North Marysville Traffic Study

Marysville, Ohio

January 30, 2009

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Introduction

The goal of this study is to determine solutions to address the safety, congestion, and geometric deficiencies found at the interchange. This is not intended as a formal Interchange Modification Study; rather an attempt to identify short-term and long-term alternatives for the interchange area that may be included in a future Interchange Modification Study. Additionally, an evaluation of the future capacity needs of the SR 4 and SR 31 corridors will be examined in order to determine what, if any, impacts that potential future road widening of these corridors might have on the interchange area.

Because the south side of the interchange has developments that closely surround the freeway and interchange ramps, the ability to make major improvements to these is unlikely. The ramps on the south side of the interchange (ramps to/from eastbound US 33/US 36) do not have any glaring geometric deficiencies or capacity problems. Additionally, future development is expected to occur north of this interchange. Therefore, this document will primarily focus on the ramps to/from westbound US 33/US 36 located on the north side of the interchange.

Existing Conditions

The existing interchange was designed over forty years ago to accommodate much lower traffic volumes, particularly on the arterial streets (SR 4 and SR 31). The current interchange was designed to allow for high-speed free-flow ramp connections to and from the north on SR 4 and SR 31. While most of the interchange ramp traffic is bound to or from the north, there are substantial traffic movements to and from the south. The existing westbound exit ramps to SR 4 and SR 31 provide for left turn movements to the south via short slip ramps. A diagram of the existing interchange is provided on **Figure 1**. There are no signals at any of the ramp terminal intersections. Analysis of the interchange components revealed numerous deficiencies in the existing design. A summary of these geometric deficiencies is as follows:

Westbound Collector-Distributor (CD) Road Weave
The existing westbound CD-road between SR 4 and SR 31 features a weaving section that no longer meets current design standards. Traffic from the SR 4 entrance ramp to westbound US 33/US 36 must weave with traffic bound for the SR 31 exit ramp. The current weave is less than 400 feet in length, which does not meet the current standard of 1000 feet for a CD-road weave length. In addition, the weaving section does not provide for a full two lanes of pavement width.

Insufficient Left Turn Storage on Ramps
The left turn movements on the two westbound exit ramps (Ramp L and Ramp E) are accommodated via short slip ramps that diverge from the main ramps. These slip ramps

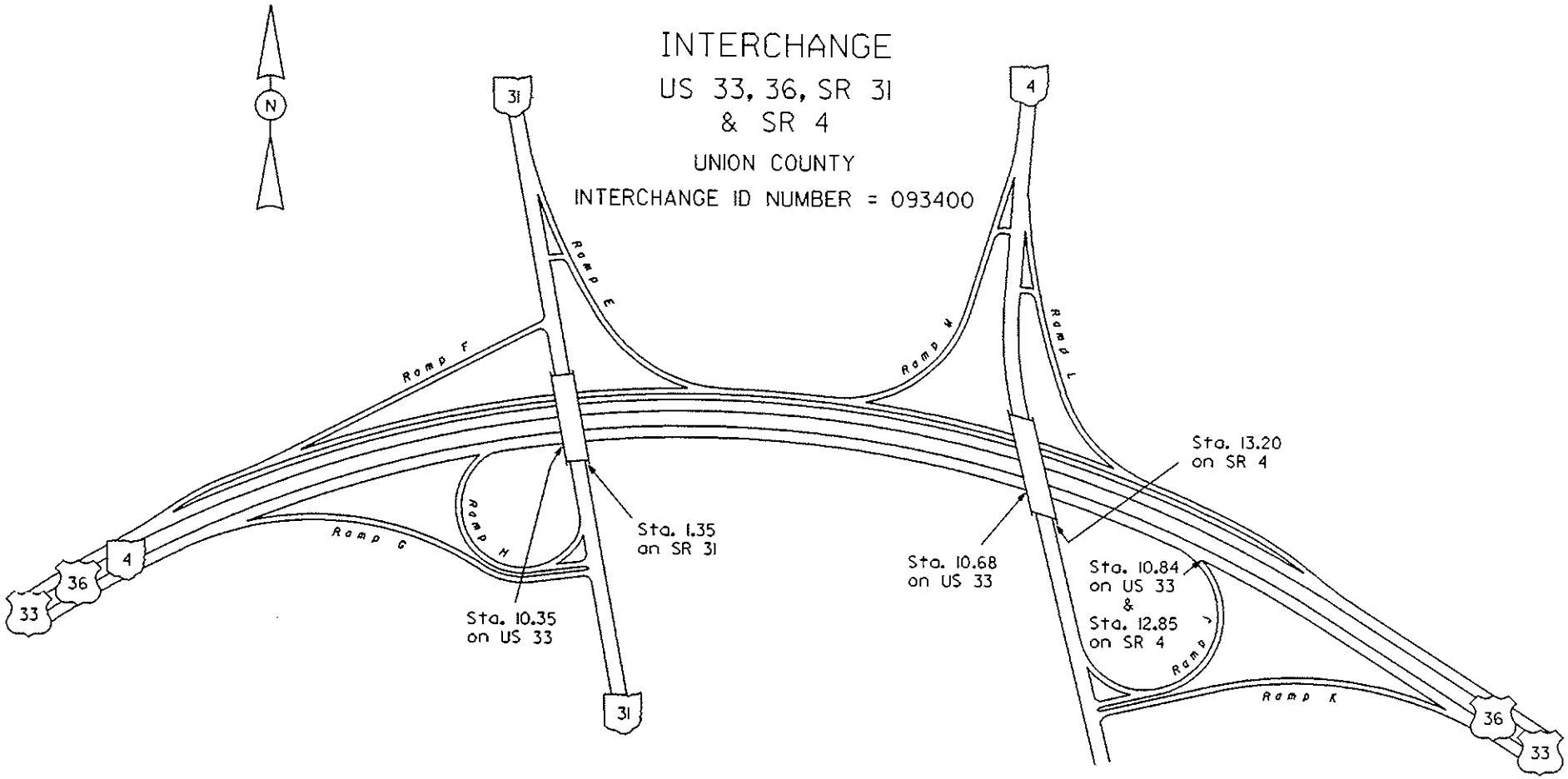

Figure 1

US 33/US 36 & SR 4/SR 31
Interchange

have between 50-100 feet of storage distance for left turning vehicles, which can result in traffic backing up onto the main ramp when more than two vehicles are queued trying to make a left turn.

Ramp Design Speeds
Several of the high-speed ramps at this interchange feature curves that do not meet current design standards. Of particular concern are the curves on Ramp L and Ramp E because they are exit ramps from the freeway. Additionally, the curves on Ramp L and Ramp E are very near the diverge points of the ramps, giving motorists little time to slow down from freeway speeds.

Lane Continuity on Arterial Streets
SR 4 and SR 31 are two-lane arterials (one through lane in each direction) both north and south of the US 33/US 36 interchange. In the interchange area, these roadways have been widened to four lanes (two lanes in each direction) with a 4-foot concrete median strip. These four-lane sections of roadway do very little to improve capacity on the arterial streets due to their relatively short length. At the end of these short four-lane sections one of the through lanes is tapered out, resulting in a merge condition and creating the possibility of sideswipe crashes. Another problem with these four-lane sections is the lack of left turn lanes provided at entrance ramp terminals. Recently, the northbound SR 31 approach to the eastbound US 33/US 36 ramp terminal has been restriped to provide an exclusive left turn lane. However, the other three entrance ramp terminals in the study area do not have left turn lanes. While some of these left turning movements have relatively small volumes, the current configuration leaves drivers waiting in the through lanes to accept gaps for left turns, which can lead to rear-end crashes.

High Speed Merges onto Arterial Streets
The existing westbound ramps to both SR 4 northbound and SR 31 northbound (Ramp L and Ramp E, respectively) are brought onto these roads via a high-speed merge conditions. This configuration can work well in low-volume conditions where there are no other major access points nearby. However, this area, particularly on SR 31, has seen rapid growth in the past several years. A signal serving a large residential development now exists at Mill Road just north of the SR 31 northbound merge area (within a lane drop). Drivers using the westbound exit ramp to SR 31 northbound (Ramp E) must merge and then weave across traffic into the left turn lane for Mill Road. The northbound left turn lane begins less than 300 feet from the ramp terminal. With traffic moving at the posted speed limit of 50 miles per hour, this can be a very difficult and unsafe maneuver.

Crash Analysis

The Marysville Police Department provided crash data for the SR 4/SR 31 interchange area for the three-year period including 2005, 2006, and 2007. These crashes include all

incidents that occurred at the interchange, regardless of whether the Marysville Police or the State Highway Patrol responded. A total of 101 crashes were reported within the study area, including the freeway, the ramp connections, and the arterial streets (on SR 31 from Quail Hollow Drive to Mill Wood Boulevard, and on SR 4 from Taylor Avenue to County Home Road). The largest concentration of crashes were related to the westbound exit ramp to SR 31 (Ramp E). During the three-year period, 26 crashes occurred either on Ramp E, at Ramp E terminals, or in the weave section between Ramp E and Ramp M. A depiction of these crashes is provided in **Figure 2** and are distributed as follows:

- 15 fixed object/left roadway crashes
- 3 angle crashes (left turns at westbound ramp terminal)
- 3 animal-related crashes
- 2 rear-end crashes
- 1 crash involving a parked vehicle
- 1 truck rollover crash
- 1 jackknifed truck crash

The existing design deficiencies on Ramp E and the westbound CD-road weave section are likely contributing to the large number of crashes involving vehicles leaving the roadway. Motorists approaching Ramp E are traveling at freeway speeds and have very little time to slow down to an appropriate speed for the curve on the ramp. Other vehicles have lost control in the westbound CD-road weaving section, which could be a result of making weaving maneuvers in a congested section of roadway.

Environmental Features

A search of records was undertaken to determine what, if any, known environmental features could impact the alternatives developed for this study. The current FEMA Flood Insurance Rate Map indicates that there are areas in the 100-year floodplain east of SR 4, both north and south of the freeway. No other lands near the interchange are within the 100-year floodplain. Ohio Wetland Inventory (OWI) data indicates possible wetlands located and other possible hydrologic features northeast and southeast of the SR 4 interchange. The OWI data also shows a hydrologic feature (possible stream) running parallel to US 33/US 36 approximately 400 feet north of the freeway. A copy of the OWI data is provided as **Figure 3**. If this feature were determined to be a jurisdictional stream, mitigation may be required if an alternative caused a disturbance to the feature. Further study would be required for any alternatives involving work on the east side of SR 4, given the possible wetlands and floodplain issues in that portion of the study area.

Capacity Analysis

Traffic volumes for the interchange area were developed based on traffic counts included in the Meijer Development Traffic Impact Study, prepared by Woolpert, Inc. on June 22, 2007. Peak hour turning movement counts were taken at many of the interchange

Figure 2

CRASHES ON RAMP E & WESTBOUND CD-ROAD (2005 – 2007)

US 33/US 36 & SR 4/SR 31 INTERCHANGE

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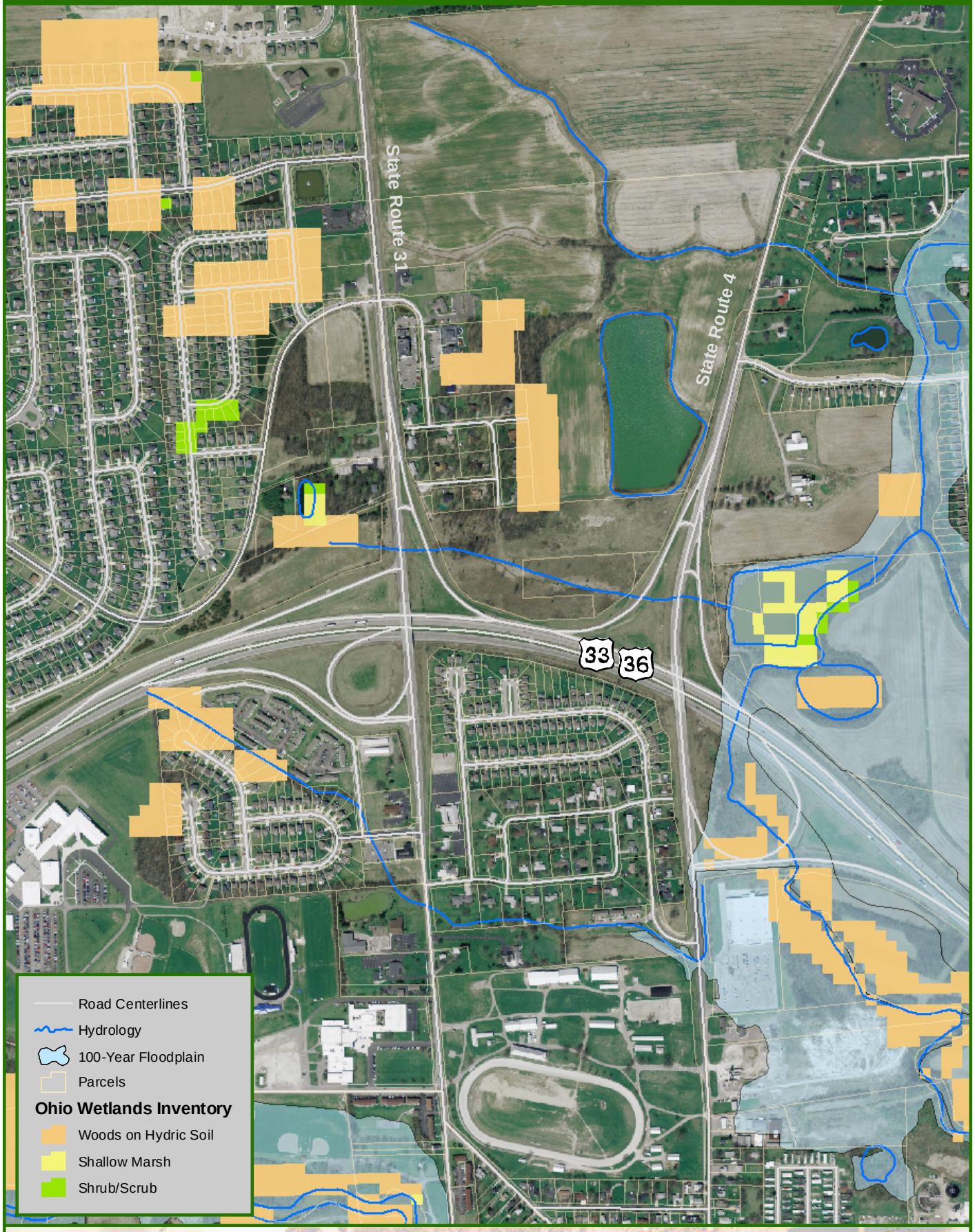
Potential Wetland Areas

Figure 3



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intersections during April of 2007. Two additional peak hour turning movement counts, at locations not counted by the Woolpert study, were taken by ms consultants in February 2008. These counts were then factored using the appropriate ODOT seasonal adjustment factors and the ODOT design hourly volume (DHV) factors to obtain existing year (2007) traffic volumes. The most recent ODOT 24-hour tube counts in the study area were used to develop peak hour truck factors for analysis purposes.

The Woolpert study developed a 1.5% linear annual growth factor for the study area. This growth rate will be used in development of future traffic volumes in this document as well. Because 2012 would be the likely first year that a major construction project could be completed, this feasibility study will analyze 2012 as the Opening Year and 2032 as the Design Year. In 2012, it will be assumed that Meijer is developed, but not the additional Cook Property development that includes 200,000 square feet of office and 300,000 square feet of additional retail because they are unlikely to be fully constructed by 2012. The 2012 traffic volumes also assume that the property bounded by Mill Road, SR 31, and US 33 (northwest quadrant of the SR 31 interchange) will be developed with retail uses. A guesstimate of trips generated by this potential development was used and added to the network. The resulting traffic volume plates used in the 2007, 2012, and 2032 analyses are included as **Figure 4**, **Figure 5**, and **Figure 6**, respectively.

Highway Capacity Software (HCS+) was used to analyze the various components of the existing interchange. The results of this analysis are depicted in **Table 1**. The table shows that the weaving section on the westbound collector-distributor (CD) road will degrade to level-of-service (LOS) E within the next five years. The Ramp E intersection with SR 31, which was identified in earlier sections of this document as having geometric and safety deficiencies, is shown to operate at LOS F with vehicle delays that are expected to nearly triple by 2012. The eastbound ramp terminal intersection on SR 31 is also shown to be operating at LOS F. For the most part, the SR 4 interchange intersections have sufficient capacity to operate acceptably through 2012. However, the eastbound ramp terminal at SR 4 is predicted to operate at LOS F by 2012. Potential solutions for all of these locations are discussed in the subsequent Interchange Alternative Development section. Copies of all HCS reports are located in **Appendix A**.

Table 1: HCS Analysis of the Existing Interchange Configuration

Location	Level-of-Service (LOS) & Average Vehicle Delays (in sec./veh.)			
	2007		2012	
	AM	PM	AM	PM
WB CD-road weaving section[1]	A 10.2	D 31.9	B 12.0	E 37.1
SR 31 & Ramp E (WB exit ramp)[2]	E 37.4	F 83.6	F 58.6	F 235.2

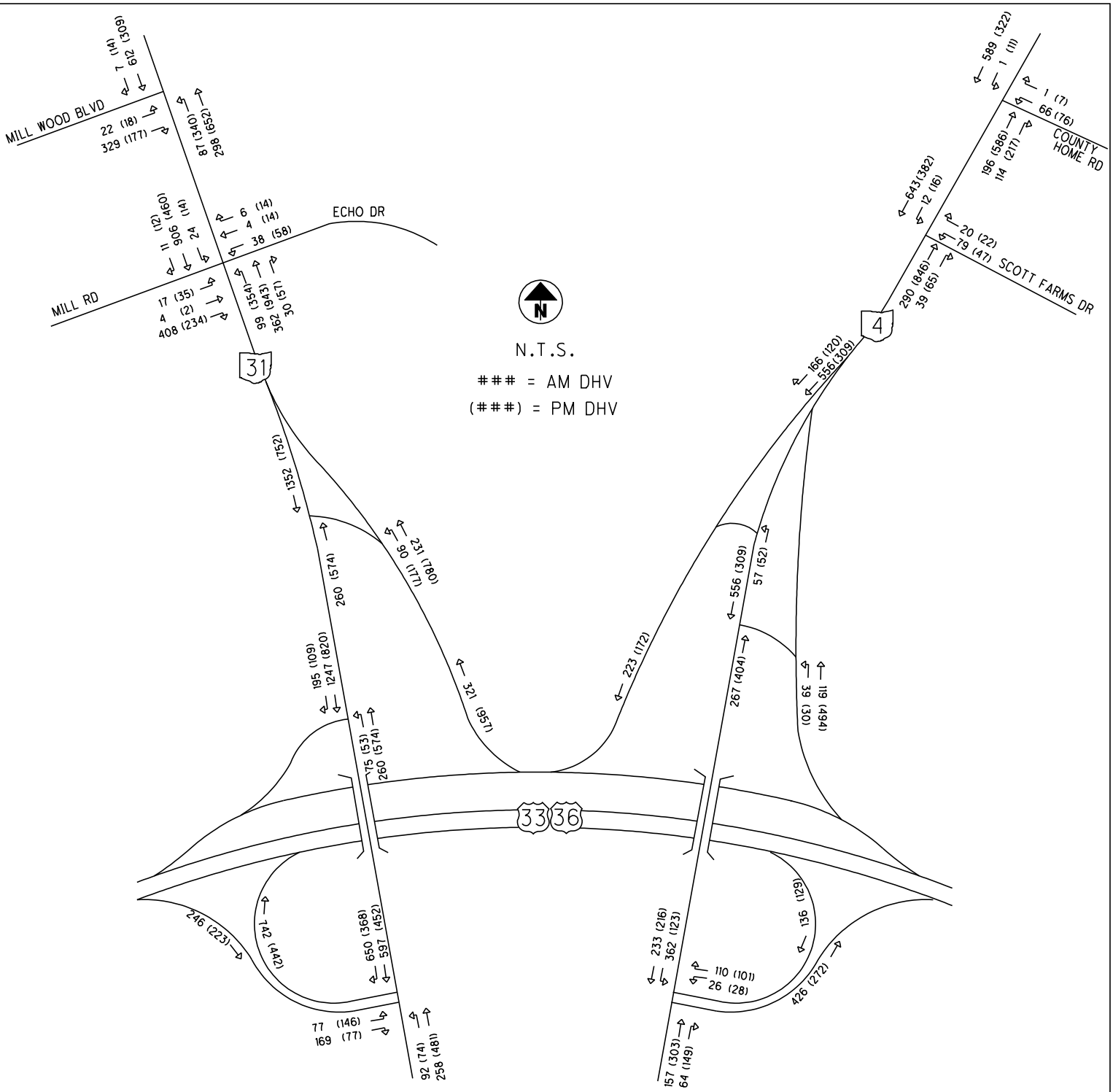

Figure 4

EXISTING YEAR (2007) DESIGN HOUR TRAFFIC VOLUMES

NORTH MARYSVILLE TRAFFIC STUDY

Marysville, OH

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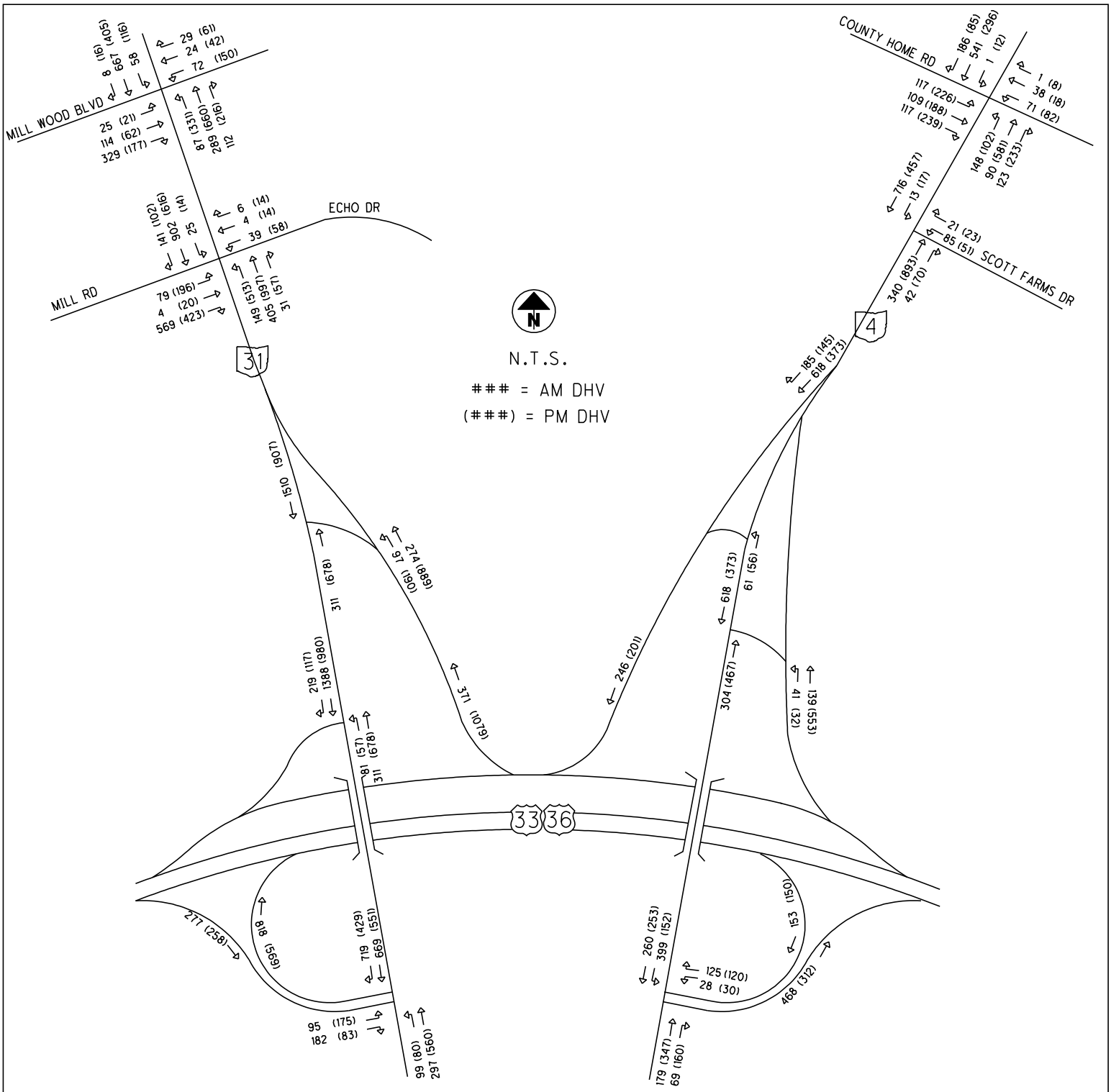

