Section Seven Corridor Opportunities Considered

PROCESS USED TO IDENTIFY IMPROVEMENT OPPORTUNITIES

The US-23 Corridor Coalition identified existing and potential issues specific to the US-23 Corridor and developed strategies to meet the overall goals documented in **Section 2 Study Purpose and Goal**s. Opportunities were evaluated and were all eliminated based on their feasibility and/or inability to resolve the key objectives identified. The following Study identified and reviewed the following corridor opportunities:

Transportation System Management
Local System Operational Improvements
Intelligent Transportation System/Incident Management

Mobility Options
Transit Service Options except commuter rail
Bus Bypass Shoulders

Capacity and Infrastructure Improvements
Additional General Purpose lanes
Additional High Occupancy Vehicle (HOV) lanes
Additional High-Occupancy Toll (HOT) Lane

Land Use Opportunities
Transit-Oriented Development

PLANNED IMPROVEMENTS FOR THE US-23 CORRIDOR AND SURROUNDING AREA

2009 Roadside Facility Improvement at Northfield Church Rest Area

2009 US-23/Geddes Road Roundabouts

2009 US-23 from CSX Railroad to south of M-59 - single course milling and fill

2011 Overlay on northbound and southbound US-23 over Silver Lake Road

2011 Overlay on northbound and southbound US-23 over Huron River Road

2011 Resurface northbound and southbound US-23 from Silver Lake to CSX Railroad Bridge

2011 Overlay northbound and southbound US-23 Over Hyne Road

2011 Superstructure Repair at Lee Road Bridge

2011 US-23 Northbound and Southbound Bridge under the Grand River - Deck patch, joint repair and full paint.

2011 US-23 under Spencer Road - Deck patch, joint repair and full paint

2011 Overlay on US-23 Northbound over Silver Lake Road

2011 Painting on US-23 Bridge under CSX Railroad

2011 Median cable barrier system on US-23 from M-36 to Genesee County Line

2012 Resurface carpool lot at Silver Lake Road

2013 Overlay on US-23 under Bemis Road

2013 Overlay on US-23 under Willis Road

2013 Bridge deck replacements, resurfacing, minor widening, and ramp extensions I-96/US-23 interchange

DESCRIBE THE TRANSPORTATION SYSTEM MANAGEMENT OPPORTUNITIES.

Local System Operational Improvements

The evaluation of traffic operation issues along the adjacent local road network could help address the lack of north-south connectivity within Washtenaw and Livingston County. There is little opportunity for the local road network to accommodate traffic, as there is no existing continuous north-south road in the study area.

Intelligent Transportation Systems and Incident Management

The US-23 and M-14 routes located within the study are not equipped with monitoring instrumentation known as Intelligent Transportation Systems (ITS). ITS technologies, including camera monitoring, vehicle detection systems, and electronic message signs, are currently located throughout much of the Metropolitan Detroit freeway system in the Wayne, Oakland and Macomb counties. These systems connect to the nerve center, the Michigan Intelligent Transportation Systems Center (MITSC), in Downtown Detroit where operators monitor traffic conditions, alert motorists of non-recurring congestion, construction activities and special events, and dispatch Freeway Courtesy Patrols or emergency responders as necessary to traffic incidents.

ITS and coordinated incident management along the US-23 corridor could help mitigate the impact of incident-related congestion, reduce secondary incidents, and help motorists make travel decisions. Furthermore, potential future transit service in the corridor could benefit from ITS, as it could help mitigate incident-related congestion for buses or provide necessary information for buses to make a determination of whether to use an alternate route.

MDOT's University Region office, which has jurisdiction within the study area, has no ITS deployments, although design is underway for systems along I-94. However, through partnership with the MDOT Metro Region, extension of freeway monitoring and courtesy patrol functions into the Ann Arbor area may be practical given the relatively contiguous nature of the Metro Detroit and Ann Arbor areas and the potential cost savings achieved by coordinating these systems.

MOBILITY OPPORTUNITIES

Commuter rail was intentionally omitted from this study because the WALLY Coalition is pursuing passenger rail service separate from this study on the Great Lakes Central rail line. **(Figure 7-1)**.

Transit Service Options

Given the lack of mobility options currently provided along the US-23 corridor, a transit market evaluation determined the viability of transit service within the study area as an alternative to single-occupant vehicle use of the corridor. This analysis included evaluation of market area demographics, population and employment densities and travel patterns in the area. The full results of the analysis are summarized in the US-23 Corridor Feasibility Study - Multi-Modal Analysis Technical Report located on CD in the back of this report.

While the US-23 transit market area **(Figure 7-1: US-23 Transit Market Shed)** did not have sufficient residential density to support local bus service, the corridor is suitable for commuter-oriented transit service. To serve the identified market effectively, it is recommended that any service be centered on a model of ridership captured at Park-And-Ride lots, with rapid, high frequency, limited stop service to major employment centers in Ann Arbor, including the downtown, central campus and medical areas. Additional service could be considered to the Plymouth Road corridor, with potential connections to St. Joseph Mercy Hospital, the U of M East Medical Center, U of M North Campus, and potential redevelopment plans at the former Pfizer site along Plymouth Road at Huron Parkway.

Express bus service from a potential 8 Mile Road Park-And-Ride lot/mixed-use development, or alternatively from the existing 9 Mile Road Park-And-Ride lot, was found to be the most favorable service concept for starting commuter service in the US-23 corridor, based on the following attributes:

- Sufficient distance from Ann Arbor needed to make service attractive
- Competitive travel times to auto travel into Ann Arbor
- Favorable demographics and travel attributes within catchment area
- Opportunity for public-private partnership for park-and-ride facilities and transit-oriented development
- Simplicity of service entirely within Washtenaw County for transit operator jurisdiction

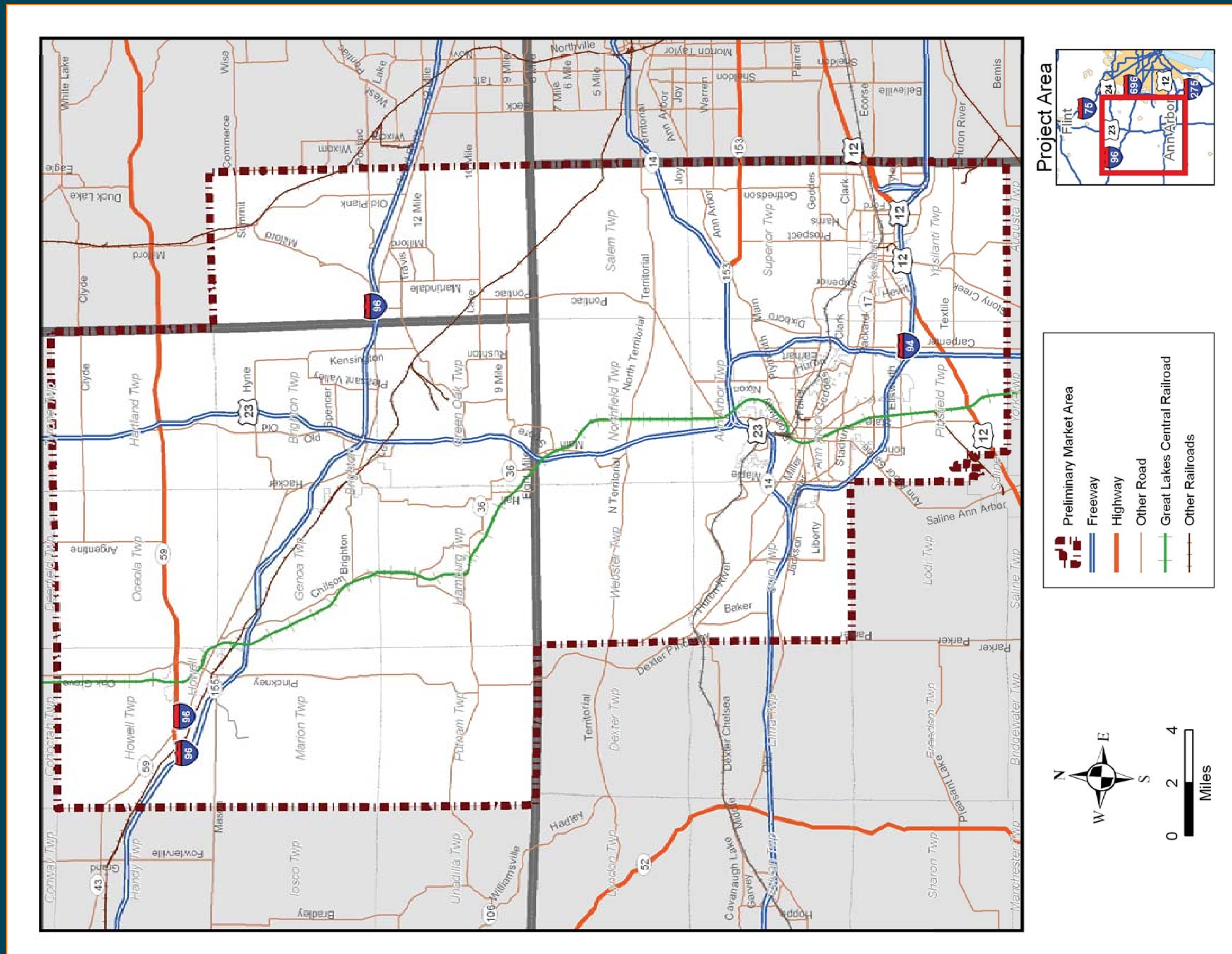
While this service was found to be most favorable, the analysis is based on generally available demographic information and not on specific traveler patterns and preferences. Before any significant capital expenditure is committed to start service in this corridor, a survey is needed to better pinpoint travel behaviors within the catchment area, verify the demand and design a transit service responsive to traveler needs. Additionally, the AATA express service from Chelsea to Ann Arbor could provide a comparable basis for similar service on US-23.

Bus Bypass Shoulders

An evaluation of bus operation on the shoulder of the freeway, known as Bus Bypass Shoulders (BBS), as a potential opportunity for improving the potential for bus operation and transit reliability in the corridor was infeasible due to the following:

- Current average travel speeds along US-23 in the peak hour/peak direction of travel were greater than 35 mph, which is the typical maximum threshold for warranting BBS.
- Should future average mainline speeds warrant BBS use, the short running segments that are physically feasible due to bridge and roadside obstructions, (combined with the maximum 15 mph speed differential between buses and mainline speed) provide little benefit relative to the associated cost.
- BBS is not an option along M-14 southwest of US-23, where some of the most significant congestion impacts traffic entering and leaving downtown Ann Arbor via Main Street. Raised guardrail sections, along with the interchange at Barton Road and the bridge over the Huron River, make BBS infeasible in this area.
- Most congestion observed in the corridor is non recurring, resulting from incidents or construction. Each of these conditions could occupy the shoulder, thereby rendering BBS ineffective.

FIGURE 7-1


Project Area
Flint
Ann Arbor
Preliminary Market Area
Freeway
Highway
Other Road
Great Lakes Central Railroad
Other Railroads
N
S
E
W
0
2
4
Miles

ADDITIONAL GENERAL PURPOSE LANES SCENARIO

Engineering Requirements

This concept would include the full reconstruction of US-23 between I-96 and M-14 to a six-lane cross-section, with full-width shoulders, drainage improvements, interchange ramp reconfiguration, replacement of bridges as required, and other improvements necessary to bring the corridor up to current design standards. **Figure 7-2: Cross-section of US-23 General Purpose Build** illustrates the cross-section of US-23 with the addition of a general purpose lane in each direction.

Operational Characteristics

Under this scenario, the corridor would operate much as it does today, but with the additional capacity associated with a third lane in each direction. All highway users, including single- and multi-occupant cars and trucks, would be able to use all lanes of the reconstructed freeway.

For the purpose of traffic analysis, the following operational changes have been included in corridor improvements for the 2030 analyses:

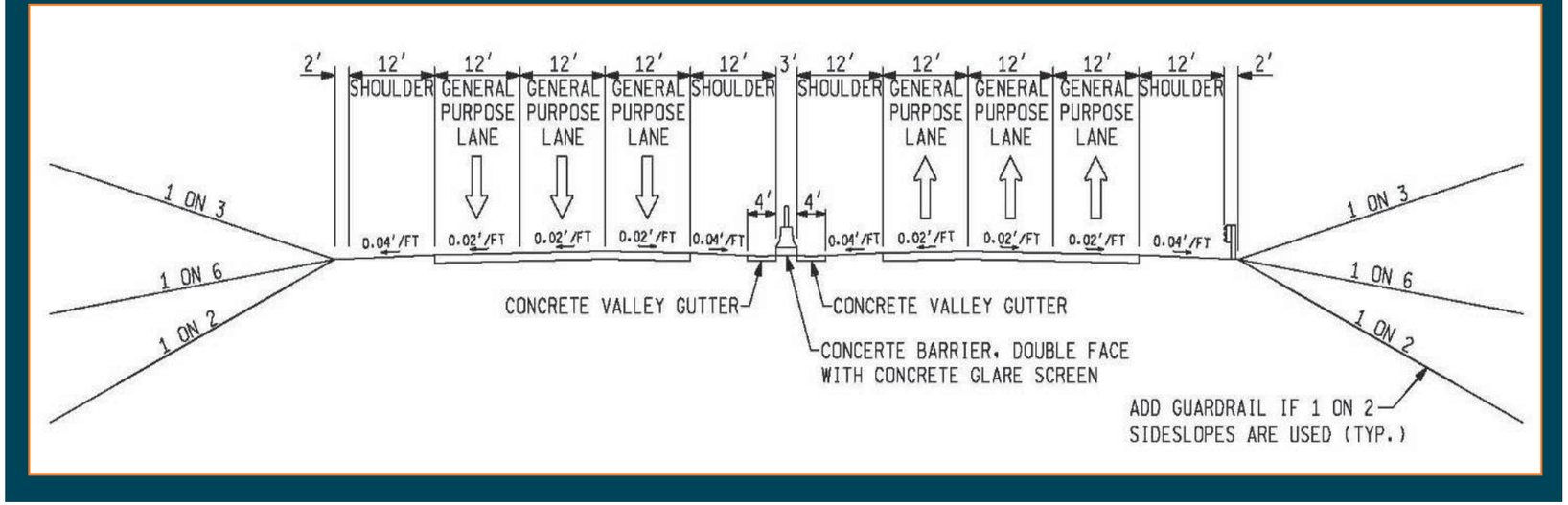
- An additional lane to each direction of US-23 between the I-96 southern most ramps and the west junction of M-14 and US-23
- Elimination of the Barker Road interchange, due to insufficient spacing between the existing interchange and 8 Mile Road
- Reconstruction of the I-96/US-23 interchange to the general configuration **(shown in Figure 7-6: Typical Approach for US-23 and I-96: General Purpose Build)** recommended as part of the Value Planning of I-96/US-23 Interchange Improvements report (Alfred Benesch & Company, 2001)

Traffic Analysis

The SEMCOG planning model provided future year (2030) peak-hour traffic projections for US-23 with an additional general purpose lane in each direction. Based on the traffic projections, travel demand for the corridor will increase with the addition of a third general purpose lane in each direction, relative to the future No-Build scenario. The largest impact occurred between North Territorial and the western US-23/M-14 junction. In the morning peak hour, approximately 1,325 additional southbound vehicles are expected, while in the evening peak hour an additional 1,025 northbound vehicles are forecasted through this area. Approximately 20 percent of these new trips originate from US-23 north of I-96, while only two percent came from I-96. The projected largest number of additional trips is from the US-23 interchanges south of I-96, with the largest contributors being to/from M-36 (15 percent) and 9 Mile Road (11 percent). Half of these new trips are continuing south along M-14 towards Ann Arbor, while the other half are continuing along to M-14 or further south along US-23. Most of induced US-23 demand under this scenario is due to local area trips that were previously using the local road system, but are now using US-23 due to the increase in capacity. **Figures 7-3, 7-4 and 7-5 (Projected 3 Lane 2030 AM/PM Peak LOS)** provide a graphical representation (by project segment) of the LOS along the US-23 corridor and its ramps under the 3 General Purpose Lane Scenario.

FIGURE 7-2

CROSS-SECTION OF US-23 GENERAL PURPOSE BUILD



2030 Forecasted Freeway Segments Analyses (3 General Purpose Lanes)

Table 7-1 shows US-23 AM and PM Peak Hour data on basic freeway segments for the Forecasted Year 2030. Although there is improvement in the lane density of the corridor, the southbound traffic from south of M-36 to the connection with the west junction of M-14 operates at an unacceptable LOS during the 2030 AM Peak Hour and in the returning movement in the PM Peak Hour.

