Enforcement

The provision of an inside breakdown/enforcement shoulder throughout the project limits affords police an opportunity to both monitor and cite violators on the left side adjacent to the HOV lane. Types of violations can include the following:

- Vehicles not having requisite number of occupants
- Other operation infractions, including speeding, failure to wear seatbelts, tailgating, etc.

Typical enforcement practice is to use one or both shoulders for HOV lane occupancy enforcement. Monitoring may occur on the left with apprehension on the right, or both functions may be performed on the left side. While each jurisdiction has preferred methods of performing enforcement and availability of staff resources for this function, the design applied for this project meets most of the likely enforcement strategies and provides areas typically considered safe for monitoring HOV traffic.

Some police agencies prefer to have left-side shoulders augmented with semi-protected monitoring areas by offsetting the median barrier at infrequent locations so as to allow for safer stationary monitoring. The barrier offset may be only a few feet laterally for motorcycle patrols (often available behind a median bridge or sign support). The barrier offset may also be much wider—the width of the combined shoulders for offsets—which is sufficient to allow officers to view both directions of traffic from a patrol car in relative safety. Enforcement monitoring areas are typically spaced every 2 to 3 miles in a tangent section. Only one location may be justified in this project area, as long as the barrier can be offset without impacting drainage or driving sight distance. Such monitoring areas should not be located in superelevated roadway sections. Figure 5-4 provides examples of enforcement monitoring with barrier offsets: left picture shows barrier offsets added to the median, and the right picture shows a full median offset consuming both left shoulders.

Figure 5-4 Examples of Enforcement Monitoring with Barrier Offsets

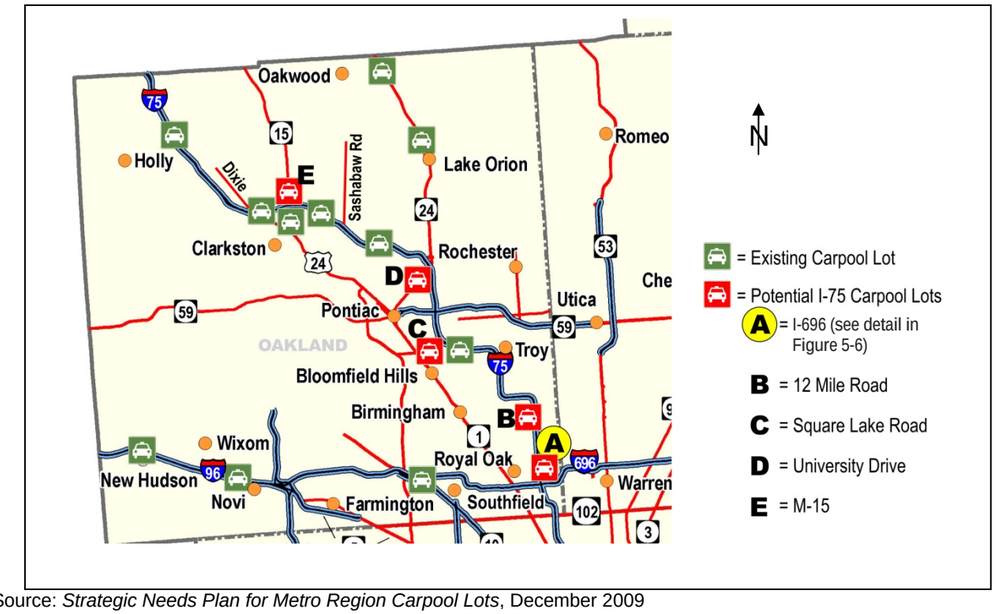
Other important components to enforcement include safety illumination along portions of the roadway where HOV enforcement occurs, since commute periods are often in limited lighting conditions and tinted windshields make it difficult to see within vehicles. Median-mounted signs posting the HOV restriction need to be placed at regular intervals (1,500 to 2,000 feet) such that a sign is within viewing distance along any portion of the project to support citations issued. Specific input from the affected enforcement agencies is appropriate during the design phase of the project to ensure police needs are met.

5.4 Carpool Lots

The *Strategic Needs Plan for Metro Region Carpool Lots* completed in December 2009 examined interchanges along I-75 in Oakland County to determine their potential for new carpool lot development. There are six existing lots in Oakland County along I-75 (Figure 5-5). Most interchanges show little or no potential for a new carpool lot; however, the Strategic Needs Plan found five good locations for new lot development potential (Figure 5-5 and Table 5-6).

Of the sites with good potential, only one is located in the section between M-102 to south of 12 Mile Road. It is at Exit 61 in the northeast quadrant of the I-696 interchange in Madison Heights (see location "A" in Figure 5-5). Potential carpool lots at Exits 63 to 75 are incorporated into the preliminary engineering for the northern section (see location "B" and "C", respectively, in Figure 5-5).

Figure 5-5 Existing Carpool Lots on I-75 in Oakland County and Potential New Carpool Lot Locations



Source: *Strategic Needs Plan for Metro Region Carpool Lots*, December 2009

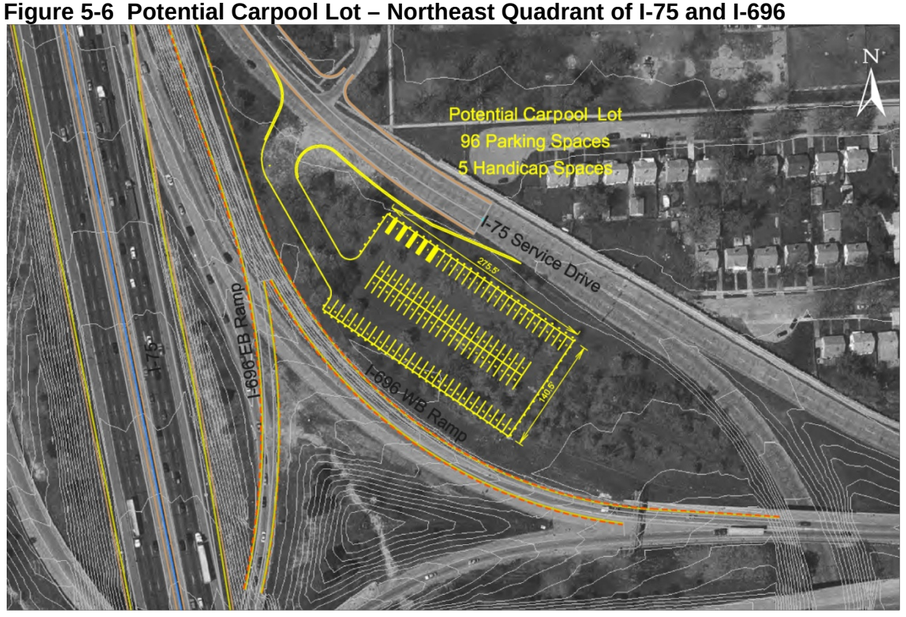
Table 5-6 I-75 Project Area Interchanges and Potential for Carpool Lot Development

I-75 / Exit 59 to 8 Mile Road	No location.
I-75 / Exit 60 9 Mile Road	No location. Split John R and 9 Mile interchange.
I-75 / Exit 61 to I-696 (Madison Heights) **(See Location "A" in Figure 5-5).**	**Good**. Existing right-of-way. Reverse commute potential with access to/from I-696 east and west, and I-75 north and south. Entrance across from Dartmouth Street. Has room for approximately 100 spaces.
I-75 / Exit 62 to 11 Mile Road	No location.

Source: *Strategic Needs Plan for Metro Region Carpool Lots*, December 2009

I-75 Exit 61 at I-696 in Madison Heights (Figure 5-6) has right-of-way available for development of a carpool lot. This system-to-system interchange also has through-routed service drives that connect with one another and the surrounding surface streets. Land between the service drive and ramps in the northeast quadrant could be developed as part of the project, which includes reconstruction in this area. An entrance could be created across the NB service drive from Dartmouth Street to minimize conflicts and maximize sight distance. There is room for approximately 100 spaces. Development would require some tree removal to clear the site and improve visibility. This lot would serve origin-destination pairs from I-696 westbound to NB I-75 and those arriving at the lot from NB I-75 via the NB service drive.

Figure 5-6 Potential Carpool Lot – Northeast Quadrant of I-75 and I-696



Source: *Strategic Needs Plan for Metro Region Carpool Lots*, December 2009

5.5 Typical Sections

The proposed cross section for I-75 depicts widening the freeway to the outside and will consist of four 12-foot lanes in each direction. The northbound and southbound median lane will function as a HOV lane during the AM and PM peak hours and a general purpose lane during the remaining hours. Northbound and southbound traffic will be separated by a double-face concrete median barrier. The median shoulder width provided along the corridor exceeds the minimum MDOT standard of 10 feet. The 10.83-foot median shoulder includes a 4-foot valley gutter. Auxiliary lanes will be present from north of 8 Mile Road to south of the I-696 interchange and from north of I-696 to south of 11 Mile Road. The outside shoulder width will be 12 feet, including a 4-foot valley gutter. Single-face barrier and retaining walls will be present along the outside of both traffic directions for the majority of the reconstruction length. Figure 5-7 shows a typical section of a four-lane mainline and a five-lane mainline (four main lanes, plus one full auxiliary lane in each direction).

The typical section for the proposed interchange ramps for M-102 (8 Mile Road), 9 Mile Road, and 11 Mile Road consist of one 12-foot lane and are designed in accordance with MDOT urban slip ramp criteria. These slip ramps will have a 6-foot left shoulder and an 8-foot right shoulder; both sides have curbs at the back of the shoulder. Retaining walls and guardrails are proposed along entrance and exit ramps to mitigate grade differential and enhance safety in areas where greater separation of the ramp from the mainline cannot be achieved.

The I-696 proposed ramp cross sections are designed with rural ramp criteria and will match existing pavement width, but the shoulders will be brought up to current standards. See Figure 5-8 for the I-696 ramp labeling. Ramps A, B, E, and G consist of one 12-foot lane, while Ramps D and F consist of two 12-foot lanes. Ramp C is a two-lane ramp that transitions to a one-lane ramp. The proposed shoulder treatments include a 7-foot shoulder on the right and a 4-foot shoulder on the left. All ramps use a curb transition near the tie-in points where necessary to match existing conditions.

The typical section of the northbound and southbound service drive will vary. The width of the service drive will minimally consist of two 12-foot lanes. Normal crown is 2% and maximum super elevation is 7% for all aforementioned sections.

5.6 Freeway and Service Drive Alignment

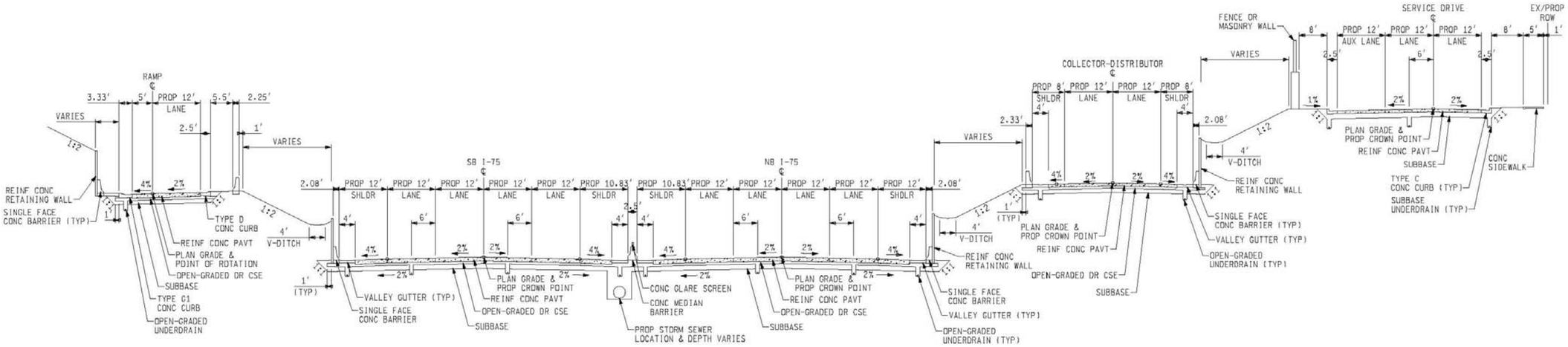
The main elements of the project are to reconstruct the existing freeway, affected service drives, and ramps to current standards, plus the addition of a lane in each direction to function as an HOV lane. Widening for the additional lanes will be to the outside, resulting in new retaining walls throughout the majority of the corridor. Additional improvements include reconstruction and lengthening of existing retaining walls, new construction and replacement of sound walls, and separation of freeway drainage from the existing combined sanitary/storm sewer outfall (CSO). Separation of the CSO requires removal of existing pump stations and construction of new pump stations. A new braided ramp design with a collector-distributor ramp configuration is proposed for the I-696 entrance ramp to northbound I-75 and for the proposed slip ramp from northbound I-75 to 11 Mile, resulting in the removal of the Dallas Avenue bridge due to its close proximity.

Stephenson Highway Bridge

The Stephenson Highway bridge at the north end of the project corridor accommodates traffic as the last segment of the northbound I-75 service drive north of Gardenia Avenue. It currently operates one-way northbound and ties into the southbound Stephenson Highway to create a five-lane two-way operation north and west of I-75. The continuous southbound I-75 service drive begins south of Gardenia Avenue and extends into downtown Detroit. See Figure 5-9 for the Stephenson Highway traffic movements north of Gardenia Avenue.

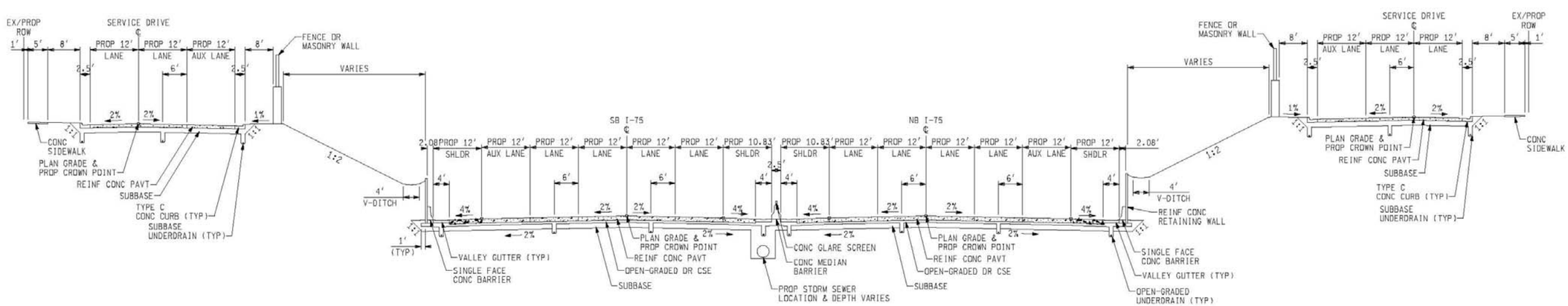
Figure 5-7 Typical Sections

I-75 with Four Lanes in Each Direction with a Collector-Distributor Road, Slip Ramp, and Service Drive



TYPICAL PROPOSED FREEWAY CROSS-SECTION FOR I-75
4-LANE SECTION WITH COLLECTOR DISTRIBUTOR ROAD, SLIP RAMP AND SERVICE DRIVE

I-75 with Five-Lanes (Four Full Lanes and One Auxiliary Lane) with Service Drives



TYPICAL PROPOSED FREEWAY CROSS-SECTION FOR I-75
5-LANE SECTION WITH SERVICE DRIVES

Figure 5-8 I-696 Ramp Labeling and Impacts

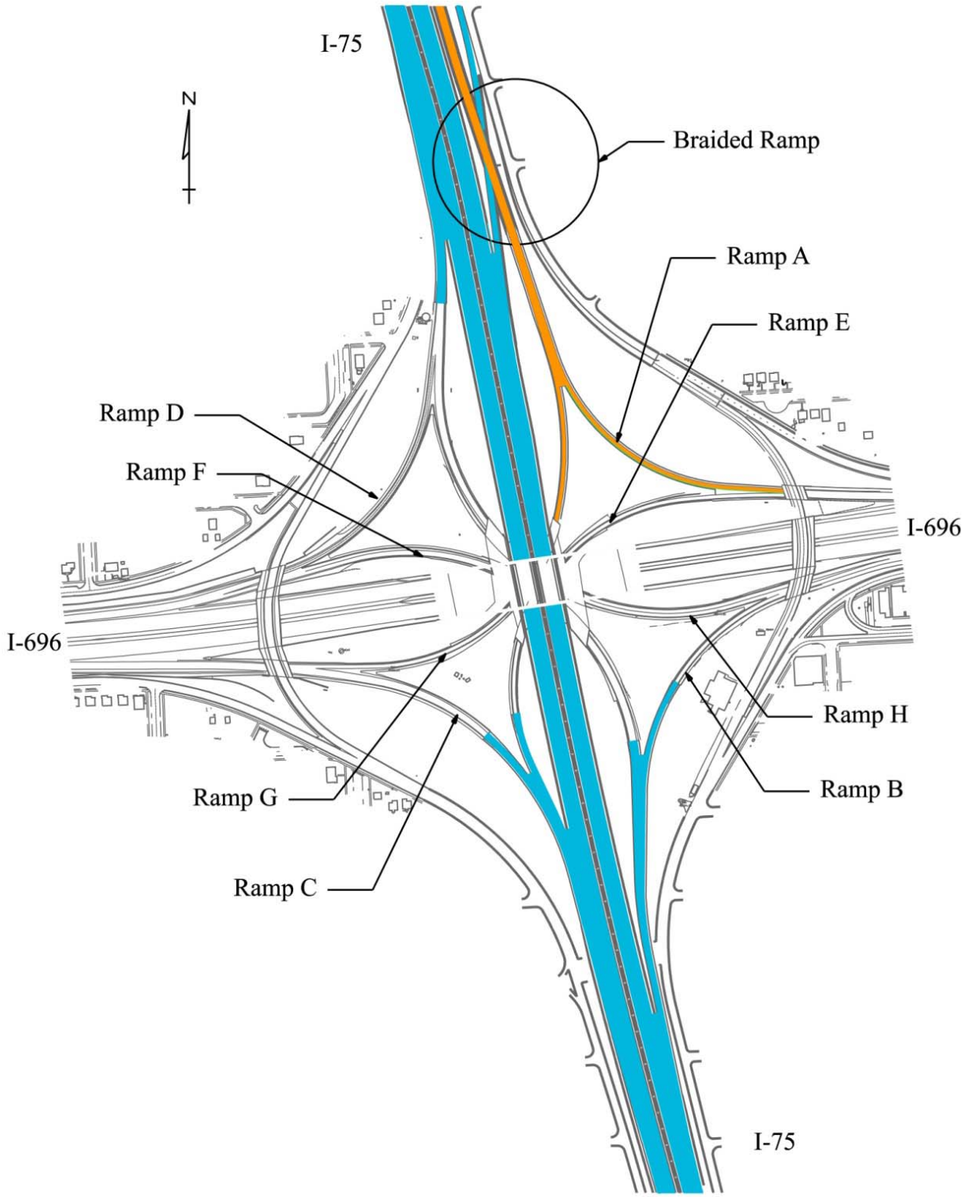
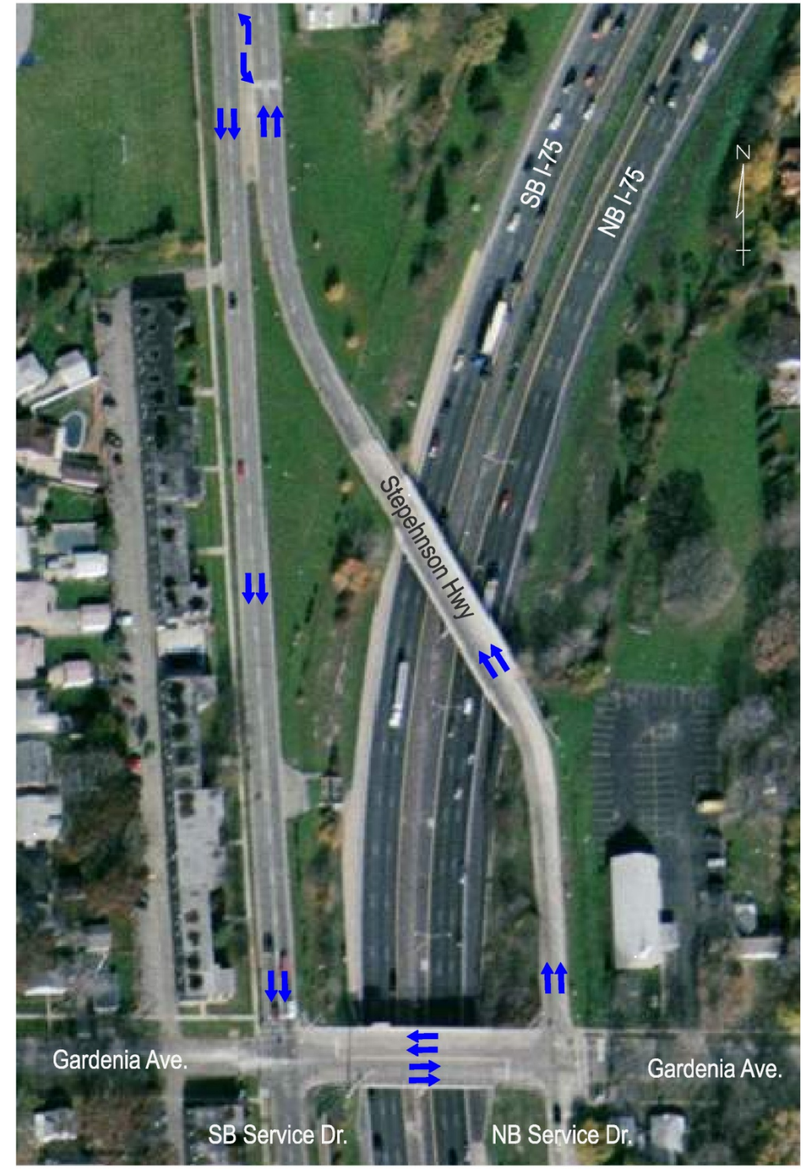


