/A Drive and Kalamazoo Avenue intersection.

Recommendations

The following are recommendations to mitigate the impact of the proposed development and improve operations within the study area:

Existing Conditions

The existing conditions analysis showed a failing LOS for the eastbound approach on A Drive at Kalamazoo Avenue. This existing failing LOS should be addressed by current maintaining agencies by striping or constructing left-turn lanes at the intersection for the eastbound and northbound approaches and a right-turn lane for the southbound approach.

Phase I (2027) Conditions

The Phase I analysis showed that delay increased at the Kalamazoo Avenue and A Drive/Hughes Street intersection compared to existing conditions, but the projected traffic volumes did not meet peak hour signal warrants. It is recommended that this intersection is monitored for traffic signal warrants after Phase I is constructed.

Turn lanes were evaluated for the proposed driveways in Phase I and a right-turn lane was warranted on southbound Kalamazoo Avenue at the north driveway and Crary Street intersection. This driveway is also recommended to have a 100-foot left-turn lane for exiting eastbound traffic.

Phase II (2029) Conditions

Based on the trip generation for Phase II, it is likely that a traffic signal will become warranted for at least the afternoon peak period at the intersection of Kalamazoo Avenue and A Drive/Hughes Street. Traffic conditions during Phases I and II should be monitored at the intersection.

A right-turn taper is anticipated to be warranted at the center driveway for the development on A Drive after Phase II is complete.

Phase III (2031) Conditions

Based on the anticipated trip generation for Phase III, a traffic signal will likely be warranted for the intersection of Kalamazoo Avenue and A Drive/Hughes Street. A signal warrant analysis is recommended to be performed at this intersection, prior to Phase III construction, to determine if traffic volumes warrant a traffic signal to be constructed if a traffic signal has not been constructed prior to Phase III.

A full-width right-turn lane is anticipated to be warranted at the center driveway for the development on A Drive during Phase III.

A full-width right-turn lane is also anticipated to be needed at the eastbound Industrial Drive (M-227) approach at Kalamazoo Avenue (M-227).

Phase IV (2033) Conditions

Based on the preceding roadway improvements and anticipated trip generation for Phase IV, no further improvements are expected to be needed for Phase IV construction.

CHAPTER 1

INTRODUCTION

GCC 550 Hughes, LLC is working to construct a housing development on a vacant parcel of land, located on the northwest corner of Hughes Street and Kalamazoo Avenue, in Marshall, Michigan, as shown in Figure 1. This development will have access to A Drive via three (3) new driveways and a connection to Kalamazoo Avenue to the east via one (1) new driveway. The dog park will also have an access drive to A Drive, but is not connected to site circulation.

The purpose of this traffic impact study was to analyze the potential impacts of the multifamily development, as defined by the Marshall Zoning Ordinance, and identify what physical and/or operational roadway system improvements may be necessary to mitigate existing or anticipated background issues and/or impacts created by this development's traffic.

Pre-study coordination was completed with the City of Marshall staff to help identify the required study area, study parameters, and any specific areas of concern. The following chapters outline the results of analyses completed during the study process. Tasks undertaken to complete the analyses include:

1. Data Collection

Morning and afternoon peak hour turning movement counts were completed at the study area intersections in June 2025. Information regarding lane configurations, speed limits, traffic controls, and other related data for the study area roadways was also collected.



Figure 1. Study Location

2. Background Growth

An annual background traffic growth rate of 0.5% (zero point five percent) was applied to the existing volumes to help reflect anticipated non-development traffic increases by the 2027 and 2033 horizon year. This background growth rate was discussed and agreed upon with Southcentral Michigan Planning Council.

3. **Trip Generation/Distribution**

The number of trips the proposed development is expected to generate during peak hours was identified. These trips were then assigned to the adjacent street system based upon the patterns followed by existing traffic and engineering judgment.

4. **Levels of Service**

Capacity calculations were completed at the study area intersections and proposed site driveways to identify existing and anticipated future peak hour operational characteristics.

5. **Mitigation**

Roadway/intersection improvements were identified, when applicable, that will enable the adjacent roadways and study area intersections to maintain equal and/or acceptable levels of operation under future conditions, upon the addition of background traffic growth and/or due to the development's traffic.

The following chapters outline the results of analyses completed during the study process.

CHAPTER 2

EXISTING CONDITIONS

The first step in the identification of potential traffic impacts is to determine how well the adjacent streets are operating under current conditions. This chapter summarizes the data collection and existing operating conditions analysis procedures.

Key Study Area Roadways

Hughes Street/A Drive

Hughes Street is an east-west collector roadway within the study area under Calhoun County Road Department jurisdiction. It has a two-lane cross section with one (1) travel lane in each direction and speed limit of 45–55 miles per hour (mph) within the study area. Weekday 24-hour traffic volumes along Hughes Street/A Drive average approximately 1,800 vehicles per day.



Hughes Street West of Kalamazoo Avenue (M-227)

Kalamazoo Avenue (M-227)

Kalamazoo Avenue (M-227) is a north-south arterial roadway within the study area under Michigan Department of Transportation (MDOT) jurisdiction. It has a two-lane cross section with one (1) travel lane in each direction and speed limit of 40–50 mph within the study area. Weekday 24-hour traffic volumes along Kalamazoo Avenue average approximately 11,000 vehicles per day.



Kalamazoo Avenue (M-227) at Crary Street

Industrial Drive (M-227)

Industrial Drive (M-227) is an arterial east-west roadway within the study area under MDOT jurisdiction. It has a two-lane cross section with one (1) travel lane in each direction and speed limit of 35 mph within the study area. Weekday 24-hour traffic volumes along Industrial Drive average approximately 2,700 vehicles per day.



Industrial Drive at Kalamazoo Avenue

Existing Intersections

The study area includes four (4) existing stop-controlled intersections, as listed in Table 1:

Table 1. Existing Intersections

Intersection	Traffic Control
Kalamazoo Avenue (M-227) / Industrial Drive (M-227)	One-Way Stop
Kalamazoo Avenue (M-227) / Crary Street	One-Way Stop
Kalamazoo Avenue (M-227) / Hughes Street	Two-Way Stop
A Drive / 15 Mile Road	Four-Way Stop

Data Collection

Morning (7:00 to 9:00 a.m.) and evening (4:00 to 6:00 p.m.) peak hour turning movement counts at the study area intersections were collected in June/July 2025 on a typical weekday. These counts indicate that the typical weekday morning peak hour generally occurs between 7:00 a.m. to 8:00 a.m. and the typical afternoon peak hour occurs between 4:00 p.m. to 5:00 p.m.

Existing Conditions Capacity Analysis

Intersection “level of service” (LOS) calculations were completed to evaluate the current operational efficiency of the study area intersections. These calculations were completed using techniques outlined in the *Highway Capacity Manual*, published by the Transportation Research Board. Per MDOT requirements, *Synchro*® traffic analysis software, version 11, based on the *Highway Capacity Manual* methodologies, was used in the analysis.

Levels of service at signalized and unsignalized intersections relate to the delay, traffic volumes, and intersection geometry. Levels of service are expressed in a range from “A” to “F,” with “A” denoting the highest or best operating conditions. Generally, a LOS “D” rating is considered the minimum acceptable service level for signalized and unsignalized intersections in most areas, although a LOS “E” or “F” can be deemed as acceptable during the peak hours. The criteria for determining the LOS at signalized and unsignalized intersections are outlined in the Appendix of this report.

The existing morning and afternoon peak hours were analyzed at the study area intersections. Table 2 shows the overall levels of service, while Figure 2 shows the levels of service for all movements at the study area intersections. Copies of the *Synchro*® analyses are included in the Appendix.

Table 2. Existing Levels of Service and Delay

Intersection	Existing Conditions			
	A.M.		P.M.	
	LOS	Delay(s)	LOS	Delay(s)
Kalamazoo Avenue (M-227) / Industrial Drive (M-227) ¹	B	11.1	C	19.3
Kalamazoo Avenue (M-227) / Crary Street ¹	B	10.3	C	15.0
Kalamazoo Avenue (M-227) / Hughes Street ¹	C	15.5	F	53.7
A Drive / 15 Mile Road ¹	A	8.9	B	10.9

¹Unsignalized intersection, critical/worst approach/movement shown

Source: Progressive Companies, August 2025

Based on the existing conditions analysis, it appears that all intersections in the study area currently operate at a LOS “C” or better, besides the left-turning movement for eastbound Hughes Street at Kalamazoo Avenue which is currently at a LOS “F.” This failing level of service is likely due to a lack of gaps in traffic on Kalamazoo Avenue. Additionally, 95th percentile queue lengths for the eastbound approach were projected to be 4.5 vehicles long for the afternoon peak period.

To address this failing level of service, the existing conditions a 150-foot long left turn for eastbound A Drive and northbound Kalamazoo Avenue was added to the intersection in the traffic model. This resulted in a LOS “E” for the eastbound approach, with a decrease in delay to 41.4 seconds and 95th percentile queue length of 3.4 vehicles.

Turn lanes on Hughes Street/A Drive can likely be created with pavement markings, since the existing pavement flares to roughly 36 feet at the intersection. Turn lanes on Kalamazoo Avenue may need additional pavement and should be constructed to MDOT standards. These turn lanes are recommended to be striped/constructed to address the existing condition poor traffic conditions.

Crash Analysis

Crash information for the most recent five (5) years available (2019–2023) was reviewed, based on information available on the *Michigan Traffic Crash Facts* website. The crash analysis was completed for each intersection in the study area:

Kalamazoo Avenue and Hughes Street/A Drive

There was a total of 12 crashes at the Kalamazoo Avenue (M-227) and Hughes Street/A Drive intersection over the last five (5) years. Of these crashes, one (1) crash resulted in a “A” serious injury, one (1) crash resulted in a “C” possible injury, and the remaining crashes resulted in no injury. Additionally, seven (7) of the 12 crashes were angle crashes, including the two (2) injury crashes. The remaining crashes were single vehicle or rear end crashes. These crashes suggest a pattern of angle crashes, which could be a result of limited sight distance or excessive delay on A Drive/Hughes Street.

Kalamazoo Avenue (M-227) and Crary Street

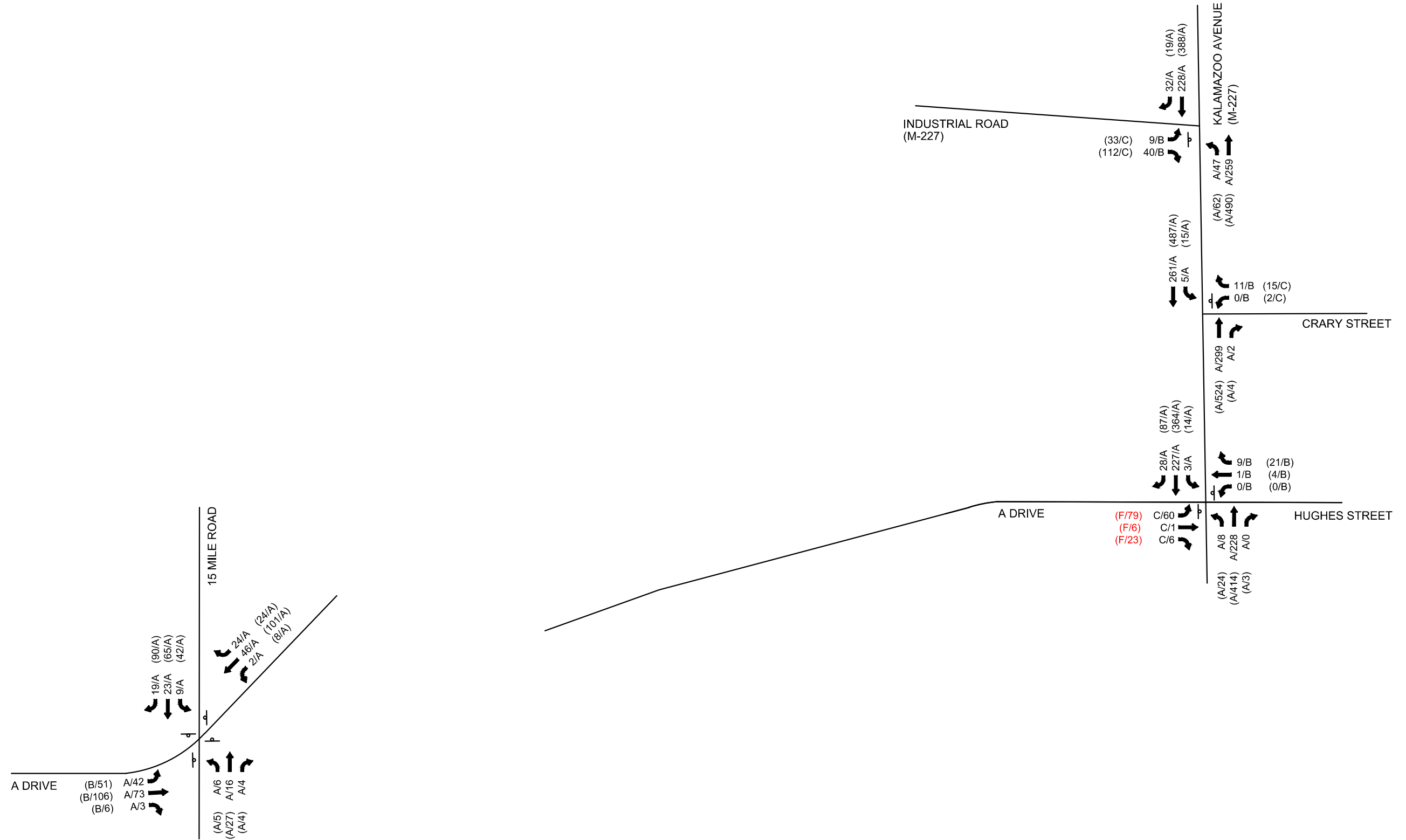
There have been three (3) crashes in the last five (5) years at the Kalamazoo Avenue and Crary Street intersection, none of which resulted in any injuries. There does not appear to be a concerning crash pattern at this location.

Kalamazoo Avenue (M-227) and Industrial Drive (M-227)

There was a total of nine (9) crashes over the last five (5) years at the Kalamazoo Avenue and Industrial Drive intersection, including one (1) “A” serious injury crash. The remaining crashes resulted in no injury and were primarily rear end or single vehicle crashes. The serious injury crash was a single vehicle crash. There does not appear to be a concerning crash pattern present at this location.

15 Mile Road and A Drive

There was a total of two (2) crashes over the last five (5) years at the 15 Mile Road and A Drive intersection. Both crashes resulted in no injury and there does not appear to be a concerning crash pattern present at this location.



LEGEND
XX (XX) = AM (PM)
A = LEVEL-OF-SERVICE
Ⓢ = SIGNALIZED INTERSECTION
Ⓟ = STOP-CONTROLLED

EXISTING PEAK-HOUR VOLUMES +
LEVELS-OF-SERVICE



FIGURE
2

CHAPTER 3

FUTURE (2027) CONDITIONS

The purpose of this chapter is to summarize the anticipated future Phase 1 (2027) traffic conditions within the study area with background traffic growth and proposed development traffic in place. This analysis will provide the before/after comparison of future conditions and help define the timing and applicability of any potential roadway improvements necessary to mitigate the impact of the proposed development.

Proposed Development and Site Access

GCC 550 Hughes, LLC is working to construct a housing development on a vacant parcel of land, located on the northwest corner of Hughes Street and Kalamazoo Avenue, in Marshall, Michigan, as shown in Figure 1. This development will have access to A Drive via three (3) new driveways and a connection to Kalamazoo Avenue to the east via one (1) new driveway. The dog park will also have an access drive to A Drive, but is not connected to site circulation.



Figure 3. Preliminary Site Plan

Background Traffic Volumes

It is known that the Ford Blue Oval battery plant is currently under construction west of Marshall, Michigan, and planned to open in 2026. This plant is forecasted to create 1,700 new jobs, many of which could be filled by residents of this proposed housing development. To our knowledge, the traffic study for the Ford Blue Oval battery plant did not include any intersections in this study area and it is unknown how the plant will affect traffic at these intersections. Construction is currently creating many trips to and from the site (trucks and employees) and traffic counts were taken while the plant's construction occurred, which would have captured any of these additional trips. Therefore, an annual growth rate of 0.5% (zero point five percent) was applied to the existing peak hour volumes to help determine background (2027 and 2033) peak hour volumes. This rate was discussed and agreed upon by the Southcentral Michigan Planning Council.

A separate analysis of the background traffic conditions was not completed as part of this study as the results would be largely the same as existing conditions, with only slightly increased delay due to the minor increase in traffic volumes.

Trip Generation

The Institute of Transportation Engineers (ITE) *Trip Generation Manual*, Eleventh Edition, was used to calculate the anticipated traffic that may be generated by the proposed development. Trips are measured individually for inbound and outbound movements; therefore, a visit to the site by a resident, for instance, generates two (2) trips – one (1) inbound and one (1) outbound. Based on the land use descriptions provided within the ITE *Trip Generation Manual*, the most applicable land uses for the proposed site are Multi Family Housing (Low-Rise) (Land Use Code 220) and Single Family Attached Housing (Land Use Code 215).

Trip generation for the site was calculated for the typical weekday morning and afternoon peak hours based on the methods of the ITE *Trip Generation Manual*. Phase I of the site is expected to generate approximately 127 weekday morning peak hour vehicle trips (31 inbound, 96 outbound) and approximately 164 weekday afternoon peak hour trips (102 inbound, 62 outbound) onto the street system. Full build-out of the development is expected to generate approximately 404 weekday morning peak hour vehicle trips (98 inbound, 306 outbound) and approximately 516 afternoon peak hour trips (323 inbound, 193 outbound).

Table 3. Phase I Trip Generation

Land Use	ITE Code	Size	A.M.			P.M.		
			Total	Enter	Exit	Total	Enter	Exit
Phase I – Single Family Attached Housing	215	50 Units	20	5	15	26	15	11
Phase I – Multifamily Housing (Low Rise)	220	272 Units	107	26	81	138	87	51
Phase I Subtotal			127	31	96	164	102	62

Trip Distribution

The directional distribution of the site generated new trips was based upon existing travel patterns and engineering judgment. New trips followed the existing traffic patterns and locations of destinations nearby. These distributions are shown below:

	<u>A.M.</u>	<u>P.M.</u>
To/from A-Drive West	12%	12%
To/from Kalamazoo Avenue North	68%	68%
To/from Kalamazoo Avenue South	20%	20%

Phase I of the development will consist of the construction of three (3) new driveways, one (1) onto Kalamazoo Avenue at Crary Street, one (1) onto A Drive aligning with an existing gated road on the south side of A Drive, and one (1) onto A Drive just west of Kalamazoo Avenue. Trips were distributed to each driveway based on the overall traffic distribution and the location of each driveway in relation to the site layout.

The anticipated site trips were added to the background (2027 and 2033) peak hour volumes to depict the estimated total future (2027 and 2033) volumes during the morning and afternoon peak hours. Figure 7 shows the total anticipated phase I future (2027) volumes and Figure 11 shows the total anticipated Phase IV future (2033) volumes.

Phase I Future (2027) Capacity Analysis

Intersection level of service calculations were completed to evaluate the Phase I future (2027) morning and afternoon peak hour conditions at the site access driveways and study area intersections, assuming the completion of the proposed development. This analysis also included the turn lanes at the Kalamazoo Avenue and Hughes Street/A Drive intersection. Table 4 and Figure 7 show a summary of the levels of service at the study area intersections. Copies of the *Synchro*® analyses are included in the Appendix.

Table 4. Future Phase I (2027) Levels of Service and Delay

Intersection	Phase I (2027) Conditions			
	A.M.		P.M.	
	LOS	Delay(s)	LOS	Delay(s)
Kalamazoo Avenue (M-227) / Industrial Drive (M-227) ¹	B	11.6	D	23.4
Kalamazoo Avenue (M-227) / Crary Street / North Driveway ¹	C	16.5	E	35.3
Kalamazoo Avenue (M-227) / Hughes Street ¹	C	16.7	F	69.9
A Drive / 15 Mile Road ¹	A	9.0	B	11.2
A Drive / East Driveway ¹	A	9.0	A	9.8
A Drive / West Driveway ¹	A	9.2	B	10.0

¹Unsignalized intersection, critical/worst approach/movement shown
Source: Progressive Companies, August 2025

The future analysis showed an increase in delay at most study intersections, with the worst delay occurring for eastbound left turns on A Drive/Hughes Street and Kalamazoo Avenue. During the afternoon peak, delay increased to 69.9 seconds for the eastbound approach. 95th percentile queues also increased to 5.8 vehicles.

Since the eastbound A Drive approach has a failing LOS for the afternoon peak period, a signal warrant for peak hours was conducted to determine if a traffic signal should be recommended at this intersection with the new traffic volumes. This signal warrant is shown in Figure 4 below:

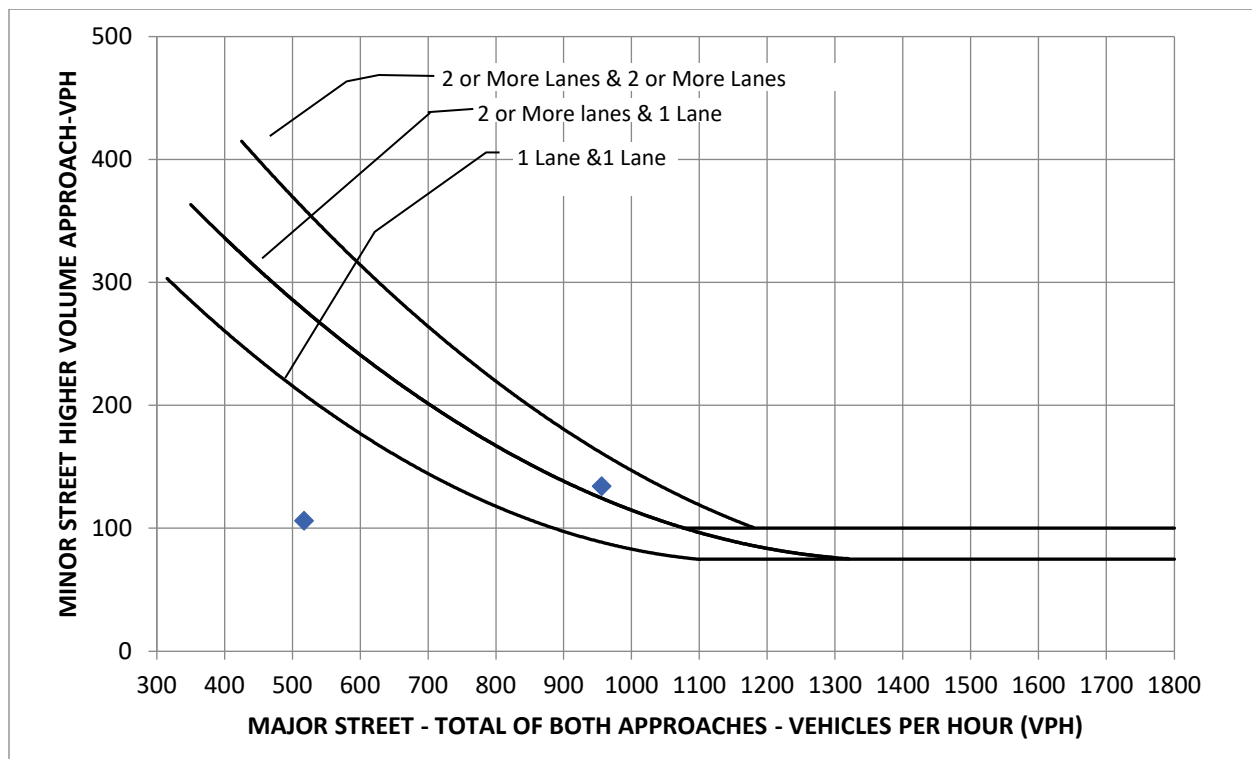


Figure 4. Kalamazoo Avenue and A Drive/Hughes Street Signal Warrant 3A

Since the peak hour signal warrant is not anticipated to be met with Phase I future traffic volumes, a signal is not recommended for Phase I. However, since the eastbound approach is anticipated to have a failing level of service, this intersection should be monitored for signal warrants once Phase I is constructed and occupied.

Phase I Driveway Turn Lanes

While the Phase I traffic model showed acceptable levels of service at each proposed driveway, MDOT's turn lane guidance was used for each driveway to determine if a right-turn or left-turn lane was warranted on A Drive or Kalamazoo Avenue. The only driveway that warranted a turn lane was the north site driveway on Kalamazoo Avenue at Crary Street. This driveway met the right-turn lane warrant for southbound Kalamazoo Avenue for the afternoon peak only.

