Table 3-1 Summary of Geometric Design Criteria

ITEM	REFERENCE	I-75	RAMPS
DESIGN YEAR 2035 ADT	MDOT	119,000 - 167,000	Dependent on Ramp location
DESIGN YEAR HOURLY VOLUMES	MDOT	3,110 - 6,230	Dependent on Ramp location
DESIGN LEVEL OF SERVICE	AASHTO EXHIBIT 2-32, pg 84-85, 504, 508-509	DES: B MIN: C	DES: C MIN: D
DESIGN SPEED - V (MPH)	MDOT RDM 3.00.01, 3.11.03 & APPENDIX 3A AASHTO EXHIBIT 10-56, pg. 625-626	75 MPH	Speed dependent on radius and super elevation
POSTED SPEEDS (MPH)	Field Inspection Michigan Vehicle Code	70 MPH	NOT POSTED
ROADWAY CLASSIFICATION	Freeway Classification RDM 3.05.01 AASHTO pg. 09 and 503 Arterial Classification RDM 3.00.02 AASHTO pg. 444 Collector Classification RDM 3.00.03 AASHTO pg. 420-422 EXHIBIT 8-1	RURAL FREEWAY	RAMP
HORIZONTAL ALIGNMENT			
MIN. RADIUS OF CURVE (ft)	MDOT RDM 3.04.03 MDOT Standard Plan R-107-G, AASHTO EQ. 3-10, pg. 140, AASHTO EXHIBIT 3-15 pg. 147	2500 (6% max) Straight-line 2044 (7% max) Standard Plan R-107-G	Straight-line (6% max) Standard Plan R-107-G (7% max)
MIN. LENGTH OF CURVE (ft)	MDOT RDM 3.03.01B AASHTO pg. 229-230	15V (1 120') min 30V (225') des	15V (dependent on ramp design speed) min 30V (dependent on ramp design speed) des
MAX. SUPERELEVATION	MDOT RDM 3.04.03 MDOT Standard Plan R-107-G	0.00% 7.00%	0.00% 7.00%
MIN. HORIZONTAL STOPPING SIGHT (ft)	AASHTO EXHIBIT 3-1, pg. 112	820 (75 mph)	Dependent on ramp design speed
HORIZONTAL SIGHTLINE OFFSET	AASHTO EXHIBIT 3-54, pg. 227	Dependent on curve radius	Dependent on curve radius and design speed
HORIZONTAL CLEARANCE	Bridge Design Guides 6.06.01 and 6.06.05	Dependent on ADT and Side Slope	Dependent on Design Speed, ADT and Side Slope
VERTICAL ALIGNMENT			
MAX. GRADE (%)	MDOT RDM 2.02.01 Freeway: AASHTO EXHIBIT 8-1, pg. 536 Ramp: AASHTO pg. 828-829	3 3.0 - 4.0 (Level - Rolling)	5% max
ROAD MIN. GRADE (%)	MDOT RDM 2.02.01 AASHTO pg. 236	DES: 0.4, MIN: 0.25 DES: 0.5, MIN: 0.3	DES: 0.4, MIN: 0.25 DES: 0.5, MIN: 0.3
BRIDGE MIN. GRADE (%)	MDOT BDM 7.01.19	DES: 0.4, MIN: 0.3	DES: 0.4, MIN: 0.3
MIN. VERTICAL STOPPING SIGHT DISTANCE (ft)	AASHTO EXHIBIT 3-1, pg. 112	820 (75 mph)	Dependent on ramp design speed
MIN. K-VALUE (CREST)	AASHTO EXHIBIT 3-72, pg. 272	312 (75 mph)	Vertical to meet or exceed horizontal ramp design speed
MIN. K-VALUE (SAG)	AASHTO EXHIBIT 3-75, pg. 277	206 (75 mph)	Vertical to meet or exceed horizontal ramp design speed
VERTICAL UNDERCLEARANCE (ft) FREEWAY UNDER	MDOT RDM 3.12 MDOT BDM 7.01.09 MDOT RDM APPENDIX 3A	DES: 16'-3" (MIN: 16'-0") DES: 16'-3" (MIN: 16'-0") MIN: 16'-0"	DES: 16'-3" (MIN: 16'-0") DES: 16'-3" (MIN: 16'-0") MIN: 16'-0"
VERTICAL UNDERCLEARANCE (ft) FREEWAY OVER	MDOT RDM 3.12 MDOT BDM 7.01.09 MDOT RDM APPENDIX 3A	NHS 16'-0" / NON-NHS 14'-6" DES: 16'-3" (MIN NHS 16'-0" / NON-NHS 14'-6") NHS 16'-0" / NON-NHS (EXEMPT - Big Beaver) 14'-6"	DES 16'-3" (MIN NHS 16'-0" / NON-NHS 14'-6") DES 16'-3" (MIN NHS 16'-0" / NON-NHS 14'-6") NHS 16'-0" / NON-NHS 14'-6"
CROSS-SECTION ELEMENTS	**REFERENCE**	**I-75**	**RAMPS**
TOTAL NUMBER OF LANES	Field Inspection	PROPOSED 8 LANE SECTION (4 each direction)	Dependent on capacity analysis
LANE WIDTH (ft)	MDOT RDM 3.07, APPENDIX 3A, A Policy on Design Standards: Interstate System pg. 4	12'-0" 12'-0"	16'-0" for single lane ramp 12'-0" for multi lane ramps
USEABLE SHOULDER WIDTH (ft)	MDOT RDM APPENDIX 6A MDOT RDM 6.05.04C AASHTO pg. 313-315, A Policy on Design Standards: Interstate System pg. 5	DES: 12'-0", MIN: 10'-0" DES: 12'-0", MIN: 10'-0" DES: 12'-0", MIN: 10'-0" DES: 12'-0", MIN: 10'-0"	LEFT: 6' (4' PAVED), RIGHT: 8' (7' PAVED) LEFT: 5'-6" Earth, RIGHT: 7'-0" PAVED
NORMAL PAVEMENT CROSS SLOPE (%)	MDOT RDM 3.11.03E	2.00%	2.00%
	MDOT RDM APPENDIX 3A	2.00%	2.00%
	MDOT RDM APPENDIX 6A	2.00%	2.00%
NORMAL SHOULDER CROSS SLOPE (%)	MDOT RDM 3.11.03I MDOT RDM APPENDIX 3A MDOT RDM APPENDIX 6A AASHTO pg. 316, A Policy on Design Standards - Interstate System pg. 5	4.0%, 6.0% with side conditions 4.00% 4.00% 2.0% - 6.0% 2.0% - 6.0%	4.0%, 6.0% with side conditions 4.00% 4.00% 2.0% - 6.0% 2.0% - 6.0%
GORE SLOPE (%)	MDOT Geometric Design Guide 100 series MDOT RDM 3.07.02B	MAX 8.0% MAX 8.0%	MAX 8.0% MAX 8.0%
SHOULDER ROLLOVER (%)	MDOT Standard Plan R-107-G AASHTO EXHIBIT pg. 313-317	6.0% Max 8.0% Max	6.0% Max 6.0% Max
GORE ROLLOVER (%)	MDOT Geometric Design Guide 100 series MDOT RDM 3.07.02B	MAX 8.3% (DES 5.0% or less) MAX 8.3% (DES 5.0% or less)	MAX 6.0% (DES 5.0% or less) MAX 6.0% (DES 5.0% or less)
CLEAR ZONE	MDOT RDM 7.01.11	34' (1 on 6 or flatter fill slopes) 46' (1 on 5 to 1 on 4 fill slopes)	Dependent on ramp design speed
SIDE SLOPE CROSS SLOPE	MDOT RDM 2.03.01 A Policy on Design Standards - Interstate System pg. 5	Fore Slope 1 on 4, des 1 on 6 or flatter Back Slope 1 on 4 or steeper to fit within ROW Fore Slope 1 on 4, des 1 on 6 or flatter	Fore Slope 1 on 4, des 1 on 6 or flatter Back Slope 1 on 4 or steeper to fit within ROW
MISCELLANEOUS			
Ramp Terminal Spacing - Entrance to Entrance	AASHTO EXHIBIT 10-69, pg. 644	1000 ft	1000 ft
Ramp Terminal Spacing - Exit to Exit	AASHTO EXHIBIT 10-69, pg. 644	1000 ft	1000 ft
Ramp Terminal Spacing - Exit to Entrance	AASHTO EXHIBIT 10-69, pg. 644	500 ft	500 ft
Ramp Terminal Spacing - Entrance to Exit	AASHTO EXHIBIT 10-69, pg. 644	2000 ft	2000 ft
Ramp Terminal Details	MDOTGeometric Design Guide VII-370	N/A	12 Mile Rd. and 14 Mile Rd. interchanges
Ramp Acceleration Lengths (ft)	MDOTGeometric Design Guide 100-300 series AASHTO EXHIBIT 10-70, pg. 647	N/A	VARIES VARIES
Ramp Deceleration Lengths (ft)	MDOTGeometric Design Guide 100-300 series AASHTO EXHIBIT 10-71, pg. 651	N/A	VARIES VARIES
Shoulder Width Transition Rate	MDOTGeometric Design Guide 100-300 series	1:25	1:25
Guardrail Flare Rate	MDOT STANDARD PLAN R-59-E 2002 AASHTO ROADSIDE DESIGN GUIDE pg. 5-32	1:15 (70 mph)	Dependent on ramp design speed
Concrete Barrier Flare Rate	MDOT STANDARD PLAN R-49-F MDOT STANDARD PLAN R-54-F 2002 AASHTO ROADSIDE DESIGN GUIDE pg. 5-32	1:24 (Double Face Barrier) 1:20 1:20 (MIN outside shy) 1:30 (MIN inside shy)	Dependent on ramp design speed
Design Vehicle	AASHTO EXHIBIT 2-1, pg. 17	WB-62	WB-62
Bridge Cross Sections	MDOT BDM	6.05.01, 6.05.02	6.05.03, 6.05.04
Clear Vision	MDOTGeometric Design Guide GEO-300 series MDOT RDM 5.06, 5.24 AASHTO EXHIBIT 3-54, pg. 227	880'(8 Sec X Design Speed (Ft/sec))	8 X Design speed of ramp, freeway, or crossroad 300' of LA ROW along ramp centerline Consideration of "HSD" distance required