Figure 5

OPENING YEAR (2012) DESIGN HOUR TRAFFIC VOLUMES

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Marysville, OH

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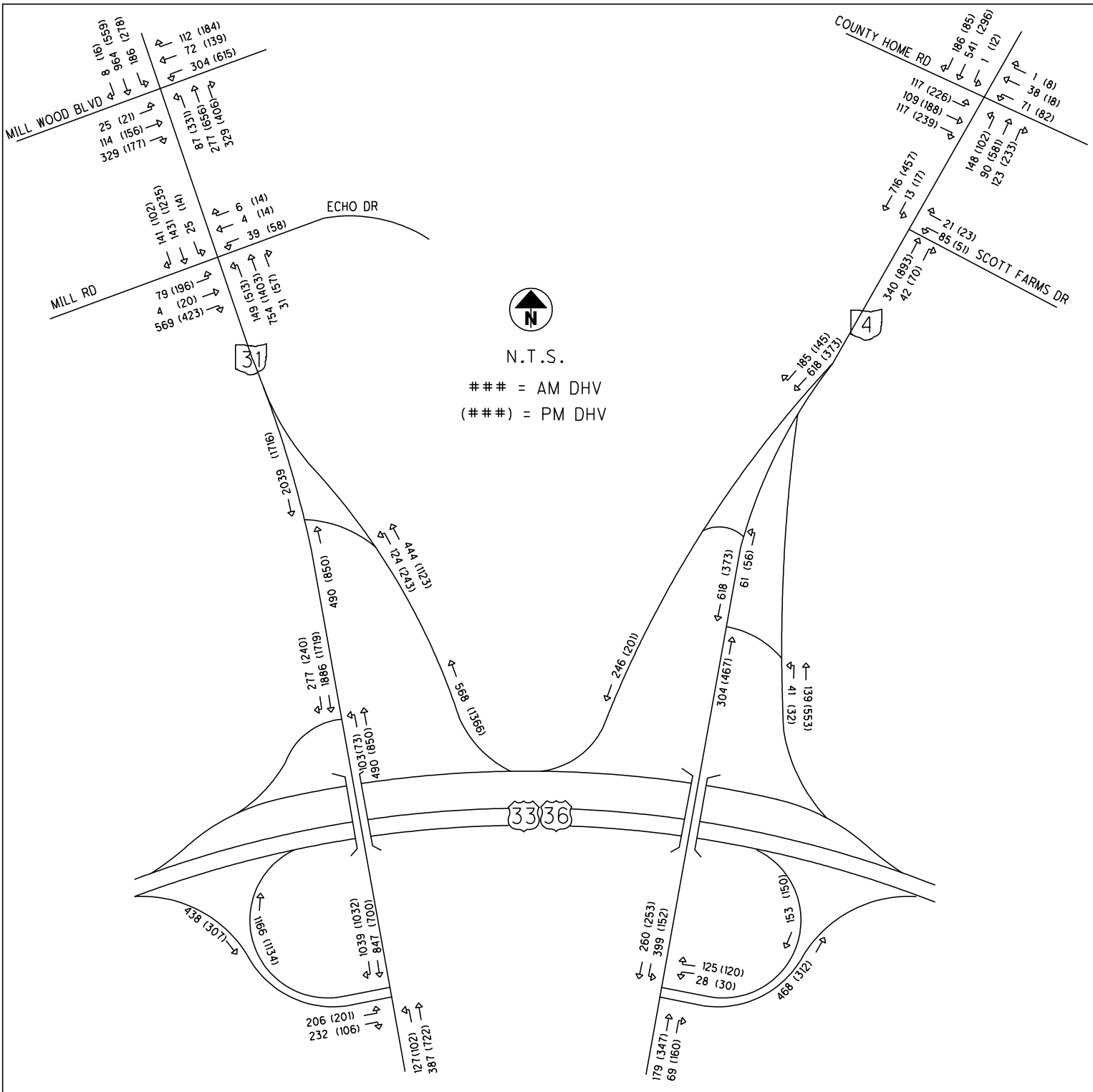

Figure 6

DESIGN YEAR (2032) DESIGN HOUR TRAFFIC VOLUMES

NORTH MARYSVILLE TRAFFIC STUDY

Marysville, OH

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SR 31 & Ramp F (WB entrance ramp)[2]	C 16.2	B 10.8	C 19.2	B 12.1
SR 31 & US 33 EB ramp terminal[2]	D 26.9	F 79.0	F 69.6	F 152.9
SR 4 & Ramp M (WB entrance ramp)[2]	A 9.0	A 8.1	A 9.3	A 8.3
SR 4 & Ramp L (WB exit ramp)[2]	B 14.4	B 14.4	C 15.7	C 16.2
SR 4 & US 33 EB ramp terminal[2]	E 39.1	C 19.9	F 53.7	D 25.1

[1]Weave section - number shown with LOS is vehicle density (in passenger cars per lane per hour)
[2]Unsignalized intersection - number shown with LOS is vehicle delay for stopped approach

Interchange Alternative Development

The goal of this study is to develop alternatives that will address the current geometric deficiencies and safety problems, while providing adequate capacity for traffic demand. The following paragraphs detail some potential improvements that could be made over the next decades. A short-term solution has been identified that would be very low cost and easy to implement. A short/intermediate-term solution has been identified that alleviate the most urgent deficiencies at a reasonable cost. Finally, long-term solutions for the interchange have been developed that can handle possible traffic growth on both the SR 4 and SR 31 corridors. These solutions are described below:

Short-Term – Arterial Street Restriping (Short-Term)
This alternative would restripe SR 4 and SR 31 to maintain only one through lane in each direction through the US 33/US 36 interchange area. This alternative would correct the undesirable features on SR 4 and SR 31 that are associated with the short four-lane pavement sections that currently exist. Exclusive left turn lanes could be striped at all four entrance ramp terminal intersections. Three of the four existing lane drop situations would be eliminated. The only lane drop/merge proposed to remain would be on SR 31 northbound. However, the lanes could be striped in a manner that significantly lengthens the distance that westbound freeway ramp traffic has to merge onto SR 31. **Figures 7-10** depicts how SR 4 and SR 31 could be restriped. No new pavement or structures would be required with this alternative. Because the alternative only involves restriping, the costs should be minimal and the implementation could be immediate. This alternative would not have a noticeable impact (either positively or negatively) on the levels-of-service of the SR 31 ramp terminal intersections.

Short/Intermediate Term – Ramp E Reconfiguration
This alternative would reconfigure the westbound exit ramp to SR 31 (Ramp E) to bring the ramp terminal under signal control. Ramp E would be aligned directly across from the existing westbound entrance ramp (Ramp F). Traffic trying to access US 33/US 36

MATCH LINE SEE FIGURE 9

MATCH LINE SEE FIGURE 8

FIGURE 7	NORTH MARYSVILLE TRAFFIC STUDY SHORT-TERM STRIPING IMPROVEMENT - SR 31 (SOUTH)	CALCULATED 1-31-08 CHECKED	0 75 50 150 HORIZONTAL SCALE IN FEET	N

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UOF: ohdotv8
PCF: 60-10527

Ohio DOT Workspace
OTC EZ-Pass Signing

$MESSAGE1$

MATCH LINE SEE FIGURE 7

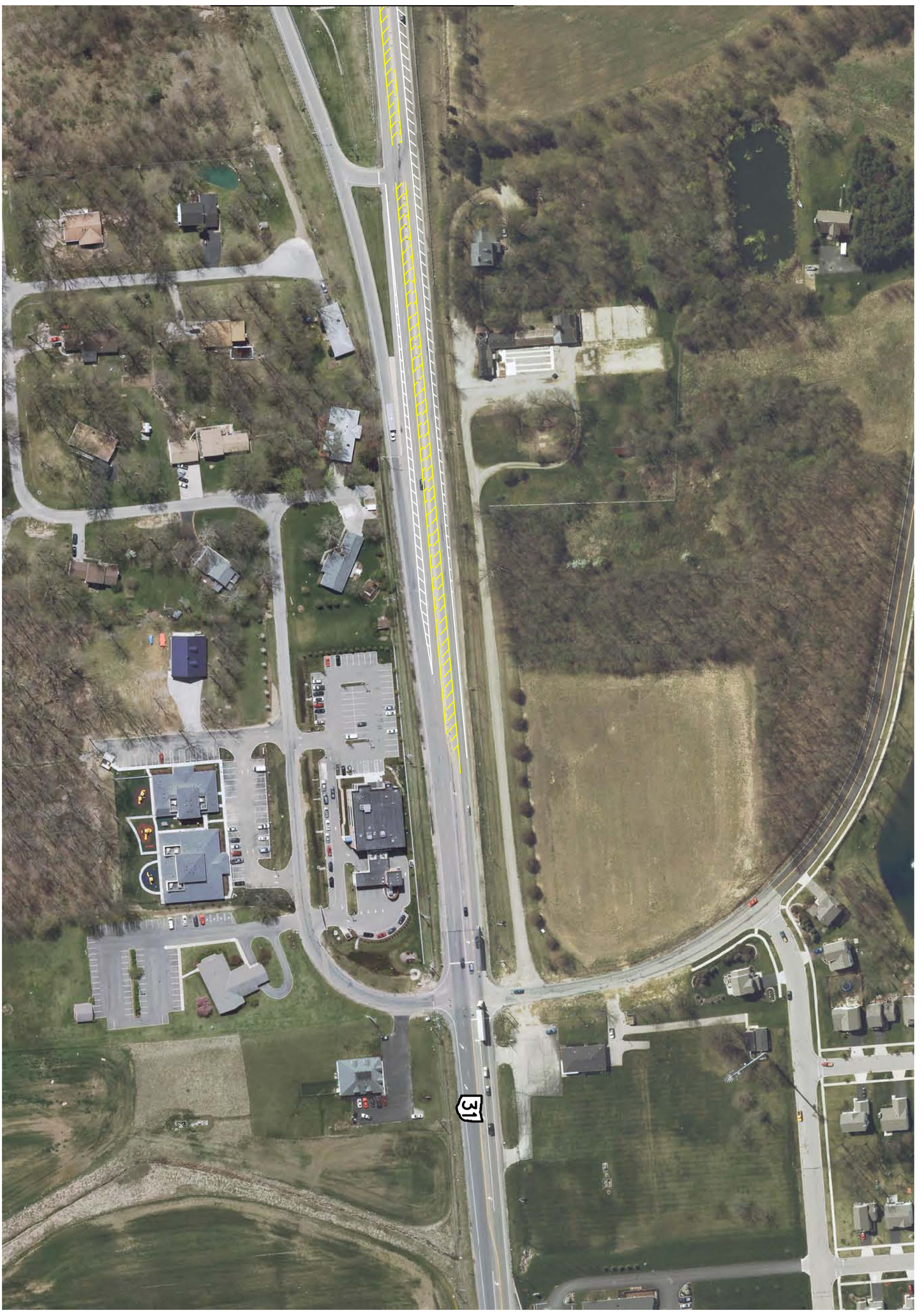

	FIGURE 8	**NORTH MARYSVILLE TRAFFIC STUDY** **SHORT-TERM STRIPING IMPROVEMENT - SR 31 (NORTH)**	CALCULATED 1-31-08 CHECKED	0 75 50 150 HORIZONTAL SCALE IN FEET

$MESSAGE2$

34" x 22"

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0 1"
0.5"

UOF: ohdotv8
PCF: 60-10527

Ohio DOT Workspace
OTC EZ-Pass Signing

$MESSAGE1$

MATCH LINE SEE FIGURE 10

MATCH LINE SEE FIGURE 7

FIGURE 9

NORTH MARYSVILLE TRAFFIC STUDY
SHORT-TERM STRIPING IMPROVEMENT - SR 4 (SOUTH)

CALCULATED 1-31-08
CHECKED

0 75
50 150
HORIZONTAL SCALE IN FEET

N

$MESSAGE2$

34" x 22"

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PCF: 60-10527

Ohio DOT Workspace
OTC EZ-Pass Signing

$MESSAGE1$

MATCH LINE SEE SHEET 9

	FIGURE 10	**NORTH MARYSVILLE TRAFFIC STUDY** **SHORT-TERM STRIPING IMPROVEMENT - SR 4 (NORTH)**	CALCULATED 1-31-08 CHECKED	0 75 50 150 HORIZONTAL SCALE IN FEET

$MESSAGE2$

westbound from SR 4 would have to pass through this signalized intersection, as the existing CD-road under SR 31 would be abandoned. This alternative would have many benefits and would address the worst safety and congestion problems, such as:

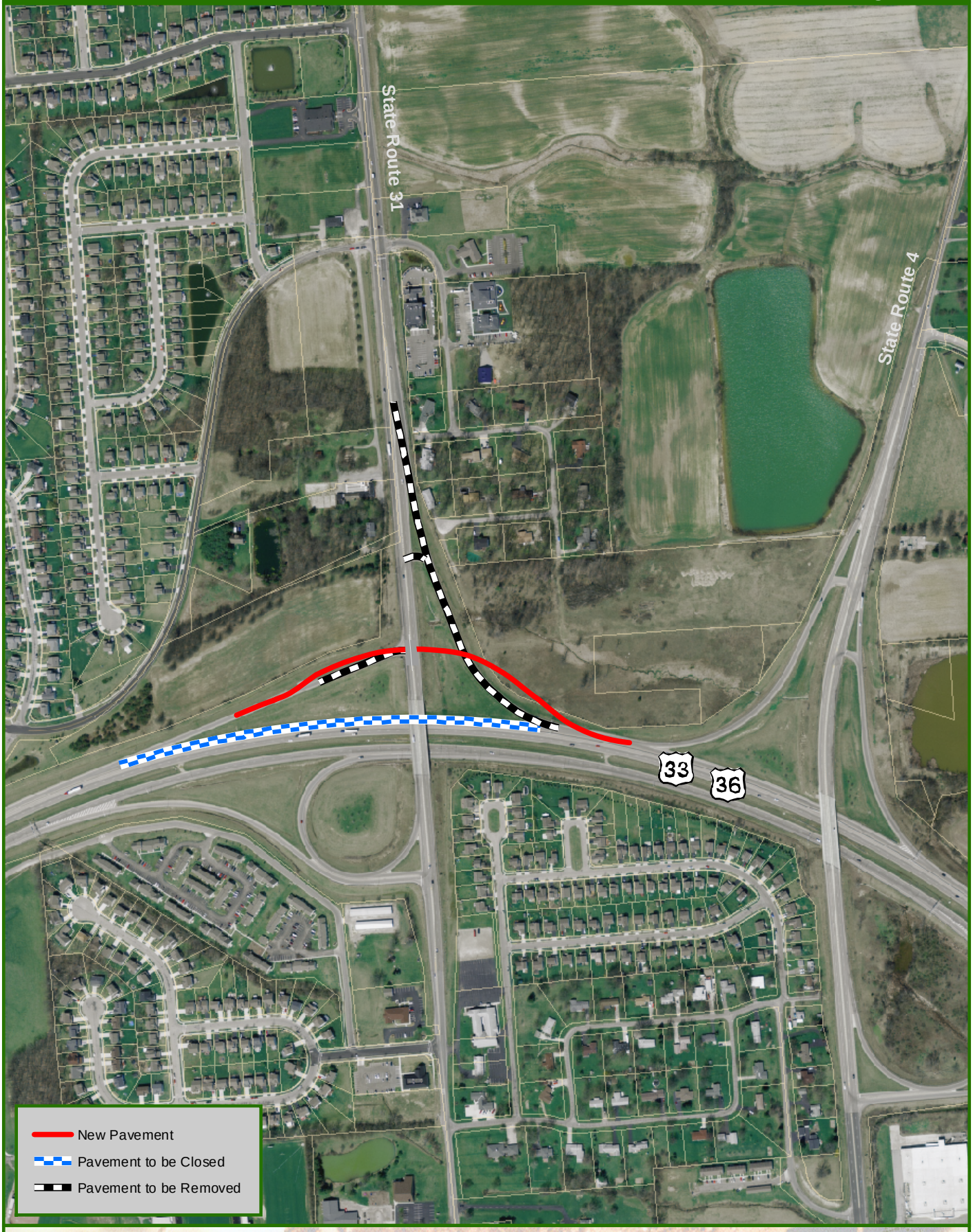
- Elimination of westbound CD-road weaving section, which a safety concern due to its short length and geometric deficiencies, as well as a congestion concern due to the predicted LOS E operation by 2009. While some weaving would exist on the proposed new ramp configuration, the traffic would have more length to change lanes and would be traveling at lower speeds due to the presence of a signal at the ramp terminal
- Elimination of Ramp E curve that experienced a large number of crashes involving vehicles leaving the roadway. The curvature on Ramp E does not meet current design standards.
- Elimination of the high-speed merge condition where Ramp E currently meets SR 31 northbound. Ramp E drivers wishing to turn left onto Mill Road would no longer need to weave across SR 31 lanes with the new signalized ramp terminal configuration. All Ramp E traffic would be under signal control at the SR 31 ramp terminal intersection.
- Elimination of the left turn slip ramp on Ramp E. The existing slip lane has insufficient storage length and can cause queuing into the main part of Ramp E. This movement is also operating at LOS F today and will continue to worsen as traffic volumes increase.

A depiction of this concept is shown on **Figure 11**. Preliminary geometric analysis was undertaken to ensure that the concept could be constructed while providing acceptable alignment. The analysis indicated that the depicted alignment on Figure 11 can be constructed to meet ODOT design standards for vertical profile design. The conceptual design would be safer than the existing deficient design. Preliminary geometric analysis also indicates that no widening would be necessary on the existing bridge over US 33/US 36 under this concept.

Table 2 demonstrates the effectiveness of the Ramp E Reconfiguration alternative on the level-of-service for the westbound ramp terminal. The existing condition is unsignalized and the numbers shown in the table represent westbound approach delays only. The build condition is assumed to be signalized and the numbers in Table 2 represent average vehicle delays of all approaches. To best accommodate future traffic volumes, the proposed reconfiguration of Ramp E should have three approach lanes at the westbound approach to SR 31, which would include dual right turn lanes. Two lanes would be needed on both the northbound and southbound approaches. The northbound approach should include a left turn lane and a through lane. In order to provide lane continuity for the northbound through traffic through the Mill Road intersection, SR 31 would be widened north of the new Ramp E terminal intersection. The widening would extend for approximately 660 feet north of the ramp terminal, at which point the northbound lanes would be transitioned to the existing pavement. Without such a widening, northbound

Ramp E Reconfiguration

Figure 11



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through traffic would be in the lane (rightmost) that is tapered out at Mill Road. As evidenced in Table 2, the lane configuration necessary to achieve LOS D in the 2012 year is predicted to eventually degrade to LOS E by 2032. However, if the westbound through traffic is removed from this intersection (as will be discussed in the long-term scenario), the lane power shown in Table 2 is predicted to be sufficient through 2032. A depiction of the proposed design of the Ramp E intersection with SR 31 is shown in **Figure 12.**

Table 2: HCS Analysis of Ramp E Reconfiguration

	Level-of-Service (LOS) & Average Vehicle Delays (in sec./veh.)			
	2012		2032	
	AM	PM	AM	PM
SR 31 & Ramp E (WB exit ramp) ***Existing Condition*** WB: L NB: T, T SB: T, T	F 58.6	F 235.2	F *	F *
SR 31 & Ramp E (WB exit/entrance ramp) ***With Ramp E Reconfiguration*** WB: LT, R, R NB: L, T SB: T, TR	C 28.1	C 27.9	E** 69.5	D** 46.7

*delays too large for HCS to calculate
**would be LOS D or better if westbound through movement was removed (part of potential long-term scenario)

The Ramp E Reconfiguration would retain the existing diverge and merge points from the freeway mainline. Thus, the freeway level-of-service would be unaffected by this change. This alternative is also consistent with potential long-term solutions for this interchange, which will be discussed in the succeeding section. The new westbound ramp terminal and intersection configuration could remain in these long-term scenarios.

Split-Diamond Configuration on North Side (Long-Term)
This alternative would convert the north side of the interchange into a split-diamond configuration. This alternative may be necessary in the future to correct geometric deficiencies and congestion at the SR 4 ramp terminals. As development continues to occur on the north side of Marysville, the existing interchange configuration at SR 4 may become incapable of handling large traffic volumes. Therefore, future SR 4 improvements would ideally be compatible with any previous improvements performed at SR 31 (Ramp E).