Figure 5-9 Stephenson Highway Traffic Movements North of Gardenia Avenue



The final proposed geometric design provides adequate vertical underclearance; however, removal of this structure was considered. Before determining if the bridge could be removed, traffic patterns were analyzed for both existing and future (2025) year conditions. "*Stephenson Bridge Operational Analysis Memo*" was performed to assess the routing and traffic volumes with and without the Stephenson Highway bridge (see Appendix F). In conclusion, the removal of this bridge and the rerouting of traffic through the two Gardenia Avenue intersections were acceptable based on an existing conditions analysis for both the AM and PM peak hours. It is recommended that the Stephenson Highway bridge be rebuilt since the benefits of removal are insignificant.

Proposed Freeway Geometry

The constraints and limitations that were encountered are discussed in this section. The proposed geometry was designed to fit within the right-of-way (ROW) established in the FEIS. To minimize impacts to local roads, the service drive elevations have been maintained. The median location was preserved where possible. Alternative design options are presented in areas where the ROW identified in the FEIS is insufficient to meet current MDOT standards. The design criteria used is located in Section 3.0.

The proposed cross section of northbound and southbound I-75 will consist of a maximum of four through lanes and an auxiliary lane. The proposed alignment, the crown point, and the point of rotation were set at the center of the four-lane through section for each roadway.

All horizontal curves along northbound and southbound I-75 are superelevated according to current MDOT standard plan R-107. Superelevation transitions and crown run-out lengths meet current MDOT standards, with the exception of the supertransition associated with the two reverse curves between the Gardenia Avenue bridge and the 12 Mile Road bridge. ROW constraints prohibit realignment of the mainline to meet current standards. The tangent length between curves is too short to apply a standard distribution, so a design exception will be necessary at this location for exceeding maximum rotation rate. The design at this location has been coordinated with the project to the north.

Horizontal Mainline I-75

The outside back-of-curb of the service drives served as constraints to limit the impact on local cities, crossroads, and residential driveways. The service drive horizontal and vertical alignments remained virtually the same as existing conditions; however, the width was reduced where necessary to provide space for widening I-75.

The horizontal alignment consists of nine curves. Two curves did not meet a design speed of 75 mph and will require a design exception for radius, one meeting a 70 mph design speed and the other reaching a 65 mph design speed. These locations are as follows:

- 9 Mile Road curve to the left at PI STA 730+75 (R=2042', 70 mph)
- 9 Mile Road curve to the right at PI STA 756+26 (R=1647', 65 mph)

To increase the design speed of these curves, each radius was increased and the tangent between the two curves lengthened for rotation. These improvements, coupled with an additional lane in each direction, forced the freeway alignment to vary from service drive alignments, reducing lateral separation between the service drive and the mainline pavement in several locations.

Design exceptions for horizontal stopping sight distance will also be necessary in both of these locations due to the tight horizontal curves with inside median barrier elevations coupled with outside retaining walls. These elements obstruct the driver's line of sight necessary to achieve the stopping sight distance of 820 feet (for a 75 mph design speed).

Locations requiring design exception for horizontal stopping sight distance are as follows:

- NB PI STA 730+75.31
- NB PI STA 756+25.78
- SB PI STA 730+25.83
- SB PI STA 756+63.62
- SB PI STA 879+49.35

Elimination or reduction of the number of design exceptions along I-75 in the 9 Mile Road area requires a freeway alignment that varies significantly from the existing alignment, resulting in significant impacts to the community. Figure 5-10 displays the ROW impacts that would result if the freeway realignment met criteria for a 75 mph design speed. This is not a viable option for further consideration.

Vertical Mainline I-75

The corridor is a depressed freeway. A minimum of 14'9" of underclearance is maintained for I-75 under local roads south of the I-696 interchange and 16'3" north of I-696. The service drive elevations have been maintained to limit the impacts to local roads. Therefore, I-75 is required to be lowered to meet the vertical underclearance at the proposed structures. The proposed mainline vertical profile is on average three feet lower than the existing profile. A maximum cut depth of approximately ten feet occurs just north of Meyers Avenue where the horizontal alignment deviates from the existing footprint. The area between 11 Mile Road and Gardenia Avenue is also being lowered to meet the vertical design speed of 75 mph.

The excavation required to widen and lower I-75 creates utility impacts throughout corridor. See Section 5.11 for utility information. All possible profile variations were assessed, yet the design speed of 75 mph could not be satisfied for the following curves:

- NB PVI 900+68.86 (70 mph) sag curve under Gardenia Avenue and Stephenson Highway bridge
- SB PVI 901+45.51 (70 mph) sag curve under Gardenia Avenue and Stephenson Highway bridge

These curves are constrained by the 12 Mile Road interchange, underclearance needs at the Gardenia Avenue and Stevenson Highway bridges, and the close proximity of these structures to each other. Design exceptions for insufficient K value will be needed for the aforementioned curves.

The proposed typical sections and alignments for the corridor between M-102 to south of 12 Mile Road are provided in plan sheets found in Appendix A.

Figure 5-10 Property Impacts on the I-75 Curves Achieving a 75 mph Design Speed

Interchanges

Four interchanges are included within the project limits:

- M-102 (two northern ramps)
- 9 Mile Road/John R Road
- I-696
- 11 Mile Road

Interchanges at M-102, 9 Mile/John R Road, and 11 Mile Road have been designed using urban slip ramps with a 25 to 45 mph design speed. Standard MDOT naming convention was used to label ramps, from the *Michigan Design Manual, Road Design, 3.07.02B.* The I-696 ramps are standard freeway interchange ramps and were designed using a 45 mph minimum design speed. The Geometric Design Criteria in Appendix A provides design details for individual ramp design, including the MDOT Geometric Design Guide used and all corresponding design lengths.

M-102 (8 Mile Road) Interchange

The proposed configuration of the 8 Mile Road interchange maintains the existing urban diamond configuration. The two northern ramps within the project limits provide access from the following:

- Northbound service drive to northbound I-75
- Southbound I-75 to southbound service drive

Both were designed as urban slips ramps. There are no anticipated design exceptions for these ramps. The northbound three-lane section is shifted 12 feet to the outside to introduce the 12-foot HOV/general purpose lane on the inside. This shift happens over 900 feet per the MDOT standard for 75 mph design speed.

9 Mile/John R Interchange

The proposed configuration of the 9 Mile Road interchange maintains the existing urban diamond configuration. The 9 Mile Road bridge was rebuilt in fall 2009.

The existing service drives follow the curvature of I-75 but not at a constant offset. To improve mainline design speed, the proposed alignment has been shifted from existing conditions, creating two pinch points. These pinch points are areas where the mainline freeway encroaches on the service drive, constraining the interchange ramp design.

Pinch Point 1 is at STA 737+15 and defines where the proposed 9 Mile/John R Road Ramp C (SW quadrant) can be located. The area where the service drive encroaches on the mainline has no additional space for a ramp lane; therefore, the ramp must begin south of Pinch Point 1. The proposed ramp begins approximately 440 feet south of the existing ramp. Furthermore, the 9 Mile/John R Road Ramp C freeway entrance is also constrained by the exit ramp to 8 Mile Road. Once the 9 Mile Road ramp lane converges with southbound I-75, that lane becomes an exit-only lane for the 8 Mile Road exit ramp. A minimum distance of 1,500 feet is recommended by the American Association of State Highway and Transportation Officials (AASHTO) between successive ramp terminal noses to provide sufficient weaving length and adequate space for signing. See Figure 5-11, Pinch Point 1 south of John R Road.

Pinch Point 2 is at STA 780+38. It is north of the 9 Mile Road bridge where the existing service drive configuration and ROW greatly constrain the mainline alignment. The existing service drives shift closer to I-75, and the distance between service drives is only enough to provide the additional HOV lane for each direction. The pinch point north of 9 Mile Road was created due to the addition of the lane and ROW constraints. See Figure 5-12, Pinch Point 2 north of 9 Mile Road.

The FEIS proposed a U-Turn structure for the NB service drive to the SB service drive between 9 Mile Road and Woodward Heights Boulevard. Due to underclearance standards and safety concerns, this structure was moved farther north to the Woodward Heights Boulevard. Combining these structures also eliminates the horizontal conflict with the 9 Mile Road interchange ramps and still follows MDOT geometric standards for an urban diamond interchange.

I-696 Interchange

Reconstruction of the I-696 interchange ramps is limited to the length required to tie the existing ramps to the proposed freeway. Neither the tri-level bridge nor any bridge structures along I-696 will be impacted. All existing single-lane ramps within this interchange have 12-foot ramp widths. Proposed design matches existing lane widths to limit the length of impact to the existing interchange ramps. Current standards require 16-foot lanes; therefore, a design exception for these four single-lane ramps will be necessary. See Figure 5-8 for the length of impact on the I-696 ramps and for ramp labeling convention**.**

Braid (I-696 and 11 Mile Road)

I-696 and I-75 are two major corridors that converge with heavy traffic demand. In the existing conditions, the one-lane ramps from eastbound and westbound I-696 merge together and enter northbound I-75 as an additional auxiliary lane on the outside. Traffic has less than a half mile to weave out of the auxiliary lane that also becomes an exit-only lane for 11 Mile Road (see Figure 5-13). The operation and safety problem caused by the conflict between entering traffic from I-696 and exiting traffic to 11 Mile Road is exacerbated by this insufficient weave length and results in backups and delay.

It is proposed to braid the entrance ramps from I-696 and the exit ramp to 11 Mile Road to improve operations and safety of northbound I-75. The proposed braid geometry eliminates the need for a weave area between the ramps. The mechanics of a “braid” is to avoid the merging (weaving lane) of two separate roadways by introducing a structure to create a vertical difference which keeps the roadways separated but maintain the same course. A new structure is required in the northeast quadrant of I-696 and I-75 (see Figure 5-14). Acquisition of ROW along the northbound service drive is required to provide adequate width to build the ramps and the new structure to current MDOT standards.

The length of proposed Ramps A and G are limited to minimize the impacts to structures along the I-696 corridor, including the tri-level bridge over I-75, and a design exception will be needed. The proposed design for Ramp A will require a design exception because the divergence angle between Ramp A and Ramp E exceeds MDOT standards. Elimination of this design exception would require reconstruction of Ramp E and replacement of the existing bridge that travels over the northbound service drive. The proposed ramp design for Ramp G ties into the existing radius of the ramp before encroaching on the existing bridge over I-75. The vertical grade required to carry Ramp G from the existing elevation at the tri-level structure to merge into Ramp A exceeds the MDOT standard of 5%, resulting in a design exception. Extending the length of the Ramp G reconstruction would be needed to flatten out the vertical grade to 5% or less; however, this would impact the tri-level bridge.

Ramps A and G combine to create a dual 24-foot lane that raises at a grade of 5.12% to travel over the 11 Mile Road exit ramp and then immediately drops at a grade of -5.88% to get underneath the Lincoln Avenue bridge. A vertical design exception will be needed to raise and drop Ramp A/G over the I-75 11 Mile Road exit. After dropping grade, the dual 24-foot lane continues as a Collector-Distributor (CD) road and runs parallel with the I-75 mainline, separated by a barrier, where it exits to either northbound I-75 or 11 Mile Road.

