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US-23 in Tawas
Traffic Operations Report

December 10, 2024

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Quality information

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Revision History

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0					

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Executive Summary

A traffic engineering analysis was performed to determine if a 3-lane configuration is feasible for the US-23 corridor from Hemlock Road (M-55) in Tawas City to Tawas Beach Road in East Tawas, Michigan. The traffic operations analysis included three (3) signalized intersections at Hemlock Road (M-55), Newman Street, and Tawas Beach Road and one (1) unsignalized intersection at Roundhouse Avenue. A safety analysis was conducted along the entire corridor.

The US-23 corridor study area spans approximately 3.5 miles. Currently, US-23 has a 4-lane undivided cross-section from Hemlock Road (M-55) to Oak Street, transitioning to a 5-lane undivided cross-section from Oak Street to approximately 500-feet east of Roundhouse Avenue before transitioning back into a 4-lane cross-section. The west leg of the intersection of Tawas Beach Road and US-23 is a 5-lane cross-section. The east leg of the intersection is a 4-lane cross-section that transitions to a 3-lane cross-section east of the project area.

Traffic data was collected by the Michigan Department of Transportation (MDOT) during the summer months to observe traffic volumes and patterns during the peak season of the corridor. The weekday AM and PM peak hours occurred on Tuesday, July 9, 2024 (7:30AM-8:30AM and 3:00PM-4:00PM). Traffic counts were also collected on Saturday, July 13, 2024. The Saturday peak hour occurred from 12:00PM-1:00PM and was used in the analysis along with the weekday peak hours

The existing weekday and Saturday peak hour volumes were simulated in Synchro/SimTraffic version 12 with the existing geometry. The analysis resulted in no study intersections or arterials exhibited a Level of Service (LOS) E or F, which was considered a failing LOS.

Future (2045) No-Build weekday and Saturday peak hour volumes were projected by applying a 0.5% compounded annual growth rate to the existing peak hour volumes. The analysis resulted in no signalized study intersections or arterials performing at a failing LOS. The Saturday peak hour at US-23 and Roundhouse Avenue resulted in a LOS F, when unsignalized, for the southbound left-turn movement due to a lack of gaps in the US-23 traffic.

The future (2045) weekday and Saturday peak hour volumes were also analysed with a 3-lane cross-section along US-23 with optimized signal timings. The results of the Build analysis was similar to the No-Build analysis. The weekday peak hours exhibited no failing LOS for the intersections with a 3-lane cross-section. The Saturday peak hour at US-23 and Roundhouse Avenue resulted in a LOS F for the southbound left-turn movement, similar to the No-Build.

A signal warrant was analyzed for Roundhouse Avenue under the 2024 Existing conditions and the 2045 No-Build conditions. The analysis concluded in a signal being warranted for Roundhouse Avenue under both conditions.

A left-turn phase warrant was analyzed for Newman Street under the 2045 No-Build conditions. A left-turn phase was warranted at Newman Street. The mitigation was evaluated in Synchro 12 and resulted in no

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failing LOS, however, significant queues were exhibited at the eastbound through movement at the intersection of US-23 and Newman Street.

The proposed lane configuration would consist of three 12-foot lanes with one (1) lane in each direction and a two-way center left-turn lane. By implementing this alternative it would allow space for pedestrian improvements along US-23, including potential mid-block crossings with median refuge islands and a shared-use nonmotorized path. These measures would improve overall safety for all users (pedestrians, bicyclists, motorists) and would encourage a community focused environment.

A predictive crash analysis was conducted for the existing and the 3-lane alternative road configurations. The existing conditions crash rate evaluation predicted an annual crash rate of 17.8 crashes per year. The crash rate evaluation for the 3-lane cross-section resulted in a predicted crash rate of 14.3 crashes per year. The predictive analysis reveals that the 3-lane cross-section would reduce crashes by 3.5 crashes per year with reduction of 1.4 annual reduction in fatal/injury crashes.

In addition to the severity and reduction of crashes (rear-end, side-swipe and left-turn crashes), another benefit of the 3-lane cross-section alternative compared to existing 4-lane cross section provides the opportunity to provide facilities for all modes of transportation, including bicyclists, pedestrians, and motorists. The 3-lane cross-section allows additional space for wider-shared use paths and more separation from the roadway, as well as mid-block pedestrian crossings with median refuge islands. The islands would reduce the length and time pedestrians are exposed to traffic along US-23 as well as provide additional protection to those pedestrians who cross US-23. The lane reduction would also reduce the number of lanes for a pedestrian to cross, thereby improving overall pedestrian safety by reducing exposure.

The overall recommendation is to implement a 3-lane cross-section throughout the corridor, which would improve vehicular safety while not causing any additional congestion. Additionally, implementing this cross-section would provide additional space for better nonmotorized facilities which would provide facilities for all users in the area and provide a more community focused solution.

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1. Introduction

The purpose of this traffic operations report is to evaluate the US-23 corridor from Hemlock Road (M-55) in Tawas City to Tawas Beach Road in East Tawas. The report is broken down into several sections that summarize the findings for existing traffic conditions, future No-Build conditions in 2045, and a Build alternative concept (3-lane cross-section).

A traffic engineering analysis was performed to determine if a 3-lane configuration is viable for US-23 from Hemlock Road (M-55) to Tawas Beach Road. AECOM completed traffic analysis, safety analysis, and impact analysis at three (3) signalized intersections and one (1) unsignalized intersection at Roundhouse Avenue. The signalized intersections include Hemlock Road (M-55), Newman Street, and Tawas Beach Road.

The study area spans the limits of US-23 within the cities of Tawas City and East Tawas, Michigan. The land use along US-23 is comprised of many commercial developments and recreational destinations, making it a popular summer tourist location. Figure 1 illustrates the four intersections that were specifically analysed as part of the study.

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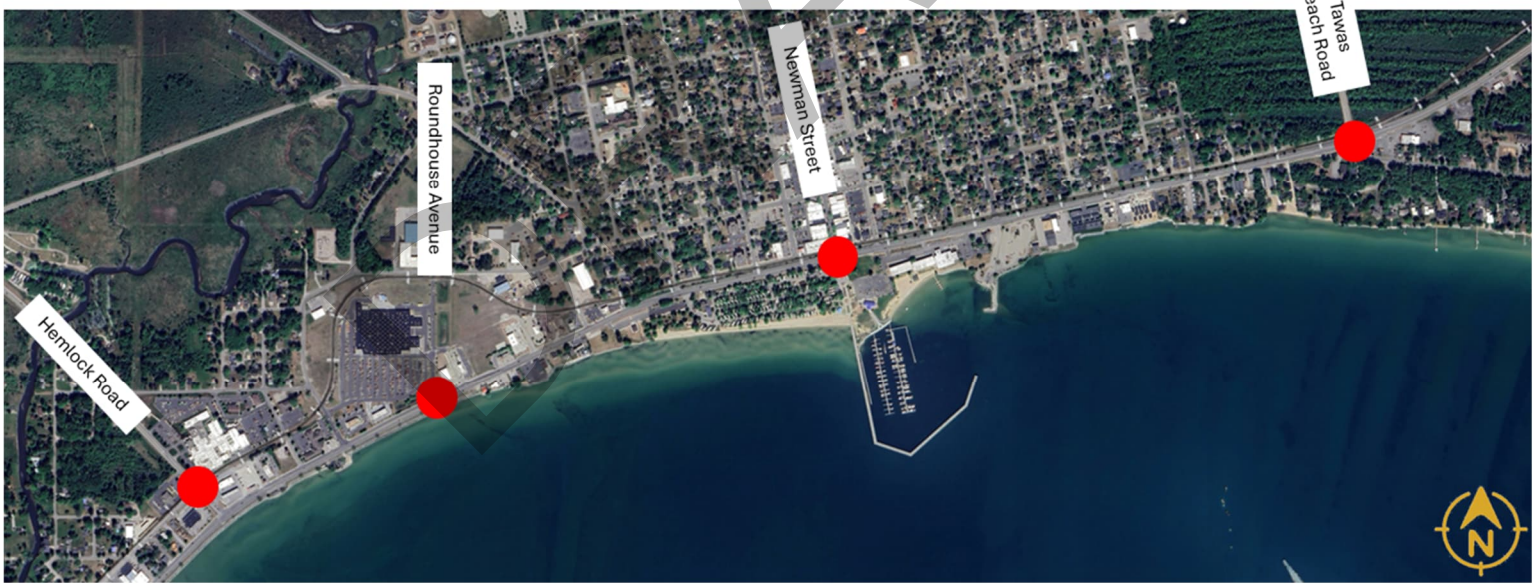
Figure 1. Study Area



2. Existing Conditions

The purpose of this section is to summarize existing conditions, including the safety and operational conditions of US-23 and the operational conditions of the four study intersections including Hemlock Road (M-55), Roundhouse Avenue, Newman Street, and Tawas Beach Road.

2.1 Corridor Overview

US-23 is generally a 4-lane undivided roadway that is approximately 48-feet wide. The speed limit is 35 miles per hour (MPH) from Hemlock Road (M-55) to approximately 1,000 feet west of Tawas Beach Road where it changes to 45 MPH. The travel lanes are approximately 12-feet wide in both directions.

The US-23 corridor study area spans approximately 3.5 miles. US-23 consists of a 3-lane undivided cross-section from the Tawas Beach bridge to North Street. US-23 transitions to a 4-lane undivided cross-section which ends at Oak Street. US-23 is a 5-lane undivided cross-section from east of Oak Street to approximately 500 feet east of Roundhouse Avenue before transitioning back to a 4-lane undivided cross-section continues to just west of Tawas Beach Road.

The west leg of the intersection of Tawas Beach Road and US-23 is a 5-lane cross-section. The east leg of the intersection is a 4-lane cross-section that transitions to a 3-lane cross-section east of the project area.

Traffic data was collected by MDOT during the summer months to observe traffic volumes and patterns during the peak season of the corridor. The weekday AM and PM peak hours occurred on Tuesday, July 9, 2024 (7:30AM-8:30AM and 3:00PM-4:00PM). Traffic counts were also collected on Saturday, July 13, 2024. The Saturday peak hour occurred from 12:00PM-1:00PM and was used in the analysis along with the aforementioned weekday peak hours.

Figure 2 illustrates existing lane configurations and traffic control throughout the US-23 study corridor.

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Figure 2. Existing US-23 Lane Configuration

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2.1.1 US-23 at Hemlock Road (M-55)

The existing US-23 at Hemlock Road (M-55) intersection is a three-legged signalized intersection. The northbound and southbound approaches have two through lanes in each direction, a right-turn lane is present on the southbound approach. The right-turn lane is approximately 115-feet long. The speed limit on Hemlock Road (M-55) is 45 MPH, and the speed limit on US-23 is 35 MPH.

The southeastbound approach of M-55 has a dedicated left-turn lane and a dedicated right-turn lane. The left-turn lane is approximately 130-feet long. Figure 3 illustrates the geometrics of the intersection.

The intersection is controlled by a US-23 actuated-coordinated traffic signal that operates on a two-phase signal with a 70-second cycle length. Below are the signal phases of the intersection:

- Phase 1 – Northbound/Southbound US-23.
- Phase 2 – Southeastbound Hemlock Road (M-55).

Figure 3. US-23 at Hemlock Road (M-55)

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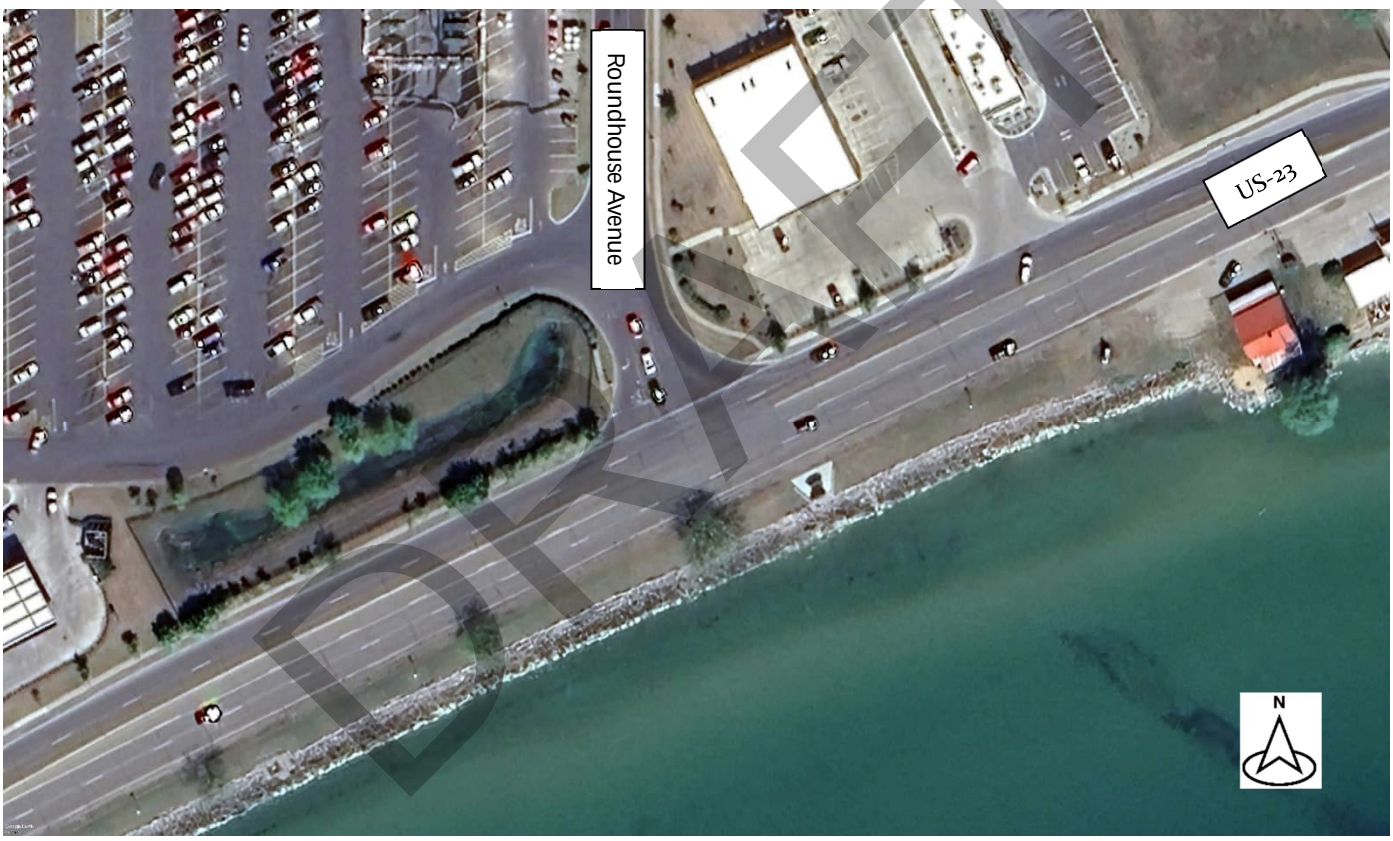
2.1.2 US-23 at Roundhouse Avenue

US-23 at Roundhouse Avenue is a three-legged unsignalized intersection. The US-23 eastbound and westbound approaches are free flow with two thru lanes and a two-way center left-turn lane. The eastbound left turn lane is approximately 350-feet long. The southbound Roundhouse Avenue approach has a dedicated left-turn lane, a dedicated right-turn lane, and is controlled by a stop sign. Roundhouse Avenue is the primary ingress/egress point for Walmart traffic.

The speed limit on Roundhouse Avenue is 25 MPH, and the speed limit on US-23 is 35 MPH.

Figure 4 illustrates the geometry of the Roundhouse Avenue and US-23 intersection.

Figure 4. US-23 at Roundhouse Avenue



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2.1.3 US-23 at Newman Street

US-23 at Newman Street is a four-legged signalized intersection. The eastbound approach has one combined thru/left-turn lane, one thru lane, and one dedicated right-turn lane. The westbound approach has one combined thru/left-turn lane and one combined thru/right-turn lane. The northbound and southbound approaches are single lane that provide for all movements. An eastbound/westbound travelling railroad is located on the southbound approach of the intersection.

Figure 5 illustrates the geometry of the intersection.

The intersection is controlled by an actuated-uncoordinated traffic signal that operates on a two-phase signal with a 70-second cycle length. Below are the signal phases of the intersection:

- Phase 1 – Eastbound/Westbound US-23
- Phase 2 – Northbound/Southbound Newman Street

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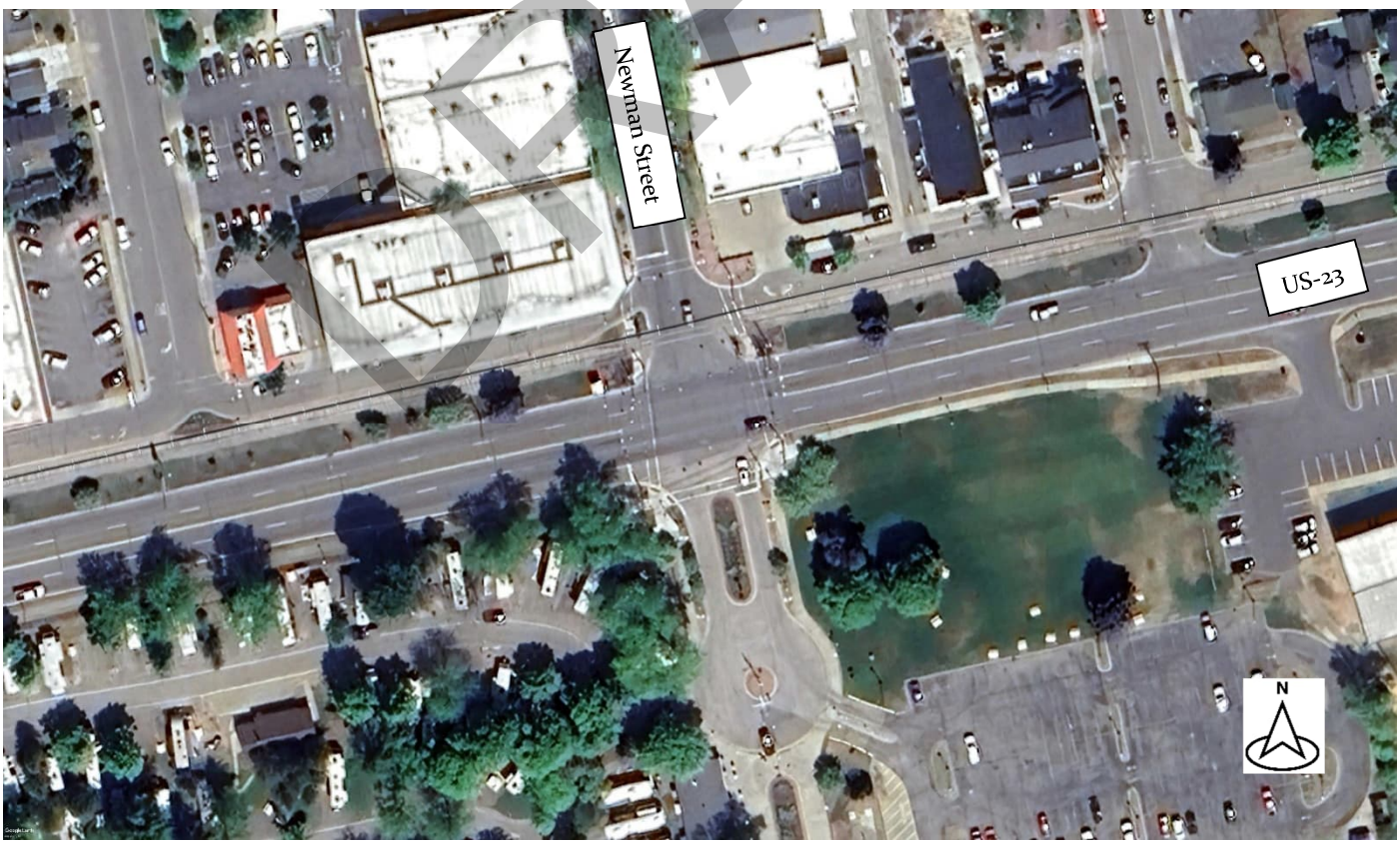
Figure 5. US-23 at Newman Street



2.1.4 US-23 at Tawas Beach Road

US-23 at Tawas Beach Road is a four-legged signalized intersection. The eastbound approach has one dedicated left-turn lane that is approximately 150-feet long, one thru lane, and one dedicated right-turn lane which is approximately 240-feet long. The westbound approach has one dedicated left-turn lane that is approximately 230-feet long, one thru lane, and one combined thru/right-turn lane. The northbound and southbound approached both have one dedicated left-turn lane that is approximately 65-feet long, and one combined thru/right-turn lane. Approximately 885-feet west of the intersection, the two eastbound lanes merge into one lane. Similar to the Newman intersection an eastbound/westbound traveling railroad is present across the southbound approach of the intersection.

The speed limit on Tawas Beach Road is 35 MPH north of US-23 and 25 MPH south of US-23. The speed limit on US-23 is 45 MPH. Figure 6 illustrates the geometry of the intersection.

The intersection is controlled by a US-23 actuated-coordinated traffic signal that operates on a two-phase signal with a 70-second cycle length. Below are the signal phases of the intersection:

- Phase 1 – Eastbound/Westbound US-23
- Phase 2 – Northbound/Southbound Tawas Beach Road

Figure 6. US-23 at Tawas Beach Road

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2.2 Crash Analysis

A crash analysis was conducted for a 5-year period (2018-2022), accounting for all crashes from January 1, 2018 through December 31, 2022 along US-23 from North Street to Tawas Beach Road. Crash data was provided by MDOT North Region and MDOT Alpena TSC for the analysis period using Roadsoft. US-23 experienced a total of 89 crashes in the 5-year period. Of these 89 crashes, 30.3% of the total crashes were rear-end straight crashes, 21.3% of the total crashes were sideswipe same crashes, 20.2% of the total crashes were angle turn crashes, 7.9% of the total crashes were fixed object crashes, and rear-end left turn crashes each, 4.5% of the total crashes for each category were angle driveway crashes, and rear-end right turn, 2.3% of the total crashes were head-on left-turn not driveway crashes, and 1.1% were misc. single vehicle crashes. A majority of crashes occurred within the spring/summer months (May through August). The summary of crash types can be found in Table 1.

Table 1. Total Crash Type Summary

Crash Type	K	A	B	C	PDO	Total	% of Total Crashes
Angle Turn		1	3	1	13	18	20.2%
Angle Driveway				1	3	4	4.5%
Head-On Left Turn				1	1	2	2.3%
Rear-End Straight		1	4	5	17	27	30.3%
Rear-End Left Turn				2	5	7	7.9%
Rear-End Right Turn				1	3	4	4.5%
Sideswipe Same				1	18	19	21.3%
Fixed Object					7	7	7.9%
Misc. Single Vehicle				1		1	1.1%
Total	0	2	7	13	67	89	100%

2.2.1 US-23 and Hemlock Road (M-55) – Signalized

US-23 at M-55 (Hemlock Road) experienced the highest crash frequency of the three signalized intersections within the study corridor with a total of 15 intersection crashes within the 5-year study period. No crashes occurred during nighttime hours (8 PM to 6 AM). The Daily Entering Vehicle (DEV) count is approximately 24,750 vehicles per day. A breakdown of crash occurrence by crash type and severity is shown in Table 2.

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Table 2. US-23 and Hemlock Road (M-55) Crash Type and Severity Breakdown

Crash Type	K	A	B	C	O	Total
Angle Driveway					2	2
Bicycle			1			1
Head-On Left Turn				1	1	2
Rear-End Straight				1	5	6
Rear-End Left Turn					1	1
Sideswipe Same					1	1
Sideswipe Opposite					1	1
Single Motor Vehicle				1		1

"K" = Fatal injury, "A" = Suspected serious injury, "B" = Suspected minor injury, "C" = Possible injury, "O" = No apparent injury

The crash analysis for this intersection suggests the following:

- Rear-End Straight Crashes (40%, 6 crashes):
    - Center left-turn lane (CLTL) could potentially reduce the number of crashes by designating a lane for left-turning traffic.
    - All crashes occurred during daylight and dry road conditions.
    - 100% of crashes were caused by driver failure to stop within a safe distance to another vehicle.

- Angle Driveway Crashes (13%, 2 crashes):
    - No significant correctable crash pattern was observed.
    - The two crashes occurred during daylight and dry road conditions.
    - The two crashes were caused by driver stop or failure to yield to oncoming through traffic when exiting the Shell/Subway parking lot.

- Head-On Left Turn Crashes (13%, 2 crashes):
    - No significant correctable crash pattern was observed.
    - The two crashes occurred during daylight and dry road conditions.
    - The two crashes were caused by driver stop or failure to yield to oncoming through traffic.

- Bicycle Crashes (6.7%, 1 crash):
    - The crash occurred during daylight and dry road conditions.
    - The crash was caused by the driver's failure to yield to a bicyclist going northbound on US-23. The driver was stopped at a red light on M-55 and looked both ways and saw no cars, so they proceeded through the intersection to turn right onto southbound US-23 when they hit the bicyclist traveling NB from the sidewalk.

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Conclusion	Mitigation
From most of the crash types, the crashes did not have significant correctable crash patterns that were observed, however, the head-on left turn crashes seem as though it can be corrected with left turn signal phasing. Additional signing may also be a good tactic to use so vehicles know when to stop far before they need to.	1. Evaluate the signal timing for clearance interval calculations. 2. Evaluate signal progression along US-23 for queue clearance and platoon movement. 3. Look into a left-turn phase from the US-23 mainline 4. The recently added box span will likely reduce red light running crashes. 5. Install improved pedestrian crosswalk markings at all approaches.

2.2.2 US-23 and Newman Street – Signalized

US-23 at Newman Street experienced a total of eight (8) intersection crashes within the 5-year study period. Only one crash occurred during nighttime hours, and the intersection has a Daily Entering Vehicle (DEV) count of approximately 15,065 vehicles per day. A breakdown of crash occurrence by crash type and severity is shown in Table 3.

Table 3. US-23 and Newman Street Crash Type and Severity Breakdown

Crash Type	K	A	B	C	O	Total
Angle Straight					1	1
Head-On Left Turn			1		1	2
Rear-End Straight			1	1	2	4
Sideswipe Same					1	1

K=Fatal, A=Incapacitating Injury, B=Non-incapacitating Injury, C=Possible Injury, O=No Injury

The crash analysis for this intersection suggests the following:

- Rear-End Straight Crashes (50%, 4 crashes):
  - No significant correctable crash pattern was observed.
  - Three of the four crashes were caused by driver failure to stop within a safe distance to another vehicle.
  - The fourth crash occurred when a driver went to stop for a red light but accidentally had his foot on both the brake and accelerator at the same time and rear-ended a vehicle in front of them.

- Angle Straight Crashes (25%, 2 crashes):
  - No significant correctable crash pattern was observed.
  - Both crashes occurred during daylight and dry road conditions.

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- One crash was caused by a driver running a red light when another driver was making a left turn at the end of a light and the other driver ran through the red and struck the left turning vehicle.

Conclusion	Mitigation
The crashes at this intersection were due to drivers' failure to yield, running red lights, and failure to stop within a safe distance. These things could be mitigated with solutions listed to the right.	1. Evaluate the signal timing for clearance interval calculations. 2. Evaluate signal progression along US-23 for queue clearance and platoon movement. 3. The recently installed box span will likely help minimize the red-light running crashes. 4. Install improved pedestrian crosswalk markings at all approaches.

2.2.3 US-23 and Tawas Beach Road – Signalized

US-23 at Tawas Beach Road experienced a total of four (4) intersection crashes within the 5-year study period. No crashes occurred during nighttime hours and there is a Daily Entering Vehicle (DEV) count of approximately 15,501 vehicles per day. A breakdown of crash occurrence by crash type and severity is shown in Table 4.

Table 4. US-23 and Tawas Beach Road Crash Type and Severity Breakdown

Crash Type	K	A	B	C	O	Total
Bicycle	1					1
Rear-End Straight					1	1
Sideswipe Same					1	1
Other				1		1

K=Fatal, A=Incapacitating Injury, B=Non-incapacitating Injury, C=Possible Injury, O=No Injury

The crash analysis for this intersection suggests the following:

- Bicycle Crashes (25%, 1 crash):
  - The "K" crash occurred under the following conditions: A motorist was turning right from northbound US-23 onto the east leg of Tawas Beach Road and struck a bicyclist crossing the east leg of Tawas Beach Road. The crash resulted in the bicyclist being fatally struck.
- Other Crash (25%, 1 crash):
  - The crash was caused by a driver failing to comply with the flashing red light at the intersection of Tawas Beach Road and US-23 from the south leg. The driver attempted to turn onto US-23 but was hit by a vehicle traveling along SB US-23

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which had the right-of-way. In August, north of Tawas Beach Rd a construction zone was noted.

Conclusion	Mitigation
Despite relatively few crashes at the Tawas Beach Road intersection, the fatal bicycle crash should be examined to determine if any mitigation measures can be implemented to improve safety.	1. Evaluate the signal timing for clearance interval calculations. 2. Evaluate the need for additional pedestrian and bicycle signs in this area. 3. Consider installing signal backplates on all signal heads to increase visibility. 4. Install improved pedestrian crosswalk markings at all approaches.

2.2.4 US-23 and Roundhouse Avenue – Unsignalized

US-23 at Roundhouse Avenue experienced a total of 17 intersection crashes within the 5-year study period. No crashes were classified as dark lighted and unlighted condition. A breakdown of crash occurrence by crash type and severity is shown in Table 5.

Table 5. US-23 and Roundhouse Avenue (Walmart Driveway) Crash Type and Severity Breakdown

Crash Type	K	A	B	C	O	Total
Angle Straight		1	1		15	17

K=Fatal, A=Incapacitating Injury, B=Non-incapacitating Injury, C=Possible Injury, O=No Injury

The crash analysis for this intersection suggests the following:

- Angle Straight Crashes (100%, 17 crashes):
    - A significant correctable crash pattern was observed with vehicles pulling out of Walmart Driveway/Roundhouse Avenue, specifically left turns from Walmart Driveway/Roundhouse Avenue onto northbound US-23.
    - The crashes were due to a driver's failure to yield, failure to follow Traffic Control Devices, and conflicts with left turns coming from the Walmart Driveway/Roundhouse Avenue.

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Conclusion	Mitigation
Mitigation measures should be considered to reduce the number of angle crashes. If a signal does not get warranted, then a signal could be provided as mitigation measure for future considerations.	1. A signal warrant study should be completed to ascertain whether a traffic signal should be installed at this high-volume intersection. 2. Evaluate progression along the corridor for queue clearance and platoon movement.

2.2.5 US-23 from Oak Street to Roundhouse Avenue

US-23 from Oak Street to Roundhouse Avenue including Oak Street but excluding Roundhouse Avenue experienced a total of six (6) crashes within the existing 5-lane section of US-23 mainline. The majority of crashes were angle turn (50.0% of total crashes) within the 5-year study period. 83.33% of crashes were during daytime hours and none of crashes involved slippery roadway conditions. A breakdown of crash occurrence by crash type and severity is shown in Table 6.

Table 6. US-23 from Oak Street to Roundhouse Avenue Crash Type and Severity Breakdown

Crash Type	K	A	B	C	O	Total
Angle Turn					3	3
Rear-End Straight					1	1
Fixed Object					2	2

K=Fatal, A=Incapacitating Injury, B=Non-incapacitating Injury, C=Possible Injury, O=No Injury

- Considerations/Recommendations for this segment:
  - Signalization of the Roundhouse Avenue intersection may correct the angle crash pattern that was observed. The Oak Street intersection could also be considered for signalization, but the M-55 signal is only 1,000 feet south of Oak Street.
  - Reducing the lane configurations will reduce the number of conflict points for left-turn movements.
  - Reducing the number of lanes along US-23 will result in fewer gaps in traffic for vehicles turning out from Walmart.
  - All crashes occurred during daylight condition with most crashes on dry road conditions

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2.2.1 US-23 from North Street to Oak Street, Roundhouse Avenue to Pine Street

US-23 from North Street to Oak Street and from north of Roundhouse Avenue to Pine Street experienced a total of 23 crashes within these two 4-lane sections of US-23. The majority of crashes were sideswipe-same (47.82% of total crashes) within the 5-year study period. All crashes were minor injury or property damage only related crash with no serious injuries. All the crashes were during daytime hours and 4.35% of crashes involved slippery roadway conditions. A breakdown of crash occurrence by crash type and severity is shown in Table 7.

Table 7. US-23 from North Street to Oak Street Crash Type and Severity Breakdown

Crash Type	K	A	B	C	O	Total
Angle Driveway				1	1	2
Rear-End Straight			1	2	5	8
Rear-End Right Turn					1	1
Sideswipe Same				1	10	11
Misc. Single Vehicle				1		1

K=Fatal, A=Incapacitating Injury, B=Non-incapacitating Injury, C=Possible Injury, O=No Injury

The crash analysis for this segment of US-23 suggests that many crashes were located near the signalized intersection at Hemlock Road (M-55) at US-23 and at the unsignalized intersection of Oak Street at US-23. The crash pattern for a signalized intersection shows no significant concern but the unsignalized intersection suggests a high level of crash concentration.

- Considerations/Recommendations for this segment:
    - Improve signal progression along US-23 to reduce the potential for rear-end crashes by keeping traffic flowing better.
    - Access management for driveways that have more than one access point should be reviewed.

2.2.2 US-23 from Pine Street to Tawas Beach Road

US-23 from Pine Street to Tawas Beach Road experienced a total of 25 crashes within its 4-lane section of US-23 mainline excluding Newman Street. The majority of crashes were rear-end straight (32.0% of total crashes) within the 5-year study period. 20.0% of crashes involved an injury with one of the crashes resulting in a serious injury (level A injury). 96.0% of crashes were during daytime hours and 28% of crashes involved slippery roadway conditions. A breakdown of crash occurrence by crash type and severity is shown in Table 8.

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Table 8. US-23 from Pine Street to Tawas Beach Road Crash Type and Severity Breakdown

Crash Type	K	A	B	C	O	Total
Angle Turn			1		1	2
Rear-End Straight		1		2	5	8
Rear-End Left Turn					2	2
Rear-End Right Turn				1		1
Sideswipe Same					7	7
Fixed Object					5	5

K=Fatal, A=Incapacitating Injury, B=Non-incapacitating Injury, C=Possible Injury, O=No Injury

The crash analysis for this segment of US-23 suggests that many crashes were located near the signalized intersection at Newman Street/US-23 and the unsignalized intersection at Church Street/US-23. The crash pattern at the signalized intersection of US-23 & Newman St shows concerns for high number of turning movement crashes (angle turn, rear-end left turn, and rear-end right turn) as well as at certain unsignalized intersection.

- Considerations/Recommendations for this segment:
    - Improve signal progression along US-23 to stop-go delays for the number of rear-end crashes in the area.
    - Currently left-turn movements at unsignalized intersections along US-23 could potentially be causing traffic stoppages along US-23 that increase the potential for a rear-end crash.
    - MDOT should consider installing left-turn permissive-protected phasing at Newman Street if a 3-lane conversion were implemented.
    - If the 3-lane conversion does not end up being installed, split phasing at Newman Street should be reviewed due to the number of rear-end crashes along US-23. Split phasing will minimize the through traffic stopping behind the left turn traffic, possibly alleviate rear ends due to having no opposing movements to stop for and wait for gaps to complete their movement. Split phasing will also provide access for adjacent side street/driveway with additional gaps.
    - Access management for driveways that have more than one access should be reviewed along US-23 from Wadsworth Street to Grant Street due to high number of crashes within the corridor.

2.2.3 Nonmotorized Crashes

There were currently no significant concerns with nonmotorized crashes along US-23 mainline during year 2018 to 2022, although there was one fatal bicycle crash at Tawas Beach Road as discussed previously. No pedestrian crashes were recorded within the 2018 to 2022 data set. There have since been two (2) pedestrian crashes at the Newman Street at US-23 intersection that are outlined below in further detail.

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- The crash occurred around 8:00 PM during clear, daylight and dry road conditions in July 2023. A pedestrian started crossing US-23 (south leg) of the Newman Street intersection. A vehicle turning left from Newman Street (east leg) was given a green light and the driver failed to yield to the pedestrian which struck them.
- The second crash occurred between 5:00-6:00 PM during clear, daylight and dry road conditions in September 2023. Two pedestrians were crossing US-23 (south leg) of the intersection when a vehicle turning right from Newman Street (west leg) failed to yield to the pedestrians and struck them.

Side street traffic operations should be reviewed at Tawas Beach Road and at M-55 (Hemlock Road) to potentially implement protected movements for both motorist and non-motorist operations. Signing improvements were noted for the Tawas Beach Road intersection due to the bicycle fatality. Improving signing for all signalized intersections is advisable to reduce future nonmotorized crashes. Installing bike lanes in roadway by reducing lane widths or shoulder widths (reduce up to 49% of bike crashes) and/or doing 3-lane cross-section (reduce up to 47% of all crashes) would have a significant impact on safety for bikes and pedestrians.

Studies have shown that the benefits of 3-Lane cross-section would potentially:

- Reduce rear-end and left-turn crashes by adding a dedicated left-turn only lane.
- Reduce angle crashes by reducing the overall roadway width.
- Reduce pedestrian crashes by reducing the overall roadway width to provide fewer lanes for pedestrians to cross with opportunity to install median refugee islands.
- Reduce bicycle crashes by adding bikes.
- Reduce speeds and weaving manoeuvres and provide more consistent speeds throughout the corridor.
- Provide benefits for streetscaping environment for all road users (non-motorized & motorized).

2.3 Traffic Volumes

Intersection turning movement counts were collected by MDOT on various days in July 2024. The counts included weekday and weekend volume counts. The peak hour of each day was evaluated, and the AM and PM weekday peak hours and the Saturday peak hour were utilized in the study. Included in the counts were passenger vehicles, light trucks, and articulated trucks. Table 9 summarizes the AM and PM weekday peak hour and the overall weekend peak hour.

Table 9. Intersection Count Summary

Date of Count	Day of Week	AM Peak Hour	PM Peak Hour
July 7, 2024	Tuesday	7:30 – 8:30 AM	3:00 – 4:00 PM
July 13, 2024	Saturday	12:00 – 1:00 PM	

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Figure 7 summarizes the AM and PM peak hour volumes for the three signalized intersections and for the unsignalized Roundhouse Avenue intersection. Appendix A contains the turning movement volumes for the study intersections.