A split-diamond configuration would eliminate all of the slip ramps and other undesirable geometric conditions that exist today. A single intersection on SR 4 would be created to serve the westbound entrance ramp and exit ramp traffic. Westbound freeway traffic

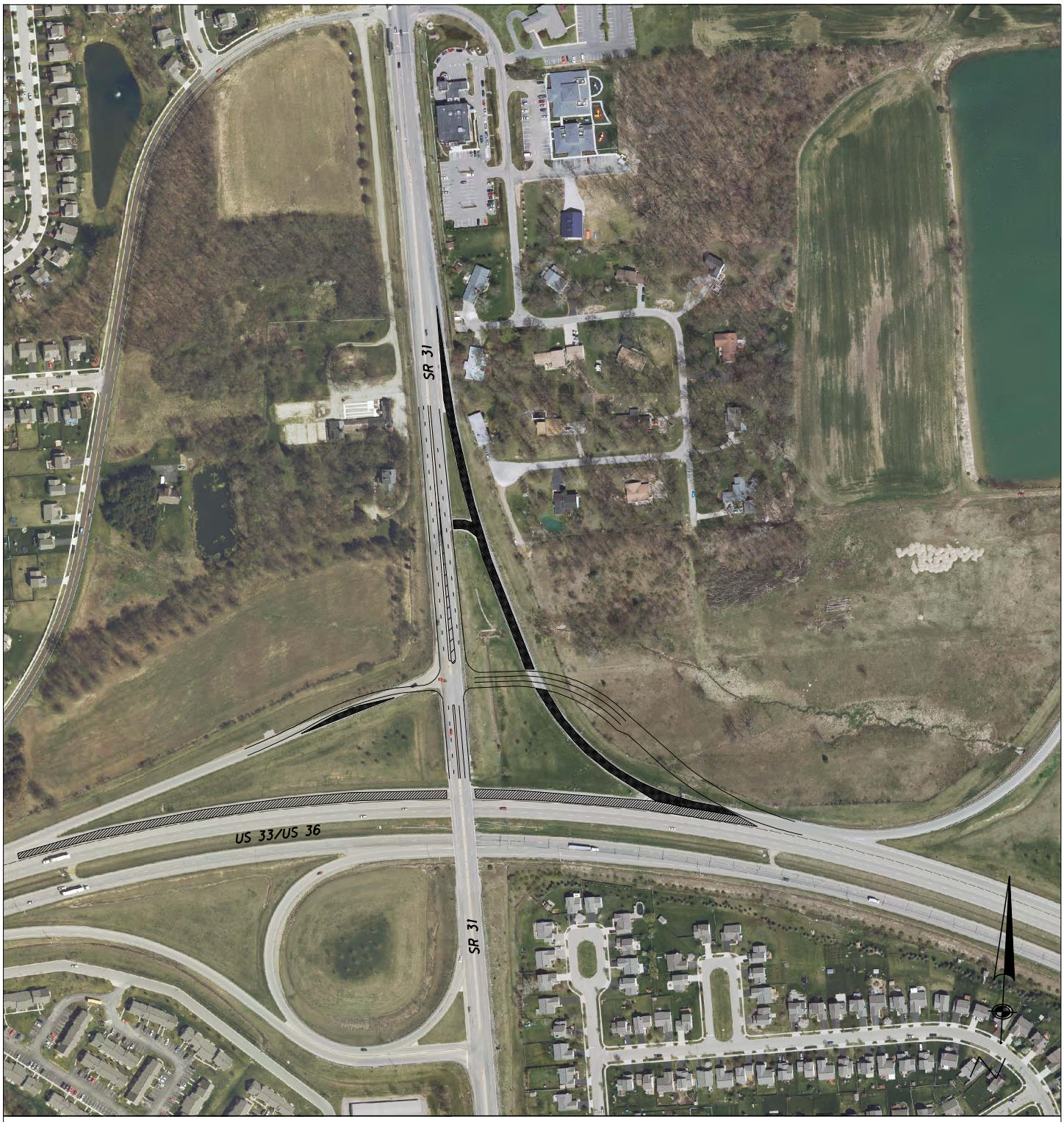

Figure 12

RAMP E RECONFIGURATION CONCEPTUAL GEOMETRY

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bound for SR 31 would have to pass through this signal on SR 4. Due to the existence of CD-road that passes under SR 31 (which would be abandoned in the "Reconfiguration of Ramp E" scenario), SR 4 traffic bound for westbound US 33/US 36 could bypass the signal at the SR 31 ramp terminal. **Figure 13** and **Figure 14** provide two possible concepts, Option A and Option B, for how the split-diamond configuration could be designed. Option A shows the westbound CD-road located further away from the freeway mainline between SR 4 and SR 31, which provides for a more tangent CD-road. Option B shows the westbound CD-road with more curvature between SR 4 and SR 31, which would require less right-of-way acquisition and therefore less costly.

A third potential long-term configuration, Option C, is similar to the split-diamond concepts, but would contain a loop exit ramp onto SR 4. The primary advantage for Option C is that no work would be necessary in the northeast quadrant of the SR 4 interchange, where floodplains and potential wetlands or other environmentally sensitive areas exist. If mitigation of impacts to these areas was too costly or infeasible, then Option C would be more desirable. Option C would not force westbound freeway traffic bound for SR 31 to pass through a signal at SR 4, but would force SR 4 traffic bound for the westbound freeway to pass through the signal at SR 31. As can be seen in **Figure 15**, separate westbound exits from the CD-road for SR 4 and SR 31 would be maintained. However, this configuration would create weaving traffic on the ramp approaching SR 31, as traffic bound for northbound SR 31 would be trying to move right while traffic from SR 4 would be trying to move left. This option would also require a larger right-of-way acquisition from the northwest quadrant of the SR 4 interchange, including areas north of the waterway that runs east-west through the interchange. Mitigation for impacts to this waterway may be necessary under this option.

If any of the long-term alternatives (Options A, B, or C) were implemented several years after the "Reconfiguration of Ramp E" was constructed, many of the elements of the previous design might be usable in the long-term design. The proposed westbound ramp terminal intersection at SR 31 would remain in this long-term alternative. Each of these alternatives would provide for a traditional intersection design at SR 4 and the westbound ramps. The existing high-speed merge and diverge would be eliminated, as would the very short left turn slip lane on the westbound exit ramp. The intersection of SR 4 with the westbound ramps would meet all current geometric standards. No widening of the SR 4 over US 33/US 36 is expected to be necessary for the long-term plans. It should be noted that the environmental overview indicated the presence of floodplain, potential wetlands, and other possible hydrologic features immediately northeast of the SR 4 interchange. Further study would be needed to determine if these environmental features could hamper or preclude construction of a new exit ramp in this area.

Other items for consideration at this interchange

As indicated in Table 1, the SR 31 intersection at the eastbound US 33/US 36 ramps is currently operating at LOS F during the peak hour, with delays that are predicted to continue increasing. Capacity analysis shows that under signal control, this intersection

Potential Long-Term Configuration - Option A

Figure 13

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Potential Long-Term Configuration - Option B

Figure 14

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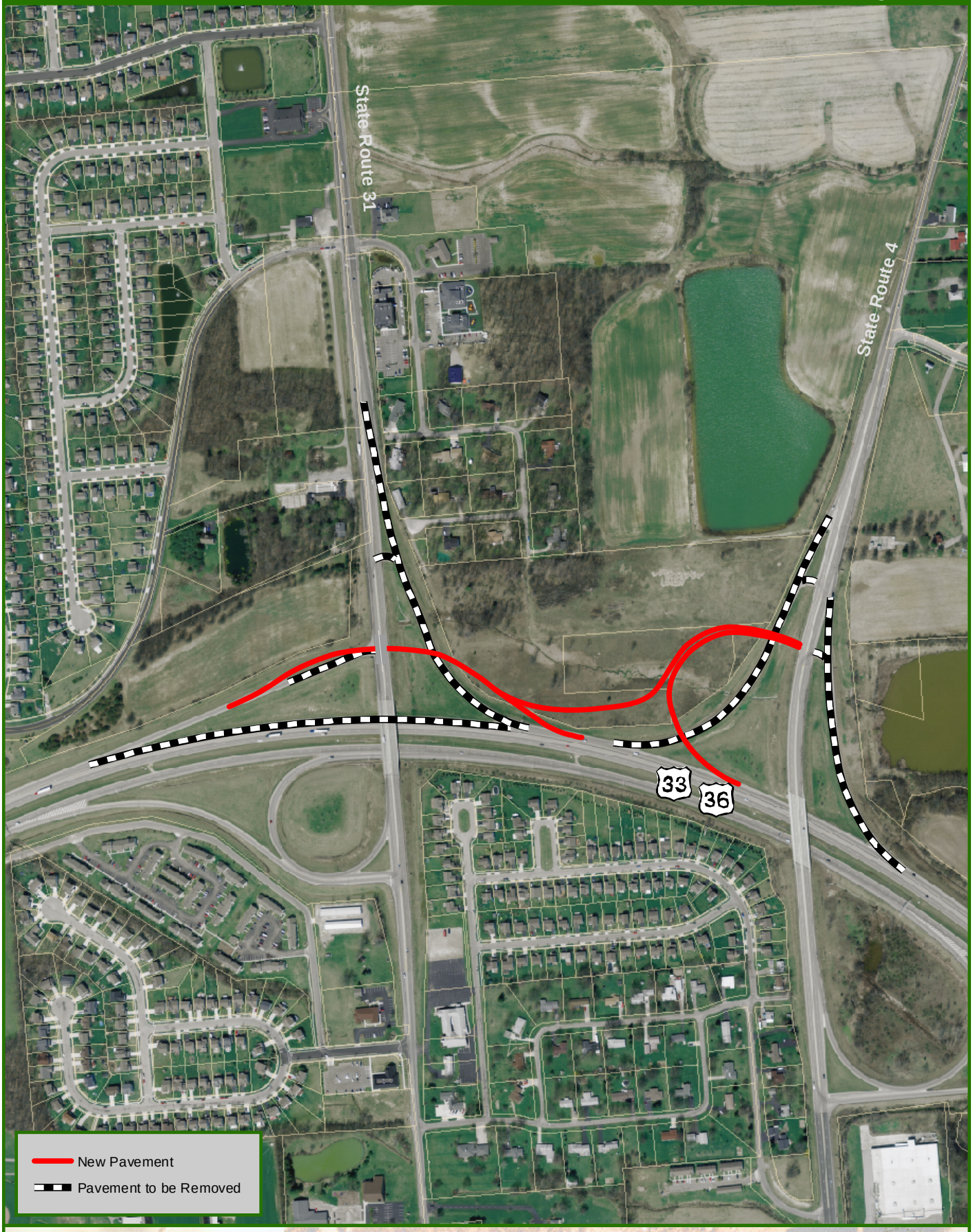
Potential Long-Term Configuration - Option C

Figure 15



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can operate at LOS D or better through 2032 without any lane additions. Based on the existing peak hour volumes, it appears that signal warrant volumes would likely be met at this location. Field observations noted substantial queuing of traffic on the eastbound exit ramp during the AM peak hour, presumably related to school traffic. Further count data and study should be undertaken to properly determine if a signal is warranted.

If a signal is provided at the SR 31/EB ramp terminal intersection, consideration should be given to bringing the southbound right turn movement (currently operating as a high-speed free-flow movement outside of the intersection) within the intersection and under signal control. This would allow for a safer crossing for pedestrians on the west side of SR 31, allowing for an improved connection between the high school and the large residential subdivisions north of the US 33/US 36 freeway. However, no pedestrian traffic was observed at this location during the school peak hours in the recent count conducted for this study. Furthermore, this would degrade the efficiency of the southbound right turn movement, a movement with very heavy traffic volumes and high truck traffic. While capacity analyses show that the intersection could operate at LOS D with this movement under signal control, the intersection would see increased delays, noise (from trucks braking and accelerating), and possibly rear-end crashes.

The SR 4/EB ramp terminal intersection is currently shown to be operating at LOS E during the existing AM peak hour and LOS F by 2012. However, this poor level-of-service is only experienced by the left turns coming off the exit ramp onto southbound Main Street. Even in 2012, this left turning volume is only expected to be 30 vehicles in the design hour. Additionally, this is a redundant movement, as eastbound US 33 drivers can use the SR 31 exit instead with minimal additional travel time in order to access areas south of the interchange. A signal would not be warranted at this location, even if the exit ramp right turns were rerouted through this intersection. Therefore, no improvements are recommended to improve the LOS for this very small volume of traffic. If future development occurs south of this interchange that causes a significant rise in left turns from this exit ramp, a future signal warrant study may be desirable.

Arterial Network Intersections

The arterial network intersections north of US 33/US 36 were analyzed with HCS to gauge the future needs of these locations. **Table 3** provides the results of these analyses, along with the lane configurations needed to achieve LOS D or better in the future years.

Table 3: HCS Analysis of Arterial Street Intersections

	2012			2032		
	Recommended Configuration	LOS/Delay		Recommended Configuration	LOS/Delay	
		AM	PM		AM	PM
SR 31 & Millwood Boulevard	EB: L, TR WB: L, TR NB: L, T, R	C 22.2	C 22.2	EB: L, T, R WB: L, L, TR NB: L, T, T, R	C 30.9	C 33.7

	SB: L, TR			SB: L, T, TR		
SR 31 & Mill Road/Echo Drive	EB: L, TR, R WB: LTR NB: L, T, TR SB: L, T, TR	C 23.6	C 26.7	EB: L, TR, R WB: LTR NB: L, T, TR SB: L, T, TR	C 34.3	C 31.8
SR 4 & County Home Road	EB: L, TR WB: L, TR NB: L, TR SB: L, TR	C 26.3	C 26.9	EB: L, TR WB: L, TR NB: L, TR SB: L, TR	C 32.7	D 42.1
SR 4 & Scott Farms Drive	WB: L, R NB: T, R SB: LT	D* 32.4	E* 44.3	EB: L, TR WB: L, TR NB: L, TR SB: L, TR	C 26.5	C 29.0

*assumed to be unsignalized – number shown represents delay for worst approach

SR 31 & Millwood Boulevard

HCS analysis shows that the existing intersection configuration, plus the addition of a fourth leg and a northbound right turn lane, will be sufficient to provide acceptable LOS through 2012. The development of the Cook Property and the increased background traffic expected in the next two decades will cause the need for other improvements. SR 31 will need an additional through lane in each direction. Dual westbound left turn lanes and an eastbound right turn lane will be needed at this location.

SR 31 & Mill Road

The HCS analyses show the need for an additional through lane in each direction at this intersection in 2012. If the property on the southwest corner of this intersection is developed for retail uses, Mill Road will need to be widened to have three eastbound approach lanes. This configuration will be needed to satisfy 2012 traffic demands, but HCS analysis shows that the recommended configuration will operate acceptably through 2032. While not shown to be necessary for capacity purposes, a westbound left turn lane (to provide better left turn sight distance) may be desirable for safety considerations at this intersection.

SR 4 & County Home Road

Upon development of the Meijer site, a fourth leg of this intersection is expected to be added by the developer. In order to obtain acceptable LOS, and for optimal intersection safety, left turn lanes are recommended for all four approaches.

SR 4 & Scott Farms Drive

The analysis shows a poor LOS in 2012, if the intersection remains unsignalized. This is a result of volume on SR 4, not high volumes on Scott Farms Drive. There is no need for improvements until a fourth leg of this intersection is added. An acceptable LOS through 2032 can be achieved through signalization of this intersection (assumed to be done when the Cook Property is built out and the west leg of intersection is added) and left turn lanes are provided on all approaches. The existing northbound right turn lane is not necessary for acceptable LOS under signalized conditions.

These results show the likelihood that SR 31 will need to be widened to five lanes from the Ramp E (westbound) terminal intersection north through the Millwood Boulevard intersection over the next two decades. These results also show that additional through lanes on SR 4 are not likely to be necessary in the future. However, it is recommended that sufficient right-of-way be acquired wherever possible to accommodate a 5-lane roadway, in the event that unexpected growth occurs in the SR 4 corridor. As future development plans in the area are submitted and finalized, recommendations for improvements at these intersections should be reviewed and revised if necessary. Also, as SR 4 and SR 31 north of US 33/US 36 become more suburban in character, these roadways should be monitored to ensure that appropriate speed limits are posted.

The future capacity needs of SR 4 and SR 31 would not preclude the interchange alternatives presented in the previous sections. Neither arterial is anticipated to require widening of the bridges spanning the US 33/US 36 freeway. **Figure 16** provides a depiction of the lane configurations needed to adequately accommodate 2012 traffic volumes, while **Figure 17** illustrates the lanes needed for 2032 traffic volumes.

Other Traffic Studies

A signal warrant study was conducted for the intersection of SR 31 (Maple Street) and Quail Hollow Drive/Taylor Avenue, which is located just south of the US 33/US 36 freeway. The results of this analysis showed that a signal is not currently warranted at this location. The full warrant study plus documentation is provided as **Appendix B**. Additionally, a speed zone study has been conducted for the SR 31 corridor north of the US 33/US 36 freeway. This study, which is provided as **Appendix C**, did not show that a lower speed limit was warranted at this time.

Conclusions

The "Reconfiguration of Ramp E" alternative would solve numerous existing safety problems, capacity problems, and geometric deficiencies in a cost-efficient manner. Implementation of this relatively low-cost solution would create a safer interchange that would have reserve capacity to handle future traffic growth. This solution is also compatible with longer-term configurations that may be needed at this interchange. Study of the eastbound ramp terminal intersection with SR 31 is recommended to determine whether signal warrants are met. Widening of SR 31, in conjunction with future developments, will be necessary to provide adequate levels-of-service over the next two decades. One additional through lane is recommended from the US 33/US 36 interchange north past the Mill Wood Boulevard intersection. As development occurs, various turn lanes on Mill Road and Mill Wood Boulevard will be needed. Based on current development plans, no additional through lanes are anticipated to be necessary on SR 4 prior to 2032; however, consideration should be given to acquiring ample right-of-way for a 5-lane roadway. As future development is proposed in this area, traffic impact

studies should be used to determine specific improvements that may be necessary for the road network.

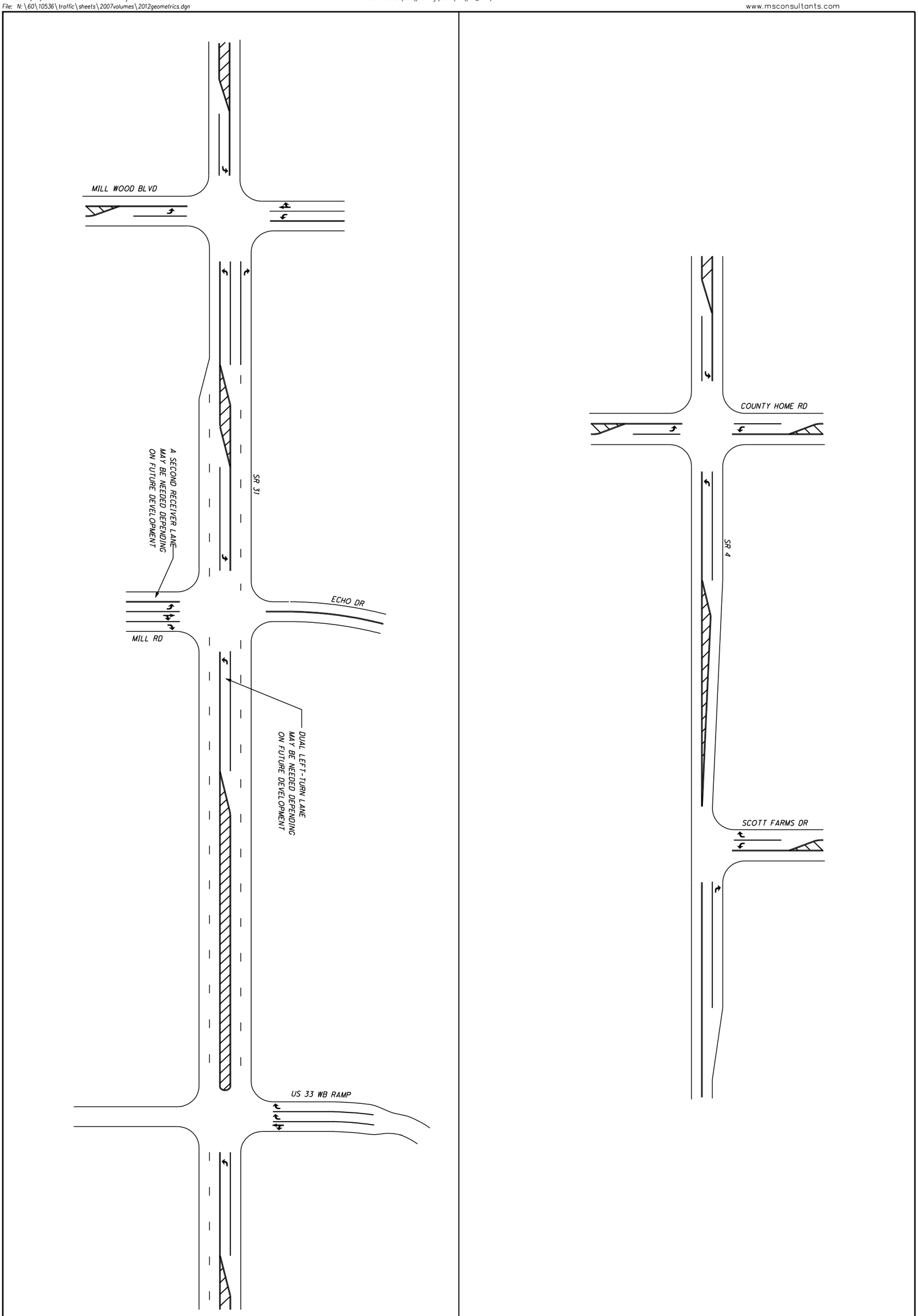

FIGURE 16

NORTH MARYSVILLE TRAFFIC STUDY
ARTERIAL STREET GEOMETRY NEEDED BY 2012

NOT TO SCALE

N

34" x 22"

Model: Design
Printed: 4/15/2008 @ 5:24:31 PM
File: N:\60\10536\traffic\sheets\2007volumes\2032geometrics.dgn
View: FENCE_VIEW1
By: nunderwood

Batchplot Spec: \\youngstown-sv1\n\60\06561\standards\plotdrv\batchplt.spc
Pen Table: S:\STD\PLOTTING\USTN\V8\PEN\V8_MS_STD.TBL
Plot Driver: S:\std\plotting\ustn\V8\pdf_half.plt

0 1"
0.5"