TABLE 7-1

FORECASTED (2030) AM AND PM PEAK HOUR LEVEL OF SERVICE BASIC FREEWAY SEGMENTS (3 GENERAL PURPOSE LANES SCENARIO)

	2030 Southbound US-23 AM Peak				2030 Southbound US-23 PM Peak			
Freeway Segment To/From	**Volume, V**	**Flow Rate, Pc/hr**	**Density*, Pc/mi/ln**	**LOS**	**Volume, V**	**Flow Rate, Pc/hr**	**Density*, Pc/mi/ln**	**LOS**
N of I-96 to I-96 Interchange*	3,950	2,326	41.5	E	2,675	1,575	22.6	C
I-96 Interchange to Lee Road	5,100	2,002	30.9	D	4,100	1,610	23.2	C
Lee Road to Silver Lake	5,175	2,032	31.6	D	4,025	1,580	22.7	C
Silver Lake to M-36 (9 Mile)	5,450	2,140	34.7	D	3,700	1,453	20.8	C
M-36 (9Mile) to 8 Mile	5,825	2,287	39.8	E	3,950	1,551	22.3	C
8 Mile to 6 Mile	6,525	2,562	>45	F	3,925	1,541	22.1	C
6 Mile to North Territorial	6,675	2,621	>45	F	3,950	1,551	22.3	C
N Territorial to M-14/US-23BR	6,500	2,552	>45	F	3,825	1,502	21.5	C
US-23BR/M-14 To US-23/M-14*	4,750	1,865	27.8	D	3,550	1,394	19.9	C
US-23/M-14 To Plymouth*	5,100	3,003	>45	F	2,700	1,590	22.9	C
	2030 Northbound US-23 AM Peak				**2030 Northbound US-23 PM Peak**			
Freeway Segment To/From	**Volume, V**	**Flow Rate, Pc/hr**	**Density*, Pc/mi/ln**	**LOS**	**Volume, V**	**Flow Rate, Pc/hr**	**Density*, Pc/mi/ln**	**LOS**
Plymouth To US-23/M-14*	3,225	1,266	18.1	C	5,075	1,992	30.6	D
US-23/M-14 To US-23BR/M-14*	2,175	854	12.2	B	5,475	2,149	34.9	E
M-14/US-23BR to N Territorial	2,600	1,021	14.6	B	5,700	2,238	37.9	E
North Territorial to 6 Mile	2,725	1,070	15.3	B	6,100	2,395	44.7	E
6 Mile to 8 Mile	2,625	1,031	14.7	B	6,000	2.356	42.8	E
8 Mile to M-36 (9 Mile)	2,675	1,050	15.0	B	5,600	2,199	36.6	E
M-36 (9 Mile) to Silver Lake	2,525	991	14.2	B	5,225	2,051	32.1	D
Silver Lake to Lee Road	2,975	1,168	16.7	B	5,000	1,963	30.0	D
Lee Road to I-96 Interchange	3,150	1,237	17.7	B	4,600	1.806	26.6	D
I-96 Interchange to N of I-96*	2,450	1,443	20.6	C	3,400	2,002	30.9	D

**Outside of Project Area*

FIGURE 7-3

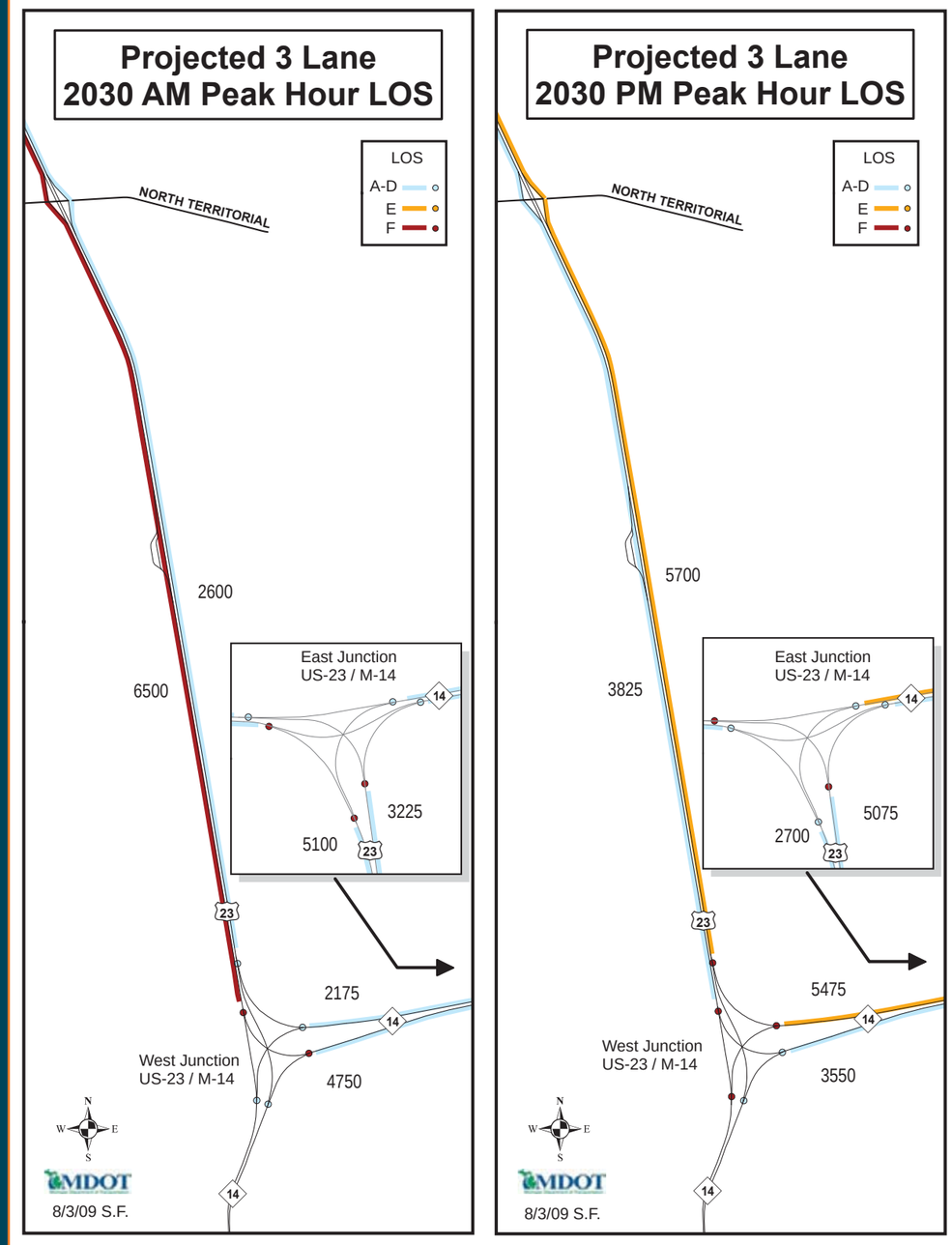


FIGURE 7-4

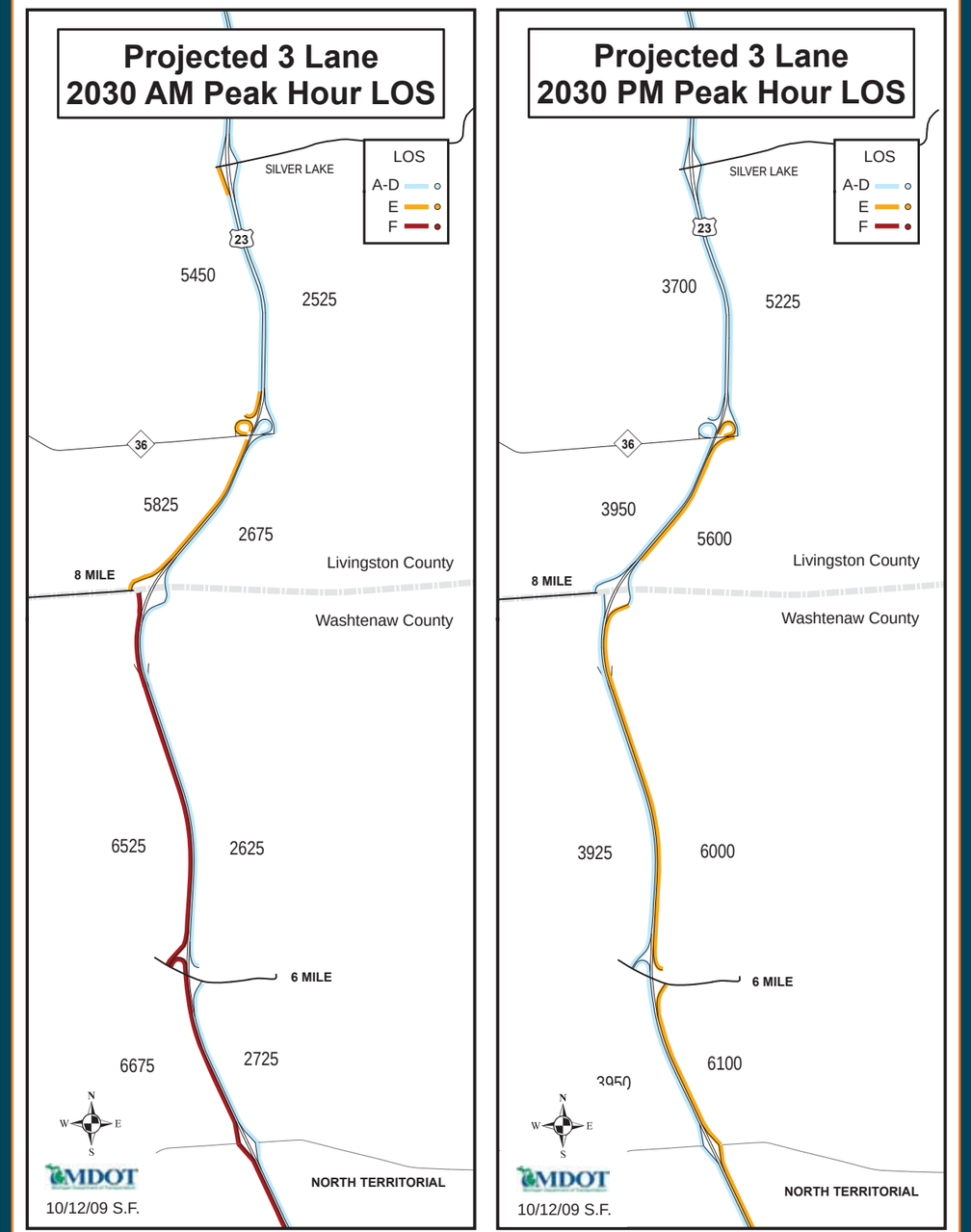
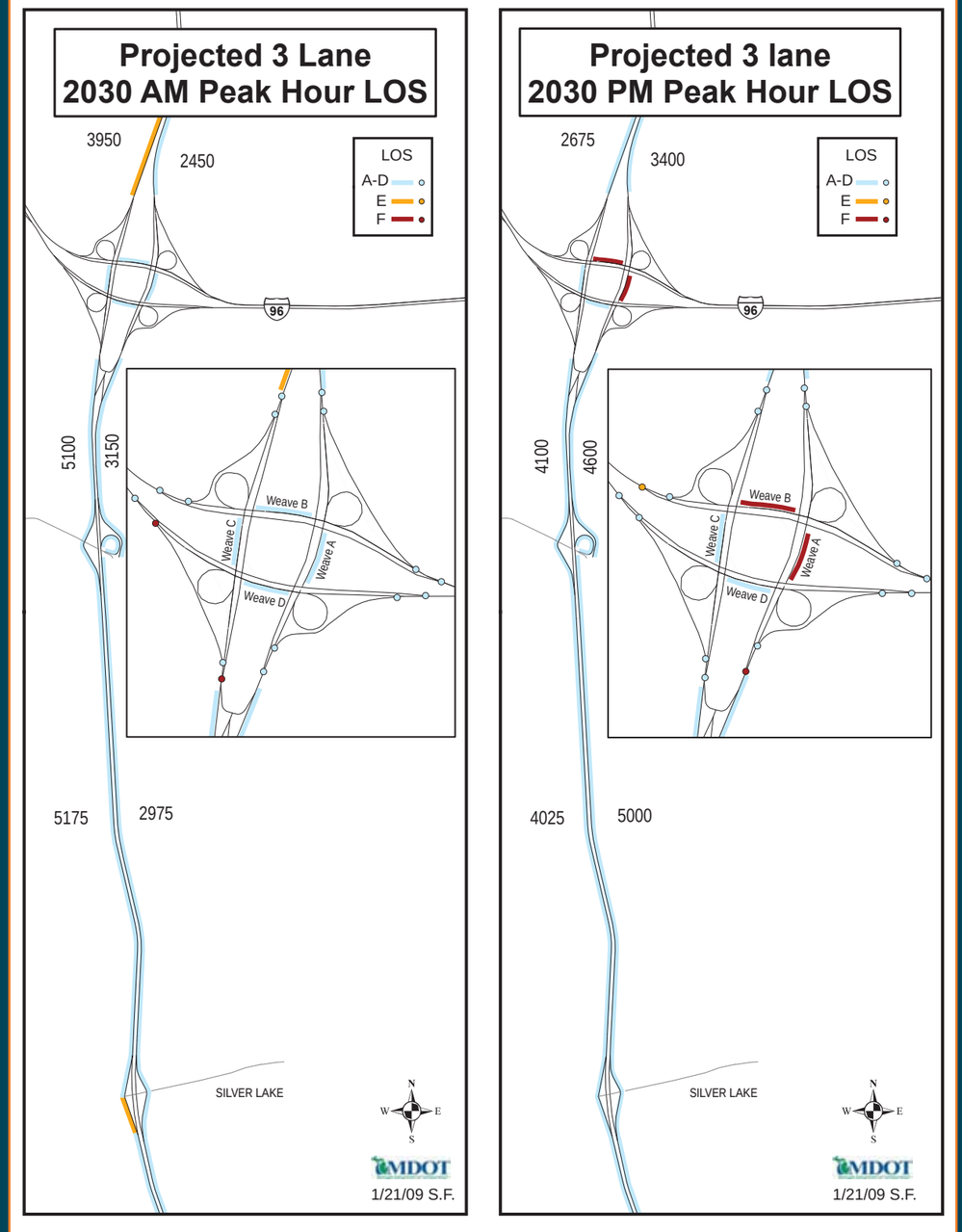


FIGURE 7-5



2030 Forecasted Ramp/Merge/Weave Analyses (3 General Purpose Lanes)

Tables 7-2 thru 7-4 provide forecasted 2030 merge/weave traffic analyses along mainline US-23 Corridor in the AM and PM Peak Hour. The analyses assume the reconstruction of the I-96/US-23 interchange by the 2030 planning horizon under all Build scenarios. The proposed configuration of this interchange is from the recommendations of the Value Planning of I-96/US-23 Interchange Improvements (Alfred Benesch & Company, 2001). There were several assumptions pertaining to laneage, speed limits, and distribution of traffic in order to conduct a proper HCS analysis. **Figure 7-6: Typical Approach for US-23 and I-96: General Purpose Build** shows the assumptions for configuration, laneage, and posted speeds for all directions of travel through the interchange.

Table 7-2 shows undesirable Level of Service (LOS) at the eastbound I-96 off to southbound US-23 ramp juncture and at the southbound US-23 Collector/Distributor (C/D) to southbound US-23 on ramp juncture in the morning peak hour. In the evening peak hour, the table shows undesirable Level of Service (LOS) at the northbound US-23 off ramp C/D and at the westbound I-96 C/D to westbound I-96 ramp juncture. The weave movement for the northbound US-23 C/D and westbound I-96 C/D both operate at Level of Service F in the evening peak hour. **Figure 7-7: I-96 and US-23 Ramp Freeway Junctions Labels** provides the numerical/letter ramp labels that correspond to column 1 in **Tables 7-2 and Table 7-3.**

FIGURE 7-6

TYPICAL APPROACH FOR US-23 AND I-96: GENERAL PURPOSE BUILD

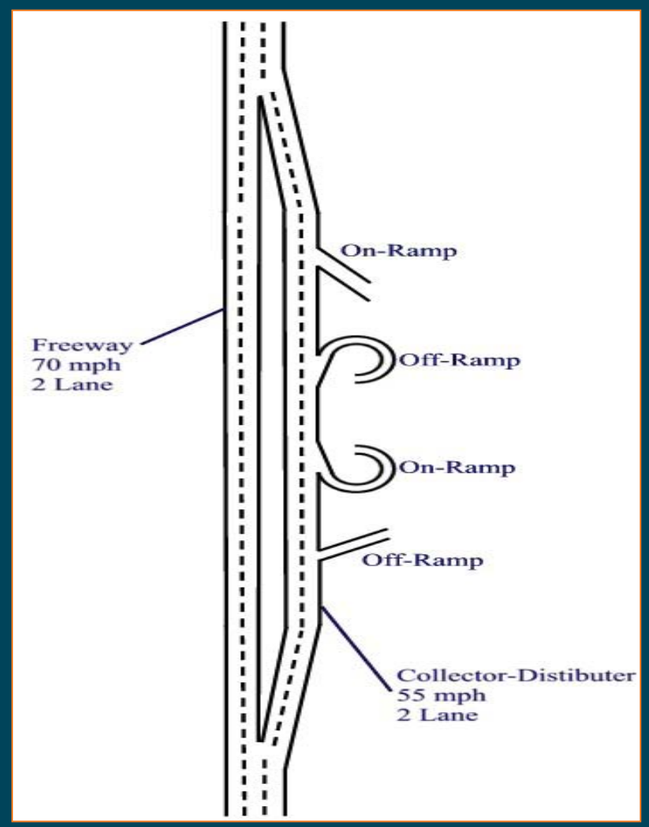


TABLE 7-2

FUTURE (2030) AM AND PM PEAK HOUR LEVEL OF SERVICE I-96 AND US-23 RAMP FREEWAY JUNCTIONS (3 GENERAL PURPOSE LANES SCENARIO)

			AM Peak Hour				PM Peak Hour			
#	Mainline	Ramp	Fwy. Volume (vph)	Ramp Volume (vph)	Density	Merge/ Diverge LOS	Fwy. Volume (vph)	Ramp Volume (vph)	Density	Merge/ Diverge LOS
1	NB US-23	To NB US-23 CD**	3150	2050	26.6	C	4600	3250	41.0	F
2	NB US-23 CD	To EB I-96	2050	850	17.0	B	3250	900	28.9	D
3	NB US-23 CD	From WB I-96	650	725	13.7	B	550	1500	19.4	B
4	NB US-23	From NB US-23 CD	1100	1375	20.8	C	1350	2050	28.8	D
5	WB I-96	To WB I-96 CD	2725	1375	16.7	B	4225	2650	30.3	D
6	WB I-96 CD	To NB US-23	1375	725	14.2	B	2650	1500	26.9	C
7	WB I-96 CD	From SB US-23	1200	650	18.0	B	2350	650	28.4	D
8	WB I-96	From WB I-96 CD	1350	1850	24.6	C	1575	3000	35.6	E
9	SB US-23	To SB US-23 CD	3950	1900	25.5	C	2675	1425	12.8	B
10	SB US-23 CD	To WB I-96	1900	650	14.0	B	1425	650	9.4	A
11	SB US-23 CD	From EB I-96	650	2400	27.9	C	1150	1700	26.5	C
12	SB US-23	From SB US-23 CD	2050	3050	43.5	F	1250	2850	34.6	D
13	EB I-96	To EB I-96 CD	6050	3050	30.0	D	4350	2250	18.0	B
14	EB I-96 CD	To SB US-23	3050	2400	31.9	F	2250	1700	23.9	C
15	EB I-96 CD	From NB US-23	1250	850	20.2	C	775	900	16.3	B
16	EB I-96	From EB I-96 CD	3000	2100	33.4	D	2100	1675	24.9	C

**vph – volume per hour **Collector-Distributor*

TABLE 7-3

FUTURE (2030) GENERAL PURPOSE BUILD AM AND PM PEAK HOUR LEVEL OF SERVICE I-96 AND US-23 WEAVE ANALYSIS

		AM Peak Hour				PM Peak Hour			
#	Mainline	Fwy. Volume (vph)	Ramp Volume (vph)	Density	Merge/ Diverge LOS	Fwy. Volume (vph)	Ramp Volume (vph)	Density	Merge/ Diverge LOS
A	NB US-23 CD	1,200	650	32.4	D	2,350	550	56.3	F
B	WB I-96 CD	650	1,200	31.7	C	1,150	2,350	69.4	F
C	SB US-23 CD	1250	650	32.5	D	1,150	775	33.0	D
D	EB I-96 CD	650	1,250	32.6	D	550	775	21.0	B