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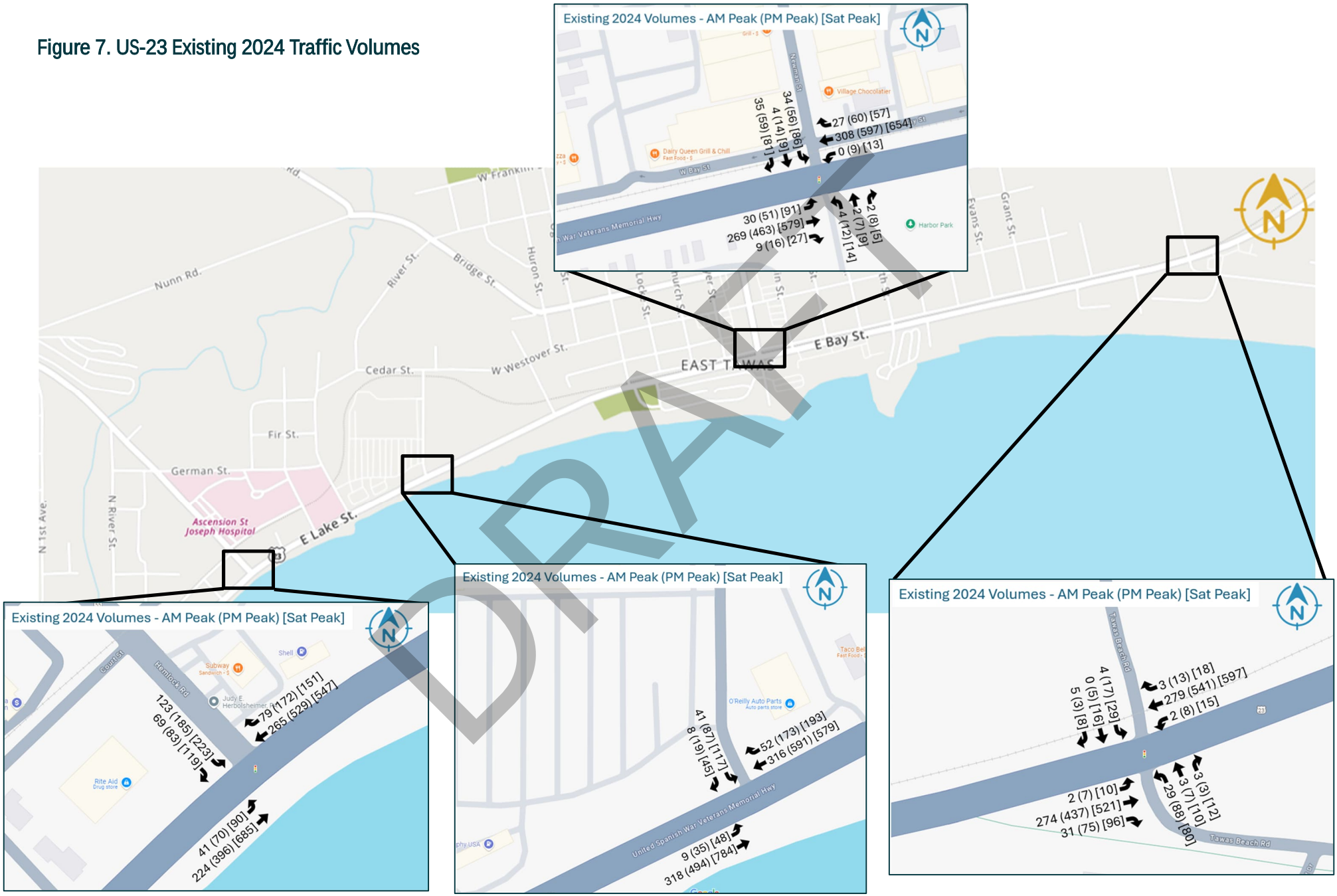
Figure 7. US-23 Existing 2024 Traffic Volumes



2.4 Existing Operational Conditions

The existing geometric configuration of the surrounding roadway network and existing traffic data were used to establish baseline conditions. The collected traffic counts and existing signal timing data at the study intersections were used to analyse the operational conditions in Synchro 12. Appendix B contains the first page of each signal timing permit as provided by MDOT. Appendix C contains the Existing Conditions Synchro reports. Tables 10, 12 and 14 summarize the existing LOS for the AM, PM and Saturday peak hours, according to the Synchro 12 reports. LOS E and LOS F are considered failing and shown in bold red. Tables 11, 13, and 15 summarizes the arterial LOS and travel time in seconds.

Table 10. Existing AM Peak Hour Levels of Service

Intersection	Eastbound			Westbound			Northbound			Southbound			Int*
	US-23						Side Street						
	L	T	R	L	T	R	L	T	R	L	T	R	
Hemlock Road (M-55)	A	A			A	A				C		C	B
		A			A						C		
**Roundhouse Avenue	A				Free Flow					A		B	B
		A									B		
Newman Street		A	A	A	A			B			B		A
		A			A			B			B		
Tawas Beach Road	A	A	A	A	A	A	C	C		C	C		A
		A			A			C			C		

Source: Synchro 12 Report *Int = Intersection **Unsignalized L-left T-thru R-right

Table 11. Existing AM Peak Hour Travel Time

Arterial Span	Direction
	Eastbound Travel Time (sec)
Hemlock Road (M-55) to Newman Street	113.1
Newman Street to Tawas Beach Road	86.2
	Westbound Travel Time (sec)
Tawas Beach Road to Newman Street	87.4
Newman Street to Hemlock Road (M-55)	109.5

Source: Synchro 12 Report

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Table 12. Existing PM Peak Hour Levels of Service

Intersection	Eastbound			Westbound			Northbound			Southbound			Int*
	US-23						Side Street						
	L	T	R	L	T	R	L	T	R	L	T	R	
Hemlock Road (M-55)	A	A			A	A				C		C	A
		A			A						C		
**Roundhouse Avenue	A				Free Flow					B		C	C
		A									B		
Newman Street		A	A	A	A			B			B		A
		A			A			B			B		
Tawas Beach Road	A	A	A	A	A	A	C	C		C	C		A
		A			A			C			C		

Source: Synchro 12 Report *Int = Intersection **Unsignalized L-left T-thru R-right

Table 13. Existing PM Peak Hour Travel Time

Arterial Span	Direction
	Eastbound Travel Time (sec)
Hemlock Road (M-55) to Newman Street	113.9
Newman Street to Tawas Beach Road	87.5
	Westbound Travel Time (sec)
Tawas Beach Road to Newman Street	88.7
Newman Street to Hemlock Road (M-55)	111.4

Source: Synchro 12 Report

Table 14. Saturday Peak Hour Levels of Service

Intersection	Eastbound			Westbound			Northbound			Southbound			Int*
	US-23						Side Street						
	L	T	R	L	T	R	L	T	R	L	T	R	
Hemlock Road (M-55)	A	A			A	A				C		C	B
		A			A						C		
**Roundhouse Avenue	A				Free Flow					B		D	D
		A									D		
Newman Street		A	A	A	A			B			B		A
		A			A			B			B		
Tawas Beach Road	A	A	A	A	A	A	C	C		C	C		A
		A			A			C			C		

Source: Synchro 12 Report *Int = Intersection **Unsignalized L-left T-thru R-right

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Table 15. Existing Saturday Peak Hour Travel Time

Arterial Span	Direction
	Eastbound Travel Time (sec)
Hemlock Road (M-55) to Newman Street	116.6
Newman Street to Tawas Beach Road	88.2
	Westbound Travel Time (sec)
Tawas Beach Road to Newman Street	90.0
Newman Street to Hemlock Road (M-55)	112.1

Source: Synchro 12 Report

Under existing weekday AM and PM peak hour conditions and Saturday peak hour conditions, all study intersections and individual turn movements operated at acceptable LOS values.

A queue analysis was also conducted for existing peak hour conditions. Utilizing the existing volumes and existing signal timings, SimTraffic was utilized to evaluate the 95th percentile queue at the study intersections. As shown in Table 16, no queue exceeded 200-feet. The SimTraffic simulation resulted in no queue blocking a turn bay or thru lane throughout the corridor.

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Table 16. Existing Queue Analysis

Existing AM Peak Hour Queue (feet)										
Intersection	**Eastbound**			**Westbound**			**Northbound**		**Southbound**	
	US-23						**Side Street**			
Hemlock Road (M-55)	LT	T		T	T	R	n/a		L	R
	68	65		63	47	44	n/a		119	40
**Roundhouse Avenue	L			TR			n/a		L	R
	15			6			n/a		52	35
Newman Street	LT	T	R	LT	TR		LTR		LTR	
	63	64	14	57	69		18		51	
Tawas Beach Road	L	T	R	L	T	TR	L	TR	L	TR
	12	132	18	10	66	60	73	25	20	16
Existing PM Peak Hour Queue (feet)										
	Eastbound			**Westbound**			**Northbound**		**Southbound**	
Hemlock Road (M-55)	LT	T		T	T	R	n/a		L	R
	103	95		127	72	56	n/a		144	50
**Roundhouse Avenue	L			TR			n/a		L	R
	46			7			n/a		81	40
Newman Street	LT	T	R	LT	TR		LTR		LTR	
	88	95	18	105	121		32		72	
Tawas Beach Road	L	T	R	L	T	TR	L	TR	L	TR
	20	172	33	25	109	120	119	26	39	22
Existing Saturday Peak Hour Queue (feet)										
	Eastbound			**Westbound**			**Northbound**		**Southbound**	
Hemlock Road (M-55)	LT	T		T	T	R	n/a		L	R
	130	143		122	81	54	n/a		182	45
**Roundhouse Avenue	L			TR			n/a		L	R
	52			16			n/a		106	42
Newman Street	LT	T	R	LT	TR		LTR		LTR	
	121	121	31	97	112		34		112	
Tawas Beach Road	L	T	R	L	T	TR	L	TR	L	TR
	22	185	33	31	135	115	118	41	54	41

Source: SimTraffic 12 Report **Unsignalized L-left T-thru LT-left-thru R-right

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2.4.1 Existing Mitigation

A signal warrant was conducted for Roundhouse Avenue under the 2024 existing volumes. The analysis under the 2024 volumes resulted in a signal being warranted at the intersection. Table 17 summarizes the Roundhouse Avenue signal warrant under the 2024 volumes.

Table 17. 2024 Roundhouse Avenue Signal Warrant

Warrant	Condition	Is the Warrant Met?
Warrant 1: Eight-Hour Vehicular Volume	Condition A	No
	Condition B	Yes
Warrant 2: Four-Hour Vehicular Volume	100%	Yes
Warrant 3: Peak-Hour Vehicular Volume	100%	Yes
	Condition A	N/A
	Condition B	Yes
Warrant 4: Pedestrian Volume	100%	No
Warrant 5: School Crossing		No
Warrant 7: Crash Experience	Condition A	No
	Condition B	Yes

The mitigation, including signalizing Roundhouse Avenue and implementing split phase timing at Newman Street, was evaluated under the existing conditions. Table 18 summarizes the new LOS found under the split timing conditions. The full mitigation tools and LOS reports for the split phase mitigation can be found in Appendix C.

Table 18. 2024 Saturday Mitigation Peak Hour Levels of Service

Intersection	Eastbound			Westbound			Northbound			Southbound			Int*	Existing Int*
	US-23						Side Street							
	L	T	R	L	T	R	L	T	R	L	T	R		
Hemlock Road (M-55)	A	A			A	A				C		C	B	B
		A			A						C			
Roundhouse Avenue	A	A			A					B		B	A	D
		A			A						B			
Newman Street	D	C		B	D			C			D		D	A
		C			D			C			D			
Tawas Beach Road	A	A	A	A	A	A	C	C		C	C		A	A
		A			A			C			C			

Source: Synchro 12 Report *Int = Intersection L-left T-thru R-right

Based on the analysis, Roundhouse Avenue went from a LOS D to an LOS A and Newman Street went from a LOS A to a LOS D. Despite Newman Street declining in level of service, it is still within the acceptable threshold.

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3. Future Year 2045 No-Build Conditions

This section of the report summarizes the future year No-Build conditions, a horizon year of 2045 was selected and analyzed. A 0.5% annually compounded growth rate was applied to existing peak hour volumes to project the future peak hour volumes for each of the study intersections.

3.1 2045 No-Build Operational Analysis

The peak hour volumes used in the 2045 No-Build analysis was calculated by applying the compound annual growth rate of 0.5% over twenty-one years, to the existing traffic volumes. The peak hour turning movement volumes are presented in Figure 8 for the four study intersections. The future year traffic volumes were input into Synchro 12 and with the existing signal timings and geometry. Tables 19, 21, and 23 summarize the 2045 AM, PM and Saturday peak hour levels of service, respectively. These are based on the Synchro 12 reports, which can be found in Appendix D. Tables 20, 22, and 24 summarizes the arterial LOS and travel time in seconds.

Table 19. Future Year 2045 No-Build AM Peak Hour Levels of Service

Intersection	Eastbound			Westbound			Northbound			Southbound			Int*
	US-23						Side Street						
	L	T	R	L	T	R	L	T	R	L	T	R	
Hemlock Road (M-55)	A	A			A	A				C		C	B
	A			A						C			
**Roundhouse Avenue	A			Free Flow						B		A	B
	A									B			
Newman Street		A	A	A	A	A		B			B		A
	A			A			B			B			
Tawas Beach Road	A	A	A	A	A		C	C		C	C		A
	A			A			C			C			

Source: Synchro 12 Report *Intersection **Unsignalized L-left T-thru R-right

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Table 20. Future Year 2045 No-Build AM Peak Hour Travel Time

Arterial Span	2024 Existing Conditions	2045 No-Build Conditions
	Direction	
	Eastbound Travel Time (sec)	
Hemlock Road (M-55) to Newman Street	113.1	113.3
Newman Street to Tawas Beach Road	86.2	86.4
	Westbound Travel Time (sec)	
Tawas Beach Road to Newman Street	87.4	87.6
Newman Street to Hemlock Road (M-55)	109.5	110.0

Source: Synchro 12 Report

Table 21. Future Year 2045 No-Build PM Peak Hour Levels of Service

Intersection	Eastbound			Westbound			Northbound			Southbound			Int*
	US-23						Side Street						
	L	T	R	L	T	R	L	T	R	L	T	R	
Hemlock Road (M-55)	A	A			A	A				C		C	B
		A			A						C		
**Roundhouse Avenue	B				Free Flow					D		B	D
		B									D		
Newman Street		A	A	A	A	A		B			B		A
		A			A			B			B		
Tawas Beach Road	A	A	A	A	A		C	C		C	C		A
		A			A			C			C		

Source: Synchro 12 Report *Intersection **Unsignalized L-left T-thru R-right

Table 22. Future Year 2045 No-Build PM Peak Hour Travel Time

Arterial Span	2024 Existing Conditions	2045 No-Build Conditions
	Direction	
	Eastbound Travel Time (sec)	
Hemlock Road (M-55) to Newman Street	113.9	114.2
Newman Street to Tawas Beach Road	87.5	87.9
	Westbound Travel Time (sec)	
Tawas Beach Road to Newman Street	88.7	89.0
Newman Street to Hemlock Road (M-55)	111.4	112.0

Source: Synchro 12 Report

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Table 23. Future Year 2045 No-Build Saturday Peak Hour Levels of Service

Intersection	Eastbound			Westbound			Northbound			Southbound			Int*
	US-23						Side Street						
	L	T	R	L	T	R	L	T	R	L	T	R	
Hemlock Road (M-55)	A	A			A	A				C		C	B
		A			A						C		
**Roundhouse Avenue	B			Free Flow						E (43.0)		B	E
		B									E		
Newman Street		B	A	A	A	A		B			B		B
		A			A			B			B		
Tawas Beach Road	A	A	A	A	A		C	C		C	C		A
		A			A			C			C		

Source: Synchro 12 Report *Intersection **Unsignalized L-left T-thru R-right

Table 24. Future Year 2045 No-Build Saturday Peak Hour Travel Time

Arterial Span	2024 Existing Conditions	2045 No-Build Conditions
	Direction	
	Eastbound Travel Time (sec)	
Hemlock Road (M-55) to Newman Street	116.6	117.8
Newman Street to Tawas Beach Road	88.2	89.0
	Westbound Travel Time (sec)	
Tawas Beach Road to Newman Street	90.0	90.5
Newman Street to Hemlock Road (M-55)	112.1	112.7

Source: Synchro 12 Report

After applying the growth rate to the existing volumes, the weekday AM and PM peak hour displayed no failing level of service at any of the study intersections. The growth rate was applied to the Saturday peak hour volumes. Under the No-Build conditions the southbound left-turn movement at the intersection of Roundhouse Avenue and US-23 exhibited a failing level of service.

A queue analysis was also conducted for the No-Build conditions. Utilizing the 2045 volumes and existing signal timing, SimTraffic was utilized to evaluate the 95th percentile queue at the study intersections. Table 25 summarizes the queue length (feet) for the AM, PM, and Saturday peak hour.

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Table 25. No-Build Queue Analysis

No-Build AM Peak Hour Queue (feet)										
Intersection	**Eastbound**			**Westbound**			**Northbound**		**Southbound**	
	US-23						**Side Street**			
Hemlock Road (M-55)	LT	T		T	T	R	n/a		L	R
	72	62		68	46	44	n/a		128	40
**Roundhouse Avenue	L			TR			n/a		L	R
	20			3			n/a		53	35
Newman Street	LT	T	R	LT	TR		LTR		LTR	
	63	76	17	99	73		17		52	
Tawas Beach Road	L	T	R	L	T	TR	L	TR	L	TR
	7	132	21	9	78	73	73	23	18	17
No-Build PM Peak Hour Queue (feet)										
	Eastbound			**Westbound**			**Northbound**		**Southbound**	
Hemlock Road (M-55)	LT	T		T	T	R	n/a		L	R
	118	112		132	82	58	n/a		161	51
**Roundhouse Avenue	L			TR			n/a		L	R
	51			16			n/a		100	42
Newman Street	LT	T	R	LT	TR		LTR		LTR	
	94	98	25	101	124		31		82	
Tawas Beach Road	L	T	R	L	T	TR	L	TR	L	TR
	21	186	32	26	123	125	123	32	43	33
No-Build Saturday Peak Hour Queue (feet)										
	Eastbound			**Westbound**			**Northbound**		**Southbound**	
Hemlock Road (M-55)	LT	T		T	T	R	n/a		L	R
	163	165		137	85	57	n/a		181	50
**Roundhouse Avenue	L			TR			n/a		L	R
	55			10			n/a		151	46
Newman Street	LT	T	R	LT	TR		LTR		LTR	
	142	134	32	113	130		39		130	
Tawas Beach Road	L	T	R	L	T	TR	L	TR	L	TR
	31	223	36	42	140	123	113	44	63	46

Source: SimTraffic 12 Report **Unsignalized L-left LT-left-thru T-thru R-right

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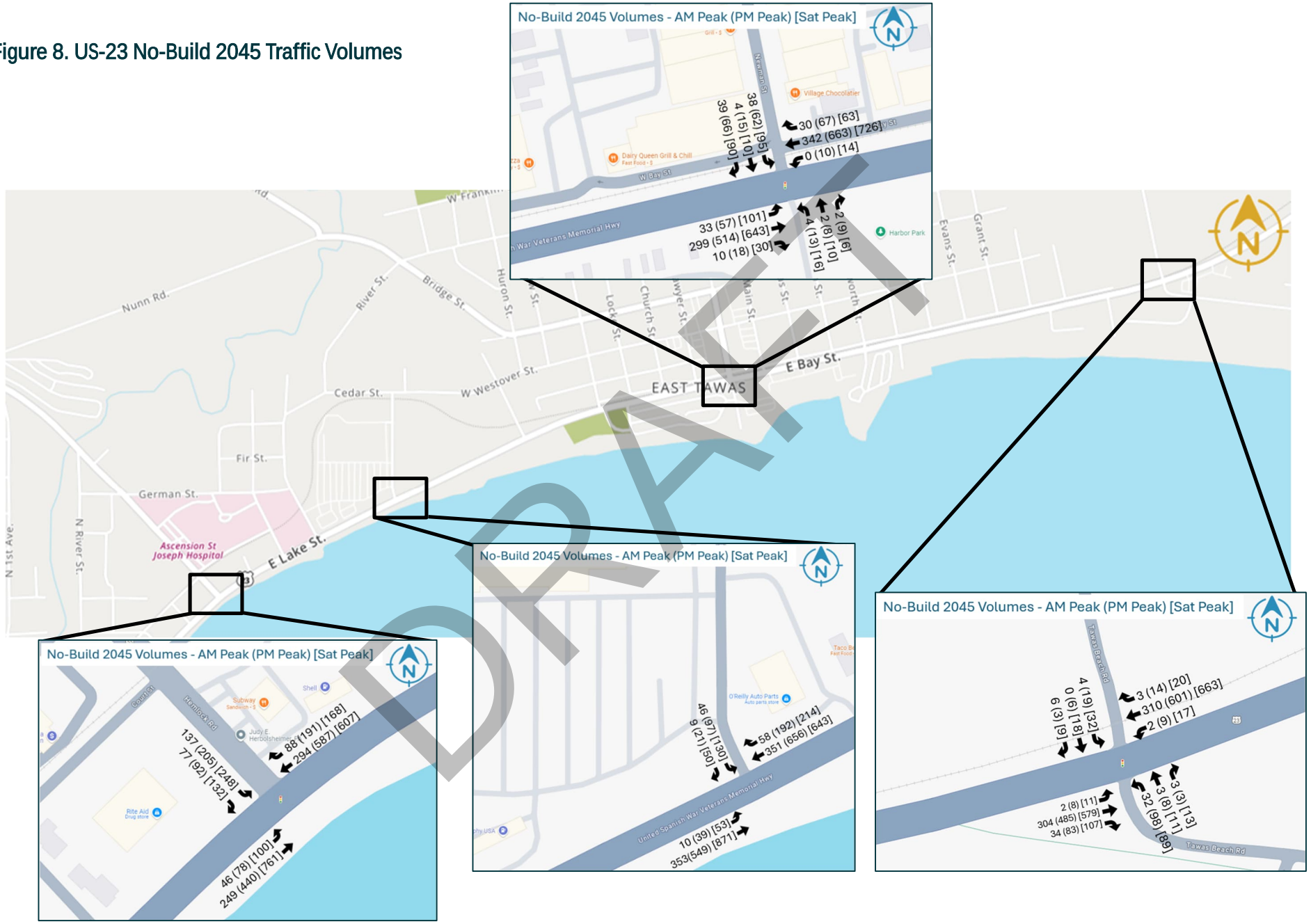
Figure 8. US-23 No-Build 2045 Traffic Volumes



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3.2 2045 No-Build Mitigation

Due to a signal being warranted under 2024 conditions, a signal warrant was not needed under the 2045 volumes. The signal at Roundhouse Avenue was implemented and evaluated in Synchro 12 under the No-Build conditions. The level of service results can be found in Table 26. The full Synchro reports and warrant can be found in Appendix D.

Table 26. Future Year 2045 No-Build Saturday Peak Hour Levels of Service – Mitigation

Intersection	Eastbound			Westbound			Northbound			Southbound			Int*	No Signal 2045
	US-23						Side Street							
	L	T	R	L	T	R	L	T	R	L	T	R		
Hemlock Road (M-55)	A	A			A	A				C		C	B	B
		A			A						C			
Roundhouse Avenue	A	A			A					B		B	A	E
		A			A						B			
Newman Street		B	A	A	A	A		B			B		B	B
		A			A			B			B			
Tawas Beach Road	A	A	A	A	A		C	C		C	C		A	A
		A			A			C			C			

Source: Synchro 12 Report *Intersection L-left T-thru R-right

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4. Alternative Analysis

This section of the report provides a review of the geometry and implementation of a proposed 3-lane cross-section along US-23 from Hemlock Road (M-55) to Tawas Beach Road. The first section will review the change in geometry followed by the impacts to traffic operations for 2045. The last section will review impacts to crashes associated with implementation of a 3-lane cross-section along US-23.

4.1 2045 Alternative Geometry

The proposed alternative consists of converting US-23 to a 3-lane cross-section (12-feet wide travel lanes) from Hemlock Road (M-55) to Tawas Beach Road. Figure 10 shows the proposed 3-lane cross-section with a proposed shared-used non-motorized path. Concept plan view drawings were created for the four study area intersections. Eastbound US-23 at Newman Street was evaluated for the need of a right-turn lane. A right-turn lane warrant was conducted under the 2024 volumes. Figures 11, 12, 13 and 14 show the 3-lane concept for Hemlock Road (M-55), Roundhouse Avenue, Newman Street and Tawas Beach Road, respectively. The traffic control for the intersections is proposed to remain the same. Reducing the overall lane configuration would allow space for a wider shared-use path, additional green space buffer between the roadway and the non-motorized facility as well as potential mid-block pedestrian crossings with median refuge islands. These islands shorten the distance and time pedestrians are exposed to traffic along US-23 and help protect pedestrians who cross US-23. A cost estimate for a proposed 3-lane conversion can be found in Appendix E, along with a cost estimate for maintaining the current road configuration.

Figure 9. 3-lane Configuration Cross-Section

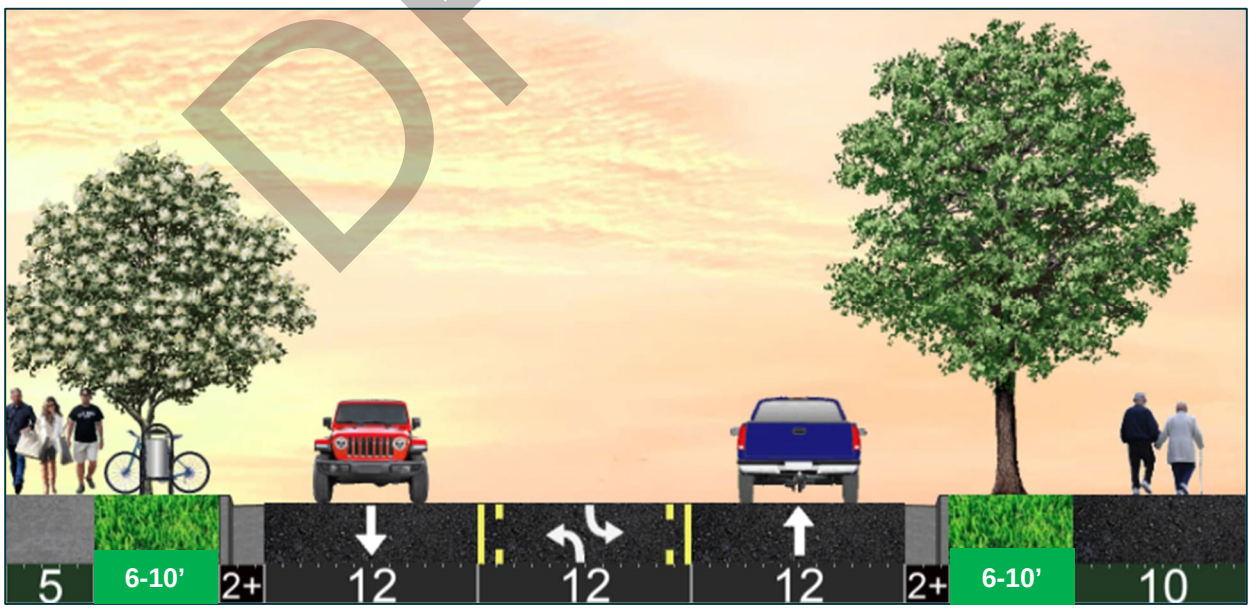

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Figure 10. Hemlock Road (M-55) 3-lane Conversion

Figure 11. Roundhouse Avenue 3-lane Conversion

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Figure 12. Newman Street 3-lane Conversion

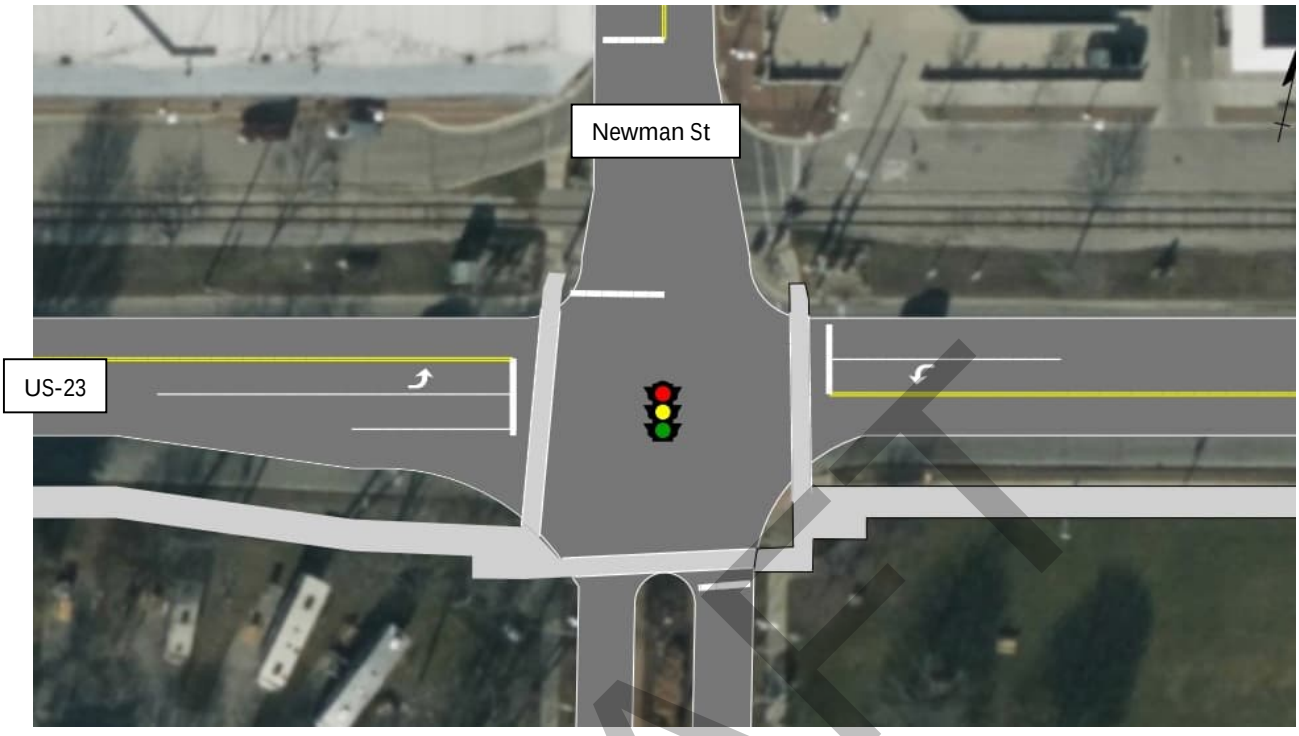
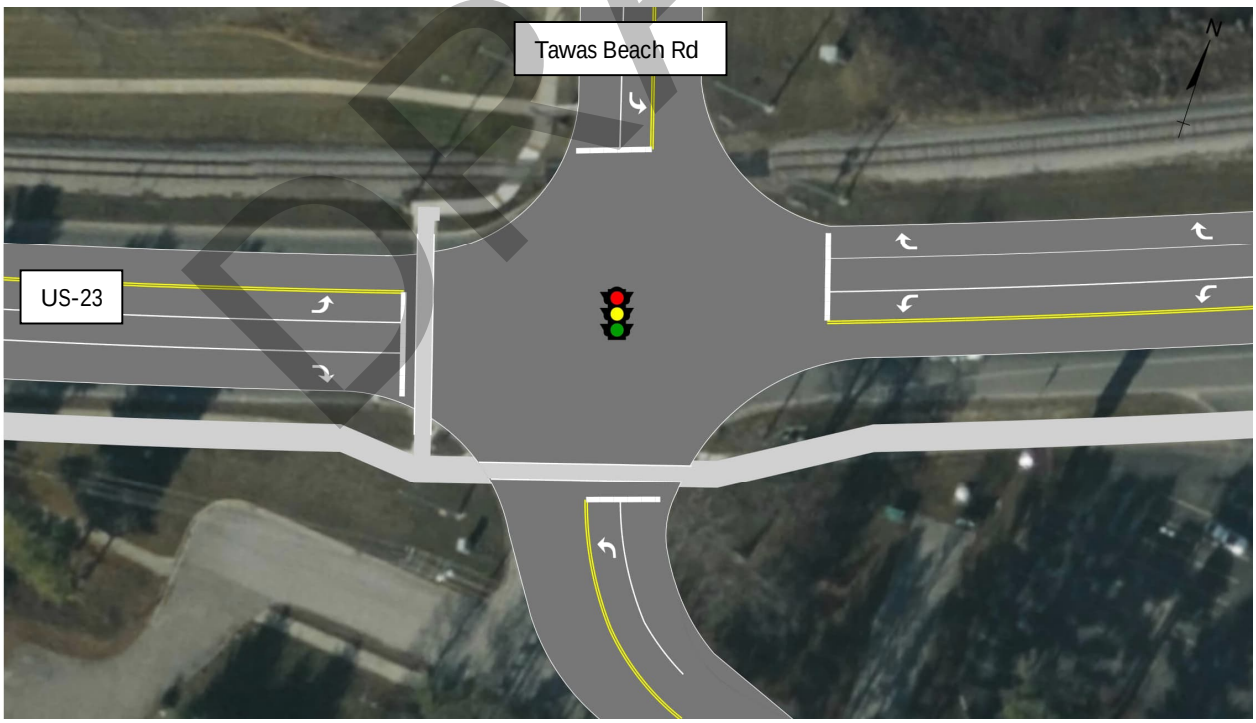


Figure 13. Tawas Beach Road 3-lane Conversion



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4.2 2045 Alternative Operational Analysis

The peak hour volumes utilized in the 2045 No-Build analysis were utilized for the analysis of a proposed 3-lane cross-section. Despite the change in geometry, the volumes of the network remain the same. The future Build year traffic volumes were entered into Synchro 12 along with optimized signal timings and the proposed 3-lane geometry. Tables 27, 29, and 31 summarize the 2045 Build AM, PM and Saturday peak hour LOS, respectively. These values are based on the Synchro 12 reports, which can be found in Appendix F. Tables 28, 30, and 32 summarize the 2045 Build arterial LOS and travel time in seconds.

Table 27. Future Year 2045 Build AM Peak Hour Levels of Service

Intersection	Eastbound			Westbound			Northbound			Southbound			Int*	No-Build Int* LOS
	US-23						Side Street							
	L	T	R	L	T	R	L	T	R	L	T	R		
Hemlock Road (M-55)	A	A			A	A				C		C	A	B
		A			A						C			
**Roundhouse Avenue	A			Free Flow						B		B	B	B
Newman Street	A	A	A	A	A			B			B		A	A
		A			A			B			B			
Tawas Beach Road	B	B	B	B	B	B	B	B		B	B		B	A
		B			B			B			B			

Source: Synchro 12 Report *Intersection **Unsignalized L-left T-thru R-right

Table 28. Future Year 2045 Build AM Peak Hour Travel Time

Arterial Span	2024 Existing Conditions	2045 No-Build Conditions	2045 Build Conditions
	Direction		
	Eastbound Travel Time (sec)		
Hemlock Road (M-55) to Newman Street	113.1	114.2	113.9
Newman Street to Tawas Beach Road	86.2	87.9	94.3
	Westbound Travel Time (sec)		
Tawas Beach Road to Newman Street	87.4	89.0	89.2
Newman Street to Hemlock Road (M-55)	109.5	112.0	111.2

Source: Synchro 12 Report

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Table 29. Future Year 2045 Build PM Peak Hour Levels of Service

Intersection	Eastbound			Westbound			Northbound			Southbound			Int*	No-Build Int* LOS
	US-23						Side Street							
	L	T	R	L	T	R	L	T	R	L	T	R		
Hemlock Road (M-55)	A	A			B	A				C		B	B	B
		A			A						C			
**Roundhouse Avenue	B			Free Flow						D		C	D	D
		B									D			
Newman Street	A	A	A	A	B			B			C		B	A
		A			B			B			C			
Tawas Beach Road	B	B	B	B	C	B	B	B		B	B		C	A
		B			C			B			B			

Source: Synchro 12 Report *Intersection **Unsignalized L-left T-thru R-right

Table 30. Future Year 2045 Build PM Peak Hour Travel Time

Arterial Span	2024 Existing Conditions	2045 No-Build Conditions	2045 Build Conditions
	Direction		
	Eastbound Travel Time (sec)		
Hemlock Road (M-55) to Newman Street	113.9	114.2	115.0
Newman Street to Tawas Beach Road	87.5	87.9	98.6
	Westbound Travel Time (sec)		
Tawas Beach Road to Newman Street	88.7	89.0	94.0
Newman Street to Hemlock Road (M-55)	111.4	112.0	117.1

Source: Synchro 12 Report

Table 31. Future Year 2045 Build Saturday Peak Hour Levels of Service

Intersection	Eastbound			Westbound			Northbound			Southbound			Int*	No-Build Int* LOS
	US-23						Side Street							
	L	T	R	L	T	R	L	T	R	L	T	R		
Hemlock Road (M-55)	A	B			B	A				C		C	B	B
		B			A						C			
**Roundhouse Avenue	B			Free Flow						F (74s)		C	F	E
Newman Street	B	B	A	A	B			B			C		B	B
		B			B			B			C			
Tawas Beach Road	B	C	B	B	C	B	B	B		B	B		C	A
		B			C			B			B			

Source: Synchro 12 Report *Intersection **Unsignalized L-left T-thru R-right

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Table 32. Future Year 2045 Build Saturday Peak Hour Travel Time

Arterial Span	2024 Existing Conditions	2045 No-Build Conditions	2045 Build Conditions
	Direction		
	Eastbound Travel Time (sec)		
Hemlock Road (M-55) to Newman Street	116.6	117.8	118.7
Newman Street to Tawas Beach Road	88.2	89.0	102.3
	Westbound Travel Time (sec)		
Tawas Beach Road to Newman Street	90.0	90.5	99.1
Newman Street to Hemlock Road (M-55)	112.1	112.7	116.8

Source: Synchro 12 Report

After evaluating the 2045 traffic volumes under the Build conditions for a 3-lane cross-section, the AM and PM weekday peak hour analysis exhibited no failing level of service at any of the study intersections. When the 2045 Saturday traffic volumes were evaluated, the southbound left-turn movement at the intersection of Roundhouse Avenue and US-23 exhibited a failing level of service.

A queue analysis was also conducted for the Build conditions for a proposed 3-lane cross-section. Utilizing the 2045 volumes and existing signal timing, SimTraffic was utilized to evaluate the 95th percentile queue at the study intersections. Table 33 summarizes the queue length (feet) for the weekday AM, PM, and Saturday peak hour.