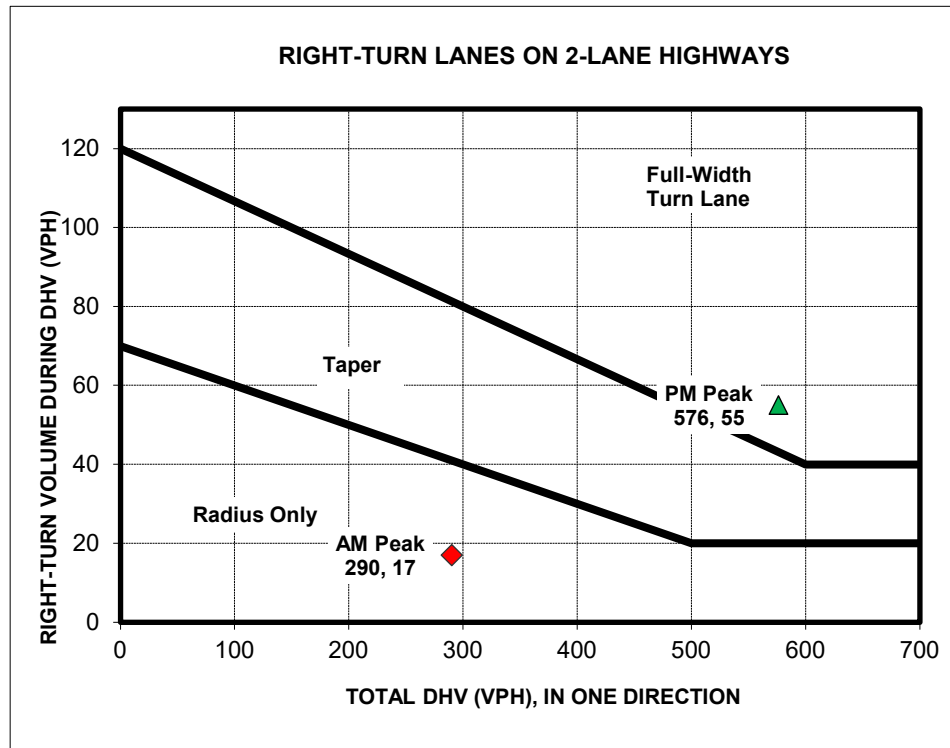
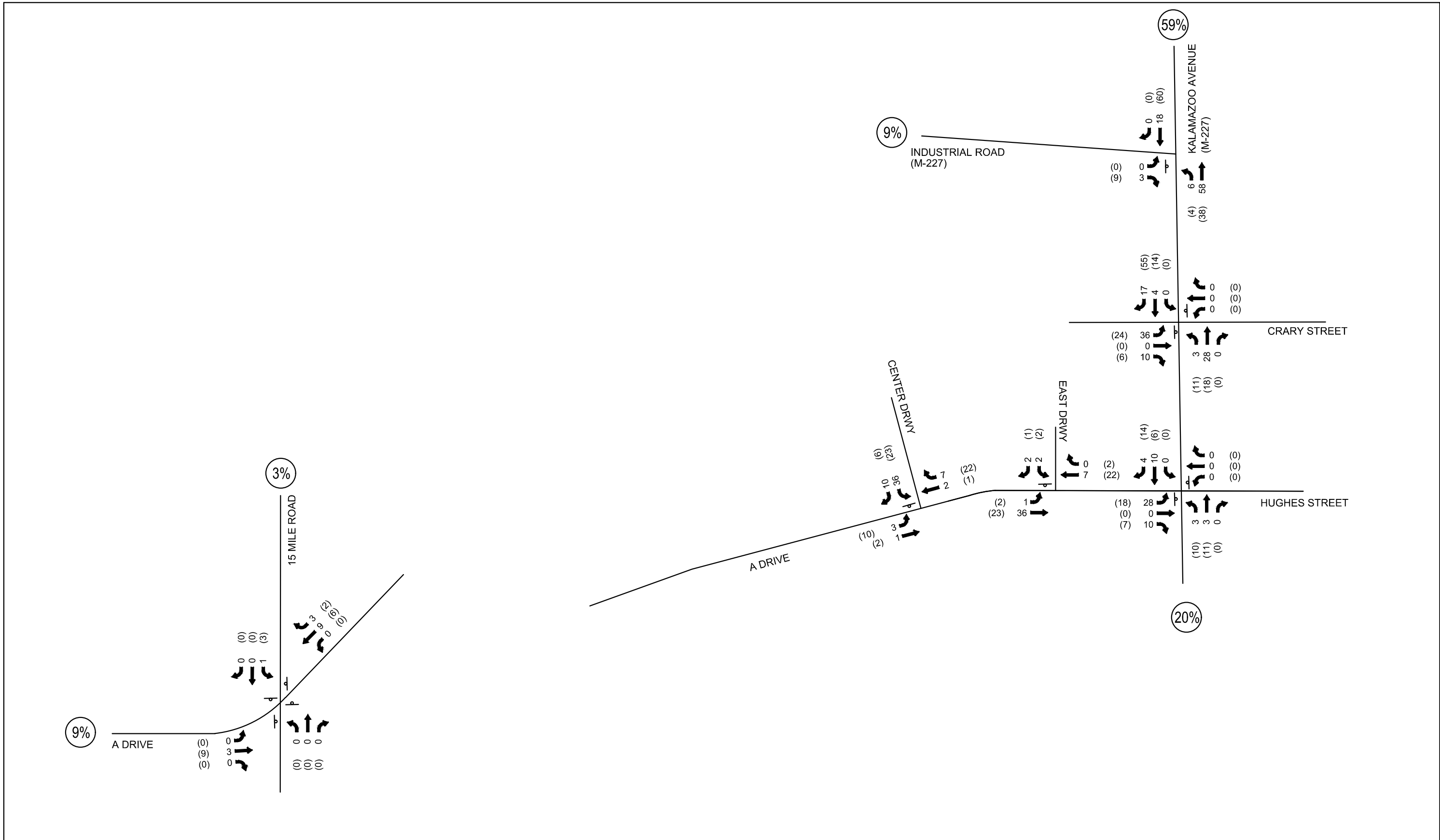
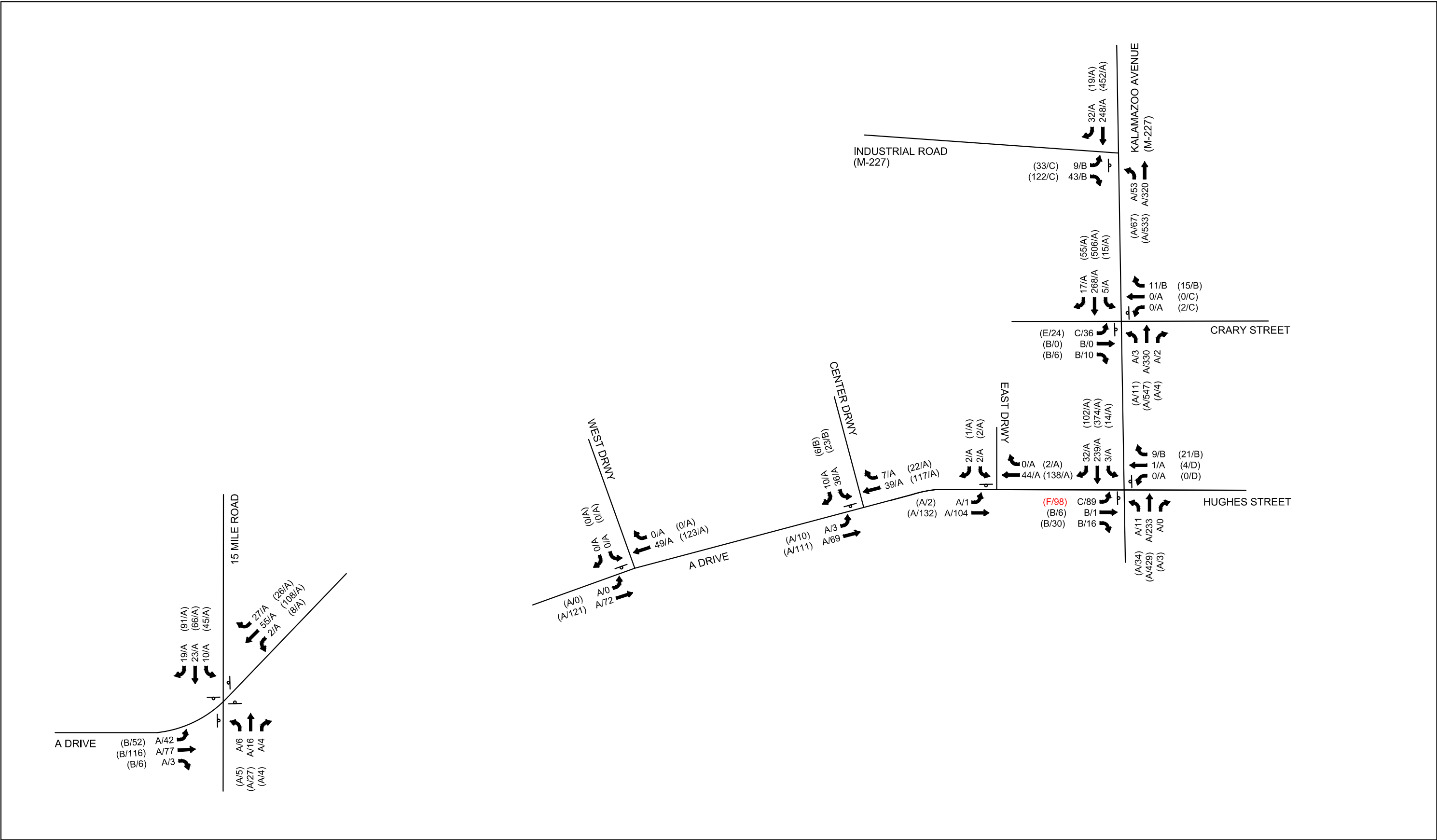


Figure 5. Right-Turn Lane Warrant, Kalamazoo Avenue Driveway at Crary Street





CHAPTER 4

FUTURE PHASE IV BUILD-OUT (2033) CONDITIONS

To ensure that the study area intersections will operate acceptably after the entire four (4) phases are built, a separate analysis was conducted using the full trip generation in Table 5 below. Improvements that were recommended with existing conditions or Phase I conditions, such as the right-turn lane for southbound Kalamazoo Avenue at the Crary Street driveway and left-turn lanes at the Kalamazoo Avenue and Hughes Street/A Drive intersection were also included in this analysis.

Table 5. Phase IV (Full Build-Out) Trip Generation

Land Use	ITE Code	Size	A.M.			P.M.		
			Total	Enter	Exit	Total	Enter	Exit
Phase I – Single Family Attached Housing	215	50 Units	20	5	15	26	15	11
Phase I – Multifamily Housing (Low Rise)	220	272 Units	107	26	81	138	87	51
Phase I Subtotal			127	31	96	164	102	62
Phase II – Multifamily Housing (Low Rise)	220	300 Units	116	28	88	150	94	56
Phase III – Multifamily Housing (Low Rise)	220	272 Units	107	26	81	138	87	51
Phase IV – Multifamily Housing (Low Rise)	220	100 Units	54	13	41	64	40	24
Total New Trips:			404	98	306	516	323	193

The Future Phase IV (2033) traffic analysis returned the delay and level of service in Table 6 below:

Table 6. Future Phase IV (2033) Levels of Service and Delay

Intersection	Phase IV (2033) Conditions			
	A.M.		P.M.	
	LOS	Delay(s)	LOS	Delay(s)
Kalamazoo Avenue (M-227) / Industrial Drive (M-227) ¹	B	12.8	E	48.0
Kalamazoo Avenue (M-227) / Crary Street / North Driveway ¹	D	25.5	F	74.2
Kalamazoo Avenue (M-227) / Hughes Street ¹	C	20.6	F	184.9
A Drive / 15 Mile Road ¹	A	9.2	B	12.2
A Drive / East Driveway ¹	B	11.0	B	12.8
A Drive / Center Driveway ¹	B	10.8	B	12.6
A Drive / West Driveway ¹	A	9.6	B	11.0

¹Unsignalized intersection, critical/worst approach/movement shown

Source: Progressive Companies, August 2025

Compared to the 2027 levels of service, delay increased significantly for the intersections of Kalamazoo Avenue/Industrial Drive, Kalamazoo Avenue/Crary Street, and Kalamazoo Avenue/Crary Street/north driveway in the afternoon peak period. 95th percentile queues at the Kalamazoo Avenue and Industrial Drive intersection increased to 5.5 vehicles. Queues at the north driveway and Crary Street intersection increased to 2.1 vehicles and queues at the Hughes Street/A Drive increased to 11.3 vehicles.

The delay and queue length at the Hughes Street/A Drive and Kalamazoo Avenue intersection are projected to be unacceptable and the 2033 projected traffic volumes were used for the MDOT peak hour traffic signal warrant. With the projected 2033 traffic volumes, peak hour traffic signal warrants are met and it is likely that a traffic signal will be warranted at this intersection. The warrant 3 chart is shown below for the 2033 traffic volumes.

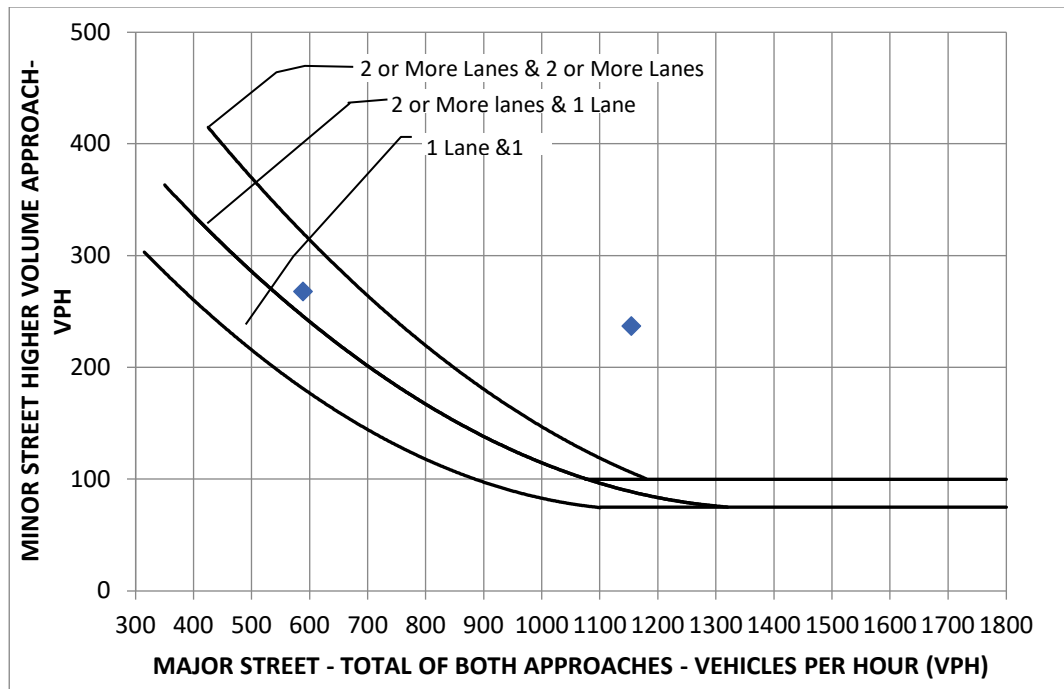


Figure 8. Phase IV (2033) Kalamazoo Avenue and Hughes Street/A Drive Signal Warrant

To address the poor LOS and queue length projected at Industrial Drive, a right-turn lane was added on the eastbound approach at Kalamazoo Avenue. This turn lane creates a dedicated left-turn and right-turn lane for this approach.

Lastly, although the north site driveway is projected to operate at a LOS “F” in the afternoon peak, 95th percentile queue lengths are projected to be 2.1 vehicles. Since Kalamazoo Avenue carries much more traffic and the queue lengths on the north driveway are not significant, this LOS for one (1) peak hour should be considered acceptable.

Driveway Turn Lane Analysis

The driveways that did not warrant a right-turn or left-turn lane with Phase I traffic were re-evaluated with Phase IV traffic to determine if any turn lanes would be warranted for full-build out conditions. This evaluation determined that a right-turn lane is warranted for the center site driveway on A Drive. This warrant is shown in Figure 9.

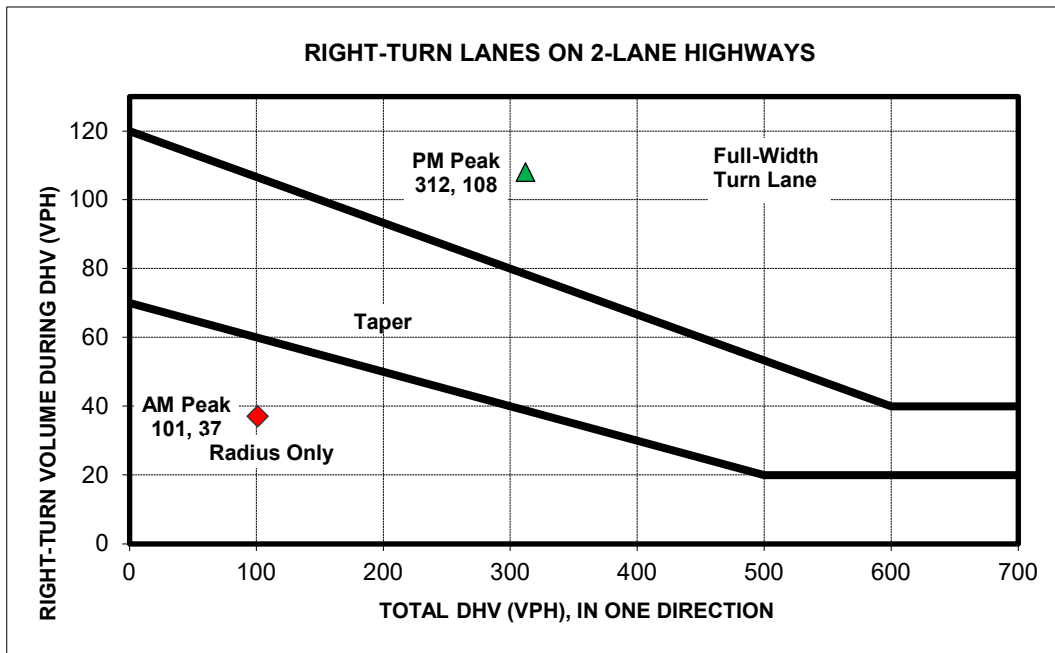


Figure 9. Phase IV (2033) Westbound A Drive Right-Turn Lane Warrant at Center Site Driveway

Future Phase IV (2033) Full Build-Out Conditions with Improvements

A final traffic model, with the improvements discussed in the previous section, was created to quantify how they would improve traffic conditions in the study area. The results of this analysis are below in Table 7.

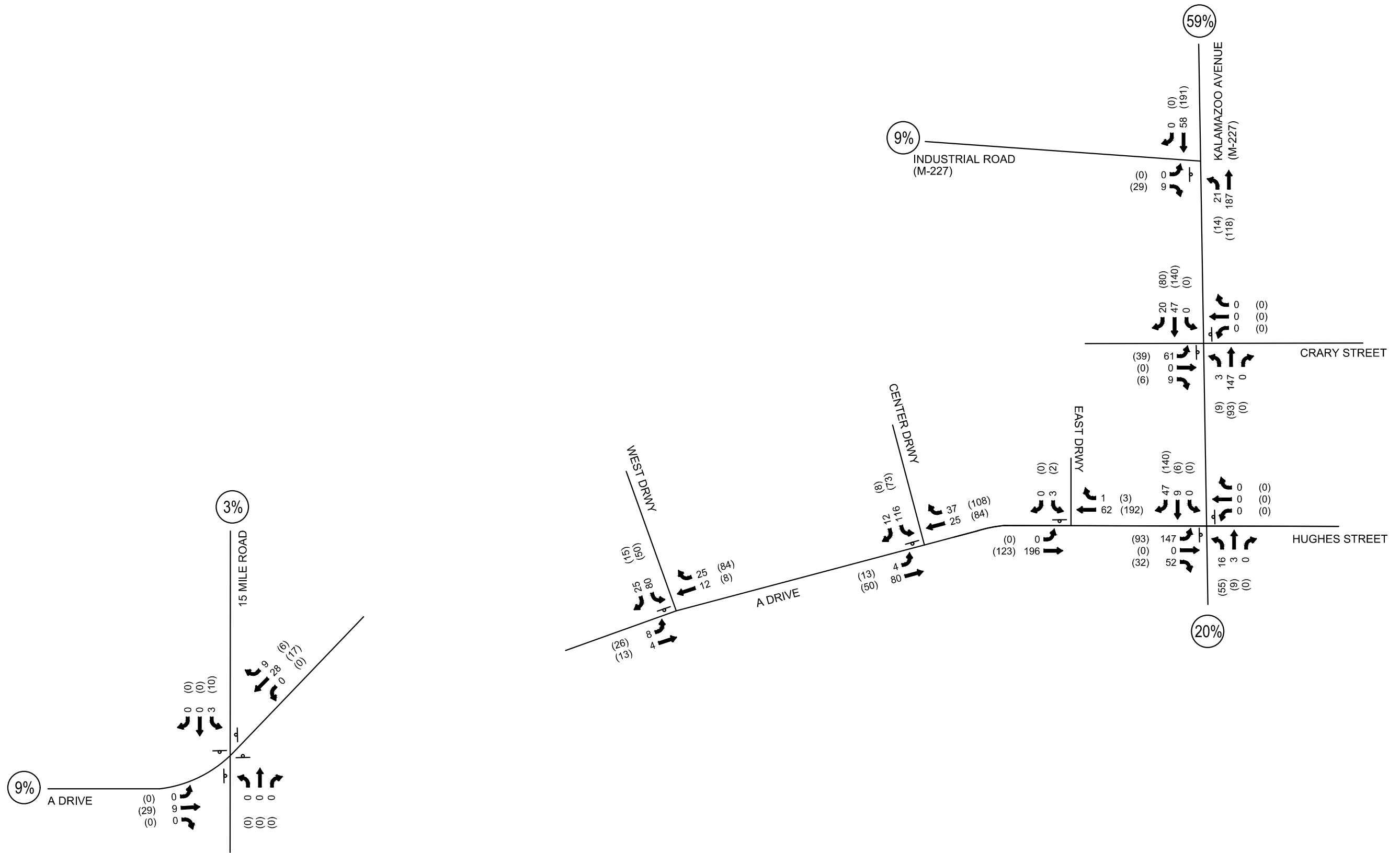
Table 7. Future Phase IV (2033) Levels of Service and Delay

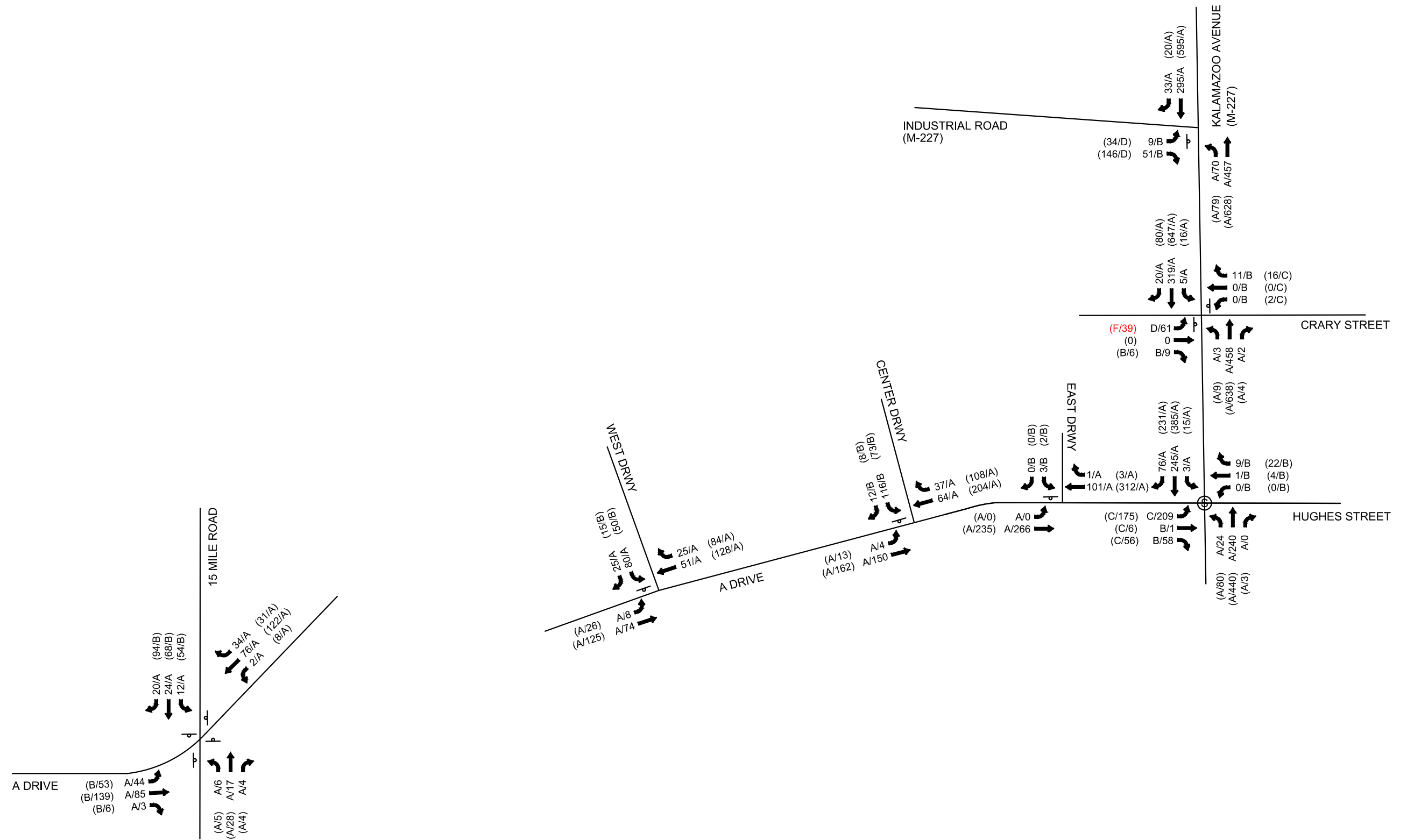
Intersection	Phase IV (2033) Conditions			
	A.M.		P.M.	
	LOS	Delay(s)	LOS	Delay(s)
Kalamazoo Avenue (M-227) / Industrial Drive (M-227) ¹	B	12.3	D	25.2
Kalamazoo Avenue (M-227) / Crary Street / North Driveway ¹	D	25.5	F	74.2
Kalamazoo Avenue (M-227) / Hughes Street	B	10.6	B	10.4
A Drive / 15 Mile Road ¹	A	9.2	B	12.2
A Drive / East Driveway ¹	B	11.0	B	12.8
A Drive / Center Driveway ¹	B	10.6	B	11.9
A Drive / West Driveway ¹	A	9.6	B	11.0

¹Unsignalized intersection, critical/worst approach/movement shown

Source: Progressive Companies, August 2025

The future Phase IV (2033) analysis with the roadway improvements, discussed above, projected that all intersections will operate at an acceptable LOS, besides the Kalamazoo Avenue and Crary Street/north driveway intersection; however, this LOS “F” at the Kalamazoo Avenue and Crary Street/north driveway intersection should still be considered acceptable due to the short 95th percentile queue lengths projected. This analysis included the addition of a turn lane on Industrial Drive, the center site driveway on A Drive, and a traffic signal at the Hughes Street/A Drive and Kalamazoo Avenue intersection.