FIGURE 7-7

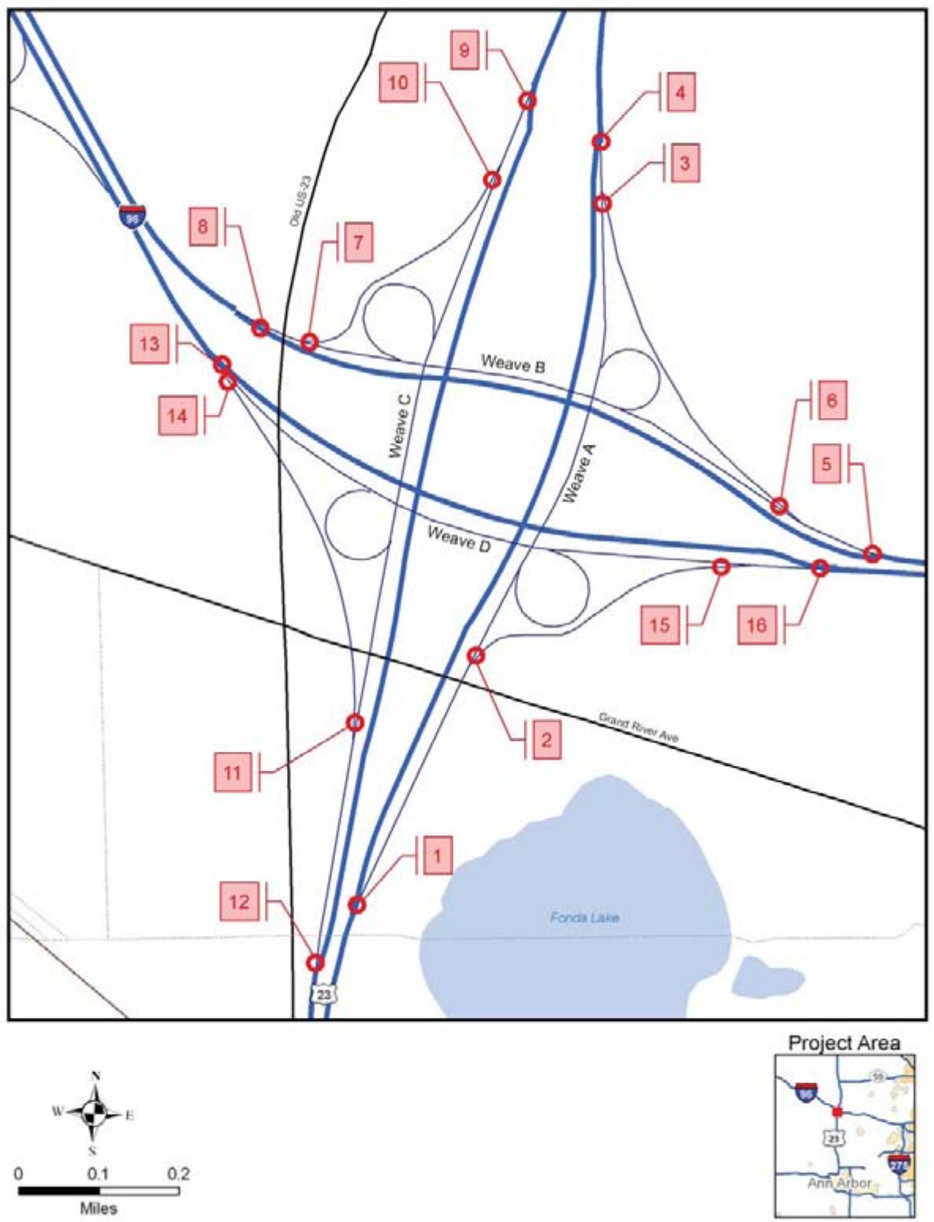


Table 7-4 shows undesirable Level of Service (LOS) and increased density for all southbound ramps except the Silver Lake off ramp in the morning peak hours. The table shows undesirable LOS and increased density for all northbound ramps except the Eight Mile off ramp in the evening peak hours.

TABLE 7-4

FUTURE (2030) AM AND PM PEAK HOUR LEVEL OF SERVICE RAMP FREEWAY JUNCTIONS (3 GENERAL PURPOSE LANES ALTERNATIVE)

	2030 Southbound US-23 AM Peak				2030 Southbound US-23 PM Peak			
	Fwy. Volume (vph)	Ramp Volume (vph)	Density	Merge/ Diverge LOS	Fwy. Volume (vph)	Ramp Volume (vph)	Density	Merge/ Diverge LOS
Lee Road Off Ramp	5,100	500	33.8	D	4,100	950	29.9	D
Lee Road On Ramp	4,600	575	30.2	D	3,150	875	24.9	C
Silver Lake Off Ramp	5,175	400	34.4	D	4,025	650	29.3	D
Silver Lake On Ramp	4,775	675	35.1	E	3,375	325	24.7	C
M-36 (9 Mile) Off Ramp	5,450	450	35.9	E	3,700	375	27.3	C
M-36 (9 Mile) On ramp	5,000	800	31.9	E	3,325	625	23.4	C
8 Mile Off Ramp	5,825	225	37.4	E	3,950	450	28.9	D
8 Mile On Ramp	5,600	925	38.1	F	3,500	425	24.7	C
6 Mile Off Ramp	6,525	325	40.1	F	3,925	250	28.3	D
6 Mile On Ramp	6,200	475	33.2	F	3,675	275	21.4	C
N. Territorial Off Ramp	6,675	750	41.0	F	3,950	500	28.7	D
N. Territorial On Ramp	5,925	575	36.8	F	3,450	375	37.5	E
	2030 Northbound US-23 AM Peak				2030 Northbound US-23 PM Peak			
	Fwy. Volume (vph)	Ramp Volume (vph)	Density	Merge/ Diverge LOS	Fwy. Volume (vph)	Ramp Volume (vph)	Density	Merge/ Diverge LOS
N. Territorial Off Ramp	2,600	250	19.8	B	5,700	500	36.2	E
N. Territorial On Ramp	2,350	375	19.2	B	5,200	900	39.1	F
6 Mile Off Ramp	2,725	250	21.5	C	6,100	525	38.7	E
6 Mile On Ramp	2,475	150	18.6	B	5,575	425	37.5	E
8 Mile Off Ramp	2,625	250	19.3	B	6,000	750	37.1	E
8 Mile On Ramp	2,375	300	177	B	5,250	350	33.7	D
M-36 (9 Mile) EB Off ramp	2,675	125	21.3	C	5,600	350	36.8	E
M-36 (9 Mile) WB Off ramp	2,550	275	21.1	C	5,250	550	35.8	E
M-36 (9 Mile) On ramp	2,275	250	17.6	B	4,700	525	33.0	D
Silver Road Off Ramp	2,525	150	19.3	B	5,225	725	28.9	D
Silver Road On Ramp	2,375	600	21.0	C	4,500	500	31.5	D
Lee Road Off Ramp	2,975	425	21.8	C	5,000	1,375	34.3	D
Lee Road On Ramp	2,550	600	20.5	C	3,625	975	29.4	D

Table 7-5 provides forecasted 2030 performance for both the east and west junctions of US-23 and M-14 with an additional general purpose lane along US-23 north of the M-14 junctions. The only physical modifications to this interchange under this scenario would occur on the north leg of the west junction, where an additional general purpose lane in each direction of US-23 is assumed. The analysis assumed no other physical modifications. However, the additional general purpose lanes along US-23 north of this interchange are expected to result in some changes to traffic volumes through the interchange.

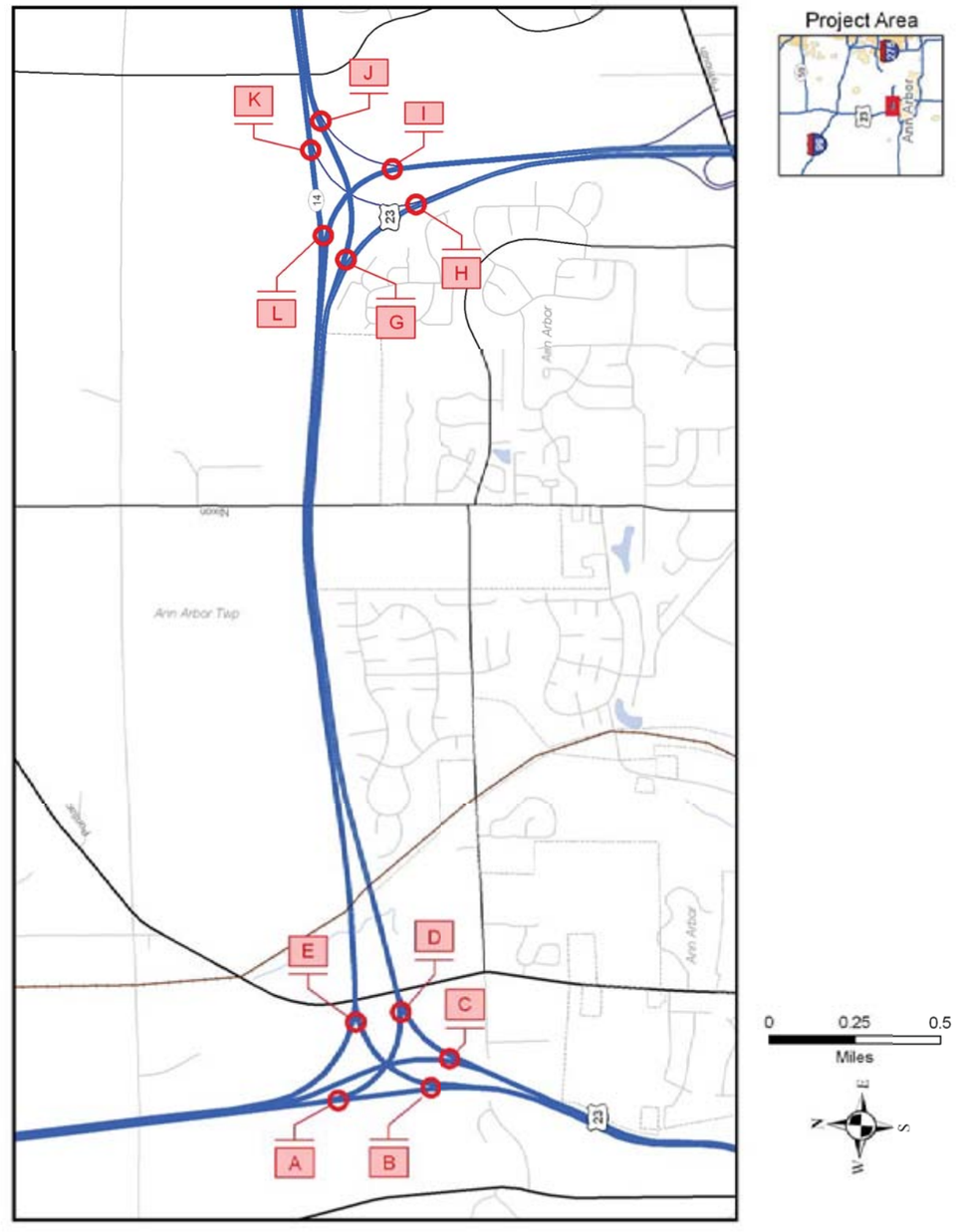
Under this scenario, interchange ramps will perform similarly to the No-Build condition, as physical changes are assumed only for the north approach to the west junction. **Figure 7-8: US-23 and M-14 Ramp Freeway Junctions Labels** provides the numerical/letter ramp labels that correspond to column 1 in **Table 7-5.**

TABLE 7-5

FUTURE (2030) AM AND PM PEAK HOUR LEVEL OF SERVICE US-23/M-14 RAMP FREEWAY JUNCTIONS (WEST AND EAST) (3 GENERAL PURPOSE LANES ALTERNATIVE)

West Junction			AM Peak Hour				PM Peak Hour			
	Mainline	Ramp	Fwy. Volume (vph)	Ramp Volume (vph)	Density	Merge/ Diverge LOS	Fwy. Volume (vph)	Ramp Volume (vph)	Density	Merge/ Diverge LOS
A	SB US-23	To WB M-14	6,500	4,150	59.3	F	3,825	2,250	35.5	E
B	WB M-14	From SB US-23	2,350	625	19.7	B	1,575	2,200	26.1	F
C	EB M-14	To NB US-23	1,650	1,050	4.8	A	3,725	2,425	25.8	C
D	EB M-14	From SB US-23	4,150	600	39.4	F	2,250	1,300	28.0	C
E	NB US-23	To WB M-14	2,175	625	12.5	B	5,475	2,200	45.4	F
F	NB US-23	From EB M-14	1,550	1,050	23.5	C	3,275	2,425	45.3	F
East Junctions			**AM Peak Hour**				**PM Peak Hour**			
	Mainline	Ramp	Fwy. Volume (vph)	Ramp Volume (vph)	Density	Merge/ Diverge LOS	Fwy. Volume (vph)	Ramp Volume (vph)	Density	Merge/ Diverge LOS
G	SB US-23	To EB M-14	4,750	925	27.6	F	3,550	1125	15.6	B
H	SB US-23	From WB M-14	3,825	1,275	46.2	F	1,250	625	24.3	C
I	NB US-23	To EB M-14	3,225	1,900	23.4	F	5,075	350	42.2	F
J	EB M-14	From NB US-23	925	1,900	27.2	C	2,300	600	33.5	D
K	WB M-14	To SB US-23	2,125	1,275	16.8	B	3,025	1200	25.9	C
L	NB US-23	From WB M-14	1,325	850	10.0	A	3,900	1500	39.9	

FIGURE 7-8



HIGH OCCUPANCY VEHICLE (HOV) SCENARIO

Engineering Requirements

Figure 7-9: Cross-section for US-23 with an HOV Lane illustrates the cross-section of US-23 with the addition of an HOV lane in each direction. The cross-section is similar to the cross-section for an additional general purpose lane; however, there is an additional four-foot buffer between the general purpose lanes and the HOV lane. The HOV lane would be on the inside, concurrent with other US-23 traffic flow. Examples of basic signing and pavement markings are shown in **Figure 7-10: High Occupancy Vehicle Lane Facilities.**

Operational Characteristics

High-Occupancy Vehicle (HOV) facilities were introduced in the late 1960s to mitigate increasing urban and suburban congestion. By prioritizing HOVs along a highway corridor, emphasis is placed on encouraging transit and ridesharing, and increasing person-throughput (Number of persons, including vehicle occupants using the corridor), as opposed to increasing the traditional measure of vehicle-throughput. HOV facilities are generally appropriate in urban or suburban corridors where significant existing or forecasted traffic congestion occur. The facilities are utilized when affinities for ridesharing and transit are high, and where the opportunity exists to bypass congestion.

HOV Lanes Scenario Assumptions

- The addition of a single lane in each direction on the US-23 Corridor, designated only for HOV use, at a minimum, during peak periods
- All vehicles with two or more occupants (HOV 2+) are allowed to use the HOV lane
- The HOV designation is dropped and general use of the lane allowed in advance of the end points of the corridor (I-96 and M-14) in order to ease transition to the existing lane configuration

Traffic Analysis

Similar to the Additional General Purpose Lane scenario, the addition of an HOV lane in each direction along US-23 between I-96 and M-14, is projected to induce additional traffic demand on US-23 relative to the 2030 No-Build Scenario. The analyses showed roughly 1,200 additional southbound vehicle-trips per hour along US-23 south of 6 Mile Road during the AM peak hour. The general purpose lanes are expected to carry approximately 5,800 vehicles per hour. The number of vehicle trips per hour expected within the general purpose lanes alone under the HOV scenario is almost equal to the total number of vehicle-trips projected under the 2030 No-Build scenario in this same section.

Modeling shows that most of these new trips originate from US-23 north of I-96 and from I-96, as opposed to being drawn from the local roadway network as is expected under the Additional General Purpose Lane scenario. This indicates that longer HOV trips will utilize US-23 in this section, while fewer local trips would utilize the freeway relative to the Additional General Purpose Lane scenario. **Figures 7-11, 7-12 and 7-13 (Projected 2 Lane (HOV) 2030 AM/PM Peak LOS)** provide a graphical representation (by project segment) of the LOS along the US-23 corridor and its ramps under the HOV Lane Scenario.