Section 4. Preliminary Design Analysis

4.1 Design Traffic Volumes

Design year (2025) traffic volumes were generated for the I-75 study area for the FEIS/ROD. A capacity analysis was then completed for a "Build" condition (construction of one additional through lane in each direction which is proposed to be used as an HOV lane) and a "No-Build" condition. The capacity analysis results for the basic freeway segments along I-75 are depicted in **Table 4-1**. As shown in the table, construction of an additional lane allows I-75 to operate at acceptable Levels of Service, except for two segments which are anticipated to operate at capacity (i.e. LOS "E") during at least one design year (2025) peak hour.

Table 4-1 Design Year (2025) Peak Hour Volumes & LOS for I-75 Basic Freeway Segments

SEGMENT	AM PEAK				PM PEAK			
	NO-BUILD		BUILD		NO-BUILD		BUILD	
	NB VOL / LOS	SB VOL / LOS	NB VOL / LOS	SB VOL / LOS	NB VOL / LOS	SB VOL / LOS	NB VOL / LOS	SB VOL / LOS
12 Mile Rd to 14 Mile Rd	6520 / F	5870 / E	7690 / E	6145 / D	7220 / F	6740 / F	7450 / E	7355 / E
14 Mile Rd to Rochester Rd	6080 / E	5420 / E	6935 / D	5860 / D	6180 / E	6590 / F	6220 / D	6855 / D
Rochester Rd to Big Beaver Rd	5800 / E	5050 / D	6655 / D	5490 / D	5460 / E	6710 / F	5450 / C	6965 / D
Big Beaver Rd to Crooks Rd	5140 / D	6130 / E	6195 / D	6570 / D	5300 / D	6500 / F	5110 / C	6745 / D
Crooks Rd to Adams Rd	4240 / D	6220 / E	4895 / C	7240 / D	5040 / D	6055 / E	5360 / C	5745 / D
Adams Rd to I-75BL	4400 / D	6350 / F	5055 / C	7370 / E	5530 / E	5555 / E	5830 / D	5055 / C

Source: The Corradino Group of Michigan, Inc.

A design year (2025) capacity analysis was also completed for the ramp/freeway junctions and weave sections along I-75 from 12 Mile Road to South Boulevard. The results of the capacity analysis are depicted in **Table 4-2** for each of the northbound I-75 ramps. As shown in the table, the ramp/freeway junctions of the Build condition are largely anticipated to operate at acceptable Levels of Service during design year (2025) peak hours along NB I-75.

The only modification to the ramp/freeway junction analysis and weave analysis from the FEIS was the modification of the I-75BL (Square Lake Road) interchange configuration to incorporate right-exiting and right-entering ramps along NB I-75. Construction of the right-exiting ramp to I-75BL created a weave section along NB I-75 between Adams Road and Square Lake Road Interchange (I-75 BL), which is anticipated to operate at LOS "C" during design year (2025) peak hours. A complete Interchange Access Justification Report for the proposed construction of right-entry and right-exiting ramps at Square Lake Road Interchange (I-75 BL), has been prepared and can be found in ***APPENDIX C: SQUARE LAKE ROAD (I-75BL) INTERCHANGE ACCESS JUSTIFICATION REPORT***.

Table 4-2 Design Year (2025) Peak Hour Volumes & LOS for I-75 Ramp Jct. & Weave Sections (NB)

NORTHBOUND RAMP	AM PEAK		PM PEAK	
	NO-BUILD	BUILD	NO-BUILD	BUILD
	RAMP VOLUME / LOS	RAMP VOLUME / LOS	RAMP VOLUME / LOS	RAMP VOLUME / LOS
Off-ramp to 12 Mile Rd	300 / F	365 / E	660 / F	825 / E
On-ramp from EB 12 Mile Rd	400 / F	470 / B	210 / F	500 / B
On-ramp from WB 12 Mile Rd	280 / F	245 / B	430 / F	235 / B
Off-ramp to EB 14 Mile Rd	660 / F	800 / B	1640 / F	2130 / C
Off-ramp to WB 14 Mile Rd	980 / D	1200 / D	450 / D	900 / C
On-ramp from 14 Mile Rd	1200 / F	1245 / B	1050 / F	1800 / B
Off-ramp to Rochester Rd	900 / F	900 / A	1570 / F	1650 / A
On-ramp from Rochester Rd	620 / D	620 / C	850 / D	880 / B
Off-ramp to EB Big Beaver Rd	730 / E	730 / E	1320 / F	1320 / D
On-ramp loop EB Big Beaver Rd	300 / weave = D	400 / weave = D	590 / weave = D	590 / weave = E
Off-ramp loop WB Big Beaver Rd	830 / weave = D	830 / weave = D	720 / weave = D	900 / weave = E
On-ramp from WB Big Beaver Rd	600 / D	700 / C	1290 / D	1290 / C
Off-ramp to Crooks Rd	1350 / E	CH2M Hill	1000 / E	CH2M Hill
On-ramp from Crooks Rd	450 / C	CH2M Hill	740 / D	CH2M Hill
Off-ramp to Adams Rd	280 / D	280 / C	100 / D	130 / C
On-ramp from Adams Rd	490 / D	490 / weave = C	370 / D	370 / weave = C
Off-ramp to I-75BL	1240 / B	1240 / weave = C	920 / B	1130 / weave = C
On-ramp from I-75BL	2650 / n/a	2650 / n/a	2770 / n/a	2770 / n/a

Source: The Corradino Group of Michigan, Inc. and URS Corporation Great Lakes

Notes:
1. assumes 12 Mile Road interchange is parclo configuration (not SPUI).
2. CH2M Hill = assumes construction of Crooks Road interchange modifications per CH2M Hill study.
3. n/a = ramp Level of Service cannot be calculated as ramp is either "lane add" or "lane drop" condition.
4. Adams Road and I-75BL ramp volumes and Level of Service are per the IAJR for I-75BL.