UCF: ohdotv8
PCF: 60-06561

Ohio DOT Workspace
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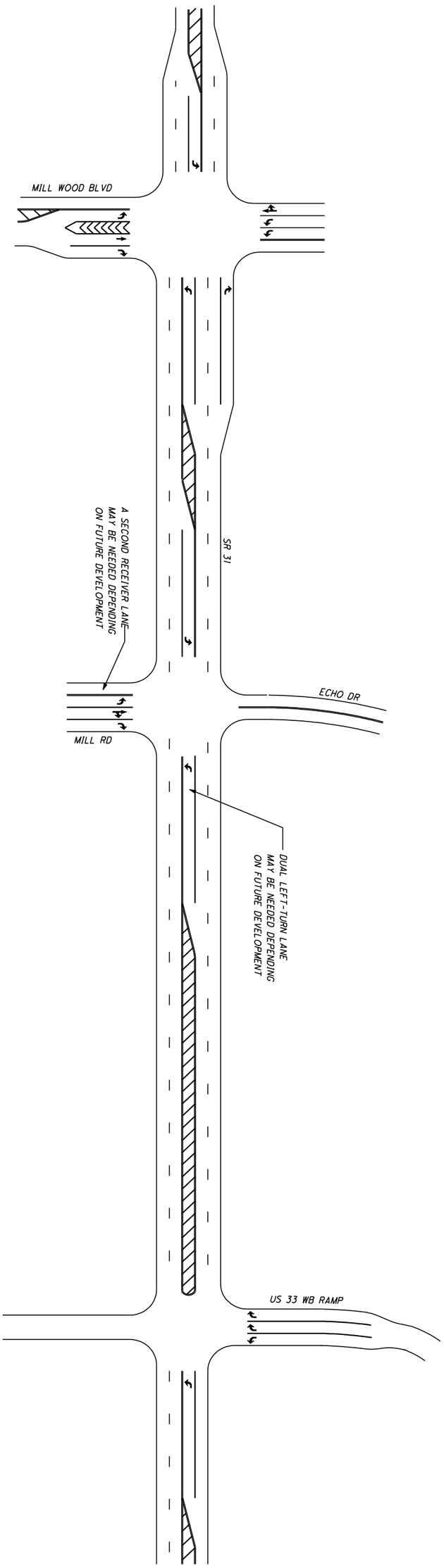


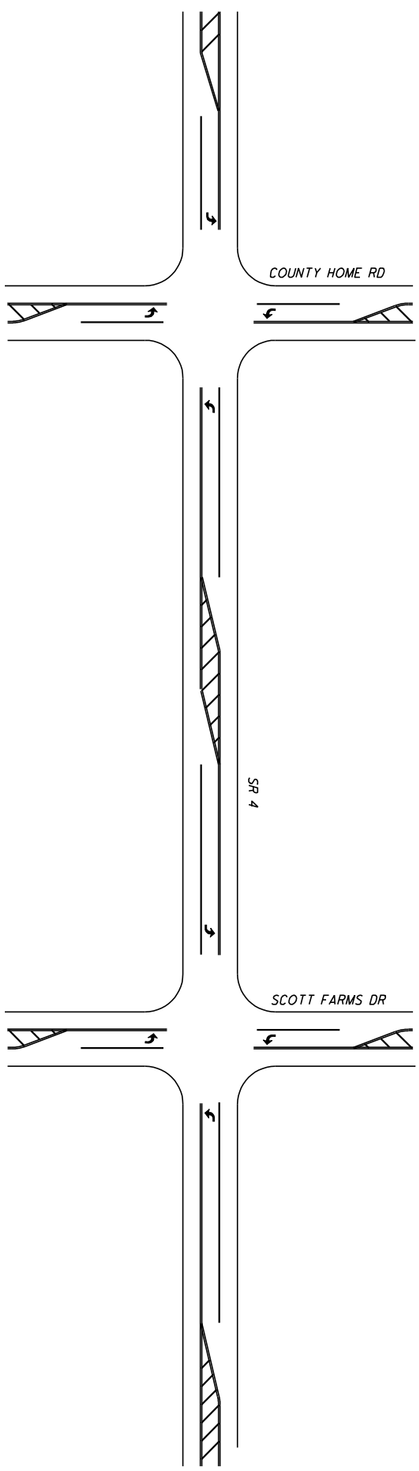


FIGURE 17

NORTH MARYSVILLE TRAFFIC STUDY
ARTERIAL STREET GEOMETRY NEEDED BY 2032

NOT TO SCALE

N

Appendix A

HCS Results

FREEWAY WEAVING WORKSHEET

General Information

Analyst	REB
Agency/Company	ms consultants
Date Performed	2/28/2008
Analysis Time Period	AM Peak Hour

Site Information

Freeway/Dir of Travel	US 33/US 36
Weaving Seg Location	between SR 4 & SR 31
Jurisdiction	Marysville, OH
Analysis Year	2007

Inputs

Freeway free-flow speed, S_{FF} (mi/h)	50	Weaving type	A
Weaving number of lanes, N	2	Volume ratio, VR	1.00
Weaving seg length, L (ft)	400	Weaving ratio, R	0.40
Terrain	Level		

Conversions to pc/h Under Base Conditions

(pc/h)	V	PHF	Truck %	RV %	E_T	E_R	f_{HV}	f_p	v
V_{o1}	0	0.90	6	0	1.5	1.2	0.971	1.00	0
V_{o2}	0	0.90	6	0	1.5	1.2	0.971	1.00	0
V_{w1}	321	0.90	13	0	1.5	1.2	0.939	1.00	379
V_{w2}	223	0.90	2	0	1.5	1.2	0.990	1.00	250
V_w				629	V_{nw}				0
V									629

Weaving and Non-Weaving Speeds

	Unconstrained		Constrained	
	Weaving (i = w)	Non-Weaving (i = nw)	Weaving (i = w)	Non-Weaving (= nw)
a (Exhibit 24-6)	0.15	0.0035		
b (Exhibit 24-6)	2.20	4.00		
c (Exhibit 24-6)	0.97	1.30		
d (Exhibit 24-6)	0.80	0.75		
Weaving intensity factor, Wi	1.51	1.11		
Weaving and non-weaving speeds, Si (mi/h)	30.93	34.00		

Number of lanes required for unconstrained operation, Nw 1.34
Maximum number of lanes, Nw (max) 1.40

☑ If Nw < Nw(max) unconstrained operation ☐ if Nw > Nw (max) constrained operation

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment speed, S (mi/h)	30.93
Weaving segment density, D (pc/mi/ln)	10.17
Level of service, LOS	B
Capacity of base condition, c_b (pc/h)	
Capacity as a 15-minute flow rate, c (veh/h)	
Capacity as a full-hour volume, c_h (veh/h)	

Notes

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

FREEWAY WEAVING WORKSHEET

General Information

Analyst	REB
Agency/Company	ms consultants
Date Performed	1/31/2008
Analysis Time Period	PM Peak Hour

Site Information

Freeway/Dir of Travel	US 33/US 36
Weaving Seg Location	between SR 4 & SR 31
Jurisdiction	Marysville, OH
Analysis Year	2007

Inputs

Freeway free-flow speed, S_{FF} (mi/h)	50	Weaving type	A
Weaving number of lanes, N	2	Volume ratio, VR	1.00
Weaving seg length, L (ft)	400	Weaving ratio, R	0.15
Terrain	Level		

Conversions to pc/h Under Base Conditions

(pc/h)	V	PHF	Truck %	RV %	E_T	E_R	f_{HV}	f_p	v
V_{o1}	0	0.90	6	0	1.5	1.2	0.971	1.00	0
V_{o2}	0	0.90	6	0	1.5	1.2	0.971	1.00	0
V_{w1}	957	0.90	4	0	1.5	1.2	0.980	1.00	1084
V_{w2}	172	0.90	2	0	1.5	1.2	0.990	1.00	193
V_w				1277	V_{nw}				0
V									1277

Weaving and Non-Weaving Speeds

	Unconstrained		Constrained	
	Weaving (i = w)	Non-Weaving (i = nw)	Weaving (i = w)	Non-Weaving (= nw)
a (Exhibit 24-6)			0.35	0.0020
b (Exhibit 24-6)			2.20	4.00
c (Exhibit 24-6)			0.97	1.30
d (Exhibit 24-6)			0.80	0.75
Weaving intensity factor, Wi			7.01	1.59
Weaving and non-weaving speeds, Si (mi/h)			19.99	30.47

Number of lanes required for unconstrained operation, Nw 1.47
Maximum number of lanes, Nw (max) 1.40

☐ If Nw < Nw(max) unconstrained operation ☑ if Nw > Nw (max) constrained operation

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment speed, S (mi/h)	19.99
Weaving segment density, D (pc/mi/ln)	31.93
Level of service, LOS	D
Capacity of base condition, c_b (pc/h)	
Capacity as a 15-minute flow rate, c (veh/h)	
Capacity as a full-hour volume, c_h (veh/h)	

Notes

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

FREEWAY WEAVING WORKSHEET

General Information

Analyst	REB
Agency/Company	ms consultants
Date Performed	2/28/2008
Analysis Time Period	AM Peak Hour

Site Information

Freeway/Dir of Travel	US 33/US 36
Weaving Seg Location	between SR 4 & SR 31
Jurisdiction	Marysville, OH
Analysis Year	2012

Inputs

Freeway free-flow speed, S_{FF} (mi/h)	50	Weaving type	A
Weaving number of lanes, N	2	Volume ratio, VR	1.00
Weaving seg length, L (ft)	400	Weaving ratio, R	0.39
Terrain	Level		

Conversions to pc/h Under Base Conditions

(pc/h)	V	PHF	Truck %	RV %	E_T	E_R	f_{HV}	f_p	v
V_{o1}	0	0.90	6	0	1.5	1.2	0.971	1.00	0
V_{o2}	0	0.90	6	0	1.5	1.2	0.971	1.00	0
V_{w1}	371	0.90	13	0	1.5	1.2	0.939	1.00	439
V_{w2}	246	0.90	2	0	1.5	1.2	0.990	1.00	276
V_w				715	V_{nw}				0
V									715

Weaving and Non-Weaving Speeds

	Unconstrained		Constrained	
	Weaving (i = w)	Non-Weaving (i = nw)	Weaving (i = w)	Non-Weaving (= nw)
a (Exhibit 24-6)	0.15	0.0035		
b (Exhibit 24-6)	2.20	4.00		
c (Exhibit 24-6)	0.97	1.30		
d (Exhibit 24-6)	0.80	0.75		
Weaving intensity factor, Wi	1.71	1.31		
Weaving and non-weaving speeds, Si (mi/h)	29.75	32.35		

Number of lanes required for unconstrained operation, Nw 1.36
Maximum number of lanes, Nw (max) 1.40

☑ If Nw < Nw(max) unconstrained operation ☐ if Nw > Nw (max) constrained operation

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment speed, S (mi/h)	29.75
Weaving segment density, D (pc/mi/ln)	12.02
Level of service, LOS	B
Capacity of base condition, c_b (pc/h)	
Capacity as a 15-minute flow rate, c (veh/h)	
Capacity as a full-hour volume, c_h (veh/h)	

Notes

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

FREEWAY WEAVING WORKSHEET

General Information

Analyst	REB
Agency/Company	ms consultants
Date Performed	1/31/2008
Analysis Time Period	PM Peak Hour

Site Information

Freeway/Dir of Travel	US 33/US 36
Weaving Seg Location	between SR 4 & SR 31
Jurisdiction	Marysville, OH
Analysis Year	2012

Inputs

Freeway free-flow speed, S_{FF} (mi/h)	50	Weaving type	A
Weaving number of lanes, N	2	Volume ratio, VR	1.00
Weaving seg length, L (ft)	400	Weaving ratio, R	0.16
Terrain	Level		

Conversions to pc/h Under Base Conditions

(pc/h)	V	PHF	Truck %	RV %	E_T	E_R	f_{HV}	f_p	v
V_{o1}	0	0.90	6	0	1.5	1.2	0.971	1.00	0
V_{o2}	0	0.90	6	0	1.5	1.2	0.971	1.00	0
V_{w1}	1079	0.90	4	0	1.5	1.2	0.980	1.00	1222
V_{w2}	201	0.90	2	0	1.5	1.2	0.990	1.00	225
V_w				1447	V_{nw}				0
V									1447

Weaving and Non-Weaving Speeds

	Unconstrained		Constrained	
	Weaving (i = w)	Non-Weaving (i = nw)	Weaving (i = w)	Non-Weaving (= nw)
a (Exhibit 24-6)			0.35	0.0020
b (Exhibit 24-6)			2.20	4.00
c (Exhibit 24-6)			0.97	1.30
d (Exhibit 24-6)			0.80	0.75
Weaving intensity factor, Wi			7.91	1.87
Weaving and non-weaving speeds, Si (mi/h)			19.49	28.96

Number of lanes required for unconstrained operation, Nw 1.49
Maximum number of lanes, Nw (max) 1.40

☐ If Nw < Nw(max) unconstrained operation ☑ if Nw > Nw (max) constrained operation

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment speed, S (mi/h)	19.49
Weaving segment density, D (pc/mi/ln)	37.13
Level of service, LOS	E
Capacity of base condition, c_b (pc/h)	
Capacity as a 15-minute flow rate, c (veh/h)	
Capacity as a full-hour volume, c_h (veh/h)	

Notes

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*REB*	Intersection	*SR 31 & Ramp E*
Agency/Co.	*ms consultants*	Jurisdiction	
Date Performed	*2/14/2008*	Analysis Year	*2007*
Analysis Time Period	*AM Peak Hour*		
Project Description	*Existing Condtions*		
East/West Street:	*WB exit ramp (Ramp E)*	North/South Street:	*SR 31 (Maple St.)*
Intersection Orientation:	*North-South*	Study Period (hrs):	*0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)		*260*			*1352*	
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*0*	*288*	*0*	*0*	*1502*	*0*
Percent Heavy Vehicles	*0*	--	--	*0*	--	--
Median Type	*Raised curb*					
RT Channelized			*0*			*0*
Lanes	*0*	*2*	*0*	*0*	*2*	*0*
Configuration		*T*			*T*	
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				*90*		
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*0*	*0*	*0*	*100*	*0*	*0*
Percent Heavy Vehicles	*0*	*0*	*0*	*13*	*0*	*0*
Percent Grade (%)		*0*			*2*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*1*	*0*	*0*
Configuration				*L*		

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration			*L*					
v (veh/h)			*100*					
C (m) (veh/h)			*208*					
v/c			*0.48*					
95% queue length			*2.36*					
Control Delay (s/veh)			*37.4*					
LOS			*E*					
Approach Delay (s/veh)	--	--	*37.4*					
Approach LOS	--	--	*E*					

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*REB*	Intersection	*SR 31 & Ramp E*
Agency/Co.	*ms consultants*	Jurisdiction	
Date Performed	*2/14/2008*	Analysis Year	*2007*
Analysis Time Period	*PM Peak Hour*		
Project Description	*Existing Condtions*		
East/West Street:	*WB exit ramp (Ramp E)*	North/South Street:	*SR 31 (Maple St.)*
Intersection Orientation:	*North-South*	Study Period (hrs):	*0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)		*574*			*752*	
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*0*	*637*	*0*	*0*	*835*	*0*
Percent Heavy Vehicles	*0*	--	--	*0*	--	--
Median Type	*Raised curb*					
RT Channelized			*0*			*0*
Lanes	*0*	*2*	*0*	*0*	*2*	*0*
Configuration		*T*			*T*	
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				*177*		
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*0*	*0*	*0*	*196*	*0*	*0*
Percent Heavy Vehicles	*0*	*0*	*0*	*4*	*0*	*0*
Percent Grade (%)		*0*			*2*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*1*	*0*	*0*
Configuration				*L*		

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration			*L*					
v (veh/h)			*196*					
C (m) (veh/h)			*218*					
v/c			*0.90*					
95% queue length			*7.31*					
Control Delay (s/veh)			*83.6*					
LOS			*F*					
Approach Delay (s/veh)	--	--	*83.6*					
Approach LOS	--	--	*F*					

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*REB*	Intersection	*SR 31 & Ramp E*
Agency/Co.	*ms consultants*	Jurisdiction	
Date Performed	*2/14/2008*	Analysis Year	*2012*
Analysis Time Period	*AM Peak Hour*		

Project Description	*Existing Condtions*
East/West Street: *WB exit ramp (Ramp E)*	North/South Street: *SR 31 (Maple St.)*
Intersection Orientation: *North-South*	Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)		*311*			*1510*	
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*0*	*345*	*0*	*0*	*1677*	*0*
Percent Heavy Vehicles	*0*	--	--	*0*	--	--
Median Type	*Raised curb*					
RT Channelized			*0*			*0*
Lanes	*0*	*2*	*0*	*0*	*2*	*0*
Configuration		*T*			*T*	
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				*97*		
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*0*	*0*	*0*	*107*	*0*	*0*
Percent Heavy Vehicles	*0*	*0*	*0*	*13*	*0*	*0*
Percent Grade (%)		*0*			*2*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*1*	*0*	*0*
Configuration				*L*		

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration			*L*					
v (veh/h)			*107*					
C (m) (veh/h)			*167*					
v/c			*0.64*					
95% queue length			*3.61*					
Control Delay (s/veh)			*58.6*					
LOS			*F*					
Approach Delay (s/veh)	--	--	*58.6*					
Approach LOS	--	--	*F*					

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*REB*	Intersection	*SR 31 & Ramp E*
Agency/Co.	*ms consultants*	Jurisdiction	
Date Performed	*2/14/2008*	Analysis Year	*2012*
Analysis Time Period	*PM Peak Hour*		
Project Description	*Existing Condtions*		
East/West Street:	*WB exit ramp (Ramp E)*	North/South Street:	*SR 31 (Maple St.)*
Intersection Orientation:	*North-South*	Study Period (hrs):	*0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)		*678*			*907*	
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*0*	*753*	*0*	*0*	*1007*	*0*
Percent Heavy Vehicles	*0*	--	--	*0*	--	--
Median Type	*Raised curb*					
RT Channelized			*0*			*0*
Lanes	*0*	*2*	*0*	*0*	*2*	*0*
Configuration		*T*			*T*	
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				*190*		
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*0*	*0*	*0*	*211*	*0*	*0*
Percent Heavy Vehicles	*0*	*0*	*0*	*4*	*0*	*0*
Percent Grade (%)		*0*			*2*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*1*	*0*	*0*
Configuration				*L*		

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration			*L*					
v (veh/h)			*211*					
C (m) (veh/h)			*160*					
v/c			*1.32*					
95% queue length			*12.64*					
Control Delay (s/veh)			*235.2*					
LOS			*F*					
Approach Delay (s/veh)	--	--	*235.2*					
Approach LOS	--	--	*F*					

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*REB*	Intersection	*SR 31 & Ramp F*
Agency/Co.	*ms consultants*	Jurisdiction	
Date Performed	*2/14/2008*	Analysis Year	*2007*
Analysis Time Period	*AM Peak Hour*		
Project Description	*Existing Condtions*		
East/West Street:	*WB entrance ramp (Ramp F)*	North/South Street:	*SR 31 (Maple St.)*
Intersection Orientation:	*North-South*	Study Period (hrs):	*0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*75*	*260*			*1247*	*195*
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*83*	*288*	*0*	*0*	*1385*	*216*
Percent Heavy Vehicles	*2*	--	--	*0*	--	--
Median Type	*Raised curb*					
RT Channelized			*0*			*0*
Lanes	*0*	*2*	*0*	*0*	*2*	*0*
Configuration	*LT*	*T*			*T*	*TR*
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)						
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*0*	*0*	*0*	*0*	*0*	*0*
Percent Heavy Vehicles	*0*	*0*	*0*	*4*	*0*	*0*
Percent Grade (%)		*0*			*2*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*0*	*0*	*0*
Configuration						

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LT*							
v (veh/h)	*83*							
C (m) (veh/h)	*405*							
v/c	*0.20*							
95% queue length	*0.76*							
Control Delay (s/veh)	*16.2*							
LOS	*C*							
Approach Delay (s/veh)	--	--						
Approach LOS	--	--						

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*REB*	Intersection	*SR 31 & Ramp F*
Agency/Co.	*ms consultants*	Jurisdiction	
Date Performed	*2/14/2008*	Analysis Year	*2007*
Analysis Time Period	*PM Peak Hour*		
Project Description	*Existing Condtions*		
East/West Street:	*WB entrance ramp (Ramp F)*	North/South Street:	*SR 31 (Maple St.)*
Intersection Orientation:	*North-South*	Study Period (hrs):	*0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*53*	*569*			*810*	*109*
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*58*	*632*	*0*	*0*	*900*	*121*
Percent Heavy Vehicles	*2*	--	--	*0*	--	--
Median Type	*Raised curb*					
RT Channelized			*0*			*0*
Lanes	*0*	*2*	*0*	*0*	*2*	*0*
Configuration	*LT*	*T*			*T*	*TR*
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)						
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*0*	*0*	*0*	*0*	*0*	*0*
Percent Heavy Vehicles	*0*	*0*	*0*	*4*	*0*	*0*
Percent Grade (%)		*0*			*2*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*0*	*0*	*0*
Configuration						

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LT*							
v (veh/h)	*58*							
C (m) (veh/h)	*675*							
v/c	*0.09*							
95% queue length	*0.28*							
Control Delay (s/veh)	*10.8*							
LOS	*B*							
Approach Delay (s/veh)	--	--						
Approach LOS	--	--						

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*REB*	Intersection	*SR 31 & Ramp F*
Agency/Co.	*ms consultants*	Jurisdiction	
Date Performed	*2/14/2008*	Analysis Year	*2012*
Analysis Time Period	*AM Peak Hour*		

Project Description	*Existing Condtions*
East/West Street: *WB entrance ramp (Ramp F)*	North/South Street: *SR 31 (Maple St.)*
Intersection Orientation: *North-South*	Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*81*	*311*			*1388*	*219*
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*90*	*345*	*0*	*0*	*1542*	*243*
Percent Heavy Vehicles	*2*	--	--	*0*	--	--
Median Type	*Raised curb*					
RT Channelized			*0*			*0*
Lanes	*0*	*2*	*0*	*0*	*2*	*0*
Configuration	*LT*	*T*			*T*	*TR*
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)						
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*0*	*0*	*0*	*0*	*0*	*0*
Percent Heavy Vehicles	*0*	*0*	*0*	*4*	*0*	*0*
Percent Grade (%)		*0*			*2*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*0*	*0*	*0*
Configuration						

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LT*							
v (veh/h)	*90*							
C (m) (veh/h)	*343*							
v/c	*0.26*							
95% queue length	*1.03*							
Control Delay (s/veh)	*19.2*							
LOS	*C*							
Approach Delay (s/veh)	--	--						
Approach LOS	--	--						

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*REB*	Intersection	*SR 31 & Ramp F*
Agency/Co.	*ms consultants*	Jurisdiction	
Date Performed	*2/14/2008*	Analysis Year	*2012*
Analysis Time Period	*PM Peak Hour*		
Project Description	*Existing Condtions*		
East/West Street:	*WB entrance ramp (Ramp F)*	North/South Street:	*SR 31 (Maple St.)*
Intersection Orientation:	*North-South*	Study Period (hrs):	*0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*57*	*678*			*980*	*117*
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*63*	*753*	*0*	*0*	*1088*	*130*
Percent Heavy Vehicles	*2*	--	--	*0*	--	--
Median Type	*Raised curb*					
RT Channelized			*0*			*0*
Lanes	*0*	*2*	*0*	*0*	*2*	*0*
Configuration	*LT*	*T*			*T*	*TR*
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)						
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*0*	*0*	*0*	*0*	*0*	*0*
Percent Heavy Vehicles	*0*	*0*	*0*	*4*	*0*	*0*
Percent Grade (%)		*0*			*2*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*0*	*0*	*0*
Configuration						