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Table 33. Build Queue Analysis

Build AM Peak Hour Queue (feet)										
Intersection	**Eastbound**			**Westbound**			**Northbound**		**Southbound**	
	US-23						**Side Street**			
Hemlock Road (M-55)	L	T		T	R		n/a		L	R
	55	97		105	42		n/a		117	46
**Roundhouse Avenue	L			TR			n/a		L	R
	18			-			n/a		49	34
Newman Street	L	T	R	L	TR		LTR		LTR	
	43	124	16	-	134		16		59	
Tawas Beach Road	L	T	R	L	T	R	L	TR	L	TR
	10	154	30	16	146	9	47	20	12	12
Build PM Peak Hour Queue (feet)										
	Eastbound			**Westbound**			**Northbound**		**Southbound**	
Hemlock Road (M-55)	L	T		T	R		n/a		L	R
	89	163		223	115		n/a		148	64
**Roundhouse Avenue	L			TR			n/a		L	R
	54			-			n/a		137	42
Newman Street	L	T	R	L	TR		LTR		LTR	
	101	179	52	45	278		35		90	
Tawas Beach Road	L	T	R	L	T	R	L	TR	L	TR
	27	223	40	54	303	25	88	26	31	16
Build Saturday Peak Hour Queue (feet)										
	Eastbound			**Westbound**			**Northbound**		**Southbound**	
Hemlock Road (M-55)	L	T		T	R		n/a		L	R
	156	271		208	102		n/a		196	69
**Roundhouse Avenue	L			TR			n/a		L	R
	65			-			-		**617**	246
Newman Street	L	T	R	L	TR		LTR		LTR	
	110	203	30	62	271		37		141	
Tawas Beach Road	L	T	R	L	T	R	L	TR	L	TR
	55	241	39	41	330	29	86	36	46	35

Source: Synchro 12 Report **Unsignalized L-left T-thru LT-left-thru R-right

The queue analysis resulted in the southbound left-turn Roundhouse Avenue having a large queue. The study network was projected to 2075 and is expected to operate at an acceptable level of service throughout the 50-year duration.

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4.3 2045 Alternative Operational Analysis Mitigation

Based on the previous signal warrants analyzed, a signal at Roundhouse Avenue and US-23 was analyzed under the build 3-lane configuration conditions. Newman Street and US-23 was analyzed under MDOT's left-turn lane warrant utilizing the 2045 volumes and the 3-lane configuration. The analysis resulted in a left-turn phase being warranted for westbound/eastbound Newman Street. The results of the level of service analysis can be found in Table 34.

Table 34. Future Year 2045 Build Saturday Peak Hour Levels of Service – Roundhouse Signal

Intersection	Eastbound			Westbound			Northbound			Southbound			Int*	No-Sig Int*
	US-23						Side Street							
	L	T	R	L	T	R	L	T	R	L	T	R		
Hemlock Road (M-55)	A	B			B	A				C		C	B	B
		B			A						C			
Roundhouse Avenue	A	A			A					C		C	B	F
		A			A						C			
Newman Street	B	B	A	A	C			C			C		B	B
		B			C			C			C			
Tawas Beach Road	B	C	B	B	C	B	B	B		B	B		C	C
		B			C			B			B			

Source: Synchro 12 Report *Intersection L-left T-thru R-right

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4.4 Predictive Safety Analysis

A predictive crash analysis was performed for existing conditions and the proposed 3-lane conversion using HCS 2023 Highway Safety Software (HSS) along US-23 from North Street to Tawas Beach Road. Reviewing the Crash Modification Factor (CMF) Clearinghouse, a reduction factor was identified for the proposed changes. The CMF and HCS 2023 software are both calibrated based on previous lane reduction studies, therefore they are both viable options when analyzing the predicted crashes of the proposed alternative.

4.4.1 HCS Analysis

The HCS 2023 software analysis shows an average predicted annual crash rate of 17.785 crashes per year for existing conditions (Table 35) and 14.343 crashes annually for the propose 3-lane conversion (Table 36). The crash comparison reveals that the lane reconfiguration changes are anticipated to reduce crashes by 3.442 annually, with a 1.451 annual reduction in fatal/injury crashes. See Table 37 below for further details related to the predictive crash comparison for existing conditions and the proposed 3-lane conversion.

Table 35. Existing HCS Results for US-23 from North Street to Tawas Beach Road

Description (South to North)	Facility Type	Roadway Configuration	Length, mi	Predicted (Total)	Predicted (Fatal/Injury)	Predicted (PDO)	Predicted Societal Crash Costs
North Street to M-55	Segment	4-Lane Undivided	0.100	0.539	0.174	0.365	$75,692
M-55 Signal	Intersection	3-Legged Signal	-	2.236	0.788	1.448	$340,665
M-55 to Oak Street	Segment	4-Lane Undivided	0.200	1.647	0.534	1.113	$231,620
Oak Street to north of Roundhouse Avenue	Segment	5-Lane Undivided with CLTL	0.300	2.533	0.737	1.796	$321,403
North of Roundhouse Avenue to Pine Street	Segment	4-Lane Undivided	0.500	2.774	0.880	1.894	$382,036
Newman Street Signal	Intersection	4-Legged Signal	-	2.059	0.740	1.319	$319,861
Pine Street to Newman Street	Segment	4-Lane Undivided	0.800	4.353	1.389	2.963	$603,331
Tawas Beach Road Signal	Intersection	4-Legged Signal	-	1.644	0.576	1.067	$249,251
Total	-	-	1.900	17.785	5.818	11.965	$ 2,523,859

Table 36. Proposed HCS Results for US-23 between North Street to Tawas Beach Road

Description (South to North)	Facility Type	Roadway Configuration	Length, mi	Predicted (Total)	Predicted (Fatal/Injury)	Predicted (PDO)	Predicted Societal Crash Costs
North Street to M-55	Segment	3-Lane Undivided with CLTL	0.100	0.441	0.119	0.322	$52,180
M-55 Signal	Intersection	3-Legged Signal with CLTL	-	2.067	0.728	1.339	$314,861
M-55 to Oak Street	Segment	3-Lane Undivided with CLTL	0.200	1.244	0.343	0.901	$149,897
Oak Street to north of Roundhouse Avenue	Segment	3-Lane Undivided with CLTL	0.300	1.548	0.434	1.114	$189,631

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North of Roundhouse Avenue to Pine Street	Segment	3-Lane Undivided with CLTL	0.500	2.232	0.611	1.621	$267,258
Newman Street Signal	Intersection	4-Legged Signal	-	1.679	0.611	1.068	$264,025
Pine Street to Newman Street	Segment	3-Lane Undivided with CLTL	0.800	3.491	0.947	2.544	$414,450
Tawas Beach Road Signal	Intersection	4-Legged Signal	-	1.641	0.574	1.067	$248,365
Total	-		1.900	14.343	4.367	9.976	$1,900,667

Table 37. HCS Summary between Existing and Proposed Conditions

Description	Roadway Configuration	Predicted (Total)	Predicted (Fatal/Injury)	Predicted (PDO)	Predicted Societal Crash Costs
Existing Configuration	4-Lane Undivided	17.785	5.818	11.965	$ 2,523,859
Proposed 3-Lane Conversion	3-Lane with CLTL	14.343	4.367	9.976	$ 1,900,667
Benefits from Existing to Proposed	-	3.442	1.451	1.989	$ 623,192

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4.4.2 CMF Analysis

The CMF clearinghouse (CMF ID: 2841) recommends using a crash modification factor of 0.53 for the conversion of a 4-lane undivided roadway to a 3-lane undivided roadway. The existing annual crash rate of 17.0 crashes per year along US-23 would potentially be reduced to 9.0 crashes per year if US-23 were reconstructed as 3-lane pavement. The CMF methodology results in a greater reduction in crashes than HCS-HSS methodology. Regardless, each predictive crash methodology reveals a safety benefit associated with implementation of a 3-lane section along US-23.

5. Conclusion

The weekday AM, PM and Saturday peak hours were evaluated under existing conditions, No-Build conditions and a proposed 3-lane conversion. The existing volumes and lane configuration throughout the corridor resulted in no failing levels of service or significant queues. The volumes were projected to 2045 for No-Build and Build conditions. The AM and PM weekday peak hour under the No-Build condition and the Build condition resulted in no failing levels of service or significant queue lengths. There was one failing LOS for the 2045 Saturday traffic volume for the No-Build and Build conditions, which included the southbound left-turn at Roundhouse Avenue and US-23. Due to the failing LOS exhibited at Roundhouse Avenue a signal warrant was conducted for the 2045 volumes. A signal is warranted for the Roundhouse Avenue intersection under the 2045 projected volumes. It is estimated that the 3-lane configuration will operate under acceptable conditions for the next 50 years.

The proposed 3-lane configuration would consist of three 12-foot lanes with one (1) lane in each direction with a continuous two-way center left-turn lane. By reducing the overall lane configuration and lane width it also allows space for pedestrian improvements along US-23, including mid-block crossings and a shared use nonmotorized path. These measures would improve overall safety for all users (pedestrians, bicyclists, motorists) and would encourage a community focused environment. Given the number of driveways along US-23 between Hemlock Road (M-55) and Roundhouse Avenue, MDOT could consider extending the proposed westbound US-23 right-turn lane from east of Roundhouse Avenue to Hemlock Road (M-55).

The predictive crash analysis for the 3-lane configuration showed a reduction of 3.442 crashes annually. The HCS 2023 software analysis shows an average predicted annual crash rate of 17.785 crashes per year for existing conditions and 14.343 crashes annually for the proposed 3-lane conversion. The CMF methodology results in a greater reduction in crashes than HCS methodology. Each predictive crash methodology reveals that implementing a 3-lane section along US-23 to be a safer option for the community.

It is recommended that a 3-lane cross-section be implemented along US-23 from Hemlock Road (M-55) to Tawas Beach Road. The proposed configuration is expected to reduce crashes along US-23 while having little impact on delay. The travel time is expected to increase by an average of 4.9 seconds. Additionally, this configuration would provide extra space for a wider shared-use path along the south side of US-23 along the lakefront with a green space between the path and the roadway.

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Appendix A – Turning Movement Counts

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AM PEAK - 7:30A - 8:30A (7/9) Intersections

US-23 & Hemlock												
Start Time	U.S. - 23 from NE (SWB)				U.S. - 23 from SW (NEB)				HEMLOCK/M-55 from NW (SEB)			
	Right	Thru	**Total**	Peds	Thru	Left	**Total**	Peds	Right	Left	**Total**	Peds
07:30 AM	18	59	**77**	0	55	10	**65**	0	13	36	**49**	0
07:45 AM	21	68	**89**	0	60	18	**78**	0	20	36	**56**	0
08:00 AM	22	67	**89**	0	61	7	**68**	0	19	23	**42**	0
08:15 AM	18	71	**89**	0	48	6	**54**	0	17	28	**45**	0
Total	79	265	**344**	0	224	41	**265**	0	69	123	**192**	0
PHF	0.90	0.93	**0.97**		0.92	0.57	**0.85**		0.86	0.85	**0.86**	
HV%	1%	2%			3%	5%			4%	3%		

US-23 & Newman St																				
Start Time	NEWMAN ST. From N (SB)					U.S. - 23 from East (WB)					NEWMAN ST. From South (NB)					U.S. - 23 from West (EB)				
	Right	Thru	Left	**Total**	Peds	Right	Thru	Left	**Total**	Peds	Right	Thru	Left	**Total**	Peds	Right	Thru	Left	**Total**	Peds
07:30 AM	6	0	11	**17**	0	4	71	0	**75**	0	0	0	0	**0**	0	1	71	4	**76**	0
07:45 AM	12	2	11	**25**	0	8	82	0	**90**	0	0	0	1	**1**	0	3	71	10	**84**	0
08:00 AM	14	0	4	**18**	0	5	70	0	**75**	0	2	1	2	**5**	0	4	61	8	**73**	0
08:15 AM	3	2	8	**13**	0	10	85	0	**95**	0	0	1	1	**2**	0	1	66	8	**75**	0
Total	35	4	34	**73**	0	27	308	0	**335**	0	2	2	4	**8**	0	9	269	30	**308**	0
PHF	0.63	0.50	0.77	**0.73**		0.68	0.91	0.00	**0.88**		0.25	0.50	0.50	**0.40**		0.56	0.95	0.75	**0.92**	
HV%	0%	0%	0%			0%	2%	0%			0%	0%	0%			0%	4%	0%		

US-23 & Roundhouse St												
Start Time	U.S. - 23 from NE (SW)				U.S. - 23 from SW (NE)				ROUNDHOUSE ST. from NW (SE)			
	Right	Thru	**Total**	Peds	Thru	Left	**Total**	Peds	Right	Left	**Total**	Peds
07:30 AM	3	68	**71**	0	83	1	**84**	0	2	7	**9**	0
07:45 AM	14	91	**105**	0	87	3	**90**	0	2	11	**13**	0
08:00 AM	13	88	**101**	0	81	1	**82**	0	0	8	**8**	0
08:15 AM	22	69	**91**	0	67	4	**71**	0	4	15	**19**	0
Total	52	316	**368**	0	318	9	**327**	0	8	41	**49**	0
PHF	0.59	0.87	**0.88**		0.91	0.56	**0.91**		0.50	0.68	**0.64**	
HV%	0%	1%			2%	0%			13%	2%		

US-23 & Tawas Beach Dr																				
Start Time	TAWAS BEACH DR from N (SB)					US-23 from NE (SWB)					TAWAS BEACH DR from E					US-23 from SW (NEB)				
	Bear Right	Left	Hard Left	**Total**	Peds	Hard Right	Thru	Hard Left	**Total**	Peds	Hard Right	Right	Bear Left	**Total**	Peds	Bear Right	Thru	Bear Left	**Total**	Peds
07:30 AM	2	0	0	**2**	0	0	54	0	**54**	0	0	1	8	**9**	0	5	75	0	**80**	0
07:45 AM	3	0	0	**3**	0	3	79	1	**83**	0	1	2	8	**11**	0	8	68	0	**76**	0
08:00 AM	0	0	1	**1**	0	0	64	1	**65**	0	1	0	6	**7**	0	10	58	1	**69**	0
08:15 AM	0	0	3	**3**	0	0	82	0	**82**	0	1	0	7	**8**	0	8	73	1	**82**	0
Total	5	0	4	**9**	0	3	279	2	**284**	0	3	3	29	**35**	0	31	274	2	**307**	0
PHF	0.42	#DIV/0!	0.33	**0.75**		0.25	0.85	0.50	**0.86**		0.75	0.38	0.91	**0.80**		0.78	0.91	0.50	**0.94**	
HV%	0%	#DIV/0!	0%			0%	1%	0%			0%	0%	0%			0%	1%	0%		

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AM PEAK - 7:30A-8:30A (7/9) Segments

240177 - in front of Grant St			
Start Time	US 23		
	NE	SW	**Total**
07:30 AM	104	73	**177**
07:45 AM	92	91	**183**
08:00 AM	78	82	**160**
08:15 AM	86	103	**189**
Total	360	349	**709**
PHF	0.87	0.85	**0.94**
HV%			

240178 - NE of Matthews			
Start Time	US 23		
	NE	SW	**Total**
07:30 AM	67	53	**120**
07:45 AM	84	68	**152**
08:00 AM	63	79	**142**
08:15 AM	67	65	**132**
Total	281	265	**546**
PHF	0.84	0.84	**0.90**
HV%			

240179 - B/W Nelson & Wilkinson			
Start Time	US 23		
	NE	SW	**Total**
07:30 AM	104	79	**183**
07:45 AM	103	114	**217**
08:00 AM	96	102	**198**
08:15 AM	91	115	**206**
Total	394	410	**804**
PHF	0.95	0.89	**0.93**
HV%			

240185 - NE of Birch			
Start Time	US 23		
	NE	SW	**Total**
07:30 AM	77	71	**148**
07:45 AM	87	97	**184**
08:00 AM	74	103	**177**
08:15 AM	66	107	**173**
Total	304	378	**682**
PHF	0.87	0.88	**0.93**
HV%			

PM PEAK - 3P-4P (7/9) Intersections

US-23 & Hemlock												
Start Time	U.S. - 23 from NE (SWB)				U.S. - 23 from SW (NEB)				HEMLOCK/M-55 from NW (SEB)			
	Right	Thru	**Total**	Peds	Thru	Left	**Total**	Peds	Right	Left	**Total**	Peds
03:00 PM	47	156	**203**	0	89	19	**108**	0	23	44	**67**	0
03:15 PM	41	126	**167**	0	84	19	**103**	0	18	58	**76**	0
03:30 PM	39	115	**154**	0	123	15	**138**	0	14	41	**55**	0
03:45 PM	45	132	**177**	0	100	17	**117**	0	28	42	**70**	0
Total	172	529	**701**	0	396	70	**466**	0	83	185	**268**	0
PHF	0.91	0.85	**0.86**		0.80	0.92	**0.84**		0.74	0.80	**0.88**	
HV%	0%	1%			1%	0%			5%	1%		

US-23 & Newman St																				
Start Time	NEWMAN ST. From N (SB)					U.S. - 23 from East (WB)					NEWMAN ST. From South (NB)					U.S. - 23 from West (EB)				
	Right	Thru	Left	**Total**	Peds	Right	Thru	Left	**Total**	Peds	Right	Thru	Left	**Total**	Peds	Right	Thru	Left	**Total**	Peds
03:00 PM	10	3	15	**28**	0	17	151	3	**171**	0	1	0	5	**6**	0	2	107	12	**121**	0
03:15 PM	19	2	12	**33**	0	20	126	5	**151**	0	3	4	2	**9**	0	1	117	12	**130**	0
03:30 PM	14	1	15	**30**	0	14	155	1	**170**	0	2	2	2	**6**	0	6	119	13	**138**	0
03:45 PM	16	8	14	**38**	0	9	165	0	**174**	0	2	1	3	**6**	0	7	120	14	**141**	0
Total	59	14	56	**129**	0	60	597	9	**666**	0	8	7	12	**27**	0	16	463	51	**530**	0
PHF	0.78	0.44	0.93	**0.85**		0.75	0.90	0.45	**0.96**		0.67	0.44	0.60	**0.75**		0.57	0.96	0.91	**0.94**	
HV%	0%	0%	0%			0%	1%	0%			0%	0%	0%			0%	1%	0%		

US-23 & Roundhouse St												
Start Time	U.S. - 23 from NE (SW)				U.S. - 23 from SW (NE)				ROUNDHOUSE ST. from NW (SE)			
	Right	Thru	**Total**	Peds	Thru	Left	**Total**	Peds	Right	Left	**Total**	Peds
03:00 PM	45	166	**211**	0	109	9	**118**	0	6	21	**27**	0
03:15 PM	43	141	**184**	0	127	5	**132**	0	2	23	**25**	0
03:30 PM	35	135	**170**	0	132	8	**140**	0	5	15	**20**	0
03:45 PM	50	149	**199**	0	126	13	**139**	0	6	28	**34**	0
Total	173	591	**764**	0	494	35	**529**	0	19	87	**106**	0
PHF	0.87	0.89	**0.91**		0.94	0.67	**0.94**		0.79	0.78	**0.78**	
HV%	0%	1%			1%	3%			5%	1%		

US-23 & Tawas Beach Dr																				
Start Time	TAWAS BEACH DR from N (SB)					US-23 from NE (SWB)					TAWAS BEACH DR from E					US-23 from SW (NEB)				
	Bear Right	Left	Hard Left	**Total**	Peds	Hard Right	Thru	Hard Left	**Total**	Peds	Hard Right	Right	Bear Left	**Total**	Peds	Bear Right	Thru	Bear Left	**Total**	Peds
03:00 PM	0	2	3	**5**	0	4	150	1	**155**	0	0	1	29	**30**	0	19	103	0	**122**	0
03:15 PM	2	0	9	**11**	0	2	108	2	**112**	0	0	1	17	**18**	0	21	106	2	**129**	0
03:30 PM	1	2	2	**5**	0	2	130	1	**133**	0	0	4	21	**25**	0	18	107	3	**128**	0
03:45 PM	0	1	3	**4**	0	5	153	4	**162**	0	3	1	21	**25**	0	17	121	2	**140**	0
Total	3	5	17	**25**	0	13	541	8	**562**	0	3	7	88	**98**	0	75	437	7	**519**	0
PHF	0.38	0.63	0.47	**0.57**		0.65	0.88	0.50	**0.87**		0.25	0.44	0.76	**0.82**		0.89	0.90	0.58	**0.93**	
HV%	0%	0%	0%			0%	1%	0%			0%	0%	0%			0%	2%	0%		

PM PEAK - 3P-4P (7/9) Segments

240177 - in front of Grant St			
Start Time	US 23		
	NE	SW	**Total**
03:00 PM	133	198	**331**
03:15 PM	141	144	**285**
03:30 PM	135	172	**307**
03:45 PM	142	191	**333**
Total	551	705	**1256**
PHF	0.97	0.89	**0.94**
HV%			

240178 - NE of Matthews			
Start Time	US 23		
	NE	SW	**Total**
03:00 PM	98	141	**239**
03:15 PM	96	152	**248**
03:30 PM	112	137	**249**
03:45 PM	112	126	**238**
Total	418	556	**974**
PHF	0.93	0.91	**0.98**
HV%			

240179 - B/W Nelson & Wilkinson			
Start Time	US 23		
	NE	SW	**Total**
03:00 PM	144	203	**347**
03:15 PM	144	167	**311**
03:30 PM	141	177	**318**
03:45 PM	161	208	**369**
Total	590	755	**1345**
PHF	0.92	0.91	**0.91**
HV%			

240185 - NE of Birch			
Start Time	US 23		
	NE	SW	**Total**
03:00 PM	112	180	**292**
03:15 PM	114	171	**285**
03:30 PM	137	141	**278**
03:45 PM	127	154	**281**
Total	490	646	**1136**
PHF	0.89	0.90	**0.97**
HV%			

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SATURDAY PEAK HOUR 7/13 12P-1P INTERSECTIONS

US-23 & Hemlock												
Start Time	U.S. - 23 from NE (SWB)				U.S. - 23 from SW (NEB)				HEMLOCK/M-55 from NW (SEB)			
	Right	Thru	**Total**	Peds	Thru	Left	**Total**	Peds	Right	Left	**Total**	Peds
12:00 PM	42	134	**176**	0	144	21	**165**	0	28	45	**73**	0
12:15 PM	34	148	**182**	0	202	21	**223**	0	29	60	**89**	0
12:30 PM	39	145	**184**	0	173	21	**194**	0	35	68	**103**	0
12:45 PM	36	120	**156**	0	166	27	**193**	0	27	50	**77**	0
Total	151	547	**698**	0	685	90	**775**	0	119	223	**342**	0
PHF	0.90	0.92	**0.95**		0.85	0.83	**0.87**		0.85	0.82	**0.83**	
HV%	0%	0%			0%	0%			0%	0%		

US-23 & Newman St																				
Start Time	NEWMAN ST. From N (SB)					U.S. - 23 from East (WB)					NEWMAN ST. From South (NB)					U.S. - 23 from West (EB)				
	Right	Thru	Left	**Total**	Peds	Right	Thru	Left	**Total**	Peds	Right	Thru	Left	**Total**	Peds	Right	Thru	Left	**Total**	Peds
12:00 PM	21	2	19	**42**	0	15	173	5	**193**	0	1	2	6	**9**	0	6	142	20	**168**	0
12:15 PM	23	1	20	**44**	0	12	165	1	**178**	0	2	1	2	**5**	0	8	157	15	**180**	0
12:30 PM	17	1	24	**42**	0	12	166	5	**183**	0	1	2	1	**4**	0	8	141	31	**180**	0
12:45 PM	20	5	23	**48**	0	18	150	2	**170**	0	1	4	5	**10**	0	5	139	25	**169**	0
Total	81	9	86	176	0	57	654	13	724	0	5	9	14	28	0	27	579	91	697	0
PHF	0.88	0.45	0.90	**0.92**		0.79	0.95	0.00	**0.94**		0.63	0.56	0.58	**0.70**		0.84	0.92	0.73	**0.97**	
HV%	0%	0%	0%	0%		0%	0%	0%			0%	0%	0%			0%	0%	0%		

US-23 & Roundhouse St												
Start Time	U.S. - 23 from NE (SW)				U.S. - 23 from SW (NE)				ROUNDHOUSE ST. from NW (SE)			
	Right	Thru	**Total**	Peds	Thru	Left	**Total**	Peds	Right	Left	**Total**	Peds
12:00 PM	50	140	**190**	0	168	6	**174**	0	15	34	**49**	0
12:15 PM	51	158	**209**	0	213	12	**225**	0	8	23	**31**	0
12:30 PM	48	145	**193**	0	211	15	**226**	0	11	20	**31**	0
12:45 PM	44	136	**180**	0	192	15	**207**	0	11	40	**51**	0
Total	193	579	**772**	0	784	48	**832**	0	45	117	**162**	0
PHF	0.95	0.92	**0.92**		0.92	0.80	**0.92**		0.75	0.73	**0.79**	
HV%	0%	1%			0%	2%			0%	0%		

US-23 & Tawas Beach Dr																				
Start Time	TAWAS BEACH DR from N (SB)					US-23 from NE (SWB)					TAWAS BEACH DR from E					US-23 from SW (NEB)				
	Bear Right	Left	Hard Left	**Total**	Peds	Hard Right	Thru	Hard Left	**Total**	Peds	Hard Right	Right	Bear Left	**Total**	Peds	Bear Right	Thru	Bear Left	**Total**	Peds
12:00 PM	7	4	5	**16**	0	10	165	5	**180**	0	7	0	21	**28**	0	15	125	5	**145**	0
12:15 PM	1	1	12	**14**	0	2	155	1	**158**	0	1	4	13	**18**	0	32	119	4	**155**	0
12:30 PM	0	5	2	**7**	0	2	148	4	**154**	0	4	0	20	**24**	0	29	139	1	**169**	0
12:45 PM	0	6	10	**16**	0	4	129	5	**138**	0	0	6	26	**32**	0	20	138	0	**158**	0
Total	8	16	29	**53**	0	18	597	15	**630**	0	12	10	80	**102**	0	96	521	10	**627**	0
PHF	0.29	0.67	0.60	**0.83**		0.45	0.90	0.75	**0.88**		0.43	0.42	0.77	**0.80**		0.75	0.94	0.50	**0.93**	
HV%	0%	0%	0%			0%	1%	0%			0%	0%	0%			0%	1%	0%		

SATURDAY PEAK 12P-1P SEGMENTS

240177 - in front of Grant St			
Start Time	US 23		
	NE	SW	**Total**
12:00 PM	131	92	**223**
12:15 PM	116	115	**231**
12:30 PM	99	104	**203**
12:45 PM	109	130	**239**
Total	455	441	**896**
PHF	0.87	0.85	**0.94**
HV%			

240178 - NE of Matthews			
Start Time	US 23		
	NE	SW	**Total**
12:00 PM	194	128	**322**
12:15 PM	208	149	**357**
12:30 PM	197	135	**332**
12:45 PM	161	141	**302**
Total	760	553	**1313**
PHF	0.91	0.93	**0.92**
HV%			

240179 - B/W Nelson & Wilkinson			
Start Time	US 23		
	NE	SW	**Total**
12:00 PM	188	193	**381**
12:15 PM	240	206	**446**
12:30 PM	235	195	**430**
12:45 PM	215	178	**393**
Total	878	772	**1650**
PHF	0.91	0.94	**0.92**
HV%			

240185 - NE of Birch			
Start Time	US 23		
	NE	SW	**Total**
12:00 PM	167	161	**328**
12:15 PM	232	186	**418**
12:30 PM	204	185	**389**
12:45 PM	191	157	**348**
Total	794	689	**1483**
PHF	0.86	0.93	**0.89**
HV%			

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Appendix B – Signal Timing Permits

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NTCIP TRAFFIC SIGNAL TIMING PERMIT

PHASE	1	2	3	4	5	6	7	8
APPROACH		EB		SB		WB		Dummy
MINIMUM GREEN		10		7		10		7
PASSAGE		3.0		3.0		3.0		3.0
MAXIMUM GREEN NO. 1		43		27		43		27
MAXIMUM GREEN NO. 2		0		0		0		0
YELLOW CLEARANCE		3.6		3.0		3.6		3.0
ALL RED CLEARANCE		2.0		5.5		2.0		5.5
WALK		7		7		0		7
FLASHING DON'T WALK (FDW) CLEARANCE		19		19		0		19
EXT PED CLR (EOG, EOY, 3.0s)		EOG		EOG		N/A		EOG
START UP PHASE(S)	☐	☒	☐	☐	☐	☒	☐	☐
VEHICLE RECALL (NONE, MIN, MAX, SOFT)		MIN		NONE		MIN		NONE
PEDESTRIAN RECALL (NONE, RECL, OTHR)		NONE		NONE		NONE		NONE
DUAL ENTRY (Y, N)		Y		Y		Y		Y
MODE (CRD, MIN, MAX, D-CRD, NOCRD)		NOCRD		NOCRD		NOCRD		NOCRD
DAILY FLASH (Y, R, DK, NA)		NA		NA		NA		NA
CONFLICT FLASH (Y, R, DK)		R		R		R		DK

EVNT/ACTN PLN	OFFSET	CYCLE
EVNT/ACTN PLN	OFFSET	CYCLE
EVNT/ACTN PLN	OFFSET	CYCLE
EVNT/ACTN PLN	OFFSET	CYCLE
EVNT/ACTN PLN	OFFSET	CYCLE
EVNT/ACTN PLN	OFFSET	CYCLE

TIMING INSTALLED 03/06/23

PRE-EMPT ☒
COUNTDOWN PEDS ☒

REMARKS

Modified by HNTB for integration into CSCS

-120 volt hot wire for the disappearing case sign should be landed on Ped Clr 2. (13Y label on Econolite cabinet)

-No load switch to be installed for phase 8. This is a dummy phase to run phase 8 peds and overlap D.

CSCS Deployment Note:
Conflict flash changed to red for all approaches.
Remap PED 13 Yellow for PRE 1 Status via MM 4 9. To log set time events please add jumper wire between D connector pin 20 (Set Clock) to HOLD 6 input (Back Panel) which has been remapped to Special status 5 input via ABC input mode 19 MM 4 8.

LESS FREQUENTLY USED FEATURES

WALK REST MODIFIER (Y, N) (Cycle Ped in Free)								
LEAD PEDESTRIAN INTERVAL								
RED MAX EXTENSION (Dilemma Zone Mitigation)								

FLASH HOURS: ____ to ____ DAILY ☐ NONE ☒

CONTROLLER and FIRMWARE#
☒ Siemens (SEPAC) M60
☐ ECONOLITE (EOS)
☐ Other:

PREPARED BY: TGB
DATE: 12/16/22

LOCATION: US-23 (Bay Street) @ Newman Street
CITY/TWP: East Tawas
COUNTY : Iosco

MILE POINT: 1.03
CONTROL SECTION-SPOT #: 35032-01-001

Job # (If Applicable):

PHASE
1
2 EB US-23
3
4 SB Newman Street Pre-Signal
5
6 WB US-23
7
8 Dummy for Northbound Peds

VEHICLE OVERLAPS

Overlap Phase	Load Bay	Phases Overlapped	T.G. (s)	Y (s)	R (s)	FYA Phases Perm	FYA Phases Prot	Flash Daily	Flash Confl
B = SB Newman St. @ US-23	10	4	2.0	3.0	3.5			R	R
D = NB Newman St. @ US-23	12	8	2.0	3.0	3.5			R	R
=									
=									
=									
=									
=									
=									

CLEAR ALL

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NTCIP TRAFFIC SIGNAL TIMING PERMIT

PHASE	1	2	3	4	5	6	7	8
APPROACH		NB/SB		SEB				
MINIMUM GREEN		10		7				
PASSAGE		0.0		4.0				
MAXIMUM GREEN NO. 1		45		25				
MAXIMUM GREEN NO. 2		0		0				
YELLOW CLEARANCE		3.6		4.3				
ALL RED CLEARANCE		1.9		1.4				
WALK		7		7				
FLASHING DON'T WALK (FDW) CLEARANCE		18		14				
EXT PED CLR (EOG, EOY, 3.0s)		EOG		EOG				
START UP PHASE(S)	☐	☒	☐	☐	☐	☐	☐	☐
VEHICLE RECALL (NONE, MIN, MAX, SOFT)		MAX		NONE				
PEDESTRIAN RECALL (NONE, RECL, OTHR)		RECL		NONE				
DUAL ENTRY (Y, N)		N		N				
MODE (CRD, MIN, MAX, D-CRD, NOCRD)		CRD		NOCRD				
DAILY FLASH (Y, R, DK, NA)		Y		R				
CONFLICT FLASH (Y, R, DK)		R		R				
EVNT/ACTN PLN 1 OFFSET 15 CYCLE 70		45		25				
EVNT/ACTN PLN OFFSET CYCLE								
EVNT/ACTN PLN OFFSET CYCLE								
EVNT/ACTN PLN OFFSET CYCLE								
EVNT/ACTN PLN OFFSET CYCLE								
EVNT/ACTN PLN OFFSET CYCLE								

TIMING INSTALLED 03/06/23

PRE-EMPT ☒
COUNTDOWN PEDS ☒

REMARKS

Modified by HNTB for integration into CSCS

CSCS Deployment Note:
Conflict flash changed to red for all approaches.

Verify that cabinet flash is set to red for all phases and overlaps. Controller is now programmed to come out of startup into 6 seconds of steady red before cutting over to stop and go operation.

LESS FREQUENTLY USED FEATURES

WALK REST MODIFIER (Y, N) (Cycle Ped in Free)								
LEAD PEDESTRIAN INTERVAL								
RED MAX EXTENSION (Dilemma Zone Mitigation)								

FLASH HOURS:
23:00 to 06:00 DAILY ☒ NONE ☐

PHASE
1
2 NB/SB US-23 (Lake Street)
3
4 SEB M-55 (Hemlock Road)
5
6
7
8

VEHICLE OVERLAPS

Overlap Phase	Load Bay	Phases Overlapped	T.G. (s)	Y (s)	R (s)	FYA Phases Perm	FYA Phases Prot	Flash Daily	Flash Confl
=									
=									
=									
=									
=									
=									
=									
=									

CONTROLLER and FIRMWARE#
☒ Siemens (SEPAC) M60
☐ ECONOLITE (EOS)
☐ Other:

PREPARED BY: TGB
DATE: 12/16/22

LOCATION:
US-23 (Lake Street) @ M-55 (Hemlock Road)
CITY/TWP: Tawas City
COUNTY : Iosco

MILE POINT 0.00
CONTROL SECTION-SPOT # 35032-01-003

Job # (If Applicable):

CLEAR ALL

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NTCIP TRAFFIC SIGNAL TIMING PERMIT

PHASE	1	2	3	4	5	6	7	8
APPROACH		NB/SB		SEB				
MINIMUM GREEN		10		7				
PASSAGE		0.0		4.0				
MAXIMUM GREEN NO. 1		45		25				
MAXIMUM GREEN NO. 2		0		0				
YELLOW CLEARANCE		3.6		4.3				
ALL RED CLEARANCE		1.9		1.4				
WALK		7		7				
FLASHING DON'T WALK (FDW) CLEARANCE		18		14				
EXT PED CLR (EOG, EOY, 3.0s)		EOG		EOG				
START UP PHASE(S)	☐	☒	☐	☐	☐	☐	☐	☐
VEHICLE RECALL (NONE, MIN, MAX, SOFT)		MAX		NONE				
PEDESTRIAN RECALL (NONE, RECL, OTHR)		RECL		NONE				
DUAL ENTRY (Y, N)		N		N				
MODE (CRD, MIN, MAX, D-CRD, NOCRD)		CRD		NOCRD				
DAILY FLASH (Y, R, DK, NA)		Y		R				
CONFLICT FLASH (Y, R, DK)		R		R				
EVNT/ACTN PLN 1 OFFSET 15 CYCLE 70		45		25				
EVNT/ACTN PLN OFFSET CYCLE								
EVNT/ACTN PLN OFFSET CYCLE								
EVNT/ACTN PLN OFFSET CYCLE								
EVNT/ACTN PLN OFFSET CYCLE								
EVNT/ACTN PLN OFFSET CYCLE								

TIMING INSTALLED 03/06/23

PRE-EMPT ☒
COUNTDOWN PEDS ☒

REMARKS

Modified by HNTB for integration into CSCS

CSCS Deployment Note:
Conflict flash changed to red for all approaches.

Verify that cabinet flash is set to red for all phases and overlaps. Controller is now programmed to come out of startup into 6 seconds of steady red before cutting over to stop and go operation.