A design year (2025) capacity analysis was also completed for the ramp/freeway junctions and weave sections along SB I-75. The results of the capacity analysis are depicted in **Table 4-3** for each of the SB I-75 ramps. As shown in the table, the ramp/freeway junctions of the Build condition are largely anticipated to operate at acceptable Levels of Service during design year (2025) peak hours along southbound I-75.

Table 4-3 Design Year (2025) Peak Hour Volumes & LOS for I-75 Ramp Jct. & Weave Sections (SB)

SOUTHBOUND RAMP	AM PEAK		PM PEAK	
	NO-BUILD	BUILD	NO-BUILD	BUILD
	RAMP VOLUME / LOS	RAMP VOLUME / LOS	RAMP VOLUME / LOS	RAMP VOLUME / LOS
Off-ramp to I-75BL	2500 / n/a	2500 / n/a	2160 / n/a	2360 / n/a
On-ramp from I-75BL	1180 / F	1180 / n/a	1160 / C	1560 / n/a
Off-ramp to Adams Road	320 / F	320 / n/a	540 / E	540 / n/a
On-ramp from Adams Road	540 / F	540 / D	290 / D	290 / C
Off-ramp to Crooks Road	1000 / F	CH2M Hill	630 / E	CH2M Hill
On-ramp from Crooks Road	910 / F	CH2M Hill	1075 / F	CH2M Hill
Off-ramp to WB Big Beaver	1250 / F	1250 = B	650 / F	810 / C
On-ramp loop from WB Big Beaver	130 / weave = C	130 / weave = C	170 / weave = A	190 / weave = B
Off-ramp loop to EB Big Beaver	750 / weave = C	750 / weave = C	310 / weave = A	390 / weave = B
On-ramp from EB Big Beaver	790 / F	790 / B	1000 / F	1230 / C
Off-ramp to Rochester Road	1000 / D	1000 / D	1060 / F	1060 / E
On-ramp from Rochester Road	1370 / D	1370 / C	940 / F	950 / C
Off-ramp to WB 14 Mile Road	210 / D	245 / D	250 / F	350 / D
Off-ramp to EB 14 Mile Road	860 / D	1050 / C	800 / F	1100 / D
On-ramp from 14 Mile Road	1520 / F	1580 / C	1200 / F	1950 / C
Off-ramp to 12 Mile Road	500 / E	395 / D	390 / F	475 / E
On-ramp from WB 12 Mile Road	480 / E	470 / C	490 / F	555 / D
On-ramp from EB 12 Mile Road	400 / F	425 / C	540 / F	610 / D

Source: The Corradino Group of Michigan, Inc. and URS Corporation Great Lakes
Notes: 1. assumes 12 Mile Road interchange is parclo configuration (not SPUI).
2. CH2M Hill = assumes construction of Crooks Road interchange modifications per CH2M Hill study.
3. n/a = ramp Level of Service cannot be calculated as ramp is either "lane add" or "lane drop" condition.
4. Adams Road and I-75BL ramp volumes and Level of Service are per the IAJR for I-75BL.

Crash patterns were reviewed and compared with crash patterns that were identified in the FEIS. No new crash patterns were noted.

4.2 HOV Implementation and Enforcement Overview

4.2.1 HOV Implementation

The proposed fourth through lane along I-75 within the project limits will be dedicated to use only by high-occupancy vehicles peak traffic hours, as originally detailed in the FEIS. A survey was done of the current practice of High Occupancy Vehicle (HOV) lane design used for select facilities in the United States, . The purpose of this study was to obtain a general overview from a cross section of agencies responsible for HOV lane management including HOV lane design. Specifically, HOV lane management agencies were contacted in Minnesota, Georgia, Virginia, California and Washington. Prior to contacting those selected agencies, URS staff developed a questionnaire related to general facility design. Please see ***APPENDIX D: HOV QUESTIONARE*** for a copy of the questionnaire, and ***APPENDIX E: HOV DESIGN OVERVIEW, SUMMARY TABLE, and PLAN SHEETS*** for a summary table that compares the various operational characteristics from the States surveyed.

The HOV facilities investigated included:

- Minnesota – Twin Cities, I-35W HOV Lanes
- Georgia – Atlanta Region: I-20, I-75, I-85 HOV Lanes
- Virginia – Hampton Roads: I-64 HOV Lanes
- California - State-wide
- Washington - I-90, I-405, I-5, SR 520 HOV Lanes

For the purpose of this study, HOV delineation/separation was defined as follows:

- Striping-skip striping used for lane delineation
- Buffer-typically double stripes separating HOV lanes from mixed flow lanes
- Barrier-concrete barrier separating HOV lanes from mixed flow lanes

The following provides a summary of the various operational aspects of the facilities reviewed as well as recommendations.

HOV Justification – Some States have established criteria for determining when an HOV lane is justified and operational criteria of its ongoing operation. These criteria are typically in vehicular volumes, operating speed and time savings. *For Michigan it is recommended that at least a one minute time savings per mile be provided to HOV users over users of general purpose lanes in order to justify the need for the HOV lane.*

How do the HOV lanes begin and end – The general practice is to construct HOV lanes by adding a lane that would start to the inside of the general purpose lanes as opposed to a general purpose lane becoming a HOV lane and requiring non-HOV traffic to then exit the HOV lane. Signing and pavement markings are used to communicate to the drivers where the HOV lane is beginning or ending, the number of passengers in the vehicle required to use the HOV lanes, what types of vehicles are eligible to use the HOV lanes, the hours of operation of the HOV lanes, and the penalty to violators. *For Michigan, it is recommended to use fixed signage and striping in lieu of ITS elements as few, if any, additional benefits would result from the use of the ITS elements for HOV purposes only.*

How are HOV lanes delineated – There are three types of HOV facilities used most frequently: 1) barrier-separated, 2) buffer-separated, and 3) contiguous access. Barrier-separated generally use a concrete barrier between the general purpose lanes and the HOV lanes. Ingress and egress to the HOV lanes is typically achieved with at-grade channelized openings in the physical barriers. Buffer-separated facilities use either pavement marking stripes and/or flexible delineator posts to separate the general purpose lanes from the HOV lanes. Ingress and egress access points are generally implemented with a skip-dash pavement marking stripe for the length of the ingress/egress area in between the buffer for a sufficient distance to allow for vehicles to enter and exit the HOV lanes. For contiguous access lanes, HOV lanes are delineated with a skip-dash pavement marking stripe that separates the HOV lanes from the general purpose lanes. If the facility is a part-time HOV facility, typically the pavement marking stripe is the same as the lane line pavement marking stripes separating the general purpose lanes. The HOV lane is typically augmented with diamond-shaped HOV lane pavement markings in the center of the HOV lane to further delineate it from the general purpose lanes, **Figure 4-1**. For full-time contiguous access facilities, there is generally a wide, single skip-dash pavement marking stripe or two standard-width skip-dash pavement marking stripes to delineate the HOV lane.

For Michigan, skip-dash pavement marking striping is recommended for transfer facilities with solid double pavement marking stripes between transfer facilities. This configuration should reduce the opportunities for violation.