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LT*							
v (veh/h)	*63*							
C (m) (veh/h)	*568*							
v/c	*0.11*							
95% queue length	*0.37*							
Control Delay (s/veh)	*12.1*							
LOS	*B*							
Approach Delay (s/veh)	--	--						
Approach LOS	--	--						

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*REB*	Intersection	*SR 31 & EB ramps*
Agency/Co.	*ms consultants*	Jurisdiction	
Date Performed	*2/14/2008*	Analysis Year	*2007*
Analysis Time Period	*AM Peak Hour*		

Project Description *Existing Condtions*

East/West Street: *EB ramps*	North/South Street: *SR 31 (Maple St.)*
Intersection Orientation: *North-South*	Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)		*284*			*658*	
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*0*	*315*	*0*	*0*	*731*	*0*
Percent Heavy Vehicles	*0*	--	--	*0*	--	--
Median Type	*Raised curb*					
RT Channelized			*0*			*0*
Lanes	*0*	*2*	*0*	*0*	*2*	*0*
Configuration		*T*			*T*	
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*85*		*187*			
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*94*	*0*	*207*	*0*	*0*	*0*
Percent Heavy Vehicles	*2*	*0*	*2*	*4*	*0*	*0*
Percent Grade (%)		*0*			*2*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*0*	*0*	*0*
Configuration		*LR*				

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration							*LR*	
v (veh/h)							*301*	
C (m) (veh/h)							*456*	
v/c							*0.66*	
95% queue length							*4.69*	
Control Delay (s/veh)							*26.9*	
LOS							*D*	
Approach Delay (s/veh)	--	--					*26.9*	
Approach LOS	--	--					*D*	

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*REB*	Intersection	*SR 31 & EB ramps*
Agency/Co.	*ms consultants*	Jurisdiction	
Date Performed	*2/14/2008*	Analysis Year	*2007*
Analysis Time Period	*PM Peak Hour*		
Project Description	*Existing Condtions*		
East/West Street:	*EB ramps*	North/South Street:	*SR 31 (Maple St.)*
Intersection Orientation:	*North-South*	Study Period (hrs):	*0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*82*	*504*			*486*	
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*91*	*560*	*0*	*0*	*540*	*0*
Percent Heavy Vehicles	*0*	--	--	*0*	--	--
Median Type	*Raised curb*					
RT Channelized			*0*			*0*
Lanes	*0*	*2*	*0*	*0*	*2*	*0*
Configuration	*LT*	*T*			*T*	
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*161*		*85*			
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*178*	*0*	*94*	*0*	*0*	*0*
Percent Heavy Vehicles	*2*	*0*	*2*	*4*	*0*	*0*
Percent Grade (%)		*0*			*2*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*0*	*0*	*0*
Configuration		*LR*				

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LT*						*LR*	
v (veh/h)	*91*						*272*	
C (m) (veh/h)	*1039*						*288*	
v/c	*0.09*						*0.94*	
95% queue length	*0.29*						*9.15*	
Control Delay (s/veh)	*8.8*						*79.0*	
LOS	*A*						*F*	
Approach Delay (s/veh)	--	--				*79.0*		
Approach LOS	--	--				*F*		

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*REB*	Intersection	*SR 31 & EB ramps*
Agency/Co.	*ms consultants*	Jurisdiction	
Date Performed	*2/14/2008*	Analysis Year	*2012*
Analysis Time Period	*AM Peak Hour*		

Project Description *Existing Condtions*

East/West Street: *EB ramps* | North/South Street: *SR 31 (Maple St.)*

Intersection Orientation: *North-South* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*99*	*297*			*669*	
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*110*	*330*	*0*	*0*	*743*	*0*
Percent Heavy Vehicles	*0*	--	--	*0*	--	--
Median Type	*Raised curb*					
RT Channelized			*0*			*0*
Lanes	*0*	*2*	*0*	*0*	*2*	*0*
Configuration	*LT*	*T*			*T*	
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*95*		*182*			
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*105*	*0*	*202*	*0*	*0*	*0*
Percent Heavy Vehicles	*2*	*0*	*2*	*4*	*0*	*0*
Percent Grade (%)		*0*			*2*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*0*	*0*	*0*
Configuration		*LR*				

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LT*						*LR*	
v (veh/h)	*110*						*307*	
C (m) (veh/h)	*873*						*330*	
v/c	*0.13*						*0.93*	
95% queue length	*0.43*						*9.39*	
Control Delay (s/veh)	*9.7*						*69.6*	
LOS	*A*						*F*	
Approach Delay (s/veh)	--	--				*69.6*		
Approach LOS	--	--				*F*		

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*REB*	Intersection	*SR 31 & EB ramps*
Agency/Co.	*ms consultants*	Jurisdiction	
Date Performed	*2/14/2008*	Analysis Year	*2012*
Analysis Time Period	*PM Peak Hour*		

Project Description *Existing Condtions*

East/West Street: *EB ramps*	North/South Street: *SR 31 (Maple St.)*
Intersection Orientation: *North-South*	Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*80*	*560*			*551*	
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*88*	*622*	*0*	*0*	*612*	*0*
Percent Heavy Vehicles	*0*	--	--	*0*	--	--
Median Type	*Raised curb*					
RT Channelized			*0*			*0*
Lanes	*0*	*2*	*0*	*0*	*2*	*0*
Configuration	*LT*	*T*			*T*	
Upstream Signal		*0*			*0*	

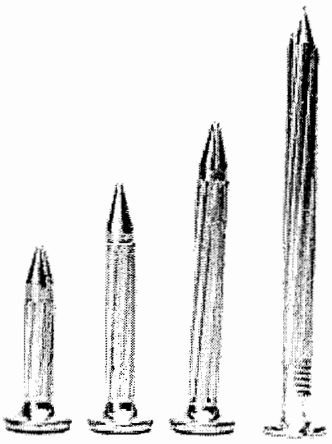
Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*175*		*83*			
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*194*	*0*	*92*	*0*	*0*	*0*
Percent Heavy Vehicles	*2*	*0*	*2*	*4*	*0*	*0*
Percent Grade (%)		*0*			*2*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*0*	*0*	*0*
Configuration		*LR*				

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LT*						*LR*	
v (veh/h)	*88*						*286*	
C (m) (veh/h)	*977*						*245*	
v/c	*0.09*						*1.17*	
95% queue length	*0.30*						*13.23*	
Control Delay (s/veh)	*9.0*						*152.9*	
LOS	*A*						*F*	
Approach Delay (s/veh)	--	--				*152.9*		
Approach LOS	--	--				*F*		

Nails

These quality nails are case hardened steel, zinc-plated for corrosion resistance. They also have a ribbed shank to assure permanent fastening to the road surface and are excellent for use with road tube clamps, webbing, temporary loops or tape switches. 2 1/2 inch lengths are generally used, use shorter length (1 1/2" or 2") in cold weather and longer lengths (3 1/2") in hot weather.



1.5 Inch PK Nails - Box of 100
Part #: J-5505 Price: $15.50 Add to Cart

2 Inch PK Nails - Box of 100
Part #: J-5506 Price: $17.50 Add to Cart

2.5 Inch PK Nails - Box of 100
Part #: J-5507 Price: $19.50 Add to Cart

3.5 Inch Hardened Nails - Box of 100
Part #: J-5504 Price: $21.00 Add to Cart

Spikes

12" and 6" long, hot-dipped, galvanized spikes are ideal for poor shoulder situations. The best application is to angle the spike away from the road.

6 Inch Spike
Part #: J-5516S Price: $ 0.50 Each Add to Cart

12 Inch Spike
Part #: J-5516 Price: $ 2.00 Each Add to Cart

Questions? Contact us and our sales staff will be happy to assist you.

On-line ordering through this site is only available to customers in the United States. Prices listed are only for US customers.
Pricing will vary for customers outside the US, based on import\export fees, distributor costs, etc. If you are outside the United States, please contact your JAMAR sales representative for pricing and ordering information, or request a quote through this web site.

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*REB*	Intersection	*SR 31 & Ramp M*
Agency/Co.	*ms consultants*	Jurisdiction	
Date Performed	*2/14/2008*	Analysis Year	*2007*
Analysis Time Period	*AM Peak Hour*		
Project Description	*Existing Condtions*		
East/West Street:	*WB entrance ramp (Ramp M)*	North/South Street:	*SR 4 (Main St.)*
Intersection Orientation:	*North-South*	Study Period (hrs):	*0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*57*	*210*			*556*	
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*63*	*233*	*0*	*0*	*617*	*0*
Percent Heavy Vehicles	*2*	--	--	*0*	--	--
Median Type	*Raised curb*					
RT Channelized			*0*			*0*
Lanes	*0*	*2*	*0*	*0*	*2*	*0*
Configuration	*LT*	*T*			*T*	
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)						
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*0*	*0*	*0*	*0*	*0*	*0*
Percent Heavy Vehicles	*0*	*0*	*0*	*4*	*0*	*0*
Percent Grade (%)		*0*			*2*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*0*	*0*	*0*
Configuration						

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LT*							
v (veh/h)	*63*							
C (m) (veh/h)	*959*							
v/c	*0.07*							
95% queue length	*0.21*							
Control Delay (s/veh)	*9.0*							
LOS	*A*							
Approach Delay (s/veh)	--	--						
Approach LOS	--	--						

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*REB*	Intersection	*SR 31 & Ramp M*
Agency/Co.	*ms consultants*	Jurisdiction	
Date Performed	*2/14/2008*	Analysis Year	*2007*
Analysis Time Period	*PM Peak Hour*		
Project Description	*Existing Condtions*		
East/West Street:	*WB entrance ramp (Ramp M)*	North/South Street:	*SR 4 (Main St.)*
Intersection Orientation:	*North-South*	Study Period (hrs):	*0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*52*	*352*			*309*	
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*57*	*391*	*0*	*0*	*343*	*0*
Percent Heavy Vehicles	*2*	--	--	*0*	--	--
Median Type	*Raised curb*					
RT Channelized			*0*			*0*
Lanes	*0*	*2*	*0*	*0*	*2*	*0*
Configuration	*LT*	*T*			*T*	
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)						
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*0*	*0*	*0*	*0*	*0*	*0*
Percent Heavy Vehicles	*0*	*0*	*0*	*4*	*0*	*0*
Percent Grade (%)		*0*			*2*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*0*	*0*	*0*
Configuration						

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LT*							
v (veh/h)	*57*							
C (m) (veh/h)	*1213*							
v/c	*0.05*							
95% queue length	*0.15*							
Control Delay (s/veh)	*8.1*							
LOS	*A*							
Approach Delay (s/veh)	--	--						
Approach LOS	--	--						

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*REB*	Intersection	*SR 31 & Ramp M*
Agency/Co.	*ms consultants*	Jurisdiction	
Date Performed	*2/14/2008*	Analysis Year	*2012*
Analysis Time Period	*AM Peak Hour*		
Project Description	*Existing Condtions*		
East/West Street:	*WB entrance ramp (Ramp M)*	North/South Street:	*SR 4 (Main St.)*
Intersection Orientation:	*North-South*	Study Period (hrs):	*0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*61*	*243*			*618*	
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*67*	*270*	*0*	*0*	*686*	*0*
Percent Heavy Vehicles	*2*	--	--	*0*	--	--
Median Type	*Raised curb*					
RT Channelized			*0*			*0*
Lanes	*0*	*2*	*0*	*0*	*2*	*0*
Configuration	*LT*	*T*			*T*	
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)						
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*0*	*0*	*0*	*0*	*0*	*0*
Percent Heavy Vehicles	*0*	*0*	*0*	*4*	*0*	*0*
Percent Grade (%)		*0*			*2*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*0*	*0*	*0*
Configuration						

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LT*							
v (veh/h)	*67*							
C (m) (veh/h)	*904*							
v/c	*0.07*							
95% queue length	*0.24*							
Control Delay (s/veh)	*9.3*							
LOS	*A*							
Approach Delay (s/veh)	--	--						
Approach LOS	--	--						

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*REB*	Intersection	*SR 31 & Ramp M*
Agency/Co.	*ms consultants*	Jurisdiction	
Date Performed	*2/14/2008*	Analysis Year	*2012*
Analysis Time Period	*PM Peak Hour*		

Project Description	*Existing Condtions*
East/West Street: *WB entrance ramp (Ramp M)*	North/South Street: *SR 4 (Main St.)*
Intersection Orientation: *North-South*	Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*56*	*411*			*373*	
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*62*	*456*	*0*	*0*	*414*	*0*
Percent Heavy Vehicles	*2*	--	--	*0*	--	--
Median Type	*Raised curb*					
RT Channelized			*0*			*0*
Lanes	*0*	*2*	*0*	*0*	*2*	*0*
Configuration	*LT*	*T*			*T*	
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)						
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*0*	*0*	*0*	*0*	*0*	*0*
Percent Heavy Vehicles	*0*	*0*	*0*	*4*	*0*	*0*
Percent Grade (%)		*0*			*2*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*0*	*0*	*0*
Configuration						

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LT*							
v (veh/h)	*62*							
C (m) (veh/h)	*1141*							
v/c	*0.05*							
95% queue length	*0.17*							
Control Delay (s/veh)	*8.3*							
LOS	*A*							
Approach Delay (s/veh)	--	--						
Approach LOS	--	--						

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*REB*	Intersection	*SR 31 & Ramp L*
Agency/Co.	*ms consultants*	Jurisdiction	
Date Performed	*2/14/2008*	Analysis Year	*2007*
Analysis Time Period	*AM Peak Hour*		
Project Description	*Existing Condtions*		
East/West Street:	*WB entrance ramp (Ramp L)*	North/South Street:	*SR 4 (Main St.)*
Intersection Orientation:	*North-South*	Study Period (hrs):	*0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)		*267*			*556*	
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*0*	*296*	*0*	*0*	*617*	*0*
Percent Heavy Vehicles	*2*	--	--	*0*	--	--
Median Type	*Raised curb*					
RT Channelized			*0*			*0*
Lanes	*0*	*2*	*0*	*0*	*2*	*0*
Configuration		*T*			*T*	
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				*39*		
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*0*	*0*	*0*	*43*	*0*	*0*
Percent Heavy Vehicles	*0*	*0*	*0*	*4*	*0*	*0*
Percent Grade (%)		*0*			*2*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*1*	*0*	*0*
Configuration				*L*		

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration			*L*					
v (veh/h)			*43*					
C (m) (veh/h)			*425*					
v/c			*0.10*					
95% queue length			*0.34*					
Control Delay (s/veh)			*14.4*					
LOS			*B*					
Approach Delay (s/veh)	--	--	*14.4*					
Approach LOS	--	--	*B*					

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*REB*	Intersection	*SR 31 & Ramp L*
Agency/Co.	*ms consultants*	Jurisdiction	
Date Performed	*2/14/2008*	Analysis Year	
Analysis Time Period	*PM Peak Hour*		

Project Description	*Existing Condtions*
East/West Street:	*WB entrance ramp (Ramp L)*
North/South Street:	*SR 4 (Main St.)*
Intersection Orientation:	*North-South*
Study Period (hrs):	*0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)		*404*			*309*	
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*0*	*448*	*0*	*0*	*343*	*0*
Percent Heavy Vehicles	*2*	--	--	*0*	--	--
Median Type	*Raised curb*					
RT Channelized			*0*			*0*
Lanes	*0*	*2*	*0*	*0*	*2*	*0*
Configuration		*T*			*T*	
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				*30*		
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*0*	*0*	*0*	*33*	*0*	*0*
Percent Heavy Vehicles	*0*	*0*	*0*	*4*	*0*	*0*
Percent Grade (%)		*0*			*2*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*1*	*0*	*0*
Configuration				*L*		

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration			*L*					
v (veh/h)			*33*					
C (m) (veh/h)			*416*					
v/c			*0.08*					
95% queue length			*0.26*					
Control Delay (s/veh)			*14.4*					
LOS			*B*					
Approach Delay (s/veh)	--	--	*14.4*					
Approach LOS	--	--	*B*					

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*REB*	Intersection	*SR 31 & Ramp L*
Agency/Co.	*ms consultants*	Jurisdiction	
Date Performed	*2/14/2008*	Analysis Year	*2012*
Analysis Time Period	*AM Peak Hour*		

Project Description	*Existing Condtions*
East/West Street: *WB entrance ramp (Ramp L)*	North/South Street: *SR 4 (Main St.)*
Intersection Orientation: *North-South*	Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)		*304*			*618*	
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*0*	*337*	*0*	*0*	*686*	*0*
Percent Heavy Vehicles	*2*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*2*	*0*	*0*	*2*	*0*
Configuration		*T*			*T*	
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				*41*		
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*0*	*0*	*0*	*45*	*0*	*0*
Percent Heavy Vehicles	*0*	*0*	*0*	*4*	*0*	*0*
Percent Grade (%)		*0*			*2*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*1*	*0*	*0*
Configuration				*L*		

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration			*L*					
v (veh/h)			*45*					
C (m) (veh/h)			*380*					
v/c			*0.12*					
95% queue length			*0.40*					
Control Delay (s/veh)			*15.7*					
LOS			*C*					
Approach Delay (s/veh)	--	--	*15.7*					
Approach LOS	--	--	*C*					

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*REB*	Intersection	*SR 31 & Ramp L*
Agency/Co.	*ms consultants*	Jurisdiction	
Date Performed	*2/14/2008*	Analysis Year	*2012*
Analysis Time Period	*PM Peak Hour*		
Project Description	*Existing Condtions*		
East/West Street:	*WB entrance ramp (Ramp L)*	North/South Street:	*SR 4 (Main St.)*
Intersection Orientation:	*North-South*	Study Period (hrs):	*0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)		*467*			*373*	
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*0*	*518*	*0*	*0*	*414*	*0*
Percent Heavy Vehicles	*2*	--	--	*0*	--	--
Median Type	*Raised curb*					
RT Channelized			*0*			*0*
Lanes	*0*	*2*	*0*	*0*	*2*	*0*
Configuration		*T*			*T*	
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				*32*		
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*0*	*0*	*0*	*35*	*0*	*0*
Percent Heavy Vehicles	*0*	*0*	*0*	*4*	*0*	*0*
Percent Grade (%)		*0*			*2*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*1*	*0*	*0*
Configuration				*L*		

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration			*L*					
v (veh/h)			*35*					
C (m) (veh/h)			*356*					
v/c			*0.10*					
95% queue length			*0.32*					
Control Delay (s/veh)			*16.2*					
LOS			*C*					
Approach Delay (s/veh)	--	--	*16.2*					
Approach LOS	--	--	*C*					

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*REB*	Intersection	*SR 4 & EB ramps*
Agency/Co.	*ms consultants*	Jurisdiction	
Date Performed	*2/14/2008*	Analysis Year	*2007*
Analysis Time Period	*AM Peak Hour*		

Project Description	*Existing Condtions*
East/West Street: *US 33 EB ramps*	North/South Street: *SR 4 (Main St.)*
Intersection Orientation: *North-South*	Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)		*157*	*64*	*362*	*233*	
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*0*	*174*	*71*	*402*	*258*	*0*
Percent Heavy Vehicles	*0*	--	--	*0*	--	--
Median Type	*Raised curb*					
RT Channelized			*0*			*0*
Lanes	*0*	*2*	*0*	*0*	*2*	*0*
Configuration		*T*	*TR*	*LT*	*T*	
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				*26*		
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*0*	*0*	*0*	*28*	*0*	*0*
Percent Heavy Vehicles	*2*	*0*	*2*	*4*	*0*	*0*
Percent Grade (%)		*0*			*2*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*1*	*0*	*0*
Configuration				*L*		

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		*LT*	*L*					
v (veh/h)		*402*	*28*					
C (m) (veh/h)		*1333*	*133*					
v/c		*0.30*	*0.21*					
95% queue length		*1.28*	*0.76*					
Control Delay (s/veh)		*8.9*	*39.1*					
LOS		*A*	*E*					
Approach Delay (s/veh)	--	--	*39.1*					
Approach LOS	--	--	*E*					

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*REB*	Intersection	*SR 4 & EB ramps*
Agency/Co.	*ms consultants*	Jurisdiction	
Date Performed	*2/14/2008*	Analysis Year	*2007*
Analysis Time Period	*PM Peak Hour*		

Project Description	*Existing Condtions*
East/West Street: *US 33 EB Ramps*	North/South Street: *SR 4 (Main St.)*
Intersection Orientation: *North-South*	Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)		*303*	*149*	*123*	*216*	
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*0*	*336*	*165*	*136*	*240*	*0*
Percent Heavy Vehicles	*0*	--	--	*0*	--	--
Median Type			*Raised curb*			
RT Channelized			*0*			*0*
Lanes	*0*	*2*	*0*	*0*	*2*	*0*
Configuration		*T*	*TR*	*LT*	*T*	
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				*28*		
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*0*	*0*	*0*	*31*	*0*	*0*
Percent Heavy Vehicles	*2*	*0*	*2*	*4*	*0*	*0*
Percent Grade (%)		*0*			*2*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*1*	*0*	*0*
Configuration				*L*		

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		*LT*	*L*					
v (veh/h)		*136*	*31*					
C (m) (veh/h)		*1074*	*273*					
v/c		*0.13*	*0.11*					
95% queue length		*0.43*	*0.38*					
Control Delay (s/veh)		*8.8*	*19.9*					
LOS		*A*	*C*					
Approach Delay (s/veh)	--	--	*19.9*					
Approach LOS	--	--	*C*					

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*REB*	Intersection	*SR 4 & EB ramps*
Agency/Co.	*ms consultants*	Jurisdiction	
Date Performed	*2/14/2008*	Analysis Year	*2012*
Analysis Time Period	*AM Peak Hour*		

Project Description	*Existing Condtions*
East/West Street: *US 33 EB Ramps*	North/South Street: *SR 4 (Main St.)*
Intersection Orientation: *North-South*	Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)		*179*	*69*	*399*	*260*	
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*0*	*198*	*76*	*443*	*288*	*0*
Percent Heavy Vehicles	*0*	--	--	*0*	--	--
Median Type	*Raised curb*					
RT Channelized			*0*			*0*
Lanes	*0*	*2*	*0*	*0*	*2*	*0*
Configuration		*T*	*TR*	*LT*	*T*	
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				*28*		
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*0*	*0*	*0*	*31*	*0*	*0*
Percent Heavy Vehicles	*2*	*0*	*2*	*4*	*0*	*0*
Percent Grade (%)		*0*			*2*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*1*	*0*	*0*
Configuration				*L*		