LESS FREQUENTLY USED FEATURES

WALK REST MODIFIER (Y, N) (Cycle Ped in Free)								
LEAD PEDESTRIAN INTERVAL								
RED MAX EXTENSION (Dilemma Zone Mitigation)								

FLASH HOURS:
23:00 to 06:00 DAILY ☒ NONE ☐

PHASE
1
2 NB/SB US-23 (Lake Street)
3
4 SEB M-55 (Hemlock Road)
5
6
7
8

VEHICLE OVERLAPS

Overlap Phase	Load Bay	Phases Overlapped	T.G. (s)	Y (s)	R (s)	FYA Phases Perm	FYA Phases Prot	Flash Daily	Flash Confl
=									
=									
=									
=									
=									
=									
=									
=									

CONTROLLER and FIRMWARE#
☒ Siemens (SEPAC) M60
☐ ECONOLITE (EOS)
☐ Other:

PREPARED BY: TGB
DATE: 12/16/22

LOCATION:
US-23 (Lake Street) @ M-55 (Hemlock Road)
CITY/TWP: Tawas City
COUNTY : Iosco

MILE POINT 0.00
CONTROL SECTION-SPOT # 35032-01-003

Job # (If Applicable):

CLEAR ALL

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Appendix C – 2024 Existing Year Synchro Reports & Mitigation

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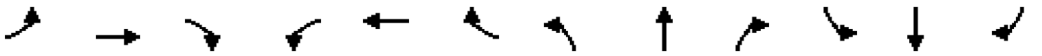

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	30	269	9	0	308	27	4	2	2	34	4	35
Future Volume (vph)	30	269	9	0	308	27	4	2	2	34	4	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.6	5.6		5.6			8.5			8.5	
Lane Util. Factor		0.95	1.00		0.95			1.00			1.00	
Frt		1.00	0.85		0.99			0.97			0.94	
Flt Protected		0.99	1.00		1.00			0.97			0.98	
Satd. Flow (prot)		3467	1615		3502			1793			1736	
Flt Permitted		0.89	1.00		1.00			0.78			0.84	
Satd. Flow (perm)		3108	1615		3502			1432			1499	
Peak-hour factor, PHF	0.92	0.92	0.92	0.88	0.88	0.88	0.60	0.60	0.60	0.73	0.73	0.73
Adj. Flow (vph)	33	292	10	0	350	31	7	3	3	47	5	48
RTOR Reduction (vph)	0	0	6	0	11	0	0	3	0	0	40	0
Lane Group Flow (vph)	0	325	4	0	370	0	0	10	0	0	60	0
Heavy Vehicles (%)	0%	4%	0%	0%	2%	0%	0%	0%	0%	0%	0%	0%
Turn Type	Perm	NA	Perm		NA		Perm	NA		Perm	NA	
Protected Phases		2			6			8			4	
Permitted Phases	2		2	6			8			4		
Actuated Green, G (s)		16.4	16.4		16.4			6.0			6.0	
Effective Green, g (s)		16.4	16.4		16.4			6.0			6.0	
Actuated g/C Ratio		0.45	0.45		0.45			0.16			0.16	
Clearance Time (s)		5.6	5.6		5.6			8.5			8.5	
Vehicle Extension (s)		3.0	3.0		3.0			3.0			3.0	
Lane Grp Cap (vph)		1396	725		1573			235			246	
v/s Ratio Prot					c0.11							
v/s Ratio Perm		0.10	0.00					0.01			c0.04	
v/c Ratio		0.23	0.01		0.24			0.04			0.24	
Uniform Delay, d1		6.2	5.5		6.2			12.8			13.3	
Progression Factor		1.00	1.00		1.00			1.00			1.00	
Incremental Delay, d2		0.1	0.0		0.1			0.1			0.5	
Delay (s)		6.3	5.6		6.3			12.9			13.8	
Level of Service		A	A		A			B			B	
Approach Delay (s/veh)		6.2			6.3			12.9			13.8	
Approach LOS		A			A			B			B	

Intersection Summary			
HCM 2000 Control Delay (s/veh)	7.3	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.24		
Actuated Cycle Length (s)	36.5	Sum of lost time (s)	14.1
Intersection Capacity Utilization	40.0%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

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Movement	SEL	SER	NEL	NET	SWT	SWR
Lane Configurations						
Traffic Volume (vph)	123	69	41	224	265	79
Future Volume (vph)	123	69	41	224	265	79
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.7	5.7		5.5	5.5	5.5
Lane Util. Factor	1.00	1.00		0.95	0.95	1.00
Frt	1.00	0.85		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.99	1.00	1.00
Satd. Flow (prot)	1752	1553		3468	3539	1599
Flt Permitted	0.95	1.00		0.88	1.00	1.00
Satd. Flow (perm)	1752	1553		3058	3539	1599
Peak-hour factor, PHF	0.86	0.86	0.85	0.85	0.95	0.95
Adj. Flow (vph)	143	80	48	264	279	83
RTOR Reduction (vph)	0	69	0	0	0	25
Lane Group Flow (vph)	143	11	0	312	279	58
Heavy Vehicles (%)	3%	4%	5%	3%	2%	1%
Turn Type	Prot	Perm	Perm	NA	NA	Perm
Protected Phases	4			2	2	
Permitted Phases		4	2			2
Actuated Green, G (s)	9.6	9.6		49.2	49.2	49.2
Effective Green, g (s)	9.6	9.6		49.2	49.2	49.2
Actuated g/C Ratio	0.14	0.14		0.70	0.70	0.70
Clearance Time (s)	5.7	5.7		5.5	5.5	5.5
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	240	212		2149	2487	1123
v/s Ratio Prot	c0.08				0.08	
v/s Ratio Perm		0.01		c0.10		0.04
v/c Ratio	0.60	0.05		0.15	0.11	0.05
Uniform Delay, d1	28.4	26.2		3.4	3.4	3.2
Progression Factor	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	3.9	0.1		0.1	0.1	0.1
Delay (s)	32.3	26.3		3.6	3.4	3.3
Level of Service	C	C		A	A	A
Approach Delay (s/veh)	30.2			3.6	3.4	
Approach LOS	C			A	A	

Intersection Summary			
HCM 2000 Control Delay (s/veh)	10.1	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.22		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	11.2
Intersection Capacity Utilization	37.4%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

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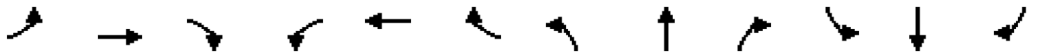

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	2	274	31	2	279	3	29	3	3	4	0	5
Future Volume (vph)	2	274	31	2	279	3	29	3	3	4	0	5
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.4	6.4	6.4	6.4	6.4		7.9	7.9		7.9	7.9	
Lane Util. Factor	1.00	1.00	1.00	1.00	0.95		1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00		1.00	0.93		1.00	0.85	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1805	1881	1615	1805	3570		1805	1758		1805	1615	
Flt Permitted	0.55	1.00	1.00	0.58	1.00		0.75	1.00		0.75	1.00	
Satd. Flow (perm)	1053	1881	1615	1105	3570		1431	1758		1430	1615	
Peak-hour factor, PHF	0.94	0.94	0.94	0.86	0.86	0.86	0.80	0.80	0.80	0.75	0.75	0.75
Adj. Flow (vph)	2	291	33	2	324	3	36	4	4	5	0	7
RTOR Reduction (vph)	0	0	12	0	1	0	0	3	0	0	6	0
Lane Group Flow (vph)	2	291	21	2	326	0	36	5	0	5	1	0
Heavy Vehicles (%)	0%	1%	0%	0%	1%	0%	0%	0%	0%	0%	0%	0%
Turn Type	Perm	NA	Perm	Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			2			4			4	
Permitted Phases	2		2	2			4			4		
Actuated Green, G (s)	44.6	44.6	44.6	44.6	44.6		11.1	11.1		11.1	11.1	
Effective Green, g (s)	44.6	44.6	44.6	44.6	44.6		11.1	11.1		11.1	11.1	
Actuated g/C Ratio	0.64	0.64	0.64	0.64	0.64		0.16	0.16		0.16	0.16	
Clearance Time (s)	6.4	6.4	6.4	6.4	6.4		7.9	7.9		7.9	7.9	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	670	1198	1028	704	2274		226	278		226	256	
v/s Ratio Prot		c0.15			0.09			0.00			0.00	
v/s Ratio Perm	0.00		0.01	0.00			c0.03			0.00		
v/c Ratio	0.00	0.24	0.02	0.00	0.14		0.16	0.02		0.02	0.00	
Uniform Delay, d1	4.6	5.5	4.7	4.6	5.1		25.4	24.8		24.9	24.8	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.0	0.5	0.0	0.0	0.1		0.3	0.0		0.0	0.0	
Delay (s)	4.6	5.9	4.7	4.6	5.2		25.8	24.9		24.9	24.8	
Level of Service	A	A	A	A	A		C	C		C	C	
Approach Delay (s/veh)		5.8			5.2			25.6			24.8	
Approach LOS		A			A			C			C	

Intersection Summary			
HCM 2000 Control Delay (s/veh)	7.1	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.23		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	14.3
Intersection Capacity Utilization	39.8%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

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Intersection	
Int Delay, s/veh	1.2

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	9	318	316	52	41	8
Future Vol, veh/h	9	318	316	52	41	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	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	91	91	88	88	64	64
Heavy Vehicles, %	0	2	1	0	2	13
Mvmt Flow	10	349	359	59	64	13

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	418	0	-	0	583	209
Stage 1	-	-	-	-	389	-
Stage 2	-	-	-	-	195	-
Critical Hdwy	4.1	-	-	-	6.84	7.16
Critical Hdwy Stg 1	-	-	-	-	5.84	-
Critical Hdwy Stg 2	-	-	-	-	5.84	-
Follow-up Hdwy	2.2	-	-	-	3.52	3.43
Pot Cap-1 Maneuver	1152	-	-	-	443	764
Stage 1	-	-	-	-	654	-
Stage 2	-	-	-	-	819	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1152	-	-	-	439	764
Mov Cap-2 Maneuver	-	-	-	-	524	-
Stage 1	-	-	-	-	649	-
Stage 2	-	-	-	-	819	-

Approach	EB	WB	SB
HCM Control Delay, s/v	0.22	0	12.33
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	1152	-	-	-	524	764
HCM Lane V/C Ratio	0.009	-	-	-	0.122	0.016
HCM Control Delay (s/veh)	8.2	-	-	-	12.8	9.8
HCM Lane LOS	A	-	-	-	B	A
HCM 95th %tile Q(veh)	0	-	-	-	0.4	0

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Intersection: 5: U.S. 23 & Dummy Node - Church St

Movement	EB	SB
Directions Served	LT	LR
Maximum Queue (ft)	49	65
Average Queue (ft)	12	29
95th Queue (ft)	40	53
Link Distance (ft)	354	482
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 13: U.S. 23 & Dummy Node - Matthews St

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 15: U.S. 23 & Dummy Node - Parking Lot

Movement	SE	SW
Directions Served	LR	R
Maximum Queue (ft)	38	42
Average Queue (ft)	14	2
95th Queue (ft)	35	18
Link Distance (ft)	49	201
Upstream Blk Time (%)	0	
Queuing Penalty (veh)	0	
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

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Intersection: 18: U.S. 23 & Dummy Node - Oak St

Movement	EB	SB
Directions Served	LT	LR
Maximum Queue (ft)	35	41
Average Queue (ft)	5	16
95th Queue (ft)	25	41
Link Distance (ft)	328	291
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 21: Dummy Node & U.S. 23

Movement	EB	EB	NB
Directions Served	T	TR	LR
Maximum Queue (ft)	11	4	48
Average Queue (ft)	0	0	15
95th Queue (ft)	8	3	35
Link Distance (ft)	870	870	163
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 24: U.S. 23

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

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Intersection: 26: U.S. 23

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 28: U.S. 23

Movement	NE	SW
Directions Served	T	T
Maximum Queue (ft)	11	4
Average Queue (ft)	0	0
95th Queue (ft)	8	0
Link Distance (ft)	554	47
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 30: U.S. 23

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

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Intersection: 33: U.S. 23 & Dummy Node - Wadsworth

Movement	SB
Directions Served	LR
Maximum Queue (ft)	58
Average Queue (ft)	27
95th Queue (ft)	53
Link Distance (ft)	480
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 36: Dummy Node - Driveway & U.S. 23

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 38: U.S. 23 & Dummy Node - Pine St

Movement	SB
Directions Served	LR
Maximum Queue (ft)	59
Average Queue (ft)	26
95th Queue (ft)	53
Link Distance (ft)	233
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

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Intersection: 40: U.S. 23 & Dummy Node - Beech Street

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 42: U.S. 23 & Dummy Node - Rite Aid

Movement	SE	NE
Directions Served	LR	LT
Maximum Queue (ft)	61	43
Average Queue (ft)	24	10
95th Queue (ft)	51	36
Link Distance (ft)	79	47
Upstream Blk Time (%)	0	0
Queuing Penalty (veh)	0	0
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 1001: Newman St & U.S. 23

Movement	EB	EB	EB	WB	WB	NB	SB
Directions Served	LT	T	R	LT	TR	LTR	LTR
Maximum Queue (ft)	71	78	25	61	80	21	66
Average Queue (ft)	29	27	2	25	28	4	29
95th Queue (ft)	63	64	14	57	69	18	51
Link Distance (ft)	594	594		1262	1262	245	500
Upstream Blk Time (%)							
Queuing Penalty (veh)							
Storage Bay Dist (ft)			50				
Storage Blk Time (%)		2	0				
Queuing Penalty (veh)		0	0				

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Intersection: 1003: U.S. 23 & Hemlock Rd

Movement	SE	SE	NE	NE	SW	SW	SW
Directions Served	L	R	LT	T	T	T	R
Maximum Queue (ft)	136	49	85	90	81	69	51
Average Queue (ft)	70	20	31	23	25	13	15
95th Queue (ft)	119	40	68	65	63	47	44
Link Distance (ft)	1258	1258	183	183	669	669	
Upstream Blk Time (%)							
Queuing Penalty (veh)							
Storage Bay Dist (ft)							115
Storage Blk Time (%)							
Queuing Penalty (veh)							

Intersection: 1010: Tawas Beach Rd & U.S. 23

Movement	EB	EB	EB	WB	WB	WB	NB	NB	SB	SB
Directions Served	L	T	R	L	T	TR	L	TR	L	TR
Maximum Queue (ft)	21	142	23	22	73	74	84	40	27	23
Average Queue (ft)	2	62	4	1	34	22	30	6	5	3
95th Queue (ft)	12	132	18	10	66	60	73	25	20	16
Link Distance (ft)		644			309	309	98	98		860
Upstream Blk Time (%)							1			
Queuing Penalty (veh)							0			
Storage Bay Dist (ft)	150		240	230					50	
Storage Blk Time (%)		0								
Queuing Penalty (veh)		0								

Intersection: 9001: U.S. 23 & Roundhouse St

Movement	EB	WB	SB	SB
Directions Served	L	TR	L	R
Maximum Queue (ft)	24	10	64	48
Average Queue (ft)	2	0	25	9
95th Queue (ft)	15	6	52	35
Link Distance (ft)		418	654	654
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)	150			
Storage Blk Time (%)				
Queuing Penalty (veh)				

Network Summary

Network wide Queuing Penalty: 1

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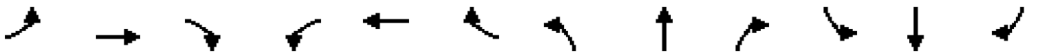

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	51	463	16	9	597	60	12	7	8	56	14	59
Future Volume (vph)	51	463	16	9	597	60	12	7	8	56	14	59
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.6	5.6		5.6			8.5			8.5	
Lane Util. Factor		0.95	1.00		0.95			1.00			1.00	
Frt		1.00	0.85		0.99			0.96			0.94	
Flt Protected		1.00	1.00		1.00			0.98			0.98	
Satd. Flow (prot)		3560	1615		3527			1782			1745	
Flt Permitted		0.84	1.00		0.95			0.79			0.84	
Satd. Flow (perm)		2997	1615		3340			1431			1501	
Peak-hour factor, PHF	0.94	0.94	0.94	0.95	0.95	0.95	0.75	0.75	0.75	0.85	0.85	0.85
Adj. Flow (vph)	54	493	17	9	628	63	16	9	11	66	16	69
RTOR Reduction (vph)	0	0	9	0	12	0	0	9	0	0	49	0
Lane Group Flow (vph)	0	547	8	0	688	0	0	27	0	0	102	0
Heavy Vehicles (%)	0%	1%	0%	0%	1%	0%	0%	0%	0%	0%	0%	0%
Turn Type	Perm	NA	Perm	Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			6			8			4	
Permitted Phases	2		2	6			8			4		
Actuated Green, G (s)		17.7	17.7		17.7			6.8			6.8	
Effective Green, g (s)		17.7	17.7		17.7			6.8			6.8	
Actuated g/C Ratio		0.46	0.46		0.46			0.18			0.18	
Clearance Time (s)		5.6	5.6		5.6			8.5			8.5	
Vehicle Extension (s)		3.0	3.0		3.0			3.0			3.0	
Lane Grp Cap (vph)		1374	740		1531			252			264	
v/s Ratio Prot												
v/s Ratio Perm		0.18	0.00		c0.21			0.02			c0.07	
v/c Ratio		0.40	0.01		0.45			0.11			0.39	
Uniform Delay, d1		6.9	5.7		7.1			13.4			14.1	
Progression Factor		1.00	1.00		1.00			1.00			1.00	
Incremental Delay, d2		0.2	0.0		0.2			0.2			0.9	
Delay (s)		7.1	5.7		7.3			13.5			15.0	
Level of Service		A	A		A			B			B	
Approach Delay (s/veh)		7.1			7.3			13.5			15.0	
Approach LOS		A			A			B			B	

Intersection Summary			
HCM 2000 Control Delay (s/veh)	8.2	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.43		
Actuated Cycle Length (s)	38.6	Sum of lost time (s)	14.1
Intersection Capacity Utilization	58.8%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

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Movement	SEL	SER	NEL	NET	SWT	SWR
Lane Configurations						
Traffic Volume (vph)	185	83	70	396	529	172
Future Volume (vph)	185	83	70	396	529	172
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.7	5.7		5.5	5.5	5.5
Lane Util. Factor	1.00	1.00		0.95	0.95	1.00
Frt	1.00	0.85		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.99	1.00	1.00
Satd. Flow (prot)	1787	1538		3553	3574	1615
Flt Permitted	0.95	1.00		0.79	1.00	1.00
Satd. Flow (perm)	1787	1538		2815	3574	1615
Peak-hour factor, PHF	0.88	0.88	0.84	0.84	0.86	0.86
Adj. Flow (vph)	210	94	83	471	615	200
RTOR Reduction (vph)	0	76	0	0	0	70
Lane Group Flow (vph)	210	18	0	554	615	130
Heavy Vehicles (%)	1%	5%	0%	1%	1%	0%
Turn Type	Prot	Perm	Perm	NA	NA	Perm
Protected Phases	4			2	2	
Permitted Phases		4	2			2
Actuated Green, G (s)	13.4	13.4		45.4	45.4	45.4
Effective Green, g (s)	13.4	13.4		45.4	45.4	45.4
Actuated g/C Ratio	0.19	0.19		0.65	0.65	0.65
Clearance Time (s)	5.7	5.7		5.5	5.5	5.5
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	342	294		1825	2317	1047
v/s Ratio Prot	c0.12				0.17	
v/s Ratio Perm		0.01		c0.20		0.08
v/c Ratio	0.61	0.06		0.30	0.27	0.12
Uniform Delay, d1	25.9	23.2		5.4	5.2	4.7
Progression Factor	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	3.3	0.1		0.4	0.3	0.2
Delay (s)	29.2	23.2		5.8	5.5	4.9
Level of Service	C	C		A	A	A
Approach Delay (s/veh)	27.3			5.8	5.4	
Approach LOS	C			A	A	

Intersection Summary			
HCM 2000 Control Delay (s/veh)	9.5	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.37		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	11.2
Intersection Capacity Utilization	51.8%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

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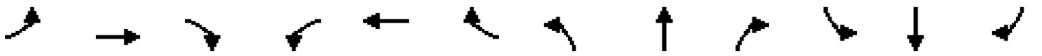

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	7	437	75	8	541	13	88	7	3	17	5	3
Future Volume (vph)	7	437	75	8	541	13	88	7	3	17	5	3
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.4	6.4	6.4	6.4	6.4		7.9	7.9		7.9	7.9	
Lane Util. Factor	1.00	1.00	1.00	1.00	0.95		1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00		1.00	0.95		1.00	0.94	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1805	1863	1615	1805	3562		1805	1812		1805	1790	
Flt Permitted	0.41	1.00	1.00	0.47	1.00		0.75	1.00		0.75	1.00	
Satd. Flow (perm)	779	1863	1615	884	3562		1423	1812		1423	1790	
Peak-hour factor, PHF	0.93	0.93	0.93	0.87	0.87	0.87	0.82	0.82	0.82	0.60	0.60	0.60
Adj. Flow (vph)	8	470	81	9	622	15	107	9	4	28	8	5
RTOR Reduction (vph)	0	0	29	0	3	0	0	3	0	0	4	0
Lane Group Flow (vph)	8	470	52	9	634	0	107	10	0	28	9	0
Heavy Vehicles (%)	0%	2%	0%	0%	1%	0%	0%	0%	0%	0%	0%	0%
Turn Type	Perm	NA	Perm	Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			2			4			4	
Permitted Phases	2		2	2			4			4		
Actuated Green, G (s)	44.6	44.6	44.6	44.6	44.6		11.1	11.1		11.1	11.1	
Effective Green, g (s)	44.6	44.6	44.6	44.6	44.6		11.1	11.1		11.1	11.1	
Actuated g/C Ratio	0.64	0.64	0.64	0.64	0.64		0.16	0.16		0.16	0.16	
Clearance Time (s)	6.4	6.4	6.4	6.4	6.4		7.9	7.9		7.9	7.9	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	496	1186	1028	563	2269		225	287		225	283	
v/s Ratio Prot		c0.25			0.18			0.01			0.00	
v/s Ratio Perm	0.01		0.03	0.01			c0.08			0.02		
v/c Ratio	0.02	0.40	0.05	0.02	0.28		0.48	0.03		0.12	0.03	
Uniform Delay, d1	4.7	6.2	4.8	4.7	5.6		26.8	24.9		25.3	24.9	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.1	1.0	0.1	0.1	0.3		1.6	0.0		0.2	0.0	
Delay (s)	4.7	7.2	4.9	4.7	5.9		28.4	25.0		25.5	24.9	
Level of Service	A	A	A	A	A		C	C		C	C	
Approach Delay (s/veh)		6.8			5.9			28.0			25.3	
Approach LOS		A			A			C			C	

Intersection Summary			
HCM 2000 Control Delay (s/veh)	8.8	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.41		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	14.3
Intersection Capacity Utilization	46.5%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

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Intersection	
Int Delay, s/veh	2

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	35	494	591	173	87	19
Future Vol, veh/h	35	494	591	173	87	19
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	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	94	94	91	91	78	78
Heavy Vehicles, %	3	1	1	0	1	5
Mvmt Flow	37	526	649	190	112	24

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	840	0	-	0	1082	420
Stage 1	-	-	-	-	745	-
Stage 2	-	-	-	-	337	-
Critical Hdwy	4.16	-	-	-	6.82	7
Critical Hdwy Stg 1	-	-	-	-	5.82	-
Critical Hdwy Stg 2	-	-	-	-	5.82	-
Follow-up Hdwy	2.23	-	-	-	3.51	3.35
Pot Cap-1 Maneuver	785	-	-	-	214	574
Stage 1	-	-	-	-	433	-
Stage 2	-	-	-	-	698	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	785	-	-	-	204	574
Mov Cap-2 Maneuver	-	-	-	-	320	-
Stage 1	-	-	-	-	412	-
Stage 2	-	-	-	-	698	-

Approach	EB	WB	SB
HCM Control Delay, s/v	0.65	0	20.26
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	785	-	-	-	320	574
HCM Lane V/C Ratio	0.047	-	-	-	0.349	0.042
HCM Control Delay (s/veh)	9.8	-	-	-	22.2	11.6
HCM Lane LOS	A	-	-	-	C	B
HCM 95th %tile Q(veh)	0.1	-	-	-	1.5	0.1

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Intersection: 4: U.S. 23 & Roundhouse St

Movement	EB	WB	WB	SB	SB
Directions Served	L	T	TR	L	R
Maximum Queue (ft)	49	5	13	114	48
Average Queue (ft)	17	0	1	42	15
95th Queue (ft)	46	4	7	81	40
Link Distance (ft)		418	418	654	654
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)	150				
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 5: U.S. 23 & Dummy Node - Church St

Movement	SB
Directions Served	LR
Maximum Queue (ft)	80
Average Queue (ft)	36
95th Queue (ft)	60
Link Distance (ft)	482
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 13: U.S. 23 & Dummy Node - Matthews St

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

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Intersection: 15: U.S. 23 & Dummy Node - Parking Lot

Movement	SE	SW
Directions Served	LR	R
Maximum Queue (ft)	64	16
Average Queue (ft)	30	1
95th Queue (ft)	56	9
Link Distance (ft)	49	201
Upstream Blk Time (%)	3	
Queuing Penalty (veh)	0	
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 18: U.S. 23 & Dummy Node - Oak St

Movement	EB	SB
Directions Served	LT	LR
Maximum Queue (ft)	45	65
Average Queue (ft)	11	33
95th Queue (ft)	39	54
Link Distance (ft)	328	291
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 21: Dummy Node & U.S. 23

Movement	EB	EB	NB
Directions Served	T	TR	LR
Maximum Queue (ft)	28	33	90
Average Queue (ft)	2	1	30
95th Queue (ft)	18	15	63
Link Distance (ft)	870	870	163
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

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Intersection: 24: U.S. 23

Movement	
Directions Served	
Maximum Queue (ft)	
Average Queue (ft)	
95th Queue (ft)	
Link Distance (ft)	
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 26: U.S. 23

Movement	
Directions Served	
Maximum Queue (ft)	
Average Queue (ft)	
95th Queue (ft)	
Link Distance (ft)	
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 28: U.S. 23

Movement	NE
Directions Served	T
Maximum Queue (ft)	32
Average Queue (ft)	2
95th Queue (ft)	18
Link Distance (ft)	554
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

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Intersection: 30: U.S. 23

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 33: U.S. 23 & Dummy Node - Wadsworth

Movement	WB	SB
Directions Served	TR	LR
Maximum Queue (ft)	7	57
Average Queue (ft)	0	19
95th Queue (ft)	5	47
Link Distance (ft)	1286	480
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 36: Dummy Node - Driveway & U.S. 23

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

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Intersection: 38: U.S. 23 & Dummy Node - Pine St

Movement	SB
Directions Served	LR
Maximum Queue (ft)	38
Average Queue (ft)	14
95th Queue (ft)	38
Link Distance (ft)	233
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 40: U.S. 23 & Dummy Node - Beech Street

Movement	EB	WB
Directions Served	LT	T
Maximum Queue (ft)	56	4
Average Queue (ft)	12	0
95th Queue (ft)	42	3
Link Distance (ft)	669	328
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 42: U.S. 23 & Dummy Node - Rite Aid

Movement	SE	NE	SW	SW
Directions Served	LR	LT	T	TR
Maximum Queue (ft)	49	54	16	4
Average Queue (ft)	21	12	1	0
95th Queue (ft)	47	44	11	3
Link Distance (ft)	79	47	183	183
Upstream Blk Time (%)	0	1		
Queuing Penalty (veh)	0	2		
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

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Intersection: 1001: Newman St & U.S. 23

Movement	EB	EB	EB	WB	WB	NB	SB
Directions Served	LT	T	R	LT	TR	LTR	LTR
Maximum Queue (ft)	109	107	35	134	142	44	91
Average Queue (ft)	50	52	3	56	67	11	41
95th Queue (ft)	88	95	18	105	121	32	72
Link Distance (ft)	594	594		1262	1262	245	500
Upstream Blk Time (%)							
Queuing Penalty (veh)							
Storage Bay Dist (ft)			50				
Storage Blk Time (%)		7	0				
Queuing Penalty (veh)		1	0				

Intersection: 1003: U.S. 23 & Hemlock Rd

Movement	SE	SE	NE	NE	SW	SW	SW
Directions Served	L	R	LT	T	T	T	R
Maximum Queue (ft)	175	62	118	112	155	94	59
Average Queue (ft)	86	25	56	45	67	27	28
95th Queue (ft)	144	50	103	95	127	72	56
Link Distance (ft)	1258	1258	183	183	669	669	
Upstream Blk Time (%)							
Queuing Penalty (veh)							
Storage Bay Dist (ft)							115
Storage Blk Time (%)						0	
Queuing Penalty (veh)						0	

Intersection: 1010: Tawas Beach Rd & U.S. 23

Movement	EB	EB	EB	WB	WB	WB	NB	NB	SB	SB
Directions Served	L	T	R	L	T	TR	L	TR	L	TR
Maximum Queue (ft)	33	232	43	33	148	157	113	40	53	31
Average Queue (ft)	4	83	11	6	58	57	66	6	12	5
95th Queue (ft)	20	172	33	25	109	120	119	26	39	22
Link Distance (ft)		644			309	309	98	98		860
Upstream Blk Time (%)							8			
Queuing Penalty (veh)							0			
Storage Bay Dist (ft)	150		240	230					50	
Storage Blk Time (%)		1							3	0
Queuing Penalty (veh)		1							0	0

Network Summary

Network wide Queuing Penalty: 5

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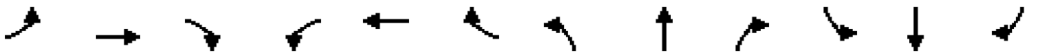

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	91	579	27	13	654	57	14	9	5	86	9	81
Future Volume (vph)	91	579	27	13	654	57	14	9	5	86	9	81
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.6	5.6		5.6			8.5			8.5	
Lane Util. Factor		0.95	1.00		0.95			1.00			1.00	
Frt		1.00	0.85		0.99			0.98			0.94	
Flt Protected		0.99	1.00		1.00			0.98			0.98	
Satd. Flow (prot)		3586	1615		3564			1810			1739	
Flt Permitted		0.76	1.00		0.94			0.75			0.83	
Satd. Flow (perm)		2736	1615		3346			1383			1470	
Peak-hour factor, PHF	0.95	0.95	0.95	0.94	0.94	0.94	0.70	0.70	0.70	0.92	0.92	0.92
Adj. Flow (vph)	96	609	28	14	696	61	20	13	7	93	10	88
RTOR Reduction (vph)	0	0	15	0	11	0	0	5	0	0	47	0
Lane Group Flow (vph)	0	705	13	0	760	0	0	35	0	0	144	0
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Turn Type	Perm	NA	Perm	Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			6			8			4	
Permitted Phases	2		2	6			8			4		
Actuated Green, G (s)		20.9	20.9		20.9			10.0			10.0	
Effective Green, g (s)		20.9	20.9		20.9			10.0			10.0	
Actuated g/C Ratio		0.46	0.46		0.46			0.22			0.22	
Clearance Time (s)		5.6	5.6		5.6			8.5			8.5	
Vehicle Extension (s)		3.0	3.0		3.0			3.0			3.0	
Lane Grp Cap (vph)		1270	750		1554			307			326	
v/s Ratio Prot												
v/s Ratio Perm		c0.26	0.01		0.23			0.02			c0.10	
v/c Ratio		0.56	0.02		0.49			0.11			0.44	
Uniform Delay, d1		8.7	6.5		8.4			14.0			15.1	
Progression Factor		1.00	1.00		1.00			1.00			1.00	
Incremental Delay, d2		0.5	0.0		0.2			0.2			1.0	
Delay (s)		9.2	6.5		8.6			14.1			16.1	
Level of Service		A	A		A			B			B	
Approach Delay (s/veh)		9.1			8.6			14.1			16.1	
Approach LOS		A			A			B			B	

Intersection Summary			
HCM 2000 Control Delay (s/veh)	9.8	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.52		
Actuated Cycle Length (s)	45.0	Sum of lost time (s)	14.1
Intersection Capacity Utilization	68.0%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

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Movement	SEL	SER	NEL	NET	SWT	SWR
Lane Configurations						
Traffic Volume (vph)	223	119	90	685	547	151
Future Volume (vph)	223	119	90	685	547	151
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.7	5.7		5.5	5.5	5.5
Lane Util. Factor	1.00	1.00		0.95	0.95	1.00
Frt	1.00	0.85		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.99	1.00	1.00
Satd. Flow (prot)	1805	1615		3589	3610	1615
Flt Permitted	0.95	1.00		0.81	1.00	1.00
Satd. Flow (perm)	1805	1615		2908	3610	1615
Peak-hour factor, PHF	0.83	0.83	0.87	0.87	0.95	0.95
Adj. Flow (vph)	269	143	103	787	576	159
RTOR Reduction (vph)	0	112	0	0	0	60
Lane Group Flow (vph)	269	31	0	890	576	99
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%
Turn Type	Prot	Perm	Perm	NA	NA	Perm
Protected Phases	4			2	2	
Permitted Phases		4	2			2
Actuated Green, G (s)	15.2	15.2		43.6	43.6	43.6
Effective Green, g (s)	15.2	15.2		43.6	43.6	43.6
Actuated g/C Ratio	0.22	0.22		0.62	0.62	0.62
Clearance Time (s)	5.7	5.7		5.5	5.5	5.5
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	391	350		1811	2248	1005
v/s Ratio Prot	c0.15				0.16	
v/s Ratio Perm		0.02		c0.31		0.06
v/c Ratio	0.69	0.09		0.49	0.26	0.10
Uniform Delay, d1	25.2	21.9		7.2	5.9	5.3
Progression Factor	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	5.0	0.1		1.0	0.3	0.2
Delay (s)	30.2	22.0		8.1	6.2	5.5
Level of Service	C	C		A	A	A
Approach Delay (s/veh)	27.3			8.1	6.0	
Approach LOS	C			A	A	

Intersection Summary			
HCM 2000 Control Delay (s/veh)	11.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.54		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	11.2
Intersection Capacity Utilization	62.9%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

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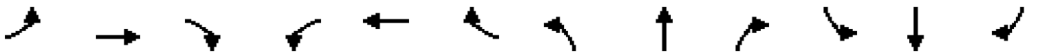

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	10	521	96	15	597	18	80	10	12	29	16	8
Future Volume (vph)	10	521	96	15	597	18	80	10	12	29	16	8
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.4	6.4	6.4	6.4	6.4		7.9	7.9		7.9	7.9	
Lane Util. Factor	1.00	1.00	1.00	1.00	0.95		1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00		1.00	0.92		1.00	0.95	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1805	1881	1615	1805	3560		1805	1747		1805	1802	
Flt Permitted	0.39	1.00	1.00	0.40	1.00		0.74	1.00		0.74	1.00	
Satd. Flow (perm)	732	1881	1615	765	3560		1403	1747		1404	1802	
Peak-hour factor, PHF	0.93	0.93	0.93	0.88	0.88	0.88	0.80	0.80	0.80	0.83	0.83	0.83
Adj. Flow (vph)	11	560	103	17	678	20	100	12	15	35	19	10
RTOR Reduction (vph)	0	0	37	0	3	0	0	13	0	0	8	0
Lane Group Flow (vph)	11	560	66	17	695	0	100	15	0	35	21	0
Heavy Vehicles (%)	0%	1%	0%	0%	1%	0%	0%	0%	0%	0%	0%	0%
Turn Type	Perm	NA	Perm	Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			2			4			4	
Permitted Phases	2		2	2			4			4		
Actuated Green, G (s)	44.6	44.6	44.6	44.6	44.6		11.1	11.1		11.1	11.1	
Effective Green, g (s)	44.6	44.6	44.6	44.6	44.6		11.1	11.1		11.1	11.1	
Actuated g/C Ratio	0.64	0.64	0.64	0.64	0.64		0.16	0.16		0.16	0.16	
Clearance Time (s)	6.4	6.4	6.4	6.4	6.4		7.9	7.9		7.9	7.9	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	466	1198	1028	487	2268		222	277		222	285	
v/s Ratio Prot		c0.30			0.20			0.01			0.01	
v/s Ratio Perm	0.02		0.04	0.02			c0.07			0.02		
v/c Ratio	0.02	0.47	0.06	0.03	0.31		0.45	0.06		0.16	0.07	
Uniform Delay, d1	4.7	6.6	4.8	4.7	5.7		26.7	25.0		25.4	25.1	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.1	1.3	0.1	0.1	0.4		1.5	0.1		0.3	0.1	
Delay (s)	4.8	7.9	4.9	4.8	6.1		28.1	25.1		25.7	25.2	
Level of Service	A	A	A	A	A		C	C		C	C	
Approach Delay (s/veh)		7.4			6.0			27.5			25.5	
Approach LOS		A			A			C			C	

Intersection Summary			
HCM 2000 Control Delay (s/veh)	9.1	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.46		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	14.3
Intersection Capacity Utilization	50.4%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

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Intersection	
Int Delay, s/veh	2.9

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	48	784	579	193	117	45
Future Vol, veh/h	48	784	579	193	117	45
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	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	79	79
Heavy Vehicles, %	2	0	1	0	0	0
Mvmt Flow	52	852	629	210	148	57

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	839	0	-	0	1265	420
Stage 1	-	-	-	-	734	-
Stage 2	-	-	-	-	530	-
Critical Hdwy	4.14	-	-	-	6.8	6.9
Critical Hdwy Stg 1	-	-	-	-	5.8	-
Critical Hdwy Stg 2	-	-	-	-	5.8	-
Follow-up Hdwy	2.22	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	791	-	-	-	164	588
Stage 1	-	-	-	-	441	-
Stage 2	-	-	-	-	560	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	791	-	-	-	153	588
Mov Cap-2 Maneuver	-	-	-	-	284	-
Stage 1	-	-	-	-	412	-
Stage 2	-	-	-	-	560	-

Approach	EB	WB	SB
HCM Control Delay, s/v	0.57	0	25.43
HCM LOS			D

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	791	-	-	-	284	588
HCM Lane V/C Ratio	0.066	-	-	-	0.521	0.097
HCM Control Delay (s/veh)	9.9	-	-	-	30.7	11.8
HCM Lane LOS	A	-	-	-	D	B
HCM 95th %tile Q(veh)	0.2	-	-	-	2.8	0.3

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Intersection: 4: U.S. 23 & Roundhouse St

Movement	EB	WB	SB	SB
Directions Served	L	TR	L	R
Maximum Queue (ft)	65	30	142	45
Average Queue (ft)	22	3	53	22
95th Queue (ft)	52	16	103	42
Link Distance (ft)		418	654	654
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)	150			
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 5: U.S. 23 & Dummy Node - Church St

Movement	EB	EB	SB
Directions Served	LT	T	LR
Maximum Queue (ft)	111	31	64
Average Queue (ft)	37	1	19
95th Queue (ft)	81	18	48
Link Distance (ft)	354	354	482
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 6: U.S. 23

Movement	WB	WB
Directions Served	LT	T
Maximum Queue (ft)	81	18
Average Queue (ft)	33	1
95th Queue (ft)	63	13
Link Distance (ft)	628	628
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

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Intersection: 13: U.S. 23 & Dummy Node - Matthews St

Movement	
Directions Served	
Maximum Queue (ft)	
Average Queue (ft)	
95th Queue (ft)	
Link Distance (ft)	
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 15: U.S. 23 & Dummy Node - Parking Lot

Movement	SE	NE	SW
Directions Served	LR	L	R
Maximum Queue (ft)	69	50	17
Average Queue (ft)	36	16	1
95th Queue (ft)	67	44	9
Link Distance (ft)	49		201
Upstream Blk Time (%)	11		
Queuing Penalty (veh)	0		
Storage Bay Dist (ft)		100	
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 18: U.S. 23 & Dummy Node - Oak St

Movement	EB	SB
Directions Served	LT	LR
Maximum Queue (ft)	66	59
Average Queue (ft)	16	34
95th Queue (ft)	48	53
Link Distance (ft)	328	291
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

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Intersection: 21: Dummy Node & U.S. 23

Movement	EB	EB	WB	WB	NB
Directions Served	T	TR	LT	T	LR
Maximum Queue (ft)	12	18	96	49	90
Average Queue (ft)	1	1	36	2	42
95th Queue (ft)	9	9	80	23	75
Link Distance (ft)	628	628	644	644	163
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 24: U.S. 23

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 26: U.S. 23

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

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Intersection: 28: U.S. 23

Movement	NE
Directions Served	T
Maximum Queue (ft)	3
Average Queue (ft)	0
95th Queue (ft)	2
Link Distance (ft)	554
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 30: U.S. 23

Movement	EB
Directions Served	T
Maximum Queue (ft)	8
Average Queue (ft)	0
95th Queue (ft)	6
Link Distance (ft)	604
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 33: U.S. 23 & Dummy Node - Wadsworth

Movement	EB	SB
Directions Served	LT	LTR
Maximum Queue (ft)	76	139
Average Queue (ft)	24	66
95th Queue (ft)	61	114
Link Distance (ft)	1256	480
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

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Intersection: 36: Dummy Node - Driveway & U.S. 23

Movement	EB	WB
Directions Served	TR	LT
Maximum Queue (ft)	5	27
Average Queue (ft)	0	1
95th Queue (ft)	4	14
Link Distance (ft)	337	354
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 38: U.S. 23 & Dummy Node - Pine St

Movement	EB	WB	SB
Directions Served	LT	TR	LR
Maximum Queue (ft)	61	4	31
Average Queue (ft)	13	0	8
95th Queue (ft)	44	3	30
Link Distance (ft)	807	604	233
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 40: U.S. 23 & Dummy Node - Beech Street

Movement	EB
Directions Served	LT
Maximum Queue (ft)	62
Average Queue (ft)	19
95th Queue (ft)	57
Link Distance (ft)	669
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

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Intersection: 42: U.S. 23 & Dummy Node - Rite Aid

Movement	SE	NE	SW
Directions Served	LR	LT	T
Maximum Queue (ft)	50	66	3
Average Queue (ft)	19	9	0
95th Queue (ft)	45	39	2
Link Distance (ft)	79	47	183
Upstream Blk Time (%)		1	
Queuing Penalty (veh)		2	
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 1001: Newman St & U.S. 23

Movement	EB	EB	EB	WB	WB	NB	SB
Directions Served	LT	T	R	LT	TR	LTR	LTR
Maximum Queue (ft)	142	143	45	118	134	44	144
Average Queue (ft)	73	70	8	58	71	13	65
95th Queue (ft)	121	121	31	97	112	34	112
Link Distance (ft)	594	594		1256	1256	245	500
Upstream Blk Time (%)							
Queuing Penalty (veh)							
Storage Bay Dist (ft)			50				
Storage Blk Time (%)		12	0				
Queuing Penalty (veh)		3	0				

Intersection: 1003: U.S. 23 & Hemlock Rd

Movement	SE	SE	NE	NE	SW	SW	SW
Directions Served	L	R	LT	T	T	T	R
Maximum Queue (ft)	215	52	140	165	143	110	63
Average Queue (ft)	104	25	77	79	69	34	26
95th Queue (ft)	182	45	130	143	122	81	54
Link Distance (ft)	1258	1258	183	183	669	669	
Upstream Blk Time (%)				0			
Queuing Penalty (veh)				0			
Storage Bay Dist (ft)							115
Storage Blk Time (%)						0	
Queuing Penalty (veh)						0	

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Intersection: 1010: Tawas Beach Rd & U.S. 23

Movement	EB	EB	EB	WB	WB	WB	NB	NB	SB	SB
Directions Served	L	T	R	L	T	TR	L	TR	L	TR
Maximum Queue (ft)	31	238	43	38	161	148	113	57	61	60
Average Queue (ft)	5	94	12	9	74	56	65	13	23	14
95th Queue (ft)	22	185	33	31	135	115	118	41	54	41
Link Distance (ft)		644			309	309	98	98		860
Upstream Blk Time (%)							9			
Queuing Penalty (veh)							0			
Storage Bay Dist (ft)	150		240	230					50	
Storage Blk Time (%)		2							7	2
Queuing Penalty (veh)		2							2	1

Network Summary

Network wide Queuing Penalty: 10

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Summary of Warrants

Spot Number:	0		
Major Street:	US-23	Minor Street:	Roundhouse
Intersection:	US-23 at Roundhouse		
City/Twp:	Tawas City		
Date Performed:	12/9/2024	Performed By:	VAF
Date Volumes Collected:	7/9/2024		

Warrant	Condition	Is Warrant Met
#REF!		**NO**
WARRANT 1: Eight-Hour Vehicular Volume		**YES**
	Condition A	NO
	Condition B	YES
	Condition A&B	NO
WARRANT 2: Four-Hour Vehicular Volume	(70%)	**YES**
WARRANT 3: Peak-Hour Vehicular Volume	(70%)	**YES**
	Condition A	**N/A**
	Condition B	**YES**
WARRANT 4: Pedestrian Volume	(70%)	**NO**
	Four Hour	NO
	Peak Hour	NO
(Threshold)	HAWK	NO
(Threshold)	RRFB	NO
WARRANT 5: School Crossing		**NO**
WARRANT 6: Coordinated Signal System		**NO**
WARRANT 7: Crash Experience		**YES**
	Condition A	NO
	Condition B	YES
WARRANT 8: Roadway Network		**NO**
WARRANT 9: Intersection Near a Grade Crossing		**#N/A**

Issue to Be Addressed by Signalization:

Crash pattern and reduce delay.