Figure 5-11 Pinch Point 1 South of John R Road

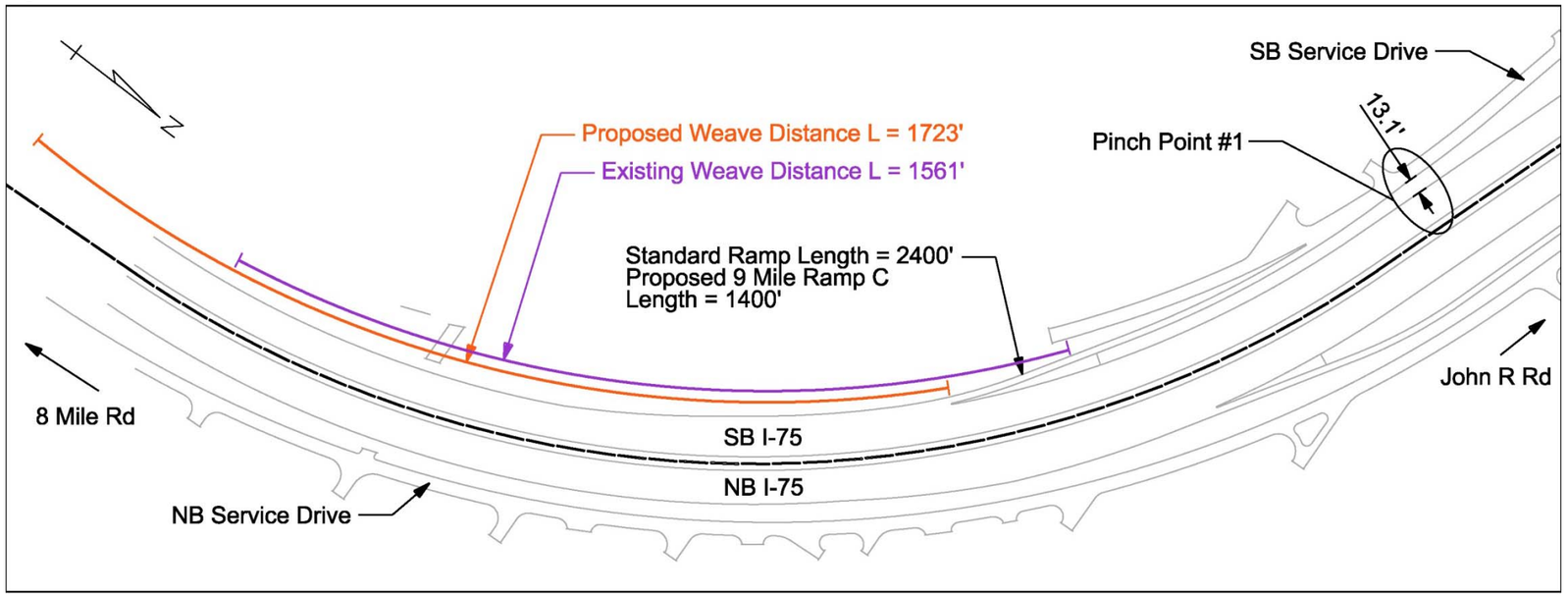


Figure 5-12 Point 2 North of 9 Mile Road

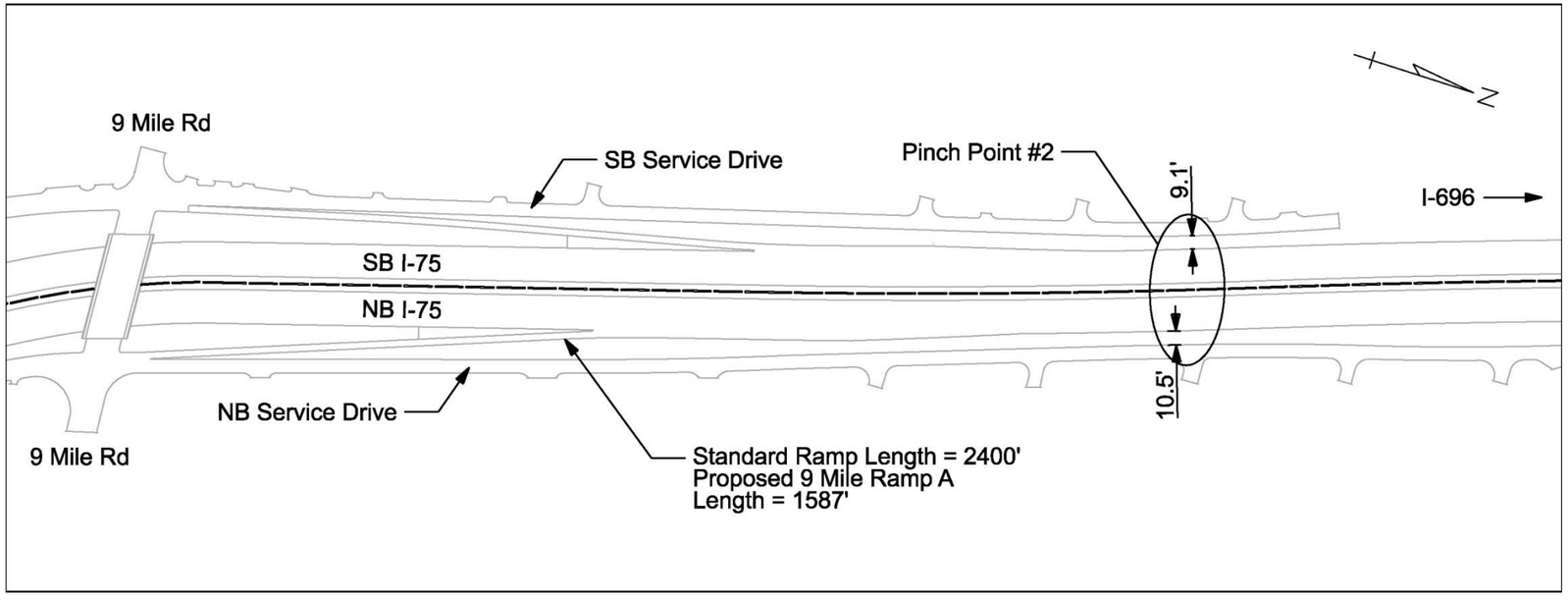
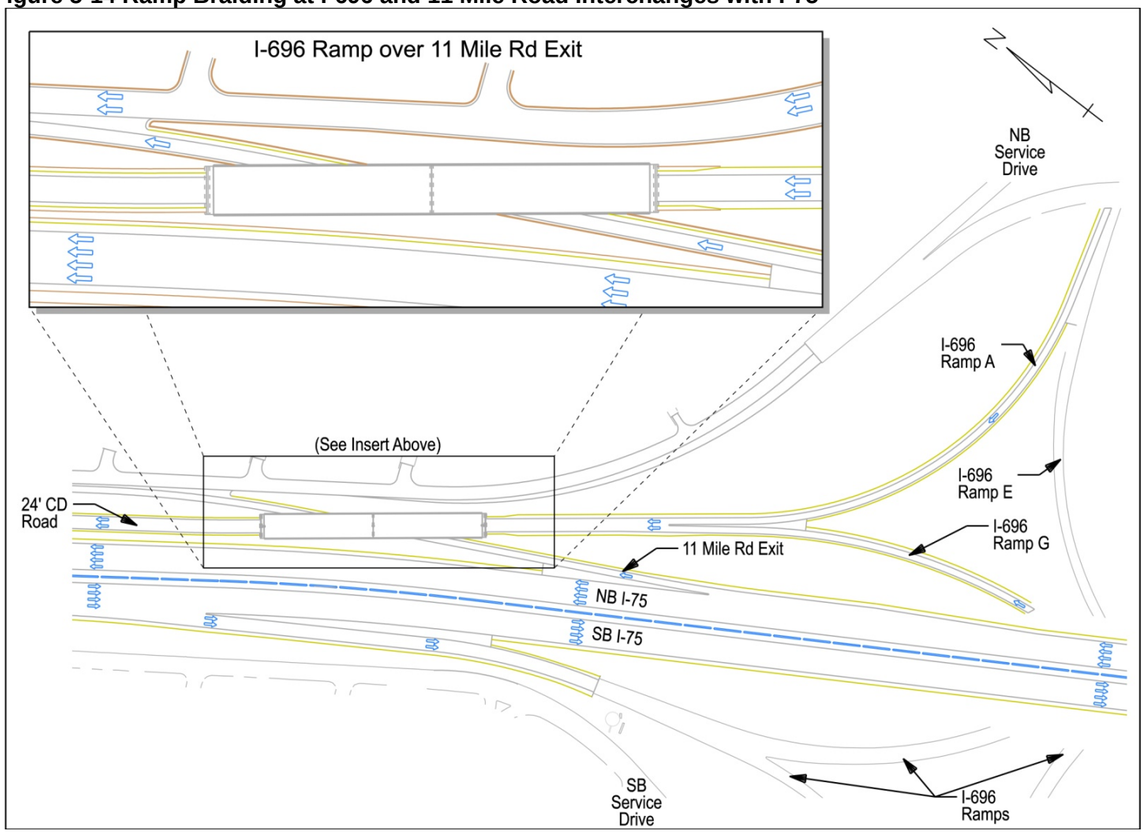


Figure 5-13 Existing I-696 and 11 Mile Road Weaving Lane

Figure 5-14 Ramp Braiding at I-696 and 11 Mile Road Interchanges with I-75



11 Mile Road Interchange

The proposed configuration of the 11 Mile Road interchange maintains the existing urban diamond configuration with the exception of the NB I-75 ramp to the NB service drive (Ramp B) that is now part of the braided design area. The ramps serving the 11 Mile Road interchange were designed as urban slips ramps. There are no anticipated design exceptions needed for the remaining three ramps.

5.7 Signing

The proposed signing plan is similar to existing conditions. The locations of the signs have changed to coordinate with the proposed geometric alignment, but the signs themselves have remained similar to existing signage. Due to the new geometric alignment, as well as the use of the new lane as a HOV lane, some new signs will need to be included. The signs will be placed throughout the project limits using the specifications and guidelines found in MDOT's *Freeway Signing Design, Placement, and Application Guidelines*.

Each sign shown within the signing plan is either a standard or is mimicking a standard sign. All of the individually drawn signs meet the attributes of the similar standard sign found in the *Standard Highway Signs Manual* that is prepared by the Traffic and Safety Division Bureau of Highways, MDOT, and the State Transportation Commission. Sign attributes, such as spacing, font style, font size, background color, and border color, all are found in the *Standard Highway Signs Manual*. Preliminary signing plans for the corridor are in Appendix B.

5.8 Driveways

Many residential and commercial driveways, residential streets, and cross-streets are located along both the northbound and southbound service drives on I-75. The standards used include GEO-680-A from the *MDOT Traffic and Safety Geometric Design Guides* and the *Administrative Rules Regulating Driveways, Banners, and Parades*. The VII-650C standard on intersection layouts was not used because all of the streets, with the exception of major roads, do not cross the service drive; they are T-intersections.

The GEO-680-A standard was used whenever possible. However, there were many right-of-way conflicts with this design, and therefore the standard was rarely used.

The *Administrative Rules Regulating Driveways, Banners, and Parades* was used for the majority of the driveways. The Residential Driveway Curbed Highway, Curb-return or Curb-out type; the Single Two-way Commercial Driveway Curbed Highway; or the Divided Commercial Driveway were used. Table 5-7 lists the number of driveways in the corridor that follow a certain type.

In several locations it was necessary to match the existing conditions to avoid encroaching on right-of-way. This means that these drives do not match the standard that applies to the location. In some cases, it is only the exiting or entrance radius that is substandard, not both. This occurs at the following locations:

- SB Service Drive at John R Road; exiting radius
- SB Service Drive at Otis Avenue; entrance radius
- SB Service Drive at the Mobile station entrance near 9 Mile Road; entrance radius
- SB Service Drive at the gas station entrance near 9 Mile Road; entrance radius
- SB Service Drive at the gas station entrance near 9 Mile Road; entrance and exiting radius
- SB Service Drive at the Tubby's entrance near 9 Mile Road; exiting radius
- NB Service Drive at the Roberts Avenue entrance; entrance radius
- NB Service Drive at Otis Avenue; entrance radius
- NB Service Drive at an apartment driveway near Farnum Avenue; entrance radius
- NB Service Drive at a second apartment driveway near Farnum Avenue; entrance radius

Table 5-7 Rules Regulating Driveways

TOTAL NUMBER OF DRIVEWAYS	TYPE OF DRIVEWAY AND RULE TO FOLLOW
103	*Administrative Rules Regulating Driveways, Banners, and Parades*: Single Two-way Commercial Driveway
44	*Administrative Rules Regulating Driveways, Banners, and Parades*: Residential Driveway
5	GEO-680-A Right-In Right-Out Driveways with Curb
8	GEO-680-A Two-Way Driveway on Highways with Curb
7	*Administrative Rules Regulating Driveways, Banners, and Parades*: Residential Driveway Curb-cut Type
1	*Administrative Rules Regulating Driveways, Banners, and Parades*: Divided Commercial Driveway

The following driveway does not have an existing curve to tie into and therefore takes right-of-way to match standards:

- NB Service Drive at a commercial driveway near 9 Mile Road; entrance radius

There are several right-of-way impacts in relation to the driveways, but all are associated with the new location of the service drive. These occur at the following locations:

- NB Service Drive at Annabelle Avenue; exiting radius
- NB Service Drive at Brockton Avenue; exiting and entrance radius
- NB Service Drive at Hudson Avenue; exiting and entrance radius
- NB Service Drive at Kalama Avenue; exiting and entrance radius
- NB Service Drive at Harwood Avenue; exiting and entrance radius
- NB Service Drive at Lincoln Avenue; exiting and entrance radius
- NB Service Drive at Hamden Avenue; exiting and entrance radius
- NB Service Drive at Cowen Avenue; exiting and entrance radius

See Appendix E, Right-of-Way Maps, for more details.

5.9 Design Exceptions

The proposed design used the design criteria in Section 3.0. In locations where MDOT and FHWA standards could not be attained, a list of anticipated design exceptions has been created (see Table 5-8).

Table 5-8 Design Exceptions

DESIGN EXCEPTION #	DESIGN EXCEPTION ELEMENT	LOCATION	EXISTING	DESIGN	STANDARD	REASON	MDOT INTERNAL EXCEPTION
1	Cross Slope	Gore, R09A	Gore slopes to standard	Best possible cross slopes	Max Cross Slope = 8%	The steep ramp profiles, caused by the large grade separation between the mainline freeway and the service drives, result in the high cross slopes on the gores	
2	Cross Slope	Gore, R09C	Gore slopes to standard	Best possible cross slopes	Max Cross Slope = 8%	The steep ramp profiles, caused by the large grade separation between the mainline freeway and the service drives, result in the high cross slopes on the gores	
3	Cross Slope	Gore, R09D	Gore slopes to standard	Best possible cross slopes	Max Cross Slope = 8%	The steep ramp profiles, caused by the large grade separation between the mainline freeway and the service drives, result in the high cross slopes on the gores	
4	Cross Slope	Gore, RCD11B	New ramp	Best possible cross slopes	Max Cross Slope = 8%	The steep ramp profiles, caused by the large grade separation between the mainline freeway and the service drives, result in the high cross slopes on the gores	
5	Horizontal Alignment	NB I-75 PI = 730+75.31	R = 2180'	R = 1994.17'	R = 2344.00'	ROW restrictions limit realignment	
		SB I-75 PI = 730+25.83	R = 2109'	R = 1922.00'	R = 2344.00'	ROW restrictions limit realignment	
6	Horizontal Alignment	NB I-75 PI = 756+25.78	R = 1280'	R = 1565.00'	R = 2344.00'	ROW restrictions limit realignment	X
		SB I-75 PI = 756+63.62	R = 1357'	R = 1637.17'	R = 2344.00'	ROW restrictions limit realignment	
7	Horizontal Alignment	Ramp Parallel Distance, R09A Approx. 605+00	S = 242'	Parallel Distance = 142'	Parallel Distance = 240'	The service drive pinches I-75 near station 779+00. ROW restrictions limit the length of the ramp	
		Ramp Parallel Section, R09A	S = 0'	S = 615'	S = 680'		
8	Horizontal Alignment	Ramp Parallel Section, R09C approx. 403+00	S = 144'	S = 300'	S = 680'	The service drive pinches I-75 near station 723+00. ROW restrictions limit the length of the ramp due to the short distance between John R Road and the pinch point	
9	Horizontal Alignment	Ramp Length, R696A	L = 788'	L = 171'	L = 300'	The length cannot be obtained without constructing into the bridge	
		Ramp Delta Angle, R696A	Δ° = 5.14°	Δ° = 1.29°	Δ° = 2.29°	The delta angle cannot be obtained without constructing into the bridge	
10	Lane Width	I-696 Non-Slip Ramps	Width = 12'	Width = 12'	Width = 16'	Match existing ramp width	
11	Vertical Alignment	NB I-75 PVI = 900+68.86	K = 141.7 (60 mph) SSD = 591.6	K = 181 (70 mph) SSD = 732.4	K = 312 (75 mph) SSD = 820	Existing geometry and bridge underclearance constraints do not provide enough length to accommodate 75 MPH design speed vertical lengths	X
12	Vertical Alignment	SB I-75 PVI = 901+45.51	K = 141.7 (60 mph) SSD = 591.6	K = 181 (70 mph) SSD = 732.3	K = 312 (75 mph) SSD = 820	Existing geometry and bridge underclearance constraints do not provide enough length to accommodate 75 mph design speed vertical lengths	X
13	Vertical Grade	R09A from 602+56.57 to 604+60.07	Grade = -3.00%	Grade = -5.78%	Max Grade = -5.00%	The steep ramp profile is caused by the fact that the Mainline freeway is lowering to get under 9 Mile Road, which causes a greater difference between the Mainline and the service drive	
14	Vertical Grade	RCD11B from 2' pt at R696A to 1103+67.21	New ramp/doesn't match existing	Grade = -0.12%	Min Grade = -0.30%	In order to tie together R696A and the service drive	
		RCD11B from 1103+67.21 to 1107+62.33	New ramp/doesn't match existing	Grade = 5.30%	Max Grade = 5.00%		
		RCD11B from 1107+62.33 to 2' pt at NB Service Drive	New ramp/doesn't match existing	Grade = 0.03%	Min Grade = 0.30%		
15	Vertical Grade	R696A from 1806+95.26 to 1816+13.51	New ramp/doesn't match existing	Grade = 5.12%	Max Grade = 5.00%	In order to go up and over R11B	
		R696A from 1816+13.51 to 1826+73.88	New ramp/doesn't match existing	Grade = -5.88%	Max Grade = -5.00%		
16	Vertical Grade	R696G from 1901+52.22 to 1903+43.52	Grade = -0.40%	Grade = 5.24%	Max Grade = 5.00%	To tie into the existing R696G and then rise up to meet R696A, which is rising to go over R11B	
		R696G from 1905+04.51 to 1905+96.44	Grade = -2.20%	Grade = 5.31%	Max Grade = 5.00%		
		R696G from 1905+96.44 to 1906+99.57	Grade = -2.20%	Grade = 5.76%	Max Grade = 5.00%		

Each design exception listed provides the substandard criteria element, location, existing value, proposed design value, and the current standard value. It also includes documentation on the reason why the design exception is necessary. The last column indicates whether the listed design exception would be for MDOT internal documentation or would be required to be submitted to FHWA. There are 16 anticipated design exceptions (3 MDOT, 13 FHWA) throughout the corridor.

5.10 Drainage

The proposed storm drainage collection system for this section of the I-75 mainline consists of seven separate drainage districts that convey stormwater via proposed pump stations to a proposed trunkline sewer under the NB service drive. Details of the drainage study are provided in the *Drainage Study, I-75, 8 Mile Road to 12 Mile Road, Engineering Report (CS 63174 – JN 45700),* December 2009.

Table 5-9 lists the drainage districts for the project and proposed hydrologic conditions.

Table 5-9 Proposed Hydrology

DRAINAGE DISTRICT	TOTAL ACRES	Q PEAK* (50 yr- 24 hr)(cfs)
8 Mile Road	15.52	53.90
Meyers Avenue	15.00	60.45
John R. Road	22.99	88.97
Woodward Heights Avenue	11.19	45.34
I-696	43.12	159.7
11 Mile Road	12.84	47.50
Gardenia Avenue	14.98	60.97

*Qpeak quantifies the peak flows for a 50-year storm in a 24-hour time frame flowing in cubic feet per second

Figure 5-15 displays a schematic of the overall storm sewer trunkline design.

In addition to seven drainage district pump stations, it was determined that the trunkline sewer will require a pump station "in-line" to avoid installation of a large-diameter storm sewer at excessive depth and to meet grade requirements of the storm sewer trunkline leading to the Red Run Drain. Based on this, seven drainage district pump stations affect the amount of flow to the trunkline. If only peak flows were considered in a stormwater collection system, the drainage district pump stations would require much larger pumps and storm sewers to convey stormwater. The in-line trunkline pump station is directly affected by design changes in the drainage district pump stations and collection systems located upstream. In an effort to reduce discharge rates in the system, it is important to evaluate storage in the collection system. Storage allows the required total pumping capacity to be reduced and thereby provides attenuation of the peak discharge rates to the trunkline.

Since I-75 is depressed in this area, storage will have to be storm sewer pipe or chamber storage below the permissible high water elevation. The first iteration of the collection system layout assumes storage volumes can be achieved by using a combination of in-line storage and parallel trunklines in the collection system. Note that further cost analysis regarding the assumed storage pipe diameters should be completed during design to ensure the most economical balance between pipe cost and length.

Table 5-10 lists the pump station locations and sizes necessary.