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		*LT*	*L*					
v (veh/h)		*443*	*31*					
C (m) (veh/h)		*1301*	*104*					
v/c		*0.34*	*0.30*					
95% queue length		*1.53*	*1.13*					
Control Delay (s/veh)		*9.2*	*53.7*					
LOS		*A*	*F*					
Approach Delay (s/veh)	--	--	*53.7*					
Approach LOS	--	--	*F*					

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*REB*	Intersection	*SR 4 & EB ramps*
Agency/Co.	*ms consultants*	Jurisdiction	
Date Performed	*2/14/2008*	Analysis Year	*2012*
Analysis Time Period	*PM Peak Hour*		

Project Description	*Existing Condtions*
East/West Street: *US 33 EB Ramps*	North/South Street: *SR 4 (Main St.)*
Intersection Orientation: *North-South*	Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)		*347*	*160*	*152*	*253*	
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*0*	*385*	*177*	*168*	*281*	*0*
Percent Heavy Vehicles	*0*	--	--	*0*	--	--
Median Type	*Raised curb*					
RT Channelized			*0*			*0*
Lanes	*0*	*2*	*0*	*0*	*2*	*0*
Configuration		*T*	*TR*	*LT*	*T*	
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				*30*		
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*0*	*0*	*0*	*33*	*0*	*0*
Percent Heavy Vehicles	*2*	*0*	*2*	*4*	*0*	*0*
Percent Grade (%)		*0*			*2*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*1*	*0*	*0*
Configuration				*L*		

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		*LT*	*L*					
v (veh/h)		*168*	*33*					
C (m) (veh/h)		*1019*	*212*					
v/c		*0.16*	*0.16*					
95% queue length		*0.59*	*0.54*					
Control Delay (s/veh)		*9.2*	*25.1*					
LOS		*A*	*D*					
Approach Delay (s/veh)	--	--	*25.1*					
Approach LOS	--	--	*D*					

HCS+: Signalized Intersections Release 5.21

Analyst: REB
Agency: ms consultants
Date: 2/19/2008
Period: AM Peak Hour
Project ID: with Ramp E Reconfiguration
E/W St: WB ramps

Inter.: SR 31 & WB ramps
Area Type: All other areas
Jurisd: Marysville, OH
Year : 2012
N/S St: SR 31

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	0	0	0	0	1	2	1	1	0	0	2	0
LGConfig					LT	R	L	T			TR	
Volume				97	246	274	81	311			1388	219
Lane Width					12.0	12.0	12.0	12.0			12.0	
RTOR Vol						0						0

Duration 0.25 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4		5	6	7	8
EB Left					NB Left	A	P		
Thru					Thru	P	P		
Right					Right				
Peds					Peds				
WB Left		A			SB Left				
Thru		A			Thru		P		
Right		A			Right		P		
Peds					Peds				
NB Right					EB Right				
SB Right					WB Right				
Green		22.0				7.0	46.0		
Yellow		3.5				3.5	3.5		
All Red		1.5				1.5	1.5		

Cycle Length: 90.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
Westbound								
LT	499	1873	0.76	0.27	37.3	D	32.9	C
R	762	2859	0.40	0.27	27.4	C		
Northbound								
L	265	1805	0.34	0.67	18.4	B		
T	1267	1900	0.27	0.67	6.6	A	9.1	A
Southbound								
TR	1890	3544	0.94	0.53	30.9	C	30.9	C

Intersection Delay = 28.1 (sec/veh) Intersection LOS = C

HCS+: Signalized Intersections Release 5.21

Analyst: REB
Agency: ms consultants
Date: 2/19/2008
Period: PM Peak Hour
Project ID: with Ramp E Reconfiguration
E/W St: WB ramps

Inter.: SR 31 & WB ramps
Area Type: All other areas
Jurisd: Marysville, OH
Year : 2012
N/S St: SR 31

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	0	0	0	0	1	2	1	1	0	0	2	0
LGConfig					LT	R	L	T			TR	
Volume				190	201	889	57	678			980	117
Lane Width					12.0	12.0	12.0	12.0			12.0	
RTOR Vol						0						0

Duration 0.25 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4		5	6	7	8
EB Left					NB Left	A	P		
Thru					Thru	P	P		
Right					Right				
Peds					Peds				
WB Left		A			SB Left				
Thru		A			Thru		P		
Right		A			Right		P		
Peds					Peds				
NB Right					EB Right				
SB Right					WB Right				
Green		33.0				7.0	35.0		
Yellow		3.5				3.5	3.5		
All Red		1.5				1.5	1.5		

Cycle Length: 90.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
Westbound								
LT	721	1855	0.60	0.39	23.4	C	31.2	C
R	1112	2859	0.89	0.39	34.7	C		
Northbound								
L	265	1805	0.24	0.54	15.4	B		
T	1034	1900	0.73	0.54	20.0-	B	19.6	B
Southbound								
TR	1464	3560	0.83	0.41	29.4	C	29.4	C

Intersection Delay = 27.9 (sec/veh) Intersection LOS = C

HCS+: Signalized Intersections Release 5.21

Analyst: REB
Agency: ms consultants
Date: 2/19/2008
Period: AM Peak Hour
Project ID: with Ramp E Reconfig., but w/o Long-term improvements
E/W St: WB ramps

Inter.: SR 31 & WB ramps
Area Type: All other areas
Jurisd: Marysville, OH
Year : 2032
N/S St: SR 31

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	0	0	0	0	1	2	1	1	0	0	2	0
LGConfig					LT	R	L	T			TR	
Volume				124	312	344	103	390			1762	277
Lane Width					12.0	12.0	12.0	12.0			12.0	
RTOR Vol						0						0

Duration 0.25 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4		5	6	7	8
EB Left					NB Left	A	P		
Thru					Thru	P	P		
Right					Right				
Peds					Peds				
WB Left		A			SB Left				
Thru		A			Thru		P		
Right		A			Right		P		
Peds					Peds				
NB Right					EB Right				
SB Right					WB Right				
Green		18.5				7.0	49.5		
Yellow		3.5				3.5	3.5		
All Red		1.5				1.5	1.5		

Cycle Length: 90.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
Westbound								
LT	427	1873	1.14	0.23	120.9	F	81.9	F
R	651	2859	0.59	0.23	32.4	C		
Northbound								
L	265	1805	0.43	0.71	20.4	C		
T	1341	1900	0.32	0.71	5.7	A	8.7	A
Southbound								
TR	2028	3544	1.12	0.57	79.5	E	79.5	E

Intersection Delay = 69.5 (sec/veh) Intersection LOS = E

HCS+: Signalized Intersections Release 5.21

Analyst: REB
Agency: ms consultants
Date: 2/19/2008
Period: PM Peak Hour
Project ID: with Ramp E Reconfig., but w/o Long-term improvements
E/W St: WB ramps

Inter.: SR 31 & WB ramps
Area Type: All other areas
Jurisd: Marysville, OH
Year : 2032
N/S St: SR 31

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	0	0	0	0	1	2	1	1	0	0	2	0
LGConfig					LT	R	L	T			TR	
Volume				243	294	1123	73	850			1226	170
Lane Width					12.0	12.0	12.0	12.0			12.0	
RTOR Vol						0						0

Duration 0.25 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4			5	6	7	8
EB Left					NB	Left	A	P		
Thru						Thru	P	P		
Right						Right				
Peds						Peds				
WB Left		A			SB	Left				
Thru		A				Thru		P	P	
Right		A				Right		P	P	
Peds						Peds				
NB Right					EB	Right				
SB Right					WB	Right			P	
Green		25.0					7.0	29.0	9.0	
Yellow		3.5					3.5	3.5	3.5	
All Red		1.5					1.5	1.5	1.5	

Cycle Length: 90.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
Westbound								
LT	557	1858	1.07	0.30	90.3	F	56.1	E
R	1302	2859	0.96	0.46	39.7	D		
Northbound								
L	266	1805	0.30	0.48	18.7	B		
T	908	1900	1.04	0.48	64.2	E	60.6	E
Southbound								
TR	1776	3551	0.87	0.50	26.3	C	26.3	C

Intersection Delay = 46.7 (sec/veh) Intersection LOS = D

HCS+: Signalized Intersections Release 5.21

Analyst: REB
Agency: ms consultants
Date: 2/19/2008
Period: AM Peak Hour
Project ID: with Ramp E Reconfiguration AND Long-term improvements
E/W St: WB ramps

Inter.: SR 31 & WB ramps
Area Type: All other areas
Jurisd: Marysville, OH
Year : 2032
N/S St: SR 31

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	0	0	0	1	0	2	1	1	0	0	2	0
LGConfig				L		R	L	T			TR	
Volume				124		344	103	390			1762	277
Lane Width				12.0		12.0	12.0	12.0			12.0	
RTOR Vol						0						0

Duration 0.25 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4		5	6	7	8
EB Left					NB Left	A	P		
Thru					Thru	P	P		
Right					Right				
Peds					Peds				
WB Left		A			SB Left				
Thru		A			Thru		P		
Right		A			Right		P		
Peds					Peds				
NB Right					EB Right				
SB Right					WB Right				
Green		13.0				7.0	55.0		
Yellow		3.5				3.5	3.5		
All Red		1.5				1.5	1.5		

Cycle Length: 90.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
Westbound								
L	301	1805	0.46	0.17	34.9	C		
							42.7	D
R	477	2859	0.80	0.17	45.5	D		
Northbound								
L	266	1805	0.43	0.77	22.3	C		
T	1457	1900	0.30	0.77	3.7	A	7.6	A
Southbound								
TR	2245	3544	1.01	0.63	37.8	D	37.8	D

Intersection Delay = 33.6 (sec/veh) Intersection LOS = C

HCS+: Signalized Intersections Release 5.21

Analyst: REB
Agency: ms consultants
Date: 2/19/2008
Period: PM Peak Hour
Project ID: with Ramp E Reconfig. AND Long-term improvements
E/W St: WB ramps

Inter.: SR 31 & WB ramps
Area Type: All other areas
Jurisd: Marysville, OH
Year : 2032
N/S St: SR 31

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	0	0	0	1	0	2	1	1	0	0	2	0
LGConfig				L		R	L	T			TR	
Volume				243		1123	73	850			1226	170
Lane Width				12.0		12.0	12.0	12.0			12.0	
RTOR Vol						0						0

Duration 0.25 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4			5	6	7	8
EB Left					NB	Left	A	P		
Thru						Thru	P	P		
Right						Right				
Peds						Peds				
WB Left		A			SB	Left				
Thru		A				Thru		P	P	
Right		A				Right		P	P	
Peds						Peds				
NB Right					EB	Right				
SB Right					WB	Right			P	
Green		23.0					7.0	31.0	9.0	
Yellow		3.5					3.5	3.5	3.5	
All Red		1.5					1.5	1.5	1.5	

Cycle Length: 90.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
Westbound								
L	501	1805	0.54	0.28	28.8	C		
							48.6	D
R	1239	2859	1.01	0.43	52.8	D		
Northbound								
L	265	1805	0.31	0.50	18.2	B		
T	950	1900	0.99	0.50	50.1	D	47.6	D
Southbound								
TR	1854	3551	0.84	0.52	22.9	C	22.9	C

Intersection Delay = 38.6 (sec/veh) Intersection LOS = D

HCS+: Signalized Intersections Release 5.21

Analyst: REB
Agency: ms consultants
Date: 1/31/2008
Period: AM Peak
Project ID: with Improvements
E/W St: Millwood Boulevard

Inter.: SR 31 & Millwood Blvd.
Area Type: All other areas
Jurisd: Marysville, OH
Year : 2012

N/S St: SR 31

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	1	1	0	1	1	0	1	1	1	1	1	0
LGConfig	L	TR		L	TR		L	T	R	L	TR	
Volume	25	114	329	72	24	29	87	289	112	58	667	8
Lane Width	12.0	12.0		12.0	12.0		12.0	12.0	12.0	12.0	12.0	
RTOR Vol			0			0			0			0

Duration 0.25 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4	5	6	7	8
EB Left	A				NB Left	A	P	
Thru	A				Thru		P	
Right	A				Right		P	
Peds					Peds			
WB Left	A				SB Left	A	P	
Thru	A				Thru		P	
Right	A				Right		P	
Peds					Peds			
NB Right					EB Right			
SB Right					WB Right			
Green	34.0					7.0	44.0	
Yellow	3.5					3.5	3.5	
All Red	1.5					1.5	1.5	

Cycle Length: 100.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
L	491	1365	0.06	0.36	21.0	C		
TR	608	1688	0.81	0.36	37.1	D	36.2	D
Westbound								
L	136	379	0.59	0.36	32.5	C		
TR	628	1745	0.09	0.36	21.3	C	27.7	C
Northbound								
L	238	1805	0.41	0.58	19.0	B		
T	874	1900	0.37	0.46	18.7	B	18.2	B
R	743	1615	0.17	0.46	16.3	B		
Southbound								
L	563	1805	0.11	0.58	10.0-	A		
TR	873	1897	0.86	0.46	34.9	C	32.9	C

Intersection Delay = 29.5 (sec/veh) Intersection LOS = C

HCS+: Signalized Intersections Release 5.21

Analyst: REB
Agency: ms consultants
Date: 1/31/2008
Period: AM Peak
Project ID: with Improvements
E/W St: Millwood Boulevard

Inter.: SR 31 & Millwood Blvd.
Area Type: All other areas
Jurisd: Marysville, OH
Year : 2032

N/S St: SR 31

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	1	1	1	2	1	0	1	2	1	1	2	0
LGConfig	L	T	R	L	TR		L	T	R	L	TR	
Volume	25	114	329	304	72	112	87	277	329	186	964	8
Lane Width	12.0	12.0	12.0	12.0	12.0		12.0	12.0	12.0	12.0	12.0	
RTOR Vol			0			0			0			0

Duration 0.25 Area Type: All other areas

Signal Operations

Phase Combination		1	2	3	4			5	6	7	8
EB	Left		A			NB	Left	A	P		
	Thru		A				Thru		P		
	Right		A				Right		P		
	Peds						Peds				
WB	Left	A				SB	Left	A	P		
	Thru	A	A				Thru		P		
	Right	A	A				Right		P		
	Peds						Peds				
NB	Right	P				EB	Right	P			
SB	Right					WB	Right				
Green		20.0	29.0					7.0	44.0		
Yellow		3.5	3.5					3.5	3.5		
All Red		1.5	1.5					1.5	1.5		

Cycle Length: 120.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
L	309	1197	0.09	0.26	33.9	C		
T	491	1900	0.26	0.26	35.6	D	34.5	C
R	579	1615	0.63	0.36	34.2	C		
Westbound								
L	643	3505	0.53	0.18	45.1	D		
TR	806	1727	0.25	0.47	19.5	B	35.5	D
Northbound								
L	198	1805	0.49	0.48	24.8	C		
T	1387	3618	0.22	0.38	25.3	C	19.9	B
R	956	1615	0.38	0.59	14.1	B		
Southbound								
L	508	1805	0.41	0.48	18.9	B		
TR	1385	3613	0.78	0.38	37.0	D	34.0	C

Intersection Delay = 30.9 (sec/veh) Intersection LOS = C

HCS+: Signalized Intersections Release 5.21

Analyst: REB
Agency: ms consultants
Date: 1/31/2008
Period: PM Peak
Project ID: with Improvements
E/W St: Millwood Boulevard

Inter.: SR 31 & Millwood Blvd.
Area Type: All other areas
Jurisd: Marysville, OH
Year : 2012

N/S St: SR 31

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	1	1	0	1	1	0	1	1	1	1	1	0
LGConfig	L	TR		L	TR		L	T	R	L	TR	
Volume	21	62	177	150	42	61	331	660	216	116	405	16
Lane Width	12.0	12.0		12.0	12.0		12.0	12.0	12.0	12.0	12.0	
RTOR Vol			0			0			0			0

Duration 0.25 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4	5	6	7	8
EB Left	A				NB Left	A	P	
Thru	A				Thru	P	P	
Right	A				Right	P	P	
Peds					Peds			
WB Left	A				SB Left		P	
Thru	A				Thru		P	
Right	A				Right		P	
Peds					Peds			
NB Right					EB Right			
SB Right					WB Right			
Green	33.0					7.0	45.0	
Yellow	3.5					3.5	3.5	
All Red	1.5					1.5	1.5	

Cycle Length: 100.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
L	427	1220	0.05	0.35	21.6	C		
TR	580	1656	0.46	0.35	25.7	C	25.4	C
Westbound								
L	296	847	0.56	0.35	28.8	C		
TR	594	1698	0.19	0.35	22.8	C	26.4	C
Northbound								
L	448	1770	0.82	0.59	34.2	C		
T	1099	1863	0.67	0.59	17.1	B	20.6	C
R	934	1583	0.26	0.59	10.6	B		
Southbound								
L	244	519	0.53	0.47	26.7	C		
TR	870	1852	0.54	0.47	21.2	C	22.4	C

Intersection Delay = 22.2 (sec/veh) Intersection LOS = C

HCS+: Signalized Intersections Release 5.21

Analyst: REB
Agency: ms consultants
Date: 1/31/2008
Period: PM Peak
Project ID: with Improvements
E/W St: Millwood Boulevard

Inter.: SR 31 & Millwood Blvd.
Area Type: All other areas
Jurisd: Marysville, OH
Year : 2032

N/S St: SR 31

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	1	1	1	2	1	0	1	2	1	1	2	0
LGConfig	L	T	R	L	TR		L	T	R	L	TR	
Volume	21	156	177	615	139	184	331	656	406	278	559	16
Lane Width	12.0	12.0	12.0	12.0	12.0		12.0	12.0	12.0	12.0	12.0	
RTOR Vol			0			0			0			0

Duration 0.25 Area Type: All other areas

Signal Operations

Phase Combination		1	2	3	4			5	6	7	8
EB	Left		A			NB	Left	A	P		
	Thru		A				Thru		P		
	Right		A				Right		P		
	Peds						Peds				
WB	Left	A				SB	Left	A	P		
	Thru	A	A				Thru		P		
	Right	A	A				Right		P		
	Peds						Peds				
NB	Right	P				EB	Right	P			
SB	Right					WB	Right				
Green		28.0	17.0					19.0	36.0		
Yellow		3.5	3.5					3.5	3.5		
All Red		1.5	1.5					1.5	1.5		

Cycle Length: 120.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
L	165	1040	0.14	0.16	43.9	D		
T	301	1900	0.57	0.16	49.4	D	38.6	D
R	579	1615	0.34	0.36	28.5	C		
Westbound								
L	876	3505	0.78	0.25	46.5	D		
TR	753	1738	0.48	0.43	24.7	C	39.0	D
Northbound								
L	460	1805	0.80	0.52	30.1	C		
T	1146	3618	0.64	0.32	37.8	D	29.5	C
R	956	1615	0.47	0.59	15.5	B		
Southbound								
L	428	1805	0.72	0.52	26.4	C		
TR	1141	3602	0.56	0.32	36.0	D	32.9	C

Intersection Delay = 33.7 (sec/veh) Intersection LOS = C

HCS+: Signalized Intersections Release 5.21

Analyst: REB
Agency: ms consultants
Date: 1/31/2008
Period: AM Peak
Project ID: with Improvements
E/W St: Mill Road/Echo Drive

Inter.: SR 31 & Mill Road
Area Type: All other areas
Jurisd: Marysville, OH
Year : 2012

N/S St: SR 31

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	1	1	1	0	1	0	1	2	0	1	2	0
LGConfig	L	TR	R	LTR			L	TR		L	TR	
Volume	79	4	569	39	4	6	149	405	31	25	902	141
Lane Width	12.0	12.0	12.0	12.0			12.0	12.0		12.0	12.0	
RTOR Vol			0			0			0			0

Duration 0.25 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4			5	6	7	8
EB Left	A				NB	Left	A	P		
Thru	A					Thru	P	P		
Right	A					Right	P	P		
Peds						Peds				
WB Left	A				SB	Left		P		
Thru	A					Thru		P		
Right	A					Right		P		
Peds						Peds				
NB Right					EB	Right				
SB Right					WB	Right				
Green	35.0						7.0	43.0		
Yellow	3.5						3.5	3.5		
All Red	1.5						1.5	1.5		

Cycle Length: 100.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
L	503	1360	0.17	0.37	21.4	C		
TR	588	1590	0.33	0.37	22.9	C	28.9	C
R	586	1583	0.75	0.37	33.1	C		
Westbound								
LTR	501	1355	0.11	0.37	20.8	C	20.8	C
Northbound								
L	250	1770	0.66	0.57	22.9	C		
TR	2000	3509	0.24	0.57	11.0	B	14.0	B
Southbound								
L	400	888	0.07	0.45	16.0	B		
TR	1564	3475	0.74	0.45	25.9	C	25.7	C

Intersection Delay = 23.6 (sec/veh) Intersection LOS = C

HCS+: Signalized Intersections Release 5.21

Analyst: REB
Agency: ms consultants
Date: 1/31/2008
Period: PM Peak
Project ID: with Improvements
E/W St: Mill Road/Echo Drive

Inter.: SR 31 & Mill Road
Area Type: All other areas
Jurisd: Marysville, OH
Year : 2012
N/S St: SR 31

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	1	1	1	0	1	0	1	2	0	1	2	0
LGConfig	L	TR	R	LTR			L	TR		L	TR	
Volume	196	20	423	58	14	14	513	997	57	14	616	102
Lane Width	12.0	12.0	12.0		12.0		12.0	12.0		12.0	12.0	
RTOR Vol			0			0			0			0

Duration 0.25 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4	5	6	7	8
EB Left	A				NB Left	A	P	
Thru	A				Thru	P	P	
Right	A				Right	P	P	
Peds					Peds			
WB Left	A				SB Left		P	
Thru	A				Thru		P	
Right	A				Right		P	
Peds					Peds			
NB Right					EB Right			
SB Right					WB Right			
Green	27.0					28.0	30.0	
Yellow	3.5					3.5	3.5	
All Red	1.5					1.5	1.5	

Cycle Length: 100.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
L	379	1306	0.58	0.29	32.4	C		
TR	470	1621	0.35	0.29	28.5	C	33.7	C
R	459	1583	0.72	0.29	37.1	D		
Westbound								
LTR	346	1192	0.28	0.29	27.8	C	27.8	C
Northbound								
L	625	1770	0.91	0.65	42.1	D		
TR	2287	3518	0.51	0.65	10.0+	B	20.5	C
Southbound								
L	144	451	0.11	0.32	25.5	C		
TR	1111	3471	0.72	0.32	34.0	C	33.8	C

Intersection Delay = 26.7 (sec/veh) Intersection LOS = C

HCS+: Signalized Intersections Release 5.21

Analyst: REB
Agency: ms consultants
Date: 1/31/2008
Period: AM Peak
Project ID: with Improvements
E/W St: Mill Road/Echo Drive

Inter.: SR 31 & Mill Road
Area Type: All other areas
Jurisd: Marysville, OH
Year : 2032
N/S St: SR 31