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Michigan Manual of Uniform Traffic Control Devices
Worksheet for Signal Warrants (Section 4C)
WARRANT 1: Eight-Hour Vehicular Volume

Intersection:	US-23 @ Roundhouse		
Date	12/9/2024	by	VAF

2	**: No. of Lanes on Major St?**
2	**: No. of Lanes on Minor St?**
35	**: Speed limit or 85th Percentile? (MPH)**
YES	**: Is the intersection within an Isolated community?**
1834	**: if answer 4 is Yes, then what is the of the population isolated community?**
YES	**: Have other remedial measures been tried?**

USE 70% FOR WARRANTS 1A AND 1B. USE 56% FOR WARRANT 1A&B

	Major Volume (Both Apr.)	Minor Volume (One Apr.)	Condition A Major Volume	Condition A Minor Volume	Warrant Condition A Met?	Condition B Major Volume	Condition B Minor Volume	Warrant Condition B Met?	Combination Major A	Combination Minor A	Combination Major B	Combination Minor B	Warrant Condition A&B met?	
Time	**N-S**	E-W												
00:01 - 01:00	38	2	420	140	**NO**	630	70	**NO**	336	112	504	56	**NO**	
01:00 - 02:00	31	4	420	140	**NO**	630	70	**NO**	336	112	504	56	**NO**	
02:00 - 03:00	35	3	420	140	**NO**	630	70	**NO**	336	112	504	56	**NO**	
03:00 - 04:00	23	0	420	140	**NO**	630	70	**NO**	336	112	504	56	**NO**	
04:00 - 05:00	121	5	420	140	**NO**	630	70	**NO**	336	112	504	56	**NO**	
05:00 - 06:00	175	15	420	140	**NO**	630	70	**NO**	336	112	504	56	**NO**	
06:00 - 07:00	403	26	420	140	**NO**	630	70	**NO**	336	112	504	56	**NO**	
07:00 - 08:00	549	40	420	140	**NO**	630	70	**NO**	336	112	504	56	**NO**	
08:00 - 09:00	697	53	420	140	**NO**	630	70	**NO**	336	112	504	56	**NO**	
09:00 - 10:00	887	75	420	140	**NO**	630	70	**YES**	336	112	504	56	**NO**	
10:00 - 11:00	1094	98	420	140	**NO**	630	70	**YES**	336	112	504	56	**NO**	
11:00 - 12:00	1202	102	420	140	**NO**	630	70	**YES**	336	112	504	56	**NO**	
12:00 - 13:00	1336	119	420	140	**NO**	630	70	**YES**	336	112	504	56	**YES**	
13:00 - 14:00	1332	108	420	140	**NO**	630	70	**YES**	336	112	504	56	**NO**	
14:00 - 15:00	1199	109	420	140	**NO**	630	70	**YES**	336	112	504	56	**NO**	
15:00 - 16:00	1293	97	420	140	**NO**	630	70	**YES**	336	112	504	56	**NO**	
16:00 - 17:00	1203	119	420	140	**NO**	630	70	**YES**	336	112	504	56	**YES**	
17:00 - 18:00	1059	108	420	140	**NO**	630	70	**YES**	336	112	504	56	**NO**	
18:00 - 19:00	873	79	420	140	**NO**	630	70	**YES**	336	112	504	56	**NO**	
19:00 - 20:00	617	66	420	140	**NO**	630	70	**NO**	336	112	504	56	**NO**	
20:00 - 21:00	547	50	420	140	**NO**	630	70	**NO**	336	112	504	56	**NO**	
21:00 - 22:00	348	46	420	140	**NO**	630	70	**NO**	336	112	504	56	**NO**	
22:00 - 23:00	184	30	420	140	**NO**	630	70	**NO**	336	112	504	56	**NO**	
23:00 - 00:00	109	14	420	140	**NO**	630	70	**NO**	336	112	504	56	**NO**	

Number of Hours that met the warrant 1A =	**0**
Number of Hours that met the warrant 1B =	**10**
Number of Hours that met the warrant 1 A & B =	**2**

A. Is the Minimum Vehicular Volume Warrant Met? (Condition A)	**NO**
B. Is the Interruption of Continuous Traffic Met? (Condition B)	**YES**
C. Combination of Warrants A and B Criteria Met?	**NO**

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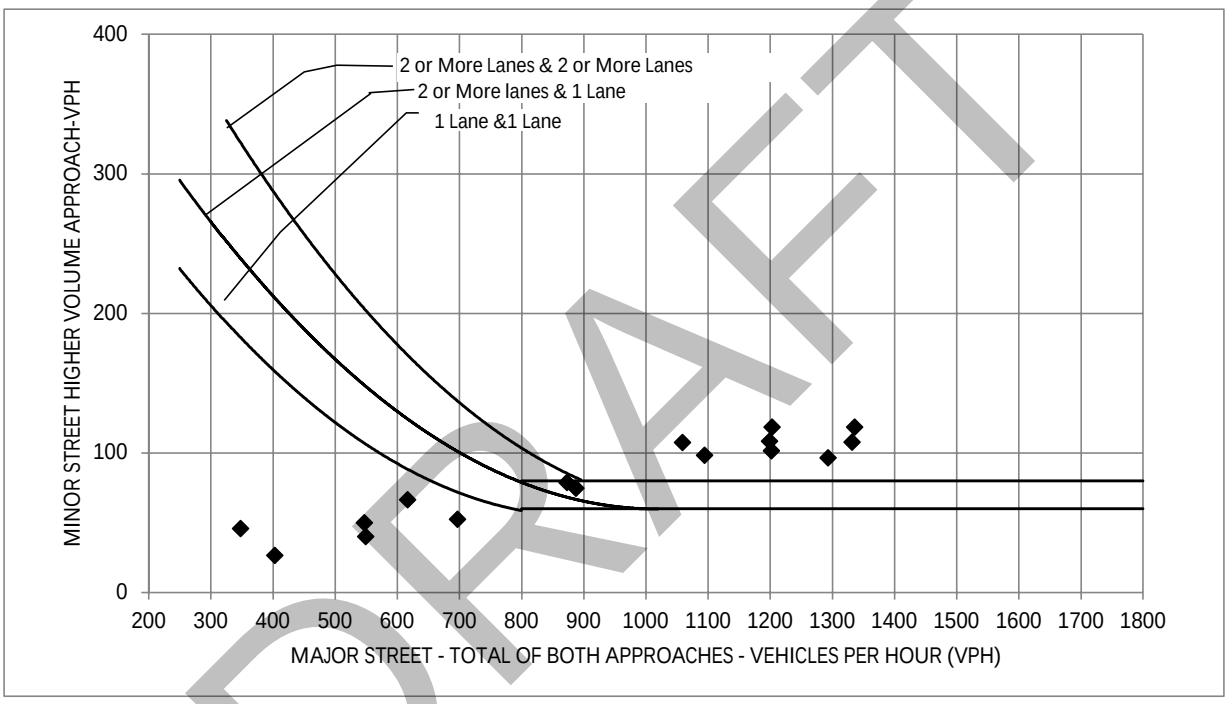
Michigan Manual of Uniform Traffic Control Devices
Worksheet for Signal Warrants (Section 4C)
WARRANT 2: Four-Hour Vehicular Volume

Spot Number:	0		
Intersection:	US-23 @ Roundhouse		
Date	12/9/2024	by	VAF

2	**: No. of Lanes on Major St.**
2	**: No. of Lanes on Minor St.**
35	**: Speed limit or 85th Percentile? (MPH)**
YES	**: Is the intersection within an Isolated community?**
1834	**: What is the of the population isolated community?**



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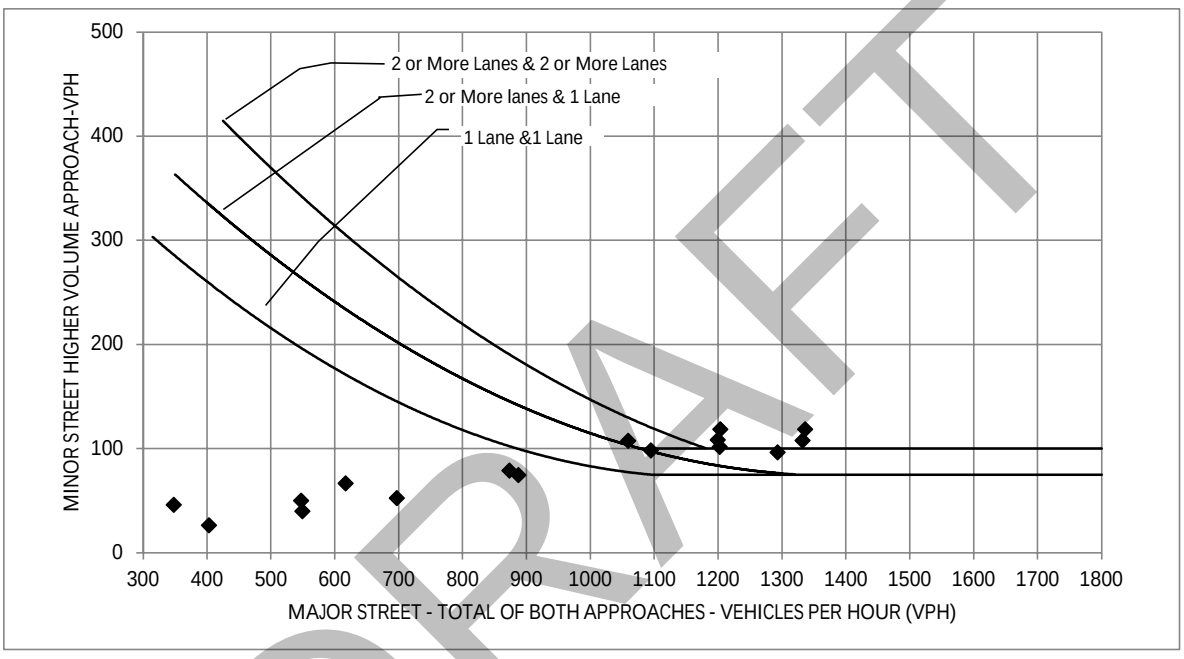
How Many Hours Are Met	**8**
Is Warrant (70%) Met?	**YES**

Michigan Manual of Uniform Traffic Control Devices
Worksheet for Signal Warrants (Section 4C)
WARRANT 3 B(70%): Peak-Hour Vehicular Volume

Spot Number:	0		
Intersection:	US-23 @ Roundhouse		
Date	12/9/2024	by	VAF

2	**: No. of Lanes on Major St.**
2	**: No. of Lanes on Minor St.**
35	**: Speed limit or 85th Percentile? (MPH)**
YES	**: Is the intersection within an Isolated community?**
1834	**: What is the of the population isolated community?**



How Many Hours Are Met	**5**
Is Warrant (70%) Met?	**YES**

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Michigan Manual of Uniform Traffic Control Devices
Worksheet for Signal Warrants (Section 4C)
WARRANT 7: Crash Experience

Spot Number:	0		
Intersection:	US-23 @ Roundhouse		
Date	12/9/2024	by	VAF

2	**: No. of Lanes on Major St?**
2	**: No. of Lanes on Minor St?**
YES	**: Has adequate trial of remedial measure with adequate enforcement been tried?**
YES	**: Are there 5 or more Crashes Susceptable to Correction by Signalization in a 12 Month Period?**

	Major Volume (Both Apr.)	Minor Volume (One Apr.)	Condition A Major Volume	Condition A Minor Volume	Warrant Condition A Met?	Condition B Major Volume	Condition B Minor Volume	Warrant Condition B Met?
Time	**N-S**	E-W						
00:01 - 01:00	38	2	336	112	**NO**	504	56	**NO**
01:00 - 02:00	31	4	336	112	**NO**	504	56	**NO**
02:00 - 03:00	35	3	336	112	**NO**	504	56	**NO**
03:00 - 04:00	23	0	336	112	**NO**	504	56	**NO**
04:00 - 05:00	121	5	336	112	**NO**	504	56	**NO**
05:00 - 06:00	175	15	336	112	**NO**	504	56	**NO**
06:00 - 07:00	403	26	336	112	**NO**	504	56	**NO**
07:00 - 08:00	549	40	336	112	**NO**	504	56	**NO**
08:00 - 09:00	697	53	336	112	**NO**	504	56	**NO**
09:00 - 10:00	887	75	336	112	**NO**	504	56	**YES**
10:00 - 11:00	1094	98	336	112	**NO**	504	56	**YES**
11:00 - 12:00	1202	102	336	112	**NO**	504	56	**YES**
12:00 - 13:00	1336	119	336	112	**YES**	504	56	**YES**
13:00 - 14:00	1332	108	336	112	**NO**	504	56	**YES**
14:00 - 15:00	1199	109	336	112	**NO**	504	56	**YES**
15:00 - 16:00	1293	97	336	112	**NO**	504	56	**YES**
16:00 - 17:00	1203	119	336	112	**YES**	504	56	**YES**
17:00 - 18:00	1059	108	336	112	**NO**	504	56	**YES**
18:00 - 19:00	873	79	336	112	**NO**	504	56	**YES**
19:00 - 20:00	617	66	336	112	**NO**	504	56	**YES**
20:00 - 21:00	547	50	336	112	**NO**	504	56	**NO**
21:00 - 22:00	348	46	336	112	**NO**	504	56	**NO**
22:00 - 23:00	184	30	336	112	**NO**	504	56	**NO**
23:00 - 00:00	109	14	336	112	**NO**	504	56	**NO**

Is there a reduction in the warrant thresholds to 56% =	**YES**
Number of Hours that met the warrant 7A =	**2**
Number of Hours that met the warrant 7B =	**11**

A. Is the Minimum Vehicular Volume Warrant Met Based on Crash Patterns? (Condition A)	**NO**
B. Is the Interruption of Continuous Traffic Met Based on Crash Patterns? (Condition B)	**YES**

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NEWMAN STREET - LEFT TURN PHASE

EASTBOUND AND WESTBOUND LEFT TURN PHASE THRESHOLDS

Please enter Data in Yellow Boxes ONLY

CONDITIONS		Items to Consider for Protected Only	Items to Consider for Permissive/Protected
EASTBOUND LEFT TURN GEOMETRY			
No. of Opposing WESTbound Thru Lanes (include combination thru lanes)	1	NO	YES
No. of Opposing WESTbound Right Turn Only Lanes	0	N/A	
What is the Opposing WESTbound speed limit or 85%ile? (mph)	35	NO	N / A
No. of EASTbound Left Turning Lanes	1	NO	N / A
What is the EASTbound sight distance in the field? (ft)	283	NO	YES
Minimum Required Sight Distance (ft)	283		
WESTBOUND LEFT TURN GEOMETRY			
No. of Opposing EASTbound Thru Lanes (include combination thru lanes)	1	NO	YES
No. of Opposing EASTbound Right Turn Only Lanes	1	N/A	
What is the Opposing EASTbound speed limit or 85%ile? (mph)	35	NO	N / A
No. of WESTbound Left Turning Lanes	1	NO	N / A
What is the WESTbound sight distance in the field? (ft)	309	NO	YES
Minimum Required Sight Distance (ft)	309		
TRAFFIC CHARACTERISTICS			
EASTbound Left Turn Vol (vph)	77	NO	
WESTbound Left Turn Vol (vph)	11	NO	
Cross Product of LEFT TURN EAST (See Chart Below)	45892	NO	NO
Cross Product of LEFT TURN WEST (See Chart Below)	5720	NO	NO
CRASH HISTORY			
Is there an existing permissive/protected or protected/permissive LT phase?	NO		
"One Left Turn Movement" refers to	Eastbound		
ONE LEFT TURN MOVEMENT: Crash History for 12 Month Period			
ONE LEFT TURN MOVEMENT: Number of Correctable crashes (Left-Turn Head-On)	0	NO	NO
ONE LEFT TURN MOVEMENT: Crash History for 24 Month Period			
ONE LEFT TURN MOVEMENT: Number of Correctable crashes (Left-Turn Head-On)	0	NO	NO
TWO LEFT TURN MOVEMENTS: Crash History for 12 Month Period			
TWO LEFT TURN MOVEMENTS: Number of Correctable crashes (Left-Turn Head-On)	0	NO	NO
TWO LEFT TURN MOVEMENTS: Crash History for 24 Month Period			
TWO LEFT TURN MOVEMENTS: Number of Correctable crashes (Left-Turn Head-On)	0	NO	NO
EASTbound Left Turn DELAY per vehicle? Sec. / Veh. (from Synchro)	95.7	YES	
EASTbound TOTAL Left Turn DELAY? Veh-Hr	2.05		
WESTbound Left Turn DELAY per vehicle? Sec. / Veh. (from Synchro)	6.1	NO	
WESTbound TOTAL Left Turn DELAY? Veh-Hr	0.02		

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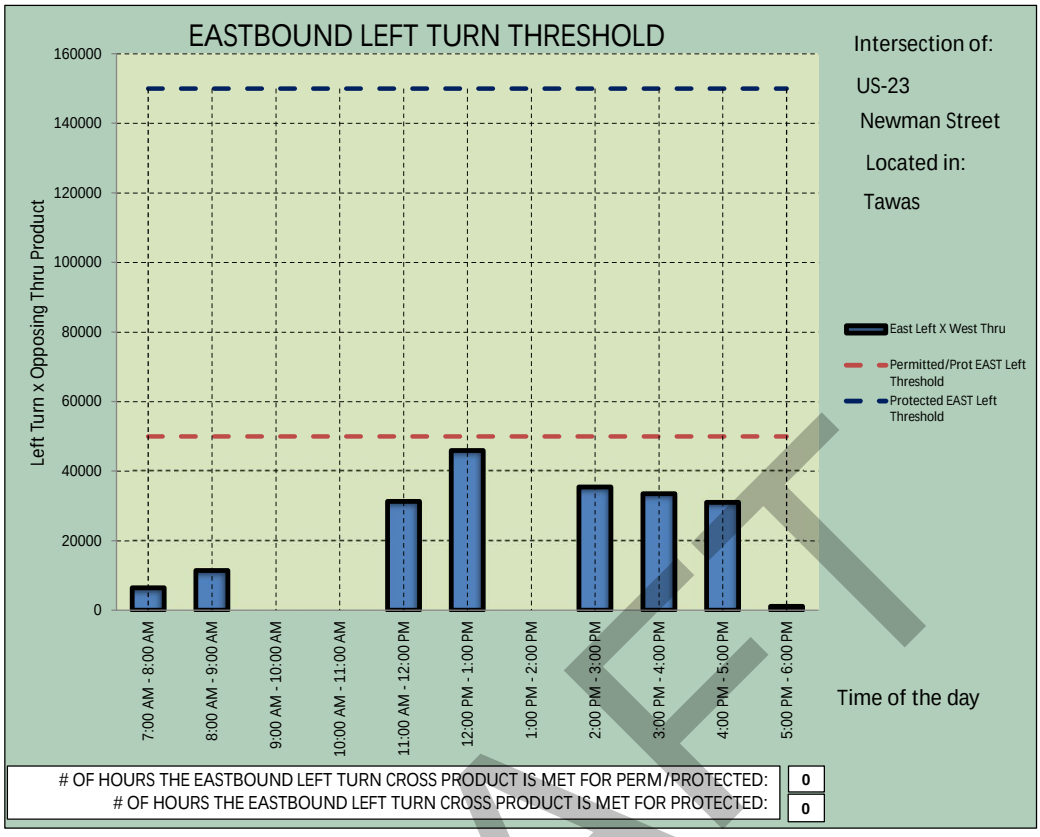
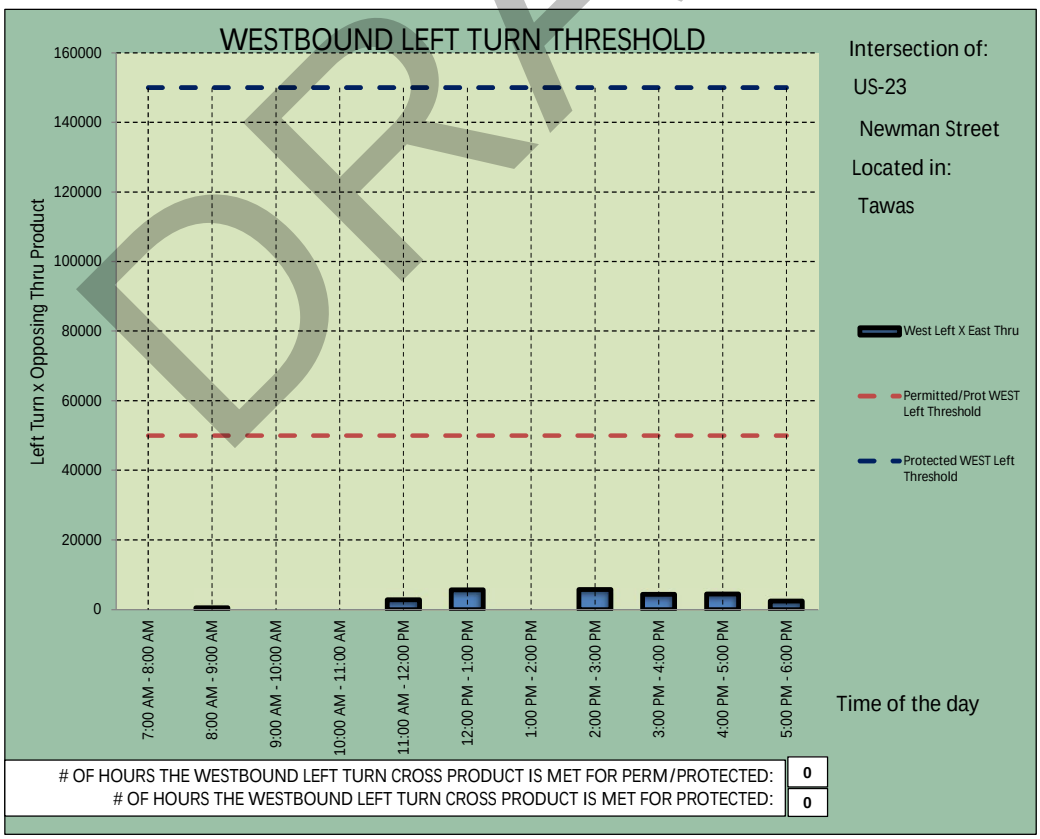
Left-turn phasing should only be approved and installed after a comprehensive engineering study indicates such an operation is necessary for the safe and efficient operation of an intersection. The type of left-turn phasing will be determined based on data from the engineering study which includes the amount of delay experienced by left-turning traffic, crash patterns that may be occurring and available capacity of the intersection.


EASTBOUND LEFT TURN THRESHOLD
Left Turn x Opposing Thru Product
160000
140000
120000
100000
80000
60000
40000
20000
0
7:00 AM - 8:00 AM
8:00 AM - 9:00 AM
9:00 AM - 10:00 AM
10:00 AM - 11:00 AM
11:00 AM - 12:00 PM
12:00 PM - 1:00 PM
1:00 PM - 2:00 PM
2:00 PM - 3:00 PM
3:00 PM - 4:00 PM
4:00 PM - 5:00 PM
5:00 PM - 6:00 PM
Time of the day
Intersection of:
US-23
Newman Street
Located in:
Tawas
East Left X West Thru
Permitted/Prot EAST Left Threshold
Protected EAST Left Threshold
OF HOURS THE EASTBOUND LEFT TURN CROSS PRODUCT IS MET FOR PERM/PROTECTED:
0
OF HOURS THE EASTBOUND LEFT TURN CROSS PRODUCT IS MET FOR PROTECTED:
0


WESTBOUND LEFT TURN THRESHOLD
Left Turn x Opposing Thru Product
160000
140000
120000
100000
80000
60000
40000
20000
0
7:00 AM - 8:00 AM
8:00 AM - 9:00 AM
9:00 AM - 10:00 AM
10:00 AM - 11:00 AM
11:00 AM - 12:00 PM
12:00 PM - 1:00 PM
1:00 PM - 2:00 PM
2:00 PM - 3:00 PM
3:00 PM - 4:00 PM
4:00 PM - 5:00 PM
5:00 PM - 6:00 PM
Time of the day
Intersection of:
US-23
Newman Street
Located in:
Tawas
West Left X East Thru
Permitted/Prot WEST Left Threshold
Protected WEST Left Threshold
OF HOURS THE WESTBOUND LEFT TURN CROSS PRODUCT IS MET FOR PERM/PROTECTED:
0
OF HOURS THE WESTBOUND LEFT TURN CROSS PRODUCT IS MET FOR PROTECTED:
0

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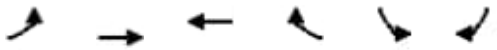

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	48	784	579	193	117	45
Future Volume (vph)	48	784	579	193	117	45
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5		4.5	4.5
Lane Util. Factor	1.00	0.95	0.95		1.00	1.00
Frt	1.00	1.00	0.96		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1770	3610	3449		1805	1615
Flt Permitted	0.32	1.00	1.00		0.95	1.00
Satd. Flow (perm)	604	3610	3449		1805	1615
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.79	0.79
Adj. Flow (vph)	52	852	629	210	148	57
RTOR Reduction (vph)	0	0	45	0	0	47
Lane Group Flow (vph)	52	852	794	0	148	10
Heavy Vehicles (%)	2%	0%	1%	0%	0%	0%
Turn Type	Perm	NA	NA		Prot	Perm
Protected Phases		4	8		6	
Permitted Phases	4					6
Actuated Green, G (s)	28.1	28.1	28.1		7.9	7.9
Effective Green, g (s)	28.1	28.1	28.1		7.9	7.9
Actuated g/C Ratio	0.62	0.62	0.62		0.18	0.18
Clearance Time (s)	4.5	4.5	4.5		4.5	4.5
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	377	2254	2153		316	283
v/s Ratio Prot		c0.24	0.23		c0.08	
v/s Ratio Perm	0.09					0.01
v/c Ratio	0.14	0.38	0.37		0.47	0.04
Uniform Delay, d1	3.5	4.2	4.1		16.7	15.4
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	0.8	0.5	0.5		1.1	0.1
Delay (s)	4.2	4.6	4.6		17.8	15.4
Level of Service	A	A	A		B	B
Approach Delay (s/veh)		4.6	4.6		17.1	
Approach LOS		A	A		B	

Intersection Summary			
HCM 2000 Control Delay (s/veh)	5.9	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.40		
Actuated Cycle Length (s)	45.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	44.1%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	91	579	27	13	654	57	14	9	5	86	9	81
Future Volume (vph)	91	579	27	13	654	57	14	9	5	86	9	81
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.5	4.5	4.5	4.5			8.5			8.5	
Lane Util. Factor		0.95	1.00	1.00	1.00			1.00			1.00	
Frt		1.00	0.85	1.00	0.99			0.98			0.94	
Flt Protected		0.99	1.00	0.95	1.00			0.98			0.98	
Satd. Flow (prot)		3586	1615	1805	1877			1810			1739	
Flt Permitted		0.99	1.00	0.95	1.00			0.75			0.83	
Satd. Flow (perm)		3586	1615	1805	1877			1397			1470	
Peak-hour factor, PHF	0.95	0.95	0.95	0.94	0.94	0.94	0.70	0.70	0.70	0.92	0.92	0.92
Adj. Flow (vph)	96	609	28	14	696	61	20	13	7	93	10	88
RTOR Reduction (vph)	0	0	22	0	3	0	0	6	0	0	36	0
Lane Group Flow (vph)	0	705	6	14	754	0	0	34	0	0	155	0
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Turn Type	Split	NA	Perm	Split	NA		Perm	NA		Perm	NA	
Protected Phases	1	1		2	2			8			4	
Permitted Phases			1				8			4		
Actuated Green, G (s)		18.5	18.5	36.1	36.1			13.4			13.4	
Effective Green, g (s)		18.5	18.5	36.1	36.1			13.4			13.4	
Actuated g/C Ratio		0.22	0.22	0.42	0.42			0.16			0.16	
Clearance Time (s)		4.5	4.5	4.5	4.5			8.5			8.5	
Vehicle Extension (s)		3.0	3.0	3.0	3.0			3.0			3.0	
Lane Grp Cap (vph)		775	349	762	792			218			230	
v/s Ratio Prot		c0.20		0.01	c0.40							
v/s Ratio Perm			0.00					0.02			c0.11	
v/c Ratio		0.91	0.02	0.02	0.95			0.16			0.67	
Uniform Delay, d1		32.7	26.4	14.4	23.9			31.2			34.0	
Progression Factor		1.00	1.00	1.00	1.00			1.00			1.00	
Incremental Delay, d2		14.5	0.0	0.0	20.9			0.3			7.5	
Delay (s)		47.2	26.4	14.4	44.8			31.5			41.5	
Level of Service		D	C	B	D			C			D	
Approach Delay (s/veh)		46.4			44.2			31.5			41.5	
Approach LOS		D			D			C			D	

Intersection Summary			
HCM 2000 Control Delay (s/veh)	44.5	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.88		
Actuated Cycle Length (s)	85.5	Sum of lost time (s)	17.5
Intersection Capacity Utilization	83.8%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

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Movement	SEL	SER	NEL	NET	SWT	SWR
Lane Configurations						
Traffic Volume (vph)	223	119	90	685	547	151
Future Volume (vph)	223	119	90	685	547	151
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.7	5.7		5.5	5.5	5.5
Lane Util. Factor	1.00	1.00		0.95	0.95	1.00
Frt	1.00	0.85		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.99	1.00	1.00
Satd. Flow (prot)	1805	1615		3589	3610	1615
Flt Permitted	0.95	1.00		0.81	1.00	1.00
Satd. Flow (perm)	1805	1615		2908	3610	1615
Peak-hour factor, PHF	0.83	0.83	0.87	0.87	0.95	0.95
Adj. Flow (vph)	269	143	103	787	576	159
RTOR Reduction (vph)	0	112	0	0	0	60
Lane Group Flow (vph)	269	31	0	890	576	99
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%
Turn Type	Prot	Perm	Perm	NA	NA	Perm
Protected Phases	4			2	2	
Permitted Phases		4	2			2
Actuated Green, G (s)	15.2	15.2		43.6	43.6	43.6
Effective Green, g (s)	15.2	15.2		43.6	43.6	43.6
Actuated g/C Ratio	0.22	0.22		0.62	0.62	0.62
Clearance Time (s)	5.7	5.7		5.5	5.5	5.5
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	391	350		1811	2248	1005
v/s Ratio Prot	c0.15				0.16	
v/s Ratio Perm		0.02		c0.31		0.06
v/c Ratio	0.69	0.09		0.49	0.26	0.10
Uniform Delay, d1	25.2	21.9		7.2	5.9	5.3
Progression Factor	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	5.0	0.1		1.0	0.3	0.2
Delay (s)	30.2	22.0		8.1	6.2	5.5
Level of Service	C	C		A	A	A
Approach Delay (s/veh)	27.3			8.1	6.0	
Approach LOS	C			A	A	

Intersection Summary			
HCM 2000 Control Delay (s/veh)	11.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.54		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	11.2
Intersection Capacity Utilization	62.9%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

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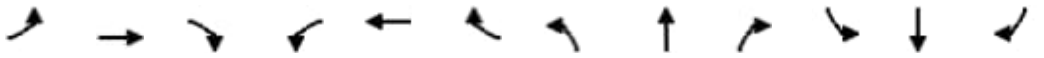

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	10	521	96	15	597	18	80	10	12	29	16	8
Future Volume (vph)	10	521	96	15	597	18	80	10	12	29	16	8
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.4	6.4	6.4	6.4	6.4		7.9	7.9		7.9	7.9	
Lane Util. Factor	1.00	1.00	1.00	1.00	0.95		1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00		1.00	0.92		1.00	0.95	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1805	1881	1615	1805	3560		1805	1747		1805	1802	
Flt Permitted	0.39	1.00	1.00	0.40	1.00		0.74	1.00		0.74	1.00	
Satd. Flow (perm)	732	1881	1615	765	3560		1403	1747		1404	1802	
Peak-hour factor, PHF	0.93	0.93	0.93	0.88	0.88	0.88	0.80	0.80	0.80	0.83	0.83	0.83
Adj. Flow (vph)	11	560	103	17	678	20	100	12	15	35	19	10
RTOR Reduction (vph)	0	0	37	0	3	0	0	13	0	0	8	0
Lane Group Flow (vph)	11	560	66	17	695	0	100	15	0	35	21	0
Heavy Vehicles (%)	0%	1%	0%	0%	1%	0%	0%	0%	0%	0%	0%	0%
Turn Type	Perm	NA	Perm	Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			2			4			4	
Permitted Phases	2		2	2			4			4		
Actuated Green, G (s)	44.6	44.6	44.6	44.6	44.6		11.1	11.1		11.1	11.1	
Effective Green, g (s)	44.6	44.6	44.6	44.6	44.6		11.1	11.1		11.1	11.1	
Actuated g/C Ratio	0.64	0.64	0.64	0.64	0.64		0.16	0.16		0.16	0.16	
Clearance Time (s)	6.4	6.4	6.4	6.4	6.4		7.9	7.9		7.9	7.9	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	466	1198	1028	487	2268		222	277		222	285	
v/s Ratio Prot		c0.30			0.20			0.01			0.01	
v/s Ratio Perm	0.02		0.04	0.02			c0.07			0.02		
v/c Ratio	0.02	0.47	0.06	0.03	0.31		0.45	0.06		0.16	0.07	
Uniform Delay, d1	4.7	6.6	4.8	4.7	5.7		26.7	25.0		25.4	25.1	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.1	1.3	0.1	0.1	0.4		1.5	0.1		0.3	0.1	
Delay (s)	4.8	7.9	4.9	4.8	6.1		28.1	25.1		25.7	25.2	
Level of Service	A	A	A	A	A		C	C		C	C	
Approach Delay (s/veh)		7.4			6.0			27.5			25.5	
Approach LOS		A			A			C			C	

Intersection Summary			
HCM 2000 Control Delay (s/veh)	9.1	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.46		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	14.3
Intersection Capacity Utilization	50.4%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

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Appendix D – Future 2045 No-Build Synchro Reports

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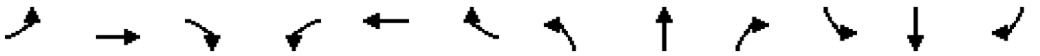