Figure 4-1 Example of HOV Lane with Striping

What constitutes an HOV vehicle – The 2+ vehicle occupancy requirement was established by federal regulation. A State agency that has jurisdiction over the operation of an HOV facility continues to have the authority to establish the occupancy requirements of vehicles operating on the facility (such as requiring 3+ vehicle occupancy requirements). Typically, vehicles with the number of occupants specified on signs may use HOV lanes, with the exception of trucks weighing over a pre-defined gross vehicle weight. Buses, motorcycles, and all law enforcement and emergency vehicles are generally allowed to use the lanes regardless of the number of occupants. While federal guidelines allow single occupant inherently low emissions vehicles (ILEVs) - which include hybrids - into HOV lanes, such permission is up to individual states based upon preservation of good operating conditions in the HOV lanes. In some states such as Washington and parts of Virginia, HOV lanes are already full during the busiest commuting periods, and the State therefore does not offer this incentive for low emission and alternative energy vehicle owners. Nationally, the federal government defines low emission and alternative energy vehicles as follows for the purpose of granting access to HOV lanes. Low Emission & Energy Efficient Vehicles – A vehicle that has been certified as meeting the Tier II emission level under section 202(i) of the Clean Air Act for that make and model year and is certified by the EPA to have achieved not less than a 50% increase in city fuel economy or not less than a 25% increase in combined city/highway fuel economy relative to a comparable vehicle that is an internal combustion gasoline fueled vehicle; or is an alternative fuel vehicle. Inherently Low Emission Vehicles (ILEV) – Any kind of vehicle which, because of the inherent properties of the fuel system design will not have significant evaporative emissions, even if its evaporative emission control system has failed. These vehicles are certified by the Environmental Protection Agency pursuant to 40 CFR 88.311-93 and labeled pursuant to 40 CFR 88.312-93. Alternate fuel vehicle – A vehicle that is operating on (1) methanol, denatured ethanol, or other alcohol; (2) a mixture containing at least 85% of methanol, denatured ethanol, and other alcohols by volume with gasoline or other fuel; (3) natural gas; (4) liquefied petroleum gas; (5) hydrogen; (6) coal derived liquid fuels; (7) fuels (except alcohol) derived from solar energy; or (8) any other fuel that the Secretary prescribes by regulation that is not substantially petroleum and that would yield substantial energy security and environmental benefits, including fuels regulated under 10 CFR 490.

For Michigan, 2+occupancy is recommended as this is typically standard practice. The minimum occupancy requirement will need to be monitored to determine if 3+ is warranted. If the HOV lanes are getting too congested with the 2+ occupancy, to provide at least a one minute time savings per mile, MDOT may need to implement a 3+ occupancy requirement. Additionally, if the state wishes to encourage the use of fuel efficient vehicles, consideration should be given to allowing these types of vehicles in the HOV lanes with less than the required number of passengers. MDOT may also wish to allow public transit vehicles (and possibly privately operated buses and coaches carrying passengers), motorcycles, vanpools, and/or all law enforcement and emergency vehicles to use the HOV lanes at all times.

Hours of operation – The determination of whether HOV lanes should be operated part or full-time is dependent on several factors. The factors include traffic safety, amount and duration of congestion, political and public considerations, air quality concerns, enforcement issues, and geographical dispersions of trip patterns (radial routes to or from a central business district or a suburban grid pattern with multiple business districts). Most of all, the need to maintain consistent and uniform HOV operation on a corridor-by-corridor and a region-wide basis is required to avoid motorist confusion.

For Michigan; It is recommended HOV lanes be in effect a minimum of two hours in the a.m. and p.m. each day. Additional analysis may be conducted after the installation of HOV lanes to determine if the hours of operation should be expanded longer than two hours in the morning and afternoon rush hours. This can be accomplished by calculating the times of day at which demand decreases and the HOV lanes cease to provide the minimum one minute time savings per mile over the general purpose lanes. However, operating the HOV lanes 24 hours per day, seven days a week may minimize some of the potential problems of enforcement.

Maintenance problems associated with HOV lanes – None of the states surveyed indicated that there was specific maintenance problems associated with the HOV lanes in their state.

Design Criteria – Several states have established and documented specific design criteria for HOV lanes that cover lane width, shoulder width, minimum length of an HOV lane, frequency of ingress/egress, advance signage, **Figure 4-2** and type of delineation.

For Michigan, a minimum of 12 foot HOV lanes are recommended and a full width shoulder (minimum 10 foot) is recommended on the left side of the HOV lane to allow for an area for enforcement, vehicle breakdowns, etc.

Prior to implementing HOV lanes, a traffic study is recommended to estimate the expected traffic volumes for the HOV operation.

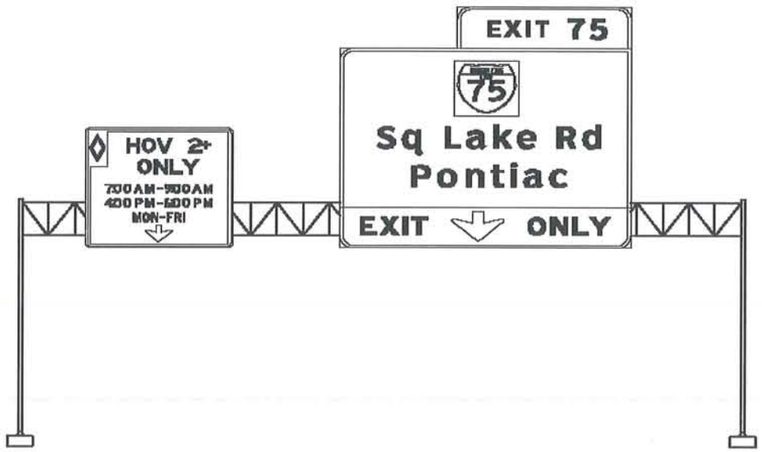

Figure 4-2 Sample HOV Sign at Square Lake Road Interchange

4.2.2 HOV Facility Design Overview

The following section provides a general description of HOV lane facilities in Minnesota, Georgia, Virginia, California, and Washington and an overview of the design elements of those facilities that are consistent with the recommendations presented to MDOT for consideration with respect to the implementation and operation of HOV facilities on I-75. A full overview of all the design elements of these facilities, including elements that differ from the recommendations made to MDOT, is provided in ***APPENDIX E: HOV DESIGN OVERVIEW, SUMMARY TABLE, and PLAN SHEETS***.

1. Minnesota

Minnesota – I-35W HOV Facility Overview

The I-35W HOV facility operates as concurrent flow with one lane in each direction. The HOV facility operates NB for a distance of 5.7 miles and SB for 7.5 miles. The HOV lanes are the left most lane. The HOV facility does not require any special maintenance practices because there are concurrent lanes and no barrier separation.

The HOV lanes are designated with painted "diamonds". Initial access points are designated prior to entry of the HOV facility by fixed static signs noting the approach to the HOV lane, hours of the HOV lane, and allowed vehicles. The I-35W corridor, including the HOV lanes and general purpose lanes, is also instrumented with a freeway management system, which includes cameras, vehicle detection, changeable message signs, and freeway service patrol.

Both directions of the I-35W HOV facility operate as HOV lanes from 6:00 a.m. to 9:00 a.m. and 3:00 p.m. to 6:00 p.m. on weekdays. At all other times the HOV lanes are open to general traffic. Allowed vehicles during operation of the HOV facility include carpools of two more people (2+), buses, vanpools, and motorcycles. HOV operating hours were determined based on peak AM and PM commute times.

2. Georgia

Atlanta – I-20, I-75, and I-85 HOV Facilities Overview

The Atlanta HOV facilities are set up as concurrent flow with one lane in each direction. Designed as buffer-separated facilities, the HOV lanes are separated from the general purpose lanes with painted solid double lines or broken lines. General purpose lanes are 11 feet and 12 feet wide, and HOV lanes are 11 feet wide. HOV lane shoulders have a minimum width of 4 feet. Shoulders are used for emergency pull offs and for enforcement purposes where there is sufficient shoulder width to do so.

No special widening was needed to accommodate the HOV lane striping. Lanes were added to provide for the HOV lanes versus taking away general purpose lanes to accommodate the HOV lanes. The buffer width between the HOV lanes and general purpose lanes is 2 feet. Double solid lines limit the continuous vehicular movement between the HOV lane and general purpose lanes. This buffer-separated design is primarily a safety measure that Georgia Department of Transportation (GDOT) believes limits the accidents caused from continuous merging into and out of the HOV lanes. They also believe continuous merging leads to congestion in the HOV lanes and the general purpose lanes while less merging leads to a smoother flow in all lanes and less overall congestion. There is no specific minimum length of HOV segment or distance between ingress and egress points. The shortest HOV segment is 7.5 miles. GDOT believes that the HOV lanes operate at their peak level when they are used for longer distances. I-20 has a total of 17 lane miles, I-75 has a total of 7.5 lane miles, and I-85 has a total of 47.8 lane miles.