FIGURE 7-9

CROSS-SECTION FOR US-23 WITH AN HOV LANE

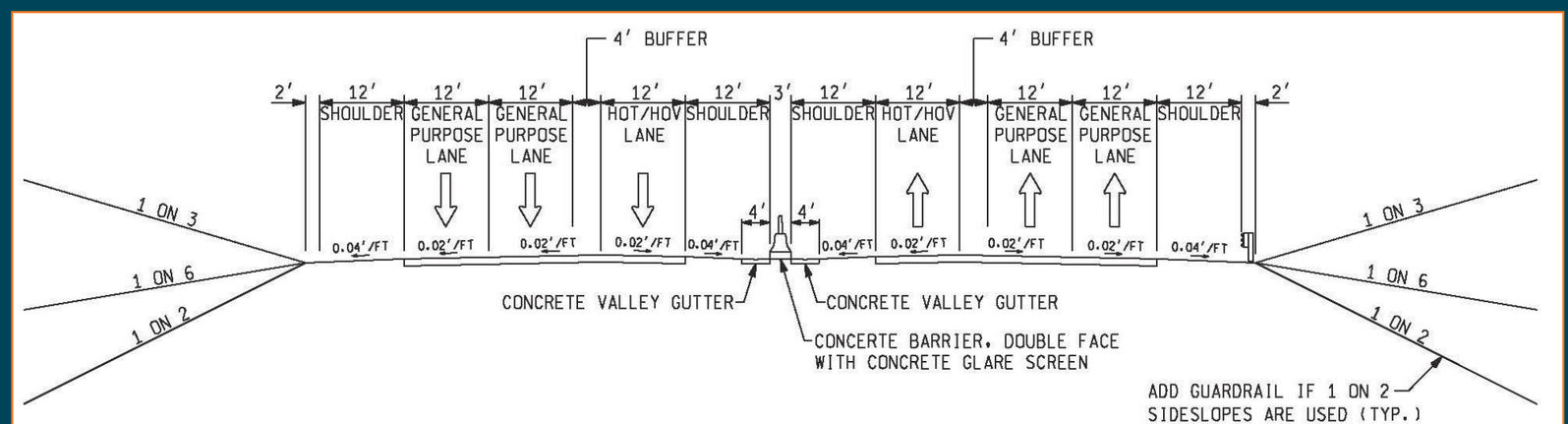


FIGURE 7-10

HIGH OCCUPANCY VEHICLE LANE FACILITIES

SIGNING

HOV OPERATIONS

ENFORCEMENT

FIGURE 7-11

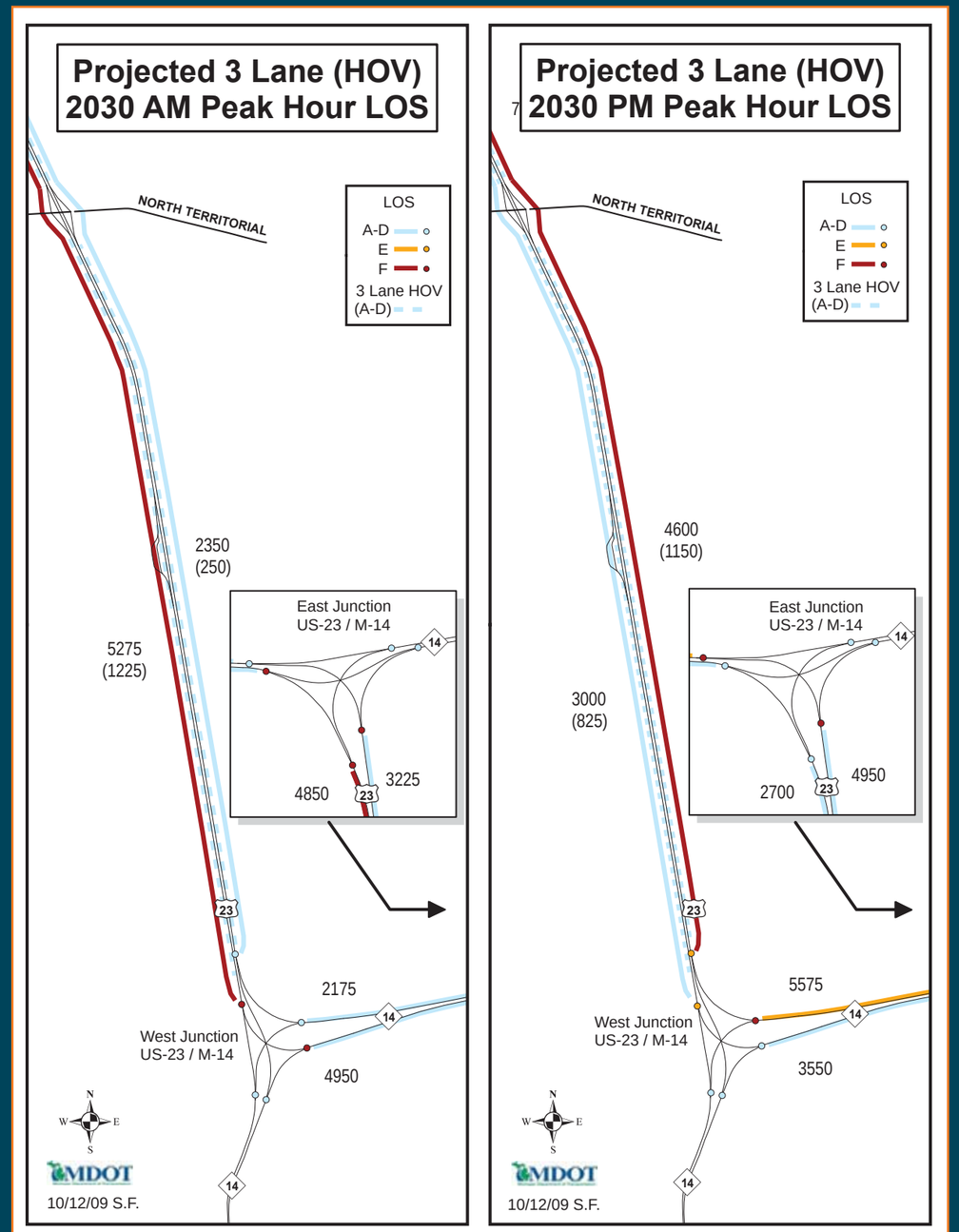


FIGURE 7-12

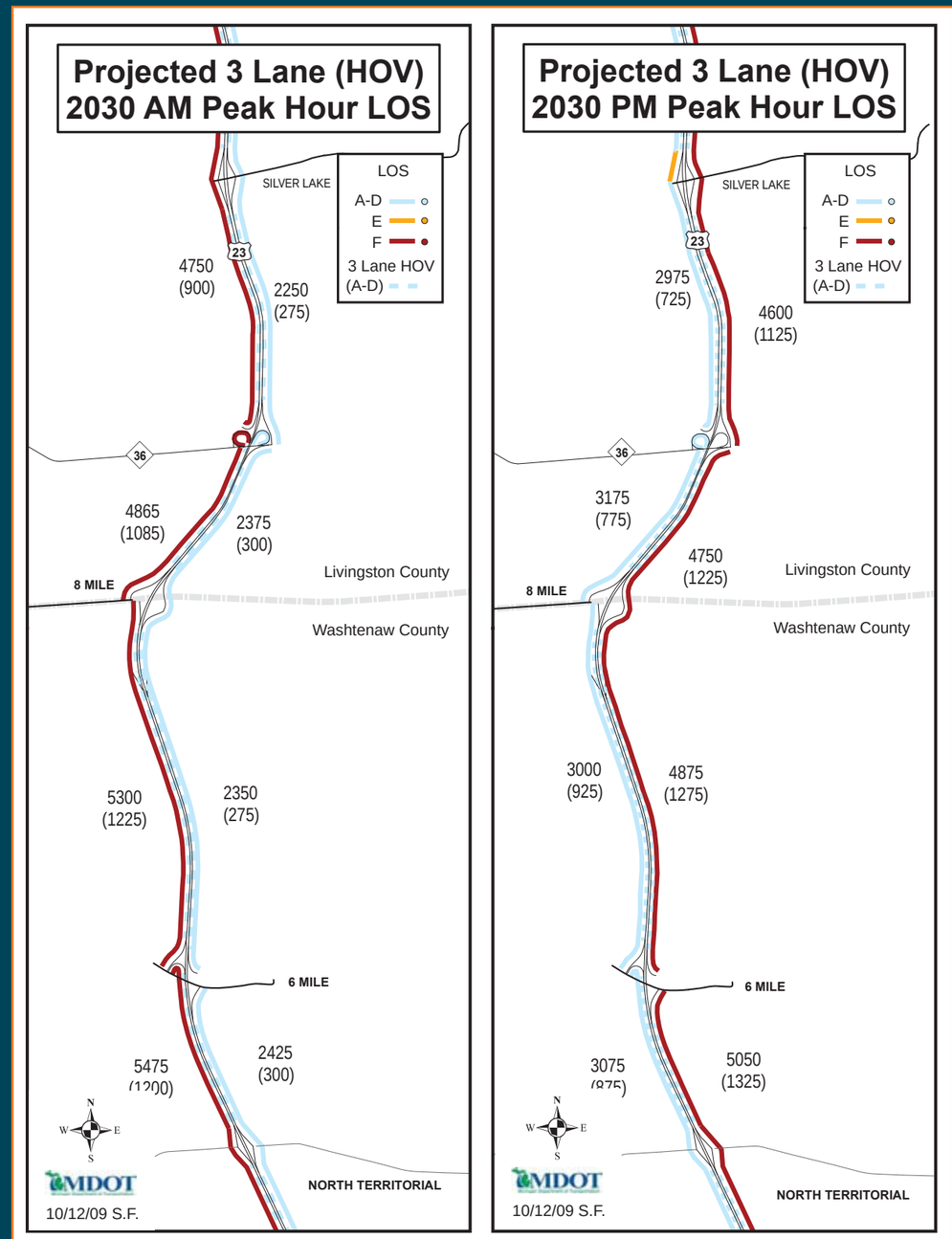
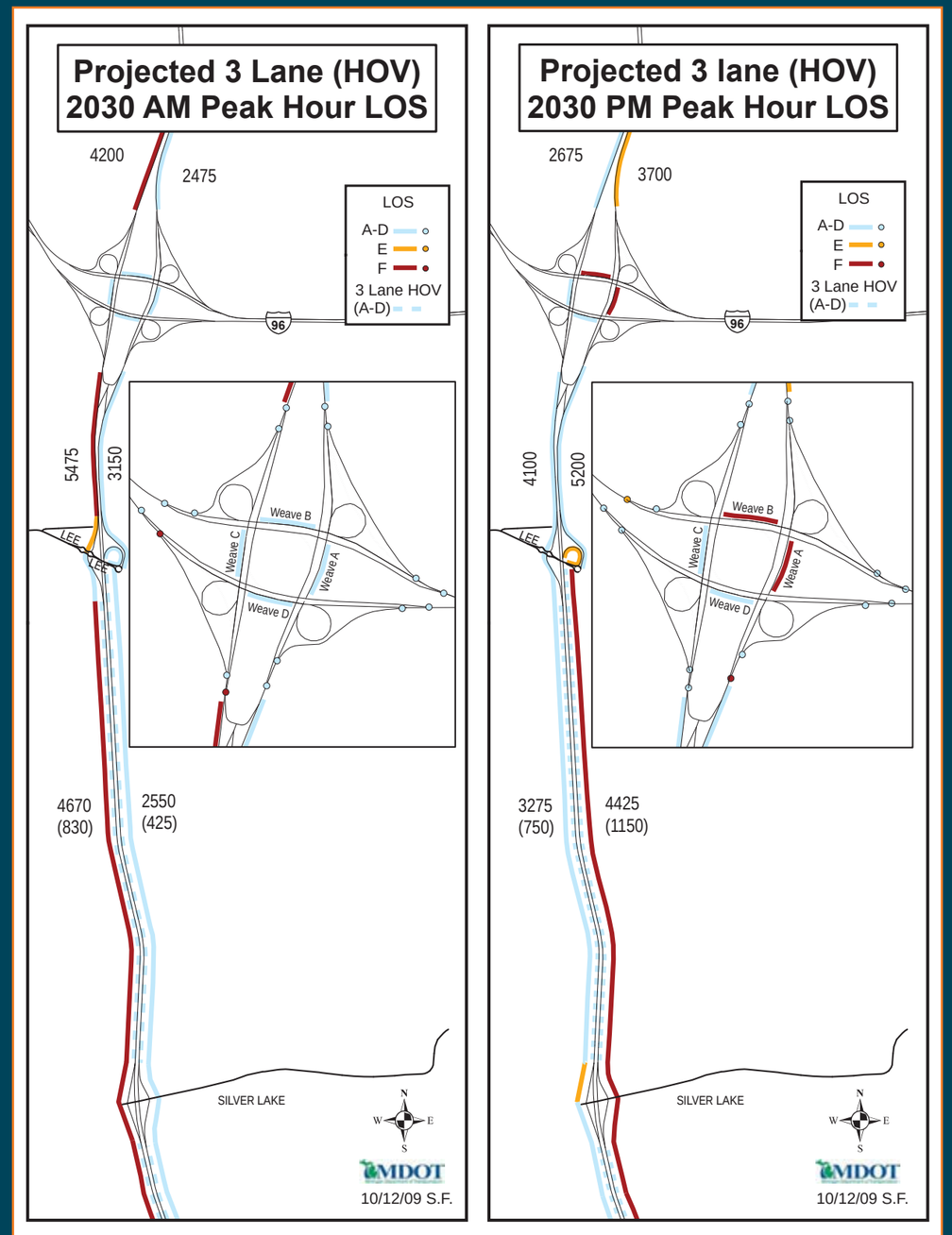


FIGURE 7-13



HOV Operating Thresholds

The SEMCOG model estimates that approximately 1,250 vehicles per hour in the peak direction would utilize an HOV lane during both the AM and the PM peak hours by the year 2030. Research has found that for an HOV lane to function properly and be utilized adequately, peak hourly volume should range from a minimum of 500 to a maximum of 1,500. As a rule of thumb, a typical minimum peak hour HOV lane use of 1,000 vehicles per hour is desirable on opening day of the facility in order to meet the public perception of being adequately utilized.

A 2015 forecast was conducted using the SEMCOG model including an HOV lane along US-23 to determine the potential opening year volumes for an HOV lane along the corridor. It was found that along southbound US-23 in the AM peak hour, the HOV lane is expected to carry approximately 700 vehicles per hour, while during the PM peak hour the northbound HOV lane is expected to carry approximately 900 vehicles per hour.

One of the challenges with forecasting HOV use using the SEMCOG model is that HOV trips are determined by using the current percentage of HOV trips. In other words, the model is not capable of estimating the number of person-trips that may shift modes of travel from SOV to HOV due to the distinct travel time advantage encountered by using an HOV lane. Therefore, under an exclusive HOV lane scenario, it is likely that the SEMCOG model is under-representing the number of future HOV trips that would utilize an HOV lane.

In the article, “High-Occupancy Vehicle Lane: An Incentive for Ridesharing?” presented to the Institute of Transportation Engineers at the 1988 annual meeting, it documents several freeway case studies where a significant mode shift was experienced after an HOV facility opened. These sites for reference included: State Route 55 (Costa Mesa Freeway) in Orange County, California, I-394 in Minneapolis, Minnesota and I-10 (Katy Freeway) in Houston, Texas. In all cases, the analyses included documented ridership statistics taken before and after the construction of an HOV lane. It was observed that an average of 40 percent of SOV shifted to HOV along these routes. The majority of this observed shift of travelers is those who previously drove the route alone and now take advantage of the HOV lane and have shifted to carpooling or transit. An overall increase of person throughput on the entire corridor also resulted.

The shift from SOV to HOV was encouraged in two cases through the implementation of adjacent park-and-ride lots – with free to minimal cost in parking – and express bus service from these lots. In the Route 55 case, the shift was due to significant timesavings by driving in the HOV lane; in this case, the occupant’s travel time was cut in half. Other tactics, such as an educational campaign and sponsored activities, encouraged SOV drivers to shift to HOV use (I-394). Lastly, the addition of an HOV lane shifted, on average, 20 percent of drivers from surrounding routes to the interstate, thus reducing congestion on surface streets. This result was actually observed in the SEMCOG model results along the US-23 corridor.

In summary, the results from the 2015 SEMCOG model estimates that approximately 700-900 vehicles per hour would use an HOV lane along US-23 between I-96 and M-14. This value uses existing occupancy information and does not account for any shift of person-trips from SOV to HOV. The value of 900 HOV is an estimated minimum number and could be expected to increase by up to 40% according to other studies done across the country, and is thus within a suitable range for opening day HOV operation.

Person Throughput

Person throughput was determined for the segment of US-23 between 6 Mile Road and North Territorial during both the AM and PM peak hours for existing and forecasted years. This segment was chosen because it was found to have the highest HOV lane volumes under the Additional HOV Lane scenario. Person throughput is the number of persons per hour, as opposed to number of vehicles per hour, traveling along the segment of a roadway. The person throughput for each of the alternatives is found by using a combination of the output from the SEMCOG model, auto occupancy rates, and total volume for the segments. The SEMCOG model determines the volume for each segment by the type of vehicle: single occupant vehicles, vehicles with two people, vehicles with three or more people, light trucks, medium trucks, and heavy trucks. It assumes that all the truck vehicles would have one occupant. The occupancy for vehicles with three or more people was determined to be 3.63. This was determined by averaging the SEMCOG occupancy rates for HOV3+ vehicles by trip type, which ranges from 3.48 to 3.74 people per vehicle. **Tables 7-6 and 7-7** summarize the person throughput for each of the alternatives in the peak direction of travel during the AM and PM peak hours.

TABLE 7-6

EXISTING AND FORECASTED PERSON-THROUGHPUT SOUTHBOUND US-23 - AM PEAK HOUR

	Existing	Future No-Build	Future Add General Purpose Lane	Future HOV Lane
Single Occupant Vehicles	3,357	4,330	5,319	5,032
Vehicles with 2 Occupants	391	547	671	867
Vehicles with 3+ Occupants	123	197	244	333
Trucks	329	375	441	443
Total Vehicles	4,200	5,449	6,675	6,675
Total HOV	514	744	915	1,200
Total Person Throughput	4,914	6,514	7,988	8,418

TABLE 7-7

EXISTING AND FORECASTED PERSON-THROUGHPUT SOUTHBOUND US-23 - PM PEAK HOUR

	Existing	Future No-Build	Future Add General Purpose Lane	Future HOV Lane
Single Occupant Vehicles	3,096	3,927	4,716	4,684
Vehicles with 2 Occupants	506	628	747	966
Vehicles with 3+ Occupants	191	240	286	359
Trucks	257	305	351	366
Total Vehicles	4,050	5,100	6,100	6,375
Total HOV	697	868	1,033	1,325
Total Person Throughput	5,058	6,359	7,599	8,285

As shown in the tables above, the Additional HOV Lane scenario estimates a person-throughput increase in the peak hour/peak direction between five to ten percent over the Additional General Purpose Lane scenario, with roughly the same number of vehicles per hour traveling the roadway.

2030 Forecasted Freeway Segments Analyses (AdditionAL HOV Lanes)

The SEMCOG Planning Model provided future year (2030) peak-hour traffic projections for the corridor and showed induced traffic occurring with the addition of a third High Occupancy Vehicle (HOV) Lane in each direction. **Tables 7-8 and 7-9** shows US-23 AM and PM Peak Hour data on basic freeway segments in the 2030 Forecasted Year for the two-lane general purpose and HOV lane respectively. The southbound traffic south of Lee Road to south of project limits operates at an unacceptable LOS during the 2030 AM Peak Hour for the two-lane segment of the roadway. The northbound traffic throughout the entire project area operates at an unacceptable LOS during the 2030 PM Peak Hour for the two-lane segment of the roadway. The HOV lanes operate at acceptable LOS during the AM and PM Peak Hours.