Table 5-10 Proposed Pump Station Discharge and Storage Estimates

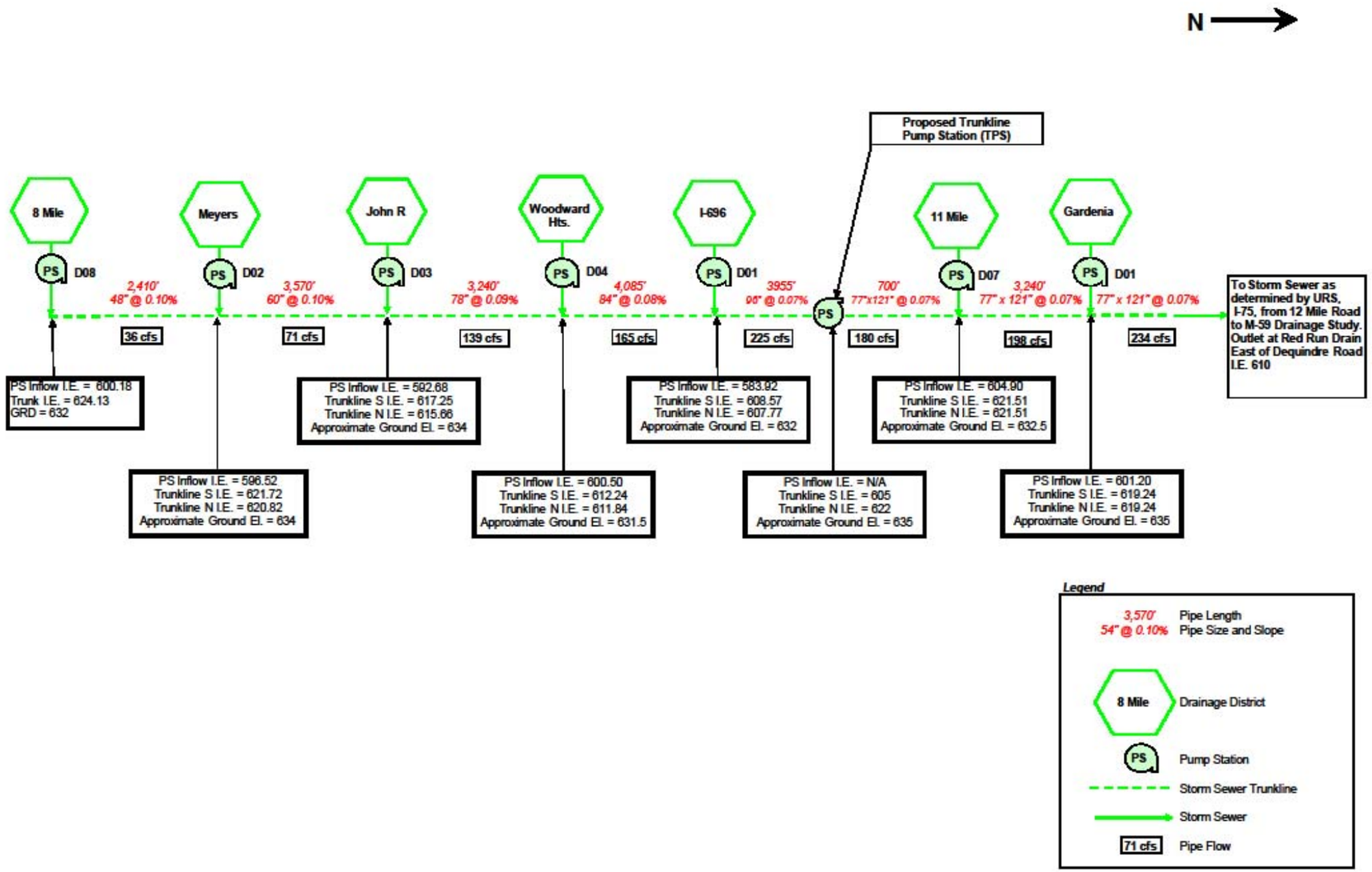
PUMP STATION LOCATION	PUMP STATION ID	Q PEAK (50 yr-24 hr) (cfs)	Q DISCHARGE(cfs)	NUMBER OF PUMPS	ESTIMATED REQUIRED STORAGE VOLUME UPSTREAM (ft^3)
8 Mile Road	D08	53.90	36.0	4	23,550
Meyers Avenue	D02	60.45	35.0	4	29,650
John R Road	D03	88.97	68.0	5	24,900
Woodward Heights Avenue	D04	45.34	26.0	4	23,200
I-696	D01	159.7	120.0	6	56,100
Trunkline Pump Station	TPS	225.0	180.0	6	173,000
11 Mile Road	D07	47.50	30.0	4	20,200
Gardenia Avenue	D01	60.97	36.0	4	25,500

cfs = cubic feet per second; ft^3 = cubic feet

NB I-75 Service Drive Impact

Construction of the storm sewer trunkline within the NB service drive will include consideration of existing utility conflicts, depth of excavation, and ROW impacts. Based on preliminary utility investigations, there are multiple existing utilities including water mains, storm and sanitary sewers, sewer siphons, gas, electrical, phone, and fiber optic lines that will need to be relocated. In some locations, particularly between I-696 and 11 Mile Road, the storm sewer trunkline depths of excavation under the NB service drive approach 30 feet. This presents challenges during construction, as groundwater will likely be encountered. The contractor will need to use multiple trench boxes and sheeting to install the large-diameter pipe. Soil borings should be conducted during the design phase to determine groundwater elevations and soil types at several locations along the storm sewer trunkline alignment. For the deeper sections of storm sewer construction or where multiple significant utility conflicts occur, it may be cost-effective to install the pipe by means of trenchless technology, such as micro-tunneling (discussed later in this section). Once costs and impacts are fully understood for utility relocation work, a cost analysis should be conducted to determine the feasibility of any trenchless technology options versus traditional open-cut storm sewer installation. In some areas, grading permits may be required to provide additional space for construction activities.

Figure 5-15 Stormwater Conveyance Schematic



Micro-tunnel Feasibility

As an alternative to installation of the freeway trunkline sewer by the open-cut method, a *Tunnel Option Feasibility Memorandum* was prepared in September 2009. It concluded that a tunnel option is feasible for the I-75 reconstruction. For comparison purposes, the same general alignment from the open-cut sewer was used for the tunnel option study, as well as three of the proposed pump stations. However, the tunnel option study was preliminary and was meant to determine method feasibility and not to recommend a preferred sewer installation method. The report outlined the following action items that need to be completed to develop the tunnel option further:

- Conduct additional soils investigation to define the underground conditions and specify the appropriate tunneling methods. The tunnel option study was based on soil borings contained in MDOT bridge plans and the 2003 Somat investigation.
- Perform preliminary tunnel design to determine the type and size of the initial (if required) and final lining, type of tunnel boring machine, and shaft location and size.
- Verify the hydraulic design for system capacity and surge. Currently, the minimum tunnel diameter for precast concrete tunnel linings is 10- to 12-feet. Therefore, a 12-foot inside diameter tunnel for construction and cost estimating purposes was assumed. During the next stage of design, after further hydraulic analysis, a cost comparison between a varying tunnel diameter using micro-tunneling technology and a single diameter tunnel could be completed to determine the most cost-effective approach.
- Conduct hydraulic analysis to determine if the Greig Street and 11 Mile Road pump stations may be eliminated to allow the tunnel to terminate north of 11 Mile Road. This may also further reduce traffic impact from crossing 11 Mile Road by the open-cut sewer installation method.
- Coordinate the storm sewer trunkline outlet at the Red Run Drain with the project team for the I-75 Engineering Report from south of 12 Mile to M-59.
- Perform clearance checks between utilities and structures and the tunnel. The horizontal tunnel alignment followed the left curb line of the NB service drive to avoid bridge and building foundations. The vertical alignment was set to provide clearance to the I-696 trunkline sewer and the I-75/I-696 interchange bridges. The final tunnel alignment will need to consider all other utilities that are not proposed for relocation or are difficult to relocate.
- Assess the alternative horizontal alignments. As mentioned previously, for comparison purposes the tunnel option alignment was based on the alignment used in the Drainage Study for the open-cut sewer. However, additional alignments could be studied to determine the most preferred based on cost, hydraulics, access, maintenance, and constructability.
- Estimate the tunnel settlement and impact of settlement on structures along the alignment.
- Prepare a detailed, probable construction cost estimate and construction schedule based on the preliminary tunnel design.
- Estimate the construction space assessment and working areas available along the alignment, considering the MDOT ROW.

To avoid impacts to local businesses and residents, this micro-tunnel option was studied, using the Draft Drainage Study report as a reference. This option reduces the need for many of the pump stations. The vertical alignment for the tunnel option was set with regards to the inflow elevation required at the 8 Mile Road drop shaft, the inflow elevations at the other drop shaft locations, and the I-696 trunkline sewer. The vertical alignment proceeds north, following the NB service drive, at a slope of 0.1% to the proposed pump station at Greig Street. At this location, flows will need to be pumped up to an elevation suitable for connection with the sewer system from north of 12 Mile Road and discharge at the Red Run Drain.

North of the Greig Street Pump Station, flows will be pumped up into the 77-inch x 121-inch elliptical pipe as analyzed in the Drainage Study. Due to shallow cover at this elevation, the pipe heading north from the pump station may be installed by the open-cut method, except where the sewer crosses 11 Mile and 12 Mile Roads, which will require jack-and-bore methods to avoid impacts to traffic.

The horizontal alignment will generally follow the left curb line of the NB service drive. Drop shaft structures (which will also serve as tunnel construction access) are assumed to be at the same location as the pump stations in the Draft Drainage Study. This will allow for easier tie-in with freeway drainage and will provide greater clearance to buildings along the east side of the service drive. Because of the depth of the tunnel, the alignment under the I-696 interchange will be under the east approach pavement of the S05 Bridge (I-696 mainline over I-75). From the as-built drawings, the east abutment of the S05 Bridge was constructed on a spread footing with a bottom of footing elevation of 651.5. The tunnel invert in this location is approximately 580.

Tunnel Overview

Several retail stores, churches, and residential structures are located along the NB service drive. The approximate 17,000-foot-long tunnel has been located under the left curb line of the service drive to increase the distance to building structures on the east side and decrease potential surface settlements inherent with soft ground tunneling. To mitigate settlement impacts on buildings and structures, an Earth Pressure Balance (closed face) tunnel boring machine (TBM) would be feasible. The final lining could be a one-pass precast concrete segmental lining constructed immediately behind the TBM.

In addition to the action items listed earlier, later design development should include the following:

- Extend the length of the tunnel and relocate the pumping station to further reduce surface impact and/or;
- Reduce the internal tunnel lining diameter once discussions are held with local precast concrete suppliers.

Appendix G contains the tunnel option feasibility drainage study and exhibit.

Red Run Drain Outfall Coordination

The proposed NB I-75 service drive trunkline sewer exits the project boundaries just north of the Gardenia Pump Station and continues north and east to the Red Run Drain. Coordination occurred with the northern project study area. It was determined that there are no fixed requirements regarding the amount of discharge the Red Run Drain can accept. This is based on the large ratio between the total contributing drainage areas of the Red Run Drain and the relatively smaller drainage areas of the project storm sewer trunkline. This will be further coordinated and discussed with the Oakland County Water Resources Commissioners office as the project progresses.

Based on no fixed discharge rate at the Red Run Drain for the storm sewer trunkline, an iterative approach to balance pumping rates and storage volumes in the stormwater collection system was performed to help reduce peak discharge to the Red Run Drain. This is a common approach used to evaluate the optimum storage volume and pumping capacity. In addition, it can minimize total life-cycle costs as well as other design issues.

5.11 Utilities

Impacted Utilities

An investigation of the existing utilities and quality levels was conducted and discussed in Section 2.8, Utilities. A conflict list (Appendix C-2) was developed to distinguish public and private utilities that could conflict with proposed construction and could add cost and time delays if not coordinated properly. Subsurface Utility Engineering (SUE) was added to improve the quality level of public utilities that had potential conflicts. In the Conflict List (Appendix C-2) a priority list of twenty vacuum excavations (SUE) are

recommended for further exploration. Two of the recommended twenty excavations are displayed in Appendix C-1.

During the 2010 reconstruction of the 9 Mile Road bridge and freeway, a 48-inch siphon storm sewer owned by the Oakland County Water Resources Commission was lowered to fit current I-75 conditions. This siphon has a high relocation cost and will need to be lowered again during the future widening of the freeway.

There is a proposed storm sewer under the NB I-75 service drive between 8 Mile Road and 12 Mile Road (see Drainage Section 5.10). This large pipe (up to 77-inch x 121-inch elliptical pipe) has two options for installation: open-cut or tunneling. The tunneling construction method would save approximately $4 million in utility relocation cost. Table 5-11 shows utility relocation cost estimates for the study corridor using the open-cut method of construction.

Table 5-11 Utility Relocation Cost Estimate

UTILITY	COST
Water Main	$1,920,000
Storm Sewer	$3,070,000
Sanitary Sewer	$2,410,000
Combined Sanitary/Storm Sewer	$3,420,000
I-75 Total Cost	$10,820,000
10% Contingency	$1,082,000
Total Utility Relocation Cost	**$11,902,000**

These cost are for non-MDOT facilities and are considered "utility" relocation costs

The next step during the design phase is to have a utility coordination meeting with all of the utility companies, after a substantial part (30% plans) is completed. A considerable amount of vertical information should be provided to help avoid or eliminate possible conflicts.

5.12 Geotechnical

Geotechnical for Roadway

For roadway reconstruction, it is recommended that a full geotechnical investigation be performed, consisting of pavement cores and borings spaced every 500 feet along each of the northbound and southbound alignments. In addition, any areas to be widened or filled should have borings performed to determine the adequacy of subgrade soils for construction of new pavement. Particular attention should be paid to areas where loose soils (N values less than 10) were encountered during this phase of the project. These results indicate areas of soils that will need improvement, either through compaction or undercutting, to provide a suitable subgrade for pavement construction. The full geotechnical investigation should attempt to define the extent of these soils.

In addition, further investigation of the existing base material should be considered and the suitability of the existing material for reuse in pavement reconstruction should be evaluated. Almost all samples tested exceeded the fine particle content for MDOT Class II granular material. Elevated fine content reduces the drainability of the material and the performance of the pavement.

Geotechnical for Structures

For the structure reconstruction investigation, only 2 of the 126 borings performed in the 1960s and none of the 19 borings in 2003 extended sufficiently deep to provide the soil information required to estimate the pile tip elevations based on the current Load and Resistance Factor Design (LRFD) standards. The two 1960s borings were 122 feet and 127 feet deep (elevation 507 feet and 512 feet) and are about 70 feet and 132 feet east and west from the centerline of I-75 at I-696, which is roughly the midpoint of the project. Even between those two relatively closely spaced borings, the apparent bedrock elevation differed by 5 feet. Thus, it is difficult to extrapolate the same soil conditions and bedrock elevations for bridges within this approximately 4-mile alignment. Hence, conservative, generalized recommendations for the steel H-piles were provided based on the available soil data from those two borings. Therefore, the final geotechnical investigation for each of these structures should include performing soil borings at each of the proposed substructures, one boring for each substructure less than 100 feet wide. Two borings are required for each substructure more than 100 feet wide. In addition, sufficient samples of the bedrock strata (a minimum 10-foot-long sample of competent rock) should be obtained for structure foundations to be driven to bear on this stratum.

Preliminarily, based on the two borings performed at the I-696 Interchange (S05, S16, S17, S18, and S19), nominal capacities of 600 kips may be achieved for HP14x73 piles that are driven from elevation 605 feet (pre-existing grades) to elevation 517 to 512 feet. It is estimated that piles driven to these elevations will terminate on or near the bedrock stratum.

Based on the 1960s log plan sheets, it is understood that all existing bridge structures along I-75 between M-102 (8 Mile Road) to south of 12 Mile Road are supported on shallow foundations, except for the I-696 interchange bridges. Shallow foundations may be a viable option for supporting the proposed bridge structures. Based on the 1960s soil logs, it is understood that the bottom of the existing footing elevations of the pedestrian bridges ranged between 6 and 20 feet below preconstruction grades or the existing service drive grades (elevation 615 feet to 631 feet), while other bridges ranged between 22 and 28 feet below preconstruction grades or existing service drives grades (elevation 611 feet to 605 feet). The graphical presentations of the 1960s and 2003 soil profiles are presented in Appendix C and Appendix G of the *Preliminary Engineering Report on Geotechnical Conditions for Structures, I-75 EPE Study from 8 Mile Road to South of 12 Mile Road, Oakland County, Michigan, CS: 63174 – JN: 45700*, February 1, 2010.

If the piers of the proposed structures are supported on shallow foundations at the same location of the piers of the existing structures, the bearing cohesive soils can be considered to be “pre-loaded.” The existing structure loading would have consolidated these soils, resulting in minimal further settlement for the reconstructed bridge, provided the foundation soil pressure is less than or equal to the existing conditions. Alternatively, shallow foundations for the proposed abutments may be bearing on soils that have not been preloaded in the past by existing structures. In these cases, the potential differential settlement between the abutments and the preloaded pier areas may become an issue for the performance of the bridge structure. However, all soils have been preconsolidated to some extent by environmental factors in the past, and it is not expected that any normally consolidated soils will be encountered for this project. This issue must be considered when selecting the foundation system for the new bridges.

Similarly for the new retaining structures, an evaluation of soil conditions should be included as part of the geotechnical investigation, with soil borings performed for every 300 feet of new retaining wall. Generally, all of the various types of walls being considered (soldier pile with concrete facing, cast-in-place (CIP) or precast cantilever, sheet pile with concrete facing, mechanically stabilized earth (MSE), or mechanically stabilized earth slope) are viable options, provided the necessary structural, geotechnical, and global stability analysis are performed as part of the final design.

5.13 Bridges and Structures

Bridges

A structure study was performed to make appropriate recommendations for bridge type and size, and included the number of spans, span lengths, superstructure type, and foundation system. The structure design addressed the roadway profile requirements to provide the minimum required underclearance. LRFD methodology was used.

The addition of a HOV lane will require the corridor bridges to be reconstructed to provide appropriate shoulder and lane widths for the widened roadway beneath the structures. The proposed profile grades on the structures will approximate the existing profile grades and the required minimum underclearance will be provided by lowering the profile. Raising the cross road profiles to increase underclearance is not possible due to the close proximity of the service drive intersections. Any noticeable change in bridge profile would impact the approach section and require reconstruction of the service drives in that area.

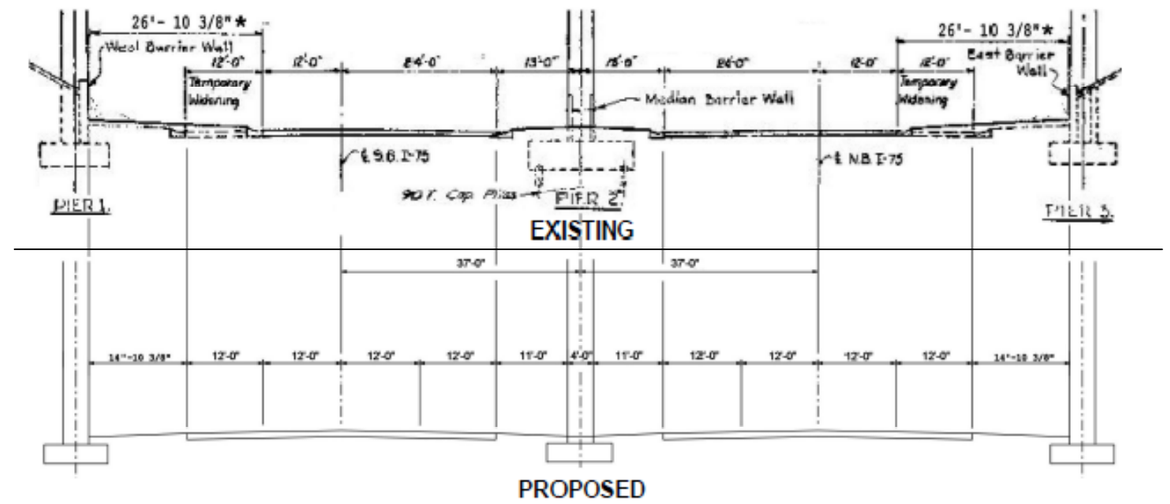
The new bridges will be designed according to current AASHTO and MDOT standards and specifications. In addition to accommodating the increased roadway width, the structures and roadway will be designed to correct deficient underclearance and carry updated live loads. Six bridge groups were selected and examined based on span lengths, beam type, skew, and bridge function. Multiple beam types were evaluated for each of the bridge groups prior to making a recommendation. Beam recommendations were based primarily on span length but also considered future maintenance and cost. The preliminary geotechnical report indicates differential settlement due to soil material properties. MSE walls were recommended for the abutments due to their lower cost when compared to full-height cast-in-place concrete cantilever walls and their ability to accommodate differential settlement. The configurations will provide safe, pedestrian access (sidewalks) and fencing. Crash-tested barriers and railing systems will also be used.