HOV lanes are identified by diamond-shaped pavement markings and overhead signs located on Interstates 20, 75 and 85. Indicators of approach to and the end of an HOV lane include "HOV Ends" pavement marking in some locations and signs on the median wall and overhead above the HOV lane. Ingress and egress is limited to designated direct merge access points as indicated by double skip-dash pavement stripes, as well as at the beginning and ending of the HOV lane. Access points are provided based on general purpose interchange access points, which are typically located ¼ to ¾ miles from the interchanges. GDOT believes that these design elements will encourage the legal use of HOV lanes and discourage use of the HOV lane as a passing lane for single occupancy vehicles.

Both fixed and variable message signs are used for HOV lanes. The variable message signs are overhead and serve both the general purpose lanes and the HOV lanes. Fixed signs are posted at the median and also overhead. Variable message signs will periodically display a travel time savings for using the HOV lane over the general purpose lanes. Camera monitoring and speed detection is available in some locations. Georgia NaviGAtor provides other general information for the HOV system as well as camera shots and speeds for the entire corridor not specific to the HOV lanes at http://www.georgia-navigator.com/. ITS elements, such as cameras and vehicle detection, are shared for both HOV and general purpose lanes.

Vehicles allowed to use the HOV facility include two or more people (2+), certified alternative fuel vehicles, motorcycles and emergency vehicles. To use the HOV lanes, owners of alternatively fueled vehicles must obtain an alternative fuel license plate by completing a vehicle request form, stating the type of fuel used to propel the vehicle.

There are no known maintenance problems or special considerations for the existing HOV lanes. However, GDOT has received a grant from the USDOT to convert an existing HOV corridor to a HOT (High Occupancy Toll) managed lane. With the conversion of this lane, GDOT intends to double the presence of GDOT HERO units (incident response) along the entire corridor.

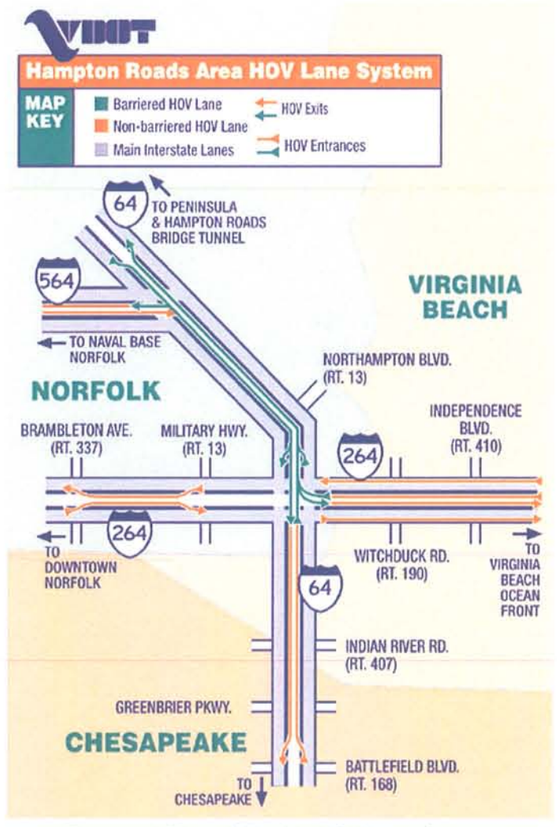

Figure 4-3 Map of Virginia HOV Lane System

3. Virginia

Virginia/Hampton Roads – I-64 Facility Overview

I-64 between I-264 to I-564, approximately 18 lane miles in length, includes a two-lane, reversible HOV facility separated by concrete barriers from the general purpose lanes. I-64, to the south of its interchange with I-264 includes concurrent, buffer-separated HOV facilities with one HOV lane in each direction separated from the general purpose lanes by double skip-dash pavement stripes, thus creating a 1 foot buffer. I-264, to the east and west of its interchange with I-64, shares the same design characteristics. HOV lanes were added to the existing freeway system without taking away general purpose lanes. In some cases the median was used or replaced to construct the HOV lanes.

Sections of the HOV lanes are equipped with changeable message signs that display occupancy requirements for using the HOV lanes, the hours HOV restrictions are in effect, and to indicate where it is permissible to enter and exit the HOV facility. The electronic signs are used in conjunction with fixed signs that provide the same information. Other ITS applications used in both the HOV lanes and general purpose lanes include CCTV, a remote controlled gate system (used for the reversible HOV facility only) and vehicle detectors (side-fire radar and acoustic detectors).

On the I-64 and I-264 buffer-separated facilities during non-operational hours, the HOV lanes are open to all traffic. The I-64 and I-264 buffer-separated facilities operate in the WB direction during the AM peak hours from 6:00 a.m.-8:00 a.m. and in the EB direction during PM peak hours from 4:00 p.m.-6:00 p.m. Conversely, the I-64 reversible barrier-separated HOV facility has two lanes, operating in the WB direction during AM peak hours and the EB direction during PM peak hours.

Allowable HOV vehicles include those vehicles occupied by two or more occupants (2+), motorcycles, emergency vehicles, buses designed to carry 16 or more people, and taxi cabs. Virginia allows vehicles with clean fuel license plates to use the HOV lanes without meeting the minimum occupancy requirements. To obtain the special plates, a vehicle owner must submit an application and documentation to the Virginia DMV headquarters Special License Plate and Consignment Center. On July 1, 2006, the DMV began issuing a new clean fuel vehicle license plate. Clean fuel vehicles licensed with clean fuel plates issued before July 1, 2006 are allowed to use the HOV lanes in Northern Virginia during HOV hours (6:00 a.m. – 9:00 a.m.; 3:30 p.m. – 6:00 p.m., Monday – Friday), however, clean fuel vehicles with clean fuel plates purchased after July 1, 2006 are not allowed to travel on the Northern Virginia HOV lanes without three people on board. All clean fuel vehicles with clean fuel plates can use all other HOV lanes in Virginia during HOV hours.

4. California

California –HOV Facilities Overview

The California HOV facilities are set up as concurrent flow, generally with one lane in each direction. Barrier-separated facilities are found on very few California highways.

Northern California

In Northern California, the HOV facilities in Caltrans Districts 3 and 4 generally operate only during the peak periods and feature contiguous access with skip-dash pavement marking stripes, which means the HOV traffic is free to enter and exit the lane throughout the length of the HOV facility.

Southern California

In Southern California, the HOV facilities in Caltrans Districts 7, 8, 11, and 12 typically use pavement marking stripes to create a buffer and thus separate the HOV lanes from the general purpose lanes. The HOV lanes generally operate 24 hours a day, 7 days a week.

All of the HOV facilities in Southern California operate 24 hours a day, 7 days a week, with the exception of SR-14, which operates as a demonstration project for part-time HOV operation from 5:00a.m.-9:00 a.m. in the SB direction and 3:00 p.m.-7:00 p.m. in the NB direction. The vast majority of the HOV facilities in Southern California are buffer-separated facilities, which means that the HOV lane is separated from the adjacent mixed-flow lanes by a combination of reflective markers and solid yellow and white painted stripes per the California Vehicle Code. These facilities offer restricted access entrances and exits that are clearly delineated with a skip-dash pavement marking stripe, and the access points are normally about 1,200 feet long.

Generally, ingress and egress access points are intended to serve two or three interchanges. Assuming interchange spacing is approximately ½ mile, the access points are generally spaced about 1 to 2 miles apart. However, Caltrans has no set standard for this spacing; it is dependent primarily on HOV demand. Two facilities only allow ingress and egress at the beginning and end of the HOV lane facility.