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	33	299	10	0	342	30	4	2	2	38	4	39
Future Volume (vph)	33	299	10	0	342	30	4	2	2	38	4	39
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.6	5.6		5.6			8.5			8.5	
Lane Util. Factor		0.95	1.00		0.95			1.00			1.00	
Frt		1.00	0.85		0.99			0.97			0.93	
Flt Protected		1.00	1.00		1.00			0.97			0.98	
Satd. Flow (prot)		3467	1615		3502			1793			1735	
Flt Permitted		0.89	1.00		1.00			0.77			0.84	
Satd. Flow (perm)		3086	1615		3502			1423			1497	
Peak-hour factor, PHF	0.92	0.92	0.92	0.88	0.88	0.88	0.60	0.60	0.60	0.73	0.73	0.73
Adj. Flow (vph)	36	325	11	0	389	34	7	3	3	52	5	53
RTOR Reduction (vph)	0	0	6	0	11	0	0	2	0	0	44	0
Lane Group Flow (vph)	0	361	5	0	412	0	0	11	0	0	66	0
Heavy Vehicles (%)	0%	4%	0%	0%	2%	0%	0%	0%	0%	0%	0%	0%
Turn Type	Perm	NA	Perm		NA		Perm	NA		Perm	NA	
Protected Phases		2			6			8			4	
Permitted Phases	2		2	6			8			4		
Actuated Green, G (s)		16.2	16.2		16.2			6.1			6.1	
Effective Green, g (s)		16.2	16.2		16.2			6.1			6.1	
Actuated g/C Ratio		0.45	0.45		0.45			0.17			0.17	
Clearance Time (s)		5.6	5.6		5.6			8.5			8.5	
Vehicle Extension (s)		3.0	3.0		3.0			3.0			3.0	
Lane Grp Cap (vph)		1373	718		1558			238			250	
v/s Ratio Prot					c0.12							
v/s Ratio Perm		0.12	0.00					0.01			c0.04	
v/c Ratio		0.26	0.01		0.26			0.04			0.26	
Uniform Delay, d1		6.3	5.6		6.4			12.7			13.2	
Progression Factor		1.00	1.00		1.00			1.00			1.00	
Incremental Delay, d2		0.1	0.0		0.1			0.1			0.6	
Delay (s)		6.5	5.6		6.4			12.8			13.8	
Level of Service		A	A		A			B			B	
Approach Delay (s/veh)		6.4			6.4			12.8			13.8	
Approach LOS		A			A			B			B	

Intersection Summary			
HCM 2000 Control Delay (s/veh)	7.4	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.26		
Actuated Cycle Length (s)	36.4	Sum of lost time (s)	14.1
Intersection Capacity Utilization	41.9%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

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Movement	SEL	SER	NEL	NET	SWT	SWR
Lane Configurations						
Traffic Volume (vph)	137	77	46	249	294	88
Future Volume (vph)	137	77	46	249	294	88
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.7	5.7		5.5	5.5	5.5
Lane Util. Factor	1.00	1.00		0.95	0.95	1.00
Frt	1.00	0.85		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.99	1.00	1.00
Satd. Flow (prot)	1752	1553		3467	3539	1599
Flt Permitted	0.95	1.00		0.86	1.00	1.00
Satd. Flow (perm)	1752	1553		3021	3539	1599
Peak-hour factor, PHF	0.86	0.86	0.85	0.85	0.95	0.95
Adj. Flow (vph)	159	90	54	293	309	93
RTOR Reduction (vph)	0	75	0	0	0	30
Lane Group Flow (vph)	159	15	0	347	309	63
Heavy Vehicles (%)	3%	4%	5%	3%	2%	1%
Turn Type	Prot	Perm	Perm	NA	NA	Perm
Protected Phases	4			2	2	
Permitted Phases		4	2			2
Actuated Green, G (s)	11.6	11.6		47.2	47.2	47.2
Effective Green, g (s)	11.6	11.6		47.2	47.2	47.2
Actuated g/C Ratio	0.17	0.17		0.67	0.67	0.67
Clearance Time (s)	5.7	5.7		5.5	5.5	5.5
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	290	257		2037	2386	1078
v/s Ratio Prot	c0.09				0.09	
v/s Ratio Perm		0.01		c0.11		0.04
v/c Ratio	0.55	0.06		0.17	0.13	0.06
Uniform Delay, d1	26.8	24.6		4.2	4.1	3.9
Progression Factor	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	2.1	0.1		0.2	0.1	0.1
Delay (s)	28.9	24.7		4.4	4.2	4.0
Level of Service	C	C		A	A	A
Approach Delay (s/veh)	27.4			4.4	4.1	
Approach LOS	C			A	A	

Intersection Summary			
HCM 2000 Control Delay (s/veh)	10.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.24		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	11.2
Intersection Capacity Utilization	38.2%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

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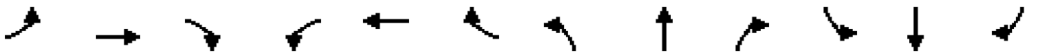

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	2	304	34	2	310	3	32	3	3	4	0	6
Future Volume (vph)	2	304	34	2	310	3	32	3	3	4	0	6
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.4	6.4	6.4	6.4	6.4		7.9	7.9		7.9	7.9	
Lane Util. Factor	1.00	1.00	1.00	1.00	0.95		1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00		1.00	0.93		1.00	0.85	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1805	1881	1615	1805	3570		1805	1758		1805	1615	
Flt Permitted	0.54	1.00	1.00	0.57	1.00		0.75	1.00		0.75	1.00	
Satd. Flow (perm)	1017	1881	1615	1074	3570		1430	1758		1430	1615	
Peak-hour factor, PHF	0.94	0.94	0.94	0.86	0.86	0.86	0.80	0.80	0.80	0.75	0.75	0.75
Adj. Flow (vph)	2	323	36	2	360	3	40	4	4	5	0	8
RTOR Reduction (vph)	0	0	13	0	1	0	0	3	0	0	7	0
Lane Group Flow (vph)	2	323	23	2	362	0	40	5	0	5	1	0
Heavy Vehicles (%)	0%	1%	0%	0%	1%	0%	0%	0%	0%	0%	0%	0%
Turn Type	Perm	NA	Perm	Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			2			4			4	
Permitted Phases	2		2	2			4			4		
Actuated Green, G (s)	44.6	44.6	44.6	44.6	44.6		11.1	11.1		11.1	11.1	
Effective Green, g (s)	44.6	44.6	44.6	44.6	44.6		11.1	11.1		11.1	11.1	
Actuated g/C Ratio	0.64	0.64	0.64	0.64	0.64		0.16	0.16		0.16	0.16	
Clearance Time (s)	6.4	6.4	6.4	6.4	6.4		7.9	7.9		7.9	7.9	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	647	1198	1028	684	2274		226	278		226	256	
v/s Ratio Prot		c0.17			0.10			0.00			0.00	
v/s Ratio Perm	0.00		0.01	0.00			c0.03			0.00		
v/c Ratio	0.00	0.27	0.02	0.00	0.16		0.18	0.02		0.02	0.00	
Uniform Delay, d1	4.6	5.6	4.7	4.6	5.1		25.5	24.8		24.9	24.8	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.0	0.6	0.0	0.0	0.1		0.4	0.0		0.0	0.0	
Delay (s)	4.6	6.1	4.7	4.6	5.3		25.9	24.9		24.9	24.8	
Level of Service	A	A	A	A	A		C	C		C	C	
Approach Delay (s/veh)		6.0			5.3			25.7			24.8	
Approach LOS		A			A			C			C	

Intersection Summary			
HCM 2000 Control Delay (s/veh)	7.2	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.25		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	14.3
Intersection Capacity Utilization	39.8%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

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Intersection	
Int Delay, s/veh	1.3

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	10	353	351	58	46	9
Future Vol, veh/h	10	353	351	58	46	9
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	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	91	91	88	88	64	64
Heavy Vehicles, %	0	2	1	0	2	13
Mvmt Flow	11	388	399	66	72	14

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	465	0	-	0	648	233
Stage 1	-	-	-	-	432	-
Stage 2	-	-	-	-	216	-
Critical Hdwy	4.1	-	-	-	6.84	7.16
Critical Hdwy Stg 1	-	-	-	-	5.84	-
Critical Hdwy Stg 2	-	-	-	-	5.84	-
Follow-up Hdwy	2.2	-	-	-	3.52	3.43
Pot Cap-1 Maneuver	1107	-	-	-	403	736
Stage 1	-	-	-	-	622	-
Stage 2	-	-	-	-	799	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1107	-	-	-	399	736
Mov Cap-2 Maneuver	-	-	-	-	493	-
Stage 1	-	-	-	-	616	-
Stage 2	-	-	-	-	799	-

Approach	EB	WB	SB
HCM Control Delay, s/v	0.2	0	12.9
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	1107	-	-	-	493	736
HCM Lane V/C Ratio	0.01	-	-	-	0.146	0.019
HCM Control Delay (s/veh)	8.3	-	-	-	13.5	10
HCM Lane LOS	A	-	-	-	B	B
HCM 95th %tile Q (veh)	0	-	-	-	0.5	0.1

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Intersection: 4: U.S. 23 & Roundhouse St

Movement	EB	WB	SB	SB
Directions Served	L	TR	L	R
Maximum Queue (ft)	25	4	67	59
Average Queue (ft)	4	0	25	9
95th Queue (ft)	20	3	53	35
Link Distance (ft)		418	654	654
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)	150			
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 5: U.S. 23 & Dummy Node - Church St

Movement	EB	SB
Directions Served	LT	LR
Maximum Queue (ft)	48	70
Average Queue (ft)	12	28
95th Queue (ft)	42	51
Link Distance (ft)	354	482
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 13: U.S. 23 & Dummy Node - Matthews St

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

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Intersection: 15: U.S. 23 & Dummy Node - Parking Lot

Movement	SE	SW
Directions Served	LR	R
Maximum Queue (ft)	43	26
Average Queue (ft)	15	1
95th Queue (ft)	39	13
Link Distance (ft)	49	201
Upstream Blk Time (%)	0	
Queuing Penalty (veh)	0	
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 18: U.S. 23 & Dummy Node - Oak St

Movement	EB	SB
Directions Served	LT	LR
Maximum Queue (ft)	40	35
Average Queue (ft)	6	14
95th Queue (ft)	27	39
Link Distance (ft)	328	291
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 21: Dummy Node & U.S. 23

Movement	EB	EB	NB
Directions Served	T	TR	LR
Maximum Queue (ft)	6	10	52
Average Queue (ft)	0	0	18
95th Queue (ft)	4	5	37
Link Distance (ft)	870	870	163
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

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Intersection: 24: U.S. 23

Movement	
Directions Served	
Maximum Queue (ft)	
Average Queue (ft)	
95th Queue (ft)	
Link Distance (ft)	
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 26: U.S. 23

Movement	
Directions Served	
Maximum Queue (ft)	
Average Queue (ft)	
95th Queue (ft)	
Link Distance (ft)	
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 28: U.S. 23

Movement	NE
Directions Served	T
Maximum Queue (ft)	23
Average Queue (ft)	1
95th Queue (ft)	10
Link Distance (ft)	554
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

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Intersection: 30: U.S. 23

Movement	
Directions Served	
Maximum Queue (ft)	
Average Queue (ft)	
95th Queue (ft)	
Link Distance (ft)	
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 33: U.S. 23 & Dummy Node - Wadsworth

Movement	SB
Directions Served	LR
Maximum Queue (ft)	62
Average Queue (ft)	31
95th Queue (ft)	56
Link Distance (ft)	480
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 36: Dummy Node - Driveway & U.S. 23

Movement	NB
Directions Served	LR
Maximum Queue (ft)	31
Average Queue (ft)	7
95th Queue (ft)	27
Link Distance (ft)	208
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

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Intersection: 38: U.S. 23 & Dummy Node - Pine St

Movement	SB
Directions Served	LR
Maximum Queue (ft)	77
Average Queue (ft)	28
95th Queue (ft)	56
Link Distance (ft)	233
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 40: U.S. 23 & Dummy Node - Beech Street

Movement	SB
Directions Served	LR
Maximum Queue (ft)	23
Average Queue (ft)	2
95th Queue (ft)	12
Link Distance (ft)	292
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 42: U.S. 23 & Dummy Node - Rite Aid

Movement	SE	NE
Directions Served	LR	LT
Maximum Queue (ft)	67	57
Average Queue (ft)	29	14
95th Queue (ft)	56	45
Link Distance (ft)	79	47
Upstream Blk Time (%)	0	1
Queuing Penalty (veh)	0	1
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

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Intersection: 1001: Newman St & U.S. 23

Movement	EB	EB	EB	WB	WB	NB	SB
Directions Served	LT	T	R	LT	TR	LTR	LTR
Maximum Queue (ft)	72	88	23	82	94	21	58
Average Queue (ft)	29	32	3	30	32	4	31
95th Queue (ft)	63	76	17	66	73	17	52
Link Distance (ft)	594	594		1262	1262	245	500
Upstream Blk Time (%)							
Queuing Penalty (veh)							
Storage Bay Dist (ft)			50				
Storage Blk Time (%)		3	0				
Queuing Penalty (veh)		0	0				

Intersection: 1003: U.S. 23 & Hemlock Rd

Movement	SE	SE	NE	NE	SW	SW	SW
Directions Served	L	R	LT	T	T	T	R
Maximum Queue (ft)	182	55	98	75	88	57	53
Average Queue (ft)	72	21	34	24	28	15	16
95th Queue (ft)	128	40	72	62	68	46	44
Link Distance (ft)	1258	1258	183	183	669	669	
Upstream Blk Time (%)							
Queuing Penalty (veh)							
Storage Bay Dist (ft)							115
Storage Blk Time (%)							
Queuing Penalty (veh)							

Intersection: 1010: Tawas Beach Rd & U.S. 23

Movement	EB	EB	EB	WB	WB	WB	NB	NB	SB	SB
Directions Served	L	T	R	L	T	TR	L	TR	L	TR
Maximum Queue (ft)	11	182	33	17	91	93	88	27	30	22
Average Queue (ft)	1	57	5	1	39	30	30	6	3	4
95th Queue (ft)	7	132	21	9	78	73	73	23	18	17
Link Distance (ft)		644			309	309	98	98		860
Upstream Blk Time (%)							1			
Queuing Penalty (veh)							0			
Storage Bay Dist (ft)	150		240	230					50	
Storage Blk Time (%)		1							0	
Queuing Penalty (veh)		0							0	

Network Summary

Network wide Queuing Penalty: 2

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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	57	514	18	10	663	67	13	8	9	62	15	66
Future Volume (vph)	57	514	18	10	663	67	13	8	9	62	15	66
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.6	5.6		5.6			8.5			8.5	
Lane Util. Factor		0.95	1.00		0.95			1.00			1.00	
Frt		1.00	0.85		0.99			0.96			0.94	
Flt Protected		1.00	1.00		1.00			0.98			0.98	
Satd. Flow (prot)		3560	1615		3527			1785			1744	
Flt Permitted		0.82	1.00		0.94			0.78			0.84	
Satd. Flow (perm)		2935	1615		3333			1431			1500	
Peak-hour factor, PHF	0.94	0.94	0.94	0.95	0.95	0.95	0.75	0.75	0.75	0.85	0.85	0.85
Adj. Flow (vph)	61	547	19	11	698	71	17	11	12	73	18	78
RTOR Reduction (vph)	0	0	10	0	12	0	0	10	0	0	49	0
Lane Group Flow (vph)	0	608	9	0	768	0	0	30	0	0	120	0
Heavy Vehicles (%)	0%	1%	0%	0%	1%	0%	0%	0%	0%	0%	0%	0%
Turn Type	Perm	NA	Perm	Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			6			8			4	
Permitted Phases	2		2	6			8			4		
Actuated Green, G (s)		19.6	19.6		19.6			7.3			7.3	
Effective Green, g (s)		19.6	19.6		19.6			7.3			7.3	
Actuated g/C Ratio		0.48	0.48		0.48			0.18			0.18	
Clearance Time (s)		5.6	5.6		5.6			8.5			8.5	
Vehicle Extension (s)		3.0	3.0		3.0			3.0			3.0	
Lane Grp Cap (vph)		1403	772		1593			254			267	
v/s Ratio Prot												
v/s Ratio Perm		0.21	0.01		c0.23			0.02			c0.08	
v/c Ratio		0.43	0.01		0.48			0.12			0.45	
Uniform Delay, d1		7.0	5.6		7.3			14.1			15.1	
Progression Factor		1.00	1.00		1.00			1.00			1.00	
Incremental Delay, d2		0.2	0.0		0.2			0.2			1.2	
Delay (s)		7.3	5.6		7.5			14.4			16.3	
Level of Service		A	A		A			B			B	
Approach Delay (s/veh)		7.2			7.5			14.4			16.3	
Approach LOS		A			A			B			B	

Intersection Summary			
HCM 2000 Control Delay (s/veh)	8.5	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.47		
Actuated Cycle Length (s)	41.0	Sum of lost time (s)	14.1
Intersection Capacity Utilization	63.6%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

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Movement	SEL	SER	NEL	NET	SWT	SWR
Lane Configurations						
Traffic Volume (vph)	205	92	78	440	587	191
Future Volume (vph)	205	92	78	440	587	191
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.7	5.7		5.5	5.5	5.5
Lane Util. Factor	1.00	1.00		0.95	0.95	1.00
Frt	1.00	0.85		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.99	1.00	1.00
Satd. Flow (prot)	1787	1538		3553	3574	1615
Flt Permitted	0.95	1.00		0.76	1.00	1.00
Satd. Flow (perm)	1787	1538		2731	3574	1615
Peak-hour factor, PHF	0.88	0.88	0.84	0.84	0.86	0.86
Adj. Flow (vph)	233	105	93	524	683	222
RTOR Reduction (vph)	0	84	0	0	0	81
Lane Group Flow (vph)	233	21	0	617	683	141
Heavy Vehicles (%)	1%	5%	0%	1%	1%	0%
Turn Type	Prot	Perm	Perm	NA	NA	Perm
Protected Phases	4			2	2	
Permitted Phases		4	2			2
Actuated Green, G (s)	14.2	14.2		44.6	44.6	44.6
Effective Green, g (s)	14.2	14.2		44.6	44.6	44.6
Actuated g/C Ratio	0.20	0.20		0.64	0.64	0.64
Clearance Time (s)	5.7	5.7		5.5	5.5	5.5
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	362	311		1740	2277	1028
v/s Ratio Prot	c0.13				0.19	
v/s Ratio Perm		0.01		c0.23		0.09
v/c Ratio	0.64	0.07		0.35	0.30	0.14
Uniform Delay, d1	25.6	22.6		6.0	5.7	5.1
Progression Factor	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	3.9	0.1		0.6	0.3	0.3
Delay (s)	29.5	22.6		6.5	6.0	5.3
Level of Service	C	C		A	A	A
Approach Delay (s/veh)	27.4			6.5	5.9	
Approach LOS	C			A	A	

Intersection Summary			
HCM 2000 Control Delay (s/veh)	10.0	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.42		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	11.2
Intersection Capacity Utilization	55.9%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

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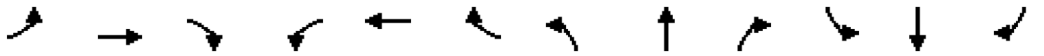

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	8	485	83	9	601	14	98	8	3	19	6	3
Future Volume (vph)	8	485	83	9	601	14	98	8	3	19	6	3
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.4	6.4	6.4	6.4	6.4		7.9	7.9		7.9	7.9	
Lane Util. Factor	1.00	1.00	1.00	1.00	0.95		1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00		1.00	0.96		1.00	0.95	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1805	1863	1615	1805	3563		1805	1819		1805	1805	
Flt Permitted	0.38	1.00	1.00	0.43	1.00		0.75	1.00		0.75	1.00	
Satd. Flow (perm)	724	1863	1615	814	3563		1421	1819		1422	1805	
Peak-hour factor, PHF	0.93	0.93	0.93	0.87	0.87	0.87	0.82	0.82	0.82	0.60	0.60	0.60
Adj. Flow (vph)	9	522	89	10	691	16	120	10	4	32	10	5
RTOR Reduction (vph)	0	0	32	0	2	0	0	3	0	0	4	0
Lane Group Flow (vph)	9	522	57	10	705	0	120	11	0	32	11	0
Heavy Vehicles (%)	0%	2%	0%	0%	1%	0%	0%	0%	0%	0%	0%	0%
Turn Type	Perm	NA	Perm	Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			2			4			4	
Permitted Phases	2		2	2			4			4		
Actuated Green, G (s)	44.6	44.6	44.6	44.6	44.6		11.1	11.1		11.1	11.1	
Effective Green, g (s)	44.6	44.6	44.6	44.6	44.6		11.1	11.1		11.1	11.1	
Actuated g/C Ratio	0.64	0.64	0.64	0.64	0.64		0.16	0.16		0.16	0.16	
Clearance Time (s)	6.4	6.4	6.4	6.4	6.4		7.9	7.9		7.9	7.9	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	461	1186	1028	518	2270		225	288		225	286	
v/s Ratio Prot		c0.28			0.20			0.01			0.01	
v/s Ratio Perm	0.01		0.04	0.01			c0.08			0.02		
v/c Ratio	0.02	0.44	0.06	0.02	0.31		0.53	0.04		0.14	0.04	
Uniform Delay, d1	4.7	6.4	4.8	4.7	5.7		27.1	24.9		25.4	24.9	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.1	1.2	0.1	0.1	0.4		2.4	0.1		0.3	0.1	
Delay (s)	4.7	7.6	4.9	4.7	6.1		29.5	25.0		25.6	25.0	
Level of Service	A	A	A	A	A		C	C		C	C	
Approach Delay (s/veh)		7.2			6.1			29.0			25.4	
Approach LOS		A			A			C			C	

Intersection Summary			
HCM 2000 Control Delay (s/veh)	9.1	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.46		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	14.3
Intersection Capacity Utilization	49.5%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

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Intersection	
Int Delay, s/veh	2.4

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	39	549	656	192	97	21
Future Vol, veh/h	39	549	656	192	97	21
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	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	94	94	91	91	78	78
Heavy Vehicles, %	3	1	1	0	1	5
Mvmt Flow	41	584	721	211	124	27

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	932	0	-	0	1201	466
Stage 1	-	-	-	-	826	-
Stage 2	-	-	-	-	375	-
Critical Hdwy	4.16	-	-	-	6.82	7
Critical Hdwy Stg 1	-	-	-	-	5.82	-
Critical Hdwy Stg 2	-	-	-	-	5.82	-
Follow-up Hdwy	2.23	-	-	-	3.51	3.35
Pot Cap-1 Maneuver	724	-	-	-	179	535
Stage 1	-	-	-	-	393	-
Stage 2	-	-	-	-	668	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	724	-	-	-	169	535
Mov Cap-2 Maneuver	-	-	-	-	285	-
Stage 1	-	-	-	-	370	-
Stage 2	-	-	-	-	668	-

Approach	EB	WB	SB
HCM Control Delay, s/v	0.68	0	24.4
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	724	-	-	-	285	535
HCM Lane V/C Ratio	0.057	-	-	-	0.436	0.05
HCM Control Delay (s/veh)	10.3	-	-	-	27.1	12.1
HCM Lane LOS	B	-	-	-	D	B
HCM 95th %tile Q(veh)	0.2	-	-	-	2.1	0.2

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Intersection: 4: U.S. 23 & Roundhouse St

Movement	EB	WB	SB	SB
Directions Served	L	TR	L	R
Maximum Queue (ft)	66	28	139	58
Average Queue (ft)	20	3	49	15
95th Queue (ft)	51	16	100	42
Link Distance (ft)		418	654	654
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)	150			
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 5: U.S. 23 & Dummy Node - Church St

Movement	SB
Directions Served	LR
Maximum Queue (ft)	70
Average Queue (ft)	34
95th Queue (ft)	58
Link Distance (ft)	482
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 13: U.S. 23 & Dummy Node - Matthews St

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

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Intersection: 15: U.S. 23 & Dummy Node - Parking Lot

Movement	SE	SW
Directions Served	LR	R
Maximum Queue (ft)	66	14
Average Queue (ft)	35	1
95th Queue (ft)	63	14
Link Distance (ft)	49	201
Upstream Blk Time (%)	7	
Queuing Penalty (veh)	0	
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 18: U.S. 23 & Dummy Node - Oak St

Movement	EB	SB
Directions Served	LT	LR
Maximum Queue (ft)	57	63
Average Queue (ft)	12	35
95th Queue (ft)	40	54
Link Distance (ft)	328	291
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 21: Dummy Node & U.S. 23

Movement	EB	EB	NB
Directions Served	T	TR	LR
Maximum Queue (ft)	45	32	85
Average Queue (ft)	3	2	33
95th Queue (ft)	22	16	67
Link Distance (ft)	870	870	163
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

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Intersection: 24: U.S. 23

Movement	
Directions Served	
Maximum Queue (ft)	
Average Queue (ft)	
95th Queue (ft)	
Link Distance (ft)	
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 26: U.S. 23

Movement	
Directions Served	
Maximum Queue (ft)	
Average Queue (ft)	
95th Queue (ft)	
Link Distance (ft)	
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 28: U.S. 23

Movement	NE
Directions Served	T
Maximum Queue (ft)	18
Average Queue (ft)	1
95th Queue (ft)	9
Link Distance (ft)	554
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

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Intersection: 30: U.S. 23

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 33: U.S. 23 & Dummy Node - Wadsworth

Movement	WB	WB	SB
Directions Served	T	TR	LR
Maximum Queue (ft)	13	23	57
Average Queue (ft)	0	1	21
95th Queue (ft)	10	15	51
Link Distance (ft)	1286	1286	480
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 36: Dummy Node - Driveway & U.S. 23

Movement	EB	NB
Directions Served	T	LR
Maximum Queue (ft)	11	31
Average Queue (ft)	0	10
95th Queue (ft)	8	33
Link Distance (ft)	337	208
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

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Intersection: 38: U.S. 23 & Dummy Node - Pine St

Movement	SB
Directions Served	LR
Maximum Queue (ft)	43
Average Queue (ft)	14
95th Queue (ft)	40
Link Distance (ft)	233
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 40: U.S. 23 & Dummy Node - Beech Street

Movement	EB	SB
Directions Served	LT	LR
Maximum Queue (ft)	74	23
Average Queue (ft)	14	3
95th Queue (ft)	50	17
Link Distance (ft)	669	292
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 42: U.S. 23 & Dummy Node - Rite Aid

Movement	SE	NE	SW	SW
Directions Served	LR	LT	T	TR
Maximum Queue (ft)	55	58	6	9
Average Queue (ft)	23	13	0	0
95th Queue (ft)	48	47	4	5
Link Distance (ft)	79	47	183	183
Upstream Blk Time (%)	0	1		
Queuing Penalty (veh)	0	2		
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

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Intersection: 1001: Newman St & U.S. 23

Movement	EB	EB	EB	WB	WB	NB	SB
Directions Served	LT	T	R	LT	TR	LTR	LTR
Maximum Queue (ft)	114	122	35	126	156	39	98
Average Queue (ft)	54	54	6	58	71	11	48
95th Queue (ft)	94	98	25	101	124	31	82
Link Distance (ft)	594	594		1262	1262	245	500
Upstream Blk Time (%)							
Queuing Penalty (veh)							
Storage Bay Dist (ft)			50				
Storage Blk Time (%)		8	0				
Queuing Penalty (veh)		1	0				

Intersection: 1003: U.S. 23 & Hemlock Rd

Movement	SE	SE	NE	NE	SW	SW	SW
Directions Served	L	R	LT	T	T	T	R
Maximum Queue (ft)	184	61	144	136	159	116	60
Average Queue (ft)	100	26	66	53	73	32	29
95th Queue (ft)	161	51	118	112	132	82	58
Link Distance (ft)	1258	1258	183	183	669	669	
Upstream Blk Time (%)			0				
Queuing Penalty (veh)			0				
Storage Bay Dist (ft)							115
Storage Blk Time (%)						0	
Queuing Penalty (veh)						0	

Intersection: 1010: Tawas Beach Rd & U.S. 23

Movement	EB	EB	EB	WB	WB	WB	NB	NB	SB	SB
Directions Served	L	T	R	L	T	TR	L	TR	L	TR
Maximum Queue (ft)	32	238	38	37	142	151	113	45	52	48
Average Queue (ft)	5	94	12	6	70	64	75	9	16	9
95th Queue (ft)	21	186	32	26	123	125	123	32	43	33
Link Distance (ft)		644			309	309	98	98		860
Upstream Blk Time (%)							12			
Queuing Penalty (veh)							0			
Storage Bay Dist (ft)	150		240	230					50	
Storage Blk Time (%)		2							5	1
Queuing Penalty (veh)		2							1	0

Network Summary

Network wide Queuing Penalty: 6

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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	101	643	30	14	726	63	16	10	6	95	10	90
Future Volume (vph)	101	643	30	14	726	63	16	10	6	95	10	90
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.6	5.6		5.6			8.5			8.5	
Lane Util. Factor		0.95	1.00		0.95			1.00			1.00	
Frt		1.00	0.85		0.99			0.97			0.94	
Flt Protected		0.99	1.00		1.00			0.98			0.98	
Satd. Flow (prot)		3586	1615		3564			1805			1739	
Flt Permitted		0.72	1.00		0.94			0.74			0.82	
Satd. Flow (perm)		2612	1615		3342			1360			1465	
Peak-hour factor, PHF	0.95	0.95	0.95	0.94	0.94	0.94	0.70	0.70	0.70	0.92	0.92	0.92
Adj. Flow (vph)	106	677	32	15	772	67	23	14	9	103	11	98
RTOR Reduction (vph)	0	0	16	0	10	0	0	7	0	0	46	0
Lane Group Flow (vph)	0	783	16	0	844	0	0	39	0	0	166	0
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Turn Type	Perm	NA	Perm	Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			6			8			4	
Permitted Phases	2		2	6			8			4		
Actuated Green, G (s)		23.9	23.9		23.9			11.1			11.1	
Effective Green, g (s)		23.9	23.9		23.9			11.1			11.1	
Actuated g/C Ratio		0.49	0.49		0.49			0.23			0.23	
Clearance Time (s)		5.6	5.6		5.6			8.5			8.5	
Vehicle Extension (s)		3.0	3.0		3.0			3.0			3.0	
Lane Grp Cap (vph)		1271	786		1626			307			331	
v/s Ratio Prot												
v/s Ratio Perm		c0.30	0.01		0.25			0.03			c0.11	
v/c Ratio		0.62	0.02		0.52			0.13			0.50	
Uniform Delay, d1		9.2	6.5		8.7			15.1			16.6	
Progression Factor		1.00	1.00		1.00			1.00			1.00	
Incremental Delay, d2		0.9	0.0		0.3			0.2			1.2	
Delay (s)		10.1	6.5		8.9			15.3			17.8	
Level of Service		B	A		A			B			B	
Approach Delay (s/veh)		10.0			8.9			15.3			17.8	
Approach LOS		A			A			B			B	

Intersection Summary			
HCM 2000 Control Delay (s/veh)	10.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	49.1	Sum of lost time (s)	14.1
Intersection Capacity Utilization	73.6%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

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Movement	SEL	SER	NEL	NET	SWT	SWR
Lane Configurations						
Traffic Volume (vph)	248	132	100	761	607	168
Future Volume (vph)	248	132	100	761	607	168
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.7	5.7		5.5	5.5	5.5
Lane Util. Factor	1.00	1.00		0.95	0.95	1.00
Frt	1.00	0.85		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.99	1.00	1.00
Satd. Flow (prot)	1805	1615		3589	3610	1615
Flt Permitted	0.95	1.00		0.78	1.00	1.00
Satd. Flow (perm)	1805	1615		2832	3610	1615
Peak-hour factor, PHF	0.83	0.83	0.87	0.87	0.95	0.95
Adj. Flow (vph)	299	159	115	875	639	177
RTOR Reduction (vph)	0	123	0	0	0	69
Lane Group Flow (vph)	299	36	0	990	639	108
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%
Turn Type	Prot	Perm	Perm	NA	NA	Perm
Protected Phases	4			2	2	
Permitted Phases		4	2			2
Actuated Green, G (s)	16.0	16.0		42.8	42.8	42.8
Effective Green, g (s)	16.0	16.0		42.8	42.8	42.8
Actuated g/C Ratio	0.23	0.23		0.61	0.61	0.61
Clearance Time (s)	5.7	5.7		5.5	5.5	5.5
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	412	369		1731	2207	987
v/s Ratio Prot	c0.17				0.18	
v/s Ratio Perm		0.02		c0.35		0.07
v/c Ratio	0.73	0.10		0.57	0.29	0.11
Uniform Delay, d1	25.0	21.3		8.1	6.4	5.7
Progression Factor	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	6.2	0.1		1.4	0.3	0.2
Delay (s)	31.2	21.4		9.5	6.8	5.9
Level of Service	C	C		A	A	A
Approach Delay (s/veh)	27.8			9.5	6.6	
Approach LOS	C			A	A	

Intersection Summary			
HCM 2000 Control Delay (s/veh)	12.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	11.2
Intersection Capacity Utilization	68.4%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

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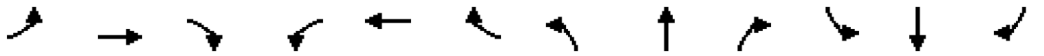

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	11	579	107	17	663	20	89	11	13	32	18	9
Future Volume (vph)	11	579	107	17	663	20	89	11	13	32	18	9
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.4	6.4	6.4	6.4	6.4		7.9	7.9		7.9	7.9	
Lane Util. Factor	1.00	1.00	1.00	1.00	0.95		1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00		1.00	0.92		1.00	0.95	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1805	1863	1615	1805	3559		1805	1748		1805	1805	
Flt Permitted	0.35	1.00	1.00	0.36	1.00		0.74	1.00		0.74	1.00	
Satd. Flow (perm)	664	1863	1615	686	3559		1398	1748		1401	1805	
Peak-hour factor, PHF	0.93	0.93	0.93	0.88	0.88	0.88	0.80	0.80	0.80	0.83	0.83	0.83
Adj. Flow (vph)	12	623	115	19	753	23	111	14	16	39	22	11
RTOR Reduction (vph)	0	0	42	0	3	0	0	13	0	0	9	0
Lane Group Flow (vph)	12	623	73	19	773	0	111	17	0	39	24	0
Heavy Vehicles (%)	0%	2%	0%	0%	1%	0%	0%	0%	0%	0%	0%	0%
Turn Type	Perm	NA	Perm	Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			2			4			4	
Permitted Phases	2		2	2			4			4		
Actuated Green, G (s)	44.6	44.6	44.6	44.6	44.6		11.1	11.1		11.1	11.1	
Effective Green, g (s)	44.6	44.6	44.6	44.6	44.6		11.1	11.1		11.1	11.1	
Actuated g/C Ratio	0.64	0.64	0.64	0.64	0.64		0.16	0.16		0.16	0.16	
Clearance Time (s)	6.4	6.4	6.4	6.4	6.4		7.9	7.9		7.9	7.9	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	423	1186	1028	437	2267		221	277		222	286	
v/s Ratio Prot		c0.33			0.22			0.01			0.01	
v/s Ratio Perm	0.02		0.05	0.03			c0.08			0.03		
v/c Ratio	0.03	0.53	0.07	0.04	0.34		0.50	0.06		0.18	0.08	
Uniform Delay, d1	4.7	6.9	4.8	4.7	5.9		26.9	25.0		25.5	25.1	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.1	1.7	0.1	0.2	0.4		1.8	0.1		0.4	0.1	
Delay (s)	4.8	8.6	5.0	4.9	6.3		28.7	25.1		25.9	25.2	
Level of Service	A	A	A	A	A		C	C		C	C	
Approach Delay (s/veh)		8.0			6.3			28.0			25.6	
Approach LOS		A			A			C			C	

Intersection Summary			
HCM 2000 Control Delay (s/veh)	9.5	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.52		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	14.3
Intersection Capacity Utilization	54.0%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

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Intersection	
Int Delay, s/veh	3.9

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	53	871	643	214	130	50
Future Vol, veh/h	53	871	643	214	130	50
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	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	79	79
Heavy Vehicles, %	2	0	1	0	0	0
Mvmt Flow	58	947	699	233	165	63

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	932	0	-	0	1404	466
Stage 1	-	-	-	-	815	-
Stage 2	-	-	-	-	589	-
Critical Hdwy	4.14	-	-	-	6.8	6.9
Critical Hdwy Stg 1	-	-	-	-	5.8	-
Critical Hdwy Stg 2	-	-	-	-	5.8	-
Follow-up Hdwy	2.22	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	730	-	-	-	~ 133	549
Stage 1	-	-	-	-	401	-
Stage 2	-	-	-	-	523	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	730	-	-	-	~ 122	549
Mov Cap-2 Maneuver	-	-	-	-	251	-
Stage 1	-	-	-	-	369	-
Stage 2	-	-	-	-	523	-

Approach	EB	WB	SB
HCM Control Delay, s/v	0.59	0	34.49
HCM LOS			D

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	730	-	-	-	251	549
HCM Lane V/C Ratio	0.079	-	-	-	0.655	0.115
HCM Control Delay (s/veh)	10.4	-	-	-	43	12.4
HCM Lane LOS	B	-	-	-	E	B
HCM 95th %tile Q(veh)	0.3	-	-	-	4.1	0.4

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

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Intersection: 4: U.S. 23 & Roundhouse St

Movement	EB	WB	WB	SB	SB
Directions Served	L	T	TR	L	R
Maximum Queue (ft)	74	18	38	194	53
Average Queue (ft)	25	1	3	78	24
95th Queue (ft)	55	10	17	151	46
Link Distance (ft)		418	418	654	654
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)	150				
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 5: U.S. 23 & Dummy Node - Church St

Movement	EB	EB	SB
Directions Served	LT	T	LR
Maximum Queue (ft)	117	16	53
Average Queue (ft)	43	1	20
95th Queue (ft)	91	11	48
Link Distance (ft)	354	354	482
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 6: U.S. 23

Movement	WB	WB
Directions Served	LT	T
Maximum Queue (ft)	93	43
Average Queue (ft)	34	2
95th Queue (ft)	73	21
Link Distance (ft)	632	632
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

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Intersection: 13: U.S. 23 & Dummy Node - Matthews St

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 15: U.S. 23 & Dummy Node - Parking Lot

Movement	SE	NE	SW
Directions Served	LR	L	R
Maximum Queue (ft)	66	53	13
Average Queue (ft)	37	19	1
95th Queue (ft)	66	48	9
Link Distance (ft)	49		201
Upstream Blk Time (%)	12		
Queuing Penalty (veh)	0		
Storage Bay Dist (ft)		100	
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 18: U.S. 23 & Dummy Node - Oak St