PROJECT NAME

FUTURE (2033) PEAK-HOUR VOLUMES +
LEVELS-OF-SERVICE



FIGURE
11

CHAPTER 5

PHASING OF ROADWAY IMPROVEMENTS

Several roadway improvements have been discussed in this report and this chapter intends to determine the timing of the improvements, based on the planned phasing of the housing project.

Existing Conditions

The existing conditions analysis showed a failing LOS for the eastbound approach on A Drive at Kalamazoo Avenue. This existing failing LOS should be addressed by current maintaining agencies by striping or constructing left-turn lanes at the intersection for the eastbound and northbound approaches and a right-turn lane for the southbound approach.

Phase I (2027) Conditions

The Phase I analysis showed that delay increased at the Kalamazoo Avenue and A Drive/Hughes Street intersection compared to existing conditions, but the projected traffic volumes did not meet peak hour signal warrants. It is recommended that this intersection is monitored for traffic signal warrants after Phase I is constructed.

Turn lanes were evaluated for the proposed driveways in Phase I and a right-turn lane was warranted on southbound Kalamazoo Avenue at the north driveway/Crary Street intersection. This driveway is also recommended to have a 100-foot left-turn lane for exiting eastbound traffic.

Phase II (2029) Conditions

Based on the trip generation for Phase II, it is likely that a traffic signal will become warranted for at least the afternoon peak period at the intersection of Kalamazoo Avenue and A Drive/Hughes Street. Traffic conditions during Phases I and II should be monitored at the intersection.

A right-turn taper is anticipated to be warranted at the center driveway for the development on A Drive after Phase II is complete.

Phase III (2031) Conditions

Based on the anticipated trip generation for Phase III, a traffic signal will likely be warranted for the intersection of Kalamazoo Avenue and A Drive/Hughes Street. A signal warrant analysis is recommended to be performed at this intersection, prior to Phase III construction, to determine if traffic volumes warrant a traffic signal to be constructed if a traffic signal has not been constructed prior to Phase III.

A full-width right-turn lane is anticipated to be warranted at the center driveway for the development on A Drive during Phase III.

A full-width right-turn lane is also anticipated to be needed at the eastbound Industrial Drive (M-227) approach at Kalamazoo Avenue (M-227).

Phase IV (2033) Conditions

Based on the preceding roadway improvements and anticipated trip generation for Phase IV, no further improvements are expected to be needed for Phase IV construction.

CHAPTER 6

CONCLUSIONS AND RECOMMENDATION

This chapter summarizes the results of the analyses performed as part of the study. A recommendation to improve the surrounding roadway network is also presented.

Conclusions

Based on the analyses performed as part of this study, the proposed development will have some impact to the surrounding roadway network. The findings of this study are as follows:

Existing Conditions

Based on the existing conditions analysis, it appears that all intersections in the study area currently operate at a level of service (LOS) "C" or better besides the left-turning movement for eastbound Hughes Street at Kalamazoo Avenue, which is currently at a LOS "F." This failing level of service is likely due to a lack of gaps in traffic on Kalamazoo Avenue. Additionally, 95th percentile queue lengths for the eastbound approach were projected to be 4.5 vehicles long for the afternoon peak period.

Turn lanes on Hughes Street/A Drive and Kalamazoo Avenue are recommended to reduce the delay at this intersection. These turn lanes can likely be created with pavement markings since the existing pavement flares to roughly 36 feet at the intersection. Turn lanes on Kalamazoo Avenue may need additional pavement and should be constructed to Michigan Department of Transportation (MDOT) standards. These turn lanes are recommended to be striped/constructed to address the existing condition poor traffic conditions.

Crash Analysis

Crash information for the most recent five (5) years available (2019–2023) was reviewed, based on information available on the *Michigan Traffic Crash Facts* website. The crash analysis was completed for each intersection in the stud area.

Kalamazoo Avenue and Hughes Street/A Drive

There was a total of 12 crashes at the Kalamazoo Avenue (M-227) and Hughes Street/A Drive intersection over the last five (5) years. Of these crashes, one (1) crash resulted in an "A" serious injury, one (1) crash resulted in a "C" possible injury, and the remaining crashes resulted in no injury. Additionally, seven (7) of the 12 crashes were angle crashes, including the two (2) injury crashes. The remaining crashes were single vehicle or rear end crashes. These crashes suggest a pattern of angle crashes, which could be a result of limited sight distance or excessive delay on A Drive/Hughes Street.

The remaining intersections in the study area did not show any crash patterns.

Future Phase I (2027) Conditions

Intersection level of service calculations were completed to evaluate the Phase I future (2027) morning and afternoon peak hour conditions at the site access driveways and study area intersections, assuming the completion of the proposed development. This analysis also included the turn lanes that were recommended for the existing conditions at the Kalamazoo Avenue and Hughes Street/A Drive intersection.

The 2027 future analysis showed an increase in delay at most study intersections, with the worst delay occurring for the eastbound approach on A Drive/Hughes Street and Kalamazoo Avenue. During the afternoon peak, delay increased 69.9 seconds for the eastbound approach. 95th percentile queues also increased to 5.8 vehicles.

Since the eastbound A Drive approach has a failing LOS for the afternoon peak period, a signal warrant for peak hours was conducted to determine if a traffic signal should be recommended at this intersection with the new traffic volumes. While the intersection did not meet warrant 3A or 3B for either morning or afternoon peak hours, this intersection should be monitored after Phase I is constructed to see if the new traffic volumes warrant a traffic signal.

Phase I Driveway Turn Lanes

While the Phase I traffic model showed acceptable levels of service at each proposed driveway, MDOT's turn lane guidance was used for each driveway to determine if a right turn or left turn lane was warranted on A Drive or Kalamazoo Avenue. The only driveway that warranted a turn lane was the driveway on Kalamazoo Avenue at Crary Street. The projected traffic volumes met the full width right-turn lane warrant for southbound Kalamazoo Avenue for the afternoon peak only.

Future Phase IV (2033) Conditions

To ensure that the study area intersections will operate acceptably after the entire four (4) phases are built, a separate analysis was conducted using the full trip generation. This analysis also grew existing traffic with the same 0.5% (zero point five percent) background growth rate to 2033, when the full development is anticipated to be completed. Improvements that were recommended with existing conditions or Phase I conditions, such as the right turn-lane for southbound Kalamazoo Avenue at the Crary Street driveway and left-turn lanes at the Kalamazoo Avenue and Hughes Street/A Drive intersection, were also included in this analysis.

Compared to the 2027 levels of service, delay increased significantly for the intersections of Kalamazoo Avenue/Industrial Drive, Kalamazoo Avenue/Crary Street, and Kalamazoo Avenue/Crary Street/north driveway in the afternoon peak period. 95th percentile queues at the Kalamazoo Avenue/Industrial Drive intersection increased to 5.5 vehicles. Queues at the north driveway and Crary Street intersection increased to 2.1 vehicles and queues at the Hughes Street/A Drive increased to 11.3 vehicles.

Future Phase IV (2033) Roadway Improvements

The delay and queue length at the Hughes Street/A Drive and Kalamazoo Avenue intersection are projected to be unacceptable and the 2033 projected traffic volumes were used with the MDOT peak hour traffic signal warrant. With the projected 2033 traffic volumes, peak hour traffic signal warrants are met and it is likely that a traffic signal will be warranted at this intersection.

To address the poor LOS and queue length projected at Industrial Drive, a right-turn lane was added on the eastbound approach at Kalamazoo Avenue. This turn lane creates a dedicated left-turn and right-turn lane for this approach.

Lastly, although the north driveway is projected to operate at a LOS "F" in the afternoon peak, 95th percentile queue lengths are projected to be 2.1 vehicles. Since Kalamazoo Avenue carries much more traffic and the queue lengths on the north site driveway are not significant, this LOS for one (1) peak hour should be considered acceptable.

Driveway Turn Lane Analysis

The driveways that did not warrant a right-turn or left-turn lane with Phase I traffic were re-evaluated with Phase IV traffic to determine if any turn lanes will be warranted for full build-out conditions. This evaluation determined that a right-turn lane is warranted for the center site driveway on A Drive.

A final traffic model, with the improvements discussed in the previous section, was created to quantify how they will improve traffic conditions in the study area. The future Phase IV (2033) analysis with the roadway improvements, discussed above, projected that all intersections will operate at an acceptable LOS, besides the Kalamazoo Avenue and Crary Street/north driveway intersection; however, this LOS "F" at the Kalamazoo Avenue and Crary Street/north driveway intersection should still be considered acceptable due to the short 95th percentile queue lengths projected. This analysis included the addition of a turn lane on Industrial Drive, the center site driveway on A Drive, and a traffic signal at the Hughes Street/A Drive and Kalamazoo Avenue intersection.

Recommendations

The following are recommendations to mitigate the impact of the proposed development and improve operations within the study area:

Existing Conditions

The existing conditions analysis showed a failing LOS for the eastbound approach on A Drive at Kalamazoo Avenue. This existing failing LOS should be addressed by current maintaining agencies by striping or constructing left-turn lanes at the intersection for the eastbound and northbound approaches and a right-turn lane for the southbound approach.

Phase I (2027) Conditions

The Phase I analysis showed that delay increased at the Kalamazoo Avenue and A Drive/Hughes Street intersection compared to existing conditions, but the projected traffic volumes did not meet peak hour signal warrants. It is recommended that this intersection is monitored for traffic signal warrants after Phase I is constructed.

Turn lanes were evaluated for the proposed driveways in Phase I and a right-turn lane was warranted on southbound Kalamazoo Avenue at the north driveway and Crary Street intersection. This driveway is also recommended to have a 100-foot left-turn lane for exiting eastbound traffic.

Phase II (2029) Conditions

Based on the trip generation for Phase II, it is likely that a traffic signal will become warranted for at least the afternoon peak period at the intersection of Kalamazoo Avenue and A Drive/Hughes Street. Traffic conditions during Phases I and II should be monitored at the intersection.

A right-turn taper is anticipated to be warranted at the center driveway for the development on A Drive after Phase II is complete.

Phase III (2031) Conditions

Based on the anticipated trip generation for Phase III, a traffic signal will likely be warranted for the intersection of Kalamazoo Avenue and A Drive/Hughes Street. A signal warrant analysis is recommended to be performed at this intersection, prior to Phase III construction, to determine if traffic volumes warrant a traffic signal to be constructed if a traffic signal has not been constructed prior to Phase III.

A full-width right-turn lane is anticipated to be warranted at the center driveway for the development on A Drive during Phase III.

A full-width right-turn lane is also anticipated to be needed at the eastbound Industrial Drive (M-227) approach at Kalamazoo Avenue (M-227).

Phase IV (2033) Conditions

Based on the preceding roadway improvements and anticipated trip generation for Phase IV, no further improvements are expected to be needed for Phase IV construction.

TECHNICAL APPENDIX

MARSHAL HOUSING PUD TRAFFIC IMPACT STUDY

- **Level of Service Definitions**
- **Glossary**
- **Site Plan**
- **Traffic Count Data**
- **Synchro Analyses Results**
- **Turn Lane Warrants**

Level of Service Definitions

Signalized Intersections

Level of Service A:	Describes operations with very low average stopped delay, i.e., less than 10.0 seconds per vehicle. This occurs when progression is extremely favorable, and most vehicles arrive during the green phase. Most vehicles do not stop at all. Short cycle lengths may also contribute to low delay.
Level of Service B:	Describes operations with an average stopped delay in the range of 10.0 to 20.0 seconds per vehicle. This generally occurs with good progression and/or short cycle lengths. More vehicles stop than for LOS A, causing higher levels of average delay.
Level of Service C:	Describes operations with an average stopped delay in the range of 20.1 to 35.0 seconds per vehicle. These higher delays may result from fair progression and/or longer cycle lengths. Individual cycle failures may begin to appear in this level. The number of vehicles stopping is significant at this level, although many still pass through the intersection without stopping.
Level of Service D:	Describes operations with an average stopped delay in the range of 35.1 to 55.0 seconds per vehicle. At Level of Service D, the influence of congestion becomes more noticeable. Longer delays may result from some combination of unfavorable progression, long cycle lengths, or high v/c (volume/capacity) ratios. Many vehicles stop, and the proportion of vehicles not stopping declines. Individual cycle failures are noticeable.
Level of Service E:	Describes operations with an average stopped delay in the range of 55.1 to 80.0 seconds per vehicle. This is considered to be the limit of acceptable delay in many cases. These high delay values generally indicate poor progression, long cycle lengths, and high v/c ratios. Individual cycle failures are a frequent occurrence.
Level of Service F:	Describes operations with an average stopped delay in excess of 80.0 seconds per vehicle. This is considered to be unacceptable to most drivers. This condition often occurs with over-saturation, i.e., when arrival flow rates exceed the capacity of the intersection. It may also occur at high v/c ratios with many individual cycle failures. Poor progression and long cycle lengths may also be major contributing causes to such delay levels.

Level of Service Definitions

Unsignalized Intersections

Level of Service A:	Average delay per vehicles for impeded movements is less than 10 seconds. There is little or no delay with typically low side street and/or main street traffic.
Level of Service B:	Average stopped delays from 10.1 seconds to 15.0 seconds. Short delays, many acceptable gaps in main street traffic stream.
Level of Service C:	Average delay per vehicle ranges from 15.1 to 25.0 seconds. Average traffic delays with frequent gaps in main street traffic.
Level of Service D:	Average delays from 25.1 to 35.0 seconds for impeded movements. Long traffic delays for impeded movements due in part to a limited number of acceptable gaps.
Level of Service E:	Average delays in the 35.1 to 50.0 second range. May experience very long delays for impeded movements with a very small number of acceptable gaps in the traffic stream.
Level of Service F:	Average vehicle delays of over 50.0 seconds. Extreme traffic delays with virtually no acceptable gaps in main street traffic.

Glossary

Approach: A set of lanes accommodating all left-turn, through, and right-turn movements arriving at an intersection from a given direction.

Arterial: Signalized streets that serve primarily through traffic and provide access to abutting properties as a secondary function.

Average Stopped Delay: The total time vehicles are stopped in an intersection approach or lane group during a specified time interval divided by the volume departing from the approach or lane group during the same time period, in seconds per vehicle.

Background Traffic: Traffic volumes that will be on the roadway network without the presence of the proposed development.

Bypass Lane: A one-lane widening on a two-lane roadway that allows through traffic to pass by waiting left-turn traffic.

Capacity: The maximum rate of flow at which persons or vehicles can be reasonably expected to traverse a point or uniform segment of a lane or roadway during a specified time period under prevailing roadway, traffic, and control conditions; usually expressed as vehicles per hour or persons per hour.

Conflicting Traffic Volume: The volume of traffic which conflicts with a specific movement at an intersection.

Corridor: A lineal study area aligned with a roadway facility in which traffic, land use, right-of-way, environmental, and other factors are evaluated to determine future transportation facility needs.

Cycle: Any complete sequence of traffic signal indications.

Cycle Length: The total time for a traffic signal to complete one cycle.

Design Hour Volume: The traffic volume for the design hour, usually a forecast of the relevant peak hour volume, in vehicles per hour.

Diverted Linked Trips: Trips from the traffic volume on roadways within the vicinity of the generator but which requires a diversion from that roadway to another roadway to gain access to the site.

Driveway Offset: Distance between driveways on opposite sides of a roadway, measured parallel to roadway.

Freeway: A multi-lane divided highway having a minimum of two lanes for exclusive use of traffic in each direction and full control of access and egress.

Gaps (Critical Gap): The median time headway between vehicles in a major traffic stream which will permit side-street vehicles to cross through or merge with the major traffic stream.

Green Time: The actual length of the "green" indication for a given movement at a signalized intersection.

Level of Service: A qualitative measure describing operational conditions within a traffic stream; generally described in terms of such factors as speed and travel time, delay, freedom to maneuver, traffic interruptions, comfort and convenience, and safety.

Operational Analysis: A use of capacity analysis to determine the prevailing level of service on an existing or projected facility, with known or projected traffic, roadway, and control conditions. This analysis can involve a particular location, such as an intersection or a corridor.

Pass-by Trips: Trips made as intermediate stops on the way from an origin to a primary trip destination.

Peak Hour (AM): The one hour period in the morning representing the highest hourly volume of traffic flow on the adjacent public street system.

Peak Hour (PM): The one hour period in the afternoon or evening representing the highest hourly volume of traffic flow on the adjacent public street system.

Peak Hour Factor: The hourly volume during the maximum volume hour of the day divided by four times the peak 15-minute flow within the peak hour; a measure of traffic demand fluctuation within the peak hour.

Phase: The part of the signal cycle allocated to any combination of traffic movements receiving the right-of-way simultaneously during one or more intervals.

Roadway Conditions: Geometric characteristics of a street or highway, including the type of facility, number and width of lanes (by direction), shoulder widths and lateral clearances, design speed, etc.

Service Drive: A roadway (usually private) that provides internal access to two or more uses.

Site Traffic: Existing or projected vehicular traffic generated by the development.

Study Area: The geographic area containing site access points and critical intersections (and connecting highway segments) which are impacted by the site-traffic generated by the development, and should be evaluated.

System Improvements: Added lanes, signal improvements, and other roadway improvements not considered site-related improvements.

Traffic Impact: The adverse impact on intersection Level of Service and/or street and highway safety and operations as determined by the criteria and procedures set forth in this handbook.

Trip (Directional Trip): A single or one-direction vehicle movement with either the origin or the destination (exiting or entering) inside a study site.

Trip Distribution: The distribution or assignment of site traffic into site driveways and study area roadways/intersections based upon expected direction of approach and departure.