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	1	1	1	0	1	0	1	2	0	1	2	0
LGConfig	L	TR	R	LTR			L	TR		L	TR	
Volume	79	4	569	39	4	6	149	754	31	25	1431	141
Lane Width	12.0	12.0	12.0	12.0			12.0	12.0		12.0	12.0	
RTOR Vol			0			0			0			0

Duration 0.25 Area Type: All other areas

Signal Operations

Phase Combination		1	2	3	4			5	6	7	8
EB	Left	A				NB	Left	A	P		
	Thru	A					Thru	P	P		
	Right	A					Right	P	P		
	Peds						Peds				
WB	Left	A				SB	Left		P		
	Thru	A					Thru		P		
	Right	A					Right		P		
	Peds						Peds				
NB	Right					EB	Right				
SB	Right					WB	Right				
Green		29.0						7.0	47.0		
Yellow		3.5						3.5	3.5		
All Red		1.5						1.5	1.5		

Cycle Length: 98.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
L	433	1368	0.20	0.32	24.7	C		
TR	503	1590	0.39	0.32	26.6	C	39.7	D
R	501	1583	0.88	0.32	48.5	D		
Westbound								
LTR	414	1310	0.13	0.32	24.0	C	24.0	C
Northbound								
L	239	1770	0.69	0.62	28.1	C		
TR	2195	3526	0.40	0.62	9.8	A	12.7	B
Southbound								
L	304	607	0.09	0.50	13.4	B		
TR	1750	3499	1.00	0.50	45.6	D	45.1	D

Intersection Delay = 34.3 (sec/veh) Intersection LOS = C

HCS+: Signalized Intersections Release 5.21

Analyst: REB
Agency: ms consultants
Date: 1/31/2008
Period: PM Peak
Project ID: with Improvements
E/W St: Mill Road/Echo Drive

Inter.: SR 31 & Mill Road
Area Type: All other areas
Jurisd: Marysville, OH
Year : 2032
N/S St: SR 31

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	1	1	1	0	1	0	1	2	0	1	2	0
LGConfig	L	TR	R	LTR			L	TR		L	TR	
Volume	196	20	423	58	14	14	513	1403	57	14	1235	102
Lane Width	12.0	12.0	12.0	12.0			12.0	12.0		12.0	12.0	
RTOR Vol			30			0			0			0

Duration 0.25 Area Type: All other areas

Signal Operations

Phase Combination		1	2	3	4			5	6	7	8
EB	Left	A				NB	Left	A	P		
	Thru	A					Thru	P	P		
	Right	A					Right	P	P		
	Peds						Peds				
WB	Left	A				SB	Left		P		
	Thru	A					Thru		P		
	Right	A					Right		P		
	Peds						Peds				
NB	Right					EB	Right	P			
SB	Right					WB	Right				
Green		18.0						27.0	40.0		
Yellow		3.5						3.5	3.5		
All Red		1.5						1.5	1.5		

Cycle Length: 100.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
L	260	1300	0.84	0.20	59.3	E		
TR	373	1863	0.06	0.20	32.4	C	30.9	C
R	823	1583	0.53	0.52	16.6	B		
Westbound								
LTR	293	1466	0.33	0.20	34.9	C	34.9	C
Northbound								
L	588	1770	0.97	0.74	43.3	D		
TR	2609	3526	0.62	0.74	7.4	A	16.7	B
Southbound								
L	120	286	0.13	0.42	20.1	C		
TR	1473	3506	1.01	0.42	54.4	D	54.1	D

Intersection Delay = 31.8 (sec/veh) Intersection LOS = C

HCS+: Signalized Intersections Release 5.21

Analyst: REB
Agency: ms consultants
Date: 1/31/2008
Period: AM Peak
Project ID: with Improvements
E/W St: County Home

Inter.: SR 4 & County Home
Area Type: All other areas
Jurisd: Marysville, OH
Year : 2012

N/S St: SR 4

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	1	1	0	1	1	0	1	1	0	1	1	0
LGConfig	L	TR		L	TR		L	TR		L	TR	
Volume	117	109	117	71	38	1	148	90	123	1	541	186
Lane Width	12.0	12.0		12.0	12.0		12.0	12.0		12.0	12.0	
RTOR Vol			30			0			0			0

Duration 0.25 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4	5	6	7	8
EB Left	A				NB Left	A	P	
Thru	A				Thru	P	P	
Right	A				Right	P	P	
Peds					Peds			
WB Left	A				SB Left		P	
Thru	A				Thru		P	
Right	A				Right		P	
Peds					Peds			
NB Right					EB Right	P		
SB Right					WB Right			
Green	28.0					7.0	50.0	
Yellow	3.5					3.5	3.5	
All Red	1.5					1.5	1.5	

Cycle Length: 100.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
L	407	1358	0.32	0.30	27.6	C		
TR	521	1738	0.42	0.30	28.6	C	28.2	C
Westbound								
L	271	902	0.29	0.30	27.4	C		
TR	557	1856	0.08	0.30	25.1	C	26.6	C
Northbound								
L	266	1770	0.62	0.64	21.5	C		
TR	1089	1701	0.22	0.64	8.0	A	13.5	B
Southbound								
L	592	1139	0.00	0.52	11.5	B		
TR	931	1791	0.87	0.52	31.8	C	31.7	C

Intersection Delay = 26.3 (sec/veh) Intersection LOS = C

HCS+: Signalized Intersections Release 5.21

Analyst: REB
Agency: ms consultants
Date: 1/31/2008
Period: PM Peak
Project ID: with Improvements
E/W St: County Home

Inter.: SR 4 & County Home
Area Type: All other areas
Jurisd: Marysville, OH
Year : 2012

N/S St: SR 4

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	1	1	0	1	1	0	1	1	0	1	1	0
LGConfig	L	TR		L	TR		L	TR		L	TR	
Volume	226	188	239	82	18	8	102	581	233	12	296	85
Lane Width	12.0	12.0		12.0	12.0		12.0	12.0		12.0	12.0	
RTOR Vol			30			0			0			0

Duration 0.25 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4		5	6	7	8
EB Left	A				NB Left	A	P		
Thru	A				Thru	P	P		
Right	A				Right	P	P		
Peds					Peds				
WB Left	A				SB Left		P		
Thru	A				Thru		P		
Right	A				Right		P		
Peds					Peds				
NB Right					EB Right	P			
SB Right					WB Right				
Green	35.0					7.0	43.0		
Yellow	3.5					3.5	3.5		
All Red	1.5					1.5	1.5		

Cycle Length: 100.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
L	509	1375	0.49	0.37	25.0	C		
TR	635	1716	0.69	0.37	30.0	C	28.2	C
Westbound								
L	185	499	0.49	0.37	26.3	C		
TR	657	1776	0.04	0.37	20.2	C	24.8	C
Northbound								
L	458	1770	0.25	0.57	11.8	B		
TR	1016	1783	0.89	0.57	30.5	C	28.4	C
Southbound								
L	101	225	0.13	0.45	18.7	B		
TR	810	1801	0.52	0.45	22.2	C	22.1	C

Intersection Delay = 26.9 (sec/veh) Intersection LOS = C

HCS+: Signalized Intersections Release 5.21

Analyst: REB
Agency: ms consultants
Date: 1/31/2008
Period: AM Peak
Project ID: with Improvements
E/W St: County Home Rd.

Inter.: SR 4 & County Home
Area Type: All other areas
Jurisd: Marysville, OH
Year : 2032
N/S St: SR 4

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	1	1	0	1	1	0	1	1	0	1	1	0
LGConfig	L	TR		L	TR		L	TR		L	TR	
Volume	117	109	117	88	35	10	148	209	162	10	764	186
Lane Width	12.0	12.0		12.0	12.0		12.0	12.0		12.0	12.0	
RTOR Vol			30			0			0			0

Duration 0.25 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4	5	6	7	8
EB Left	A				NB Left	A	P	
Thru	A				Thru	P	P	
Right	A				Right	P	P	
Peds					Peds			
WB Left	A				SB Left		P	
Thru	A				Thru		P	
Right	A				Right		P	
Peds					Peds			
NB Right					EB Right	P		
SB Right					WB Right			
Green	20.0					7.0	58.0	
Yellow	3.5					3.5	3.5	
All Red	1.5					1.5	1.5	

Cycle Length: 100.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
L	297	1349	0.44	0.22	34.7	C		
TR	382	1738	0.57	0.22	36.8	D	36.0	D
Westbound								
L	165	750	0.59	0.22	40.7	D		
TR	396	1801	0.13	0.22	31.4	C	37.5	D
Northbound								
L	233	1770	0.70	0.72	37.6	D		
TR	1254	1741	0.33	0.72	5.8	A	14.9	B
Southbound								
L	582	970	0.02	0.60	8.2	A		
TR	1085	1808	0.97	0.60	40.8	D	40.5	D

Intersection Delay = 32.7 (sec/veh) Intersection LOS = C

HCS+: Signalized Intersections Release 5.21

Analyst: REB
Agency: ms consultants
Date: 1/31/2008
Period: PM Peak
Project ID: with Improvements
E/W St: County Home

Inter.: SR 4 & County Home
Area Type: All other areas
Jurisd: Marysville, OH
Year : 2032
N/S St: SR 4

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	1	1	0	1	1	0	1	1	0	1	1	0
LGConfig	L	TR		L	TR		L	TR		L	TR	
Volume	226	188	239	107	50	10	213	675	307	10	384	263
Lane Width	12.0	12.0		12.0	12.0		12.0	12.0		12.0	12.0	
RTOR Vol			30			0			0			0

Duration 0.25 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4	5	6	7	8
EB Left	A				NB Left	A	P	
Thru	A				Thru	P	P	
Right	A				Right	P	P	
Peds					Peds			
WB Left	A				SB Left		P	
Thru	A				Thru		P	
Right	A				Right		P	
Peds					Peds			
NB Right					EB Right	P		
SB Right					WB Right			
Green	32.0					7.0	46.0	
Yellow	3.5					3.5	3.5	
All Red	1.5					1.5	1.5	

Cycle Length: 100.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
L	452	1329	0.56	0.34	28.4	C		
TR	583	1716	0.76	0.34	35.0-	C	32.6	C
Westbound								
L	147	433	0.81	0.34	57.7	E		
TR	618	1817	0.11	0.34	22.7	C	45.1	D
Northbound								
L	279	1770	0.85	0.60	39.5	D		
TR	1065	1775	1.02	0.60	53.9	D	51.4	D
Southbound								
L	74	155	0.15	0.48	18.8	B		
TR	840	1749	0.86	0.48	33.8	C	33.6	C

Intersection Delay = 42.1 (sec/veh) Intersection LOS = D

HCS+: Signalized Intersections Release 5.21

Analyst: REB
Agency: ms consultants
Date: 1/31/2008
Period: AM Peak
Project ID: with Improvements
E/W St: Scott Farms

Inter.: SR 4 & Scott Farms
Area Type: All other areas
Jurisd: Marysville, OH
Year : 2032

N/S St: SR 4

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	1	1	0	1	1	0	1	1	0	1	1	0
LGConfig	L	TR		L	TR		L	TR		L	TR	
Volume	24	13	46	109	27	17	61	478	54	15	913	41
Lane Width	12.0	12.0		12.0	12.0		12.0	12.0		12.0	12.0	
RTOR Vol			30			0			0			0

Duration 0.25 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4			5	6	7	8
EB Left	A				NB	Left	A	P		
Thru	A					Thru	P	P		
Right	A					Right	P	P		
Peds						Peds				
WB Left	A				SB	Left		P		
Thru	A					Thru		P		
Right	A					Right		P		
Peds						Peds				
NB Right					EB	Right	P			
SB Right					WB	Right				
Green	20.0						7.0	58.0		
Yellow	3.5						3.5	3.5		
All Red	1.5						1.5	1.5		

Cycle Length: 100.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
L	297	1351	0.09	0.22	31.2	C		
TR	375	1706	0.09	0.22	31.1	C	31.1	C
Westbound								
L	302	1372	0.40	0.22	34.2	C		
TR	386	1754	0.13	0.22	31.4	C	33.4	C
Northbound								
L	233	1770	0.29	0.72	22.1	C		
TR	1320	1834	0.45	0.72	6.9	A	8.5	A
Southbound								
L	493	822	0.03	0.60	8.3	A		
TR	1111	1851	0.95	0.60	36.7	D	36.3	D

Intersection Delay = 26.5 (sec/veh) Intersection LOS = C

HCS+: Signalized Intersections Release 5.21

Analyst: REB
Agency: ms consultants
Date: 1/31/2008
Period: PM Peak
Project ID: with Improvements
E/W St: Scott Farms

Inter.: SR 4 & Scott Farms
Area Type: All other areas
Jurisd: Marysville, OH
Year : 2032

N/S St: SR 4

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	1	1	0	1	1	0	1	1	0	1	1	0
LGConfig	L	TR		L	TR		L	TR		L	TR	
Volume	46	28	77	66	36	14	80	1135	90	21	478	50
Lane Width	12.0	12.0		12.0	12.0		12.0	12.0		12.0	12.0	
RTOR Vol			30			0			0			0

Duration 0.25 Area Type: All other areas

Signal Operations

Phase Combination		1	2	3	4			5	6	7	8
EB	Left	A				NB	Left	A	P		
	Thru	A					Thru	P	P		
	Right	A					Right	P	P		
	Peds						Peds				
WB	Left	A				SB	Left		P		
	Thru	A					Thru		P		
	Right	A					Right		P		
	Peds						Peds				
NB	Right					EB	Right	P			
SB	Right					WB	Right				
Green		18.0						7.0	60.0		
Yellow		3.5						3.5	3.5		
All Red		1.5						1.5	1.5		

Cycle Length: 100.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
L	268	1342	0.19	0.20	33.6	C		
TR	338	1688	0.25	0.20	34.0	C	33.9	C
Westbound								
L	251	1253	0.29	0.20	34.6	C		
TR	357	1783	0.16	0.20	33.2	C	34.0	C
Northbound								
L	544	1770	0.16	0.74	5.6	A		
TR	1363	1842	1.00	0.74	37.0	D	35.1	D
Southbound								
L	74	120	0.31	0.62	19.6	B		
TR	1138	1836	0.52	0.62	12.3	B	12.6	B

Intersection Delay = 29.0 (sec/veh) Intersection LOS = C

Appendix B

Maple Street & Quail Hollow Drive/ Taylor Avenue

Signal Warrant Study

October 17, 2008

ms consultants, inc.
engineers, architects, planners

Signal Warrant Study

Maple Street & Quail Hollow Drive/
Taylor Avenue

October 27, 2008

ms consultants, inc.
engineers, architects, planners
2221 Schrock Road
Columbus, Ohio 43229-1547

ms consultants, inc.
engineers - architects - planners

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Introduction

ms consultants has performed a signal warrant analysis for the intersections of Maple Street (SR 31) with Quail Hollow Drive and Taylor Avenue in the northern portion of Marysville, Ohio. Quail Hollow Drive and Taylor Avenue form offset T-intersections with Maple Street south of the US 33/US 36/SR 4 freeway. Quail Hollow Drive intersects Maple Street 250 feet north of the Taylor Avenue intersection. A map showing the study location is provided on **Figure 1**.

Existing Conditions

Maple Street, which is designated as SR 31 in this part of the city, is a two-lane north-south arterial. The speed limit on Maple Street is 35 miles per hour. Quail Hollow Drive is a 25-mph residential street extending west of Maple Street. Quail Hollow Drive serves an apartment complex, a residential subdivision, and provides an alternate access point for Marysville High School. Quail Hollow Drive has one eastbound approach lane at its intersection with Maple Street. Taylor Drive, which extends east from Maple Street, serves a single-family residential neighborhood. Taylor Drive has a 25-mph speed limit and has one westbound approach lane at Maple Street.

Traffic Volumes

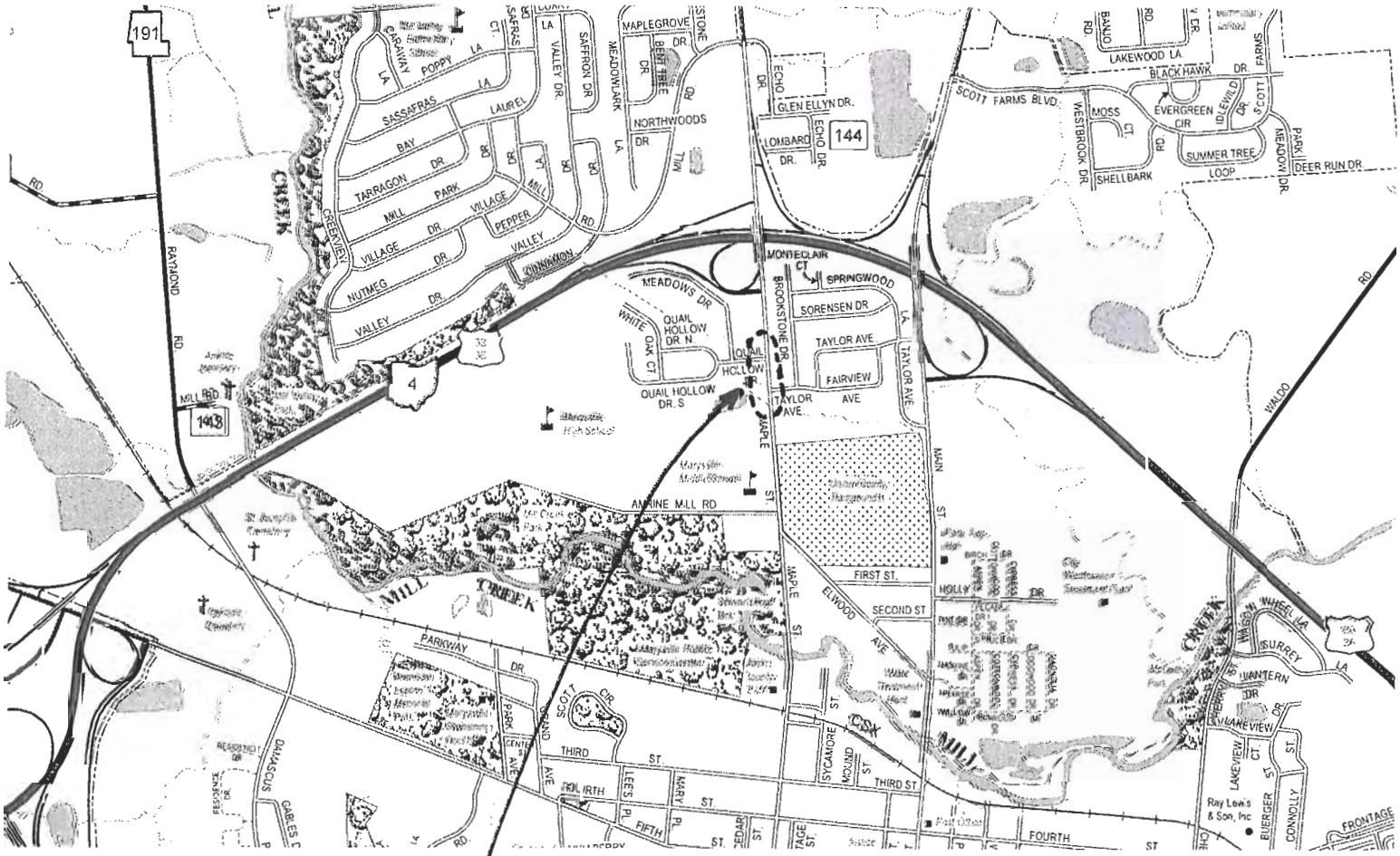
The City of Marysville collected automatic tube count data on Friday, October 3 – Monday, October 7, 2008. Tube counts were conducted on Maple Street, Quail Hollow Drive, and Taylor Avenue. A copy of the raw count data is provided in the **Appendix**. The weekday (Friday and Monday) counts were used for the signal warrant analysis. Since signal warrants are based on the average day of the year, the raw count data was adjusted using the appropriate ODOT Seasonal Adjustment factors for October (0.952 for Mondays, 0.864 for Fridays). This resulted in traffic for an average day of the year, which is shown on **Figure 2**.

Signal Warrant

The Maple Street/Quail Hollow Drive and the Maple Street/Taylor Avenue intersections were analyzed for signal warrants according to the criteria outlined in the Ohio Manual of Uniform Traffic Control Devices (OMUTCD). The OMUTCD contains eight possible warrants that an intersection can meet. The two study area intersections have been analyzed for these eight warrant criteria and the results are listed below:

Warrant 1 (Eight-Hour Volume)
In order to meet Warrant 1, the volumes must meet OMUTCD criteria for each of 8 hours in an average day. The volumes from Figure 2 were entered into a spreadsheet (which is provided in the Appendix) to check for Conditions A, B, and C of the eight-hour warrant.

Figure 1: Study Location



Maple St. & Quail Hollow Dr./Taylor Ave.

Figure 2

MAPLE STREET & QUAIL HOLLOW/TAYLOR COUNT DATA

With Seasonal Adjustment Factor Applied

	MAJOR STREET	MINOR STREETS	
	Maple (NB + SB)	Quail Hollow EB	Taylor WB
6:00 AM	544	26	23
7:00 AM	674	71	34
8:00 AM	720	24	18
9:00 AM	429	14	18
10:00 AM	389	15	17
11:00 AM	458	27	12
12:00 PM	456	23	18
1:00 PM	476	31	25
2:00 PM	684	97	20
3:00 PM	832	52	22
4:00 PM	857	48	33
5:00 PM	707	38	24
6:00 PM	554	27	16
7:00 PM	378	26	15
8:00 PM	301	15	13

ODOT Seasonal adjustment factor is 0.952 for Oct. Mondays, 0.864 for Oct. Fridays.

Because the speed limit on Maple Street is less than 40 miles per hour, the 70% reduction factor cannot be applied to the volume criteria. The analysis found that none of the conditions for Warrant 1 were met during any hour of the day. (It should be noted that the results would be the same even if the raw count data were used.) Therefore, Warrant 1 is not met for either intersection.

Warrant 2 (Four-Hour Volume)
The OMUTCD provides a chart for determining whether an intersection meets Four-Hour Warrant criteria. The highest four hours of the minor street traffic volumes were used for this analysis. Copies of the Four-Hour Warrant analyses are provided in the Appendix. The fourth-highest hourly volumes are plotted on the charts in the Appendix. Because the speed limit on Maple Street is less than 40 miles per hour, the 70% reduction factor cannot be applied to the volume criteria. Neither the Quail Hollow Drive intersection nor the Taylor Avenue intersection meets the Warrant 2 criteria for any of the four peak hours of the day.

Warrant 3 (Peak Hour Volume)
The OMUTCD provides a chart for determining whether an intersection meets Peak Hour Warrant criteria. The peak hours of the minor street traffic volumes were used for this analysis. Copies of the Peak Hour Warrant analyses are provided in the Appendix. Because the speed limit on Maple Street is less than 40 miles per hour, the 70% reduction factor cannot be applied to the volume criteria. Neither the Quail Hollow Drive intersection nor the Taylor Avenue intersection meets the Warrant 3 criteria.