Statewide HOV design characteristics

Caltrans design guidance calls for lanes to be 12 feet wide, but typically various geometric constraints require the lane width to be reduced to 11 feet. The far right lanes are typically kept at 12 feet in order to accommodate large trucks, which are sometimes restricted by law to those lanes. Caltrans typically provides one HOV lane in each direction, although there is one HOV facility and one HOT facility that provide two lanes in each direction. Outside shoulder widths are typically 10 feet. Inside shoulder widths are generally 5 feet but are typically reduced to as little as 2 feet. Inside shoulders are for emergency purposes where sufficient width is available. Initially, inside shoulders were widened to as much as 14 feet in spots to provide space for enforcement officers to pull violators over and issue citations. However, the California Highway Patrol (CHP) has recently indicated within the past year that they will pull violators out of the HOV lane and use the right shoulder for enforcement to issue citations regardless of the space available on the inside shoulder. In cases where the outside shoulder is not the 10 foot standard, they have requested that enforcement pullouts be provided. The CHP has indicated that the reasons for this new approach are twofold. The California Vehicle Code requires that if an emergency vehicle is flashing its lights that vehicles are supposed to pull to the right and not to the left. The other concern is for officer safety; the officers are required to operate next to high-speed traffic on the inside shoulder of the HOV lane, and it is also difficult and dangerous to re-enter the high-speed traffic stream after stopping a violator.

Caltrans uses fixed signage mounted in the median or on a median barrier in order to communicate to drivers such pertinent information as ingress and egress points, hours of the HOV lane, and permitted vehicles. Most of the signage is regulatory (black-on-white). HOV signage starting at least ½ mile in advance of the beginning of the lane announces that the HOV lane is ahead, including hours of operation. Subsequent signage displays the occupancy requirement and the fine for violation.

There is no minimum length of an HOV segment, either from beginning to end or between ingress/egress points. However, it should be noted shorter segments may have little utilization; leading to the public perception that the HOV lane is not being used.

The practice in California has been to construct HOV lanes by adding a lane on the inside of the general purpose lanes as opposed to a general purpose lane becoming a HOV lane and requiring non-HOV traffic to then exit the HOV lane. There was an unsuccessful attempt at converting a general purpose lane to HOV in the mid-1970s, and since then, Caltrans has tried to avoid doing this. Where a general purpose lane has been converted to an HOV lane the main reason has been to provide HOV system continuity where there are limited or no negative consequences.

Generally, an HOV lane begins on the left of the inside general purpose lane as a new lane, at a 90-degree angle to full width. For a buffer-separated facility, a minimum of 1,200 feet of skip-dash white line is offered on the right before the painted buffer begins to provide consistency of appearance with ingress and egress areas. The beginning of any buffer typically begins no earlier than a distance equivalent to 600 feet per lane change required to enter the HOV lane from the nearest on-ramp. Additional skip-dash white lines may be desired if visibility of the striping is compromised within the 1,200 feet distance; for example, at locations where vertical and horizontal curves are present.

The HOV lanes generally end in a continuing lane, which enables the HOV traffic to continue without a merge. If the HOV lane has to be merged back into the freeway traffic, a minimum of 1,200 feet of skip-dash white line is provided before the end of the HOV lane taper begins. Additional length is desired to achieve enhanced or improved visibility of skip-dash striping at location where horizontal or vertical alignments vary. Typically, no less than 600 feet per lane change is provided from the end of the buffer to the next off-ramp or connector. Where feasible, greater length is provided. In addition, the outside general purpose lane is sometimes dropped at an off-ramp if engineering analysis has determined that congestion does not result near the lane drop location. Typically, this is only done where there is a high demand exiting the off-ramp where the lane drop is implemented.

For buffer-separated facilities, access to and from the HOV lane is provided at every freeway-to-freeway interchange. Ingress and egress to State highways and major arterials is provided where demand exists and where operation is not severely impacted. Ingress and egress locations are typically located on a tangent and away from CHP enforcement areas whenever possible. District Traffic Operations personnel and the Headquarters' Traffic Liaison are consulted early in the design phase to ensure ingress and egress locations are placed at optimal locations.

With respect to ITS elements used in conjunction with HOV lanes, in addition to changeable message signs, loop detectors or roadside radar units measure speeds and volumes. Closed-circuit TV cameras allow for the monitoring of congestion and incidents.

Caltrans typically defines an allowed HOV as 2 or more persons per vehicle. Some facilities have a 3 person minimum, and on most of those, two-seater vehicles with 2 occupants are acceptable. Motorcycles are allowed. Use of these lanes with only one occupant in a clean fuel vehicle requires an identification sticker issued by the California Department of Motor Vehicles; however the number of decals issued is limited to prevent the number of solo drivers in clean fuel vehicles from significantly degrading HOV lane performance. These stickers will be valid until January 1, 2011 at which time this access program will expire. Access for cleaner hybrid vehicles under this program was limited to the first 85,000 applicants. This limit has been reached and there are no further extensions of this program anticipated.

There are no known maintenance problems related to the lanes. The urban areas of California are typically not subject to severe weather conditions such as snow.

5. Washington

I-90, I-405, I-5, SR 520 HOV and SR 167 HOT Facility Overview

The Washington HOV facilities are set up as concurrent flow, one lane in each direction in general. The HOV facilities are all located in the Greater Puget Sound area. Washington State Department of Transportation (WSDOT) has established performance standards (see below) to ensure that the state's freeway HOV system helps provide reliable travel time and dependability for transit users, vanpoolers, and carpoolers. The speed and reliability of the HOV system are monitored year-round.

By and large, freeway HOV lanes are not barrier-separated; they are denoted by delineation and signing only, and users can enter and exit the HOV lanes anywhere they choose. The exceptions are the SR 167 HOT lanes, a buffer-separated facility using double solid white pavement marking stripes to separate the general purpose lanes from the HOV lanes with designated access points provided approximately 1½ to 2 miles apart; and the I-5 & I-90 Express Lanes, which are a barrier-separated, multi-lane, mixed use facilities, with no mainline access points provided except at either end of the HOV facility. HOV facilities typically have the following characteristics:

- HOV lanes are typically 12 feet wide.
- Striping is white and 8 inches wide.

- General traffic lanes are 11 to 12 feet wide, and the width of the inside shoulder varies from 2 to 10 feet.
- Where practical, inside shoulders are used for emergency purposes as well as enforcement. Much of the Washington State urban freeway system is posted as a tow away zone – shoulder parking is prohibited.

Almost all of the HOV lanes begin as an added lane. In general, lanes were added to provide HOV lanes with the exception of a stretch on I-90 where a combination of take-a-lane and utilization of a portion of the shoulder was used to create HOV lanes.

WSDOT guidelines dictate that the HOV segment must be of sufficient length to provide a minimum of a 5 minute travel time advantage during the peak hour while meeting the performance standards previously referenced. In general, a mainline HOV lane would not be implemented if it was not at least 2 to 3 miles long.
With respect to ITS elements used in conjunction with HOV lanes, all general traffic and HOV lanes use standard ITS elements including detection, cameras, and VMS. As mentioned, SR 167 is a HOT lane system, and the I-5 and I-90 Express Lanes are both reversible and thus include dynamic signage and gates, which affects HOV access but is in place to control all vehicular access.

WSDOT typically defines an HOV as 2 or more persons per vehicle, while one facility has a 3 person minimum. The Washington Administrative Code provides that vehicles with the number of occupants specified on signs may use HOV lanes, with the exception of trucks weighing over 10,000 pounds gross vehicle weight. Recreational vehicles are not subject to this weight limit. Buses, motorcycles, and all law enforcement and emergency vehicles are allowed to use the lanes regardless of the number of occupants. While federal guidelines allow single occupant inherently low emissions vehicles (ILEVs) - which include hybrids - into HOV lanes, such permission is up to individual states based upon preservation of good operating conditions in the HOV lanes. Currently most of WSDOT's HOV lanes are already full during the busiest commuting periods, and WSDOT therefore does not offer this incentive for hybrid or other green vehicle owners.

With respect to any known maintenance problems related to the HOV lanes and special considerations for snow removal, snowfall is infrequent within the central Puget Sound region where the HOV lanes are located.