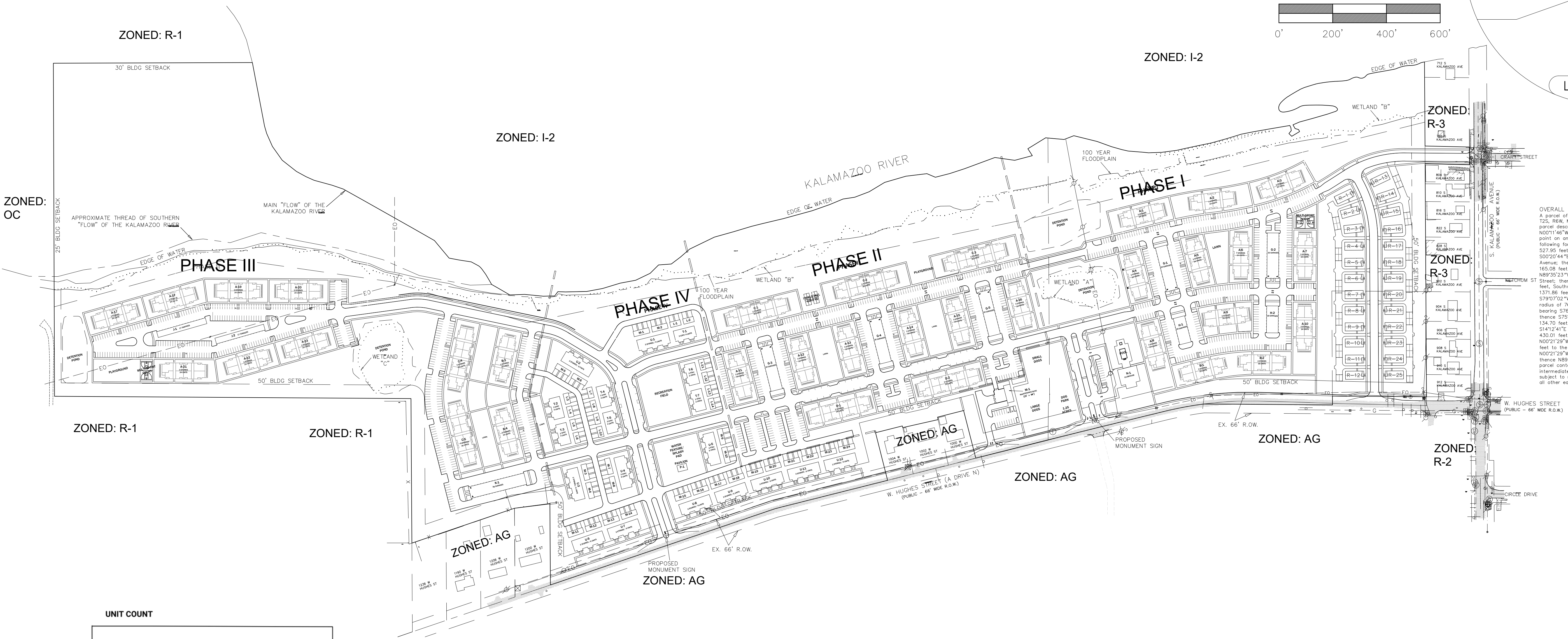
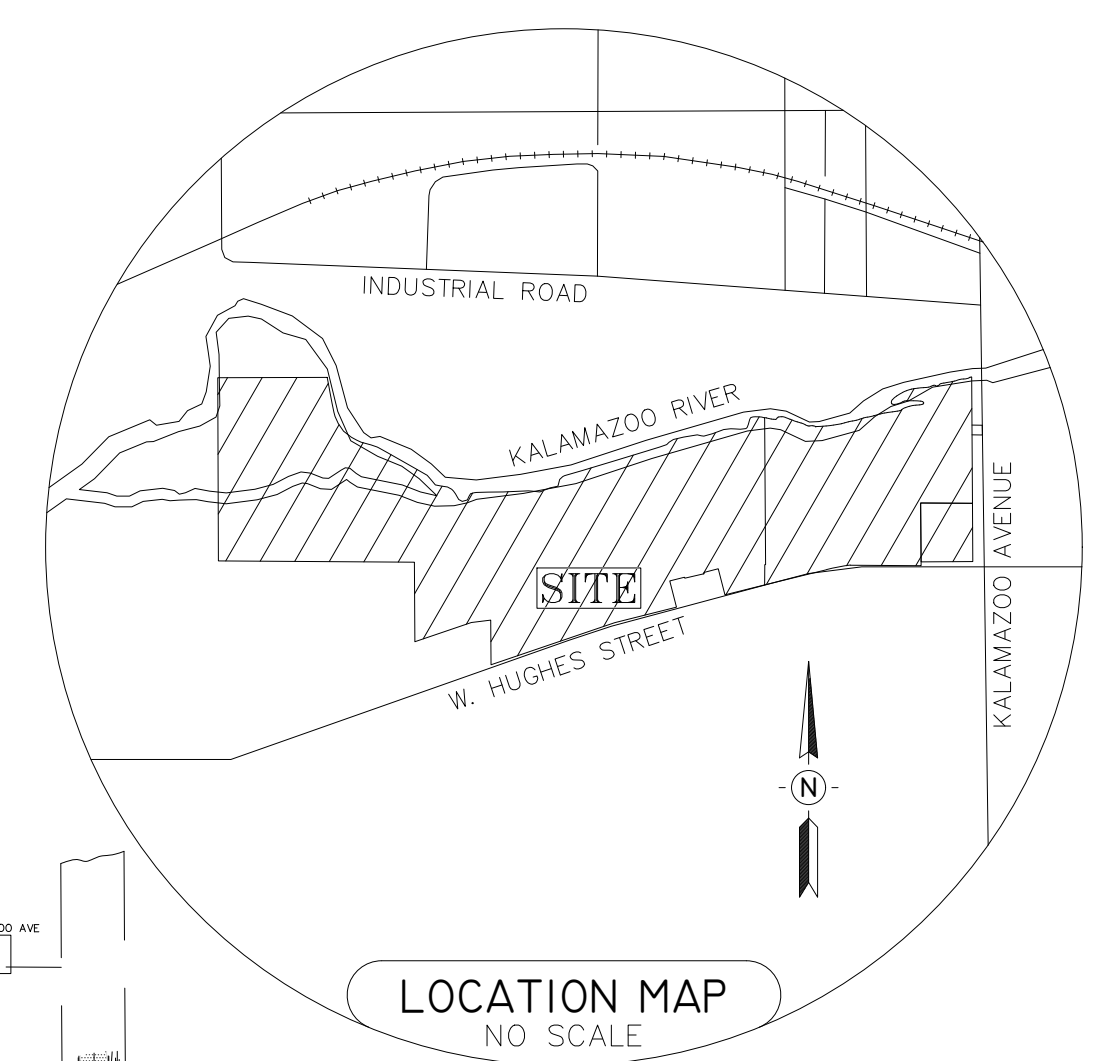
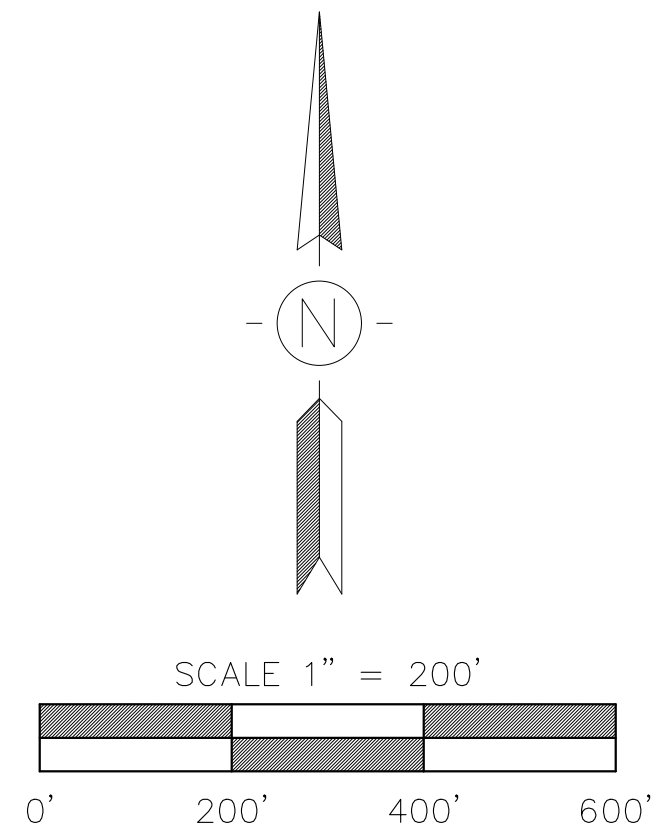
Unsignalized Intersection: Any intersection not controlled by traffic signals.

Volume: The number of persons or vehicles passing a point on a lane or roadway during some time interval, such as one hour or during an average day.

Volume-to-Capacity Ratio (V/C): The ratio of demand flow rate to capacity for a traffic facility

Site Plan

MARSHALL HOUSING
CITY OF MARSHALL, CALHOUN COUNTY, MICHIGAN



OVERALL LEGAL DESCRIPTION:
A parcel of land in the South 1/2 of Section 26 and the North 1/2 of Section 35, T2S, R6W, Marshall Township, Calhoun County, Michigan, the surveyed boundary of said parcel described as: Beginning at the Southwest corner of said Section 26, thence N00°11'46"W along the West line of said Section 26 a distance of 332.89 feet to a point on an intermediate traverse line; thence along said intermediate traverse line the following four courses: N74°37'59"E 676.58 feet, S81°07'19"E 607.81 feet, S73°13'25"E 527.95 feet, N78°17'17"E 1978.08 feet and N76°10'50"E 1441.90 feet; thence S00°20'44"E 88.78 feet; thence S88°41'31"E 165.08 feet to the West line of Kalamazoo Avenue; thence S00°20'22"E along said West line 65.99 feet; thence N88°37'11"W 165.08 feet; thence S00°20'44"E 475.89 feet; thence S00°20'44"E 391.00 feet; thence N89°35'23"W 350.00 feet; thence S00°20'44"E 33.00 feet to the centerline of Hughes Street; thence along said centerline the following four courses: N89°35'23"W 478.66 feet, Southwesterly 163.54 feet on a curve to the left, said curve having a radius of 1371.86 feet, a delta angle of 6°49'29" and a chord length of 163.44 feet bearing S79°07'02"W, Southwesterly 431.06 feet on a curve to the left, said curve having a radius of 76283.27 feet, a delta angle of 0°19'26" and a chord length of 431.06 feet bearing S75°13'18"W and S75°51'40"W 277.35 feet; thence N14°21'15"W 182.59 feet; thence S75°52'48"W 99.85 feet; thence S10°36'16"E 9.51 feet; thence S77°15'59"W 134.70 feet; thence N12°47'18"W 6.32 feet; thence S75°46'56"W 102.89 feet; thence S14°12'41"E 182.61 feet to said centerline; thence S75°51'40"W along said centerline 430.01 feet; thence S71°14'40"W continuing along said centerline 884.04 feet; thence N00°21'28"W 301.84 feet; thence S82°51'40"W 132.70 feet; thence S71°14'40"W 403.04 feet to the East line of the West 1/2 of the Northwest 1/4 of said Section 35; thence N00°21'28"W along said East line 537.59 feet to the South line of said Section 26; thence N89°37'33"W along said South line 1325.86 feet to the point of beginning; said parcel containing 122.4 acres, more or less, including lands lying between the intermediate traverse line and the water's edge of the Kalamazoo River; said parcel subject to right of way for road purposes along Hughes Street; said parcel subject to all other easements and restrictions, if any.

UNIT COUNT

PHASE I			
TWO-FAMILY RESIDENCES:			
TYPE R: ONE-STORY, 2-UNIT BUILDINGS	QTY. 25	50 UNITS	
MULTI-FAMILY BUILDINGS:			
TYPE A: THREE-STORY, 24-UNIT BUILDINGS	QTY. 10	240 UNITS	
TYPE B: TWO-STORY, 16-UNIT BUILDINGS	QTY. 2	32 UNITS	
TOTAL DWELLING UNITS:		322 UNITS	
PHASE II			
MULTI-FAMILY BUILDINGS:			
TYPE A: THREE-STORY, 24-UNIT BUILDINGS	QTY. 6	144 UNITS	
TYPE C: THREE-STORY, 36-UNIT BUILDINGS	QTY. 3	108 UNITS	
TYPE D: TWO-STORY, 24-UNIT BUILDINGS	QTY. 2	48 UNITS	
TOTAL DWELLING UNITS:		300 UNITS	
PHASE III			
MULTI-FAMILY BUILDINGS:			
TYPE A: THREE-STORY, 24-UNIT BUILDINGS	QTY. 7	168 UNITS	
TYPE B: TWO-STORY, 16-UNIT BUILDINGS	QTY. 2	32 UNITS	
TYPE C: THREE-STORY, 36-UNIT BUILDINGS	QTY. 2	72 UNITS	
TOTAL DWELLING UNITS		272 UNITS	
PHASE IV			
TOWNHOMES:			
TYPE T: TWO-STORY, 4-UNIT BUILDING	QTY. 7	28 UNITS	
TYPE U: TWO-STORY, 6-UNIT BUILDING	QTY. 12	72 UNITS	
TOTAL DWELLING UNITS		100 UNITS	
ALL PHASES			
TYPE A: THREE-STORY, 24-UNIT BUILDINGS	QTY. 7	552 UNITS	
TYPE B: TWO-STORY, 16-UNIT BUILDINGS	QTY. 2	64 UNITS	
TYPE C: THREE-STORY, 36-UNIT BUILDINGS	QTY. 2	180 UNITS	
TYPE D: TWO-STORY, 24-UNIT BUILDINGS	QTY. 2	48 UNITS	
TYPE R: TWO-FAMILY RESIDENCES	QTY. 25	50 UNITS	
TYPE T: TWO-STORY, 4-UNIT TOWNHOME	QTY. 7	28 UNITS	
TYPE U: TWO-STORY, 6-UNIT TOWNHOME	QTY. 12	72 UNITS	
TOTAL DWELLING UNITS		994 UNITS	

DEVELOPER:
GRAND CITY CAPITAL
GRAND RAPIDS, MI 49506

INDIGO DESIGN + DEVELOPMENT
920 CHERRY ST SE, SUITE 3
GRAND RAPIDS, MI 49506
616-574-6474
LIVEINDIGO.COM

REVISIONS	COMMENTS	KEBS, INC. KYES ENGINEERING BRYAN LAND SURVEYS	
2-28-25	PRELIM PLANS	2116 HASLETT ROAD, HASLETT, MI 48840 PH. 517-339-1014 FAX. 517-339-8047	
7-24-25		Marshall Office Ph. 269-781-9800	
		MARSHALL HOUSING PRELIMINARY ENGINEERING MASTER PLAN	
SCALE: 1"=200'	DESIGNED BY: AJP	APPROVED BY:	
DATE: 14-Nov-24	PROJECT MGR.: AJP	JOB #: 101596	
AUTHORIZED BY:		SHEET #	
INDIGO DESIGN AND DEVELOPMENT		C1.00	OF 23

Traffic Count Data



Count Name: Kalamazoo Ave
(M-227) & Industrial Rd
Site Code:
Start Date: 06/25/2025
Page No: 1



Count Name: Kalamazoo Ave
(M-227) & Industrial Rd
Site Code:
Start Date: 06/25/2025
Page No: 2

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Count Name: Kalamazoo Ave
(M-227) & Crary St
Site Code:
Start Date: 06/25/2025
Page No: 1



Count Name: Kalamazoo Ave
(M-227) & Crary St
Site Code:
Start Date: 06/25/2025
Page No: 2

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Grand Rapids, Michigan, United States 49525
(616) 361-2664

Count Name: Kalamazoo Ave
(M-227) & Hughes St
Site Code:
Start Date: 06/25/2025
Page No: 1

06/25/2025	Hughes St Eastbound					Hughes St Westbound					Kalamazoo Ave (M-227) Northbound					Kalamazoo Ave (M-227) Southbound					Int. Total
	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	
7:00 AM	7	0	0	0	7	0	0	1	0	1	4	45	0	0	49	1	75	5	0	81	138
7:15 AM	19	0	1	0	20	0	1	0	0	1	2	68	0	0	70	2	54	9	0	65	156
7:30 AM	16	1	2	0	19	0	0	3	0	3	1	54	0	0	55	0	38	4	0	42	119
7:45 AM	18	0	3	0	21	0	0	5	0	5	1	61	0	0	62	0	60	10	0	70	158
Hourly Total	60	1	6	0	67	0	1	9	0	10	8	228	0	0	236	3	227	28	0	258	571
8:00 AM	12	0	2	0	14	0	0	0	0	0	4	49	0	0	53	2	35	13	0	50	117
8:15 AM	11	0	0	1	11	0	0	3	0	3	3	53	0	0	56	2	37	6	0	45	115
8:30 AM	15	1	4	0	20	0	0	5	0	5	3	53	0	0	56	1	41	16	0	58	139
8:45 AM	13	0	2	0	15	0	0	4	0	4	4	60	1	0	65	3	38	7	0	48	132
Hourly Total	51	1	8	1	60	0	0	12	0	12	14	215	1	0	230	8	151	42	0	201	503
06/25/2025	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4:00 PM	13	0	5	0	18	0	0	9	0	9	8	140	0	0	148	5	83	25	0	113	288
4:15 PM	25	2	5	0	32	0	0	5	0	5	4	73	1	0	78	2	97	24	0	123	238
4:30 PM	28	3	7	0	38	0	2	4	1	6	9	130	2	0	141	3	97	21	0	121	306
4:45 PM	13	1	6	0	20	0	2	3	0	5	3	71	0	0	74	4	87	17	0	108	207
Hourly Total	79	6	23	0	108	0	4	21	1	25	24	414	3	0	441	14	364	87	0	465	1039
5:00 PM	17	1	2	0	20	0	1	6	0	7	3	82	1	0	86	7	95	31	0	133	246
5:15 PM	31	1	3	0	35	0	0	5	0	5	5	79	2	0	86	19	75	18	0	112	238
5:30 PM	24	0	4	0	28	0	0	0	0	0	2	75	0	0	77	9	85	17	0	111	216
5:45 PM	23	3	3	0	29	2	0	9	0	11	2	75	1	0	78	5	56	22	0	83	201
Hourly Total	95	5	12	0	112	2	1	20	0	23	12	311	4	0	327	40	311	88	0	439	901
Grand Total	285	13	49	1	347	2	6	62	1	70	58	1168	8	0	1234	65	1053	245	0	1363	3014
Approach %	82.1	3.7	14.1	-	-	2.9	8.6	88.6	-	-	4.7	94.7	0.6	-	-	4.8	77.3	18.0	-	-	-
Total %	9.5	0.4	1.6	-	11.5	0.1	0.2	2.1	-	2.3	1.9	38.8	0.3	-	40.9	2.2	34.9	8.1	-		



Count Name: Kalamazoo Ave
(M-227) & Hughes St
Site Code:
Start Date: 06/25/2025
Page No: 2

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Count Name: Hughes St & A Dr
& 15 Mile
Site Code:
Start Date: 07/08/2025
Page No: 1



Count Name: Hughes St & A Dr
& 15 Mile
Site Code:
Start Date: 07/08/2025
Page No: 2

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Synchro Analysis Results

Intersection	
Intersection Delay, s/veh	8.4
Intersection LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↱	↱		↱	↱		↱			↱	↱
Traffic Vol, veh/h	42	73	3	2	46	24	6	16	4	9	23	19
Future Vol, veh/h	42	73	3	2	46	24	6	16	4	9	23	19
Peak Hour Factor	0.80	0.80	0.80	0.86	0.86	0.86	0.60	0.60	0.60	0.71	0.71	0.71
Heavy Vehicles, %	0	0	0	1	1	1	0	0	0	2	2	2
Mvmt Flow	53	91	4	2	53	28	10	27	7	13	32	27
Number of Lanes	0	1	1	0	1	1	0	1	0	0	1	1

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	2	2	2	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	2	1	2	2
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	2	2	2
HCM Control Delay	8.9	7.8	8.5	8
HCM LOS	A	A	A	A

Lane	NBLn1	EBLn1	EBLn2	WBLn1	WBLn2	SBLn1	SBLn2
Vol Left, %	23%	37%	0%	4%	0%	28%	0%
Vol Thru, %	62%	63%	0%	96%	0%	72%	0%
Vol Right, %	15%	0%	100%	0%	100%	0%	100%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	26	115	3	48	24	32	19
LT Vol	6	42	0	2	0	9	0
Through Vol	16	73	0	46	0	23	0
RT Vol	4	0	3	0	24	0	19
Lane Flow Rate	43	144	4	56	28	45	27
Geometry Grp	4b	5	5	5	5	5	5
Degree of Util (X)	0.062	0.202	0.004	0.077	0.033	0.066	0.033
Departure Headway (Hd)	5.121	5.05	4.164	4.964	4.24	5.294	4.45
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	701	713	862	724	846	678	806
Service Time	3.139	2.764	1.878	2.68	1.956	3.011	2.167
HCM Lane V/C Ratio	0.061	0.202	0.005	0.077	0.033	0.066	0.033
HCM Control Delay	8.5	9	6.9	8.1	7.1	8.4	7.3
HCM Lane LOS	A	A	A	A	A	A	A
HCM 95th-tile Q	0.2	0.8	0	0.2	0.1	0.2	0.1

Intersection												
Int Delay, s/veh	2.2											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕	↕		↕			↕	↕
Traffic Vol, veh/h	60	1	6	0	1	9	8	228	0	3	227	28
Future Vol, veh/h	60	1	6	0	1	9	8	228	0	3	227	28
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	65	-	-	-	-	-	60
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	80	80	80	60	60	60	84	84	84	80	80	80
Heavy Vehicles, %	0	0	0	0	0	0	3	3	3	2	2	2
Mvmt Flow	75	1	8	0	2	15	10	271	0	4	284	35

Major/Minor	Minor2		Minor1		Major1			Major2				
Conflicting Flow All	592	583	284	605	618	271	319	0	0	271	0	0
Stage 1	292	292	-	291	291	-	-	-	-	-	-	-
Stage 2	300	291	-	314	327	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.5	6.2	7.1	6.5	6.2	4.13	-	-	4.12	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.5	4	3.3	2.227	-	-	2.218	-	-
Pot Cap-1 Maneuver	421	427	760	413	408	773	1235	-	-	1292	-	-
Stage 1	720	675	-	721	675	-	-	-	-	-	-	-
Stage 2	713	675	-	701	651	-	-	-	-	-	-	-
Platoon blocked, %								-	-	-	-	-
Mov Cap-1 Maneuver	407	421	760	404	402	773	1235	-	-	1292	-	-
Mov Cap-2 Maneuver	407	421	-	404	402	-	-	-	-	-	-	-
Stage 1	713	672	-	714	668	-	-	-	-	-	-	-
Stage 2	690	668	-	690	648	-	-	-	-	-	-	-

Approach	EB		WB		NB			SB				
HCM Control Delay, s	15.5		10.1		0.3			0.1				
HCM LOS	C		B									

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1WBLn1WBLn2	SBL	SBT	SBR
Capacity (veh/h)	1235	-	-	425 402 773	1292	-	-
HCM Lane V/C Ratio	0.008	-	-	0.197 0.004 0.019	0.003	-	-
HCM Control Delay (s)	7.9	0	-	15.5 14 9.7	7.8	0	-
HCM Lane LOS	A	A	-	C B A	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0.7 0 0.1	0	-	-

Intersection												
Int Delay, s/veh	0.3											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	0	0	0	0	0	11	0	299	2	5	261	0
Future Vol, veh/h	0	0	0	0	0	11	0	299	2	5	261	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	2	2	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	85	85	78	78	92
Heavy Vehicles, %	2	2	2	0	2	0	2	2	2	2	2	2
Mvmt Flow	0	0	0	0	0	12	0	352	2	6	335	0





Major/Minor	Minor2		Minor1		Major1		Major2					
Conflicting Flow All	706	703	335	702	702	355	335	0	0	356	0	0
Stage 1	347	347	-	355	355	-	-	-	-	-	-	-
Stage 2	359	356	-	347	347	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.1	6.52	6.2	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.1	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.1	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.5	4.018	3.3	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	351	362	707	355	362	693	1224	-	-	1203	-	-
Stage 1	669	635	-	666	630	-	-	-	-	-	-	-
Stage 2	659	629	-	673	635	-	-	-	-	-	-	-
Platoon blocked, %								-	-	-	-	-
Mov Cap-1 Maneuver	343	359	707	353	359	692	1224	-	-	1201	-	-
Mov Cap-2 Maneuver	343	359	-	353	359	-	-	-	-	-	-	-
Stage 1	669	631	-	665	629	-	-	-	-	-	-	-
Stage 2	648	628	-	669	631	-	-	-	-	-	-	-

Approach	EB		WB		NB		SB	
HCM Control Delay, s	0		10.3		0		0.2	
HCM LOS	A		B					

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1224	-	-	-	692	1201	-
HCM Lane V/C Ratio	-	-	-	-	0.017	0.005	-
HCM Control Delay (s)	0	-	-	0	10.3	8	0
HCM Lane LOS	A	-	-	A	B	A	A
HCM 95th %tile Q(veh)	0	-	-	-	0.1	0	-

HCM 6th TWSC
4: S Kalamazoo Ave & Industrial Rd

Marshall Housing PUD - TIS
Existing AM Peak

Intersection						
Int Delay, s/veh	1.5					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	9	40	47	259	228	32
Future Vol, veh/h	9	40	47	259	228	32
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	150	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	82	82	88	88	87	87
Heavy Vehicles, %	4	4	2	2	3	3
Mvmt Flow	11	49	53	294	262	37
Major/Minor	Minor2	Major1		Major2		
Conflicting Flow All	681	281	299	0	-	0
Stage 1	281	-	-	-	-	-
Stage 2	400	-	-	-	-	-
Critical Hdwy	6.44	6.24	4.12	-	-	-
Critical Hdwy Stg 1	5.44	-	-	-	-	-
Critical Hdwy Stg 2	5.44	-	-	-	-	-
Follow-up Hdwy	3.536	3.336	2.218	-	-	-
Pot Cap-1 Maneuver	413	753	1262	-	-	-
Stage 1	762	-	-	-	-	-
Stage 2	673	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	396	753	1262	-	-	-
Mov Cap-2 Maneuver	396	-	-	-	-	-
Stage 1	730	-	-	-	-	-
Stage 2	673	-	-	-	-	-
Approach	EB	NB		SB		
HCM Control Delay, s	11.1	1.2		0		
HCM LOS	B					
Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR	
Capacity (veh/h)	1262	-	646	-	-	
HCM Lane V/C Ratio	0.042	-	0.093	-	-	
HCM Control Delay (s)	8	-	11.1	-	-	
HCM Lane LOS	A	-	B	-	-	
HCM 95th %tile Q(veh)	0.1	-	0.3	-	-	

Intersection	
Intersection Delay, s/veh	9.8
Intersection LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↱	↱		↱	↱		↱↲			↱	↱
Traffic Vol, veh/h	51	106	6	8	101	24	5	27	4	42	65	90
Future Vol, veh/h	51	106	6	8	101	24	5	27	4	42	65	90
Peak Hour Factor	0.83	0.83	0.83	0.90	0.90	0.90	0.64	0.64	0.64	0.71	0.71	0.71
Heavy Vehicles, %	2	2	2	0	0	0	0	0	0	0	0	0
Mvmt Flow	61	128	7	9	112	27	8	42	6	59	92	127
Number of Lanes	0	1	1	0	1	1	0	1	0	0	1	1

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	2	2	2	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	2	1	2	2
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	2	2	2
HCM Control Delay	10.9	9.4	9.4	9.4
HCM LOS	B	A	A	A