Warrant 4 (Pedestrian Volume)
Pedestrians were not counted as part of the data collection for this study. In order to meet this warrant, greater than 100 pedestrians are needed for each of 4 hours, or 190 pedestrians are needed during one hour. It is unlikely that this volume of pedestrian activity exists, thus Warrant 4 would not be met.

Warrant 5 (School Crossing)
While these intersections are near the location of schools, there is no marked school crosswalk present at either intersection. A minimum of 20 students crossing SR 31 would be needed to meet this warrant, and a study would have to be completed to show that insufficient gaps exist in the current traffic flow on SR 31. Pedestrians can cross SR 31 at the Amrine Mill Road intersection to access the school sites. Therefore, Warrant 5 is not met at Quail Hollow Drive or at Taylor Avenue, unless future pedestrian counts and gap studies indicate otherwise.

Warrant 6 (Coordinated Signal System)
The Maple Street/Quail Hollow Drive/Taylor Avenue intersections are not located in a signalized corridor. The nearest signal to the south on Maple Street is 1000 feet away (Amrine Mill Road), while the nearest signal to the north is over ½ mile away on the

other side of the US 33/US 36/SR 4 freeway interchange. Warrant 6 is not met for either of these intersections.

Warrant 7 (Crash Experience)
To meet Warrant 7, five or more correctable crashes are needed at an intersection within a one-year period. Based on the most recent three-year period of crash data (2005-2007) provided by the City of Marysville, neither study area intersection has experienced has experienced five or more crashes in a 12-month period. Warrant 7 is therefore not met.

Warrant 8 (Roadway Network)
This warrant applies to locations where both streets are major routes (arterials). Quail Hollow Drive and Taylor Avenue are both residential streets with limited connectivity and are not considered major routes for traffic flow in the city. Therefore, Warrant 8 is not met for this location.

While the Quail Hollow and the Taylor Avenue intersections were analyzed separately, it should be noted that the warrant results would be the same if the intersections were treated as one 4-leg intersection. This is because the OMUTCD criteria for minor street volumes are based on the highest-volume approach. Therefore, the Quail Hollow Drive and Taylor Avenue volumes could not be added together to get higher minor street volumes.

Conclusion

The Maple Street/Quail Hollow Drive and the Maple Street/Taylor Avenue intersections were each analyzed to determine whether a signal warrant is met. After conducting the analyses, it was determined that a signal is not warranted at either intersection.

Appendix

MAPLE STREET & QUAIL HOLLOW/TAYLOR RAW COUNT DATA

	MAJOR STREET				MINOR STREETS			
	Maple NB		Maple SB		Quail Hollow EB		Taylor WB	
	Mon.	Fri.	Mon.	Fri.	Mon.	Fri.	Mon.	Fri.
6:00 AM	154		417		27		24	
7:00 AM	233		475		75		36	
8:00 AM	300		456		25		19	
9:00 AM	185		266		15		19	
10:00 AM	183		226		16		18	
11:00 AM	248		233		28		13	
12:00 PM	242		237		24		19	
1:00 PM	240		260		33		26	
2:00 PM	357		362		102		21	
3:00 PM		464		499	52	68		26
4:00 PM		497		495	56	55		38
5:00 PM		401		417	49	39		28
6:00 PM		337		304	40	22		19
7:00 PM		256		182	38	22		17
8:00 PM		192		156	17	18		15

ms consultants, inc.

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Traffic Signal Warrant Analysis

Project Name: Signal Warrant Study Location: Maple Street & Taylor Avenue Year: 2008 Project Number: 60-10536

Time (Hour Starting)	Traffic Volumes (Vehicles Per Hour)		Warrant #1 Conditions								
			A				B				C
	Major Street	Minor Street	Full Requirements		80% Requirements		Full Requirements		80% Requirements		
	Total of Both Approaches	Higher Volume Approach	Major Street 500	Minor Street 150	Major Street 400	Minor Street 120	Major Street 750	Minor Street 75	Major Street 600	Minor Street 60	Hours satisfying 80% of stated values for Warrants 1 & 2
12:00 AM											
1:00 AM											
2:00 AM											
3:00 AM											
4:00 AM											
5:00 AM											
6:00 AM	544	23	✓		✓						
7:00 AM	674	34	✓		✓				✓		
8:00 AM	720	18	✓		✓				✓		
9:00 AM	429	18			✓						
10:00 AM	389	17									
11:00 AM	458	12			✓						
12:00 PM	456	18			✓						
1:00 PM	476	25			✓						
2:00 PM	684	20	✓		✓				✓		
3:00 PM	832	22	✓		✓		✓		✓		
4:00 PM	857	33	✓		✓		✓		✓		
5:00 PM	707	24	✓		✓				✓		
6:00 PM	554	16	✓		✓						
7:00 PM	378	15									
8:00 PM	301	13									
9:00 PM											
10:00 PM											
11:00 PM											
Totals			0 Hours				0 Hours				0 Hours
Warrant Met? (8+ Hours Required)			No				No				No

Comments: Based on traffic count data provided by the City.

Conclusion: Signal not warranted

Print Date - 10/24/2008

ms consultants, inc.

Engineers ● Architects ● Planners

Traffic Signal Warrant Analysis

Project Name: Signal Warrant Study **Location:** Maple Street & Quail Hollow Drive **Year:** 2008 **Project Number:** 60-10536

Time (Hour Starting)	Traffic Volumes (Vehicles Per Hour)		Warrant #1 Conditions								
			A				B				C
	Major Street	Minor Street	Full Requirements		80% Requirements		Full Requirements		80% Requirements		Hours satisfying
	Total of Both Approaches	Higher Volume Approach	Major Street 500	Minor Street 150	Major Street 400	Minor Street 120	Major Street 750	Minor Street 75	Major Street 600	Minor Street 60	80% of stated values for Warrants 1 & 2
12:00 AM											
1:00 AM											
2:00 AM											
3:00 AM											
4:00 AM											
5:00 AM											
6:00 AM	544	26	✓		✓						
7:00 AM	674	71	✓		✓				✓	✓	
8:00 AM	720	24	✓		✓				✓		
9:00 AM	429	14			✓						
10:00 AM	389	15									
11:00 AM	458	27			✓						
12:00 PM	456	23			✓						
1:00 PM	476	31			✓						
2:00 PM	684	97	✓		✓			✓	✓	✓	
3:00 PM	832	52	✓		✓		✓		✓		
4:00 PM	857	48	✓		✓		✓		✓		
5:00 PM	707	38	✓		✓				✓		
6:00 PM	554	27	✓		✓						
7:00 PM	378	26									
8:00 PM	301	15									
9:00 PM											
10:00 PM											
11:00 PM											
Totals			**0 Hours**				**0 Hours**				**0 Hours**
Warrant Met? (8+ Hours Required)			**No**				**No**				**No**

Comments: Based on traffic count data provided by the City.

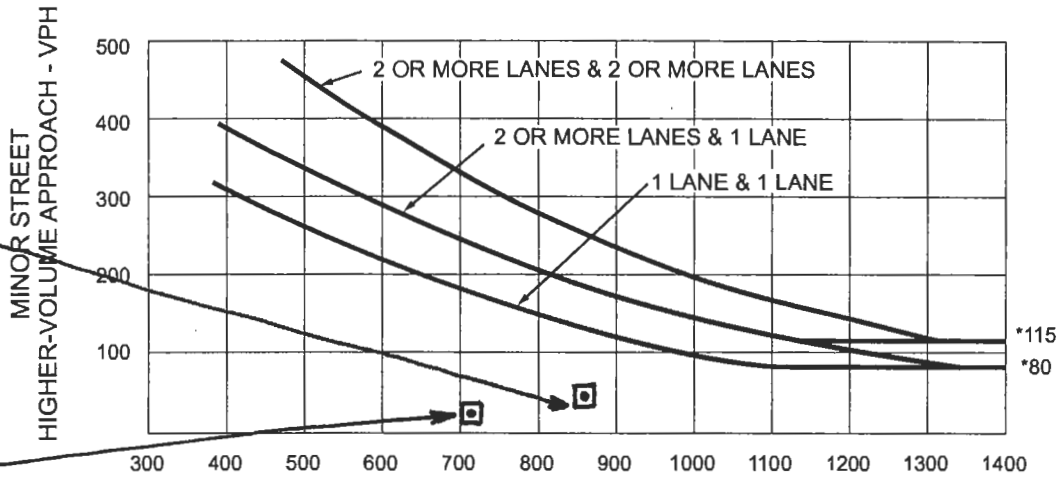
Conclusion: Signal not warranted

Print Date - 10/24/2008

Figure 4C-1. Warrant 2, Four-Hour Vehicular Volume

Quail Hollow Drive
857 major street
48 minor street
NOT WARRANTED

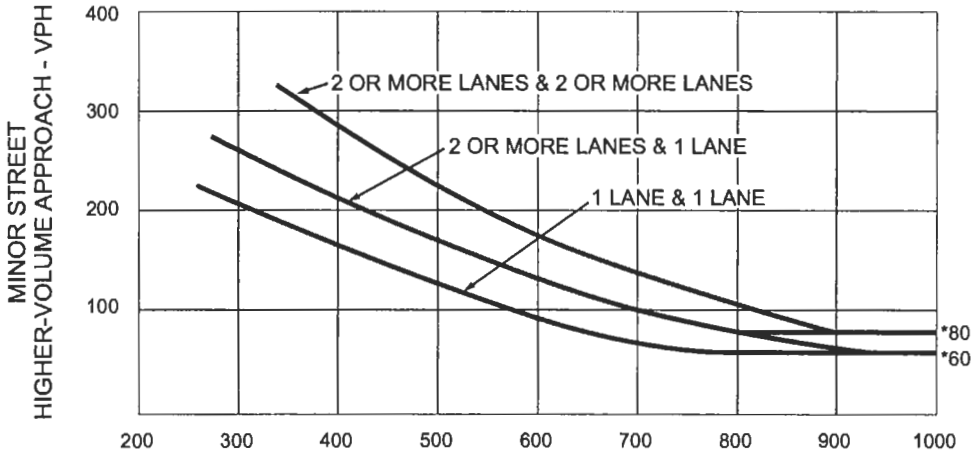
Taylor Ave.
707 major street
24 minor street
NOT WARRANTED



*Note: 115 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 80 vph applies as the lower threshold volume for a minor-street approach with one lane.

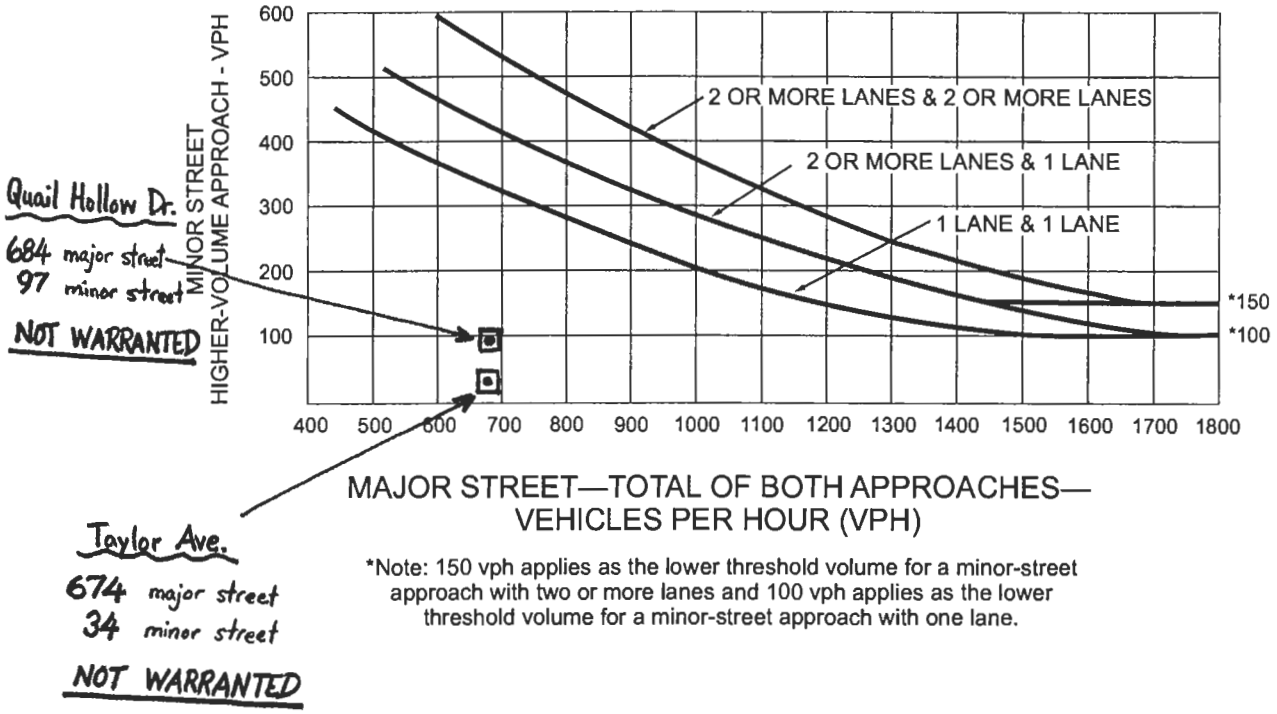
Figure 4C-2. Warrant 2, Four-Hour Vehicular Volume (70% Factor)

(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 70 km/h OR ABOVE 40 mph ON MAJOR STREET)



*Note: 80 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 60 vph applies as the lower threshold volume for a minor-street approach with one lane.

Figure 4C-3. Warrant 3, Peak Hour



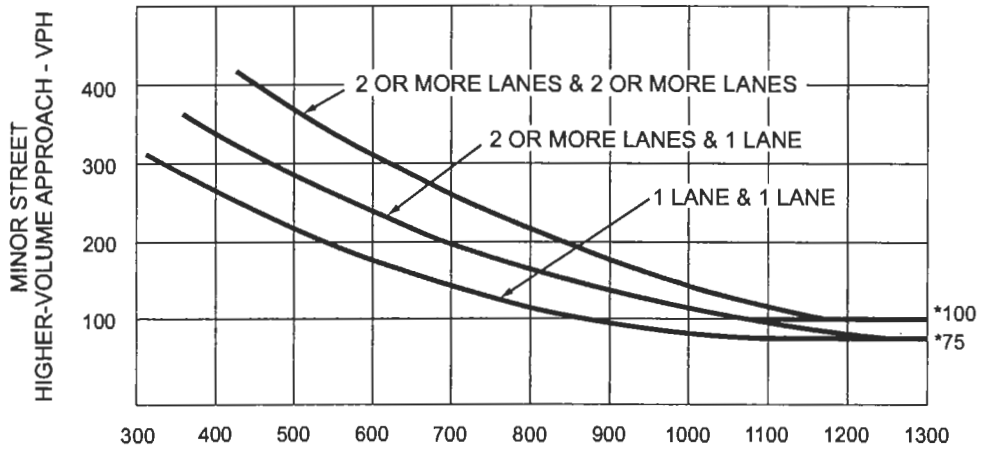
Quail Hollow Dr.
684 major street
97 minor street
NOT WARRANTED

Taylor Ave.
674 major street
34 minor street
NOT WARRANTED

*Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Figure 4C-4. Warrant 3, Peak Hour (70% Factor)

(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 70 km/h OR ABOVE 40 mph ON MAJOR STREET)



*Note: 100 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 75 vph applies as the lower threshold volume for a minor-street approach with one lane.

Appendix C

SR 31 Speed Zone Warrant Study

November 18, 2008

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November 18, 2008

Mr. Brian Palmer, PE
City of Marysville Engineering Department
135 East Sixth Street
Marysville, OH 43040

RE: Speed Zone Warrant Study
SR 31 – Mill Road to Creekview Drive
Marysville, Ohio

Dear Mr. Palmer:

At the request of the City of Marysville, **ms consultants** has performed a speed study for a section of SR 31 between Mill Road and Creekview Drive in the northern portion of the City. The purpose of this study is to determine whether the existing 55-mph speed limit could be lowered.

The ODOT Traffic Engineering Manual (TEM) indicates the process for determining the appropriate speed limit for a particular location, and whether a lower speed limit is warranted. The criteria used in this determination are highway development, roadway features, the crash rate, the 85th-percentile speed, the pace speed, and test run speeds. These are the criteria outlined in TEM Form 1296-2, which is used to determine an appropriate speed limit for a roadway section. Aerial photographs, combined with field observations, were used for the highway development and roadway features categories. The calculations for the remaining criteria are discussed in the sections below.

Crash Rate

Based on the 2005-2007 crash data provided by the City of Marysville, a total of 6 crashes occurred on this section of SR 31 during the three-year period. As per the instructions in the TEM, this total only includes the crashes on SR 31 and not any crashes occurring on side street approaches. Also, crashes on the northbound approach to the Mill Road intersection should not be counted because they do not occur within the bounds of the proposed speed reduction zone. The 6 crashes, combined with the 2008 ODOT daily volume of 14,920 vehicles for this section, results in a rate of 0.58 crashes per million vehicle-miles.

85th-Percentile Speed & Pace Speed

The City of Marysville collected speed data from automatic traffic counters on Friday, October 3 – Monday, October 7, 2008. This data was collected for both northbound and southbound directions at two locations within the study area. Count location #1 was on SR 31 north of Millwood Boulevard, while count location #2 was on SR 31 south of Millwood Boulevard. The speed data was collected in 5-mph intervals. **Table 1** shows the number of vehicles in each 5-mph speed interval at both locations.

Table 1: Spot Speed Study Results

	Location #1: SR 31 north of Millwood			Location #2: SR 31 south of Millwood		
	North-bound	South-bound	Cumulative % of vehs.	North-bound	South-bound	Cumulative % of vehs.
>10 mph	0	18	0.05%	2	101	0.2%
10-15 mph	5	56	0.2%	60	267	0.9%
15-20 mph	13	49	0.4%	67	397	1.9%
20-25 mph	25	82	0.7%	143	568	3.4%
25-30 mph	52	125	1.2%	531	1407	7.6%
30-35 mph	89	397	2.5%	1741	3648	19.1%
35-40 mph	329	1486	7.6%	3777	6037	40.1%
40-45 mph	1202	3797	21.6%	4428	5543	61.5%
45-50 mph	3404	5520	46.5%	4508	4111	79.9%
50-55 mph	5230	4255	72.9%	3306	2368	92.0%
55-60 mph	5164	1612	91.9%	1772	694	97.3%
60-65 mph	1715	367	97.7%	519	145	98.7%
65-70 mph	547	76	99.4%	287	43	99.4%
70-75 mph	84	35	99.7%	116	23	99.7%
75-80 mph	73	22	100%	114	7	100%

One of the primary criteria in a study to identify the proper speed limit for a roadway is the 85th-percentile speed. This is the speed that 85% of vehicles are traveling at or above. According to the above table, the 85th-percentile speed for Location #1 is between 55-60 miles per hour. The 85th-percentile speed for Location #2 is between 50-55 miles per hour. The pace speed for Location #1 is approximately 50 mph, while the pace speed for Location #2 is approximately 40 mph. Taking the average of the two locations, the 85th-percentile speed for the entire study area would be 55 mph, and the pace speed for the study area would be 45 mph.

Speed Zone Warrant Results

After entering all of the data into TEM Form 1296-2, the calculated speed for this section of SR 31 was 53.02 mph. A completed copy of TEM Form 1296-2 is attached to this letter. Test runs for this section were not performed, but given the lack of horizontal or vertical curvature on this section of SR 31, the free-flow speed would likely be 55 mph or higher. (According to the TEM, test runs should be driven during low-volume hours when other vehicles will not impede the results.) Therefore, the analysis indicates that the existing 55-mph speed limit is appropriate for this section of roadway. If this section were entirely annexed into the city limits, the speed limit would default to 35 mph. Until such annexation occurs, it is unlikely the speed limit could be lowered unless this section experienced more crashes or development.

If you have any questions about the results of this study, please do not hesitate to call our office anytime.

Sincerely,

Ryan Bush, PE
Traffic Engineer

REB:leb
File: 60-10536-00 C/M/W
N:\60-10536\traffic\docs\Speed & Warrant studies\SR 31 Speed Zone Report 111808.doc

Attachment

Form 1296-2. Speed Zone Warrant Sheet

Ohio

Warrants for Speed Zones

DATE: 11/7/08

COUNTY: Union ROUTE/STREET: SR 31

BEGIN: _____ END: _____ LENGTH: 0.634 ADT: 14920

(End Length minus Begin Length)

I. HIGHWAY DEVELOPMENT

(A) BUILDING DEVELOPMENT				(B) INTERSECTION CLASSIFICATION			
TYPE 1 - UNITS	4	x 1 =	4	CLASS A - NO.	0	x 2 =	0
TYPE 2 - UNITS	4	x 2 =	8	CLASS B - NO.	0	x 3 =	0
TYPE 3 - UNITS	0	x 3 =	0	CLASS C - NO.	1	x 4 =	4
TYPE 4 -UNITS	0	x 4 =	0	TOTAL CLASS (B)			4
TOTAL TYPE (A)			12				

HIGHWAY DEVELOPMENT = (A) + (B) / LENGTH (MILES) = 16 / 0.634 = 25.2

II. ROADWAY FEATURES

FACTORS	8	9	10	11	12	
1) LANE WIDTH, FEET	< 9	9	10	11	≥ 12	12
2) SHOULDER.... UNIMPROVED	< 2	< 4	< 6	≥ 6		
IMPROVED		< 2	< 4	< 6	≥ 6	9
3) CHARACTERISTICS	E	D	C	B	A	12

TOTAL ROADWAY FEATURES = 33

III. CRASH CALCULATIONS: 2740 x Crashes / ADT x Years x Miles = Crashes / Mil. Veh. Miles = 0.58

SPEED LIMIT FACTORS	45	55	64	73	82	91	100	
HIGHWAY DEVELOPMENT	> 80	69-80	57-68	45-56	33-44	21-32	<21	91
ROADWAY FEATURES	24	25-26	27-28	29-30	31-32	33-34	35-36	91
85th-PERCENTILE (MPH)	23-27	28-32	33-37	38-42	43-47	48-52	> 52	100
PACE (MPH)	13-27	18-32	23-37	28-42	33-47	38-52	43-57	100
CRASHES/MVM	> 5.0	4.4-5.0	3.7-4.3	3.0-3.6	2.3-2.9	1.6-2.2	<1.5	100

TOTAL FACTORS = 482

IV. CALCULATED SPEED: Total Factors / 5 X 55 / 100 = 53.02

V. TEST RUN, AVERAGE _____ MPH WARRANTED SPEED = _____ MPH

Study by: _____ Requested Speed Limit _____

Additional information & comments _____