Two bridges along the corridor were eliminated, resulting in construction and future maintenance cost savings. The braided ramp design results in the removal of the Dallas Avenue bridge due to proximity, and the U-turn structure at 9 Mile Road will be combined with the one at John R Road for one double U-turn structure.

The existing tri-level structures at the I-75/I-696 interchange will not have to be rebuilt to accommodate the addition of an HOV lane in each direction. The existing horizontal clearance along I-75 under the interchange bridges as constructed in 1971 is wide enough to fit the proposed section for the corridor. Figure 5-16 illustrates the proposed and existing I-75 sections under the existing tri-level structures at the I-75/I-696 interchange bridges.

A new structure due to the ramp braid is proposed north of the I-696/I-75 interchange that will eliminate the existing weave problem between Ramp A traffic (I-696 EB/WB to I-75 NB) and traffic exiting NB I-75 to 11 Mile Road. A map indicating bridge locations is included in Section 1, Figure 1-2 and shows two constructability segments (one north of I-696 and one south of I-696). Table 5-12 provides the structures summary table, including information on existing and recommended proposed structures and estimated cost.

Figure 5-16 Existing and Proposed I-75 Section Under the Existing I-75/I-696 Interchange



* The 26'-10 3/8" dimension as shown in Figure 5-16 was verified by pick-up survey as part of the study

Retaining Walls

Widening of the corridor will require cutting into the existing embankment slopes on each side of I-75. Subsequently, the exposed fill will need to be retained by a wall.

Many concepts were evaluated, refer to Appendix D. Various wall types and the issues associated with each wall type were evaluated for the corridor. This analysis considered four retaining wall types:

- Steel soldier pile wall
- Steel sheet pile wall
- Cast-in-place (CIP) or precast concrete cantilever wall
- MSE walls

The two recommended walls for the corridor are the concrete cantilever (CIP or gravity) and MSE walls.

Table 5-12 Structure Summary Table

CONSTRUCTION SEGMENT AND ANTICIPATED CONSTRUCTION START DATE	STRUCTURE NUMBER	PB STUDY GROUP	DESCRIPTION	EXISTING STRUCTURE	RECOMMENDED STRUCTURE	COMMENTS	2009 ESTIMATED COST
Construction Segment 1 - 2026 (I-696 to 12 Mile Road)	S06 of 63103		I-75 under Dallas Double U-Turn	Two Span Steel Stringer Continuous Composite		Structure Eliminated	$434,000
	S33 of 63174	Group 6 *	11 Mile Road Exit Ramp under I-696 Ramp A	N/A	Two Span Continuous Structural Steel Plate Girders (Braided Ramp)	New Structure	$4,197,000
	S30 of 63174	Group 2	I-75 under 10 1/2 Mile Road	Two Span Steel Stringer Composite	Two Span Continuous, Skewed & ~90 Degrees, Type IV PCI Beams 54"	Reconstructed	$3,847,000
	S31 of 63174	Group 1 *	I-75 under 11 Mile Road	Four Span Steel Stringer Composite	Two Span Continuous, ~90 Degrees, Type III PCI Beams 45"	Reconstructed	$3,350,000
	S01 of 63174	Group 1	I-75 under Gardenia Road	Two Span Steel Stringer Continuous	Two Span Continuous, ~90 Degrees, Type III PCI Beams 45"	Reconstructed	$2,301,000
	S02 of 63174	Group 4*	I-75 under NB Service Road	Two Span Steel Stringer Continuous	Two Span Continuous, Skewed, Structural Steel Plate Girders	Reconstructed	$2,126,000
						Segment #1 Subtotal	**$16,255,000**
Construction Segment 2 - 2028 (M-102 to I-696)	P02 of 63174	Group 5	I-75 under Bernhard Street Walkover	Fifteen Span Steel Girder & Floor Beam	Four Span Continuous, Structural Steel Plate Girders	Reconstructed	$2,030,000
	S22 of 63174	Group 2 *	I-75 under Meyers Avenue	Four Span Steel Stringer Composite	Two Span Continuous, Skewed & ~90 Degrees, Type IV PCI Beams 54"	Reconstructed	$1,909,000
	P03 of 63174	Group 5 *	I-75 under Harry Avenue Walkover	Fourteen Span Steel Girder & Floor Beam	Four Span Continuous, Structural Steel Plate Girders	Reconstructed	$2,144,000
	P04 of 63174	Group 5	I-75 under Highland Avenue Walkover	Fourteen Span Steel Girder & Floor Beam	Four Span Continuous, Structural Steel Plate Girders	Reconstructed	$2,052,000
	S23 of 63174	Group 2	I-75 under SB U-Turn at John R	Four Span Steel Stringer Composite	Two Span Continuous, Skewed & ~90 Degrees, Type IV PCI Beams 54"	Reconstructed	$1,554,000
	S24 of 63174	Group 2	I-75 under John R	Four Span Steel Stringer Composite	Two Span Continuous, Skewed & ~90 Degrees, Type IV PCI Beams 54"	Reconstructed	$3,336,000
	S25 of 63174	Group 2	I-75 under NB U-Turn at John R	Four Span Steel Stringer Composite	Two Span Continuous, Skewed & ~90 Degrees, Type IV PCI Beams 54"	Reconstructed	$2,700,000
	S26 of 63174	Group 2	I-75 under SB U-Turn at 9 Mile Road	Four Span Steel Stringer Composite	Two Span Continuous, Skewed & ~90 Degrees, Type IV PCI Beams 54"	Combined with S25	$166,000
	S27 of 63174		I-75 under 9 Mile Road	Four Span Steel Stringer Composite	N/A	Rebuilt Fall 2009	$0
	P06 of 63174	Group 5	I-75 under Orchard Street Walkover	Fourteen Span Steel Girder & Floor Beam	Four Span Continuous, Structural Steel Plate Girders	Reconstructed	$1,866,000
	S28 of 63174	Group 2	I-75 under Woodward Heights Boulevard	Two Span Steel Stringer Composite	Two Span Continuous, Skewed & ~90 Degrees, Type IV PCI Beams 54"	Reconstructed	$3,847,000
	P05 of 63174	Group 5	I-75 under Browning Avenue Walkover	Fourteen Span Steel Girder & Floor Beam	Four Span Continuous, Structural Steel Plate Girders	Reconstructed	$1,908,000
	S04 of 63103	Group 3 *	I-75 under Shevlin Double U-Turn	Two Span Steel Stringer Plate Girder Composite	Two Span Continuous, ~ 90 Degrees, Michigan 1800 PCI Beams 71"	Reconstructed	$3,978,000
						Segment #2 Subtotal	**$27,490,000**

* = Studied in Detail

The structures within the I-696 Interchange; S05 of 63103, S16 of 63103, S17 of 63103, S18 of 63103 and S19 of 63103 will not require alteration for the addition of the HOV lane as studied in the Engineering Report.

Concrete Cantilever Wall (CIP, Precast, and Gravity Wall)

Concrete cantilever walls can be constructed in cut or fill sections. In cut sections, construction of concrete cantilever walls on spread footings would involve excavating to the bottom of the proposed wall footing and excavating behind the wall, forming and casting the reinforced concrete wall footing and stem, installing a drainage system, and backfilling around the wall to grade. In the same class of concrete walls is a very short wall (less than 10 feet) that is called a concrete gravity wall. Precast concrete cantilever wall elements can expedite construction and provide higher quality materials and create a uniform finished appearance. Concrete cantilever walls on spread footings are not suitable for areas with differential settlement.

Construction of concrete cantilever walls on spread footings typically involves trackhoes, bulldozers, or other excavating equipment along with conventional reinforced concrete construction. This construction is flexible and can accommodate longitudinal and transverse subsurface utilities and overhead restrictions. Precast elements can expedite construction by removing the labor-intensive field-reinforced concrete construction from the critical path, which will minimize disruption to traffic. Reinforced concrete cantilever walls require little maintenance.

Mechanically Stabilized Earth Wall

MSE walls can be constructed in fill or cut sections. In cut sections, MSE walls can be used for bridge foundation construction. In a cut region the construction of MSE walls involves excavating to the bottom of the leveling pad and behind the wall, casting a small leveling pad, and placing lifts of wall panels, wall reinforcement, and free draining granular backfill.

MSE walls are practical in regions where excavation is required for bridge abutments. The combination of a MSE wall and stub abutment wall on a single row of piling has cost benefits from the reduction of concrete and piling. See the Bridge Study for additional discussion.

Due to the flexible nature of these systems, differential settlement is more tolerable than the rigid CIP system. In numerous locations, MSE soil reinforcement straps would extend under proposed service drives, requiring coordination of proposed utility work with wall construction. In addition, MSE soil reinforcing straps under the service drives could restrict future utility work.

Construction is flexible and can accommodate subsurface utilities (running perpendicular to the walls), overhead restrictions, and placed around utilities and obstructions. Prefabricated MSE wall elements can expedite construction and minimize disruption to I-75 or service drive traffic. MSE walls require little maintenance. MSE walls are generally more economical when the retaining area is greater than 1,000 square feet and wall height is greater than 10 feet.

Table 5-13 presents the wall designations (e.g., A, B, C, etc.), recommended wall type, and recommendation considerations. Common to all recommendations is economy and individual physical constraints. Appendix D provides the wall locations. Each individual wall designation (A, B, C, etc.) is a separate wall section. Adjacent wall sections will be designated with a number, such as D1 through D4. The bridge study recommends MSE walls at the bridge abutments. In some areas, for example Wall A and S22 of 63174, there will be a concrete cantilever wall adjacent to an MSE wall. Having adjacent walls of different types will require attention in the final design phase to account for differences in differential settlement and rotation at the interface.

Table 5-13 Wall Recommendations and Considerations

WALL DESIGNATION	RECOMMENDED WALL TYPE	COMMENTS
A	Concrete Cantilever (CIP)	• Minimize embankment excavation to preclude the use of tiebacks or MSE wall straps under the adjacent service drives • 60-inch storm drain parallel to Wall B • Proposed pump station located next to Wall B
B	Concrete Cantilever (CIP)	• Same as A
C	Concrete Cantilever (CIP)	• Minimize embankment excavation under the SB service drive
D1	Concrete Cantilever (CIP)	• Minimize embankment excavation • The proposed 60-inch storm drain and NB service drive are both approximately 40 feet from the wall face and may be sufficiently beyond excavation limits to permit the use of an MSE wall at this location
D2	MSE	• Wall passes under the proposed John R and 9 Mile Road bridges and has a maximum height of approximately 35 feet • Beyond the practical range of a typical concrete cantilever wall • Proposed 78-inch storm drain under the NB service drive may need to be located away from Wall D2 to avoid interference with MSE wall straps • The adjacent multi-story hotel at John R and 9 Mile Road may potentially be within the Wall D2 excavation limits, and temporary shoring will be required for wall construction
D3	Concrete Cantilever (CIP)	• Minimize embankment excavation that would interfere with the proposed storm drain and extend under the NB service drive • The NB service drive and proposed 78-inch diameter storm drain are approximately 15 feet from the face of Wall D3
D4	Concrete Cantilever (CIP)	• Same as D3
E	Concrete Cantilever (Gravity)	• Horizontal alignment shifts to the east away from Wall E, and the maximum required wall height is approximately 8 feet
F	Concrete Cantilever (CIP)	• Minimize embankment excavation • Preclude the use of tiebacks or MSE wall straps under the adjacent SB service drive and to match the appearance of Wall D4 on the east side of I-75 • The distance between the face of Wall F and the SB service drive varies between approximately 4 feet to 40 feet • The proposed grade of I-75 is lowered several feet under Woodward Heights Boulevard
G	Concrete Cantilever (CIP)	• Minimize embankment excavation and to preclude the use of tiebacks or MSE wall straps under adjacent service drives • Simplify construction of the relocated service drive and the 96-inch storm drain parallel to Wall I
H1	MSE	• Wall pairs around braided ramp
H2	MSE	• Same as H1

WALL DESIGNATION	RECOMMENDED WALL TYPE	COMMENTS
H3	MSE	• Same as H1
H4	MSE	• Same as H1
I	Concrete Cantilever (CIP)	• Same as G
J	Concrete Cantilever (CIP)	• Minimize embankment excavation and to preclude the use of tiebacks or MSE wall straps under adjacent service drives • Proposed 77-inch x 121-inch storm drain parallel to Wall K • Proposed pump station located adjacent to Wall K
K	Concrete Cantilever (CIP)	• Same as J
L	Concrete Cantilever (CIP)	• Minimize embankment excavation
M1	Concrete Cantilever (CIP)	• Minimize embankment excavation • 77-inch x 121-inch storm drain and NB service drive, both approximately 35 feet from the wall face
M2	MSE	• Wall passes under the proposed Gardenia Avenue bridge and the Gardenia Avenue flyover structure and has a maximum height of approximately 35 feet • Beyond the practical range of a typical concrete cantilever wall • Proposed 77-inch x 121-inch storm drain under the north service drive may need to be located away from Wall M2 to avoid interference with MSE wall straps
M3	Concrete Cantilever (CIP)	• Minimize embankment excavation • 77-inch x 121-inch storm drain

Using a general unit cost estimate by wall type, the project area retaining walls are estimated to be $36.3 million (2009 dollars). These estimated costs are based on moderately high walls (around 20 to 25 feet high). Wall costs were estimated based on a generic design and historic MDOT unit costs. All wall costs assume a cut section with granular backfill. Temporary shoring is not included in the costs as this is a location-specific cost. As walls become shorter or taller, the cost difference between walls will change. (See Appendix D).

5.14 Right-of-Way

The ROW needs have been updated to reflect geometric adjustments that have resulted in reduced ROW impacts than were originally documented. Table 5-14 summarizes east side and west side impacts, comparing the FEIS ROW impacts to the updated impacts. Design modifications reduced the number of parcel impacts by 18 on the east side and 4 on the west side, for a total of 22 reduced parcel impacts and a reduction in one acre of land.

Table 5-14 Right-of-Way Summary from the FEIS through the Engineering Report Refinement

EAST SIDE ROW	FEIS	REFINEMENT	REDUCED
Number of Parcels	62	44	18
Total Area	258,851 Square Feet	223,885 Square Feet	34,966 Square Feet
Acres	5.942 Acres	4.943 Acres	0.999 Acres
WEST SIDE ROW	FEIS	REFINEMENT	REDUCED
Number of Parcels	13	9	4
Total Area	20,420 Square Feet	12,365 Square Feet	8,055 Square Feet
Acres	0.468 Acres	0.284 Acres	0.184 Acres

See Appendix E for detailed ROW maps.

5.15 Non-Motorized Facilities

All existing pedestrian overpasses (the six locations identified in Section 2.2.9) are being replaced following the Americans with Disabilities Act ramp criteria. These new pedestrian ramp facilities need to acquire additional right-of-way due to these requirements. The locations and right-of-way required for the facilities are shown in Appendix E.

5.16 Maintenance of Traffic

5.16.1 MOTSIM Analysis

A freeway network (MOTSIM model) was created to analyze traffic impacts to major roads between M-59, Woodward, the Davison freeway, and Dequindre, resulting from the following I-75 maintenance of traffic alternatives:

- Alternative 1—Full closure
- Alternative 2—Two lanes in each direction open
- Alternative 3—Three lanes in each direction open

5.16.2 Develop Maintenance of Traffic Concepts

A technical memorandum was prepared to address the development of maintenance of traffic (MOT) concepts, consistent with the FEIS. These MOT concepts incorporated the following information:

- Proposed improvements (geometric, bridge, retaining wall, drainage, and traffic)
- Traffic and constructability impacts to I-75 and to the local community, consistent with MDOT's policy for the development of Transportation Management Plans
- Constructability issues, viable staging, traffic operational impacts, and the advantages and disadvantages of each MOT conceptual alternative

Design Criteria

The following were considered for each MOT concept alternative:

- Shifts in I-75 horizontal alignment
- Grade differentials between existing and proposed I-75 construction
- Grade differentials between proposed NB and SB alignments
- Temporary construction to remove raised shoulders
- Maintain positive drainage
- Local access
- Retain lighting, Intelligent Transportation Systems (ITS), and utility systems in service
- Safe areas
- Community involvement
- Service drive pavement condition
- Bridge pier and foundation removal and construction
- Distance required to facilitate paving equipment
- Minimum lane widths of pavements for contra-flow
- Construction of retaining wall
- Investigate incident management strategies
- Minimal right-of-way acquisition
- Project design criteria

All were developed using MDOT MOT design criteria. Since the retaining walls are between I-75 and the service drives, at locations where service drives or ramps are close to the I-75 shoulder, cast-in-place or precast concrete walls are recommended based on space requirements to maintain traffic. At locations where service drives or ramps are far from the I-75 shoulder and a wall is required in front of a proposed bridge abutment, cast-in-place or precast concrete cantilever retaining walls and/or MSE walls are recommended.

5.17 Corridor Construction Phasing

Viable construction phasing was evaluated to provide a baseline for comparison of the conceptual MOT alternatives. Two methods have been identified for construction phasing that can be applied to separate projects into smaller, constructible contracts. The first method consists of separating the project into **segments** and performing all construction work in between established limits, as shown in Section 1, Figure 1-3. The second method separates the project into **components**, such as separating service drive and temporary freeway construction from the mainline I-75 construction.

Segment Construction

Separation of the project into logical, constructible segments are driven by differences between existing and proposed horizontal alignments, grade differentials caused by profile or superelevation improvements, the need to provide positive drainage, and local access. Existing and proposed grades closely match, outside of superelevation areas, north of 13 Mile Road, south of 11 Mile Road, north of I-696, and south of 8 Mile Road within the project limits that would facilitate crossover construction. In addition, the outlet of the proposed storm sewer is at the Red Run Drain, just north of 12 Mile Road. If contracts are broken into segments, construction will need to start at this drainage outlet.

As a result, up two separate construction contracts are feasible as described here and shown on Section 1, Figure 1-3.

1. I-75 construction from north of 13 Mile Road to I-696 (I-75 STA 820+00)
2. I-75 construction from I-696 (I-75 STA. 820+00) to 8 Mile Road

Segment construction would include all bridge, retaining wall, service drive, drainage, mainline, and other miscellaneous construction work. Dependant on project funding, it may be possible to combine segments.

Combining segments has the following advantages/disadvantages:

1) Advantages—Construction can be completed more quickly at a reduced overall cost. Congestion reduction and safety improvements at the I-696 and 12 Mile Road interchanges would be realized with construction of the first contract. A drainage outlet would be provided for construction south of I-696. Project construction duration could be reduced.

2) Disadvantages—Smaller contractors may not be able to bid on the project and project financing may be difficult.

Keeping segments separated have the following advantages/disadvantages:

1) Advantages—Smaller contractors would be able to participate in the project bid process. Project financing would be easier.

2) Disadvantages—Multiple mobilizations and temporary mainline pavement at the crossovers of up to 500 feet will result in higher overall construction cost and longer construction duration.