TABLE 7-8

FORECASTED (2030) AM AND PM PEAK HOUR LEVEL OF SERVICE BASIC FREEWAY SEGMENTS (HOV LANES ALTERNATIVE) TWO-LANE GENERAL PURPOSE

	2030 Southbound US-23 AM Peak				2030 Southbound US-23 PM Peak			
Freeway Segment To/From	**Volume, V**	**Flow Rate, Pc/hr**	**Density*, Pc/mi/ln**	**LOS**	**Volume, V**	**Flow Rate, Pc/hr**	**Density*, Pc/mi/ln**	**LOS**
N of I-96 to I-96 Interchange*	4,200	2,473	41.9	F	2,675	1,575	22.6	C
I-96 Interchange to Lee Road	5,475	2,149	34.9	D	4,100	1,610	23.2	C
Lee Road to Silver Lake	4,670	2,750	>45	F	3,275	1,929	29.2	D
Silver Lake to M-36 (9 Mile)	4,750	2,797	>45	F	2,975	1.752	25.6	C
M-36 (9Mile) to 8 Mile	4,865	2,865	>45	F	3,175	1,870	27.9	D
8 Mile to 6 Mile	5,300	3,121	>45	F	3,000	1,767	25.9	C
6 Mile to North Territorial	5,475	3,224	>45	F	3,075	1,811	26.7	D
N Territorial to M-14/US-23BR	5,275	3,106	>45	F	3,000	1,767	25.9	C
US-23BR/M-14 To US-23/M-14*	4,950	1,943	29.5	D	3,550	1,394	19.9	C
US-23/M-14 To Plymouth*	4,850	2,856	>45	F	2,700	1,590	22.9	C
	2030 Northbound US-23 AM Peak				**2030 Northbound US-23 PM Peak**			
Freeway Segment To/From	**Volume, V**	**Flow Rate, Pc/hr**	**Density*, Pc/mi/ln**	**LOS**	**Volume, V**	**Flow Rate, Pc/hr**	**Density*, Pc/mi/ln**	**LOS**
Plymouth To US-23/M-14*	3,225	1,266	18.1	C	4,950	1,943	29.5	D
US-23/M-14 To US-23BR/M-14*	2,175	854	12.2	B	5,575	2,189	36.2	E
M-14/US-23BR to N Territorial	2,350	1,384	19.8	C	4,600	2,709	>45	F
North Territorial to 6 Mile	2,425	1.428	20.4	C	5,050	2,974	>45	F
6 Mile to 8 Mile	2,350	1,384	19.8	C	4,875	2.871	>45	F
8 Mile to M-36 (9 Mile)	2,375	1,399	20.0	C	4,750	2,797	>45	F
M-36 (9 Mile) to Silver Lake	2,250	1,325	18.9	C	4,600	2,709	>45	F
Silver Lake to Lee Road	2,550	1,502	21.5	C	4,425	2,606	>45	F
Lee Road to I-96 Interchange	3,150	1,237	17.7	B	5,200	2,041	31.9	D
I-96 Interchange to N of I-96*	2,475	1,458	20.9	C	3,700	2,179	35.9	

**Outside of Project Area*

TABLE 7-9

**FORECASTED (2030) AM AND PM PEAK HOUR LEVEL OF SERVICE
BASIC FREEWAY SEGMENTS (HOV LANES ALTERNATIVE)
HOV LANE SEGMENT**

	2030 Southbound US-23 AM Peak				2030 Southbound US-23 PM Peak			
Freeway Segment To/From	Volume, V	Flow Rate, Pc/hr	Density*, Pc/mi/ln	LOS	Volume, V	Flow Rate, Pc/hr	Density*, Pc/mi/ln	LOS
Lee Road to Silver Lake	830	978	14.0	B	750	883	12.6	B
Silver Lake to M-36 (9 Mile)	900	1,060	15.1	B	725	854	12.2	B
M-36 (9Mile) to 8 Mile	1,085	1,278	18.3	C	775	913	13.0	B
8 Mile to 6 Mile	1,225	1,443	20.6	C	925	1,089	15.6	B
6 Mile to North Territorial	1,200	1,413	20.2	C	875	1,031	14.7	B
N Territorial to M-14/US-23BR	1,225	1,443	20.6	C	825	972	13.9	B
	2030 Northbound US-23 AM Peak				2030 Northbound US-23 PM Peak			
Freeway Segment To/From	Volume, V	Flow Rate, Pc/hr	Density*, Pc/mi/ln	LOS	Volume, V	Flow Rate, Pc/hr	Density*, Pc/mi/ln	LOS
M-14/US-23BR to N Territorial	250	294	4.2	A	1,250	1,472	21.1	C
North Territorial to 6 Mile	300	353	5.0	A	1,325	1,561	22.4	C
6 Mile to 8 Mile	275	324	4.6	A	1,275	1,502	21.5	C
8 Mile to M-36 (9 Mile)	300	353	5.0	A	1,225	1,443	20.6	C
M-36 (9 Mile) to Silver Lake	275	324	4.6	A	1,125	1,325	18.9	C
Silver Lake to Lee Road	425	501	7.2	A	1,150	1,354	19.3	C

2030 Forecasted Ramp/Merge/Weave Analyses (Additional HOV Lanes)

The configuration of the interchange of US-23 and I-96 for the HOV lane scenario is similar to the Additional General Purpose Lane scenario. **Tables 7-10 and 7-11** summarize the anticipated performance of the US-23/I-96 interchange during the AM and PM peak hours.

As shown in **Tables 7-10 and 7-11**, similar to the Additional General Purpose Lane scenario, the majority of the ramps and weaving maneuvers operate at a LOS D or better under the assumed configuration of this interchange. However, some movements are anticipated to operate at LOS E or F, and would be subject to further refinement during any future design activities in order to maintain acceptable levels of service through the planning horizon.

TABLE 7-10

**FUTURE (2030) HOV LANE AM AND PM PEAK HOUR LEVEL OF SERVICE
I-96 AND US-23 RAMP FREEWAY JUNCTIONS**

			AM Peak Hour				PM Peak Hour			
#	Mainline	Ramp	Fwy. Volume (vph)	Ramp Volume (vph)	Density	Merge/ Diverge LOS	Fwy. Volume (vph)	Ramp Volume (vph)	Density	Merge/ Diverge LOS
1	NB US-23	To NB US-23 CD**	3,150	2,050	26.6	C	5,200	3,550	46.9	F
2	NB US-23 CD	To EB I-96	2,050	850	17.0	B	3,550	925	31.9	D
3	NB US-23 CD	From WB I-96	650	725	13.7	B	550	1,500	19.4	B
4	NB US-23	From NB US-23 CD	1,100	1,375	20.8	C	1,650	2,050	31.5	D
5	WB I-96	To WB I-96 CD	2,800	1,450	17.4	B	4,225	2,650	30.3	D
6	WB I-96 CD	To NB US-23	1,450	725	15.0	B	2,650	1,500	26.9	C
7	WB I-96 CD	From SB US-23	1,200	675	18.3	B	2,625	650	30.9	D
8	WB I-96	From WB I-96 CD	1,350	1,875	24.8	C	1,575	3,275	37.9	E
9	SB US-23	To SB US-23 CD	4,200	1,975	28.0	F	2,675	1,425	12.8	B
10	SB US-23 CD	To WB I-96	1,975	675	17.8	B	1,425	650	9.4	A
11	SB US-23 CD	From EB I-96	725	2,525	29.7	D	1,150	1,700	26.5	C
12	SB US-23	From SB US-23 CD	2,225	3,250	46.8	F	1,250	2,850	34.6	D
13	EB I-96	To EB I-96 CD	6,250	3,175	31.6	F	4,350	2,250	18.0	B
14	EB I-96 CD	To SB US-23	3,175	252	33.1	F	2,250	1,700	23.9	C
15	EB I-96 CD	From NB US-23	1,300	850	20.6	C	775	925	16.5	B
16	EB I-96	From EB I-96 CD	3,075	2,150	34.2	D	2,100	1,700	25.1	C

**vph – volume per hour **Collector-Distributor*

TABLE 7-11

**FUTURE (2030) HOV LANE AM AND PM PEAK HOUR LEVEL OF SERVICE
I-96 AND US-23 WEAVE ANALYSIS**

		AM Peak Hour				PM Peak Hour			
#	Mainline	Fwy. Volume (vph)	Ramp Volume (vph)	Density	Merge/ Diverge LOS	Fwy. Volume (vph)	Ramp Volume (vph)	Density	Merge/ Diverge LOS
A	NB US-23 CD	1200	650	32.4	D	2,625	550	63.0	F
B	WB I-96 CD	725	1,200	33.2	D	1,150	2,625	76.2	F
C	SB US-23 CD	1,300	725	35.1	D	1,150	775	33.0	D
D	EB I-96 CD	650	1,300	33.7	D	550	775	21.0	B

Table 7-12 provides forecasted 2030 merge/weave traffic analyses along mainline US-23 Corridor in the AM and PM Peak Hour under the HOV Lane Alternative. The analyses shows undesirable LOS and increased density for the northbound Silver Lake off ramp and all southbound ramps except the Lee Road on ramp in the morning peak hours and an undesirable LOS and increased density for all northbound ramps during evening peak hour conditions except for the Lee Road on-ramp.

TABLE 7-12

FUTURE (2030) AM AND PM PEAK HOUR LEVEL OF SERVICE RAMP FREEWAY JUNCTIONS (HOV LANE ALTERNATIVE)

	2030 Southbound US-23 AM Peak				2030 Southbound US-23 PM Peak			
	Fwy. Volume (vph)	Ramp Volume (vph)	Density	Merge/ Diverge LOS	Fwy. Volume (vph)	Ramp Volume (vph)	Density	Merge/ Diverge LOS
Lee Road Off Ramp	5,475	600	35.6	E	4,100	950	29.9	D
Lee Road On Ramp	4,875	625	32.1	D	3,150	875	24.9	C
Silver Lake Off Ramp	4,670	425	65.9	F	3,275	650	35.2	E
Silver Lake On Ramp	4,245	575	47.7	F	2,625	325	30.7	D
M-36 (9 Mile) Off Ramp	4,750	550	50.4	F	2,975	375	32.4	D
M-36 (9 Mile) On ramp	4,200	850	48.0	F	2,600	625	30.5	D
8 Mile Off Ramp	4,865	200	68.4	F	3,175	450	34.4	D
8 Mile On Ramp	4,625	775	51.6	F	2,725	425	30.9	D
6 Mile Off Ramp	5,300	300	56.0	F	3,000	250	32.7	D
6 Mile On Ramp	5,000	450	50.4	F	2,750	275	28.3	D
N. Territorial Off Ramp	5,475	875	57.5	F	3,075	500	33.2	D
N. Territorial On Ramp	4,600	700	52.3	F	2,575	375	31.0	D
	2030 Northbound US-23 AM Peak				2030 Northbound US-23 PM Peak			
	Fwy. Volume (vph)	Ramp Volume (vph)	Density	Merge/ Diverge LOS	Fwy. Volume (vph)	Ramp Volume (vph)	Density	Merge/ Diverge LOS
N. Territorial Off Ramp	2,350	250	24.5	C	4,600	450	48.0	F
N. Territorial On Ramp	2,100	375	25.9	B	4,150	975	49.7	F
6 Mile Off Ramp	2,425	250	26.8	C	5,050	600	53.4	F
6 Mile On Ramp	2,175	150	25.3	C	4,450	375	48.1	F
8 Mile Off Ramp	2,350	250	25.2	C	4,875	650	50.0	F
8 Mile On Ramp	2,100	300	24.1	C	4,225	475	45.1	F
M-36 (9 Mile) EB Off ramp	2,375	125	26.7	C	4,750	300	50.7	F
M-36 (9 Mile) WB Off ramp	2,250	275	25.7	C	4,450	500	48.0	F
M-36 (9 Mile) On ramp	1,975	250	23.5	C	3,950	550	44.2	F
Silver Road Off Ramp	2,250	150	24.3	C	4,600	725	48.1	F
Silver Road On Ramp	2,100	600	27.8	C	3,875	575	43.9	F
Lee Road Off Ramp	2,975	425	21.8	C	5,575	1,375	36.7	E
Lee Road On Ramp	2,550	600	20.5	C	4,200	1,000	32.7	D

**vph – volume per hour*

Table 7-13 summarizes the anticipated levels of service for the west and east junctions of the US-23/M-14 interchanges. Because this scenario would not differ physically or operationally from the Additional General Purpose Lane scenario, the expected future ramp performance will not be appreciably different between the two scenarios.

TABLE 7-13

FUTURE (2030) HOV LANE AM AND PM PEAK HOUR LEVEL OF SERVICE US-23 AND M-14 RAMP FREEWAY JUNCTIONS (WEST AND EAST)

West Junction			AM Peak Hour				PM Peak Hour			
	Mainline	Ramp	Fwy. Volume (vph)	Ramp Volume (vph)	Density	Merge/ Diverge LOS	Fwy. Volume (vph)	Ramp Volume (vph)	Density	Merge/ Diverge LOS
A	SB US-23	To WB M-14	6,500	4,350	60.5	F	3,825	2,250	35.5	E
B	WB M-14	From SB US-23	2,350	625	17.8	B	1,575	2,200	26.1	C
C	EB M-14	To NB US-23	1,650	1,050	4.8	A	3,775	2,475	26.3	C
D	EB M-14	From SB US-23	4,350	600	41.2	F	2,250	1,300	28.0	C
E	NB US-23	To WB M-14	2,175	625	12.5	B	5,575	2,200	46.4	F
F	NB US-23	From EB M-14	1,550	1,050	23.5	C	3,375	2,475	46.3	E
East Junctions			**AM Peak Hour**				**PM Peak Hour**			
	Mainline	Ramp	Fwy. Volume (vph)	Ramp Volume (vph)	Density	Merge/ Diverge LOS	Fwy. Volume (vph)	Ramp Volume (vph)	Density	Merge/ Diverge LOS
G	SB US-23	To EB M-14	4,750	925	27.6	F	3,550	1125	15.6	B
H	SB US-23	From WB M-14	3,825	1,275	46.2	F	1,250	625	24.3	C
I	NB US-23	To EB M-14	3,225	1,900	23.4	F	5,075	350	42.2	F
J	EB M-14	From NB US-23	925	1,900	27.2	C	2,300	600	33.5	D
K	WB M-14	To SB US-23	2,125	1,275	16.8	B	3,025	1200	25.9	C
L	NB US-23	From WB M-14	1,325	850	10.0	A	3,775	1,800	40.7	F

**vph – volume per hour*

HIGH OCCUPANCY TOLL (HOT LANE SCENARIO)

Operational Characteristics

A High-Occupancy Toll (HOT) lane is a managed lane that allows a mix of free and for-fee travel, dynamically adjusted to maintain free-flow operating conditions, thus maintaining the advantage for users relative to utilization of the general purpose lanes. Typically, all HOVs (or at a minimum HOVs with three or more occupants) are able to utilize the lane at no cost, while SOVs are charged a fee for use. These user fees vary depending on the level of congestion in the general purpose lanes, and the density of traffic in the HOT lane, in order to maintain optimum utilization of the HOT lane. HOT lanes represent a tool to enable road operators to achieve optimum use of the overall facility in terms of person-throughput by "selling" underutilized capacity of a traditional HOV lane while dynamically maintaining the operating conditions and travel time advantage of using the HOT lane.

Because of the requirements for tolling of the lanes, access to HOT lanes is typically more controlled than a traditional HOV lane. In the case of US-23, access points to the HOT lanes, depicted in **Figure 7-14: Conceptual HOT Lanes and Tolling Points** were designed based on travel characteristics of the corridor, along with typical thresholds for minimum operating length.

Four scenarios were considered for HOT lane operation to determine the usage of the lane and potential revenue generation: More information regarding methodology and conclusions are located in the "Managed Lanes and Toll Finance Assessment" report located on a compact disc in the back of this report.

- Scenario 1: All SOVs tolled, all HOVs free
- Scenario 2: All SOVs and HOV2s tolled, HOV3+ free
- Scenario 3: All vehicles tolled
- Scenario 4: All vehicles tolled on all lanes

Under each of these scenarios, no commercial trucks would be allowed to utilize the HOT lane, and transit and emergency vehicles would be allowed to use the lane for no charge.

The HOT lane scenario would function similar to the HOV Lane scenario, but would transfer a small portion of SOV traffic from the general purpose lanes to the HOT lane. In doing so, the shift of SOV traffic could help to alleviate some general purpose lane congestion, while maintaining free-flow conditions in the HOT lane using dynamic pricing. Therefore, traffic operational performance is expected to be a slight improvement over the Additional HOV Lane scenario. Traffic flow over all lanes would be more uniform and the HOT lane utilized to its maximum potential.

Engineering Requirements

The overall roadway infrastructure of the Additional HOT Lane scenario would be similar to the HOV Lane scenario. However, while the HOV lane would have relatively frequent access points, the HOT lanes would have more limited locations for traffic to enter and exit the facility due to tolling requirements. In addition, electronic tolling equipment is required at one location along the corridor, including overhead gantries for tag-reader or plate-reader technology. The additional cost of implementing a HOT lane scenario is anticipated to be approximately $4 million.

LAND USE OPPORTUNITIES

Transit-Oriented Development

Transit-Oriented Development (TOD) is a strategy to create compact, walkable, vibrant, livable developments and communities around a high quality transit investment. Many communities, developers and transit agencies around the country are participating in TOD programs that focus growth and development near transit corridors and station areas. Ultimately, TOD leverages the private real estate market to build at a greater density than the community average, with a mix of uses and a transit-oriented design.

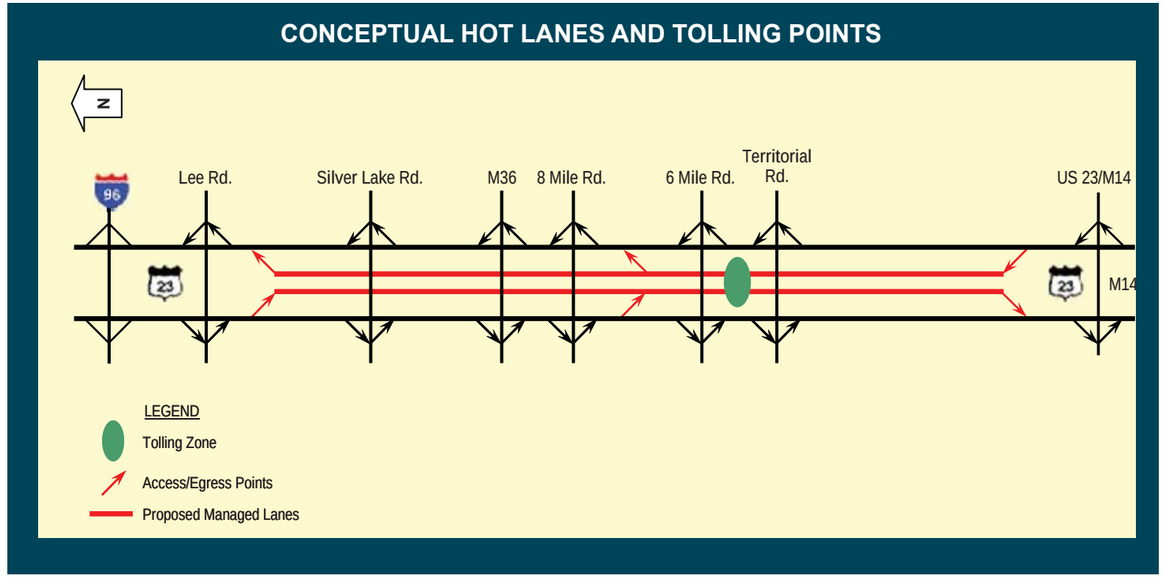
An effective TOD contains residential and commercial uses concentrated within close proximity (generally .25 mile) of a transit stop or station. Walking distances to transit at the home and work ends of the trip have the greatest influence over transit usage. In general, transit mode share declines as the distance to a transit station increases. Research on TOD projects has shown that residents living near stations are five- to six-times more likely to ride transit. As a result, TOD implementation should focus on station-area planning and often involves a joint development agreement between transit agencies, local government and one or more developers.

On May 20, 2008, the US-23 Corridor Coalition and project stakeholders met for a TOD workshop in order to discuss the opportunities and challenges for implementing transit in the corridor. In general, many of the local governments in the study area are updating master plans and zoning ordinances to promote mixed use and higher density development along the US-23 corridor. In addition, the Northfield Township Board recently approved a developer's mixed-use development in the southwest corner of the Eight Mile and US-23 interchange, and the Village of Hamburg is studying a town center development using TOD principals. Both of these areas are potential station stops for the proposed WALLY rail line. Utilizing the existing Park-And-Ride lots as possible commuter bus station along the US-23 corridor could also provide opportunities for TOD investment.