Lane	NBLn1	EBLn1	EBLn2	WBLn1	WBLn2	SBLn1	SBLn2
Vol Left, %	14%	32%	0%	7%	0%	39%	0%
Vol Thru, %	75%	68%	0%	93%	0%	61%	0%
Vol Right, %	11%	0%	100%	0%	100%	0%	100%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	36	157	6	109	24	107	90
LT Vol	5	51	0	8	0	42	0
Through Vol	27	106	0	101	0	65	0
RT Vol	4	0	6	0	24	0	90
Lane Flow Rate	56	189	7	121	27	151	127
Geometry Grp	4b	5	5	5	5	5	5
Degree of Util (X)	0.09	0.3	0.01	0.189	0.036	0.238	0.168
Departure Headway (Hd)	5.751	5.711	4.84	5.617	4.873	5.682	4.78
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	617	624	732	633	726	628	744
Service Time	3.847	3.491	2.62	3.403	2.658	3.454	2.551
HCM Lane V/C Ratio	0.091	0.303	0.01	0.191	0.037	0.24	0.171
HCM Control Delay	9.4	11	7.7	9.7	7.8	10.2	8.5
HCM Lane LOS	A	B	A	A	A	B	A
HCM 95th-tile Q	0.3	1.3	0	0.7	0.1	0.9	0.6

Intersection												
Int Delay, s/veh	7.2											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕	↕		↕			↕	↕
Traffic Vol, veh/h	79	6	23	0	4	21	24	414	3	14	364	87
Future Vol, veh/h	79	6	23	0	4	21	24	414	3	14	364	87
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	1	1	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	65	-	-	-	-	-	60
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	71	71	71	69	69	69	74	74	74	95	95	95
Heavy Vehicles, %	0	0	0	0	0	0	1	1	1	1	1	1
Mvmt Flow	111	8	32	0	6	30	32	559	4	15	383	92

Major/Minor	Minor2		Minor1		Major1		Major2					
Conflicting Flow All	1056	1041	383	1105	1131	562	475	0	0	564	0	0
Stage 1	413	413	-	626	626	-	-	-	-	-	-	-
Stage 2	643	628	-	479	505	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.5	6.2	7.1	6.5	6.2	4.11	-	-	4.11	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.5	4	3.3	2.209	-	-	2.209	-	-
Pot Cap-1 Maneuver	205	232	669	190	205	530	1092	-	-	1013	-	-
Stage 1	620	597	-	475	480	-	-	-	-	-	-	-
Stage 2	465	479	-	571	544	-	-	-	-	-	-	-
Platoon blocked, %								-	-	-	-	-
Mov Cap-1 Maneuver	180	217	669	167	192	530	1092	-	-	1012	-	-
Mov Cap-2 Maneuver	180	217	-	167	192	-	-	-	-	-	-	-
Stage 1	593	585	-	454	459	-	-	-	-	-	-	-
Stage 2	414	458	-	525	533	-	-	-	-	-	-	-

Approach	EB		WB		NB		SB	
HCM Control Delay, s	53.7		14.1		0.5		0.3	
HCM LOS	F		B					

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1WBLn1WBLn2	SBL	SBT	SBR
Capacity (veh/h)	1092	-	-	216 192 530	1012	-	-
HCM Lane V/C Ratio	0.03	-	-	0.704 0.03 0.057	0.015	-	-
HCM Control Delay (s)	8.4	0	-	53.7 24.3 12.2	8.6	0	-
HCM Lane LOS	A	A	-	F C B	A	A	-
HCM 95th %tile Q(veh)	0.1	-	-	4.5 0.1 0.2	0	-	-

HCM 6th TWSC
3: S Kalamazoo Ave & North Drwy/Crary St





Marshall Housing PUD - TIS
Existing PM Peak

Intersection												
Int Delay, s/veh	0.4											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔			↔			↔	
Traffic Vol, veh/h	0	0	0	2	0	15	0	524	4	15	487	0
Future Vol, veh/h	0	0	0	2	0	15	0	524	4	15	487	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	3	3	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	85	92	85	92	80	80	95	95	92
Heavy Vehicles, %	2	2	2	0	2	0	2	1	1	1	1	2
Mvmt Flow	0	0	0	2	0	18	0	655	5	16	513	0

Major/Minor	Minor2		Minor1		Major1		Major2					
Conflicting Flow All	1212	1208	513	1206	1206	661	513	0	0	663	0	0
Stage 1	545	545	-	661	661	-	-	-	-	-	-	-
Stage 2	667	663	-	545	545	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.1	6.52	6.2	4.12	-	-	4.11	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.1	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.1	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.5	4.018	3.3	2.218	-	-	2.209	-	-
Pot Cap-1 Maneuver	159	183	561	162	184	466	1052	-	-	931	-	-
Stage 1	523	519	-	455	460	-	-	-	-	-	-	-
Stage 2	448	459	-	526	519	-	-	-	-	-	-	-
Platoon blocked, %								-	-	-	-	-
Mov Cap-1 Maneuver	150	178	561	159	179	465	1052	-	-	929	-	-
Mov Cap-2 Maneuver	150	178	-	159	179	-	-	-	-	-	-	-
Stage 1	523	507	-	454	459	-	-	-	-	-	-	-
Stage 2	431	458	-	513	507	-	-	-	-	-	-	-

Approach	EB		WB		NB		SB	
HCM Control Delay, s	0		15		0		0.3	
HCM LOS	A		C					

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1052	-	-	-	379	929	-
HCM Lane V/C Ratio	-	-	-	-	0.053	0.017	-
HCM Control Delay (s)	0	-	-	0	15	8.9	0
HCM Lane LOS	A	-	-	A	C	A	A
HCM 95th %tile Q(veh)	0	-	-	-	0.2	0.1	-

Intersection						
Int Delay, s/veh	3					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	33	112	62	490	388	19
Future Vol, veh/h	33	112	62	490	388	19
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	150	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	86	86	80	80	95	95
Heavy Vehicles, %	2	2	1	1	1	1
Mvmt Flow	38	130	78	613	408	20
Major/Minor	Minor2	Major1		Major2		
Conflicting Flow All	1187	418	428	0	-	0
Stage 1	418	-	-	-	-	-
Stage 2	769	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.11	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.209	-	-	-
Pot Cap-1 Maneuver	208	635	1137	-	-	-
Stage 1	664	-	-	-	-	-
Stage 2	457	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	194	635	1137	-	-	-
Mov Cap-2 Maneuver	194	-	-	-	-	-
Stage 1	618	-	-	-	-	-
Stage 2	457	-	-	-	-	-
Approach	EB	NB		SB		
HCM Control Delay, s	19.3	0.9		0		
HCM LOS	C					
Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR	
Capacity (veh/h)	1137	-	418	-	-	
HCM Lane V/C Ratio	0.068	-	0.403	-	-	
HCM Control Delay (s)	8.4	-	19.3	-	-	
HCM Lane LOS	A	-	C	-	-	
HCM 95th %tile Q(veh)	0.2	-	1.9	-	-	

Intersection	
Intersection Delay, s/veh	8.4
Intersection LOS	A









Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↱	↱		↱	↱		↱			↱	↱
Traffic Vol, veh/h	42	73	3	2	46	24	6	16	4	9	23	19
Future Vol, veh/h	42	73	3	2	46	24	6	16	4	9	23	19
Peak Hour Factor	0.80	0.80	0.80	0.86	0.86	0.86	0.60	0.60	0.60	0.71	0.71	0.71
Heavy Vehicles, %	0	0	0	1	1	1	0	0	0	2	2	2
Mvmt Flow	53	91	4	2	53	28	10	27	7	13	32	27
Number of Lanes	0	1	1	0	1	1	0	1	0	0	1	1

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	2	2	2	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	2	1	2	2
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	2	2	2
HCM Control Delay	8.9	7.8	8.5	8
HCM LOS	A	A	A	A

Lane	NBLn1	EBLn1	EBLn2	WBLn1	WBLn2	SBLn1	SBLn2
Vol Left, %	23%	37%	0%	4%	0%	28%	0%
Vol Thru, %	62%	63%	0%	96%	0%	72%	0%
Vol Right, %	15%	0%	100%	0%	100%	0%	100%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	26	115	3	48	24	32	19
LT Vol	6	42	0	2	0	9	0
Through Vol	16	73	0	46	0	23	0
RT Vol	4	0	3	0	24	0	19
Lane Flow Rate	43	144	4	56	28	45	27
Geometry Grp	4b	5	5	5	5	5	5
Degree of Util (X)	0.062	0.202	0.004	0.077	0.033	0.066	0.033
Departure Headway (Hd)	5.121	5.05	4.164	4.964	4.24	5.294	4.45
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	701	713	862	724	846	678	806
Service Time	3.139	2.764	1.878	2.68	1.956	3.011	2.167
HCM Lane V/C Ratio	0.061	0.202	0.005	0.077	0.033	0.066	0.033
HCM Control Delay	8.5	9	6.9	8.1	7.1	8.4	7.3
HCM Lane LOS	A	A	A	A	A	A	A
HCM 95th-tile Q	0.2	0.8	0	0.2	0.1	0.2	0.1

HCM 6th TWSC
2: S Kalamazoo Ave & A Dr N/E Hughes St

Marshall Housing PUD - TIS
Existing AM Peak w/ Turn Lanes

Intersection												
Int Delay, s/veh	2.2											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	60	1	6	0	1	9	8	228	0	3	227	28
Future Vol, veh/h	60	1	6	0	1	9	8	228	0	3	227	28
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	150	-	-	-	-	65	150	-	-	-	-	60
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	80	80	80	60	60	60	84	84	84	80	80	80
Heavy Vehicles, %	0	0	0	0	0	0	3	3	3	2	2	2
Mvmt Flow	75	1	8	0	2	15	10	271	0	4	284	35

Major/Minor	Minor2		Minor1		Major1			Major2				
Conflicting Flow All	592	583	284	605	618	271	319	0	0	271	0	0
Stage 1	292	292	-	291	291	-	-	-	-	-	-	-
Stage 2	300	291	-	314	327	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.5	6.2	7.1	6.5	6.2	4.13	-	-	4.12	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.5	4	3.3	2.227	-	-	2.218	-	-
Pot Cap-1 Maneuver	421	427	760	413	408	773	1235	-	-	1292	-	-
Stage 1	720	675	-	721	675	-	-	-	-	-	-	-
Stage 2	713	675	-	701	651	-	-	-	-	-	-	-
Platoon blocked, %								-	-	-	-	-
Mov Cap-1 Maneuver	408	422	760	404	403	773	1235	-	-	1292	-	-
Mov Cap-2 Maneuver	408	422	-	404	403	-	-	-	-	-	-	-
Stage 1	714	672	-	715	670	-	-	-	-	-	-	-
Stage 2	692	670	-	690	648	-	-	-	-	-	-	-

Approach	EB		WB		NB		SB	
HCM Control Delay, s	15.2		10.1		0.3		0.1	
HCM LOS	C		B					

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	1235	-	-	408	682	403	773	1292	-	-
HCM Lane V/C Ratio	0.008	-	-	0.184	0.013	0.004	0.019	0.003	-	-
HCM Control Delay (s)	7.9	0	-	15.8	10.3	14	9.7	7.8	0	-
HCM Lane LOS	A	A	-	C	B	B	A	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0.7	0	0	0.1	0	-	-

HCM 6th TWSC
3: S Kalamazoo Ave & North Drwy/Crary St

Marshall Housing PUD - TIS
Existing AM Peak w/ Turn Lanes

Intersection												
Int Delay, s/veh	0.3											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔			↔			↔	
Traffic Vol, veh/h	0	0	0	0	0	11	0	299	2	5	261	0
Future Vol, veh/h	0	0	0	0	0	11	0	299	2	5	261	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	2	2	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	85	85	78	78	92
Heavy Vehicles, %	2	2	2	0	2	0	2	2	2	2	2	2
Mvmt Flow	0	0	0	0	0	12	0	352	2	6	335	0




Major/Minor	Minor2		Minor1		Major1		Major2					
Conflicting Flow All	706	703	335	702	702	355	335	0	0	356	0	0
Stage 1	347	347	-	355	355	-	-	-	-	-	-	-
Stage 2	359	356	-	347	347	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.1	6.52	6.2	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.1	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.1	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.5	4.018	3.3	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	351	362	707	355	362	693	1224	-	-	1203	-	-
Stage 1	669	635	-	666	630	-	-	-	-	-	-	-
Stage 2	659	629	-	673	635	-	-	-	-	-	-	-
Platoon blocked, %								-	-	-	-	-
Mov Cap-1 Maneuver	343	359	707	353	359	692	1224	-	-	1201	-	-
Mov Cap-2 Maneuver	343	359	-	353	359	-	-	-	-	-	-	-
Stage 1	669	631	-	665	629	-	-	-	-	-	-	-
Stage 2	648	628	-	669	631	-	-	-	-	-	-	-

Approach	EB		WB		NB		SB	
HCM Control Delay, s	0		10.3		0		0.2	
HCM LOS	A		B					

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1224	-	-	-	692	1201	-
HCM Lane V/C Ratio	-	-	-	-	0.017	0.005	-
HCM Control Delay (s)	0	-	-	0	10.3	8	0
HCM Lane LOS	A	-	-	A	B	A	A
HCM 95th %tile Q(veh)	0	-	-	-	0.1	0	-

HCM 6th TWSC
4: S Kalamazoo Ave & Industrial Rd

Marshall Housing PUD - TIS
Existing AM Peak w/ Turn Lanes

Intersection						
Int Delay, s/veh	1.5					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	9	40	47	259	228	32
Future Vol, veh/h	9	40	47	259	228	32
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	82	82	88	88	87	87
Heavy Vehicles, %	4	4	2	2	3	3
Mvmt Flow	11	49	53	294	262	37
Major/Minor	Minor2	Major1		Major2		
Conflicting Flow All	681	281	299	0	-	0
Stage 1	281	-	-	-	-	-
Stage 2	400	-	-	-	-	-
Critical Hdwy	6.44	6.24	4.12	-	-	-
Critical Hdwy Stg 1	5.44	-	-	-	-	-
Critical Hdwy Stg 2	5.44	-	-	-	-	-
Follow-up Hdwy	3.536	3.336	2.218	-	-	-
Pot Cap-1 Maneuver	413	753	1262	-	-	-
Stage 1	762	-	-	-	-	-
Stage 2	673	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	392	753	1262	-	-	-
Mov Cap-2 Maneuver	392	-	-	-	-	-
Stage 1	724	-	-	-	-	-
Stage 2	673	-	-	-	-	-
Approach	EB	NB		SB		
HCM Control Delay, s	11.2	1.2		0		
HCM LOS	B					
Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR	
Capacity (veh/h)	1262	-	644	-	-	
HCM Lane V/C Ratio	0.042	-	0.093	-	-	
HCM Control Delay (s)	8	0	11.2	-	-	
HCM Lane LOS	A	A	B	-	-	
HCM 95th %tile Q(veh)	0.1	-	0.3	-	-	

Intersection	
Intersection Delay, s/veh	9.8
Intersection LOS	A









Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↰	↱		↰	↱		↰↱			↰	↱
Traffic Vol, veh/h	51	106	6	8	101	24	5	27	4	42	65	90
Future Vol, veh/h	51	106	6	8	101	24	5	27	4	42	65	90
Peak Hour Factor	0.83	0.83	0.83	0.90	0.90	0.90	0.64	0.64	0.64	0.71	0.71	0.71
Heavy Vehicles, %	2	2	2	0	0	0	0	0	0	0	0	0
Mvmt Flow	61	128	7	9	112	27	8	42	6	59	92	127
Number of Lanes	0	1	1	0	1	1	0	1	0	0	1	1

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	2	2	2	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	2	1	2	2
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	2	2	2
HCM Control Delay	10.9	9.4	9.4	9.4
HCM LOS	B	A	A	A

Lane	NBLn1	EBLn1	EBLn2	WBLn1	WBLn2	SBLn1	SBLn2
Vol Left, %	14%	32%	0%	7%	0%	39%	0%
Vol Thru, %	75%	68%	0%	93%	0%	61%	0%
Vol Right, %	11%	0%	100%	0%	100%	0%	100%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	36	157	6	109	24	107	90
LT Vol	5	51	0	8	0	42	0
Through Vol	27	106	0	101	0	65	0
RT Vol	4	0	6	0	24	0	90
Lane Flow Rate	56	189	7	121	27	151	127
Geometry Grp	4b	5	5	5	5	5	5
Degree of Util (X)	0.09	0.3	0.01	0.189	0.036	0.238	0.168
Departure Headway (Hd)	5.751	5.711	4.84	5.617	4.873	5.682	4.78
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	617	624	732	633	726	628	744
Service Time	3.847	3.491	2.62	3.403	2.658	3.454	2.551
HCM Lane V/C Ratio	0.091	0.303	0.01	0.191	0.037	0.24	0.171
HCM Control Delay	9.4	11	7.7	9.7	7.8	10.2	8.5
HCM Lane LOS	A	B	A	A	A	B	A
HCM 95th-tile Q	0.3	1.3	0	0.7	0.1	0.9	0.6

HCM 6th TWSC
2: S Kalamazoo Ave & A Dr N/E Hughes St

Marshall Housing PUD - TIS
Existing PM Peak w/ Turn Lanes

Intersection												
Int Delay, s/veh	5.7											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	79	6	23	0	4	21	24	414	3	14	364	87
Future Vol, veh/h	79	6	23	0	4	21	24	414	3	14	364	87
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	1	1	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	150	-	-	-	-	65	150	-	-	-	-	60
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	71	71	71	69	69	69	74	74	74	95	95	95
Heavy Vehicles, %	0	0	0	0	0	0	1	1	1	1	1	1
Mvmt Flow	111	8	32	0	6	30	32	559	4	15	383	92

Major/Minor	Minor2		Minor1		Major1		Major2					
Conflicting Flow All	1056	1041	383	1105	1131	562	475	0	0	564	0	0
Stage 1	413	413	-	626	626	-	-	-	-	-	-	-
Stage 2	643	628	-	479	505	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.5	6.2	7.1	6.5	6.2	4.11	-	-	4.11	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.5	4	3.3	2.209	-	-	2.209	-	-
Pot Cap-1 Maneuver	205	232	669	190	205	530	1092	-	-	1013	-	-
Stage 1	620	597	-	475	480	-	-	-	-	-	-	-
Stage 2	465	479	-	571	544	-	-	-	-	-	-	-
Platoon blocked, %								-	-	-	-	-
Mov Cap-1 Maneuver	182	221	669	169	195	530	1092	-	-	1012	-	-
Mov Cap-2 Maneuver	182	221	-	169	195	-	-	-	-	-	-	-
Stage 1	602	585	-	461	466	-	-	-	-	-	-	-
Stage 2	420	465	-	525	533	-	-	-	-	-	-	-

Approach	EB		WB		NB		SB	
HCM Control Delay, s	41.4		14.1		0.5		0.3	
HCM LOS	E		B					

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	1092	-	-	182	471	195	530	1012	-	-
HCM Lane V/C Ratio	0.03	-	-	0.611	0.087	0.03	0.057	0.015	-	-
HCM Control Delay (s)	8.4	0	-	51.7	13.4	24	12.2	8.6	0	-
HCM Lane LOS	A	A	-	F	B	C	B	A	A	-
HCM 95th %tile Q(veh)	0.1	-	-	3.4	0.3	0.1	0.2	0	-	-

HCM 6th TWSC
3: S Kalamazoo Ave & North Drwy/Crary St

Marshall Housing PUD - TIS
Existing PM Peak w/ Turn Lanes

Intersection												
Int Delay, s/veh	0.4											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	0	0	0	2	0	15	0	524	4	15	487	0
Future Vol, veh/h	0	0	0	2	0	15	0	524	4	15	487	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	3	3	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	85	92	85	92	80	80	95	95	92
Heavy Vehicles, %	2	2	2	0	2	0	2	1	1	1	1	2
Mvmt Flow	0	0	0	2	0	18	0	655	5	16	513	0

Major/Minor	Minor2		Minor1		Major1		Major2					
Conflicting Flow All	1212	1208	513	1206	1206	661	513	0	0	663	0	0
Stage 1	545	545	-	661	661	-	-	-	-	-	-	-
Stage 2	667	663	-	545	545	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.1	6.52	6.2	4.12	-	-	4.11	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.1	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.1	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.5	4.018	3.3	2.218	-	-	2.209	-	-
Pot Cap-1 Maneuver	159	183	561	162	184	466	1052	-	-	931	-	-
Stage 1	523	519	-	455	460	-	-	-	-	-	-	-
Stage 2	448	459	-	526	519	-	-	-	-	-	-	-
Platoon blocked, %								-	-	-	-	-
Mov Cap-1 Maneuver	150	178	561	159	179	465	1052	-	-	929	-	-
Mov Cap-2 Maneuver	150	178	-	159	179	-	-	-	-	-	-	-
Stage 1	523	507	-	454	459	-	-	-	-	-	-	-
Stage 2	431	458	-	513	507	-	-	-	-	-	-	-

Approach	EB		WB		NB		SB	
HCM Control Delay, s	0		15		0		0.3	
HCM LOS	A		C					

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1052	-	-	-	379	929	-
HCM Lane V/C Ratio	-	-	-	-	0.053	0.017	-
HCM Control Delay (s)	0	-	-	0	15	8.9	0
HCM Lane LOS	A	-	-	A	C	A	A
HCM 95th %tile Q(veh)	0	-	-	-	0.2	0.1	-

HCM 6th TWSC
4: S Kalamazoo Ave & Industrial Rd

Marshall Housing PUD - TIS
Existing PM Peak w/ Turn Lanes

Intersection

Int Delay, s/veh 3.1

Movement EBL EBR NBL NBT SBT SBR

Lane Configurations 

Traffic Vol, veh/h 33 112 62 490 388 19

Future Vol, veh/h 33 112 62 490 388 19

Conflicting Peds, #/hr 0 0 0 0 0 0

Sign Control Stop Stop Free Free Free Free

RT Channelized - None - None - None

Storage Length 0 - - - - -

Veh in Median Storage, # 0 - - 0 0 -

Grade, % 0 - - 0 0 -

Peak Hour Factor 86 86 80 80 95 95

Heavy Vehicles, % 2 2 1 1 1 1

Mvmt Flow 38 130 78 613 408 20

Major/Minor Minor2 Major1 Major2

Conflicting Flow All 1187 418 428 0 - 0

Stage 1 418 - - - - -

Stage 2 769 - - - - -

Critical Hdwy 6.42 6.22 4.11 - - -

Critical Hdwy Stg 1 5.42 - - - - -

Critical Hdwy Stg 2 5.42 - - - - -

Follow-up Hdwy 3.518 3.318 2.209 - - -

Pot Cap-1 Maneuver 208 635 1137 - - -

Stage 1 664 - - - - -

Stage 2 457 - - - - -

Platoon blocked, % - - -

Mov Cap-1 Maneuver 186 635 1137 - - -

Mov Cap-2 Maneuver 186 - - - - -

Stage 1 595 - - - - -

Stage 2 457 - - - - -

Approach EB NB SB

HCM Control Delay, s 19.8 0.9 0

HCM LOS C

Minor Lane/Major Mvmt NBL NBT EBLn1 SBT SBR

Capacity (veh/h) 1137 - 410 - -

HCM Lane V/C Ratio 0.068 - 0.411 - -

HCM Control Delay (s) 8.4 0 19.8 - -

HCM Lane LOS A A C - -

HCM 95th %tile Q(veh) 0.2 - 2 - -

Intersection	
Intersection Delay, s/veh	8.4
Intersection LOS	A









Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↱	↱		↱	↱		↱			↱	↱
Traffic Vol, veh/h	42	77	3	2	55	27	6	16	4	10	23	19
Future Vol, veh/h	42	77	3	2	55	27	6	16	4	10	23	19
Peak Hour Factor	0.80	0.80	0.80	0.86	0.86	0.86	0.60	0.60	0.60	0.71	0.71	0.71
Heavy Vehicles, %	0	0	0	1	1	1	0	0	0	2	2	2
Mvmt Flow	53	96	4	2	64	31	10	27	7	14	32	27
Number of Lanes	0	1	1	0	1	1	0	1	0	0	1	1

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	2	2	2	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	2	1	2	2
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	2	2	2
HCM Control Delay	9	7.8	8.5	8.1
HCM LOS	A	A	A	A

Lane	NBLn1	EBLn1	EBLn2	WBLn1	WBLn2	SBLn1	SBLn2
Vol Left, %	23%	35%	0%	4%	0%	30%	0%
Vol Thru, %	62%	65%	0%	96%	0%	70%	0%
Vol Right, %	15%	0%	100%	0%	100%	0%	100%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	26	119	3	57	27	33	19
LT Vol	6	42	0	2	0	10	0
Through Vol	16	77	0	55	0	23	0
RT Vol	4	0	3	0	27	0	19
Lane Flow Rate	43	149	4	66	31	46	27
Geometry Grp	4b	5	5	5	5	5	5
Degree of Util (X)	0.062	0.209	0.004	0.091	0.037	0.069	0.033
Departure Headway (Hd)	5.169	5.059	4.18	4.969	4.249	5.35	4.495
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	695	711	858	723	844	672	798
Service Time	3.187	2.775	1.896	2.687	1.966	3.067	2.212
HCM Lane V/C Ratio	0.062	0.21	0.005	0.091	0.037	0.068	0.034
HCM Control Delay	8.5	9.1	6.9	8.2	7.1	8.5	7.4
HCM Lane LOS	A	A	A	A	A	A	A
HCM 95th-tile Q	0.2	0.8	0	0.3	0.1	0.2	0.1