Component Construction

Separation of the project into separate components that could be constructed independently is the second method of construction phasing. Components can be constructed as discussed below:

- Advanced Service Drive and Drainage Construction—The northbound and southbound service drives from 8 Mile Road to north of Gardenia Avenue, along with retaining and noise abatement walls, could be built as a separate contract in advance of the I-75 construction. This would include construction of the proposed storm sewer system along the northbound service drives to the outlet north of 12 Mile Road. Provisions need to be addressed to disconnect the freeway drainage system from the existing CSO after the I-75 proposed storm sewer construction is complete. In addition, gaps in walls may be required to facilitate drainage and ramp construction. Several benefits derived from this advance construction work would be that new service drive pavement condition and signalization would be in place to better handle I-75 spillover traffic, and the permanent drainage system for I-75 would be built and available in advance of mainline I-75 pavement construction work.
- Advanced Freeway Temporary Construction—Temporary construction required to facilitate maintenance of traffic on I-75 can be advanced. This work includes, but is not limited to, removal of the raised shoulders, curb and gutter, and median barrier; adjustment of existing drain castings; construction of shoulders flush with the pavement; and the placement of concrete barrier to separate median traffic.
- Advanced Staging of Bridge Construction—The required permanent underclearance is 14’9” for crossover bridges south of I-696 and 16’3” inches for crossover bridges north of I-696. In the past, MDOT and FHWA have approved a temporary underclearance of 14’0” minimum as work is being performed to bring bridge underclearance to standard upon construction completion. If a 14’0”minimum underclearance is allowed during construction, bridges could be removed and replaced in advance of I-75 mainline construction work. This would mitigate impacts to local traffic

that desires to cross the freeway during construction. A slight raise in crossroad profile grade, not impacting crossroad right-of-way, may be required. Bridge crossroad traffic could be maintained with part-width construction, or detoured if it is desired to construct the entire bridge over a shorter period of time. On I-75, one lane in each direction would need to be closed, additional temporary underclearance advanced warning signing would be required, and off-peak short-term intermittent closures would be necessary to remove and construct bridge beams.

If MDOT or FHWA does not approve a temporary bridge underclearance of 14'0" minimum, then the bridges at Woodward Heights Boulevard, Shevlin Avenue Double U-turn, Lincoln Avenue, 11 Mile Road, and Gardenia Avenue cannot be advance constructed. They would need to be constructed at the same time as I-75 mainline construction work.

- Construction I-75 Mainline—Construction of the mainline road, grading, drainage, signing, miscellaneous appurtenances, and possibly bridges would be the last component of construction. This component can be separated into smaller limits consistent with the description in the segment section. For the purposes of the *Maintenance of Traffic Technical Memorandum*, it was determined to evaluate the entire project from north of 13 Mile Road to 8 Mile Road.

Four alternative maintenance of traffic schemes were developed for the corridor. For each alternative, one segment broken up into components was recommended. Advanced construction work is to be performed as a pre-stage, with two I-75 lanes open in each direction as a minimum. After pre-stage work is complete, one mainline segment would be performed as subsequent staged construction. The anticipated duration of pre-stage work is approximately one year. The duration of the mainline segment construction varies depending on the alternative considered. Detailed construction critical paths and cost estimates have been provided in the *Maintenance of Traffic Technical Memorandum*. If more than one segment of construction is required for the project, as discussed previously, maintenance of traffic alternatives considered here will still apply; however, the duration of overall construction will be longer, and the impacts to the local community will be higher.

Alternative 1—Full Freeway Closure

With the full freeway closure alternative, I-75 is proposed to be closed at the M-102 (8 Mile Road) NB service drive exit ramp and at the SB 12 Mile Road exit ramp. All traffic is proposed to be detoured onto the service drives. All service drive ramps within the construction limits, as well as the I-75/I-696 interchange ramps, will be closed. Service drives and the proposed trunkline sewer under the NB service drive are proposed to be constructed in a pre-stage, with the service drives remaining open during the freeway closure to lessen impacts on the community. Crossroad bridges can be constructed either part-width or in the pre-stage if approved by MDOT and FHWA, or the closure stage.

It is anticipated that the pre-staged work and Alternative 1 construction duration would require two years. The maintenance of traffic cost estimate for Alternative 1 is $1.8 million dollars in 2009 dollars, the lowest construction cost of any alternative considered.

Alternative 2—Two-Lane Operation in Each Direction

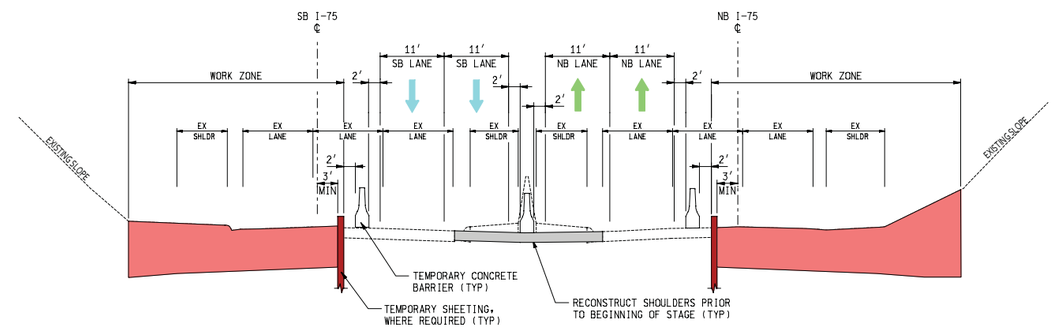
Two separate alternatives, Part-Width Construction and Crossover Construction, were modeled that could both equally maintain two lanes of traffic on I-75 in each direction. These alternatives are described as follows:

Alternative 2A—Part-Width Construction

Under this alternative, two lanes of traffic in each direction would be maintained using lane shifts and shoulder closures to facilitate staged construction.

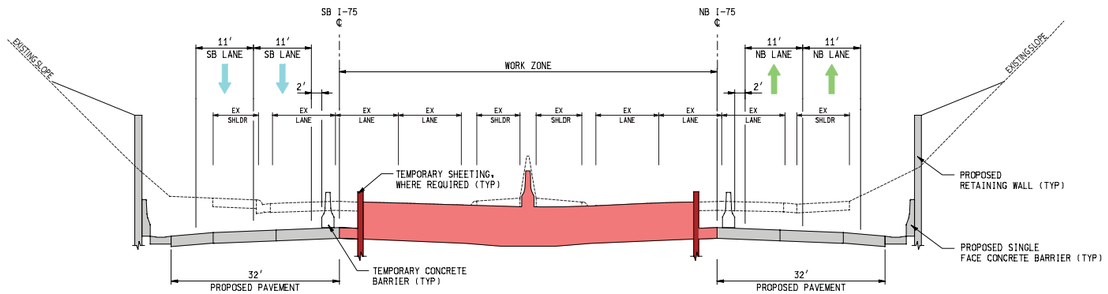
In the mainline construction, two lanes of traffic in each direction are shifted to the inside lanes and shoulders. Construction would commence on the outside lanes, shoulders, and ramps, as shown in Figure 5-17. To minimize ramp closure durations, sub-stages could be added to keep ramps open outside of active construction areas. Due to grade differential and required sheeting, gapping ramp construction to keep them open in active construction areas will be challenging and add cost to maintaining traffic operations. For this analysis, it was assumed they would be closed.

Figure 5-17 Alternative 2A—Part-Width Construction—Stage I



Second, two lanes of traffic in each direction are shifted to the newly constructed outside lanes and shoulders, as shown in Figure 5-18. Construction is performed on the inside lanes, shoulders, and median. All service drive ramps and the I-696 ramps would be open to traffic during this stage, including the new CD roadway being constructed for I-696 traffic entering NB I-75.

Figure 5-18 Alternative 2A—Part-Width Construction—Stage II



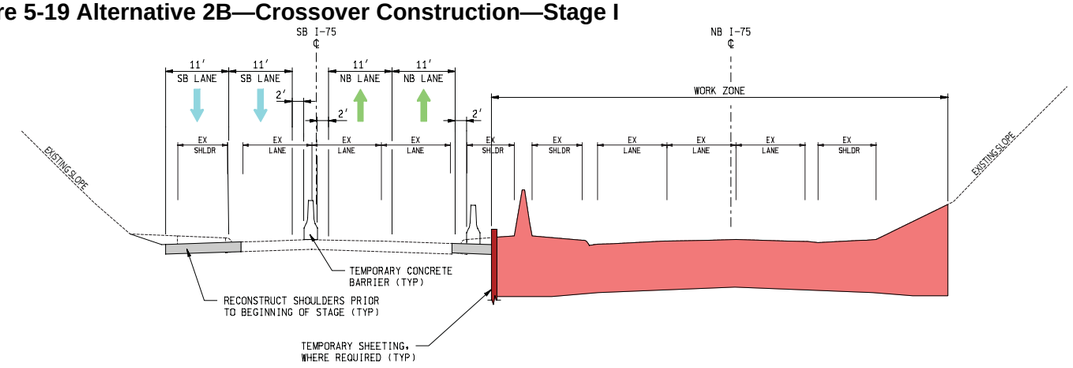
It is anticipated that the pre-staged work and Alternative 2A construction duration would require three years. The total maintenance of traffic cost estimate for Alternative 2A is $13.1 million in 2009 dollars.

Alternative 2B—Crossover Construction

Under this alternative, two lanes of traffic would be maintained in each direction using crossovers to shift all traffic onto one bound of the freeway, while the other bound of the freeway is constructed.

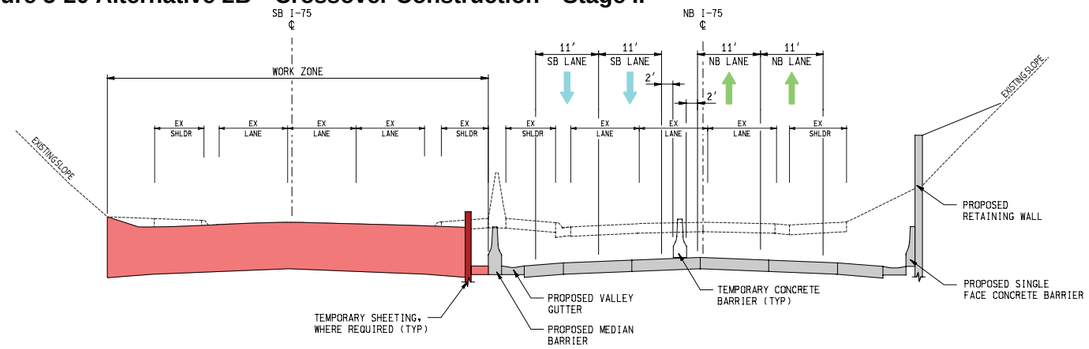
All traffic would be shifted to the existing southbound lanes and construction would commence on the northbound lanes, shoulders, and ramps, including the I-696 to NB I-75 CD roadway, as shown in Figure 5-19. It is anticipated that all southbound ramps can remain open. All northbound ramps would be closed. To minimize ramp closure durations, sub-stages could be added to keep ramps open outside of active construction areas. Due to grade differential and required sheeting, gapping northbound ramp construction to keep them open in active construction areas would be challenging and add cost to maintaining traffic operations. For this analysis, it was assumed they would be closed.

Figure 5-19 Alternative 2B—Crossover Construction—Stage I



Second, the two I-75 lanes in each direction are shifted to the newly constructed northbound lanes using crossovers. Construction would then commence on the southbound lanes, shoulders, and ramps, as shown in Figure 5-20. It is anticipated that all northbound ramps would remain open and that all southbound ramps would be closed. Gapping the above-mentioned southbound ramps to keep them open instead of closing them in construction areas would be challenging and add cost.

Figure 5-20 Alternative 2B—Crossover Construction—Stage II



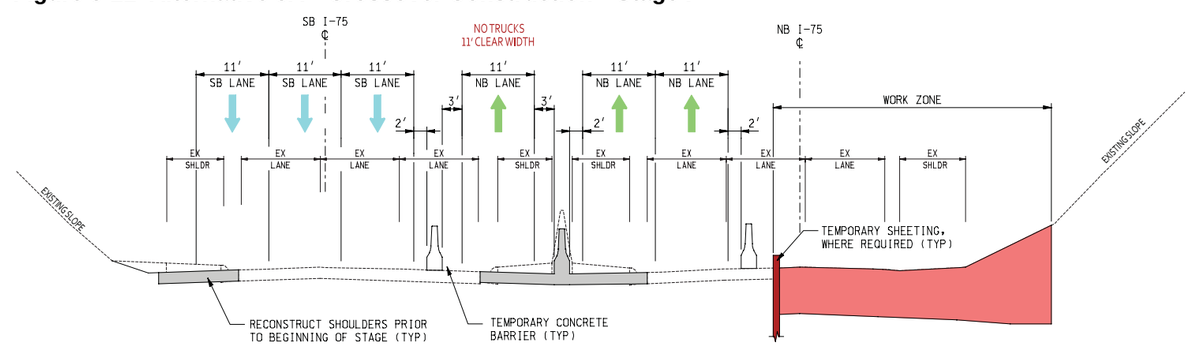
It is anticipated that the pre-staged work and Alternative 2B construction duration would require three years. The maintenance of traffic cost estimate for Alternative 2B is $11.4 million in 2009 dollars.

Alternative 3—Three-Lane Operation in Each Direction

Under this alternative, three lanes of traffic in each direction would be maintained during construction. This would be accomplished by crossing one lane onto the opposite bound of pavement while maintaining lanes on the original bound. This crossed over lane would operate as an “express” lane, with no opportunity for entrance to or exit from the lane within the construction area. After the pre-stage work is complete, four additional stages would be required.

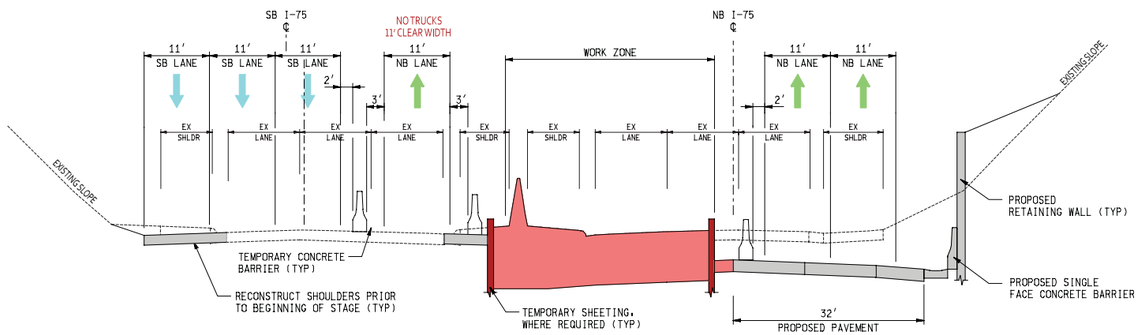
Three lanes of southbound traffic would be shifted to the outside southbound lanes and shoulder, and one lane of northbound traffic would cross over to the northbound pavement, as shown in Figure 5-21. The remaining two northbound lanes would be on the northbound median shoulder and inside northbound lane. Construction can commence on the northbound outside lanes, shoulders, and ramps. All northbound ramps would be closed. To minimize ramp closure durations, sub-stages could be added to keep ramps open outside of active construction areas. Due to grade differential and required sheeting, gapping northbound ramp construction to keep them open in active construction areas would be challenging and add cost to maintaining traffic operations. For this analysis, they are assumed to be closed.

Figure 5-21 Alternative 3A—Crossover Construction—Stage I



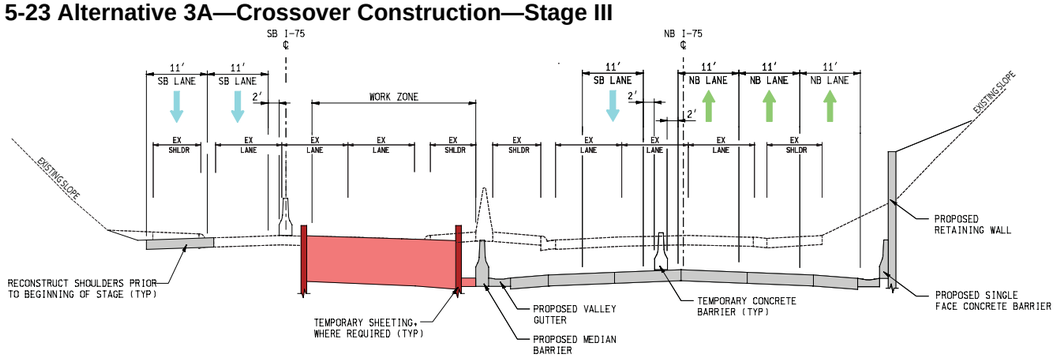
Second, the three southbound lanes and one northbound lane of traffic would remain on the southbound pavement, while two northbound lanes would be shifted to the newly constructed pavement from Stage I, as shown in Figure 5-22. Construction would be performed on the inside northbound lanes, shoulders, and median barrier. All service drive ramps and the I-696 ramps would be open during this stage, including the new CD roadway that was constructed in Stage I for I-696 traffic entering northbound I-75.

Figure 5-22 Alternative 3A—Crossover Construction—Stage II



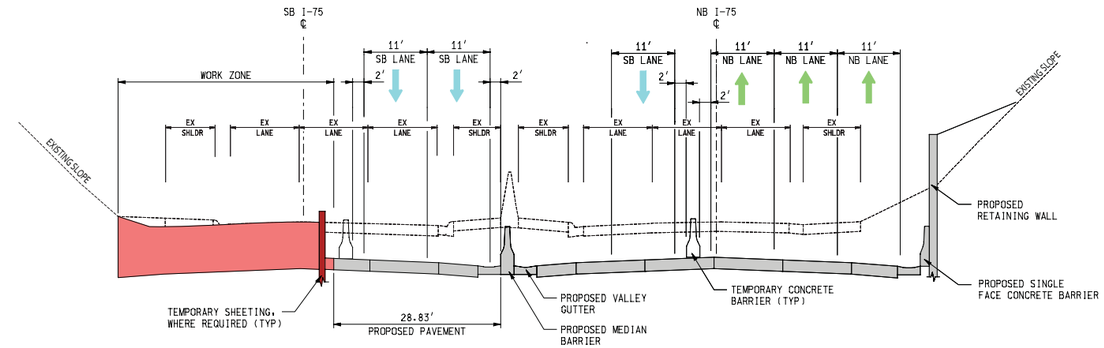
Third, three northbound lanes and one southbound lane would crossover onto the new northbound pavement completed in Stages I and II. Two southbound lanes of traffic would remain on the southbound pavement. Construction would be performed on the southbound median lane, shoulder, and median, as shown in Figure 5-23. All service drive ramps and the I-696 ramps would be open during this stage.