A wide variety of TOD projects have been built or planned around the country. There is no singular definition or formula for TOD to reach a desired outcome. Research on TOD case studies recognizes the following important observations and factors that communities and planning agencies should consider for further evaluation:

- TODs are a catalyst for achieving broader planning objectives such as quality of life and increased transit mode share.
- Successful TODs start with shared visions; political leadership, on-going public input, and diverse public-private partnerships are essential for TOD success.
- Designing for pedestrian usage at the outset of plan development is critical for the success of projects.
- Communities should initiate TOD planning considerations early as TODs are cumulative products of many individual development decisions.
- Adjust the parking requirements by appropriately limiting it within the TOD considering the context of the use and location – too much parking is a huge barrier to TOD, and is what sets TOD apart from traditional development.
- Plan for a mix of uses early in the process.
- TOD requires experienced leadership.
- Density does matter in TOD performance.
- Demonstration projects can accelerate TOD implementation.
- Institutional coordination and government streamlining are crucial to TOD implementation.

FIGURE 7-14



Section Eight
Toll Finance Analyses

ISSUES AND FUNDING OPPORTUNITIES FOR HIGHWAY IMPROVEMENTS

Given the current economic climate and declining revenues for transportation, funding major highway improvements has become a significant challenge. As such, the Michigan legislature established the Transportation Funding Task Force (TF2) charged with evaluating alternative mechanisms for funding transportation improvements. Tolling is an option to consider for funding projects and supporting overall transportation revenues.

A preliminary traffic and revenue assessment was conducted in order to determine the degree to which tolling could help offset the capital costs of proposed improvements along US-23. There were several scenarios considered, including:

- **Scenario 1: One additional lane in each direction designated as a managed lane.**
  Only single occupant vehicles (SOV) tolled in the managed lanes. High occupancy vehicles with two occupants (HOV2) and with three or more occupants (HOV3+) would be free. Trucks not allowed in the managed lanes.
- **Scenario 2: SOV and HOV2 tolled in the managed lanes, HOV3+ free.**
  Trucks not allowed in the managed lanes.
- **Scenario 3: SOV, HOV2 and HOV3+ tolled in managed lanes.**
  Trucks not allowed in the managed lanes.
- **Scenario 4: All vehicles tolled on all lanes, trucks pay higher tolls.**
  No managed lanes, three lanes in each direction.

Methodology

The analytical approach involved the development of a travel forecasting tool that could model the above mentioned toll scenarios. A selected sub-area of the SEMCOG regional model calibrated traffic counts along US-23 using the 2005 traffic counts. After achieving an acceptable basic calibration, a tolling algorithm was introduced within the model. The tolling model then analyzed the scenarios mentioned above. As the initial step, a toll sensitivity analysis was performed using a range of toll rates. The suitable toll rates thus determined the revenue estimate for years 2015 and 2030. Next, these revenue estimates aided in developing a revenue forecast for the 40-year period from 2015 to 2055. Further analysis used the revenue forecast to determine the financial viability of the proposed tolling scenarios.

Revenue Estimates

Figure 8-1 represents the estimated annual net toll revenue for each scenario using the above methodology and shows negligible revenue potential for all managed-lanes scenarios. The only scenario projected to have a significant revenue potential is Scenario 4, which involves tolling all traffic in the corridor, without any managed lanes.

Using the toll revenue estimates for 2015 and 2030, a revenue forecast was developed for each scenario for a 40-year period from 2015 to 2055. **Figure 8-2** shows the annual net revenue for Scenario 4 after adjusting for inflation and the effects of the “ramp-up” period or initial acceptance phase for the new facility.

FIGURE 8-1

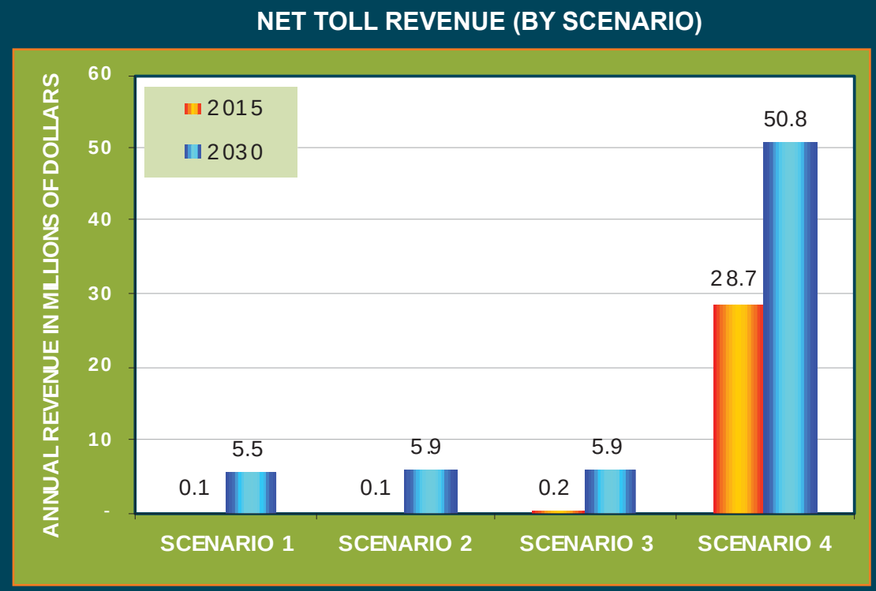
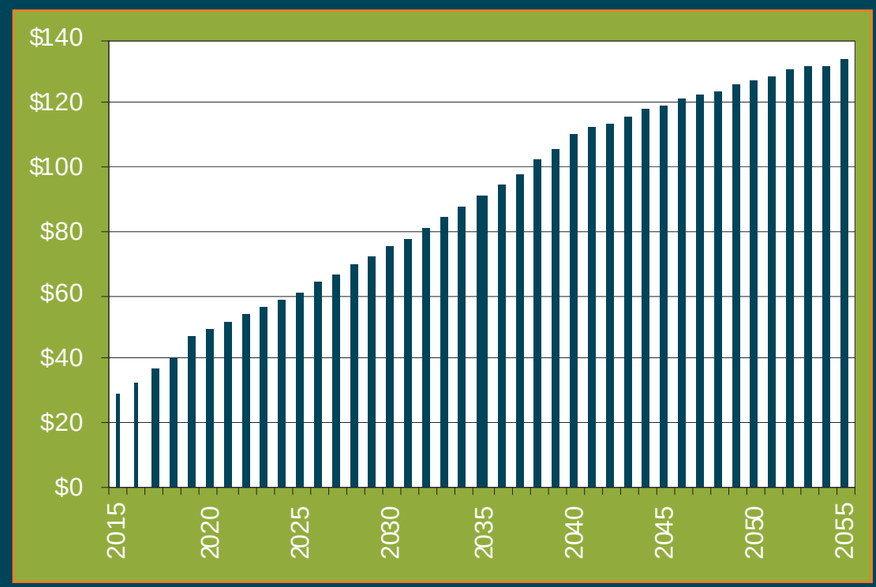


FIGURE 8-2



Based on the revenue estimates and revenue projection for the period from 2015 to 2055, a preliminary analysis of bonding capacity was conducted for each scenario. This analysis used two scenarios relating to roadway operations and maintenance (O&M) cost. In the first case, the toll revenue is credited to the roadway O&M costs. In the second case, MDOT will continue to maintain the roadway under present arrangements. The results of this analysis are summarized in **Table 8-1**.

Conclusions

The following are the major conclusions from this preliminary analysis of revenue potential under the four tolling scenarios:

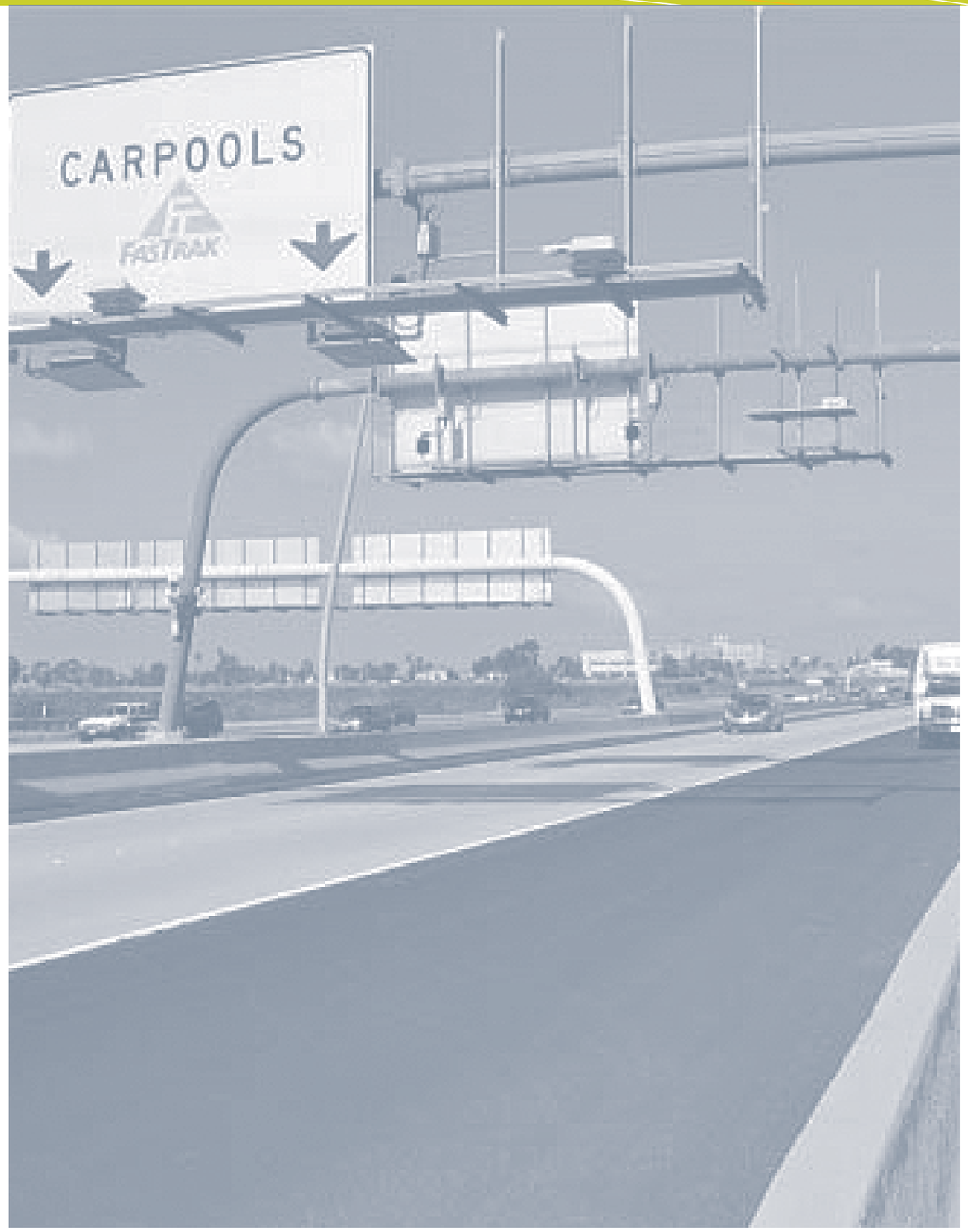
- The managed lanes scenarios provide relatively low revenue potential, not sufficient for project financing.
- The differences between various tolling methodologies within the managed lanes scenarios 1, 2 and 3, are not significant in terms of revenue.
- Any effort to generate higher revenue from managed lanes approach will be at the cost of excessive congestion in the general purpose lanes.
- The only scenario expected to generate significant revenue is Scenario 4, which assumes tolling all traffic on the facility.
- The expected revenue from Scenario 4 will not be sufficient to cover all the cost of construction, but could offset a significant portion of the cost.
- The traffic model developed for this study was based on the SEMCOG regional travel forecasting model available at the time this study began. The socio-economic forecasts used in the SEMCOG model may need revisions in view of recent economic changes in the state of Michigan, particularly related to the auto industry. The data sets available for the current study may not have adequate reflection of the more recent economic downturn. The results of this study, therefore, need interpretation in the proper context of the changes in the regional and national economies.

TABLE 8-1

BONDING CAPACITY BY SCENARIO

	Bonding Capacity (Millions of Dollars)	
	Roadway O&M from Toll Revenue	**Roadway O&M by MDOT**
Scenerio 1	$18	$24
Scenerio 2	$19	$25
Scenerio 3	$20	$26
Scenerio 4	$273	$279

NOTES:
1. Based on 2015-2055 revenue projection
2. Construction period 2012-2015
3. Assumed roadway maintenance cost of 1.0 million per year
4. Assumed interest rate of 6.0 percent
5. Cost of construction assumed to be 413 million (current dollars)



Chapter Nine
Corridor Recommendations

GENERAL RECOMMENDATIONS FOR FUTURE ACTION OR FURTHER STUDY

The following are opportunities recommended for implementation or further consideration in future phases of study. Funding opportunities under the Department's traditional programs should be pursued in addition to the following areas:

- Transit Service: It was determined that a commuter-oriented transit service was a viable option for improving mobility along the US-23 corridor, and should be considered for further study and implementation by local transit operators. It is recommended that service be considered either between the existing 9 Mile Road (M-36) carpool lot, or from a potential Park-And-Ride lot opportunity at 8 Mile Road, working in partnership with a local developer. These locations provide the optimum distance from employer concentrations in Ann Arbor.
- Tolling: Given the current economic climate and declining tax revenues for transportation, tolling should continue to be an option for helping to fund future capital improvements to the corridor, or at least providing some operating revenue into the future. The toll finance analysis found that while tolling is not the single answer to funding improvements in the corridor, significant revenue is possible from a full-tolling scenario given the lack of viable alternatives to the corridor.
- Transit-Oriented Development: Communities along the corridor should consider adopting land use policies that encourage Transit-Oriented Development (TOD) as a means to improving the viability of transit as a mobility option in the corridor. TOD is an effective tool to encourage transit use and reduce vehicle trips by providing a mix of uses in close proximity to one another, and at a pedestrian scale. Without a TOD-type approach, land use densities in communities along the corridor will inhibit further development of transit as an alternative to single-occupant vehicle use of US-23.

CORRIDOR SPECIFIC RECOMMENDATIONS FOR ALL SEGMENTS

- **Near-Term Opportunities**

Deploy ITS Technologies

It is recommended that ITS be deployed along US-23 in the south segment as a means to better monitor congestion and respond to incidents in the area. Non-recurring congestion was found to be a key factor in traffic issues in the corridor, and ITS could help to mitigate this factor by providing improved information to motorists and enabling faster incident clearance.

Expand Freeway Courtesy Patrol

Expansion of the Freeway Courtesy Patrol Program currently utilized in MDOT's Metro Region could also help mitigate non-recurring congestion by enabling faster clearance of disabled vehicles from the roadside.

- **Long-Term Opportunities**

Mainline US-23 Reconstruction and Widening

Both the assessment of current infrastructure conditions and traffic capacity analysis illustrate the long-term need for replacement and widening of mainline US-23. The north segment is the least critical in terms of traffic congestion. The mainline will experience congestion by the 2030 planning horizon without improvements and selected segments of the US-23 Corridor will continue to operate at unacceptable LOS during peak hours, even with an additional lane.. It is recommended that all three scenarios for capacity enhancement (3 Lane General Purpose, HOV, HOT) be carried forward for further evaluation in the environmental process, as each was found to present a viable option for improving traffic operations and throughput of the corridor.

CORRIDOR SPECIFIC RECOMMENDATIONS FOR THE SOUTH SEGMENT

Figures 9-1 and 9-2 located in the back of this section provide feasibility concepts for the interchanges and freeway sections in the south segment.

- **Mid-Term Opportunities**

Replace Bridges over US-23

The bridges at Warren Road, Joy Road, and N. Territorial Road have a horizontal clearance that will limit the ability to widen US-23 in the future. All three bridges have inadequate underclearance that present issues for moving oversized freight. While the condition of these structures is currently rated "Fair", replacing each during the mid-term timeframe as individual projects will allow for future widening when conditions require and funding becomes available for lane replacement.

Operational Improvements

Improvements to the North Territorial Road interchange include lengthening all ramp acceleration and deceleration lanes and evaluating ramp terminal operations. This would include adjusting terminal turn lanes, signal optimization and investigating the opportunity for roundabouts. Modifications to the US-23/M-14 west tri-level would improve safety and weaving deficiencies.

CORRIDOR SPECIFIC RECOMMENDATIONS FOR THE CENTER SEGMENT

Figures 9-3 through 9-5 located in the back of this section provide feasibility concepts for the interchanges and freeway sections in the center segment.

- **Mid-Term Opportunities**

Replace Critical Bridges

The 6 Mile Road and 8 Mile Road bridges over US-23 rated in "Poor" condition and are in need of replacement. These replacements could also provide the horizontal clearance required for future widening of US-23 when conditions warrant and funding is available.

Replace/Widen US-23 Mainline Bridges

The bridges carrying US-23 over Barker Road, the CSX railroad and 9 Mile Road (M-36) are designed to carry two lanes of traffic in each direction only and will require widening to accommodate future widening of US-23. These structures currently rate in "Fair" condition.

Operational Improvements

Improvements to all interchanges in the center segment include lengthening every ramp acceleration and deceleration lanes. Evaluating ramp terminal operations at the Eight Mile and M-36 (Nine Mile) interchanges would include adjusting terminal turn lanes, signal optimization and investigating the opportunity for roundabouts. MDOT will continue to monitor the interchange needs at the 6 Mile Road and Barker Road interchanges due to potential land development changes.

CORRIDOR SPECIFIC RECOMMENDATIONS FOR THE NORTH SEGMENT

Figures 9-6 and 9-7 located in the back of this section provide feasibility concepts for the interchanges and freeway sections in the north segment.

- **Mid-Term Opportunities**

Operational Improvements

Improvements to the Silver Lake Road and Lee Road interchanges include lengthening all ramp acceleration and deceleration lanes and evaluating ramp terminal operations. MDOT will continue to monitor the interchange needs at the Silver Lake Road interchange due to potential land development changes.

- **Long-Term Opportunities**

Replace Constraining Bridges

All bridges in the north segment constrain the ability to widen US-23 in the future and require either widening or replacement. MDOT should evaluate each on a case-by-case basis given current structure conditions and available funds.