HCM 6th TWSC
2: S Kalamazoo Ave & A Dr N/E Hughes St

Marshall Housing PUD - TIS
Future Phase I (2027) AM Peak

Intersection												
Int Delay, s/veh	3.2											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	89	1	16	0	1	9	11	233	0	3	239	32
Future Vol, veh/h	89	1	16	0	1	9	11	233	0	3	239	32
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	150	-	-	-	-	65	150	-	-	-	-	150
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	80	80	80	60	60	60	84	84	84	80	80	80
Heavy Vehicles, %	0	0	0	0	0	0	3	3	3	2	2	2
Mvmt Flow	111	1	20	0	2	15	13	277	0	4	299	40






Major/Minor	Minor2		Minor1		Major1			Major2				
Conflicting Flow All	619	610	299	641	650	277	339	0	0	277	0	0
Stage 1	307	307	-	303	303	-	-	-	-	-	-	-
Stage 2	312	303	-	338	347	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.5	6.2	7.1	6.5	6.2	4.13	-	-	4.12	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.5	4	3.3	2.227	-	-	2.218	-	-
Pot Cap-1 Maneuver	404	412	745	390	391	767	1215	-	-	1286	-	-
Stage 1	707	665	-	711	667	-	-	-	-	-	-	-
Stage 2	703	667	-	681	638	-	-	-	-	-	-	-
Platoon blocked, %								-	-	-	-	-
Mov Cap-1 Maneuver	390	406	745	374	385	767	1215	-	-	1286	-	-
Mov Cap-2 Maneuver	390	406	-	374	385	-	-	-	-	-	-	-
Stage 1	699	662	-	703	660	-	-	-	-	-	-	-
Stage 2	680	660	-	659	635	-	-	-	-	-	-	-

Approach	EB		WB		NB			SB				
HCM Control Delay, s	16.7		10.3		0.4			0.1				
HCM LOS	C		B									

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	1215	-	-	390	710	385	767	1286	-	-
HCM Lane V/C Ratio	0.011	-	-	0.285	0.03	0.004	0.02	0.003	-	-
HCM Control Delay (s)	8	-	-	17.9	10.2	14.4	9.8	7.8	0	-
HCM Lane LOS	A	-	-	C	B	B	A	A	A	-
HCM 95th %tile Q(veh)	0	-	-	1.2	0.1	0	0.1	0	-	-

HCM 6th TWSC
3: S Kalamazoo Ave & North Drwy/Crary St






Marshall Housing PUD - TIS
Future Phase I (2027) AM Peak




Intersection												
Int Delay, s/veh	1.2											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	36	0	10	0	0	11	3	330	2	5	268	17
Future Vol, veh/h	36	0	10	0	0	11	3	330	2	5	268	17
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	2	2	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	75	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	85	85	78	78	92
Heavy Vehicles, %	2	2	2	0	2	0	2	2	2	2	2	2
Mvmt Flow	39	0	11	0	0	12	3	388	2	6	344	18

Major/Minor	Minor2		Minor1		Major1		Major2					
Conflicting Flow All	766	763	353	768	771	391	362	0	0	392	0	0
Stage 1	365	365	-	397	397	-	-	-	-	-	-	-
Stage 2	401	398	-	371	374	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.1	6.52	6.2	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.1	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.1	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.5	4.018	3.3	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	320	334	691	321	331	662	1197	-	-	1167	-	-
Stage 1	654	623	-	633	603	-	-	-	-	-	-	-
Stage 2	626	603	-	653	618	-	-	-	-	-	-	-
Platoon blocked, %								-	-	-	-	-
Mov Cap-1 Maneuver	312	330	691	313	327	661	1197	-	-	1165	-	-
Mov Cap-2 Maneuver	312	330	-	313	327	-	-	-	-	-	-	-
Stage 1	652	619	-	630	600	-	-	-	-	-	-	-
Stage 2	613	600	-	639	614	-	-	-	-	-	-	-

Approach	EB		WB		NB		SB	
HCM Control Delay, s	16.5		10.5		0.1		0.1	
HCM LOS	C		B					





Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1197	-	-	312	691	661	1165	-	-
HCM Lane V/C Ratio	0.003	-	-	0.125	0.016	0.018	0.006	-	-
HCM Control Delay (s)	8	0	-	18.2	10.3	10.5	8.1	0	-
HCM Lane LOS	A	A	-	C	B	B	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0.4	0	0.1	0	-	-

Intersection						
Int Delay, s/veh	1.5					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	9	43	53	320	248	32
Future Vol, veh/h	9	43	53	320	248	32
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	150	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	82	82	88	88	87	87
Heavy Vehicles, %	4	4	2	2	3	3
Mvmt Flow	11	52	60	364	285	37
Major/Minor	Minor2	Major1		Major2		
Conflicting Flow All	788	304	322	0	-	0
Stage 1	304	-	-	-	-	-
Stage 2	484	-	-	-	-	-
Critical Hdwy	6.44	6.24	4.12	-	-	-
Critical Hdwy Stg 1	5.44	-	-	-	-	-
Critical Hdwy Stg 2	5.44	-	-	-	-	-
Follow-up Hdwy	3.536	3.336	2.218	-	-	-
Pot Cap-1 Maneuver	357	731	1238	-	-	-
Stage 1	744	-	-	-	-	-
Stage 2	616	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	340	731	1238	-	-	-
Mov Cap-2 Maneuver	340	-	-	-	-	-
Stage 1	708	-	-	-	-	-
Stage 2	616	-	-	-	-	-
Approach	EB	NB		SB		
HCM Control Delay, s	11.6	1.1		0		
HCM LOS	B					
Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR	
Capacity (veh/h)	1238	-	610	-	-	
HCM Lane V/C Ratio	0.049	-	0.104	-	-	
HCM Control Delay (s)	8.1	-	11.6	-	-	
HCM Lane LOS	A	-	B	-	-	
HCM 95th %tile Q(veh)	0.2	-	0.3	-	-	

Intersection						
Int Delay, s/veh	0.3					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	1	104	44	0	2	2
Future Vol, veh/h	1	104	44	0	2	2
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	1	113	48	0	2	2
Major/Minor	Major1	Major2		Minor2		
Conflicting Flow All	48	0	-	0	163	48
Stage 1	-	-	-	-	48	-
Stage 2	-	-	-	-	115	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1559	-	-	-	828	1021
Stage 1	-	-	-	-	974	-
Stage 2	-	-	-	-	910	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1559	-	-	-	827	1021
Mov Cap-2 Maneuver	-	-	-	-	827	-
Stage 1	-	-	-	-	973	-
Stage 2	-	-	-	-	910	-
Approach	EB	WB		SB		
HCM Control Delay, s	0.1	0		9		
HCM LOS	A					
Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	
Capacity (veh/h)	1559	-	-	-	914	
HCM Lane V/C Ratio	0.001	-	-	-	0.005	
HCM Control Delay (s)	7.3	0	-	-	9	
HCM Lane LOS	A	A	-	-	A	
HCM 95th %tile Q(veh)	0	-	-	-	0	

Intersection

Int Delay, s/veh 2.7

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	3	69	39	7	36	10
Future Vol, veh/h	3	69	39	7	36	10
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	3	75	42	8	39	11

Major/Minor	Major1	Major2	Minor2		
Conflicting Flow All	50	0	0	127	46
Stage 1	-	-	-	46	-
Stage 2	-	-	-	81	-
Critical Hdwy	4.12	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	3.518	3.318
Pot Cap-1 Maneuver	1557	-	-	868	1023
Stage 1	-	-	-	976	-
Stage 2	-	-	-	942	-
Platoon blocked, %	-	-	-	-	-
Mov Cap-1 Maneuver	1557	-	-	866	1023
Mov Cap-2 Maneuver	-	-	-	866	-
Stage 1	-	-	-	974	-
Stage 2	-	-	-	942	-

Approach	EB	WB	SB
HCM Control Delay, s	0.3	0	9.2
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	1557	-	-	-	866	1023
HCM Lane V/C Ratio	0.002	-	-	-	0.045	0.011
HCM Control Delay (s)	7.3	0	-	-	9.4	8.6
HCM Lane LOS	A	A	-	-	A	A
HCM 95th %tile Q(veh)	0	-	-	-	0.1	0

Intersection						
Int Delay, s/veh	0					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑	↑		↓	↗
Traffic Vol, veh/h	0	72	49	0	0	0
Future Vol, veh/h	0	72	49	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	78	53	0	0	0
Major/Minor	Major1	Major2		Minor2		
Conflicting Flow All	-	0	-	0	131	53
Stage 1	-	-	-	-	53	-
Stage 2	-	-	-	-	78	-
Critical Hdwy	-	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	0	-	-	0	863	1014
Stage 1	0	-	-	0	970	-
Stage 2	0	-	-	0	945	-
Platoon blocked, %		-	-			
Mov Cap-1 Maneuver	-	-	-	-	863	1014
Mov Cap-2 Maneuver	-	-	-	-	863	-
Stage 1	-	-	-	-	970	-
Stage 2	-	-	-	-	945	-
Approach	EB	WB		SB		
HCM Control Delay, s	0	0		0		
HCM LOS				A		
Minor Lane/Major Mvmt	EBT	WBT	SBLn1	SBLn2		
Capacity (veh/h)	-	-	-	-		
HCM Lane V/C Ratio	-	-	-	-		
HCM Control Delay (s)	-	-	0	0		
HCM Lane LOS	-	-	A	A		
HCM 95th %tile Q(veh)	-	-	-	-		

Intersection	
Intersection Delay, s/veh	10
Intersection LOS	A









Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↱	↱		↱	↱		↱↲			↱	↱
Traffic Vol, veh/h	52	116	6	8	108	26	5	27	4	45	66	91
Future Vol, veh/h	52	116	6	8	108	26	5	27	4	45	66	91
Peak Hour Factor	0.83	0.83	0.83	0.90	0.90	0.90	0.64	0.64	0.64	0.71	0.71	0.71
Heavy Vehicles, %	2	2	2	0	0	0	0	0	0	0	0	0
Mvmt Flow	63	140	7	9	120	29	8	42	6	63	93	128
Number of Lanes	0	1	1	0	1	1	0	1	0	0	1	1

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	2	2	2	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	2	1	2	2
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	2	2	2
HCM Control Delay	11.2	9.5	9.5	9.6
HCM LOS	B	A	A	A

Lane	NBLn1	EBLn1	EBLn2	WBLn1	WBLn2	SBLn1	SBLn2
Vol Left, %	14%	31%	0%	7%	0%	41%	0%
Vol Thru, %	75%	69%	0%	93%	0%	59%	0%
Vol Right, %	11%	0%	100%	0%	100%	0%	100%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	36	168	6	116	26	111	91
LT Vol	5	52	0	8	0	45	0
Through Vol	27	116	0	108	0	66	0
RT Vol	4	0	6	0	26	0	91
Lane Flow Rate	56	202	7	129	29	156	128
Geometry Grp	4b	5	5	5	5	5	5
Degree of Util (X)	0.093	0.323	0.01	0.203	0.039	0.25	0.172
Departure Headway (Hd)	5.94	5.741	4.878	5.658	4.916	5.752	4.843
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	607	619	725	628	718	619	733
Service Time	3.94	3.532	2.669	3.456	2.713	3.534	2.625
HCM Lane V/C Ratio	0.092	0.326	0.01	0.205	0.04	0.252	0.175
HCM Control Delay	9.5	11.3	7.7	9.9	7.9	10.5	8.6
HCM Lane LOS	A	B	A	A	A	B	A
HCM 95th-tile Q	0.3	1.4	0	0.8	0.1	1	0.6

HCM 6th TWSC
2: S Kalamazoo Ave & A Dr N/E Hughes St

Marshall Housing PUD - TIS
Future Phase I (2027) PM Peak

Intersection												
Int Delay, s/veh	10.4											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	98	6	30	0	4	21	34	429	3	14	374	102
Future Vol, veh/h	98	6	30	0	4	21	34	429	3	14	374	102
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	1	1	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	150	-	-	-	-	65	150	-	-	-	-	150
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	71	71	71	69	69	69	74	74	74	95	95	95
Heavy Vehicles, %	0	0	0	0	0	0	1	1	1	1	1	1
Mvmt Flow	138	8	42	0	6	30	46	580	4	15	394	107






Major/Minor	Minor2		Minor1		Major1		Major2					
Conflicting Flow All	1116	1101	394	1178	1206	583	501	0	0	585	0	0
Stage 1	424	424	-	675	675	-	-	-	-	-	-	-
Stage 2	692	677	-	503	531	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.5	6.2	7.1	6.5	6.2	4.11	-	-	4.11	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.5	4	3.3	2.209	-	-	2.209	-	-
Pot Cap-1 Maneuver	187	214	659	169	185	516	1068	-	-	995	-	-
Stage 1	612	590	-	447	456	-	-	-	-	-	-	-
Stage 2	437	455	-	555	529	-	-	-	-	-	-	-
Platoon blocked, %								-	-	-	-	-
Mov Cap-1 Maneuver	163	200	659	146	173	516	1068	-	-	994	-	-
Mov Cap-2 Maneuver	163	200	-	146	173	-	-	-	-	-	-	-
Stage 1	586	578	-	427	436	-	-	-	-	-	-	-
Stage 2	388	435	-	501	518	-	-	-	-	-	-	-

Approach	EB		WB		NB		SB	
HCM Control Delay, s	69.9		14.7		0.6		0.2	
HCM LOS	F		B					

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	1068	-	-	163	477	173	516	994	-	-
HCM Lane V/C Ratio	0.043	-	-	0.847	0.106	0.034	0.059	0.015	-	-
HCM Control Delay (s)	8.5	-	-	90.6	13.4	26.5	12.4	8.7	0	-
HCM Lane LOS	A	-	-	F	B	D	B	A	A	-
HCM 95th %tile Q(veh)	0.1	-	-	5.8	0.4	0.1	0.2	0	-	-

HCM 6th TWSC
3: S Kalamazoo Ave & North Drwy/Crary St





Marshall Housing PUD - TIS
Future Phase I (2027) PM Peak

Intersection												
Int Delay, s/veh	1.2											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	24	0	6	2	0	15	11	547	4	15	506	55
Future Vol, veh/h	24	0	6	2	0	15	11	547	4	15	506	55
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	3	3	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	75	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	85	92	85	92	80	80	95	95	92
Heavy Vehicles, %	2	2	2	0	2	0	2	1	1	1	1	2
Mvmt Flow	26	0	7	2	0	18	12	684	5	16	533	60

Major/Minor	Minor2		Minor1		Major1		Major2					
Conflicting Flow All	1315	1311	563	1313	1339	690	593	0	0	692	0	0
Stage 1	595	595	-	714	714	-	-	-	-	-	-	-
Stage 2	720	716	-	599	625	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.1	6.52	6.2	4.12	-	-	4.11	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.1	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.1	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.5	4.018	3.3	2.218	-	-	2.209	-	-
Pot Cap-1 Maneuver	135	159	526	137	153	449	983	-	-	908	-	-
Stage 1	491	492	-	425	435	-	-	-	-	-	-	-
Stage 2	419	434	-	492	477	-	-	-	-	-	-	-
Platoon blocked, %								-	-	-	-	-
Mov Cap-1 Maneuver	125	151	526	130	146	448	983	-	-	906	-	-
Mov Cap-2 Maneuver	125	151	-	130	146	-	-	-	-	-	-	-
Stage 1	481	479	-	416	425	-	-	-	-	-	-	-
Stage 2	394	424	-	473	464	-	-	-	-	-	-	-




Approach	EB		WB		NB		SB	
HCM Control Delay, s	35.3		16		0.1		0.2	
HCM LOS	E		C					

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	983	-	-	125	526	348	906	-	-
HCM Lane V/C Ratio	0.012	-	-	0.209	0.012	0.057	0.017	-	-
HCM Control Delay (s)	8.7	0	-	41.2	11.9	16	9	0	-
HCM Lane LOS	A	A	-	E	B	C	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0.7	0	0.2	0.1	-	-

Intersection						
Int Delay, s/veh	3.5					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	33	122	67	533	452	19
Future Vol, veh/h	33	122	67	533	452	19
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	150	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	86	86	80	80	95	95
Heavy Vehicles, %	2	2	1	1	1	1
Mvmt Flow	38	142	84	666	476	20
Major/Minor	Minor2	Major1		Major2		
Conflicting Flow All	1320	486	496	0	-	0
Stage 1	486	-	-	-	-	-
Stage 2	834	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.11	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.209	-	-	-
Pot Cap-1 Maneuver	173	581	1073	-	-	-
Stage 1	618	-	-	-	-	-
Stage 2	426	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	160	581	1073	-	-	-
Mov Cap-2 Maneuver	160	-	-	-	-	-
Stage 1	570	-	-	-	-	-
Stage 2	426	-	-	-	-	-
Approach	EB	NB		SB		
HCM Control Delay, s	23.4	1		0		
HCM LOS	C					
Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR	
Capacity (veh/h)	1073	-	372	-	-	
HCM Lane V/C Ratio	0.078	-	0.484	-	-	
HCM Control Delay (s)	8.6	-	23.4	-	-	
HCM Lane LOS	A	-	C	-	-	
HCM 95th %tile Q(veh)	0.3	-	2.5	-	-	

Intersection

Int Delay, s/veh 0.2

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	2	132	138	2	2	1
Future Vol, veh/h	2	132	138	2	2	1
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	2	143	150	2	2	1





Major/Minor	Major1	Major2	Minor2
Conflicting Flow All	152	0	0 298 151
Stage 1	-	-	- 151 -
Stage 2	-	-	- 147 -
Critical Hdwy	4.12	-	- 6.42 6.22
Critical Hdwy Stg 1	-	-	- 5.42 -
Critical Hdwy Stg 2	-	-	- 5.42 -
Follow-up Hdwy	2.218	-	- 3.518 3.318
Pot Cap-1 Maneuver	1429	-	- 693 895
Stage 1	-	-	- 877 -
Stage 2	-	-	- 880 -
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	1429	-	- 692 895
Mov Cap-2 Maneuver	-	-	- 692 -
Stage 1	-	-	- 875 -
Stage 2	-	-	- 880 -

Approach	EB	WB	SB
HCM Control Delay, s	0.1	0	9.8
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1429	-	-	-	749
HCM Lane V/C Ratio	0.002	-	-	-	0.004
HCM Control Delay (s)	7.5	0	-	-	9.8
HCM Lane LOS	A	A	-	-	A
HCM 95th %tile Q(veh)	0	-	-	-	0

Intersection

Int Delay, s/veh 1.3

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	10	111	117	22	23	6
Future Vol, veh/h	10	111	117	22	23	6
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	11	121	127	24	25	7

Major/Minor	Major1	Major2	Minor2
Conflicting Flow All	151	0	0 282 139
Stage 1	-	-	- 139 -
Stage 2	-	-	- 143 -
Critical Hdwy	4.12	-	- 6.42 6.22
Critical Hdwy Stg 1	-	-	- 5.42 -
Critical Hdwy Stg 2	-	-	- 5.42 -
Follow-up Hdwy	2.218	-	- 3.518 3.318
Pot Cap-1 Maneuver	1430	-	- 708 909
Stage 1	-	-	- 888 -
Stage 2	-	-	- 884 -
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	1430	-	- 702 909
Mov Cap-2 Maneuver	-	-	- 702 -
Stage 1	-	-	- 881 -
Stage 2	-	-	- 884 -

Approach	EB	WB	SB
HCM Control Delay, s	0.6	0	10
HCM LOS			B









Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	1430	-	-	-	702	909
HCM Lane V/C Ratio	0.008	-	-	-	0.036	0.007
HCM Control Delay (s)	7.5	0	-	-	10.3	9
HCM Lane LOS	A	A	-	-	B	A
HCM 95th %tile Q(veh)	0	-	-	-	0.1	0

Intersection	
Intersection Delay, s/veh	8.6
Intersection LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔	↔		↔	↔		↔			↔	↔
Traffic Vol, veh/h	44	85	3	2	76	34	6	17	4	12	24	20
Future Vol, veh/h	44	85	3	2	76	34	6	17	4	12	24	20
Peak Hour Factor	0.80	0.80	0.80	0.86	0.86	0.86	0.60	0.60	0.60	0.71	0.71	0.71
Heavy Vehicles, %	0	0	0	1	1	1	0	0	0	2	2	2
Mvmt Flow	55	106	4	2	88	40	10	28	7	17	34	28
Number of Lanes	0	1	1	0	1	1	0	1	0	0	1	1

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	2	2	2	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	2	1	2	2
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	2	2	2
HCM Control Delay	9.2	8	8.7	8.3
HCM LOS	A	A	A	A

Lane	NBLn1	EBLn1	EBLn2	WBLn1	WBLn2	SBLn1	SBLn2
Vol Left, %	22%	34%	0%	3%	0%	33%	0%
Vol Thru, %	63%	66%	0%	97%	0%	67%	0%
Vol Right, %	15%	0%	100%	0%	100%	0%	100%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	27	129	3	78	34	36	20
LT Vol	6	44	0	2	0	12	0
Through Vol	17	85	0	76	0	24	0
RT Vol	4	0	3	0	34	0	20
Lane Flow Rate	45	161	4	91	40	51	28
Geometry Grp	4b	5	5	5	5	5	5
Degree of Util (X)	0.066	0.229	0.004	0.126	0.047	0.077	0.036
Departure Headway (Hd)	5.287	5.107	4.233	5.003	4.287	5.476	4.606
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	678	705	846	717	836	655	778
Service Time	3.317	2.829	1.955	2.726	2.01	3.202	2.331
HCM Lane V/C Ratio	0.066	0.228	0.005	0.127	0.048	0.078	0.036
HCM Control Delay	8.7	9.3	7	8.4	7.2	8.7	7.5
HCM Lane LOS	A	A	A	A	A	A	A
HCM 95th-tile Q	0.2	0.9	0	0.4	0.1	0.2	0.1

Intersection												
Int Delay, s/veh	6.8											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	209	1	58	0	1	9	24	240	0	3	245	76
Future Vol, veh/h	209	1	58	0	1	9	24	240	0	3	245	76
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	100	-	-	-	-	65	150	-	-	-	-	60
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	80	80	80	60	60	60	84	84	84	80	80	80
Heavy Vehicles, %	0	0	0	0	0	0	3	3	3	2	2	2
Mvmt Flow	261	1	73	0	2	15	29	286	0	4	306	95







Major/Minor	Minor2		Minor1		Major1			Major2				
Conflicting Flow All	667	658	306	743	753	286	401	0	0	286	0	0
Stage 1	314	314	-	344	344	-	-	-	-	-	-	-
Stage 2	353	344	-	399	409	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.5	6.2	7.1	6.5	6.2	4.13	-	-	4.12	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.5	4	3.3	2.227	-	-	2.218	-	-
Pot Cap-1 Maneuver	375	387	739	334	341	758	1152	-	-	1276	-	-
Stage 1	701	660	-	676	640	-	-	-	-	-	-	-
Stage 2	668	640	-	631	600	-	-	-	-	-	-	-
Platoon blocked, %								-	-	-	-	-
Mov Cap-1 Maneuver	358	376	739	294	331	758	1152	-	-	1276	-	-
Mov Cap-2 Maneuver	358	376	-	294	331	-	-	-	-	-	-	-
Stage 1	683	657	-	659	624	-	-	-	-	-	-	-
Stage 2	637	624	-	566	598	-	-	-	-	-	-	-

Approach	EB		WB		NB			SB				
HCM Control Delay, s	20.6		10.4		0.7			0.1				
HCM LOS	C		B									

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	1152	-	-	358	467	331	758	1276	-	-
HCM Lane V/C Ratio	0.025	-	-	0.486	0.344	0.005	0.02	0.003	-	-
HCM Control Delay (s)	8.2	-	-	24.2	16.7	15.9	9.8	7.8	0	-
HCM Lane LOS	A	-	-	C	C	C	A	A	A	-
HCM 95th %tile Q(veh)	0.1	-	-	2.6	1.5	0	0.1	0	-	-