Figure 5-23 Alternative 3A—Crossover Construction—Stage III



Last, the three northbound lanes and one southbound lane would continue on the new northbound pavement. The two southbound lanes of traffic would shift to the southbound pavement constructed in Stage III. Construction would be performed on the remaining southbound lanes, outside shoulder, and ramps, as shown in Figure 5-24. Similar to the northbound ramps in Stage I, the southbound ramps would be considered closed for the purposes of this analysis. However, each location may be evaluated during the final design phase to determine the feasibility and practicality of using gapped construction to keep these ramps open, at least in non-active construction zones.

Figure 5-24 Alternative 3A—Crossover Construction—Stage IV



It is anticipated that the pre-staged work and Alternative 3 construction duration would require four years. This duration could be reduced to two years, but the construction cost as compared to Alternative 2A or 2B would still be higher. The maintenance of traffic cost estimate over the four years of construction for Alternative 3 is $19.7 million in 2009 dollars, the highest maintenance of traffic cost estimate of any alternative.

MOTSIM Analysis for MOT Alternatives

Traffic modeling and simulations were performed by using the I-75 MOTSIM model for the existing condition (baseline) and each of the above-mentioned conceptual MOT alternatives. Below is a summary of the results.

Baseline—Existing Conditions

I-75 travel times for the corridor from 8 Mile Road to M-59:

- AM is 30 minutes for southbound traffic and 25 minutes for northbound traffic
- PM is 25 minutes for southbound traffic and 30 minutes for northbound traffic

Alternative 1 – Full Closure

Detailed operational analysis results indicated that very severe congestion would be expected under the Full Closure option due to the coupled effects of the amount of detoured traffic volumes and inadequate availability of detour routes. This alternative exhibits the highest level of delay of the alternatives evaluated, with over a 60-minute travel time on I-75 from 8 Mile Road to M-59 for both directions in the AM peak period and over a 90-minute travel time through this section for both directions during the PM peak period.

Alternatives 2A and 2B—Two-Lane Operation in Each Direction

Under the two-lane operation alternatives, with either the I-696 ramps left open or closed and no other MOT traffic measures taken, some portions of the network would experience severe congestion due to lane closures, but by the end of each peak period, the network would have recovered or started to recover. The worse-case travel times are estimated between 35 and 40 minutes for northbound and southbound traffic, respectively, in the AM peak period and from 40 to 55 minutes for northbound and southbound traffic, respectively, in the PM peak period.

Alternative 3—Three-Lane Operation in Each Direction

Under the three-lane operation alternative with the I-696 ramps left open or closed, a moderate level of congestion is expected if any of the I-696 ramps are closed. However, the network recovers to the baseline condition toward the end of the AM and PM peak periods. The worse-case travel time is estimated at 30 minutes for both northbound and southbound traffic in the AM peak period, and between 30 and 35 minutes for southbound and northbound traffic, respectively, in the PM peak period.

Preferred MOT Alternatives

A decision matrix was generated and is included as Figure 5-25. Alternatives 2B and 3 have emerged as viable options for consideration and further analysis. Alternative 1 mobility impacts were determined to be too high and not favorable. Therefore this alternative was discarded for further consideration. The reasons that the remaining alternatives are being carried forward as the preferred concepts are as follows:

- Alternatives 2A and 2B had similar mobility impacts. Traffic impacts considered both alternatives favorable. Alternative 2A is more difficult to construct than Alternative 2B, as there is more construction traffic mixing with vehicular traffic. This could lead to safety concerns and potential crashes related to speed differentials and the potential of traffic slowdowns and stoppages that users may not anticipate. Since Alternative 2B does not have these concerns but does provide the same user mobility benefits as Alternative 2A, Alternative 2B was recommended for further consideration as a preferred alternative and Alternative 2A was discarded from further consideration.
- Alternative 3 mobility impacts were low. This alternative does have similar constructability concerns as Alternative 2A, with construction traffic mixing with vehicular traffic; however, maintaining an extra lane in each direction has minimal mobility impacts and tremendous economic savings to the user. Less congestion would reduce the potential of traffic slowdowns and stoppages, which could reduce the overall potential of crashes. Alternative 3 would cost more and take longer to construct than Alternative 2B, but the overall reduction of mobility impacts justifies that this alternative also be carried forward as a preferred alternative.

A detailed description of all the alternatives is contained in Section 6 of the MOT Technical Memorandum, and a detailed description of the selection process is contained in Section 8. As stakeholder involvement increases as the project continues in development, it is recommended that these options be presented and a final alternative be selected based on this additional input.

Figure 5-25 I-75 MOT Alternative Decisions Matrix

Goal: Identify a practical alternative to optimize mobility, safety, duration and costs during construction

CATEGORY	CRITERION	Alternative 1 Full Closure	Alternative 2A 2 Lanes with Lane Shifts	Alternative 2B 2 Lanes with Crossovers	Alternative 3 Contra flow
WILL THE ALTERNATIVE RESULT IN ACHIEVING THE GOAL OF:					
SAFETY	Maximizing separation between traffic and work zone	●	◒	●	◒
	Minimizing traffic incidents on I-75	◒	◒	◒	●
	Minimizing system-wide incidents	○	◒	◒	●
	Minimizing use of crossovers and lane shifts	●	●	◒	◒
MOBILITY	Minimizing system-wide user delay	○	◒	◒	●
	Minimizing detour travel distance	○	◒	◒	◒
	Minimizing congestion on I-75	○	◒	◒	●
	Minimizing system-wide congestion	○	◒	◒	●
	Minimizing construction duration	●	◒	◒	○
	Maximizing accommodation of special event traffic	○	◒	◒	◒
	Maximizing cross street mobility / emergency response times	○	◒	◒	◒
LOCAL COMMUNITY	Maximizing access to businesses and residents	○	◒	◒	●
	Minimizing duration of ramp closures	●	◒	◒	◒
	Minimizing noise and dust	◒	◒	◒	○
DRAINAGE	Minimizing complexity of maintenance of drainage during construction	●	○	◒	○
COST	Minimizing the number of construction stages	●	◒	◒	○
	Maximizing contractor work space for materials and delivery	●	○	◒	○
	Minimizing off site construction and signing	○	◒	◒	●
	Maximizing flexibility for contractor construction methods	●	○	◒	○
	Minimizing public information plan effort	○	◒	◒	●
	Minimizing constructability issues	●	◒	●	○
	Minimizing economic impact cost	○	◒	◒	●
	Minimizing overall MOT construction cost	●	◒	◒	○
	Minimizing local road improvement cost	○	◒	◒	●
Meets Goal		10	1	2	10
Partially meets goal		2	20	22	6
Does not meet goal		12	3	0	8

Recommendation			X	X

Legend:

Meets Goal ●

Partially meets goal ◒

Does not meet goal ○

5.18 Intelligent Transportation System Initiatives and Strategies

ITS is used as a cost-effective means to help better manage a region's transportation system to improve traveler and commuter safety. MDOT's ITS infrastructure in the metro region covers over 200 miles of freeway, consisting of closed circuit TV (CCTV) cameras, dynamic message signs (DMS), loop and microwave vehicle detection systems (MVDS), and environmental sensor stations (ESS).

At the core of the ITS network is a telecommunications infrastructure consisting of wireline and wireless technology. Field devices are aggregated to towers strategically located throughout the region. Node 4, 5, 7, 8, and 11 towers are connected via licensed wireless links to hub towers that reside on the network backbone. The telecommunication network backbone operates on leased fiber from Verizon (formerly MCI) with entry points at the following hub locations:

- MITS Center—1050 Sixth St. Detroit
- Hub 2—I-75 and I-696 interchange
- Hub 6—I-696 and M-10 and US-24 interchange
- Hub 9—I-94 and Greenfield Road
- Hub 10—I-96 and Greenfield Road

Figure 5-26 illustrates the existing telecommunications topology and geographical footprint.

MDOT's ITS infrastructure is operated and maintained by the Michigan Intelligent Transportation Systems (MITS) Center, a traffic management center (TMC) in downtown Detroit. The MITS Center uses ITS devices to monitor roadways, manage traffic, respond to incidents, and keep motorists informed.

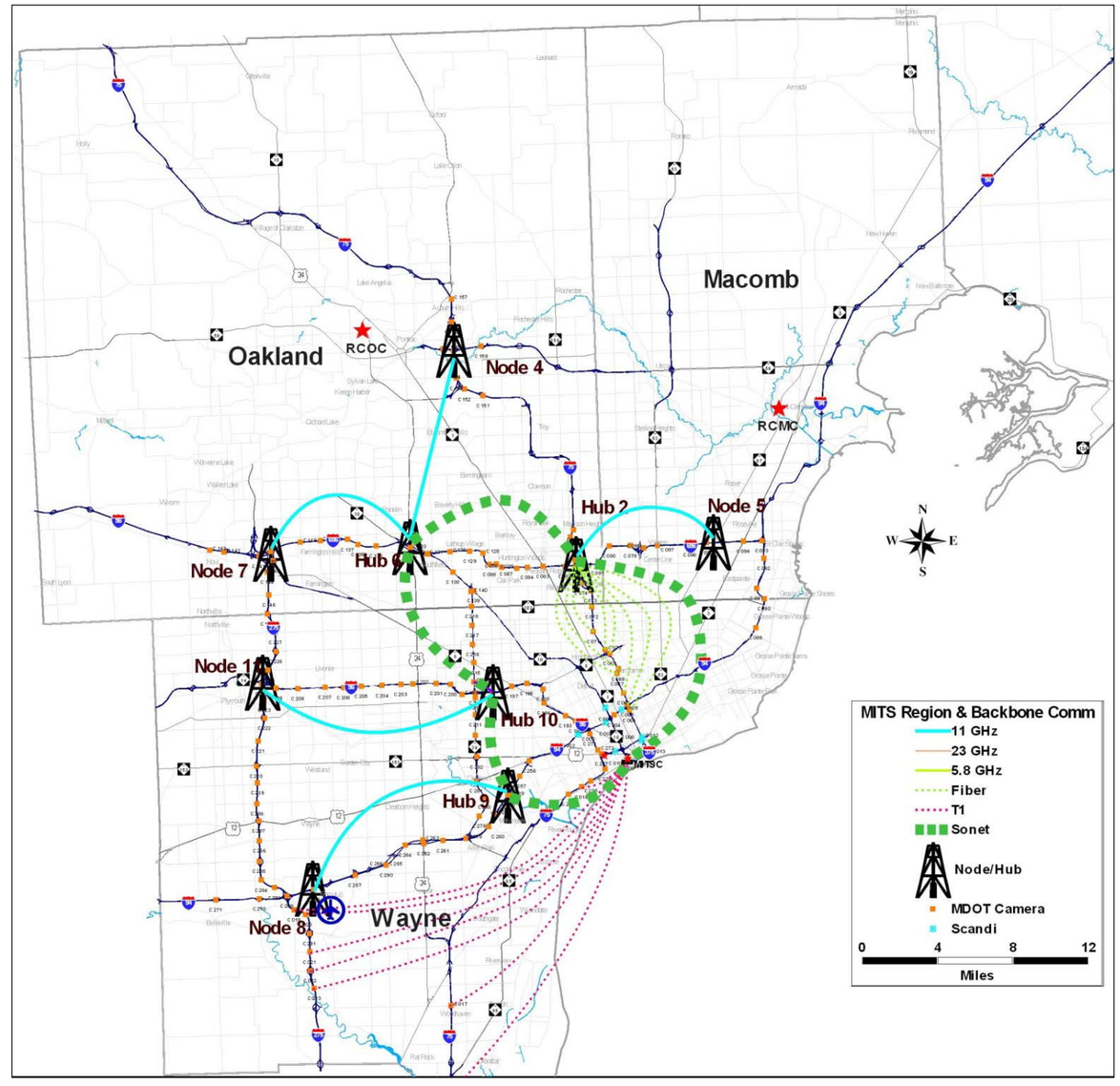
Existing ITS devices and conflicts, along with ITS work-zone considerations, are provided in Appendix H.

Recommendations

Several ITS components and existing infrastructure will be impacted with the new roadway alignment. With any new roadway construction where ITS will be deployed or is currently deployed, it is important to evaluate new and improved modifications to the system. The following are general actions that can be taken to build redundancy and provide core infrastructure to expand ITS infrastructure:

- Build new conduit in both directions of travel along I-75 up to the I-75/I-696 interchange: MDOT has its own 2-to-3-inch conduit up to Hub 2 at the I-75/I-696 interchange interconnecting all field devices and core infrastructure through the corridor. The conduit currently resides on the I-75 SB shoulder or service drive and has junction points to connect devices that are on the NB shoulder. By expanding to the I-75 NB service drive, an alternate path is created for devices on the opposite side of the roadway to be connected at Hub 2. Additionally, installation of new 2-to-3-inch conduit (at a minimum) can serve as a back-up route for all cabling to and from Hub 2 if that run becomes inoperable.
- Build new conduit (both directions of travel) north of the I-75/I-696 interchange: All devices in this corridor are currently interconnected back to Hub 2 via wireless links. Expansion of the conduit from Hub 2 to 12 Mile Road would provide MDOT with the ability to run new fiber to all existing devices and eliminate the antiquated wireless links. This would improve reliability and lifespan for the interconnection.

Figure 5-26 MDOT ITS Telecommunication Network Overview



If conduit is installed in both directions of travel, main conduit interconnects should also be installed at key junction points, or at a minimum every mile segment. At a minimum, handholes should be installed every 400 feet for pulling and conduit access points. Device-specific site needs may warrant additional conduit connections and handholes for pulling tensions, power service, and access to cabinet locations. Coordination of conduit installation with MDOT Freeway Lighting may be beneficial to both parties.

ITS Work-Zone Considerations

ITS infrastructure will be severely impacted by the new roadway plan. Devices along I-75, I-696, and Node 5 use Hub 2 as an aggregation point to send data downstream to the MITS center. The fiber that runs through the conduit along the I-75 corridor will require a plan to avoid any disruptions of service. The following are a subset of recommendations and considerations to keep the ITS functionality intact and identify necessary components that should be operational during construction. These same ITS devices could be used to assist with work zone traffic control during construction.

Keep MDOT Fiber connection from Hub 2 to MITS Center Undisturbed

To avoid any disruptions, a migration strategy or a temporary plan must be in place to keep the communication line intact. The fiber connection in the MDOT-owned conduit can remain intact by using the following methods.

- Aerial Fiber—use temporary utility poles to re-route fiber connection overhead in impacted construction zones
- Phased Construction Approach—build one side of the new freeway at a time to allow the existing conduit and fiber to be used while building I-75 NB with new conduit and then re-routing the fiber before building I-75 SB
- Keep CCTV and strategic DMS active during construction, whenever possible
- Seven CCTV cameras monitor roadways from the MITS Center and should be maintained in work zones to provide additional visibility to traffic conditions and to monitor work zone safety. The use of DMS will provide motorists with key information for detour routes and lane or highway closures in other corridors beyond 12 Mile Road and M-102. If specific locations are not able to be kept operational or a more desirable device placement is required during construction, the use of temporary work zone ITS devices could be used to supplement gaps in coverage.

Enhancements to Existing ITS Infrastructure

- Due to limitations and interoperability issues between the existing ITS devices and the new Ethernet-based communication system and Advanced Traffic Management Systems (ATMS) software platforms, some if not all, of these devices will need to be upgraded. In the interim to address these types of issues, MDOT is implementing protocol translators for the legacy DMS, upgrading communication links to Ethernet technology, and using a dual backbone architecture to enable use of the new and legacy ATMS platforms simultaneously until all antiquated ITS devices and technology are replaced. As Table H-1 shows in Appendix H, MDOT has already upgraded about half of the ITS devices within the project limits to newer technology. This roadway reconstruction presents an ideal opportunity to upgrade the remaining ITS devices and communication links to ensure seamless integration into MDOT's new Ethernet-based telecommunication network and statewide ATMS software platform.
- MDOT currently has a "Device Upgrade" project that includes replacement of these types of antiquated links and devices, which should be coordinated with this reconstruction project based on overall schedules. The following are recommendations to enhance the ITS devices along the I-75 corridor with the understanding that these issues have not been resolved prior to commencement of this reconstruction project:

- **Upgrade Analog/Serial Communication Links**
  - Some existing wireless communication links use antiquated technology or equipment. Some equipment is no longer cost-effective to maintain or has very limited availability for spare parts. In addition, these communication links present issues for existing ITS devices being able to establish communication with the new ATMS software platforms (discussed below) and Ethernet-based communication.
  - Replace existing DMS signs with newer DMS technology
  - Replace existing DMS signs at Woodward Heights Boulevard with newer DMS signs with full LED-pixel technology and full NTCIP compliance to seamlessly integrate with the new ATMS. However, at a minimum the communications technology should be upgraded to allow for the use of the Ethernet-based protocol converters, which will enable communication interoperability between these legacy DMS and the new ATMS. Based on available funding, replacing DMS north and south of the project limits should be considered.
  - Replace legacy loop detectors with newer vehicle detection systems
  - Replace all legacy loop detector stations with newer technology similar to the Microwave Vehicle Detection Systems, Wireless Pavement Sensors, or Magnetometers to continue capturing vehicle information such as speed, occupancy, classification, and count. This is also necessary due to interoperability with the new ATMS software platforms and protocols used.
- **Upgrade Legacy CCTV Cameras**
  - Replace existing legacy CCTV cameras with newer technology and full NTCIP compliance to seamlessly integrate with the new ATMS. At a minimum, the communications technology should be upgraded to newer Ethernet-based communication with the ATMS for maintenance. Based on available funding, the CCTV cameras north and south of the project limits should be considered for replacement.
- **Additional Operational Recommendations**

  In addition to managing work-zone traffic control and enhancing existing devices for the proposed roadway construction, the following ITS-related solutions can be implemented to help reduce crashes and congestion. These advanced technology solutions can also provide additional information to MDOT and partner agencies about existing roadway conditions and enhance their ability to make decisions for incident response.
  - Road Weather Information System (RWIS), Environmental Sensor Station (ESS): A RWIS consists of remote sensing locations that together form an information system to gather and transmit road-related weather information. Future enhancements for weather-related sensing technology should be considered.
  - Additional curve/speed warning systems on I-75 corridor: Curve locations along the I-75 corridor north and south of the project limits could benefit from implementation of a curve speed warning system. Additional warning systems at these locations could be similar to those used at 9 Mile Road to help reduce vehicle accidents and notify motorists of up-coming road conditions.
  - Ramp metering to manage traffic flow
  - Managed lanes approach: The most common application is the use of High Occupancy Toll (HOT) lanes, where the number of cars using the reserved lanes can be controlled via electronic

toll collection so as to maintain free-flowing traffic at all times, even during rush hour. This application, when used correctly, can provide superb mobility through otherwise congested corridors of freeway. Installation of such an application would require an overhead gantry at every major interchange and exit and entrance ramp to begin and end electronic tolling.

- Incident management and safety service patrols: Incident management systems enable MDOT to improve motorist safety and reduce overall travel times. At the core of an incident management system is the operations staff and some form of ATMS software platform. An automated decision support system could tie into existing and planned ITS devices to help reduce detection and dispatch times. MDOT Freeway Courtesy Patrol assisted over 35,000 stranded motorists on 12 Metro Detroit freeways in 2008, and increased surveillance and detection algorithms could help increase that number. In addition, for purposes of this project additional (dedicated) service patrols could be in place during times of heavy construction and/or expected travel problems (weather, special events, holiday travel, rush hours, etc).