FIGURE 9-1


CONSTRUCT THREE LANE ROADWAY WITH 12' INSIDE AND OUTSIDE SHOULDER
CONSTRUCT DOUBLE FACED CONCRETE BARRIER IN MEDIAN
EX 250' ROW
US-23(SB)
US-23(NB)
EX 100'
EX 103' ROW
EX 100'
CONSTRUCT FOUR LANE ROADWAY REDUCED TO THREE LANES WITH 12' INSIDE AND OUTSIDE SHOULDERS
BR US-23(SB)/M-14(WB)
CONSTRUCT CONTINUOUS TWO LANE ROADWAY TO MERGE WITH NB US-23
US-23(SB)/M-14(EB)
US-23(NB)
US-23(NB)
BR US-23(SB)/M-14(WB)
EX 103' ROW
LEGEND
EX. PARCEL LINES
EX. RIGHT OF WAY
EX. LIMITED ACCESS RIGHT OF WAY
PROP. EDGE OF PAVEMENT AND SHOULDER
PROP. CONCRETE BARRIER
NORTH
100'
0
200'
SCALE: 1" = 200'
MDOT
Michigan Department of Transportation
FEASIBLE CONCEPT FOR
NORTH SIDE OF US-23/M-14 INTERCHANGE
DATE 09/24/08
CONT. SEC. 47013
JOB NO. 101993
DESIGN UNIT HULLEY
SHEET NO. R.O.W CONST.
DATE: 09/24/08
WORKED ON BY: M. Sanchez
DATE:
CHECKED BY:
FILE NAME: 23-14 Interchg N-FC.dgn

FIGURE 9-2

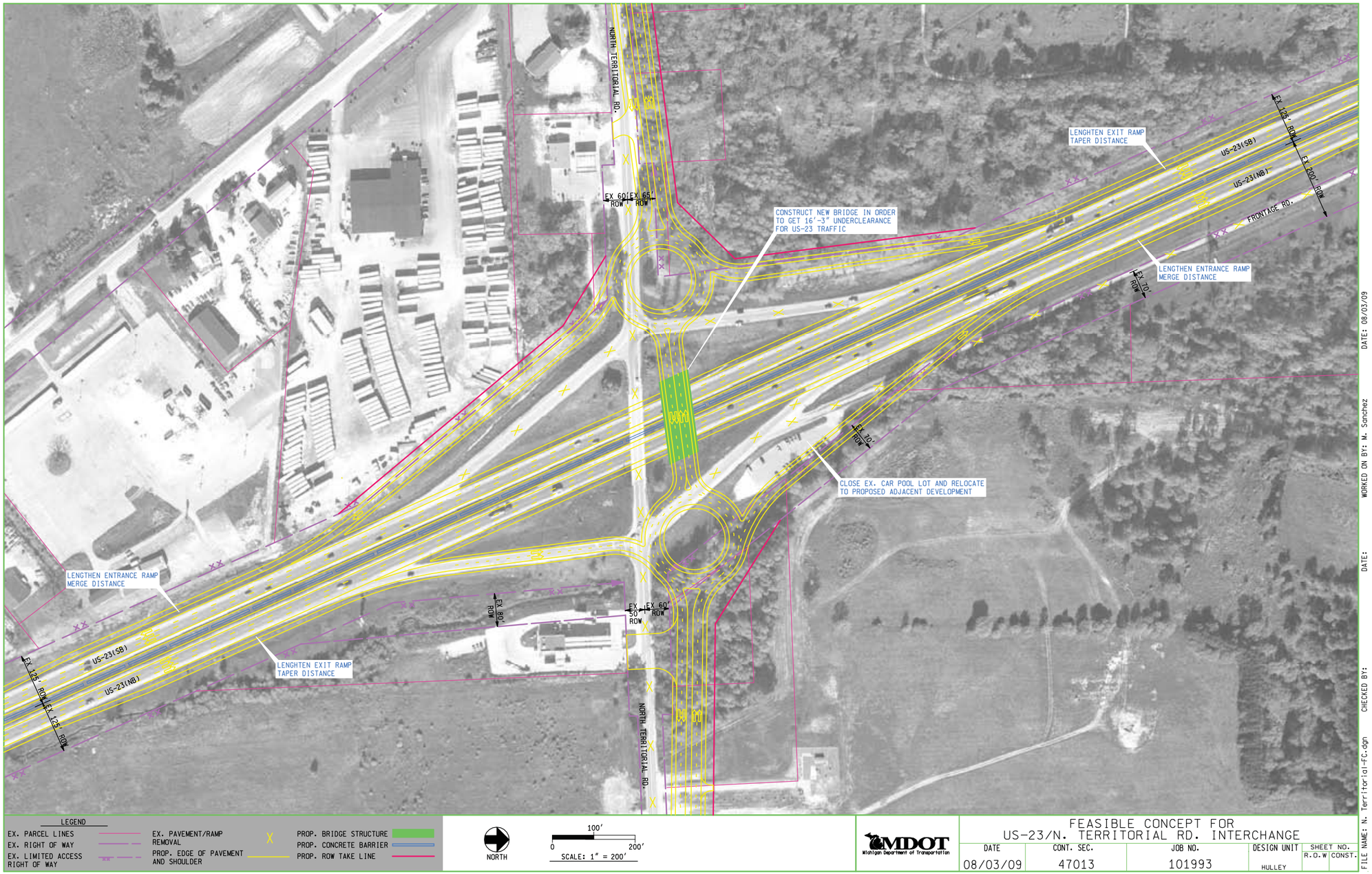

NORTH TERRITORIAL RD.
EX 60'(EX 65' ROW) ROW
CONSTRUCT NEW BRIDGE IN ORDER TO GET 16'-3" UNDERCLEARANCE FOR US-23 TRAFFIC
LENGHTEN EXIT RAMP TAPER DISTANCE
US-23(SB)
US-23(NB)
EX 225' ROW
EX 200' ROW
FRONTAGE RD.
LENGTHEN ENTRANCE RAMP MERGE DISTANCE
EX 10' ROW
CLOSE EX. CAR POOL LOT AND RELOCATE TO PROPOSED ADJACENT DEVELOPMENT
LENGTHEN ENTRANCE RAMP MERGE DISTANCE
EX 80' ROW
EX 50' ROW
EX 60' ROW
LENGTHEN EXIT RAMP TAPER DISTANCE
US-23(SB)
US-23(NB)
EX 225' ROW
EX 223' ROW
NORTH TERRITORIAL RD.
LEGEND
EX. PARCEL LINES
EX. RIGHT OF WAY
EX. LIMITED ACCESS RIGHT OF WAY
EX. PAVEMENT/RAMP REMOVAL
PROP. EDGE OF PAVEMENT AND SHOULDER
PROP. BRIDGE STRUCTURE
PROP. CONCRETE BARRIER
PROP. ROW TAKE LINE
NORTH
100'
0
200'
SCALE: 1" = 200'
MDOT
Michigan Department of Transportation
FEASIBLE CONCEPT FOR
US-23/N. TERRITORIAL RD. INTERCHANGE
DATE 08/03/09
CONT. SEC. 47013
JOB NO. 101993
DESIGN UNIT HULLEY
SHEET NO. R.O.W CONST.
DATE: 08/03/09
WORKED ON BY: M. Sanchez
DATE:
CHECKED BY:
FILE NAME: N. Territorial-FC.dgn

FIGURE 9-3

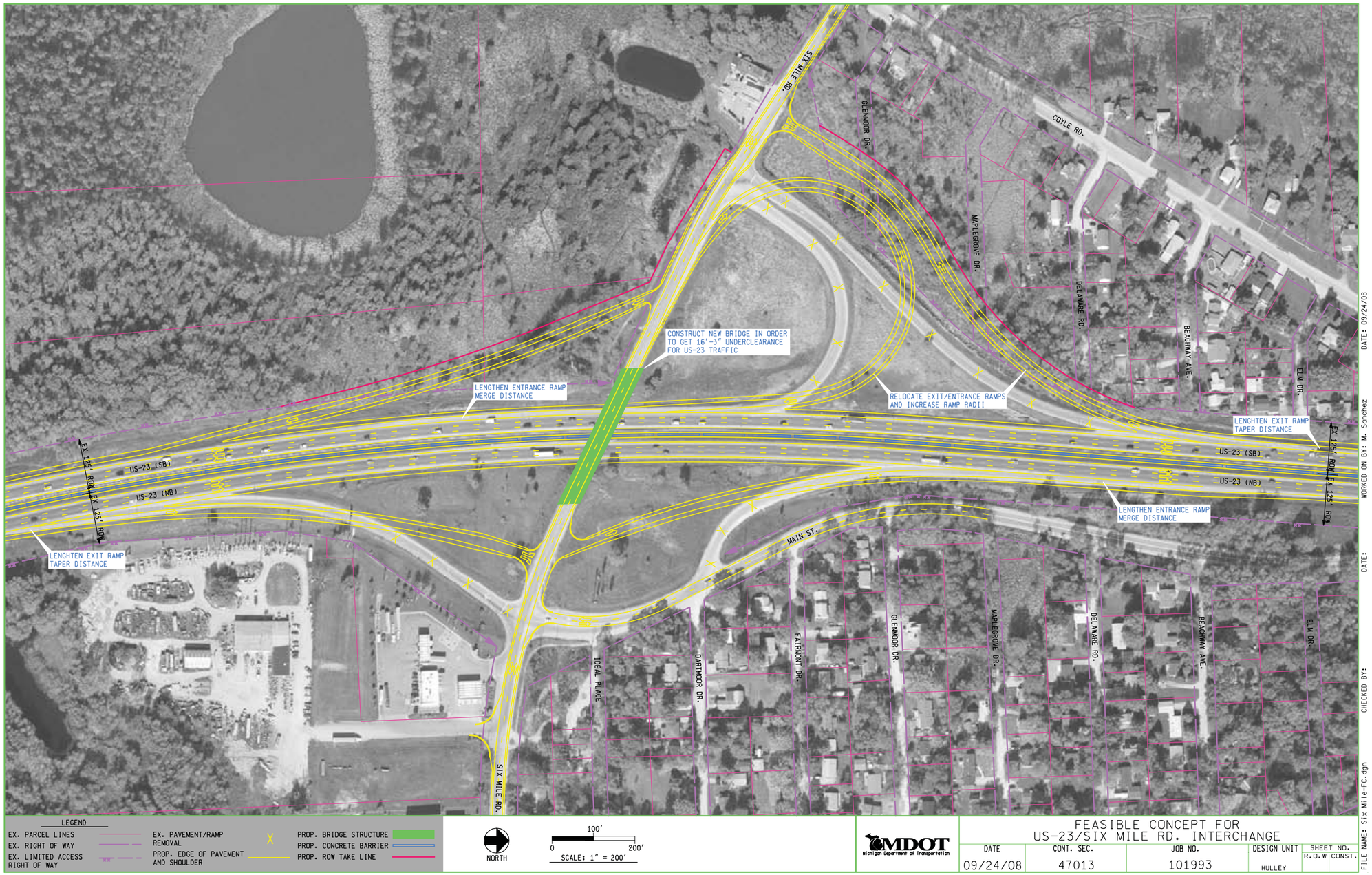
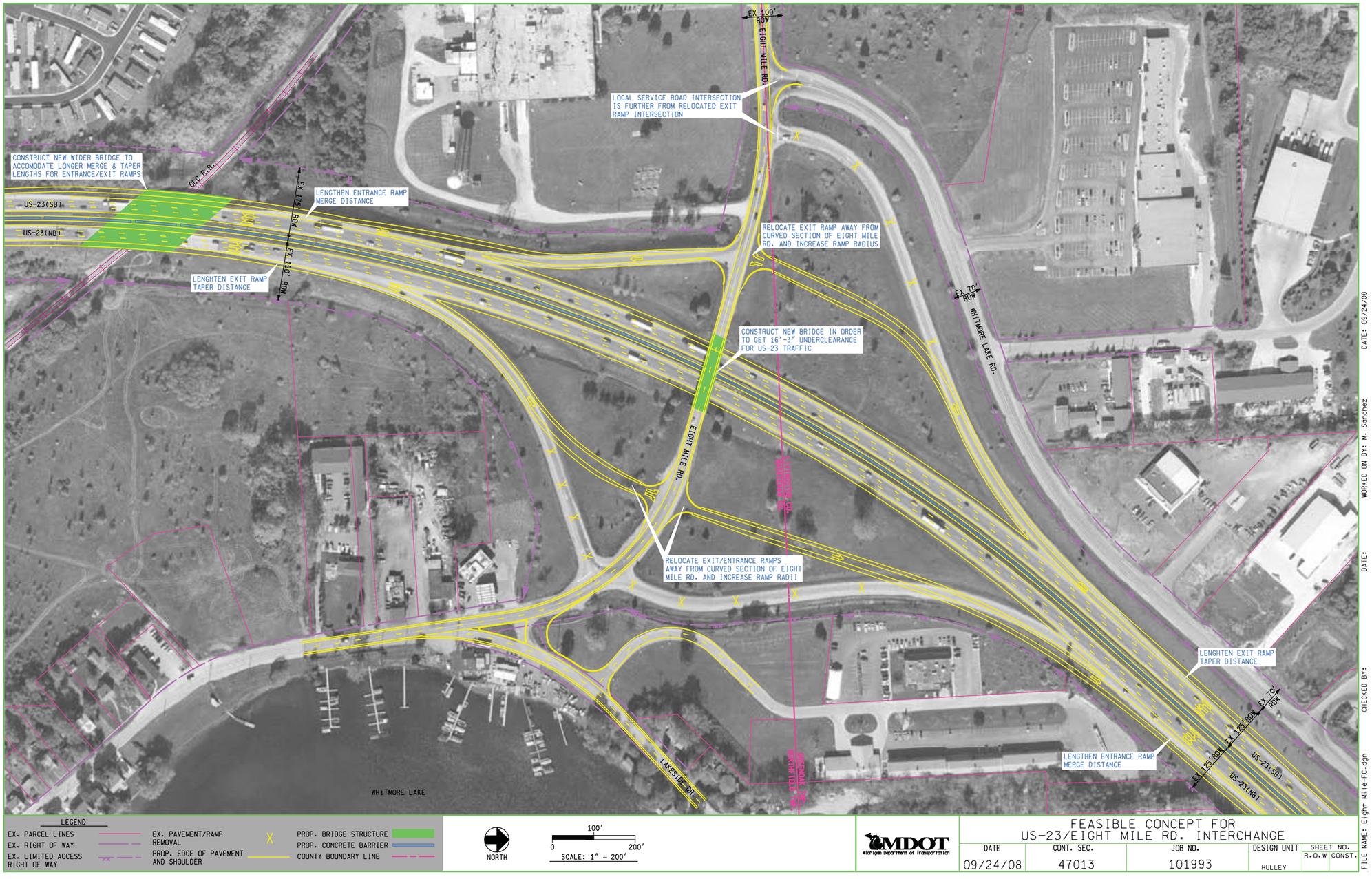

SIX MILE RD.
GLENMOR DR.
COYLE RD.
MAPLEGROVE DR.
DELAWARE RD.
BEACHWAY AVE.
ELM DR.
CONSTRUCT NEW BRIDGE IN ORDER TO GET 16'-3" UNDERCLEARANCE FOR US-23 TRAFFIC
LENGTHEN ENTRANCE RAMP MERGE DISTANCE
RELOCATE EXIT/ENTRANCE RAMPS AND INCREASE RAMP RADII
LENGHTEN EXIT RAMP TAPER DISTANCE
EX. 125' ROW
US-23 (SB)
US-23 (NB)
LENGHTEN ENTRANCE RAMP MERGE DISTANCE
LENGHTEN EXIT RAMP TAPER DISTANCE
MAIN ST.
IDEAL PLACE
DARTMOOR DR.
FAIRMONT DR.
SIX MILE RD.
LEGEND
EX. PARCEL LINES
EX. RIGHT OF WAY
EX. LIMITED ACCESS RIGHT OF WAY
EX. PAVEMENT/RAMP REMOVAL
PROP. EDGE OF PAVEMENT AND SHOULDER
PROP. BRIDGE STRUCTURE
PROP. CONCRETE BARRIER
PROP. ROW TAKE LINE
NORTH
100'
0
200'
SCALE: 1" = 200'
MDOT
Michigan Department of Transportation
FEASIBLE CONCEPT FOR
US-23/SIX MILE RD. INTERCHANGE
DATE 09/24/08
CONT. SEC. 47013
JOB NO. 101993
DESIGN UNIT HULLEY
SHEET NO. R.O.W CONST.
DATE: 09/24/08
WORKED ON BY: M. Sanchez
CHECKED BY:
FILE NAME: Six Mile-fc.dgn

FIGURE 9-4


EX 100' ROW
EIGHT MILE RD.
LOCAL SERVICE ROAD INTERSECTION IS FURTHER FROM RELOCATED EXIT RAMP INTERSECTION
CONSTRUCT NEW WIDER BRIDGE TO ACCOMODATE LONGER MERGE & TAPER LENGTHS FOR ENTRANCE/EXIT RAMPS
GLC R.R.
US-23(SB)
US-23(NB)
EX 125' ROW
EX 150' ROW
LENGTHEN ENTRANCE RAMP MERGE DISTANCE
LENGHTEN EXIT RAMP TAPER DISTANCE
RELOCATE EXIT RAMP AWAY FROM CURVED SECTION OF EIGHT MILE RD. AND INCREASE RAMP RADIUS
EX 70' ROW
WHITMORE LAKE RD.
CONSTRUCT NEW BRIDGE IN ORDER TO GET 16'-3" UNDERCLEARANCE FOR US-23 TRAFFIC
EIGHT MILE RD.
LIVINGSTON CO.
WASHTENAW CO.
RELOCATE EXIT/ENTRANCE RAMPS AWAY FROM CURVED SECTION OF EIGHT MILE RD. AND INCREASE RAMP RADII
LENGHTEN EXIT RAMP TAPER DISTANCE
LENGTHEN ENTRANCE RAMP MERGE DISTANCE
WHITMORE LAKE
LAKESHORE DR.
SEMINAL RIDGE
LEGEND
EX. PARCEL LINES
EX. RIGHT OF WAY
EX. LIMITED ACCESS RIGHT OF WAY
EX. PAVEMENT/RAMP REMOVAL
PROP. EDGE OF PAVEMENT AND SHOULDER
PROP. BRIDGE STRUCTURE
PROP. CONCRETE BARRIER
COUNTY BOUNDARY LINE
NORTH
100'
0
200'
SCALE: 1" = 200'
MDOT
Michigan Department of Transportation
FEASIBLE CONCEPT FOR
US-23/EIGHT MILE RD. INTERCHANGE
DATE 09/24/08
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JOB NO. 101993
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SHEET NO. R.O.W CONST.
DATE: 09/24/08
WORKED ON BY: M. Sanchez
CHECKED BY:
FILE NAME: Eight Mile-FC.dgn