HCM 6th TWSC
3: S Kalamazoo Ave & North Drwy/Crary St






Marshall Housing PUD - TIS
Future Phase IV (2033) AM Peak

Intersection												
Int Delay, s/veh	2											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	61	0	9	0	0	11	3	458	2	5	319	20
Future Vol, veh/h	61	0	9	0	0	11	3	458	2	5	319	20
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	2	2	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	100	-	-	-	-	-	-	-	-	-	-	100
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	85	85	78	78	92
Heavy Vehicles, %	2	2	2	0	2	0	2	2	2	2	2	2
Mvmt Flow	66	0	10	0	0	12	3	539	2	6	409	22

Major/Minor	Minor2		Minor1		Major1		Major2					
Conflicting Flow All	973	970	409	985	991	542	431	0	0	543	0	0
Stage 1	421	421	-	548	548	-	-	-	-	-	-	-
Stage 2	552	549	-	437	443	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.1	6.52	6.2	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.1	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.1	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.5	4.018	3.3	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	231	253	642	229	246	544	1129	-	-	1026	-	-
Stage 1	610	589	-	524	517	-	-	-	-	-	-	-
Stage 2	518	516	-	602	576	-	-	-	-	-	-	-
Platoon blocked, %								-	-	-	-	-
Mov Cap-1 Maneuver	224	249	642	223	243	543	1129	-	-	1024	-	-
Mov Cap-2 Maneuver	224	249	-	223	243	-	-	-	-	-	-	-
Stage 1	608	584	-	521	514	-	-	-	-	-	-	-
Stage 2	505	513	-	588	571	-	-	-	-	-	-	-

Approach	EB		WB		NB		SB	
HCM Control Delay, s	25.5		11.8		0		0.1	
HCM LOS	D		B					

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1129	-	-	224	642	543	1024	-	-
HCM Lane V/C Ratio	0.003	-	-	0.296	0.015	0.022	0.006	-	-
HCM Control Delay (s)	8.2	0	-	27.7	10.7	11.8	8.5	0	-
HCM Lane LOS	A	A	-	D	B	B	A	A	-
HCM 95th %tile Q(veh)	0	-	-	1.2	0	0.1	0	-	-

Intersection						
Int Delay, s/veh	1.5					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	9	51	70	457	295	33
Future Vol, veh/h	9	51	70	457	295	33
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	150	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	82	82	88	88	87	87
Heavy Vehicles, %	4	4	2	2	3	3
Mvmt Flow	11	62	80	519	339	38
Major/Minor	Minor2	Major1		Major2		
Conflicting Flow All	1037	358	377	0	-	0
Stage 1	358	-	-	-	-	-
Stage 2	679	-	-	-	-	-
Critical Hdwy	6.44	6.24	4.12	-	-	-
Critical Hdwy Stg 1	5.44	-	-	-	-	-
Critical Hdwy Stg 2	5.44	-	-	-	-	-
Follow-up Hdwy	3.536	3.336	2.218	-	-	-
Pot Cap-1 Maneuver	254	682	1181	-	-	-
Stage 1	703	-	-	-	-	-
Stage 2	500	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	237	682	1181	-	-	-
Mov Cap-2 Maneuver	237	-	-	-	-	-
Stage 1	655	-	-	-	-	-
Stage 2	500	-	-	-	-	-
Approach	EB	NB		SB		
HCM Control Delay, s	12.8	1.1		0		
HCM LOS	B					
Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR	
Capacity (veh/h)	1181	-	532	-	-	
HCM Lane V/C Ratio	0.067	-	0.138	-	-	
HCM Control Delay (s)	8.3	-	12.8	-	-	
HCM Lane LOS	A	-	B	-	-	
HCM 95th %tile Q(veh)	0.2	-	0.5	-	-	

Intersection						
Int Delay, s/veh	0.1					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑	↑		↓	↓
Traffic Vol, veh/h	0	266	101	1	3	0
Future Vol, veh/h	0	266	101	1	3	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	289	110	1	3	0
Major/Minor	Major1	Major2		Minor2		
Conflicting Flow All	-	0	-	0	400	111
Stage 1	-	-	-	-	111	-
Stage 2	-	-	-	-	289	-
Critical Hdwy	-	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	0	-	-	-	606	942
Stage 1	0	-	-	-	914	-
Stage 2	0	-	-	-	760	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	-	-	-	-	606	942
Mov Cap-2 Maneuver	-	-	-	-	606	-
Stage 1	-	-	-	-	914	-
Stage 2	-	-	-	-	760	-
Approach	EB	WB		SB		
HCM Control Delay, s	0	0		11		
HCM LOS				B		
Minor Lane/Major Mvmt	EBT	WBT	WBR	SBLn1		
Capacity (veh/h)	-	-	-	606		
HCM Lane V/C Ratio	-	-	-	0.005		
HCM Control Delay (s)	-	-	-	11		
HCM Lane LOS	-	-	-	B		
HCM 95th %tile Q(veh)	-	-	-	0		

Intersection						
Int Delay, s/veh	3.7					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑	↑		↓	↗
Traffic Vol, veh/h	4	150	64	37	116	12
Future Vol, veh/h	4	150	64	37	116	12
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	150
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	4	163	70	40	126	13
Major/Minor	Major1	Major2		Minor2		
Conflicting Flow All	110	0	-	0	261	90
Stage 1	-	-	-	-	90	-
Stage 2	-	-	-	-	171	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1480	-	-	-	728	968
Stage 1	-	-	-	-	934	-
Stage 2	-	-	-	-	859	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1480	-	-	-	726	968
Mov Cap-2 Maneuver	-	-	-	-	726	-
Stage 1	-	-	-	-	931	-
Stage 2	-	-	-	-	859	-
Approach	EB	WB		SB		
HCM Control Delay, s	0.2	0		10.8		
HCM LOS				B		
Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	1480	-	-	-	726	968
HCM Lane V/C Ratio	0.003	-	-	-	0.174	0.013
HCM Control Delay (s)	7.4	-	-	-	11	8.8
HCM Lane LOS	A	-	-	-	B	A
HCM 95th %tile Q(veh)	0	-	-	-	0.6	0

Intersection

Int Delay, s/veh 4.1

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑	↑		↓	↓
Traffic Vol, veh/h	8	74	51	25	80	25
Future Vol, veh/h	8	74	51	25	80	25
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	150
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	9	80	55	27	87	27

Major/Minor	Major1	Major2	Minor2
Conflicting Flow All	82	0	0 167 69
Stage 1	-	-	- 69 -
Stage 2	-	-	- 98 -
Critical Hdwy	4.12	-	- 6.42 6.22
Critical Hdwy Stg 1	-	-	- 5.42 -
Critical Hdwy Stg 2	-	-	- 5.42 -
Follow-up Hdwy	2.218	-	- 3.518 3.318
Pot Cap-1 Maneuver	1515	-	- 823 994
Stage 1	-	-	- 954 -
Stage 2	-	-	- 926 -
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	1515	-	- 818 994
Mov Cap-2 Maneuver	-	-	- 818 -
Stage 1	-	-	- 948 -
Stage 2	-	-	- 926 -

Approach	EB	WB	SB
HCM Control Delay, s	0.7	0	9.6
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	1515	-	-	-	818	994
HCM Lane V/C Ratio	0.006	-	-	-	0.106	0.027
HCM Control Delay (s)	7.4	-	-	-	9.9	8.7
HCM Lane LOS	A	-	-	-	A	A
HCM 95th %tile Q(veh)	0	-	-	-	0.4	0.1

Intersection	
Intersection Delay, s/veh	10.7
Intersection LOS	B









Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↱	↱		↱	↱		↱↲			↱	↱
Traffic Vol, veh/h	53	139	6	8	122	31	5	28	4	54	68	94
Future Vol, veh/h	53	139	6	8	122	31	5	28	4	54	68	94
Peak Hour Factor	0.83	0.83	0.83	0.90	0.90	0.90	0.64	0.64	0.64	0.71	0.71	0.71
Heavy Vehicles, %	2	2	2	0	0	0	0	0	0	0	0	0
Mvmt Flow	64	167	7	9	136	34	8	44	6	76	96	132
Number of Lanes	0	1	1	0	1	1	0	1	0	0	1	1

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	2	2	2	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	2	1	2	2
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	2	2	2
HCM Control Delay	12.2	10	9.9	10.2
HCM LOS	B	A	A	B

Lane	NBLn1	EBLn1	EBLn2	WBLn1	WBLn2	SBLn1	SBLn2
Vol Left, %	14%	28%	0%	6%	0%	44%	0%
Vol Thru, %	76%	72%	0%	94%	0%	56%	0%
Vol Right, %	11%	0%	100%	0%	100%	0%	100%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	37	192	6	130	31	122	94
LT Vol	5	53	0	8	0	54	0
Through Vol	28	139	0	122	0	68	0
RT Vol	4	0	6	0	31	0	94
Lane Flow Rate	58	231	7	144	34	172	132
Geometry Grp	4b	5	5	5	5	5	5
Degree of Util (X)	0.099	0.381	0.01	0.236	0.049	0.288	0.188
Departure Headway (Hd)	6.154	5.932	5.085	5.884	5.144	6.037	5.108
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	582	608	704	611	696	600	707
Service Time	4.19	3.661	2.813	3.614	2.874	3.737	2.808
HCM Lane V/C Ratio	0.1	0.38	0.01	0.236	0.049	0.287	0.187
HCM Control Delay	9.9	12.3	7.9	10.4	8.1	11.2	9
HCM Lane LOS	A	B	A	B	A	B	A
HCM 95th-tile Q	0.3	1.8	0	0.9	0.2	1.2	0.7







HCM 6th TWSC
2: S Kalamazoo Ave & A Dr N/E Hughes St

Marshall Housing PUD - TIS
Future Phase IV (2033) PM Peak

Intersection												
Int Delay, s/veh	36.4											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	175	6	56	0	4	22	80	440	3	15	385	231
Future Vol, veh/h	175	6	56	0	4	22	80	440	3	15	385	231
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	1	1	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	100	-	-	-	-	65	150	-	-	-	-	60
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	71	71	71	69	69	69	74	74	74	95	95	95
Heavy Vehicles, %	0	0	0	0	0	0	1	1	1	1	1	1
Mvmt Flow	246	8	79	0	6	32	108	595	4	16	405	243
Major/Minor	Minor2		Minor1			Major1			Major2			
Conflicting Flow All	1269	1253	405	1416	1494	598	648	0	0	600	0	0
Stage 1	437	437	-	814	814	-	-	-	-	-	-	-
Stage 2	832	816	-	602	680	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.5	6.2	7.1	6.5	6.2	4.11	-	-	4.11	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.5	4	3.3	2.209	-	-	2.209	-	-
Pot Cap-1 Maneuver	~ 147	174	650	116	124	506	943	-	-	982	-	-
Stage 1	602	583	-	375	394	-	-	-	-	-	-	-
Stage 2	366	393	-	490	454	-	-	-	-	-	-	-
Platoon blocked, %								-	-	-	-	-
Mov Cap-1 Maneuver	~ 118	150	650	87	107	506	943	-	-	981	-	-
Mov Cap-2 Maneuver	~ 118	150	-	87	107	-	-	-	-	-	-	-
Stage 1	533	567	-	332	348	-	-	-	-	-	-	-
Stage 2	299	347	-	413	442	-	-	-	-	-	-	-
Approach	EB		WB			NB			SB			
HCM Control Delay, s	184.9		16.9			1.4			0.2			
HCM LOS	F		C									
Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	WBLn2	SBL	SBT	SBR		
Capacity (veh/h)	943	-	-	118	194	107	506	981	-	-		
HCM Lane V/C Ratio	0.115	-	-	1.393	0.874	0.054	0.063	0.016	-	-		
HCM Control Delay (s)	9.3	-	-	287.9	85.1	40.6	12.6	8.7	0	-		
HCM Lane LOS	A	-	-	F	F	E	B	A	A	-		
HCM 95th %tile Q(veh)	0.4	-	-	11.3	6.6	0.2	0.2	0	-	-		
Notes												
~: Volume exceeds capacity		\$: Delay exceeds 300s		+: Computation Not Defined				*: All major volume in platoon				

HCM 6th TWSC
3: S Kalamazoo Ave & North Drwy/Crary St





Marshall Housing PUD - TIS
Future Phase IV (2033) PM Peak

Intersection												
Int Delay, s/veh	2.6											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	39	0	6	2	0	16	9	638	4	16	647	80
Future Vol, veh/h	39	0	6	2	0	16	9	638	4	16	647	80
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	3	3	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	100	-	-	-	-	-	-	-	-	-	-	100
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	85	92	85	92	80	80	95	95	92
Heavy Vehicles, %	2	2	2	0	2	0	2	1	1	1	1	2
Mvmt Flow	42	0	7	2	0	19	10	798	5	17	681	87

Major/Minor	Minor2		Minor1		Major1		Major2					
Conflicting Flow All	1545	1541	681	1586	1626	804	768	0	0	806	0	0
Stage 1	715	715	-	824	824	-	-	-	-	-	-	-
Stage 2	830	826	-	762	802	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.1	6.52	6.2	4.12	-	-	4.11	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.1	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.1	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.5	4.018	3.3	2.218	-	-	2.209	-	-
Pot Cap-1 Maneuver	93	115	450	88	102	386	846	-	-	823	-	-
Stage 1	422	434	-	370	387	-	-	-	-	-	-	-
Stage 2	364	387	-	400	396	-	-	-	-	-	-	-
Platoon blocked, %								-	-	-	-	-
Mov Cap-1 Maneuver	85	108	450	83	96	385	846	-	-	821	-	-
Mov Cap-2 Maneuver	85	108	-	83	96	-	-	-	-	-	-	-
Stage 1	413	418	-	361	378	-	-	-	-	-	-	-
Stage 2	339	378	-	380	381	-	-	-	-	-	-	-

Approach	EB		WB		NB		SB	
HCM Control Delay, s	74.2		19.2		0.1		0.2	
HCM LOS	F		C					

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	846	-	-	85	450	274	821	-	-
HCM Lane V/C Ratio	0.012	-	-	0.499	0.014	0.077	0.021	-	-
HCM Control Delay (s)	9.3	0	-	83.6	13.1	19.2	9.5	0	-
HCM Lane LOS	A	A	-	F	B	C	A	A	-
HCM 95th %tile Q(veh)	0	-	-	2.1	0	0.2	0.1	-	-

Intersection						
Int Delay, s/veh	6.3					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	34	146	79	628	595	20
Future Vol, veh/h	34	146	79	628	595	20
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	150	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	86	86	80	80	95	95
Heavy Vehicles, %	2	2	1	1	1	1
Mvmt Flow	40	170	99	785	626	21
Major/Minor	Minor2	Major1		Major2		
Conflicting Flow All	1620	637	647	0	-	0
Stage 1	637	-	-	-	-	-
Stage 2	983	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.11	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.209	-	-	-
Pot Cap-1 Maneuver	113	477	943	-	-	-
Stage 1	527	-	-	-	-	-
Stage 2	362	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	101	477	943	-	-	-
Mov Cap-2 Maneuver	101	-	-	-	-	-
Stage 1	472	-	-	-	-	-
Stage 2	362	-	-	-	-	-
Approach	EB	NB		SB		
HCM Control Delay, s	48	1		0		
HCM LOS	E					
Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR	
Capacity (veh/h)	943	-	280	-	-	
HCM Lane V/C Ratio	0.105	-	0.748	-	-	
HCM Control Delay (s)	9.3	-	48	-	-	
HCM Lane LOS	A	-	E	-	-	
HCM 95th %tile Q(veh)	0.3	-	5.5	-	-	

Intersection						
Int Delay, s/veh	0					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑	↑		↕	↕
Traffic Vol, veh/h	0	235	312	3	2	0
Future Vol, veh/h	0	235	312	3	2	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	255	339	3	2	0
Major/Minor	Major1	Major2		Minor2		
Conflicting Flow All	-	0	-	0	596	341
Stage 1	-	-	-	-	341	-
Stage 2	-	-	-	-	255	-
Critical Hdwy	-	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	0	-	-	-	466	701
Stage 1	0	-	-	-	720	-
Stage 2	0	-	-	-	788	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	-	-	-	-	466	701
Mov Cap-2 Maneuver	-	-	-	-	466	-
Stage 1	-	-	-	-	720	-
Stage 2	-	-	-	-	788	-
Approach	EB	WB		SB		
HCM Control Delay, s	0	0		12.8		
HCM LOS	B					
Minor Lane/Major Mvmt	EBT	WBT	WBR	SBLn1		
Capacity (veh/h)	-	-	-	466		
HCM Lane V/C Ratio	-	-	-	0.005		
HCM Control Delay (s)	-	-	-	12.8		
HCM Lane LOS	-	-	-	B		
HCM 95th %tile Q(veh)	-	-	-	0		

Intersection						
Int Delay, s/veh	2					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑	↑		↓	↗
Traffic Vol, veh/h	13	162	204	108	73	8
Future Vol, veh/h	13	162	204	108	73	8
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	150
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	14	176	222	117	79	9
Major/Minor	Major1	Major2		Minor2		
Conflicting Flow All	339	0	-	0	485	281
Stage 1	-	-	-	-	281	-
Stage 2	-	-	-	-	204	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1220	-	-	-	541	758
Stage 1	-	-	-	-	767	-
Stage 2	-	-	-	-	830	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1220	-	-	-	534	758
Mov Cap-2 Maneuver	-	-	-	-	534	-
Stage 1	-	-	-	-	757	-
Stage 2	-	-	-	-	830	-
Approach	EB	WB		SB		
HCM Control Delay, s	0.6	0		12.6		
HCM LOS				B		
Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	1220	-	-	-	534	758
HCM Lane V/C Ratio	0.012	-	-	-	0.149	0.011
HCM Control Delay (s)	8	-	-	-	12.9	9.8
HCM Lane LOS	A	-	-	-	B	A
HCM 95th %tile Q(veh)	0	-	-	-	0.5	0

Intersection						
Int Delay, s/veh	2.1					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑	↑		↓	↓
Traffic Vol, veh/h	26	125	128	84	50	15
Future Vol, veh/h	26	125	128	84	50	15
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	150
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	28	136	139	91	54	16
Major/Minor	Major1	Major2		Minor2		
Conflicting Flow All	230	0	-	0	377	185
Stage 1	-	-	-	-	185	-
Stage 2	-	-	-	-	192	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1338	-	-	-	625	857
Stage 1	-	-	-	-	847	-
Stage 2	-	-	-	-	841	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1338	-	-	-	611	857
Mov Cap-2 Maneuver	-	-	-	-	611	-
Stage 1	-	-	-	-	828	-
Stage 2	-	-	-	-	841	-
Approach	EB	WB		SB		
HCM Control Delay, s	1.3	0		11		
HCM LOS	B					
Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	1338	-	-	-	611	857
HCM Lane V/C Ratio	0.021	-	-	-	0.089	0.019
HCM Control Delay (s)	7.7	-	-	-	11.5	9.3
HCM Lane LOS	A	-	-	-	B	A
HCM 95th %tile Q(veh)	0.1	-	-	-	0.3	0.1

Intersection	
Intersection Delay, s/veh	8.6
Intersection LOS	A





















Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↱	↱		↱	↱		↱			↱	↱
Traffic Vol, veh/h	44	85	3	2	76	34	6	17	4	12	24	20
Future Vol, veh/h	44	85	3	2	76	34	6	17	4	12	24	20
Peak Hour Factor	0.80	0.80	0.80	0.86	0.86	0.86	0.60	0.60	0.60	0.71	0.71	0.71
Heavy Vehicles, %	0	0	0	1	1	1	0	0	0	2	2	2
Mvmt Flow	55	106	4	2	88	40	10	28	7	17	34	28
Number of Lanes	0	1	1	0	1	1	0	1	0	0	1	1

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	2	2	2	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	2	1	2	2
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	2	2	2
HCM Control Delay	9.2	8	8.7	8.3
HCM LOS	A	A	A	A

Lane	NBLn1	EBLn1	EBLn2	WBLn1	WBLn2	SBLn1	SBLn2
Vol Left, %	22%	34%	0%	3%	0%	33%	0%
Vol Thru, %	63%	66%	0%	97%	0%	67%	0%
Vol Right, %	15%	0%	100%	0%	100%	0%	100%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	27	129	3	78	34	36	20
LT Vol	6	44	0	2	0	12	0
Through Vol	17	85	0	76	0	24	0
RT Vol	4	0	3	0	34	0	20
Lane Flow Rate	45	161	4	91	40	51	28
Geometry Grp	4b	5	5	5	5	5	5
Degree of Util (X)	0.066	0.229	0.004	0.126	0.047	0.077	0.036
Departure Headway (Hd)	5.287	5.107	4.233	5.003	4.287	5.476	4.606
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	678	705	846	717	836	655	778
Service Time	3.317	2.829	1.955	2.726	2.01	3.202	2.331
HCM Lane V/C Ratio	0.066	0.228	0.005	0.127	0.048	0.078	0.036
HCM Control Delay	8.7	9.3	7	8.4	7.2	8.7	7.5
HCM Lane LOS	A	A	A	A	A	A	A
HCM 95th-tile Q	0.2	0.9	0	0.4	0.1	0.2	0.1







HCM Signalized Intersection Capacity Analysis 2: S Kalamazoo Ave & A Dr N/E Hughes St

Marshall Housing PUD - TIS
Future Phase IV (2033) w Improvements AM Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	209	1	58	0	1	9	24	240	0	3	245	76
Future Volume (vph)	209	1	58	0	1	9	24	240	0	3	245	76
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.5			5.5	5.5	5.5	5.5			5.5	5.5
Lane Util. Factor	0.95	0.95			1.00	1.00	1.00	1.00			1.00	1.00
Frt	1.00	0.93			1.00	0.85	1.00	1.00			1.00	0.85
Flt Protected	0.95	0.97			1.00	1.00	0.95	1.00			1.00	1.00
Satd. Flow (prot)	1715	1639			1900	1615	1752	1845			1862	1583
Flt Permitted	0.76	0.83			1.00	1.00	0.57	1.00			1.00	1.00
Satd. Flow (perm)	1366	1396			1900	1615	1055	1845			1856	1583
Peak-hour factor, PHF	0.80	0.80	0.80	0.60	0.60	0.60	0.84	0.84	0.84	0.80	0.80	0.80
Adj. Flow (vph)	261	1	72	0	2	15	29	286	0	4	306	95
RTOR Reduction (vph)	0	57	0	0	0	12	0	0	0	0	0	41
Lane Group Flow (vph)	172	106	0	0	2	3	29	286	0	0	310	54
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	3%	3%	3%	2%	2%	2%
Turn Type	Perm	NA			NA	Perm	Perm	NA		Perm	NA	Perm
Protected Phases		4			8		2			6		6
Permitted Phases	4			8		8	2		6			6
Actuated Green, G (s)	12.0	12.0			12.0	12.0	30.3	30.3			30.3	30.3
Effective Green, g (s)	12.0	12.0			12.0	12.0	30.3	30.3			30.3	30.3
Actuated g/C Ratio	0.23	0.23			0.23	0.23	0.57	0.57			0.57	0.57
Clearance Time (s)	5.5	5.5			5.5	5.5	5.5	5.5			5.5	5.5
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0			3.0	3.0
Lane Grp Cap (vph)	307	314			427	363	599	1048			1055	899
v/s Ratio Prot					0.00			0.16				
v/s Ratio Perm	c0.13	0.08				0.00	0.03			c0.17	0.03	
v/c Ratio	0.56	0.34			0.00	0.01	0.05	0.27		0.29	0.06	
Uniform Delay, d1	18.3	17.3			16.0	16.0	5.1	5.9		6.0	5.1	
Progression Factor	1.00	1.00			1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	2.3	0.6			0.0	0.0	0.2	0.6		0.7	0.1	
Delay (s)	20.6	18.0			16.0	16.0	5.3	6.5		6.7	5.3	
Level of Service	C	B			B	B	A	A		A	A	
Approach Delay (s)		19.3			16.0			6.4		6.3		
Approach LOS		B			B			A		A		
Intersection Summary												
HCM 2000 Control Delay			10.6									
HCM 2000 Volume to Capacity ratio			0.37									
Actuated Cycle Length (s)			53.3									
Intersection Capacity Utilization			43.4%									
Analysis Period (min)			15									
c Critical Lane Group												