Movement	EB	EB	WB	WB	SB
Directions Served	LT	T	T	TR	LR
Maximum Queue (ft)	87	31	4	4	66
Average Queue (ft)	19	1	0	0	34
95th Queue (ft)	57	17	3	3	54
Link Distance (ft)	328	328	786	786	291
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

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Intersection: 21: Dummy Node & U.S. 23

Movement	EB	EB	WB	WB	NB
Directions Served	T	TR	LT	T	LR
Maximum Queue (ft)	25	24	119	8	126
Average Queue (ft)	1	1	42	0	46
95th Queue (ft)	13	12	92	6	85
Link Distance (ft)	632	632	644	644	163
Upstream Blk Time (%)					0
Queuing Penalty (veh)					0
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 24: U.S. 23

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 26: U.S. 23

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

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Intersection: 28: U.S. 23

Movement	NE
Directions Served	T
Maximum Queue (ft)	7
Average Queue (ft)	0
95th Queue (ft)	5
Link Distance (ft)	554
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 30: U.S. 23

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 33: U.S. 23 & Dummy Node - Wadsworth

Movement	EB	EB	SB
Directions Served	LT	TR	LTR
Maximum Queue (ft)	81	31	186
Average Queue (ft)	31	1	69
95th Queue (ft)	70	14	119
Link Distance (ft)	1256	1256	480
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

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Intersection: 36: Dummy Node - Driveway & U.S. 23

Movement	WB	NB
Directions Served	LT	LR
Maximum Queue (ft)	48	35
Average Queue (ft)	6	7
95th Queue (ft)	30	28
Link Distance (ft)	354	208
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 38: U.S. 23 & Dummy Node - Pine St

Movement	EB	EB
Directions Served	LT	T
Maximum Queue (ft)	89	16
Average Queue (ft)	18	1
95th Queue (ft)	58	12
Link Distance (ft)	807	807
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 40: U.S. 23 & Dummy Node - Beech Street

Movement	EB	EB	WB	SB
Directions Served	LT	T	TR	LR
Maximum Queue (ft)	82	24	4	30
Average Queue (ft)	22	1	0	4
95th Queue (ft)	62	17	3	20
Link Distance (ft)	669	669	328	292
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

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Intersection: 42: U.S. 23 & Dummy Node - Rite Aid

Movement	SE	NE	SW
Directions Served	LR	LT	T
Maximum Queue (ft)	48	74	9
Average Queue (ft)	18	16	0
95th Queue (ft)	46	56	0
Link Distance (ft)	79	47	183
Upstream Blk Time (%)	0	1	
Queuing Penalty (veh)	0	4	
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 1001: Newman St & U.S. 23

Movement	EB	EB	EB	WB	WB	NB	SB
Directions Served	LT	T	R	LT	TR	LTR	LTR
Maximum Queue (ft)	167	152	31	132	150	47	168
Average Queue (ft)	84	80	10	69	82	15	72
95th Queue (ft)	142	134	32	113	130	39	130
Link Distance (ft)	594	594		1256	1256	245	500
Upstream Blk Time (%)							
Queuing Penalty (veh)							
Storage Bay Dist (ft)			50				
Storage Blk Time (%)		13	0				
Queuing Penalty (veh)		4	0				

Intersection: 1003: U.S. 23 & Hemlock Rd

Movement	SE	SE	NE	NE	SW	SW	SW
Directions Served	L	R	LT	T	T	T	R
Maximum Queue (ft)	192	58	195	181	167	111	66
Average Queue (ft)	115	28	100	96	75	41	30
95th Queue (ft)	181	50	163	165	137	85	57
Link Distance (ft)	1258	1258	183	183	669	669	
Upstream Blk Time (%)			1	0			
Queuing Penalty (veh)			2	1			
Storage Bay Dist (ft)							115
Storage Blk Time (%)						0	
Queuing Penalty (veh)						0	

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Intersection: 1010: Tawas Beach Rd & U.S. 23

Movement	EB	EB	EB	WB	WB	WB	NB	NB	SB	SB
Directions Served	L	T	R	L	T	TR	L	TR	L	TR
Maximum Queue (ft)	41	259	48	59	158	139	113	55	74	74
Average Queue (ft)	9	124	14	14	85	66	63	17	29	16
95th Queue (ft)	31	223	36	42	140	123	113	44	63	46
Link Distance (ft)		644			309	309	98	98		860
Upstream Blk Time (%)							8			
Queuing Penalty (veh)							0			
Storage Bay Dist (ft)	150		240	230					50	
Storage Blk Time (%)		3							12	3
Queuing Penalty (veh)		4							3	1

Network Summary

Network wide Queuing Penalty: 19

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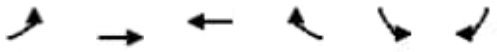

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	53	871	643	214	130	50
Future Volume (vph)	53	871	643	214	130	50
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5		4.5	4.5
Lane Util. Factor	1.00	0.95	0.95		1.00	1.00
Frt	1.00	1.00	0.96		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1770	3610	3449		1805	1615
Flt Permitted	0.29	1.00	1.00		0.95	1.00
Satd. Flow (perm)	531	3610	3449		1805	1615
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.79	0.79
Adj. Flow (vph)	58	947	699	233	165	63
RTOR Reduction (vph)	0	0	46	0	0	52
Lane Group Flow (vph)	58	947	886	0	165	11
Heavy Vehicles (%)	2%	0%	1%	0%	0%	0%
Turn Type	Perm	NA	NA		Prot	Perm
Protected Phases		4	8		6	
Permitted Phases	4					6
Actuated Green, G (s)	27.8	27.8	27.8		8.2	8.2
Effective Green, g (s)	27.8	27.8	27.8		8.2	8.2
Actuated g/C Ratio	0.62	0.62	0.62		0.18	0.18
Clearance Time (s)	4.5	4.5	4.5		4.5	4.5
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	328	2230	2130		328	294
v/s Ratio Prot		c0.26	0.26		c0.09	
v/s Ratio Perm	0.11					0.01
v/c Ratio	0.18	0.42	0.42		0.50	0.04
Uniform Delay, d1	3.7	4.5	4.4		16.6	15.2
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	1.2	0.6	0.6		1.2	0.1
Delay (s)	4.9	5.1	5.0		17.8	15.2
Level of Service	A	A	A		B	B
Approach Delay (s/veh)		5.0	5.0		17.1	
Approach LOS		A	A		B	

Intersection Summary			
HCM 2000 Control Delay (s/veh)	6.3	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.44		
Actuated Cycle Length (s)	45.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	47.2%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	101	643	30	14	726	63	16	10	6	95	10	90
Future Volume (vph)	101	643	30	14	726	63	16	10	6	95	10	90
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.6	5.6		5.6			8.5			8.5	
Lane Util. Factor		0.95	1.00		0.95			1.00			1.00	
Frt		1.00	0.85		0.99			0.97			0.94	
Flt Protected		0.99	1.00		1.00			0.98			0.98	
Satd. Flow (prot)		3586	1615		3564			1805			1739	
Flt Permitted		0.72	1.00		0.94			0.74			0.82	
Satd. Flow (perm)		2612	1615		3342			1360			1465	
Peak-hour factor, PHF	0.95	0.95	0.95	0.94	0.94	0.94	0.70	0.70	0.70	0.92	0.92	0.92
Adj. Flow (vph)	106	677	32	15	772	67	23	14	9	103	11	98
RTOR Reduction (vph)	0	0	16	0	10	0	0	7	0	0	46	0
Lane Group Flow (vph)	0	783	16	0	844	0	0	39	0	0	166	0
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Turn Type	Perm	NA	Perm	Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			6			8			4	
Permitted Phases	2		2	6			8			4		
Actuated Green, G (s)		23.9	23.9		23.9			11.1			11.1	
Effective Green, g (s)		23.9	23.9		23.9			11.1			11.1	
Actuated g/C Ratio		0.49	0.49		0.49			0.23			0.23	
Clearance Time (s)		5.6	5.6		5.6			8.5			8.5	
Vehicle Extension (s)		3.0	3.0		3.0			3.0			3.0	
Lane Grp Cap (vph)		1271	786		1626			307			331	
v/s Ratio Prot												
v/s Ratio Perm		c0.30	0.01		0.25			0.03			c0.11	
v/c Ratio		0.62	0.02		0.52			0.13			0.50	
Uniform Delay, d1		9.2	6.5		8.7			15.1			16.6	
Progression Factor		1.00	1.00		1.00			1.00			1.00	
Incremental Delay, d2		0.9	0.0		0.3			0.2			1.2	
Delay (s)		10.1	6.5		8.9			15.3			17.8	
Level of Service		B	A		A			B			B	
Approach Delay (s/veh)		10.0			8.9			15.3			17.8	
Approach LOS		A			A			B			B	

Intersection Summary			
HCM 2000 Control Delay (s/veh)	10.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	49.1	Sum of lost time (s)	14.1
Intersection Capacity Utilization	73.6%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

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Movement	SEL	SER	NEL	NET	SWT	SWR
Lane Configurations						
Traffic Volume (vph)	248	132	100	761	607	168
Future Volume (vph)	248	132	100	761	607	168
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.7	5.7		5.5	5.5	5.5
Lane Util. Factor	1.00	1.00		0.95	0.95	1.00
Frt	1.00	0.85		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.99	1.00	1.00
Satd. Flow (prot)	1805	1615		3589	3610	1615
Flt Permitted	0.95	1.00		0.78	1.00	1.00
Satd. Flow (perm)	1805	1615		2832	3610	1615
Peak-hour factor, PHF	0.83	0.83	0.87	0.87	0.95	0.95
Adj. Flow (vph)	299	159	115	875	639	177
RTOR Reduction (vph)	0	123	0	0	0	69
Lane Group Flow (vph)	299	36	0	990	639	108
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%
Turn Type	Prot	Perm	Perm	NA	NA	Perm
Protected Phases	4			2	2	
Permitted Phases		4	2			2
Actuated Green, G (s)	16.0	16.0		42.8	42.8	42.8
Effective Green, g (s)	16.0	16.0		42.8	42.8	42.8
Actuated g/C Ratio	0.23	0.23		0.61	0.61	0.61
Clearance Time (s)	5.7	5.7		5.5	5.5	5.5
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	412	369		1731	2207	987
v/s Ratio Prot	c0.17				0.18	
v/s Ratio Perm		0.02		c0.35		0.07
v/c Ratio	0.73	0.10		0.57	0.29	0.11
Uniform Delay, d1	25.0	21.3		8.1	6.4	5.7
Progression Factor	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	6.2	0.1		1.4	0.3	0.2
Delay (s)	31.2	21.4		9.5	6.8	5.9
Level of Service	C	C		A	A	A
Approach Delay (s/veh)	27.8			9.5	6.6	
Approach LOS	C			A	A	

Intersection Summary			
HCM 2000 Control Delay (s/veh)	12.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	11.2
Intersection Capacity Utilization	68.4%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

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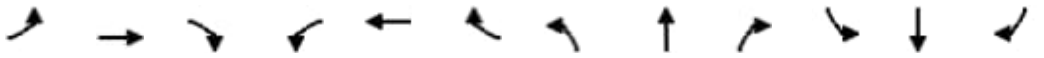

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	11	579	107	17	663	20	89	11	13	32	18	9
Future Volume (vph)	11	579	107	17	663	20	89	11	13	32	18	9
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.4	6.4	6.4	6.4	6.4		7.9	7.9		7.9	7.9	
Lane Util. Factor	1.00	1.00	1.00	1.00	0.95		1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00		1.00	0.92		1.00	0.95	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1805	1863	1615	1805	3559		1805	1748		1805	1805	
Flt Permitted	0.35	1.00	1.00	0.36	1.00		0.74	1.00		0.74	1.00	
Satd. Flow (perm)	664	1863	1615	686	3559		1398	1748		1401	1805	
Peak-hour factor, PHF	0.93	0.93	0.93	0.88	0.88	0.88	0.80	0.80	0.80	0.83	0.83	0.83
Adj. Flow (vph)	12	623	115	19	753	23	111	14	16	39	22	11
RTOR Reduction (vph)	0	0	42	0	3	0	0	13	0	0	9	0
Lane Group Flow (vph)	12	623	73	19	773	0	111	17	0	39	24	0
Heavy Vehicles (%)	0%	2%	0%	0%	1%	0%	0%	0%	0%	0%	0%	0%
Turn Type	Perm	NA	Perm	Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			2			4			4	
Permitted Phases	2		2	2			4			4		
Actuated Green, G (s)	44.6	44.6	44.6	44.6	44.6		11.1	11.1		11.1	11.1	
Effective Green, g (s)	44.6	44.6	44.6	44.6	44.6		11.1	11.1		11.1	11.1	
Actuated g/C Ratio	0.64	0.64	0.64	0.64	0.64		0.16	0.16		0.16	0.16	
Clearance Time (s)	6.4	6.4	6.4	6.4	6.4		7.9	7.9		7.9	7.9	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	423	1186	1028	437	2267		221	277		222	286	
v/s Ratio Prot		c0.33			0.22			0.01			0.01	
v/s Ratio Perm	0.02		0.05	0.03			c0.08			0.03		
v/c Ratio	0.03	0.53	0.07	0.04	0.34		0.50	0.06		0.18	0.08	
Uniform Delay, d1	4.7	6.9	4.8	4.7	5.9		26.9	25.0		25.5	25.1	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.1	1.7	0.1	0.2	0.4		1.8	0.1		0.4	0.1	
Delay (s)	4.8	8.6	5.0	4.9	6.3		28.7	25.1		25.9	25.2	
Level of Service	A	A	A	A	A		C	C		C	C	
Approach Delay (s/veh)		8.0			6.3			28.0			25.6	
Approach LOS		A			A			C			C	

Intersection Summary			
HCM 2000 Control Delay (s/veh)	9.5	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.52		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	14.3
Intersection Capacity Utilization	54.0%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

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Appendix E – 3-Lane Conversion Cost Estimate

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Project	US-23 Reconstruction Tawas River Bridge to Tawas Beach Road
Alternative	Three Lane Conversion with Curb and Gutter and Storm Sewer
Source	MDOT Average Unit Prices as of 04/08/2024
Date	10/1/2024

Pay Item Code	Item Description	Unit	Unit Price	Quantity	Cost	POB to M-55 (3-lane) Quantity	POB to M-55 (3-lane) Cost	M-55 to POE (3-lane) Quantity	M-55 to POE (3-lane) Cost
Removal and Construction									
Miscellaneous									
2040050	Pavt, Rem	Syd	$ 9.00	80,790	$ 727,110	35,078	$ 315,702	45,712	$ 411,408
2040055	Sidewalk, Rem	Syd	$ 14.00	16067	$ 224,938	6,976	$ 97,664	9,091	$ 127,274
2030011	Dr Structure, Rem	Each	$ 510.00	133	$ 67,830	58	$ 29,580	75	$ 38,250
2030015	Sewer, Rem, Less than 24 inch	Ft	$ 16.50	18720	$ 308,880	8,132	$ 134,178	10,588	$ 174,702
2050010	Embankment, CIP	Cyd	$ 10.00	1837	$ 18,370	798	$ 7,980	1,039	$ 10,390
2050016	Excavation, Earth	Cyd	$ 12.00	30018	$ 360,216	13053	$ 156,636	16965	$ 203,580
2057051	Subgrade Corrections	LS	$ 1.00	9200	$ 9,200	4000	$ 4,000	5200	$ 5,200
3010002	Subbase, CIP	Cyd	$ 21.00	29561	$ 620,781	12854	$ 269,934	16707	$ 350,847
3020016	Aggregate Base, 6 inch	Syd	$ 11.00	73900	$ 812,900	32133	$ 353,463	41767	$ 459,437
4027000	Storm Sewer (use 24" conc)	Ft	$ 127.00	18720	$ 2,377,440	8132	$ 1,032,764	10588	$ 1,344,676
4037000	Drainage Structures and Covers	Each	$ 4,335.00	133	$ 576,555	58	$ 251,430	75	$ 325,125
4040063	Underdrain, Subbase, 6 inch	Ft	$ 10.50	33050	$ 347,025	14350	$ 150,675	18700	$ 196,350
5012012	HMA, 3EL (5" base course)	Ton	$ 100.00	17799	$ 1,779,900	7741	$ 774,100	10058	$ 1,005,800
5012024	HMA, 4EL (2" leveling course)	Ton	$ 100.00	7120	$ 712,000	3097	$ 309,700	4023	$ 402,300
5012036	HMA, 5EL (1.5" top course)	Ton	$ 100.00	5341	$ 534,100	2323	$ 232,300	3018	$ 301,800
8027001A	Curb and Gutter, Conc, Det XX	Ft	$ 34.00	33050	$ 1,123,700	14350	$ 487,900	18700	$ 635,800
8167011	Turf Establishment, Performance	Syd	$ 8.50	36723	$ 312,146	15,945	$ 135,533	20,778	$ 176,613
8030044	Sidewalk, Conc, 4 inch	Sft	$ 5.30	82625	$ 437,913	35875	$ 190,138	46750	$ 247,775
8060020	Shared use Path, Conc	Syd	$ 51.00	18362	$ 936,462	7973	$ 406,623	10389	$ 529,839
3010002	Subbase, CIP	Cyd	$ 21.00	3031	$ 63,651	1316	$ 27,636	1715	$ 36,015
		0.2		Contingency (20%)	$ 2,470,223	Contingency	$ 1,073,587	Contingency	$ 1,396,636
SUBTOTAL					**$ 14,821,339**		**$ 6,441,522**		**$ 8,379,817**
						Lft Cost	**$ 900**	**Lft Cost**	**$ 900**

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Project	US-23 Reconstruction Tawas River Bridge to Tawas Beach Road
Alternative	Three to Four Lane No-Build Config. w/ Curb and Gutter and Storm Sewer
Source	MDOT Average Unit Prices as of 04/08/2024
Date	10/1/2024

Pay Item Code	Item Description	Unit	Unit Price	Quantity	Cost	POB to M-55 (3-lane) Quantity	POB to M-55 (3-lane) Cost	M-55 to POE (4-lane) Quantity	M-55 to POE (4-lane) Cost
Removal and Construction									
Miscellaneous									
2040050	Pavt, Rem	Syd	$ 9.00	80790	$ 727,110	35,078	$ 315,702	45,712	$ 411,408
2040055	Sidewalk, Rem	Syd	$ 14.00	16067	$ 224,938	6,976	$ 97,664	9,091	$ 127,274
2030011	Dr Structure, Rem	Each	$ 510.00	133	$ 67,830	58	$ 29,580	75	$ 38,250
2030015	Sewer, Rem, Less than 24 inch	Ft	$ 16.50	19132	$ 315,678	8,132	$ 134,178	11,000	$ 181,500
2050010	Embankment, CIP	Cyd	$ 10.00	1837	$ 18,370	798	$ 7,980	1,039	$ 10,390
2050016	Excavation, Earth	Cyd	$ 12.00	34660	$ 415,920	13053	$ 156,636	21607	$ 259,284
2057051	Subgrade Corrections	LS	$ 1.00	10900	$ 10,900	4000	$ 4,000	6900	$ 6,900
3010002	Subbase, CIP	Cyd	$ 21.00	34132	$ 716,772	12854	$ 269,934	21278	$ 446,838
3020016	Aggregate Base, 6 inch	Syd	$ 11.00	85328	$ 938,608	32133	$ 353,463	53195	$ 585,145
4027000	Storm Sewer (use 24" conc)	Ft	$ 127.00	19132	$ 2,429,764	8132	$ 1,032,764	11000	$ 1,397,000
4037000	Drainage Structures and Covers	Each	$ 4,335.00	133	$ 576,555	58	$ 251,430	75	$ 325,125
4040063	Underdrain, Subbase, 6 inch	Ft	$ 10.50	33050	$ 347,025	14350	$ 150,675	18700	$ 196,350
5012012	HMA, 3EL (5" base course)	Ton	$ 100.00	20941	$ 2,094,100	7741	$ 774,100	13200	$ 1,320,000
5012024	HMA, 4EL (2" leveling course)	Ton	$ 100.00	8377	$ 837,700	3097	$ 309,700	5280	$ 528,000
5012036	HMA, 5EL (1.5" top course)	Ton	$ 100.00	6283	$ 628,300	2323	$ 232,300	3960	$ 396,000
8027001A	Curb and Gutter, Conc, Det XX	Ft	$ 34.00	33050	$ 1,123,700	14350	$ 487,900	18700	$ 635,800
8167011	Turf Establishment, Performance	Syd	$ 8.50	36723	$ 312,146	15,945	$ 135,533	20,778	$ 176,613
8030044	Sidewalk, Conc, 4 inch	Sft	$ 5.30	82625	$ 437,913	35875	$ 190,138	46750	$ 247,775
8060020	Shared use Path, Conc	Syd	$ 51.00	18362	$ 936,462	7973	$ 406,623	10389	$ 529,839
3010002	Subbase, CIP	Cyd	$ 21.00	3031	$ 63,651	1316	$ 27,636	1715	$ 36,015
		0.2		Contingency (15%)	$ 2,644,688	Contingency	$ 1,073,587	Contingency	$ 1,571,101
SUBTOTAL					**$ 15,868,129**		**$ 6,441,522**		**$ 9,426,607**
						Lft Cost	**$ 900**	**Lft Cost**	**$ 1,010**

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Appendix F – 2045 Build Synchro Reports

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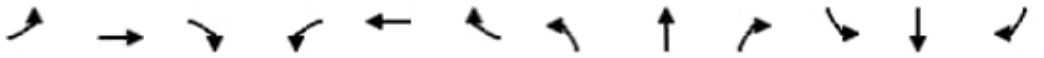

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	33	299	10	0	342	30	4	2	2	38	4	39
Future Volume (vph)	33	299	10	0	342	30	4	2	2	38	4	39
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.6	5.6	5.6		5.6			8.5			8.5	
Lane Util. Factor	1.00	1.00	1.00		1.00			1.00			1.00	
Frt	1.00	1.00	0.85		0.99			0.97			0.93	
Flt Protected	0.95	1.00	1.00		1.00			0.97			0.98	
Satd. Flow (prot)	1805	1827	1615		1843			1793			1735	
Flt Permitted	0.50	1.00	1.00		1.00			0.77			0.84	
Satd. Flow (perm)	947	1827	1615		1843			1423			1497	
Peak-hour factor, PHF	0.92	0.92	0.92	0.88	0.88	0.88	0.60	0.60	0.60	0.73	0.73	0.73
Adj. Flow (vph)	36	325	11	0	389	34	7	3	3	52	5	53
RTOR Reduction (vph)	0	0	6	0	5	0	0	3	0	0	45	0
Lane Group Flow (vph)	36	325	5	0	418	0	0	10	0	0	65	0
Heavy Vehicles (%)	0%	4%	0%	0%	2%	0%	0%	0%	0%	0%	0%	0%
Turn Type	Perm	NA	Perm	Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			6			8			4	
Permitted Phases	2		2	6			8			4		
Actuated Green, G (s)	20.2	20.2	20.2		20.2			6.3			6.3	
Effective Green, g (s)	20.2	20.2	20.2		20.2			6.3			6.3	
Actuated g/C Ratio	0.50	0.50	0.50		0.50			0.16			0.16	
Clearance Time (s)	5.6	5.6	5.6		5.6			8.5			8.5	
Vehicle Extension (s)	3.0	3.0	3.0		3.0			3.0			3.0	
Lane Grp Cap (vph)	471	909	803		916			220			232	
v/s Ratio Prot		0.18			c0.23							
v/s Ratio Perm	0.04		0.00					0.01			c0.04	
v/c Ratio	0.08	0.36	0.01		0.46			0.05			0.28	
Uniform Delay, d1	5.3	6.2	5.1		6.6			14.6			15.1	
Progression Factor	1.00	1.00	1.00		1.00			1.00			1.00	
Incremental Delay, d2	0.1	0.2	0.0		0.4			0.1			0.7	
Delay (s)	5.4	6.5	5.1		7.0			14.7			15.8	
Level of Service	A	A	A		A			B			B	
Approach Delay (s/veh)		6.3			7.0			14.7			15.8	
Approach LOS		A			A			B			B	

Intersection Summary			
HCM 2000 Control Delay (s/veh)	7.9	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.41		
Actuated Cycle Length (s)	40.6	Sum of lost time (s)	14.1
Intersection Capacity Utilization	45.0%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

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Movement	SEL	SER	NEL	NET	SWT	SWR
Lane Configurations						
Traffic Volume (vph)	137	77	46	249	294	88
Future Volume (vph)	137	77	46	249	294	88
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.7	5.7	5.5	5.5	5.5	5.5
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1752	1553	1719	1845	1863	1599
Flt Permitted	0.95	1.00	0.57	1.00	1.00	1.00
Satd. Flow (perm)	1752	1553	1036	1845	1863	1599
Peak-hour factor, PHF	0.86	0.86	0.85	0.85	0.95	0.95
Adj. Flow (vph)	159	90	54	293	309	93
RTOR Reduction (vph)	0	76	0	0	0	32
Lane Group Flow (vph)	159	14	54	293	309	61
Heavy Vehicles (%)	3%	4%	5%	3%	2%	1%
Turn Type	Prot	Perm	Perm	NA	NA	Perm
Protected Phases	4			2	2	
Permitted Phases		4	2			2
Actuated Green, G (s)	9.4	9.4	39.4	39.4	39.4	39.4
Effective Green, g (s)	9.4	9.4	39.4	39.4	39.4	39.4
Actuated g/C Ratio	0.16	0.16	0.66	0.66	0.66	0.66
Clearance Time (s)	5.7	5.7	5.5	5.5	5.5	5.5
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	274	243	680	1211	1223	1050
v/s Ratio Prot	c0.09			0.16	c0.17	
v/s Ratio Perm		0.01	0.05			0.04
v/c Ratio	0.58	0.06	0.08	0.24	0.25	0.06
Uniform Delay, d1	23.5	21.5	3.7	4.2	4.2	3.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	3.1	0.1	0.2	0.5	0.5	0.1
Delay (s)	26.6	21.6	4.0	4.7	4.7	3.8
Level of Service	C	C	A	A	A	A
Approach Delay (s/veh)	24.8			4.6	4.5	
Approach LOS	C			A	A	

Intersection Summary			
HCM 2000 Control Delay (s/veh)	9.6	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.32		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	11.2
Intersection Capacity Utilization	45.3%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

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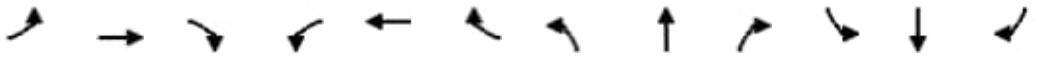

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	2	304	34	2	310	3	32	3	3	4	0	6
Future Volume (vph)	2	304	34	2	310	3	32	3	3	4	0	6
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.4	6.4	6.4	6.4	6.4	6.4	7.9	7.9		7.9	7.9	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.93		1.00	0.85	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1805	1881	1615	1805	1881	1615	1805	1758		1805	1615	
Flt Permitted	0.49	1.00	1.00	0.53	1.00	1.00	0.75	1.00		0.75	1.00	
Satd. Flow (perm)	934	1881	1615	1007	1881	1615	1430	1758		1430	1615	
Peak-hour factor, PHF	0.94	0.94	0.94	0.86	0.86	0.86	0.80	0.80	0.80	0.75	0.75	0.75
Adj. Flow (vph)	2	323	36	2	360	3	40	4	4	5	0	8
RTOR Reduction (vph)	0	0	20	0	0	2	0	3	0	0	5	0
Lane Group Flow (vph)	2	323	16	2	360	1	40	5	0	5	3	0
Heavy Vehicles (%)	0%	1%	0%	0%	1%	0%	0%	0%	0%	0%	0%	0%
Turn Type	Perm	NA	Perm	Perm	NA	Perm	Perm	NA		Perm	NA	
Protected Phases		2			2			4			4	
Permitted Phases	2		2	2		2	4			4		
Actuated Green, G (s)	31.7	31.7	31.7	31.7	31.7	31.7	24.0	24.0		24.0	24.0	
Effective Green, g (s)	31.7	31.7	31.7	31.7	31.7	31.7	24.0	24.0		24.0	24.0	
Actuated g/C Ratio	0.45	0.45	0.45	0.45	0.45	0.45	0.34	0.34		0.34	0.34	
Clearance Time (s)	6.4	6.4	6.4	6.4	6.4	6.4	7.9	7.9		7.9	7.9	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	422	851	731	456	851	731	490	602		490	553	
v/s Ratio Prot		0.17			c0.19			0.00			0.00	
v/s Ratio Perm	0.00		0.01	0.00		0.00	c0.03			0.00		
v/c Ratio	0.00	0.38	0.02	0.00	0.42	0.00	0.08	0.01		0.01	0.00	
Uniform Delay, d1	10.5	12.7	10.6	10.5	13.0	10.5	15.5	15.2		15.2	15.1	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.0	1.3	0.1	0.0	1.5	0.0	0.1	0.0		0.0	0.0	
Delay (s)	10.5	13.9	10.6	10.5	14.5	10.5	15.6	15.2		15.2	15.1	
Level of Service	B	B	B	B	B	B	B	B		B	B	
Approach Delay (s/veh)		13.6			14.4			15.5			15.2	
Approach LOS		B			B			B			B	

Intersection Summary			
HCM 2000 Control Delay (s/veh)	14.1	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.28		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	14.3
Intersection Capacity Utilization	39.8%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

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Intersection	
Int Delay, s/veh	1.3

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	10	353	351	58	46	9
Future Vol, veh/h	10	353	351	58	46	9
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	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	91	91	88	88	64	64
Heavy Vehicles, %	0	2	1	0	2	13
Mvmt Flow	11	388	399	66	72	14

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	465	0	-	0	842	432
Stage 1	-	-	-	-	432	-
Stage 2	-	-	-	-	410	-
Critical Hdwy	4.1	-	-	-	6.42	6.33
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.2	-	-	-	3.518	3.417
Pot Cap-1 Maneuver	1107	-	-	-	334	601
Stage 1	-	-	-	-	655	-
Stage 2	-	-	-	-	670	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1107	-	-	-	331	601
Mov Cap-2 Maneuver	-	-	-	-	452	-
Stage 1	-	-	-	-	648	-
Stage 2	-	-	-	-	670	-

Approach	EB	WB	SB
HCM Control Delay, s/v	0.2	0	13.9
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	1107	-	-	-	452	601
HCM Lane V/C Ratio	0.01	-	-	-	0.159	0.023
HCM Control Delay (s/veh)	8.3	-	-	-	14.5	11.1
HCM Lane LOS	A	-	-	-	B	B
HCM 95th %tile Q (veh)	0	-	-	-	0.6	0.1

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Arterial Level of Service: EB U.S. 23

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Hemlock Rd	III	32	153.7	5.8	159.5	1.38	31.1	A
Newman St	III	35	105.4	8.5	113.9	1.02	32.3	A
Tawas Beach Rd	III	36	80.0	14.3	94.3	0.81	30.8	A
Total	III		339.1	28.6	367.7	3.21	31.4	A

Arterial Level of Service: SW U.S. 23

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Tawas Beach Rd	II	36	18.3	14.9	33.2	0.15	15.8	E
Newman St	II	36	80.0	9.2	89.2	0.81	32.6	B
Hemlock Rd	II	35	105.4	5.8	111.2	1.02	33.1	B
Total	II		203.7	29.9	233.6	1.98	30.5	B

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Intersection: 5: U.S. 23 & Dummy Node - Church St

Movement	EB	SB
Directions Served	L	LR
Maximum Queue (ft)	49	51
Average Queue (ft)	10	27
95th Queue (ft)	36	49
Link Distance (ft)		488
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)	100	
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 13: U.S. 23 & Dummy Node - Matthews St

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 15: U.S. 23 & Dummy Node - Parking Lot

Movement	SE	SW
Directions Served	LR	R
Maximum Queue (ft)	47	32
Average Queue (ft)	16	2
95th Queue (ft)	38	14
Link Distance (ft)	49	201
Upstream Blk Time (%)	0	
Queuing Penalty (veh)	0	
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

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Intersection: 18: U.S. 23 & Dummy Node - Oak St

Movement	EB	SB
Directions Served	L	LR
Maximum Queue (ft)	31	40
Average Queue (ft)	4	14
95th Queue (ft)	22	39
Link Distance (ft)		297
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)	200	
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 21: Dummy Node & U.S. 23

Movement	NB
Directions Served	LR
Maximum Queue (ft)	53
Average Queue (ft)	24
95th Queue (ft)	49
Link Distance (ft)	171
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 24: U.S. 23

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

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Intersection: 26: U.S. 23

Movement	
Directions Served	
Maximum Queue (ft)	
Average Queue (ft)	
95th Queue (ft)	
Link Distance (ft)	
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 28: U.S. 23

Movement	NE
Directions Served	T
Maximum Queue (ft)	66
Average Queue (ft)	4
95th Queue (ft)	29
Link Distance (ft)	554
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 30: U.S. 23

Movement	
Directions Served	
Maximum Queue (ft)	
Average Queue (ft)	
95th Queue (ft)	
Link Distance (ft)	
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

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Intersection: 33: U.S. 23 & Dummy Node - Wadsworth

Movement	SB
Directions Served	LR
Maximum Queue (ft)	58
Average Queue (ft)	31
95th Queue (ft)	56
Link Distance (ft)	486
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 36: Dummy Node - Driveway & U.S. 23

Movement	NB
Directions Served	LR
Maximum Queue (ft)	30
Average Queue (ft)	6
95th Queue (ft)	26
Link Distance (ft)	213
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 38: U.S. 23 & Dummy Node - Pine St

Movement	SB
Directions Served	LR
Maximum Queue (ft)	64
Average Queue (ft)	29
95th Queue (ft)	50
Link Distance (ft)	240
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

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Intersection: 40: U.S. 23 & Dummy Node - Beech Street

Movement	SB
Directions Served	LR
Maximum Queue (ft)	34
Average Queue (ft)	5
95th Queue (ft)	22
Link Distance (ft)	298
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 42: U.S. 23 & Dummy Node - Rite Aid

Movement	SE	NE	SW
Directions Served	LR	LT	TR
Maximum Queue (ft)	58	72	15
Average Queue (ft)	25	17	1
95th Queue (ft)	50	54	9
Link Distance (ft)	85	48	183
Upstream Blk Time (%)	0	1	
Queuing Penalty (veh)	0	2	
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 1001: Newman St & U.S. 23

Movement	EB	EB	EB	WB	NB	SB
Directions Served	L	T	R	TR	LTR	LTR
Maximum Queue (ft)	51	155	35	167	21	77
Average Queue (ft)	14	57	2	58	3	34
95th Queue (ft)	43	124	16	134	16	59
Link Distance (ft)		610		1260	251	506
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)	200		50			
Storage Blk Time (%)		7	0	0		
Queuing Penalty (veh)		3	0	0		

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Intersection: 1003: U.S. 23 & Hemlock Rd

Movement	SE	SE	NE	NE	SW	SW
Directions Served	L	R	L	T	T	R
Maximum Queue (ft)	144	59	73	113	126	50
Average Queue (ft)	66	22	20	44	49	15
95th Queue (ft)	117	46	55	97	105	42
Link Distance (ft)	1264	1264		183	669	
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)			200			115
Storage Blk Time (%)					0	
Queuing Penalty (veh)					0	

Intersection: 1010: Tawas Beach Rd & U.S. 23

Movement	EB	EB	EB	WB	WB	WB	NB	NB	SB	SB
Directions Served	L	T	R	L	T	R	L	TR	L	TR
Maximum Queue (ft)	21	197	41	32	182	17	60	31	25	22
Average Queue (ft)	1	84	10	2	79	1	16	4	2	2
95th Queue (ft)	10	154	30	16	146	9	47	20	12	12
Link Distance (ft)		643			309	309	98	98		860
Upstream Blk Time (%)										
Queuing Penalty (veh)										
Storage Bay Dist (ft)	150		240	230					50	
Storage Blk Time (%)		1			0					
Queuing Penalty (veh)		0			0					

Intersection: 9001: U.S. 23 & Roundhouse St

Movement	EB	SB	SB
Directions Served	L	L	R
Maximum Queue (ft)	24	60	50
Average Queue (ft)	3	24	9
95th Queue (ft)	18	49	34
Link Distance (ft)		666	666
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)	150		
Storage Blk Time (%)			
Queuing Penalty (veh)			

Network Summary

Network wide Queuing Penalty: 6

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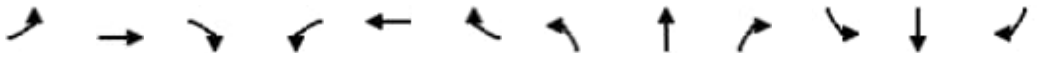

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	57	514	18	10	663	67	13	8	9	62	15	66
Future Volume (vph)	57	514	18	10	663	67	13	8	9	62	15	66
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.6	5.6	5.6	5.6	5.6			8.5			8.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00			1.00			1.00	
Frt	1.00	1.00	0.85	1.00	0.99			0.96			0.94	
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.98			0.98	
Satd. Flow (prot)	1805	1881	1615	1805	1857			1785			1744	
Flt Permitted	0.23	1.00	1.00	0.40	1.00			0.78			0.84	
Satd. Flow (perm)	442	1881	1615	754	1857			1431			1500	
Peak-hour factor, PHF	0.94	0.94	0.94	0.95	0.95	0.95	0.75	0.75	0.75	0.85	0.85	0.85
Adj. Flow (vph)	61	547	19	11	698	71	17	11	12	73	18	78
RTOR Reduction (vph)	0	0	8	0	5	0	0	10	0	0	62	0
Lane Group Flow (vph)	61	547	11	11	764	0	0	30	0	0	107	0
Heavy Vehicles (%)	0%	1%	0%	0%	1%	0%	0%	0%	0%	0%	0%	0%
Turn Type	Perm	NA	Perm	Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			6			8			4	
Permitted Phases	2		2	6			8			4		
Actuated Green, G (s)	27.4	27.4	27.4	27.4	27.4			7.3			7.3	
Effective Green, g (s)	27.4	27.4	27.4	27.4	27.4			7.3			7.3	
Actuated g/C Ratio	0.56	0.56	0.56	0.56	0.56			0.15			0.15	
Clearance Time (s)	5.6	5.6	5.6	5.6	5.6			8.5			8.5	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0			3.0			3.0	
Lane Grp Cap (vph)	248	1056	906	423	1042			214			224	
v/s Ratio Prot		0.29			c0.41							
v/s Ratio Perm	0.14		0.01	0.01				0.02			c0.07	
v/c Ratio	0.25	0.52	0.01	0.03	0.73			0.14			0.48	
Uniform Delay, d1	5.4	6.6	4.7	4.8	8.0			18.0			19.0	
Progression Factor	1.00	1.00	1.00	1.00	1.00			1.00			1.00	
Incremental Delay, d2	0.5	0.4	0.0	0.0	2.7			0.3			1.6	
Delay (s)	6.0	7.0	4.7	4.8	10.7			18.3			20.6	
Level of Service	A	A	A	A	B			B			C	
Approach Delay (s/veh)		6.9			10.6			18.3			20.6	
Approach LOS		A			B			B			C	