FIGURE 9-5

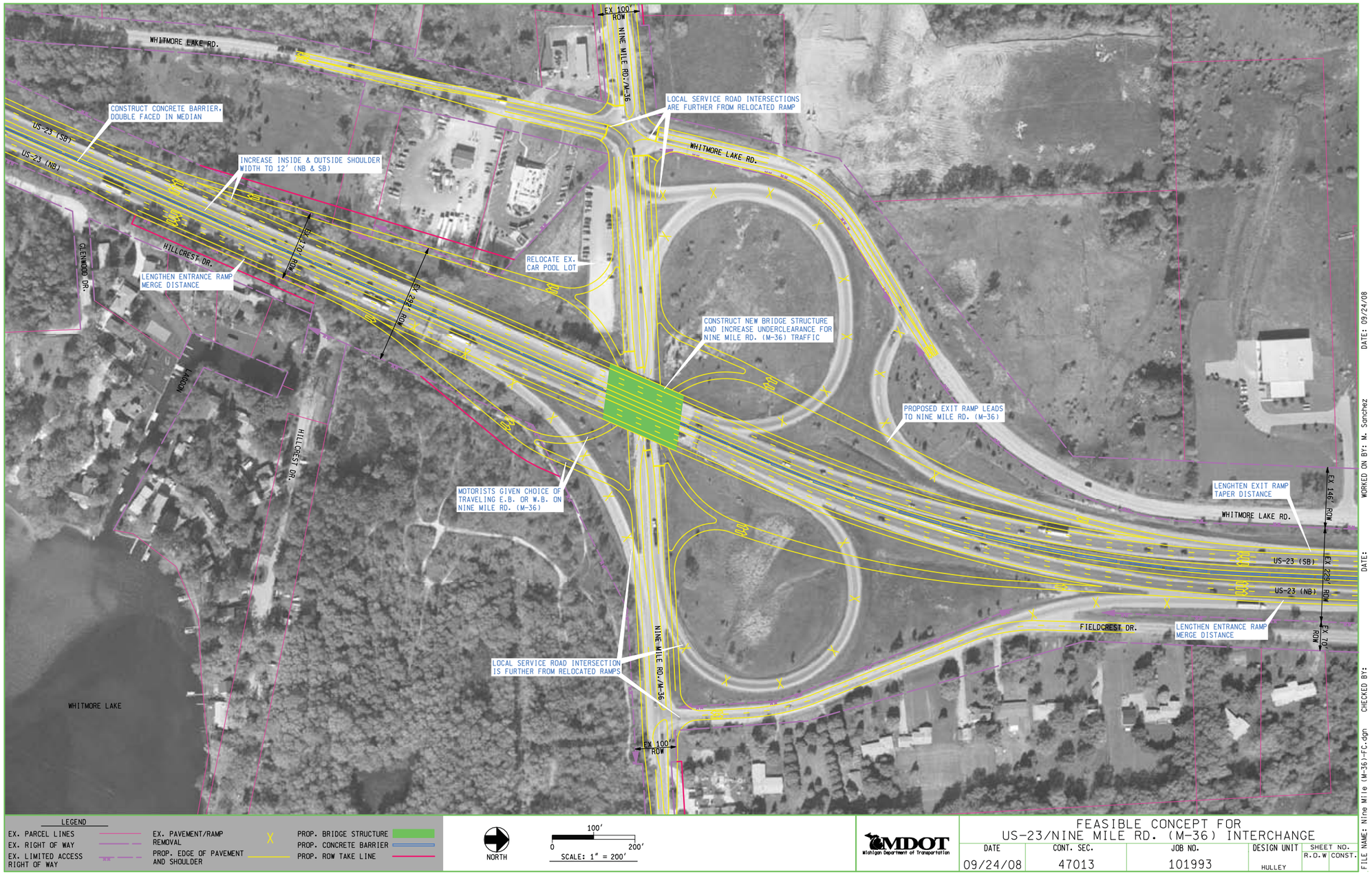
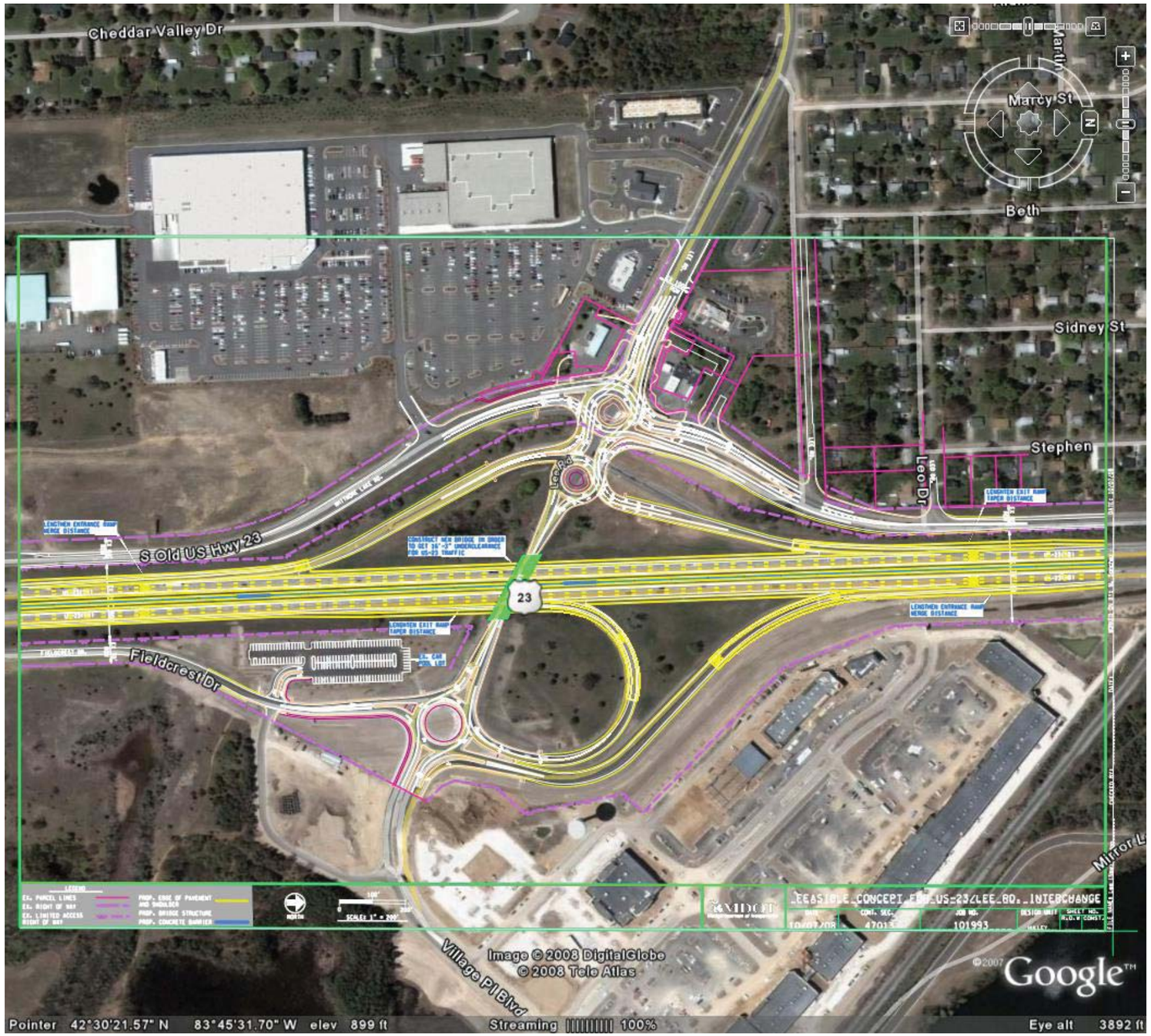

WHITMORE LAKE RD.
EX. 100' ROW
NINE MILE RD./M-36
LOCAL SERVICE ROAD INTERSECTIONS ARE FURTHER FROM RELOCATED RAMP
CONSTRUCT CONCRETE BARRIER, DOUBLE FACED IN MEDIAN
US-23 (SB)
US-23 (NB)
INCREASE INSIDE & OUTSIDE SHOULDER WIDTH TO 12' (NB & SB)
WHITMORE LAKE RD.
GLENWOOD DR.
HILLCREST DR.
LENGTHEN ENTRANCE RAMP MERGE DISTANCE
EX. 100' ROW
EX. 122' ROW
RELOCATE EX. CAR POOL LOT
CONSTRUCT NEW BRIDGE STRUCTURE AND INCREASE UNDERCLEARANCE FOR NINE MILE RD. (M-36) TRAFFIC
PROPOSED EXIT RAMP LEADS TO NINE MILE RD. (M-36)
LINCOLN
HILLCREST RD.
MOTORISTS GIVEN CHOICE OF TRAVELING E.B. OR W.B. ON NINE MILE RD. (M-36)
LENGTHEN EXIT RAMP TAPER DISTANCE
WHITMORE LAKE RD.
EX. 146' ROW
US-23 (SB)
EX. 122' ROW
US-23 (NB)
FIELDCREST DR.
LENGTHEN ENTRANCE RAMP MERGE DISTANCE
EX. 70' ROW
WHITMORE LAKE
LOCAL SERVICE ROAD INTERSECTION IS FURTHER FROM RELOCATED RAMPS
NINE MILE RD./M-36
EX. 100' ROW
LEGEND
EX. PARCEL LINES
EX. RIGHT OF WAY
EX. LIMITED ACCESS RIGHT OF WAY
EX. PAVEMENT/RAMP REMOVAL
PROP. EDGE OF PAVEMENT AND SHOULDER
PROP. BRIDGE STRUCTURE
PROP. CONCRETE BARRIER
PROP. ROW TAKE LINE
NORTH
100'
0
200'
SCALE: 1" = 200'
MDOT
Michigan Department of Transportation
FEASIBLE CONCEPT FOR
US-23/NINE MILE RD. (M-36) INTERCHANGE
DATE 09/24/08
CONT. SEC. 47013
JOB NO. 101993
DESIGN UNIT HULLEY
SHEET NO. R.O.W
SHEET NO. CONST.
DATE: 09/24/08
WORKED ON BY: M. Sanchez
CHECKED BY:
FILE NAME: Nine Mile (M-36)-fc.dgn

FIGURE 9-6


WINANS LAKE RD.
BUILD ROUNDABOUT TO CORDINATE TRAFFIC FOR SILVER LAKE ROAD, RAMPS, AND LOCAL SERVICE ROAD
LENGTHEN EXIT RAMP TAPER DISTANCE
OLD US-23
EX 80' ROW
US-23(SB)
EX 229' ROW
US-23(NB)
EX 70' ROW
LENGTHEN ENTRANCE RAMP MERGE DISTANCE
WHITMORE LAKE RD.
EX 53' ROW
US-23(SB)
EX 229' ROW
US-23(NB)
EX 70' ROW
FIELDCREST DR.
CONSTRUCT NEW BRIDGE STRUCTURE AND INCREASE UNDERCLEARANCE FOR SILVER LAKE RD. TRAFFIC
RELOCATE OR RECONSTRUCT EX. CAR POOL LOT
FIELDCREST DR.
FERNBROOK DR.
LENGTHEN ENTRANCE RAMP MERGE DISTANCE
CONSTRUCT NEW WIDER BRIDGE TO ACCOMODATE LONGER MERGE & TAPER LENGTHS FOR ENTRANCE/EXIT RAMPS
LENGTHEN EXIT RAMP TAPER DISTANCE
BUILD ROUNDABOUT TO CORDINATE TRAFFIC FOR SILVER LAKE ROAD, RAMPS, AND LOCAL SERVICE ROAD
SILVER LAKE RD.
HURON RIVER
LEGEND
EX. PARCEL LINES
EX. RIGHT OF WAY
EX. LIMITED ACCESS RIGHT OF WAY
EX. PAVEMENT/RAMP REMOVAL
EX. BRIDGE STRUCTURE
PROP. EDGE OF PAVEMENT AND SHOULDER
PROP. BRIDGE STRUCTURE
PROP. ROW TAKE LINE
NORTH
100'
0
200'
SCALE: 1" = 200'
MDOT
Michigan Department of Transportation
FEASIBLE CONCEPT FOR
US-23/SILVER LAKE RD. INTERCHANGE
DATE 09/24/08
CONT. SEC. 47013
JOB NO. 101993
DESIGN UNIT HULLEY
SHEET NO. R.O.W CONST.
DATE: 09/24/08
WORKED ON BY: M. Sanchez
DATE:
CHECKED BY:
FILE NAME: Silver Lake-fc.dgn

FIGURE 9-7


Cheddar Valley Dr
Marcy St
Martin
Beth
Sidney St
Stephen
Lee Dr
Lee Rd
S Old US Hwy 23
23
Fielderest Dr
Village Pl Blvd
Image © 2008 DigitalGlobe
© 2008 Tele Atlas
©2007 Google™
Pointer 42°30'21.57" N 83°45'31.70" W elev 899 ft
Streaming 100%
Eye alt 3892 ft

Section Ten Priority Segments/Logical Termini

KEY ISSUES/STRATEGIES TO CONSIDER WHEN DEVELOPING A PRIORITIZATION SCHEDULE

The analysis has shown the need for full reconstruction and widening of mainline US-23 and replacement of most corridor bridges within the planning horizon. However, funding has not been identified for any of these recommended improvements at this time. As such, improvements along the corridor must be prioritized and undertaken as funding becomes available. The following summarize some of the key considerations used to develop a prioritization of corridor improvements.

Critical Infrastructure Needs

Several bridges within the corridor have been identified in "poor" condition and in need of major rehabilitation or replacement in the near future. Replacement of these structures was identified as a top priority, not only to address structural deficiencies but to improve vertical clearance to meet today's standard and to improve horizontal clearance over US-23 that would enable future highway widening.

Bridge Constraints

Most bridges within the corridor over US-23 do not have the adequate horizontal clearance to allow widening of the mainline highway. Additionally, the existing bridges carrying mainline US-23 over roadways, railroads and waterways are designed to accommodate only two lanes of traffic in each direction. As a result, widening or replacement of these constraining bridges was identified as a priority as it is required in order to facilitate future widening of US-23.

Existing FHWA regulations and policy must also be considered when developing a prioritization schedule. NEPA regulations which require the development of projects with logical termini, air quality conformity analysis, and 4R versus 3R type fixes must also be considered when evaluating the feasibility of future projects.

Congestion Mitigation

Congestion is an existing issue primarily in the southern portion of the corridor, and is projected to increase in magnitude and extent, eventually affecting the majority of the corridor by 2030. Given this condition and anticipated pattern, widening of US-23 beginning at the southern section was determined to be the priority in order to mitigate observed and forecasted congestion.

Minimum Operating Segments

Some options recommended for further consideration for congestion mitigation, including HOV and HOT lane approaches, require a minimum length, or minimum operating segment, in order to be viable. The generally accepted minimum operating segment for an HOV lane on a freeway is five miles. In order to keep these options in consideration, any initial widening project should meet this minimum length criterion.

Safety

A safety analysis was conducted for the southern, center and northern segments of the US-23 corridor. In all segments, there is a trend of rear-end crashes along several sections of US-23 and near the interchange areas. This is due to insufficient ramp deceleration and acceleration lanes and recurring congestion on US-23 during the peak traffic hours. Improved capacity for both mainline US-23 and the interchanges is a priority in regards to safety.

In the southern section, there is a pattern of fixed object crashes on the western M-14/US-23 interchange ramps, mostly guardrail crashes, which primarily occur during wet or icy conditions. Mitigation measures to increase friction are recommended to prevent these types of crashes.

Several overturn crashes were identified on the northern segment at the US-23 and I-96 interchange. Currently, the ramps at this interchange do not meet the current standards. In order to improve the overturn crashes at the location it is recommended that the ramps be upgraded to current standards. It should be noted that because of the complexity of the interchange, any reconfiguring or upgrading these ramps to design standards may necessitate full reconstruction of the interchange.

ALL PURPOSE LANE ALTERNATIVE PRIORITY SEGMENTS

Based on the considerations described above, key project elements were prioritized and ordered into the following phases: Cost estimates are considered provisional.

Phase 1: Critical Structures and Mainline Operations Improvements in Washtenaw County

In this phase, critical structures (currently rated in "poor" condition) are replaced with structures with sufficient vertical clearance to meet today's standards and horizontal clearance to allow future widening of US-23. Replacement of Six Mile Road and Eight Mile Road bridges would include reconstruction/reconfiguration of interchanges. In addition, identified operational improvements within this segment would be undertaken. Specific projects include:

- Replace Six Mile Road Bridge over US-23 including operational improvements
- Replace Eight Mile Road Bridge over US-23 including operational improvements
- Widen southbound US-23 to three lanes from M-14 to Warren Road
- Extend ramp tapers at North Territorial Road, Barker Road, and M-36

Estimated Cost – Phase 1: $40 Million

Phase 2: Replace/Widen Non-Critical Structures in Washtenaw County

In this phase, the remaining structures that constrain the future widening of US-23 are rated in "fair" condition and would be replaced or widened as necessary. Replacement of N. Territorial Road and Barker Road bridges would include reconstruction/reconfiguration of service interchanges. Specific projects include:

- Replace and widen US-23 over Barker Road and CSX Railroad bridges
- Replace North Territorial Road over US-23 Bridge
- Replace Joy Road over US-23 bridge
- Replace Warren Road over US-23 bridge

Estimated Cost – Phase 2: $40 Million

Phase 3A/B: Washtenaw County Mainline US-23 Widening/Livingston County Bridge Replacements

Depending on available funding, current bridge conditions, and other priorities, Phase 3 would begin with either widening of US-23 in Washtenaw County, or replacement of bridges in Livingston County. Replacement of M-36, Silver Lake Road and Lee Road bridges would include reconstruction/reconfiguration of service interchanges.

Estimated Cost – Washtenaw County Mainline Widening: $95 Million

Estimated Cost – Livingston County Bridge Replacements: $55 Million

Phase 4: Livingston County Mainline Widening

The final phase of improvements would include widening of mainline US-23 between Eight Mile Road and I-96 in Livingston County.

Estimated Cost – Phase 4: $90 Million

Independent Phase: Reconstruct US-23/I-96 Interchange

The US-23/I-96 interchange was identified as a segment of independent utility within the corridor. This means that future reconstruction of this interchange, identified as a recommended future improvement, could happen at any time, independent of other proposed improvements. Reconstruction of this interchange would not preclude other recommended projects and would not require other improvements to be in place as a prerequisite to reconstruction. Discussions are currently underway between MDOT and FHWA to move forward with interim improvements to address critical bridge conditions within the interchange.

Estimated Cost – US-23/I-96 Interchange Reconstruction: $93 Million

Total Long-Term Improvement Costs – US-23 Corridor from M-14 to I-96: $413 million.

Michigan Department of Transportation

US-23 FEASIBILITY STUDY

MDOT: Providing the highest quality integrated transportation services for economic benefit and improved quality of life.

Prepared by: MDOT Graphics
\Planning\Project Planning\US-23 Feasibility Report (11/09 rld)