HCM 6th TWSC
3: S Kalamazoo Ave & North Drwy/Crary St

Marshall Housing PUD - TIS
Future Phase IV (2033) w Improvements AM Peak

Intersection												
Int Delay, s/veh	2											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	61	0	9	0	0	11	3	458	2	5	319	20
Future Vol, veh/h	61	0	9	0	0	11	3	458	2	5	319	20
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	2	2	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	100	-	-	-	-	-	-	-	-	-	-	100
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	85	85	78	78	92
Heavy Vehicles, %	2	2	2	0	2	0	2	2	2	2	2	2
Mvmt Flow	66	0	10	0	0	12	3	539	2	6	409	22







Major/Minor	Minor2		Minor1		Major1		Major2					
Conflicting Flow All	973	970	409	985	991	542	431	0	0	543	0	0
Stage 1	421	421	-	548	548	-	-	-	-	-	-	-
Stage 2	552	549	-	437	443	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.1	6.52	6.2	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.1	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.1	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.5	4.018	3.3	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	231	253	642	229	246	544	1129	-	-	1026	-	-
Stage 1	610	589	-	524	517	-	-	-	-	-	-	-
Stage 2	518	516	-	602	576	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	224	249	642	223	243	543	1129	-	-	1024	-	-
Mov Cap-2 Maneuver	224	249	-	223	243	-	-	-	-	-	-	-
Stage 1	608	584	-	521	514	-	-	-	-	-	-	-
Stage 2	505	513	-	588	571	-	-	-	-	-	-	-

Approach	EB		WB		NB		SB	
HCM Control Delay, s	25.5		11.8		0		0.1	
HCM LOS	D		B					

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1129	-	-	224	642	543	1024	-	-
HCM Lane V/C Ratio	0.003	-	-	0.296	0.015	0.022	0.006	-	-
HCM Control Delay (s)	8.2	0	-	27.7	10.7	11.8	8.5	0	-
HCM Lane LOS	A	A	-	D	B	B	A	A	-
HCM 95th %tile Q(veh)	0	-	-	1.2	0	0.1	0	-	-

HCM 6th TWSC
4: S Kalamazoo Ave & Industrial Rd

Marshall Housing PUD - TIS
Future Phase IV (2033) w Improvements AM Peak

Intersection						
Int Delay, s/veh	1.5					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	9	51	70	457	295	33
Future Vol, veh/h	9	51	70	457	295	33
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	150	150	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	82	82	88	88	87	87
Heavy Vehicles, %	4	4	2	2	3	3
Mvmt Flow	11	62	80	519	339	38
Major/Minor	Minor2	Major1		Major2		
Conflicting Flow All	1037	358	377	0	-	0
Stage 1	358	-	-	-	-	-
Stage 2	679	-	-	-	-	-
Critical Hdwy	6.44	6.24	4.12	-	-	-
Critical Hdwy Stg 1	5.44	-	-	-	-	-
Critical Hdwy Stg 2	5.44	-	-	-	-	-
Follow-up Hdwy	3.536	3.336	2.218	-	-	-
Pot Cap-1 Maneuver	254	682	1181	-	-	-
Stage 1	703	-	-	-	-	-
Stage 2	500	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	237	682	1181	-	-	-
Mov Cap-2 Maneuver	237	-	-	-	-	-
Stage 1	655	-	-	-	-	-
Stage 2	500	-	-	-	-	-
Approach	EB	NB		SB		
HCM Control Delay, s	12.3	1.1		0		
HCM LOS	B					
Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	1181	-	237	682	-	-
HCM Lane V/C Ratio	0.067	-	0.046	0.091	-	-
HCM Control Delay (s)	8.3	-	20.9	10.8	-	-
HCM Lane LOS	A	-	C	B	-	-
HCM 95th %tile Q(veh)	0.2	-	0.1	0.3	-	-

Intersection						
Int Delay, s/veh	0.1					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑	↑		↓	↓
Traffic Vol, veh/h	0	266	101	1	3	0
Future Vol, veh/h	0	266	101	1	3	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	289	110	1	3	0
Major/Minor	Major1	Major2		Minor2		
Conflicting Flow All	-	0	-	0	400	111
Stage 1	-	-	-	-	111	-
Stage 2	-	-	-	-	289	-
Critical Hdwy	-	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	0	-	-	-	606	942
Stage 1	0	-	-	-	914	-
Stage 2	0	-	-	-	760	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	-	-	-	-	606	942
Mov Cap-2 Maneuver	-	-	-	-	606	-
Stage 1	-	-	-	-	914	-
Stage 2	-	-	-	-	760	-
Approach	EB	WB		SB		
HCM Control Delay, s	0	0		11		
HCM LOS				B		
Minor Lane/Major Mvmt	EBT	WBT	WBR	SBLn1		
Capacity (veh/h)	-	-	-	606		
HCM Lane V/C Ratio	-	-	-	0.005		
HCM Control Delay (s)	-	-	-	11		
HCM Lane LOS	-	-	-	B		
HCM 95th %tile Q(veh)	-	-	-	0		

Intersection						
Int Delay, s/veh	3.6					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑	↑	↗	↘	↗
Traffic Vol, veh/h	4	150	64	37	116	12
Future Vol, veh/h	4	150	64	37	116	12
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	150	0	150
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	4	163	70	40	126	13
Major/Minor	Major1	Major2		Minor2		
Conflicting Flow All	110	0	-	0	241	70
Stage 1	-	-	-	-	70	-
Stage 2	-	-	-	-	171	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1480	-	-	-	747	993
Stage 1	-	-	-	-	953	-
Stage 2	-	-	-	-	859	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1480	-	-	-	745	993
Mov Cap-2 Maneuver	-	-	-	-	745	-
Stage 1	-	-	-	-	950	-
Stage 2	-	-	-	-	859	-
Approach	EB	WB		SB		
HCM Control Delay, s	0.2	0		10.6		
HCM LOS				B		
Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	1480	-	-	-	745	993
HCM Lane V/C Ratio	0.003	-	-	-	0.169	0.013
HCM Control Delay (s)	7.4	-	-	-	10.8	8.7
HCM Lane LOS	A	-	-	-	B	A
HCM 95th %tile Q(veh)	0	-	-	-	0.6	0

Intersection

Int Delay, s/veh 4.1

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑	↑		↓	↓
Traffic Vol, veh/h	8	74	51	25	80	25
Future Vol, veh/h	8	74	51	25	80	25
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	150
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	9	80	55	27	87	27

Major/Minor	Major1	Major2	Minor2
Conflicting Flow All	82	0	0 167 69
Stage 1	-	-	- 69 -
Stage 2	-	-	- 98 -
Critical Hdwy	4.12	-	- 6.42 6.22
Critical Hdwy Stg 1	-	-	- 5.42 -
Critical Hdwy Stg 2	-	-	- 5.42 -
Follow-up Hdwy	2.218	-	- 3.518 3.318
Pot Cap-1 Maneuver	1515	-	- 823 994
Stage 1	-	-	- 954 -
Stage 2	-	-	- 926 -
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	1515	-	- 818 994
Mov Cap-2 Maneuver	-	-	- 818 -
Stage 1	-	-	- 948 -
Stage 2	-	-	- 926 -

Approach	EB	WB	SB
HCM Control Delay, s	0.7	0	9.6
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	1515	-	-	-	818	994
HCM Lane V/C Ratio	0.006	-	-	-	0.106	0.027
HCM Control Delay (s)	7.4	-	-	-	9.9	8.7
HCM Lane LOS	A	-	-	-	A	A
HCM 95th %tile Q(veh)	0	-	-	-	0.4	0.1

Intersection	
Intersection Delay, s/veh	10.7
Intersection LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↱	↱		↱	↱		↱			↱	↱
Traffic Vol, veh/h	53	139	6	8	122	31	5	28	4	54	68	94
Future Vol, veh/h	53	139	6	8	122	31	5	28	4	54	68	94
Peak Hour Factor	0.83	0.83	0.83	0.90	0.90	0.90	0.64	0.64	0.64	0.71	0.71	0.71
Heavy Vehicles, %	2	2	2	0	0	0	0	0	0	0	0	0
Mvmt Flow	64	167	7	9	136	34	8	44	6	76	96	132
Number of Lanes	0	1	1	0	1	1	0	1	0	0	1	1





















Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	2	2	2	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	2	1	2	2
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	2	2	2
HCM Control Delay	12.2	10	9.9	10.2
HCM LOS	B	A	A	B

Lane	NBLn1	EBLn1	EBLn2	WBLn1	WBLn2	SBLn1	SBLn2
Vol Left, %	14%	28%	0%	6%	0%	44%	0%
Vol Thru, %	76%	72%	0%	94%	0%	56%	0%
Vol Right, %	11%	0%	100%	0%	100%	0%	100%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	37	192	6	130	31	122	94
LT Vol	5	53	0	8	0	54	0
Through Vol	28	139	0	122	0	68	0
RT Vol	4	0	6	0	31	0	94
Lane Flow Rate	58	231	7	144	34	172	132
Geometry Grp	4b	5	5	5	5	5	5
Degree of Util (X)	0.099	0.381	0.01	0.236	0.049	0.288	0.188
Departure Headway (Hd)	6.154	5.932	5.085	5.884	5.144	6.037	5.108
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	582	608	704	611	696	600	707
Service Time	4.19	3.661	2.813	3.614	2.874	3.737	2.808
HCM Lane V/C Ratio	0.1	0.38	0.01	0.236	0.049	0.287	0.187
HCM Control Delay	9.9	12.3	7.9	10.4	8.1	11.2	9
HCM Lane LOS	A	B	A	B	A	B	A
HCM 95th-tile Q	0.3	1.8	0	0.9	0.2	1.2	0.7

HCM Signalized Intersection Capacity Analysis







2: S Kalamazoo Ave & A Dr N/E Hughes St

Marshall Housing PUD - TIS
Future Phase IV (2033) w Improvements PM Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	175	6	56	0	4	22	80	440	3	15	385	231
Future Volume (vph)	175	6	56	0	4	22	80	440	3	15	385	231
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.5			5.5	5.5	5.5	5.5			5.5	5.5
Lane Util. Factor	0.95	0.95			1.00	1.00	1.00	1.00			1.00	1.00
Frpb, ped/bikes	1.00	1.00			1.00	1.00	1.00	1.00			1.00	1.00
Flpb, ped/bikes	1.00	1.00			1.00	1.00	1.00	1.00			1.00	1.00
Frt	1.00	0.93			1.00	0.85	1.00	1.00			1.00	0.85
Flt Protected	0.95	0.98			1.00	1.00	0.95	1.00			1.00	1.00
Satd. Flow (prot)	1715	1636			1900	1615	1787	1879			1878	1599
Flt Permitted	0.75	0.85			1.00	1.00	0.49	1.00			0.97	1.00
Satd. Flow (perm)	1361	1420			1900	1615	929	1879			1833	1599
Peak-hour factor, PHF	0.71	0.71	0.71	0.69	0.69	0.69	0.74	0.74	0.74	0.95	0.95	0.95
Adj. Flow (vph)	246	8	79	0	6	32	108	595	4	16	405	243
RTOR Reduction (vph)	0	62	0	0	0	25	0	0	0	0	0	96
Lane Group Flow (vph)	170	101	0	0	6	7	108	599	0	0	421	147
Confl. Peds. (#/hr)									1	1		
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	1%	1%	1%	1%	1%	1%
Turn Type	Perm	NA			NA	Perm	Perm	NA		Perm	NA	Perm
Protected Phases		4			8		2			6		
Permitted Phases	4			8		8	2			6		6
Actuated Green, G (s)	12.1	12.1			12.1	12.1	35.3	35.3			35.3	35.3
Effective Green, g (s)	12.1	12.1			12.1	12.1	35.3	35.3			35.3	35.3
Actuated g/C Ratio	0.21	0.21			0.21	0.21	0.60	0.60			0.60	0.60
Clearance Time (s)	5.5	5.5			5.5	5.5	5.5	5.5			5.5	5.5
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0			3.0	3.0
Lane Grp Cap (vph)	281	294			393	334	561	1135			1107	966
v/s Ratio Prot					0.00			c0.32				
v/s Ratio Perm	c0.12	0.07				0.00	0.12				0.23	0.09
v/c Ratio	0.60	0.34			0.02	0.02	0.19	0.53			0.38	0.15
Uniform Delay, d1	21.0	19.8			18.4	18.4	5.2	6.7			5.9	5.0
Progression Factor	1.00	1.00			1.00	1.00	1.00	1.00			1.00	1.00
Incremental Delay, d2	3.7	0.7			0.0	0.0	0.8	1.8			1.0	0.3
Delay (s)	24.6	20.5			18.4	18.5	5.9	8.5			6.9	5.4
Level of Service	C	C			B	B	A	A			A	A
Approach Delay (s)		22.6			18.4			8.1			6.4	
Approach LOS		C			B			A			A	
Intersection Summary												
HCM 2000 Control Delay			10.4				HCM 2000 Level of Service			B		
HCM 2000 Volume to Capacity ratio			0.55									
Actuated Cycle Length (s)			58.4				Sum of lost time (s)			11.0		
Intersection Capacity Utilization			71.6%				ICU Level of Service			C		
Analysis Period (min)			15									
c Critical Lane Group												

HCM 6th TWSC
3: S Kalamazoo Ave & North Drwy/Crary St

Marshall Housing PUD - TIS
Future Phase IV (2033) w Improvements PM Peak

Intersection												
Int Delay, s/veh	2.6											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	39	0	6	2	0	16	9	638	4	16	647	80
Future Vol, veh/h	39	0	6	2	0	16	9	638	4	16	647	80
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	3	3	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	100	-	-	-	-	-	-	-	-	-	-	100
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	85	92	85	92	80	80	95	95	92
Heavy Vehicles, %	2	2	2	0	2	0	2	1	1	1	1	2
Mvmt Flow	42	0	7	2	0	19	10	798	5	17	681	87







Major/Minor	Minor2		Minor1		Major1		Major2					
Conflicting Flow All	1545	1541	681	1586	1626	804	768	0	0	806	0	0
Stage 1	715	715	-	824	824	-	-	-	-	-	-	-
Stage 2	830	826	-	762	802	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.1	6.52	6.2	4.12	-	-	4.11	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.1	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.1	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.5	4.018	3.3	2.218	-	-	2.209	-	-
Pot Cap-1 Maneuver	93	115	450	88	102	386	846	-	-	823	-	-
Stage 1	422	434	-	370	387	-	-	-	-	-	-	-
Stage 2	364	387	-	400	396	-	-	-	-	-	-	-
Platoon blocked, %								-	-	-	-	-
Mov Cap-1 Maneuver	85	108	450	83	96	385	846	-	-	821	-	-
Mov Cap-2 Maneuver	85	108	-	83	96	-	-	-	-	-	-	-
Stage 1	413	418	-	361	378	-	-	-	-	-	-	-
Stage 2	339	378	-	380	381	-	-	-	-	-	-	-

Approach	EB		WB		NB		SB	
HCM Control Delay, s	74.2		19.2		0.1		0.2	
HCM LOS	F		C					

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	846	-	-	85	450	274	821	-	-
HCM Lane V/C Ratio	0.012	-	-	0.499	0.014	0.077	0.021	-	-
HCM Control Delay (s)	9.3	0	-	83.6	13.1	19.2	9.5	0	-
HCM Lane LOS	A	A	-	F	B	C	A	A	-
HCM 95th %tile Q(veh)	0	-	-	2.1	0	0.2	0.1	-	-

HCM 6th TWSC
4: S Kalamazoo Ave & Industrial Rd

Marshall Housing PUD - TIS
Future Phase IV (2033) w Improvements PM Peak

Intersection						
Int Delay, s/veh	3.5					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	34	146	79	628	595	20
Future Vol, veh/h	34	146	79	628	595	20
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	150	150	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	86	86	80	80	95	95
Heavy Vehicles, %	2	2	1	1	1	1
Mvmt Flow	40	170	99	785	626	21
Major/Minor	Minor2	Major1		Major2		
Conflicting Flow All	1620	637	647	0	-	0
Stage 1	637	-	-	-	-	-
Stage 2	983	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.11	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.209	-	-	-
Pot Cap-1 Maneuver	113	477	943	-	-	-
Stage 1	527	-	-	-	-	-
Stage 2	362	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	101	477	943	-	-	-
Mov Cap-2 Maneuver	101	-	-	-	-	-
Stage 1	472	-	-	-	-	-
Stage 2	362	-	-	-	-	-
Approach	EB	NB		SB		
HCM Control Delay, s	25.2	1		0		
HCM LOS	D					
Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	943	-	101	477	-	-
HCM Lane V/C Ratio	0.105	-	0.391	0.356	-	-
HCM Control Delay (s)	9.3	-	61.9	16.7	-	-
HCM Lane LOS	A	-	F	C	-	-
HCM 95th %tile Q(veh)	0.3	-	1.6	1.6	-	-

Intersection						
Int Delay, s/veh	0					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑	↑		↓	↓
Traffic Vol, veh/h	0	235	312	3	2	0
Future Vol, veh/h	0	235	312	3	2	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	255	339	3	2	0
Major/Minor	Major1	Major2		Minor2		
Conflicting Flow All	-	0	-	0	596	341
Stage 1	-	-	-	-	341	-
Stage 2	-	-	-	-	255	-
Critical Hdwy	-	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	0	-	-	-	466	701
Stage 1	0	-	-	-	720	-
Stage 2	0	-	-	-	788	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	-	-	-	-	466	701
Mov Cap-2 Maneuver	-	-	-	-	466	-
Stage 1	-	-	-	-	720	-
Stage 2	-	-	-	-	788	-
Approach	EB	WB		SB		
HCM Control Delay, s	0	0		12.8		
HCM LOS	B					
Minor Lane/Major Mvmt	EBT	WBT	WBR	SBLn1		
Capacity (veh/h)	-	-	-	466		
HCM Lane V/C Ratio	-	-	-	0.005		
HCM Control Delay (s)	-	-	-	12.8		
HCM Lane LOS	-	-	-	B		
HCM 95th %tile Q(veh)	-	-	-	0		

Intersection						
Int Delay, s/veh	1.9					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑	↑	↗	↘	↗
Traffic Vol, veh/h	13	162	204	108	73	8
Future Vol, veh/h	13	162	204	108	73	8
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	150	0	150
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	14	176	222	117	79	9
Major/Minor	Major1	Major2		Minor2		
Conflicting Flow All	339	0	-	0	426	222
Stage 1	-	-	-	-	222	-
Stage 2	-	-	-	-	204	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1220	-	-	-	585	818
Stage 1	-	-	-	-	815	-
Stage 2	-	-	-	-	830	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1220	-	-	-	577	818
Mov Cap-2 Maneuver	-	-	-	-	577	-
Stage 1	-	-	-	-	804	-
Stage 2	-	-	-	-	830	-
Approach	EB	WB		SB		
HCM Control Delay, s	0.6	0		11.9		
HCM LOS				B		
Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	1220	-	-	-	577	818
HCM Lane V/C Ratio	0.012	-	-	-	0.138	0.011
HCM Control Delay (s)	8	-	-	-	12.2	9.4
HCM Lane LOS	A	-	-	-	B	A
HCM 95th %tile Q(veh)	0	-	-	-	0.5	0

Intersection						
Int Delay, s/veh	2.1					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑	↑		↓	↓
Traffic Vol, veh/h	26	125	128	84	50	15
Future Vol, veh/h	26	125	128	84	50	15
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	150
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	28	136	139	91	54	16
Major/Minor	Major1	Major2		Minor2		
Conflicting Flow All	230	0	-	0	377	185
Stage 1	-	-	-	-	185	-
Stage 2	-	-	-	-	192	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1338	-	-	-	625	857
Stage 1	-	-	-	-	847	-
Stage 2	-	-	-	-	841	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1338	-	-	-	611	857
Mov Cap-2 Maneuver	-	-	-	-	611	-
Stage 1	-	-	-	-	828	-
Stage 2	-	-	-	-	841	-
Approach	EB	WB		SB		
HCM Control Delay, s	1.3	0		11		
HCM LOS				B		
Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	1338	-	-	-	611	857
HCM Lane V/C Ratio	0.021	-	-	-	0.089	0.019
HCM Control Delay (s)	7.7	-	-	-	11.5	9.3
HCM Lane LOS	A	-	-	-	B	A
HCM 95th %tile Q(veh)	0.1	-	-	-	0.3	0.1

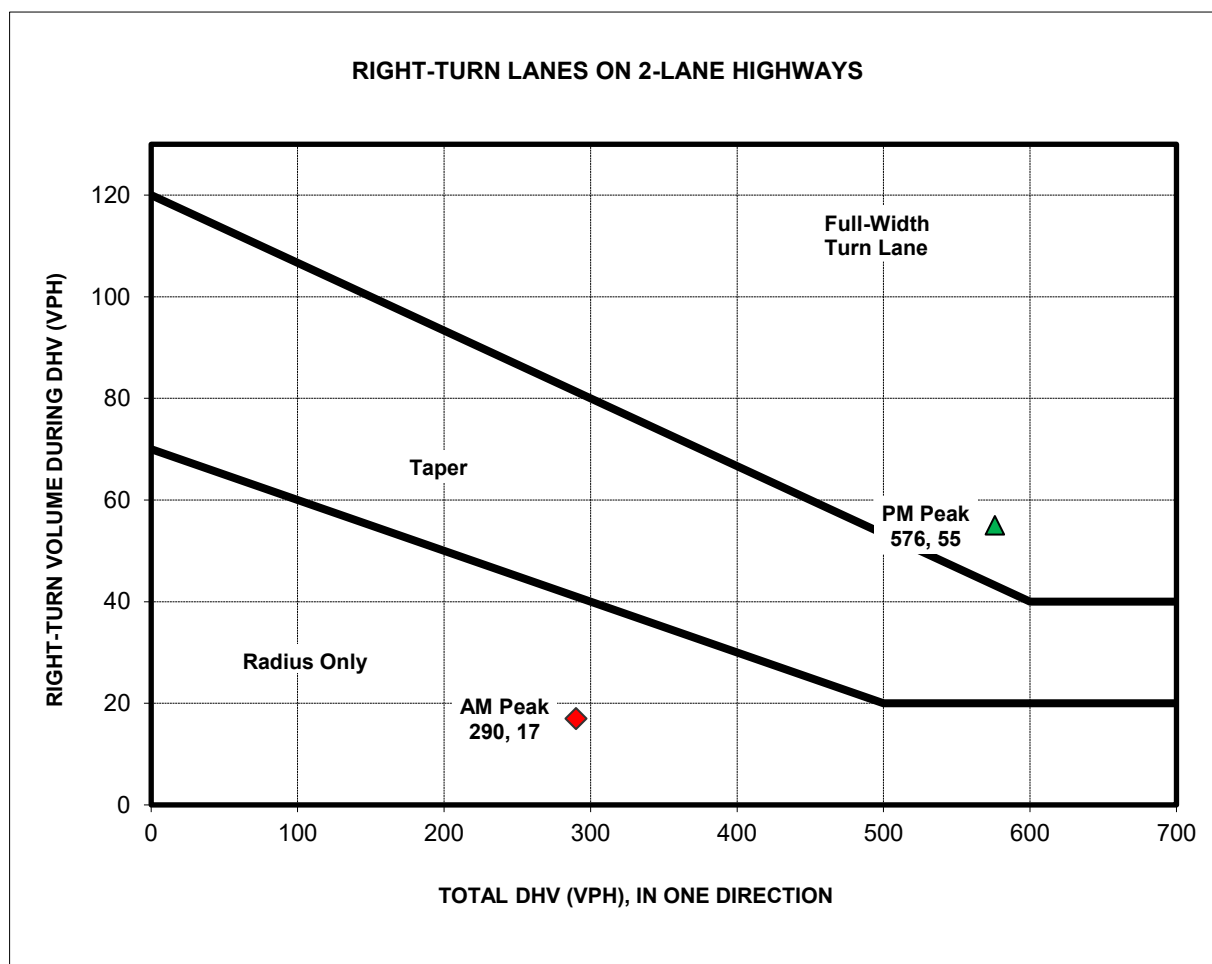
Turn Lane Warrants

Right-Turn Lane on 2-lane Highway

Project: Marshall Housing PUD
 Scenario: Phase I (2027) Conditions

Major Road: Kalamazoo Avenue (M-227)
 Minor Road: North Site Driveway
 Direction: SB

	AM	PM
Right-Turn Volume During DHV (Vehicles per Hour)	17	55
Total DHV (Vehicles per Hour)	290	576



Right-Turn Lane on 2-lane Highway

Project: Marshall Housing PUD
Scenario: Phase IV (2033) Conditions

Major Road: A Drive
Minor Road: Center Driveway
Direction: WB

	AM	PM
Right-Turn Volume During DHV (Vehicles per Hour)	37	108
Total DHV (Vehicles per Hour)	101	312