Intersection Summary			
HCM 2000 Control Delay (s/veh)	10.4	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	48.8	Sum of lost time (s)	14.1
Intersection Capacity Utilization	69.7%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

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Movement	SEL	SER	NEL	NET	SWT	SWR
Lane Configurations						
Traffic Volume (vph)	205	92	78	440	587	191
Future Volume (vph)	205	92	78	440	587	191
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.7	5.7	5.5	5.5	5.5	5.5
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1787	1538	1805	1881	1881	1615
Flt Permitted	0.95	1.00	0.30	1.00	1.00	1.00
Satd. Flow (perm)	1787	1538	568	1881	1881	1615
Peak-hour factor, PHF	0.88	0.88	0.84	0.84	0.86	0.86
Adj. Flow (vph)	233	105	93	524	683	222
RTOR Reduction (vph)	0	82	0	0	0	83
Lane Group Flow (vph)	233	23	93	524	683	139
Heavy Vehicles (%)	1%	5%	0%	1%	1%	0%
Turn Type	Prot	Perm	Perm	NA	NA	Perm
Protected Phases	4			2	2	
Permitted Phases		4	2			2
Actuated Green, G (s)	13.1	13.1	35.7	35.7	35.7	35.7
Effective Green, g (s)	13.1	13.1	35.7	35.7	35.7	35.7
Actuated g/C Ratio	0.22	0.22	0.60	0.60	0.60	0.60
Clearance Time (s)	5.7	5.7	5.5	5.5	5.5	5.5
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	390	335	337	1119	1119	960
v/s Ratio Prot	c0.13			0.28	c0.36	
v/s Ratio Perm		0.01	0.16			0.09
v/c Ratio	0.60	0.07	0.28	0.47	0.61	0.15
Uniform Delay, d1	21.1	18.6	5.9	6.8	7.7	5.4
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	2.5	0.1	2.0	1.4	2.5	0.3
Delay (s)	23.5	18.7	7.9	8.2	10.2	5.7
Level of Service	C	B	A	A	B	A
Approach Delay (s/veh)	22.0			8.2	9.1	
Approach LOS	C			A	A	

Intersection Summary			
HCM 2000 Control Delay (s/veh)	11.1	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	11.2
Intersection Capacity Utilization	64.5%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

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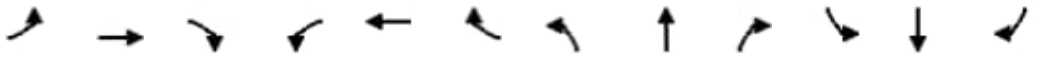

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	8	485	83	9	601	14	98	8	3	19	6	3
Future Volume (vph)	8	485	83	9	601	14	98	8	3	19	6	3
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.4	6.4	6.4	6.4	6.4	6.4	7.9	7.9		7.9	7.9	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.96		1.00	0.95	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1805	1863	1615	1805	1881	1615	1805	1819		1805	1805	
Flt Permitted	0.18	1.00	1.00	0.33	1.00	1.00	0.75	1.00		0.75	1.00	
Satd. Flow (perm)	343	1863	1615	633	1881	1615	1421	1819		1422	1805	
Peak-hour factor, PHF	0.93	0.93	0.93	0.87	0.87	0.87	0.82	0.82	0.82	0.60	0.60	0.60
Adj. Flow (vph)	9	522	89	10	691	16	120	10	4	32	10	5
RTOR Reduction (vph)	0	0	49	0	0	9	0	3	0	0	3	0
Lane Group Flow (vph)	9	522	40	10	691	7	120	11	0	32	12	0
Heavy Vehicles (%)	0%	2%	0%	0%	1%	0%	0%	0%	0%	0%	0%	0%
Turn Type	Perm	NA	Perm	Perm	NA	Perm	Perm	NA		Perm	NA	
Protected Phases		2			2			4			4	
Permitted Phases	2		2	2		2	4			4		
Actuated Green, G (s)	31.7	31.7	31.7	31.7	31.7	31.7	24.0	24.0		24.0	24.0	
Effective Green, g (s)	31.7	31.7	31.7	31.7	31.7	31.7	24.0	24.0		24.0	24.0	
Actuated g/C Ratio	0.45	0.45	0.45	0.45	0.45	0.45	0.34	0.34		0.34	0.34	
Clearance Time (s)	6.4	6.4	6.4	6.4	6.4	6.4	7.9	7.9		7.9	7.9	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	155	843	731	286	851	731	487	623		487	618	
v/s Ratio Prot		0.28			c0.37			0.01			0.01	
v/s Ratio Perm	0.03		0.02	0.02		0.00	c0.08			0.02		
v/c Ratio	0.06	0.62	0.06	0.03	0.81	0.01	0.25	0.02		0.07	0.02	
Uniform Delay, d1	10.8	14.6	10.7	10.6	16.6	10.5	16.5	15.2		15.5	15.2	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.7	3.4	0.1	0.2	8.3	0.0	0.3	0.0		0.1	0.0	
Delay (s)	11.5	18.0	10.9	10.9	24.9	10.5	16.8	15.2		15.5	15.2	
Level of Service	B	B	B	B	C	B	B	B		B	B	
Approach Delay (s/veh)		16.9			24.4			16.6			15.4	
Approach LOS		B			C			B			B	

Intersection Summary			
HCM 2000 Control Delay (s/veh)	20.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	14.3
Intersection Capacity Utilization	55.6%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

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Intersection	
Int Delay, s/veh	2.7

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	39	549	656	192	97	21
Future Vol, veh/h	39	549	656	192	97	21
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	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	94	94	91	91	78	78
Heavy Vehicles, %	3	1	1	0	1	5
Mvmt Flow	41	584	721	211	124	27

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	932	0	-	0	1493	827
Stage 1	-	-	-	-	827	-
Stage 2	-	-	-	-	666	-
Critical Hdwy	4.13	-	-	-	6.41	6.25
Critical Hdwy Stg 1	-	-	-	-	5.41	-
Critical Hdwy Stg 2	-	-	-	-	5.41	-
Follow-up Hdwy	2.227	-	-	-	3.509	3.345
Pot Cap-1 Maneuver	730	-	-	-	136	367
Stage 1	-	-	-	-	431	-
Stage 2	-	-	-	-	513	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	730	-	-	-	128	367
Mov Cap-2 Maneuver	-	-	-	-	264	-
Stage 1	-	-	-	-	407	-
Stage 2	-	-	-	-	513	-

Approach	EB	WB	SB
HCM Control Delay, s/v	0.7	0	27.6
HCM LOS			D

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	730	-	-	-	264	367
HCM Lane V/C Ratio	0.057	-	-	-	0.471	0.073
HCM Control Delay (s/veh)	10.2	-	-	-	30.2	15.6
HCM Lane LOS	B	-	-	-	D	C
HCM 95th %tile Q (veh)	0.2	-	-	-	2.4	0.2

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Arterial Level of Service: EB U.S. 23

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Hemlock Rd	III	32	153.7	9.5	163.2	1.38	30.4	A
Newman St	III	35	105.4	9.6	115.0	1.02	32.0	A
Tawas Beach Rd	III	36	80.0	18.6	98.6	0.81	29.5	B
Total	III		339.1	37.7	376.8	3.21	30.7	A

Arterial Level of Service: SW U.S. 23

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Tawas Beach Rd	II	36	18.3	26.3	44.6	0.15	11.8	F
Newman St	II	36	80.0	14.0	94.0	0.81	30.9	B
Hemlock Rd	II	35	105.4	11.7	117.1	1.02	31.4	B
Total	II		203.7	52.0	255.7	1.98	27.8	C

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Intersection: 5: U.S. 23 & Dummy Node - Church St

Movement	SB
Directions Served	LR
Maximum Queue (ft)	89
Average Queue (ft)	42
95th Queue (ft)	75
Link Distance (ft)	488
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 13: U.S. 23 & Dummy Node - Matthews St

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 15: U.S. 23 & Dummy Node - Parking Lot

Movement	SE	SW
Directions Served	LR	R
Maximum Queue (ft)	71	12
Average Queue (ft)	37	0
95th Queue (ft)	69	6
Link Distance (ft)	49	201
Upstream Blk Time (%)	8	
Queuing Penalty (veh)	0	
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

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Intersection: 18: U.S. 23 & Dummy Node - Oak St

Movement	EB	SB
Directions Served	L	LR
Maximum Queue (ft)	46	83
Average Queue (ft)	12	39
95th Queue (ft)	39	67
Link Distance (ft)		297
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)	200	
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 21: Dummy Node & U.S. 23

Movement	EB	NB
Directions Served	TR	LR
Maximum Queue (ft)	4	105
Average Queue (ft)	0	46
95th Queue (ft)	3	86
Link Distance (ft)	870	171
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 24: U.S. 23

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

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Intersection: 26: U.S. 23

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 28: U.S. 23

Movement	NE	SW
Directions Served	T	T
Maximum Queue (ft)	143	4
Average Queue (ft)	12	0
95th Queue (ft)	73	3
Link Distance (ft)	554	48
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 30: U.S. 23

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

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Intersection: 33: U.S. 23 & Dummy Node - Wadsworth

Movement	SB
Directions Served	LR
Maximum Queue (ft)	58
Average Queue (ft)	20
95th Queue (ft)	51
Link Distance (ft)	486
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 36: Dummy Node - Driveway & U.S. 23

Movement	NB
Directions Served	LR
Maximum Queue (ft)	34
Average Queue (ft)	7
95th Queue (ft)	29
Link Distance (ft)	213
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 38: U.S. 23 & Dummy Node - Pine St

Movement	SB
Directions Served	LR
Maximum Queue (ft)	52
Average Queue (ft)	15
95th Queue (ft)	43
Link Distance (ft)	240
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

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Intersection: 40: U.S. 23 & Dummy Node - Beech Street

Movement	EB	SB
Directions Served	L	LR
Maximum Queue (ft)	54	30
Average Queue (ft)	13	4
95th Queue (ft)	40	20
Link Distance (ft)		298
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)	200	
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 42: U.S. 23 & Dummy Node - Rite Aid

Movement	SE	NE	SW
Directions Served	LR	LT	TR
Maximum Queue (ft)	56	79	20
Average Queue (ft)	23	18	1
95th Queue (ft)	49	61	14
Link Distance (ft)	85	48	183
Upstream Blk Time (%)	0	2	
Queuing Penalty (veh)	0	13	
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 1001: Newman St & U.S. 23

Movement	EB	EB	EB	WB	WB	NB	SB
Directions Served	L	T	R	L	TR	LTR	LTR
Maximum Queue (ft)	137	209	98	74	324	43	108
Average Queue (ft)	42	95	9	8	166	13	54
95th Queue (ft)	101	179	52	45	278	35	90
Link Distance (ft)		610			1260	251	506
Upstream Blk Time (%)							
Queuing Penalty (veh)							
Storage Bay Dist (ft)	200		50	200			
Storage Blk Time (%)		15	0		4		
Queuing Penalty (veh)		11	0		0		

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Intersection: 1003: U.S. 23 & Hemlock Rd

Movement	SE	SE	NE	NE	SW	SW
Directions Served	L	R	L	T	T	R
Maximum Queue (ft)	173	88	112	192	272	182
Average Queue (ft)	86	31	43	85	120	43
95th Queue (ft)	148	64	89	163	223	115
Link Distance (ft)	1264	1264		183	669	
Upstream Blk Time (%)				0		
Queuing Penalty (veh)				1		
Storage Bay Dist (ft)			200			115
Storage Blk Time (%)				0	5	
Queuing Penalty (veh)				0	10	

Intersection: 1010: Tawas Beach Rd & U.S. 23

Movement	EB	EB	EB	WB	WB	WB	B23	NB	NB	SB	SB
Directions Served	L	T	R	L	T	R	T	L	TR	L	TR
Maximum Queue (ft)	33	248	53	93	355	29	40	109	36	48	24
Average Queue (ft)	7	132	18	8	182	6	2	46	6	9	3
95th Queue (ft)	27	223	40	54	303	25	21	88	26	31	16
Link Distance (ft)		643			309	309	364	98	98		860
Upstream Blk Time (%)					2			1			
Queuing Penalty (veh)					0			0			
Storage Bay Dist (ft)	150		240	230						50	
Storage Blk Time (%)		5			4					1	
Queuing Penalty (veh)		4			0					0	

Intersection: 9001: U.S. 23 & Roundhouse St

Movement	EB	WB	SB	SB
Directions Served	L	TR	L	R
Maximum Queue (ft)	67	27	159	51
Average Queue (ft)	20	3	67	15
95th Queue (ft)	54	16	137	42
Link Distance (ft)		1281	666	666
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)	150			
Storage Blk Time (%)				
Queuing Penalty (veh)				

Network Summary

Network wide Queuing Penalty: 42

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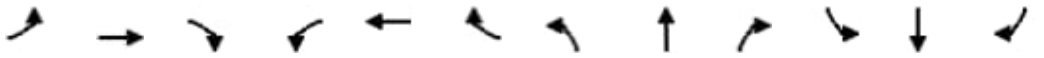

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	101	643	30	14	726	63	16	10	6	95	10	90
Future Volume (vph)	101	643	30	14	726	63	16	10	6	95	10	90
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.6	5.6	5.6	5.6	5.6			8.5			8.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00			1.00			1.00	
Frt	1.00	1.00	0.85	1.00	0.99			0.97			0.94	
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.98			0.98	
Satd. Flow (prot)	1805	1900	1615	1805	1877			1805			1739	
Flt Permitted	0.17	1.00	1.00	0.28	1.00			0.78			0.82	
Satd. Flow (perm)	315	1900	1615	534	1877			1447			1465	
Peak-hour factor, PHF	0.95	0.95	0.95	0.94	0.94	0.94	0.70	0.70	0.70	0.92	0.92	0.92
Adj. Flow (vph)	106	677	32	15	772	67	23	14	9	103	11	98
RTOR Reduction (vph)	0	0	14	0	4	0	0	7	0	0	48	0
Lane Group Flow (vph)	106	677	18	15	835	0	0	39	0	0	164	0
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Turn Type	Perm	NA	Perm	Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			6			8			4	
Permitted Phases	2		2	6			8			4		
Actuated Green, G (s)	32.5	32.5	32.5	32.5	32.5			11.9			11.9	
Effective Green, g (s)	32.5	32.5	32.5	32.5	32.5			11.9			11.9	
Actuated g/C Ratio	0.56	0.56	0.56	0.56	0.56			0.20			0.20	
Clearance Time (s)	5.6	5.6	5.6	5.6	5.6			8.5			8.5	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0			3.0			3.0	
Lane Grp Cap (vph)	175	1055	897	296	1042			294			298	
v/s Ratio Prot		0.36			c0.44							
v/s Ratio Perm	0.34		0.01	0.03				0.03			c0.11	
v/c Ratio	0.61	0.64	0.02	0.05	0.80			0.13			0.55	
Uniform Delay, d1	8.7	9.0	5.8	5.9	10.4			19.1			20.9	
Progression Factor	1.00	1.00	1.00	1.00	1.00			1.00			1.00	
Incremental Delay, d2	5.8	1.3	0.0	0.1	4.5			0.2			2.2	
Delay (s)	14.5	10.3	5.9	6.0	14.9			19.3			23.1	
Level of Service	B	B	A	A	B			B			C	
Approach Delay (s/veh)		10.7			14.8			19.3			23.1	
Approach LOS		B			B			B			C	

Intersection Summary			
HCM 2000 Control Delay (s/veh)	14.1	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	58.5	Sum of lost time (s)	14.1
Intersection Capacity Utilization	80.8%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

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Movement	SEL	SER	NEL	NET	SWT	SWR
Lane Configurations						
Traffic Volume (vph)	248	132	100	761	607	168
Future Volume (vph)	248	132	100	761	607	168
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.7	5.7	5.5	5.5	5.5	5.5
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1805	1615	1805	1900	1900	1615
Flt Permitted	0.95	1.00	0.33	1.00	1.00	1.00
Satd. Flow (perm)	1805	1615	619	1900	1900	1615
Peak-hour factor, PHF	0.83	0.83	0.87	0.87	0.95	0.95
Adj. Flow (vph)	299	159	115	875	639	177
RTOR Reduction (vph)	0	122	0	0	0	68
Lane Group Flow (vph)	299	37	115	875	639	109
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%
Turn Type	Prot	Perm	Perm	NA	NA	Perm
Protected Phases	4			2	2	
Permitted Phases		4	2			2
Actuated Green, G (s)	16.4	16.4	42.4	42.4	42.4	42.4
Effective Green, g (s)	16.4	16.4	42.4	42.4	42.4	42.4
Actuated g/C Ratio	0.23	0.23	0.61	0.61	0.61	0.61
Clearance Time (s)	5.7	5.7	5.5	5.5	5.5	5.5
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	422	378	374	1150	1150	978
v/s Ratio Prot	c0.17			c0.46	0.34	
v/s Ratio Perm		0.02	0.19			0.07
v/c Ratio	0.71	0.10	0.31	0.76	0.56	0.11
Uniform Delay, d1	24.6	21.0	6.7	10.1	8.2	5.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	5.4	0.1	2.1	4.8	1.9	0.2
Delay (s)	30.0	21.1	8.8	14.9	10.1	6.1
Level of Service	C	C	A	B	B	A
Approach Delay (s/veh)	26.9			14.2	9.3	
Approach LOS	C			B	A	

Intersection Summary			
HCM 2000 Control Delay (s/veh)	15.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	11.2
Intersection Capacity Utilization	67.9%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

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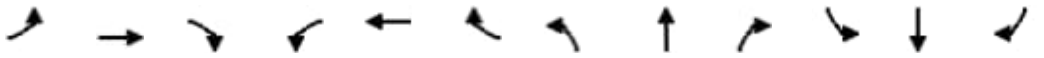

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	11	579	107	17	663	20	89	11	13	32	18	9
Future Volume (vph)	11	579	107	17	663	20	89	11	13	32	18	9
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.4	6.4	6.4	6.4	6.4	6.4	7.9	7.9		7.9	7.9	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.92		1.00	0.95	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1805	1863	1615	1805	1881	1615	1805	1748		1805	1805	
Flt Permitted	0.13	1.00	1.00	0.24	1.00	1.00	0.74	1.00		0.74	1.00	
Satd. Flow (perm)	240	1863	1615	458	1881	1615	1398	1748		1401	1805	
Peak-hour factor, PHF	0.93	0.93	0.93	0.88	0.88	0.88	0.80	0.80	0.80	0.83	0.83	0.83
Adj. Flow (vph)	12	623	115	19	753	23	111	14	16	39	22	11
RTOR Reduction (vph)	0	0	63	0	0	13	0	11	0	0	7	0
Lane Group Flow (vph)	12	623	52	19	753	10	111	19	0	39	26	0
Heavy Vehicles (%)	0%	2%	0%	0%	1%	0%	0%	0%	0%	0%	0%	0%
Turn Type	Perm	NA	Perm	Perm	NA	Perm	Perm	NA		Perm	NA	
Protected Phases		2			2			4			4	
Permitted Phases	2		2	2		2	4			4		
Actuated Green, G (s)	31.7	31.7	31.7	31.7	31.7	31.7	24.0	24.0		24.0	24.0	
Effective Green, g (s)	31.7	31.7	31.7	31.7	31.7	31.7	24.0	24.0		24.0	24.0	
Actuated g/C Ratio	0.45	0.45	0.45	0.45	0.45	0.45	0.34	0.34		0.34	0.34	
Clearance Time (s)	6.4	6.4	6.4	6.4	6.4	6.4	7.9	7.9		7.9	7.9	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	108	843	731	207	851	731	479	599		480	618	
v/s Ratio Prot		0.33			c0.40			0.01			0.01	
v/s Ratio Perm	0.05		0.03	0.04		0.01	c0.08			0.03		
v/c Ratio	0.11	0.74	0.07	0.09	0.88	0.01	0.23	0.03		0.08	0.04	
Uniform Delay, d1	11.0	15.7	10.8	10.9	17.5	10.5	16.4	15.3		15.5	15.3	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	2.1	5.8	0.2	0.9	13.0	0.0	0.2	0.0		0.1	0.0	
Delay (s)	13.1	21.5	11.0	11.8	30.5	10.6	16.7	15.3		15.6	15.4	
Level of Service	B	C	B	B	C	B	B	B		B	B	
Approach Delay (s/veh)		19.8			29.5			16.4			15.5	
Approach LOS		B			C			B			B	

Intersection Summary			
HCM 2000 Control Delay (s/veh)	23.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	14.3
Intersection Capacity Utilization	58.4%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

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Intersection	
Int Delay, s/veh	6.4

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	53	871	643	214	130	50
Future Vol, veh/h	53	871	643	214	130	50
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	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	79	79
Heavy Vehicles, %	2	0	1	0	0	0
Mvmt Flow	58	947	699	233	165	63

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	932	0	-	0	1879	816
Stage 1	-	-	-	-	816	-
Stage 2	-	-	-	-	1063	-
Critical Hdwy	4.12	-	-	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	2.218	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	734	-	-	-	~ 79	380
Stage 1	-	-	-	-	438	-
Stage 2	-	-	-	-	335	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	734	-	-	-	~ 73	380
Mov Cap-2 Maneuver	-	-	-	-	200	-
Stage 1	-	-	-	-	403	-
Stage 2	-	-	-	-	335	-

Approach	EB	WB	SB
HCM Control Delay, s/v	0.6	0	58
HCM LOS			F

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	734	-	-	-	200	380
HCM Lane V/C Ratio	0.078	-	-	-	0.823	0.167
HCM Control Delay (s/veh)	10.3	-	-	-	74	16.4
HCM Lane LOS	B	-	-	-	F	C
HCM 95th %tile Q (veh)	0.3	-	-	-	5.9	0.6

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

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Arterial Level of Service: EB U.S. 23

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Hemlock Rd	III	32	153.7	17.3	171.0	1.38	29.1	B
Newman St	III	35	105.4	13.3	118.7	1.02	31.0	A
Tawas Beach Rd	III	36	80.0	22.3	102.3	0.81	28.4	B
Total	III		339.1	52.9	392.0	3.21	29.5	B

Arterial Level of Service: SW U.S. 23

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Tawas Beach Rd	II	36	18.3	32.3	50.6	0.15	10.4	F
Newman St	II	36	80.0	19.1	99.1	0.81	29.4	B
Hemlock Rd	II	35	105.4	11.4	116.8	1.02	31.5	B
Total	II		203.7	62.8	266.5	1.98	26.7	C

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Intersection: 4: U.S. 23

Movement	WB
Directions Served	L
Maximum Queue (ft)	65
Average Queue (ft)	29
95th Queue (ft)	61
Link Distance (ft)	
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	100
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 5: U.S. 23 & Dummy Node - Church St

Movement	EB	SB
Directions Served	L	LR
Maximum Queue (ft)	83	59
Average Queue (ft)	35	18
95th Queue (ft)	67	48
Link Distance (ft)		488
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)	100	
Storage Blk Time (%)	0	
Queuing Penalty (veh)	0	

Intersection: 13: U.S. 23 & Dummy Node - Matthews St

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

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Intersection: 15: U.S. 23 & Dummy Node - Parking Lot

Movement	SE	NE	SW
Directions Served	LR	L	R
Maximum Queue (ft)	64	59	19
Average Queue (ft)	35	18	1
95th Queue (ft)	68	47	11
Link Distance (ft)	49		201
Upstream Blk Time (%)	12		
Queuing Penalty (veh)	0		
Storage Bay Dist (ft)		100	
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 18: U.S. 23 & Dummy Node - Oak St

Movement	EB	SB
Directions Served	L	LR
Maximum Queue (ft)	52	78
Average Queue (ft)	19	38
95th Queue (ft)	46	64
Link Distance (ft)		297
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)	200	
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 21: Dummy Node & U.S. 23

Movement	WB	NB
Directions Served	L	LR
Maximum Queue (ft)	77	126
Average Queue (ft)	34	53
95th Queue (ft)	65	93
Link Distance (ft)		171
Upstream Blk Time (%)		0
Queuing Penalty (veh)		0
Storage Bay Dist (ft)	150	
Storage Blk Time (%)		
Queuing Penalty (veh)		

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Intersection: 24: U.S. 23

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 26: U.S. 23

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 28: U.S. 23

Movement	NE
Directions Served	T
Maximum Queue (ft)	277
Average Queue (ft)	33
95th Queue (ft)	188
Link Distance (ft)	554
Upstream Blk Time (%)	0
Queuing Penalty (veh)	0
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

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Intersection: 30: U.S. 23

Movement	
Directions Served	
Maximum Queue (ft)	
Average Queue (ft)	
95th Queue (ft)	
Link Distance (ft)	
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 33: U.S. 23 & Dummy Node - Wadsworth

Movement	EB	SB
Directions Served	L	LTR
Maximum Queue (ft)	72	178
Average Queue (ft)	27	82
95th Queue (ft)	58	141
Link Distance (ft)		486
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)	100	
Storage Blk Time (%)	0	
Queuing Penalty (veh)	0	

Intersection: 36: Dummy Node - Driveway & U.S. 23

Movement	WB	NB
Directions Served	L	LR
Maximum Queue (ft)	31	30
Average Queue (ft)	6	6
95th Queue (ft)	25	26
Link Distance (ft)		213
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)	100	
Storage Blk Time (%)		
Queuing Penalty (veh)		

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Intersection: 38: U.S. 23 & Dummy Node - Pine St

Movement	EB
Directions Served	L
Maximum Queue (ft)	48
Average Queue (ft)	12
95th Queue (ft)	38
Link Distance (ft)	
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	100
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 40: U.S. 23 & Dummy Node - Beech Street

Movement	EB	SB
Directions Served	L	LR
Maximum Queue (ft)	48	24
Average Queue (ft)	16	3
95th Queue (ft)	43	17
Link Distance (ft)		298
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)	200	
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 42: U.S. 23 & Dummy Node - Rite Aid

Movement	SE	NE	SW
Directions Served	LR	LT	TR
Maximum Queue (ft)	51	107	17
Average Queue (ft)	17	34	1
95th Queue (ft)	44	99	9
Link Distance (ft)	85	48	183
Upstream Blk Time (%)		5	
Queuing Penalty (veh)		47	
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

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Intersection: 1001: Newman St & U.S. 23

Movement	EB	EB	EB	WB	WB	NB	SB
Directions Served	L	T	R	L	TR	LTR	LTR
Maximum Queue (ft)	137	237	36	120	317	50	174
Average Queue (ft)	61	125	8	14	163	14	80
95th Queue (ft)	110	203	30	62	271	37	141
Link Distance (ft)		610			1254	251	506
Upstream Blk Time (%)							
Queuing Penalty (veh)							
Storage Bay Dist (ft)	200		50	200			
Storage Blk Time (%)	0	18	0		3		
Queuing Penalty (veh)	1	24	0		0		

Intersection: 1003: U.S. 23 & Hemlock Rd

Movement	SE	SE	NE	NE	SW	SW
Directions Served	L	R	L	T	T	R
Maximum Queue (ft)	232	82	182	257	248	180
Average Queue (ft)	116	35	73	161	114	35
95th Queue (ft)	196	69	156	271	208	102
Link Distance (ft)	1264	1264		183	669	
Upstream Blk Time (%)			0	5		
Queuing Penalty (veh)			0	48		
Storage Bay Dist (ft)			200			115
Storage Blk Time (%)			0	5	5	
Queuing Penalty (veh)			1	6	9	

Intersection: 1010: Tawas Beach Rd & U.S. 23

Movement	EB	EB	EB	WB	WB	WB	B23	NB	NB	SB	SB
Directions Served	L	T	R	L	T	R	T	L	TR	L	TR
Maximum Queue (ft)	90	269	43	54	368	30	24	91	45	54	46
Average Queue (ft)	15	153	21	13	208	8	1	44	11	18	12
95th Queue (ft)	55	241	39	41	330	29	17	86	36	46	35
Link Distance (ft)		643			309	309	364	98	98		860
Upstream Blk Time (%)					2			0			
Queuing Penalty (veh)					0			0			
Storage Bay Dist (ft)	150		240	230						50	
Storage Blk Time (%)		7			6					2	0
Queuing Penalty (veh)		8			1					0	0

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Intersection: 9001: U.S. 23 & Roundhouse St

Movement	EB	WB	SB	SB
Directions Served	L	TR	L	R
Maximum Queue (ft)	80	33	548	269
Average Queue (ft)	29	3	338	54
95th Queue (ft)	65	18	617	246
Link Distance (ft)		1281	666	666
Upstream Blk Time (%)			2	0
Queuing Penalty (veh)			0	0
Storage Bay Dist (ft)	150			
Storage Blk Time (%)				
Queuing Penalty (veh)				

Network Summary

Network wide Queuing Penalty: 146

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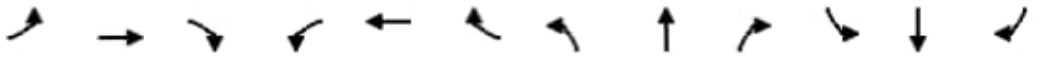

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	101	643	30	14	726	63	16	10	6	95	10	90
Future Volume (vph)	101	643	30	14	726	63	16	10	6	95	10	90
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	5.6	5.6	4.5	5.6			8.5			8.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00			1.00			1.00	
Frt	1.00	1.00	0.85	1.00	0.99			0.97			0.94	
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.98			0.98	
Satd. Flow (prot)	1805	1900	1615	1805	1877			1805			1739	
Flt Permitted	0.11	1.00	1.00	0.29	1.00			0.76			0.82	
Satd. Flow (perm)	213	1900	1615	552	1877			1398			1465	
Peak-hour factor, PHF	0.95	0.95	0.95	0.94	0.94	0.94	0.70	0.70	0.70	0.92	0.92	0.92
Adj. Flow (vph)	106	677	32	15	772	67	23	14	9	103	11	98
RTOR Reduction (vph)	0	0	14	0	3	0	0	7	0	0	41	0
Lane Group Flow (vph)	106	677	18	15	836	0	0	39	0	0	171	0
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Turn Type	pm+pt	NA	Perm	pm+pt	NA		Perm	NA		Perm	NA	
Protected Phases	5	2		1	6			8			4	
Permitted Phases	2		2	6			8			4		
Actuated Green, G (s)	45.3	41.5	41.5	39.5	38.6			13.0			13.0	
Effective Green, g (s)	45.3	41.5	41.5	39.5	38.6			13.0			13.0	
Actuated g/C Ratio	0.61	0.56	0.56	0.53	0.52			0.18			0.18	
Clearance Time (s)	4.5	5.6	5.6	4.5	5.6			8.5			8.5	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0			3.0			3.0	
Lane Grp Cap (vph)	212	1065	905	309	979			245			257	
v/s Ratio Prot	c0.03	0.36		0.00	c0.45							
v/s Ratio Perm	0.28		0.01	0.03				0.03			c0.12	
v/c Ratio	0.50	0.64	0.02	0.05	0.85			0.16			0.66	
Uniform Delay, d1	12.3	11.1	7.2	9.0	15.3			25.9			28.5	
Progression Factor	1.00	1.00	1.00	1.00	1.00			1.00			1.00	
Incremental Delay, d2	1.9	1.3	0.0	0.1	7.3			0.3			6.3	
Delay (s)	14.2	12.3	7.2	9.0	22.6			26.2			34.8	
Level of Service	B	B	A	A	C			C			C	
Approach Delay (s/veh)		12.4			22.4			26.2			34.8	
Approach LOS		B			C			C			C	

Intersection Summary			
HCM 2000 Control Delay (s/veh)	19.6	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	74.0	Sum of lost time (s)	18.6
Intersection Capacity Utilization	77.1%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

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Movement	SEL	SER	NEL	NET	SWT	SWR
Lane Configurations						
Traffic Volume (vph)	248	132	100	761	607	168
Future Volume (vph)	248	132	100	761	607	168
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.7	5.7	5.5	5.5	5.5	5.5
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1805	1615	1805	1900	1900	1615
Flt Permitted	0.95	1.00	0.33	1.00	1.00	1.00
Satd. Flow (perm)	1805	1615	619	1900	1900	1615
Peak-hour factor, PHF	0.83	0.83	0.87	0.87	0.95	0.95
Adj. Flow (vph)	299	159	115	875	639	177
RTOR Reduction (vph)	0	122	0	0	0	68
Lane Group Flow (vph)	299	37	115	875	639	109
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%
Turn Type	Prot	Perm	Perm	NA	NA	Perm
Protected Phases	4			2	2	
Permitted Phases		4	2			2
Actuated Green, G (s)	16.4	16.4	42.4	42.4	42.4	42.4
Effective Green, g (s)	16.4	16.4	42.4	42.4	42.4	42.4
Actuated g/C Ratio	0.23	0.23	0.61	0.61	0.61	0.61
Clearance Time (s)	5.7	5.7	5.5	5.5	5.5	5.5
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	422	378	374	1150	1150	978
v/s Ratio Prot	c0.17			c0.46	0.34	
v/s Ratio Perm		0.02	0.19			0.07
v/c Ratio	0.71	0.10	0.31	0.76	0.56	0.11
Uniform Delay, d1	24.6	21.0	6.7	10.1	8.2	5.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	5.4	0.1	2.1	4.8	1.9	0.2
Delay (s)	30.0	21.1	8.8	14.9	10.1	6.1
Level of Service	C	C	A	B	B	A
Approach Delay (s/veh)	26.9			14.2	9.3	
Approach LOS	C			B	A	

Intersection Summary			
HCM 2000 Control Delay (s/veh)	15.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	11.2
Intersection Capacity Utilization	67.9%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

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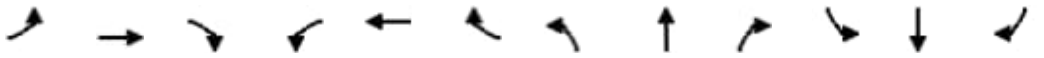

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	11	579	107	17	663	20	89	11	13	32	18	9
Future Volume (vph)	11	579	107	17	663	20	89	11	13	32	18	9
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.4	6.4	6.4	6.4	6.4	6.4	7.9	7.9		7.9	7.9	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.92		1.00	0.95	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1805	1863	1615	1805	1881	1615	1805	1748		1805	1805	
Flt Permitted	0.13	1.00	1.00	0.24	1.00	1.00	0.74	1.00		0.74	1.00	
Satd. Flow (perm)	240	1863	1615	458	1881	1615	1398	1748		1401	1805	
Peak-hour factor, PHF	0.93	0.93	0.93	0.88	0.88	0.88	0.80	0.80	0.80	0.83	0.83	0.83
Adj. Flow (vph)	12	623	115	19	753	23	111	14	16	39	22	11
RTOR Reduction (vph)	0	0	63	0	0	13	0	11	0	0	7	0
Lane Group Flow (vph)	12	623	52	19	753	10	111	19	0	39	26	0
Heavy Vehicles (%)	0%	2%	0%	0%	1%	0%	0%	0%	0%	0%	0%	0%
Turn Type	Perm	NA	Perm	Perm	NA	Perm	Perm	NA		Perm	NA	
Protected Phases		2			2			4			4	
Permitted Phases	2		2	2		2	4			4		
Actuated Green, G (s)	31.7	31.7	31.7	31.7	31.7	31.7	24.0	24.0		24.0	24.0	
Effective Green, g (s)	31.7	31.7	31.7	31.7	31.7	31.7	24.0	24.0		24.0	24.0	
Actuated g/C Ratio	0.45	0.45	0.45	0.45	0.45	0.45	0.34	0.34		0.34	0.34	
Clearance Time (s)	6.4	6.4	6.4	6.4	6.4	6.4	7.9	7.9		7.9	7.9	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	108	843	731	207	851	731	479	599		480	618	
v/s Ratio Prot		0.33			c0.40			0.01			0.01	
v/s Ratio Perm	0.05		0.03	0.04		0.01	c0.08			0.03		
v/c Ratio	0.11	0.74	0.07	0.09	0.88	0.01	0.23	0.03		0.08	0.04	
Uniform Delay, d1	11.0	15.7	10.8	10.9	17.5	10.5	16.4	15.3		15.5	15.3	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	2.1	5.8	0.2	0.9	13.0	0.0	0.2	0.0		0.1	0.0	
Delay (s)	13.1	21.5	11.0	11.8	30.5	10.6	16.7	15.3		15.6	15.4	
Level of Service	B	C	B	B	C	B	B	B		B	B	
Approach Delay (s/veh)		19.8			29.5			16.4			15.5	
Approach LOS		B			C			B			B	

Intersection Summary			
HCM 2000 Control Delay (s/veh)	23.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	14.3
Intersection Capacity Utilization	58.4%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

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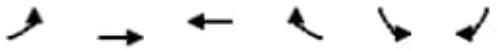

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	53	871	643	214	130	50
Future Volume (vph)	53	871	643	214	130	50
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5		4.5	4.5
Lane Util. Factor	1.00	1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.97		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1770	1900	1822		1805	1615
Flt Permitted	0.21	1.00	1.00		0.95	1.00
Satd. Flow (perm)	395	1900	1822		1805	1615
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.79	0.79
Adj. Flow (vph)	58	947	699	233	165	63
RTOR Reduction (vph)	0	0	13	0	0	54
Lane Group Flow (vph)	58	947	919	0	165	9
Heavy Vehicles (%)	2%	0%	1%	0%	0%	0%
Turn Type	Perm	NA	NA		Prot	Perm
Protected Phases		4	8		6	
Permitted Phases	4					6
Actuated Green, G (s)	46.2	46.2	46.2		9.8	9.8
Effective Green, g (s)	46.2	46.2	46.2		9.8	9.8
Actuated g/C Ratio	0.71	0.71	0.71		0.15	0.15
Clearance Time (s)	4.5	4.5	4.5		4.5	4.5
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	280	1350	1295		272	243
v/s Ratio Prot		0.50	c0.50		c0.09	
v/s Ratio Perm	0.15					0.01
v/c Ratio	0.21	0.70	0.71		0.61	0.04
Uniform Delay, d1	3.2	5.4	5.5		25.8	23.6
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	1.7	3.1	3.3		3.8	0.1
Delay (s)	4.9	8.5	8.8		29.6	23.6
Level of Service	A	A	A		C	C
Approach Delay (s/veh)		8.3	8.8		28.0	
Approach LOS		A	A		C	

Intersection Summary			
HCM 2000 Control Delay (s/veh)	10.6	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	61.6%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

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