5.19 Environmental Impacts

Reconstruction of I-75 with an HOV lane on land taken from the side slopes of the depressed (below grade) section between M-102 and south of 12 Mile Road would have minimal environmental impacts.

The FEIS and Record of Decision (ROD) noted two business relocations, but due to the further refinement there are now no business relocations. The three residential relocations associated with reconstruction of the five pedestrian bridges over I-75 will reduce to two due to further design refinement. The redesign of the braiding of the ramp carrying traffic from I-696 north onto I-75 with the northbound I-75 exit ramp will reduce residential relocations from 23 to 21(since the publication of the FEIS), because the braid will be constructed at a more acute angle that penetrates less into the community. The FEIS listed one church for relocation and that will not change.

There will be no disruption to community cohesion except when pedestrian bridges are reconstructed. There will be no disproportionate effect on minority or low-income persons, on land use, any protected resources such as parks, historic sites, or farmlands, and on threatened or endangered species or wetlands. The vegetated outside embankments along I-75 will be reduced as I-75 is widened.

The braid design affects noise mitigation. Today, a noise wall generally 14 feet high begins south of Brockton Avenue and extends along the west side of the service drive almost to Lincoln Avenue. After a break at Lincoln Avenue, it continues in this position on the west side of the service drive until it is broken again south of 11 Mile Road, where the exit ramp from northbound I-75 joins the service drive. It resumes on the north side of 11 Mile Road near West University Avenue and extends north to Gardenia Avenue, where it terminates. See Figure 5-27.

This existing noise wall arrangement is very effective at screening noise from this depressed section of I-75. The profile of I-75 has low points under crossroads, but rises to 5 or 6 feet below the surrounding grade between these low points. Noise from the service drives is <u>not</u> blocked by the noise walls (except for a short section between Andover Avenue and 11 Mile Road).

The braid will change the profile of noise emissions. See Figure 5-27 for the existing and proposed noise wall locations. The northbound ramps from eastbound and westbound I-696 will join as they do today (Ramp A), but with the braid will ascend at an approximate 5-percent grade to pass over the northbound exit ramp from I-75 (Ramp B). This will put Ramp A almost 30 feet above the surrounding grade of the neighborhood at its highest point near Brockton Avenue, meaning it will block noise from I-75. The ramp will then descend to meet I-75, matching the surrounding elevation of the neighborhood north of Kalama Avenue. North of Hudson Avenue, a new noise wall similar to the existing noise wall can be constructed (shifted in position consistent with the shift in position of the northbound service drive), with little change in noise levels. Analysis was performed using the Transportation Noise Model (TNM, version 2.5) to determine the changes brought by the addition of the revised elevated braided ramp.

The finding is that the section of Ramp A that is elevated will effectively block all noise coming from I-75; that has a considerable effect on the noise received in the adjacent neighborhood—up to a 5 dBA reduction at receivers on Dallas Avenue. That is, noise conditions will improve on the east side of I-75 just north of I-696, even south of the point where protection is afforded by a noise wall today. It also means the elevated ramp will substitute for the existing noise wall such that a noise wall is not needed south of Hudson Avenue, while north of Hudson Avenue a noise wall similar to what is provided today will be built.

With the revised braid design and replacement of the existing noise wall north of Hudson Avenue, the noises emanating from I-75, Ramp A, and the service drive never reach above 62 dBA for the residences nearest to I-75 (Table 5-15). Thus, no other new noise wall is considered reasonable for this section, as the triggering criteria for FHWA's Noise Abatement Criteria, Land Use Category B, which includes residential use, is 67 dBA (effectively 66 dBA as one must consider abatement if the criterion is "approached"). Assumptions of traffic volumes on I-75, Ramp A, and the service drive and the percentage of medium and heavy trucks and their speeds were all conservative, designed to model the worst case.

The existing noise wall north of Lincoln Avenue will have to be modified. Today, it is positioned between I-75 and the service drive to a point south of Greig Avenue. With the project, the new northbound exit ramp to 11 Mile Road merges with the service drive south of that point near Cowan Avenue, requiring removal of part of that wall. A new wall will replace the section to be removed, positioned along the east side of the service drive and tied to the existing wall north of Andover Avenue. Cowan Avenue will remain connected to the service drive. Andover Avenue, which connects to the service drive today, will end in a cul-de-sac. Greig Avenue, which is cut off from the service drive by a noise wall today, will remain closed at the service drive.

North of 11 Mile Road there is no noise wall today at the location of the northbound entrance ramp. This ramp will be shifted north. The noise wall is between I-75 and the service drive. Much of that existing wall can remain in place. A new wall should be added between 11 Mile Road and the new ramp ensuring sight distance requirements are met. The existing wall and new wall will have a 4:1 overlap. This will afford protection similar to what is provided today.

Figure 5-27 Existing and Proposed Noise Walls from Dallas Avenue to Lincoln Avenue

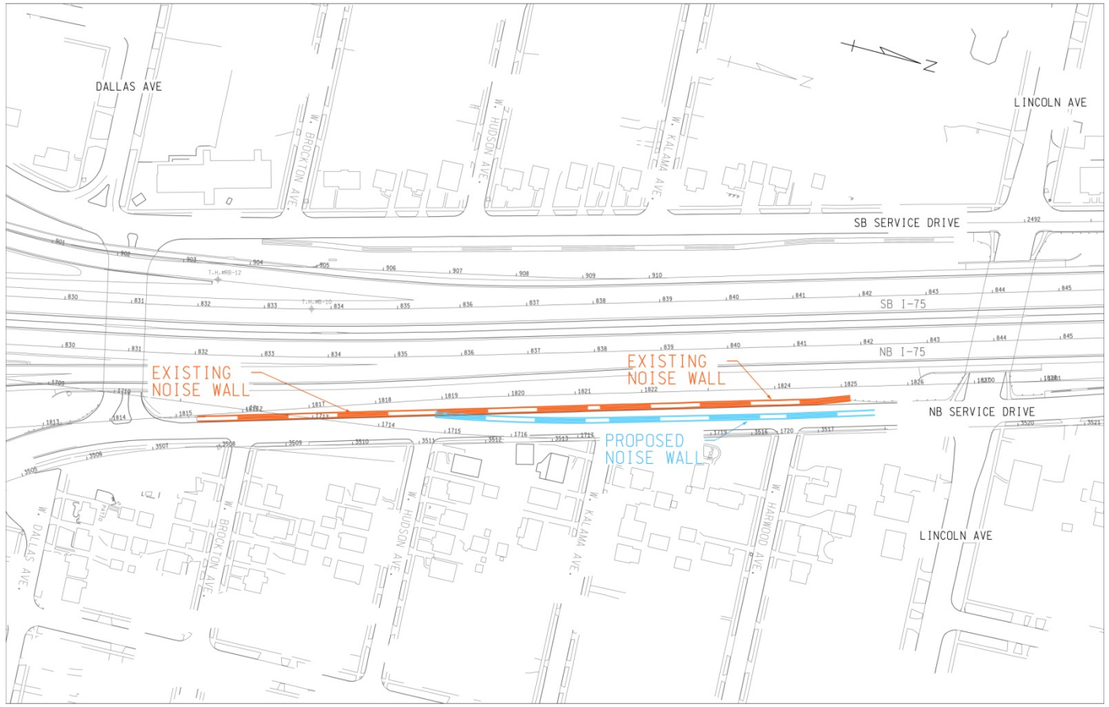


Table 5-15 TNM 2.5 Sound Levels from Dallas to Lincoln Avenues with Braid Ramp A and Relocation of Existing Noise Wall between Hudson and Lincoln Avenues

RECEIVER NAME	NO.	#DUs	EXISTING	NO-BARRIER		INCREASE OVER EXISTING		WITH BARRIER			
				Calculated	Criterion	Calculated	Criterion Increase	Calculated	Noise Reduction Calculated	Goal	Calculated minus Goal
			dBA	dBA	dBA	dB	dB	dBA	dB	dB	dB
S Dallas	1	1	0	54.6	66	54.6	10	54.6	0	8	-8
N Dallas	2	1	0	53.3	66	53.3	10	53.3	0	8	-8
S Brockton	3	1	0	54.2	66	54.2	10	54.2	0	8	-8
N Brockton	4	1	0	57.7	66	57.7	10	57.7	0	8	-8
S Hudson	5	1	0	61.8	66	61.8	10	61.8	0	8	-8
N Hudson	6	1	0	59	66	59	10	59	0	8	-8
S Kalama	7	1	0	54.2	66	54.2	10	54.2	0	8	-8
N Kalama	8	1	0	50.9	66	50.9	10	50.9	0	8	-8
S Harwood	9	1	0	57.6	66	57.6	10	57.6	0	8	-8
S Hudson E	11	1	0	52.3	66	52.3	10	52.3	0	8	-8

5.20 Cost Estimates

The cost estimate for this project is shown in Table 5-16. This table summarizes the probable opinions of cost for the I-75 reconstruction from M-102 (8 Mile Road) to south of 12 Mile Road. It is recommended that Segment 1 be built in coordination with Segment 1 of the project to the north, and the costs of both segments should be combined.

Table 5-16 Construction Costs by Construction Segment and Total

CONSTRUCTION SEGMENT	2009 CONSTRUCTION COST	PRELIMINARY ENGINEERING	CONSTRUCTION ENGINEERING	ROW	TOTAL
Construction Segment 1	$140,099,711	$8,405,983	$14,009,971	$7,100,000	$169,615,665
Construction Segment 2	$176,356,508	$10,581,390	$17,635,651	$1,000,000	$205,573,550
				TOTAL	**$375,189,215**

The construction costs were established using standard MDOT estimating procedures and pay item average unit prices from the MDOT *Weighted Average Item Price Report, 2009*. The elements that are included within the construction cost estimate include roadway elements, utilities, maintenance of traffic, structures, and right-of-way acquisition. A detailed breakdown is shown in Table 5-17. Detailed spreadsheets that include pay item breakdown per segment are included in Appendix I.

Table 5-17 Baseline Cost Estimate for I-75 from M-102 to South of 12 Mile Road

CONSTRUCTION COST (in millions)	*2009 DOLLARS*	*2026 DOLLARS*	*2030 DOLLARS*
		(Using 4% inflation)	
Segments 1 & 2			
I-75 Mainline and Ramps	$181.2	$353.0	$412.9
Roadway, Service Drives	$23.6	$46.0	$53.8
Subtotal	**$204.8**	**$398.9**	**$466.7**
Utility			
Subtotal	**$11.9**	**$23.2**	**$27.1**
Maintenance of Traffic			
Subtotal - (Alternative 3)	**$19.7**	**$38.4**	**$44.9**
Bridge			
Bridges	$43.7	$85.1	$99.6
Retaining Walls	$36.4	$70.9	$82.9
Subtotal	**$80.1**	**$156.0**	**$182.5**
Right-of-Way Acquisition			
ROW east side of I-75	$7.0	$13.6	$16.0
ROW for pedestrian structures	$1.0	$1.9	$2.3
ROW west side of I-75	$0.1	$0.2	$0.2
Subtotal	**$8.1**	**$15.8**	**$18.5**
Total (excluding engineering costs)	**$324.6**	**$632.3**	**$739.7**

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6.0 Agency Coordination

Formal agency meetings and public involvement were not a part of this phase of the project. Updates on preliminary engineering were provided to those interested. Additional public involvement and more formal technical coordination are expected to be completed during the design phase.

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7.0 Project Implementation

This section summarizes construction contracting, funding, utility coordination, value engineering, and environmental commitments.

7.1 Construction Contracting

Various methods of construction are currently used in Michigan for delivery of projects. The traditional procurement method for MDOT is Design-Bid-Build. For expedited projects, Design-Build (DB) Procurement is being used. Depending on the funding available, either delivery method is appropriate for this project.

Design – Bid – Build Procurement

1. The design is performed prior to the start of construction
2. MDOT would contract for the construction (low bid)
3. A contractor would build the project for MDOT
4. MDOT would provide construction oversight

Advantages:

1. Familiar delivery method
2. Simple process to manage
3. Low and ideally "best" price for construction
4. Price risk shifted to the contractor
5. Design plans need to be comprehensive at the outset using a fully defined scope of work

Disadvantages:

1. MDOT takes on construction quality risk (due to low bid), but mitigates with fully defined scope and specifications in design plans and strict construction oversight
2. Longer duration to finish the project from design inception
3. Price unknown until low bids are received (although estimate should be close later in design stage using unit prices from the region)
4. No design phase input from the contractor
5. Change orders and claims may increase the "best" price
6. Consolidates responsibility for construction of the project into one entity

Design – Build Procurement

Various DB procurement methods are as follows:

1. Low bid with no short-listing (one step)
2. Low bid with short-listing (two steps)
3. Best value (two steps)

The criteria for the latter two methods listed above for the short-listing process is variable and can be established to match the selection process to the project's needs. MDOT reviews the scoring criteria for approval and has certain requirements that must be met. The selection process establishes the weighting of the technical proposal/qualifications score and price.

Advantages:

1. Familiar delivery method that MDOT has used since 2008
2. Project can be advertised quickly
3. Simple project – low price for design and construction can be pursued
4. Complex project – most qualified designer and constructor can be pursued
5. Much of the price risk shifted to design-builder
6. Mechanisms are established to control price risk where appropriate (to mitigate having excessive risk priced into the project)
7. Design-build team knows and coordinates design with construction
8. Utility coordination is consolidated into single entity (design-builder) and is ongoing through both design and construction of the project

Disadvantages

1. Excessive risk priced into the project raised the costs
2. Increased risk of key design elements being overlooked due to rapid plan preparation, review, and approval process
3. May increase number of firms involved in a project (MDOT, FHWA, procurement consultant, construction engineering consultant, design-builder consultant); costs may be increased

7.2 Funding

SEMCOG's 2035 Regional Transportation Plan, Direction 2035, includes funding for improvements on I-75 from M-102 to M-59 for $1.2 billion to widen I-75 to four lanes in each direction (three exist) and reconstruct the interchanges. The project should not exceed four lanes plus an auxiliary lane. According to the plan, construction for the southern section (north of 8 Mile Road to south of 12 Mile Road) is expected to begin in 2021 with $220,751,000 in federal funds and $55,188,000 in state funds. The northern section (south of 12 Mile Road to south of M-59) is expected to commence in 2026 and includes $745,687,000 in federal funds and $185,653,000 in state funds. If additional federal or state funds become available or smaller independent projects can proceed with funding, portions of the project may proceed earlier.

7.3 Utility Coordination

A list of possible conflicts is located in Appendix C2. This information was taken from the best available plans and survey available to date. The next step is to have a utility coordination meeting with all of the utility companies after a substantial part of the design process is completed. A considerable amount of vertical information should be provided to help avoid or eliminate possible conflicts during design.

7.4 Value Engineering

No external value engineering study was performed during the project. However, based on the size and impact of the project, value engineering is expected to be completed in future phases of the project.

7.5 Commitments

The mitigation measures for this project were detailed in the FEIS (April 2005). According to the FEIS, "the goal of mitigation measures is to preserve, to the greatest extent possible, existing neighborhoods, land use, and natural resources, while improving transportation." It is expected that some impacts are unavoidable; precautions will be taken through the design and construction process to protect as many social and environmental systems as possible and minimize impacts. Table 7-1 contains the status of the FEIS Green Sheet and the status of the items mitigated with this report.

Table 7-1 FEIS Green Sheet: Project Mitigation Status

Impact Category	Mitigation Measures	Status
I. Social and Economic Environment		
a. Noise	Analysis found 10 individual reasonable and feasible noise walls, plus replacement noise walls in Madison Heights (see Table 4-14 in FEIS).	Further analysis will be needed during final design.
b. Fire Hydrant Access	MDOT will consult with local fire departments during the design phase to ensure adequate placement of and access to fire hydrants in locations where noise walls are to be constructed.	Further design details will be developed during final design.
c. Visual Effects	Noise wall construction and construction materials will be discussed with the affected public in the vicinity of potential construction.	Additional public involvement and context sensitive solutions will be developed during final design.
II. Natural Environment		
a. Wetlands	A permit will be obtained from the Michigan Department of Environmental Quality for any wetland mitigation necessary.	No mitigation for wetlands has been recognized within the study area.
b. Tree Removal/Clearing/Landscaping	Mature trees will be preserved within MDOT right-of-way (principally at fence lines), where safety requirements are met. Property owners will be notified before any trees in front of their residences are removed and will be offered replacement trees. Native vegetation will be considered in plantings.	During final design, tree impacts will need to be categorized and tree replacements budgeted. Primary impacts are along the embankments.
c. Water Quality	The project will include separation of MDOT storm water south of 12 Mile Road from the combined sewer system that now carries this storm water. Detention will be included in pump stations and possibly within the 12 Mile Road interchange allowing settling of debris and sediment. Oil/water separators will be included in the system. Storm water management will be incorporated into final roadway design.	Further drainage analysis needs to be conducted during final design to complete the sizing of the pump stations, as well as the storm sewer system to be built under the northbound service drive.
III. Hazardous / Contaminated Materials		
a. Contaminated Sites	A Project Area Contamination Survey has been completed. The Marathon Unit #711 (Service Drive Auto) at 402 South Stephenson Highway in Royal Oak has been identified for a Preliminary Site Investigation, prior to right-of-way acquisition. Any areas of contamination found by that PSI will be marked on the design plans. Additional standard mitigation measures that could apply include the following: • Testing/treatment of water from any dewatering operations before pumping to storm drains or surface water discharge points. • Testing of river bottom sediments to determine proper disposal methods. • Preparation of underground utility plans to ensure no deep utility cuts will impact any contaminated areas. Any utility cuts in contaminated areas will be reviewed to ensure proper excavation and backfill methods. • Preparation of a Risk Assessment Plan, which includes a Worked Health and Safety Plan, to reduce dermal exposure and address direct contact issues, if contaminated materials are encountered. • Closing and abandoning any monitoring wells properly.	During final design, any areas of contamination will need to be designated on the plan sheets and quantities estimated.
IV. Construction		
a. Maintenance of Traffic	Two lanes of traffic will be maintained in both directions at all times on I-75.	The recommended maintenance of traffic concept includes two lanes in each direction along I-75.
b. Vibration	Basement surveys will be offered in areas where vibration effects could occur. These areas will be identified during the design phase, where pavement and bridge removal will occur, or where piling and/or steel sheeting is planned.	Further analysis will be needed during the design phase.
c. Wetlands	Delineated wetlands are to be included on construction plan sheets so they can be flagged for avoidance during construction.	None are anticipated in the project area from M-102 to south of 12 Mile Road.
d. Parks	Reconstruction of the service drive adjacent to Maddock Park (Royal Oak) may be necessary. No grading permit will be obtained for the park.	Final assessment will be confirmed during the design phase.