Manual of Uniform Traffic Control Devices Guidance on Traffic Control Devices for HOV Lanes

The Manual on Uniform Traffic Control Devices (MUTCD) provides guidance and standards related to the designation, operational considerations, signing, pavement markings, and other considerations for preferential only lanes, including HOV lanes, is provided in Sections 2B.26, 2B.27, 2B.28, 2C.52, 2E.59, 3B.22, and 3B.23.

- Section 2B.26 introduces Preferential Only Lane signs, which shall be used, in combinations with Preferential Lane pavement markings, to advise road users about lanes designated for special traffic uses such as HOVs.
- Section 2B.27 provides guidance on operational guidelines and eligibility requirements for HOV lanes and the need for coordination with FHWA "if a significant operational change is proposed that could reasonably be expected to affect a specific HOV lane or portions of the HOV system that were funded or approved by FHWA."
- Section 2B.28 provides guidance on Preferential Only Lane sign applications and placement, including specific guidance for barrier separated lanes, buffer-separated lanes, concurrently-flow lanes, and direct access ramps to preferential only lanes.
- Section 2C.52 discusses the situations when a HOV supplemental plaque may be used with a combination with a warning or regulatory sign to warn drivers in a HOV lane of specific condition.
- Section 2E.59 provides guidance on guide signs on freeways and expressways for preferential only lanes and provides examples of ground-mounted and overhead advance guide signs, guide signs, and exit signs applicable to HOV lanes and direct access ramps to HOV lanes.
- Section 3B.22 provides guidance on word and symbol markings for preferential lanes.
- Section 3B.23 provides guidance on longitudinal markings for motor vehicles for preferential lanes.

4.2.3 HOV Enforcement

This section summarizes a current practice survey of select HOV lane facility enforcement techniques in the United States. The purpose of this analysis is to obtain a general overview from a cross section of agencies responsible for HOV enforcement. Specifically, HOV lane management agencies were contacted in Minnesota, Georgia, Virginia, California and Washington. Prior to contacting these selected agencies, URS staff developed a questionnaire related to general facility design and enforcement techniques. The questionnaire was completed to the extent possible based on readily online documentation prior to forwarding to the agency representative. Please see ***APPENDIX D: HOV QUESTONNAIRE*** for a copy of the questionnaire.

This section reviews the enforcement efforts of the following states and study's:

- HOV Facility Enforcement Overview
  - Minnesota – Twin Cities, I-35W HOV Lanes
  - Georgia – Atlanta Region: I-20, I-75, I-85 HOV Lanes
  - Virginia – Hampton Roads: I-64 HOV Lanes
  - California – State-wide
  - Washington – I-90, I-405, I-5, SR 520 HOV Lanes
- Excerpt from HOV/Managed Use Lane (MUL) Pooled Fund Study – "HOV Enforcement Handbook"

HOV enforcement is typically the jurisdiction of the state highway patrol. In the states surveyed, the state highway patrols use both roaming patrols and patrol vehicles stationed at strategic locations to help identify violators. Where sufficient inside shoulder width exists, patrol vehicles will park and scan for violators. Additionally, in Georgia, the state highway patrol uses specially designed accident investigation sites in the median as a location from which they can scan for violators. They also park their vehicles on on-ramps and scan for violators at ramps that have HOV-bypass lanes. Georgia also uses video surveillance to identify violators.

Each of the states surveyed indicated that the state highway patrol pull violators over and issues a citation. When pulling a violator over to issue a citation, the state highway patrol will use the inside shoulder of the HOV lane if sufficient shoulder width exists. Otherwise, patrol vehicles will pull violators over to the right shoulder or, as is the case in Georgia, into an accident investigation site if possible.

The states surveyed generally define a violator to be any person who operates a vehicle on an HOV lane with less than the required minimum number of occupants or does not have the required identification on their vehicle (sticker on license plate or vehicle) to designate their vehicle as a special fuel vehicle eligible to use the HOV lane with less than the required minimum number of occupants.

The fines levied against unauthorized HOV lane violators vary significantly from state to state. Virginia, California, and Georgia use an escalating fine structure based on the number of violations in a 12-month period; Virginia and Georgia also issue points on a driver's record for violations.

As mentioned in the previous section, most HOV facilities must make do with budgets that support little more than routine enforcement. Enforcement is an essential component of HOV lane operations. The presence of stationary and roving patrols on an HOV facility helps ensure that vehicle-occupancy and eligibility requirements are adhered to and that the lane operates as intended. Light, consistent (but not predictable) enforcement appears to be an effective approach for reducing HOV violations and related safety incidents. The most effective enforcement programs result in manageable violation rates that keep the HOV lanes operating as intended without overburdening the enforcement staff or budget.

Violation rates vary depending on the type of separation between the HOV lanes and the general purpose lanes. HOV lanes with barriers or buffers appear to have lower violation rates than facilities with striping that allow continuous ingress and egress. A target for a violation rate on facilities with striping for continuous access appears to be on the order of 10% to 20% and worse, depending on the amount and structure of the fines and penalties.

Using routine enforcement with a combination of limited special and selective enforcement, as practiced in Southern California on its buffer-separated facilities, when coupled with significant fines and penalties using an escalated scale, appears to be the most cost conscious and effective enforcement plan. When successfully deployed, this plan can reasonably achieve violation rates in an acceptable 5%-10% range or better.

APPENDIX E: HOV SUMMARY TABLE and PLAN SHEETS contains a summary table that compares the various enforcement characteristics from the states surveyed.

1. Minnesota

Minnesota – I-35W HOV Facility Enforcement Overview

Minnesota does not assign primary jurisdiction for enforcement of HOV/HOT lanes to any particular agency. The Minnesota State Patrol, as well as county and municipal enforcement agencies, has authority to enforce traffic laws on trunk roadways and toll facilities. The HOV lanes are the left most lane, and are separated from two 12 foot general purpose lanes by a skip-dash pavement striping. Access to and from the I-35W HOV facility in both directions is continuous, thus allowing motorists to enter and exit the HOV facility at any location.

Minnesota defines a violator to be any person who operates a vehicle on an HOV lane with less than the required minimum number of occupants. The fine for unauthorized use of an HOV lane is $130.00. The concurrent flow lanes on I-35W had high average peak period violation rate of 33% to 41% (2006). Average peak period violation rates along the barrier-separated section of the I-394 facility ranged from 6% to 12%, while the concurrent flow sections reported rates of 19% to 24%.

HOV offenders are identified during roving (routine) patrols. Violators are pulled over and issued a citation. However, the relatively open design of the concurrent flow lanes has made enforcement difficult because the design allows violators an easy opportunity to leave the HOV lane. Apprehending violators on the median shoulders often results in severe congestion on the general purpose lanes due to onlooker delay. Enforcement has therefore been restricted to roving patrols, which requires law enforcement to pull violators across the general use lanes to the far right shoulder. This policy has discouraged law enforcement from engaging in anything more than sporadic attempts to catch violators.

There is currently no source of enforcement funding (e.g. normal or special legislative appropriations) or special budget for the I-35 HOV facility and HOV fine revenue does not go towards continued enforcement efforts. Refer to the excerpt at the end of this memorandum from the HOV Lane Enforcement Handbook (2006) for an explanation of funding and revenue related to HOV facilities.

2. Georgia

Atlanta – I-20, I-75, and I-85 HOV Enforcement Overview

HOV enforcement is the jurisdiction of the Georgia State Patrol (GSP), a division of the Georgia Department of Public Safety. The GSP uses both roaming patrols and patrol vehicles stationed at strategic locations to help identify violators. Where sufficient inside shoulder width exists, patrol vehicles will park and scan for violators. When pulling a violator over to issue a citation, the GSP will use the inside shoulder of the HOV lane to do so if sufficient shoulder width exists. Otherwise, patrol vehicles will pull violators over to the right shoulder or into an accident investigation site if possible.

The Atlanta HOV facilities are set up as concurrent flow with one lane in each direction. Designed as buffer-separated facilities, the HOV lanes are separated from the general purpose lanes with painted solid double lines or broken lines.

Georgia defines a violator to be any person who operates a vehicle on an HOV lane with less than the required minimum number of occupants. Georgia legislation allows a broad range of prima facie evidence as proof of an HOV violation. Direct observation by an officer, or video surveillance, either by magnetic imaging or photographic copy of the offense, together with proof that the driver was at the time of the violation the registered owner of the vehicle, constitutes evidence as a confirmation the registered owner of the vehicle was the person committing the violation.

HOV lane violators are subject to graduated misdemeanor fines ($101.00/$126.00/$176.00). Additionally, one point is issued for a fourth and subsequent offense in a 12 month period. Violators of Inherently Low Emission Vehicles (ILEV) regulations, which represent alternative fuel vehicles, are subject to the same graduated misdemeanor fines for general HOV lane violations. Fines begin at $101.00 for the first offense, graduating to a $176.00 fine plus one point on a violator's driver's license for fourth and subsequent offenses in a 12 month period. ILEV are defined as any vehicle which, because of the inherent properties of the fuel system design will not have significant evaporative emissions, even if its evaporative emission control system has failed. These vehicles are certified by the Environmental Protection Agency pursuant to 40 CFR 88.311-93 and labeled pursuant to 40 CFR 88.312-93.

3. Virginia

Virginia/Hampton Roads – I-64 Facility Enforcement Overview

HOV lane enforcement is the jurisdiction of the Virginia State Police (VSP). The VSP uses both roaming patrols and patrol vehicles stationed at strategic locations to help identify violators. Where sufficient inside shoulder width exists, patrol vehicles will park and scan for violators. When pulling a violator over to issue a citation, the VSP will use the inside shoulder of the HOV lane to do so if sufficient shoulder width exists. Otherwise, patrol vehicles will pull violators over to the right shoulder if necessary.

I-64 between I-264 to I-564, approximately 18 lane miles in length, includes a two lane, reversible HOV facility separated by concrete barriers from the general purpose lanes. I-64, to the south of its interchange with I-264, and I-264, to the east and west of its interchange with I-64, include concurrent, buffer-separated HOV facilities with one HOV lane in each direction separated from the general purpose lanes by double skip-dash pavement stripes, thus creating a 1 foot buffer.

Virginia defines a violator to be any person who operates a vehicle on an HOV lane with less than the required minimum number of occupants. Currently, enforcement is conducted in law enforcement cruisers on periodic basis. The violator is pulled over and issued the citation. Virginia's structure of escalating fines is also notable in that HOV violations are tracked for a five year period from the first such violation. Virginia has in place legislative provisions for escalating fines ($125.00, $250.00, $500.00, $1,000.00) and point assessments (3 points for each violation after the first violation) for HOV violations, but only in the northern Virginia region. Outside this area, HOV violations are a flat $100.00 fine.

Though not specific to the I-64 HOV lanes, in 2003 the Virginia Department of Transportation convened the HOV Enforcement Task Force to address high violations during morning peaks on I-95, I-395, I-66 and Dulles Toll Road HOV lanes in northern Virginia. Violation rates ranges for specific roadways/half-hour were 38% to 68%. Violations rates for the entire morning peak were 26%to 35%. Based on recommendations from the HOV Enforcement Task Force a "No Excuses" public information campaign was launched coupled with "Special" and "Selective" enforcement techniques using morning peak periods to target problem locations. Over 18,000 citations were issued over a 17 month period, and the stepped up enforcement reduced overall violation rates during morning peak to approximately 21% to 22%.

Northern Virginia launched a peer enforcement program (self enforcement) for the northern Virginia HOV lanes in 1989. Modeled after Seattle's HERO program, it allowed motorists to call a hotline when they witnessed another motorist violating the HOV restrictions. The first offense earned the violator a friendly letter from the DMV with information on HOV restrictions and other educational information. A second violation resulted in a somewhat more forceful letter, and the third violation yielded a letter warning the violator that they could be ticketed if they continued to violate the HOV restrictions. The program was very successful for the about the first 6 months, with violation rates going from approximately 40% to around 10%. However, violators quickly caught on to the fact that there were no teeth behind the warning program, and violations quickly returned to their previous level. After two years, the peer enforcement program was disbanded due to budget cuts.

4. California

California –Facility Enforcement Overview

The California Highway Patrol (CHP) is the responsible agency in HOV lane enforcement issues, and they are an integral part of ensuring a successful HOV facility. The CHP has primary law enforcement responsibility on state highways and enforces HOV statutes in the course of their routine patrols on the freeways.

The California HOV facilities are set up as concurrent flow, generally with one lane in each direction. Barrier-separated facilities are found on very few California highways. In Northern California, the HOV facilities in Caltrans Districts 3 and 4 generally operate only during the peak periods and feature contiguous access with skip-dash pavement marking stripes, which means the HOV traffic is free to enter and exit the lane throughout the length of the HOV facility. In Southern California, the HOV facilities in Caltrans Districts 7, 8, 11, and 12 typically use pavement marking stripes to create a buffer and thus separate the HOV lanes from the general purpose lanes. The HOV lanes in Southern California generally operate 24 hours a day, 7 days a week.

Caltrans HOV guidelines recommend that a violation target level below 10% be considered for mainline HOV facilities. Experience indicates that routine enforcement combined with moderate applications of heightened enforcement can keep HOV violation rates between 5% and 10%. Special enforcement, characterized by continuing, systematic manpower allocations and enforcement tactics specifically dedicated to enforce HOV violations, is typically found on Caltrans HOT facilities where the toll revenues are used to cover the costs of the CHP efforts on HOV and HOT lanes. Selective enforcement, which seeks to induce a high level of motorist compliance by applying routine and special enforcement strategies in an unscheduled manner, is used on occasion, particularly when a high level of violations is noticed by Caltrans, the public and/or news media. Caltrans provides the CHP with copies of HOV facility performance reports, which includes violation rates. When providing this information, they may request CHP support in reducing the violation rates. Also, the CHP has a toll-free number that allows motorists to report non-emergency situations; however, this program has not been promoted as a means for them to report HOV violations.

The budget for providing HOV lane enforcement is set up to support no more than routine enforcement, although CHP will occasionally receive special funds for selective enforcement activities. None of the citation revenue from HOV enforcement goes towards continued HOV enforcement efforts. HOV fines are not distributed back to CHP but are instead allocated to the county in which the violation occurred.

In terms of identifying violators, CHP officers typically cruise the HOV facilities and watch for violators. As previously mentioned, motorists are not asked to report violators, and photo enforcement is currently not used. Tests were underway in the spring of 2009 on automated enforcement technology.

First time violators incur a $401.00 fine for illegal use of the HOV lanes. Drivers are pulled over and a citation is issued by the CHP. When pulling a violator over to issue a citation, the CHP will use the inside shoulder of the HOV lane if sufficient shoulder width exists. Otherwise, patrol vehicles will pull violators over to the right shoulder. However, the CHP has recently indicated within the past year that they will pull violators out of the HOV lane and use the right shoulder for enforcement to issue citations regardless of the available space on the inside shoulder, and in cases where the outside shoulder is not the 10 foot standard, they have requested that enforcement pullouts be provided. The CHP has indicated that the reasons for this new approach are two fold. The California Vehicle Code requires that if an emergency vehicle is flashing its lights that vehicles are supposed to pull to the right and not to the left. The other concern is for officer safety; the officers are required to operate next to high-speed traffic on the inside shoulder of the HOV lane, and it is also difficult and dangerous to re-enter the high-speed traffic stream after stopping a violator.

With respect to the level of compliance being achieved for the enforcement program, the latest data from the San Francisco Bay Area indicated a violation rate of 10%to 13% while the latest data from Los Angeles County indicated an average violation rate of 1.2%. Violation rates have been typically lower for buffered facilities, as crossing the buffer is considered a separate violation, and counts as a moving violation. There has been some interest in converting buffered facilities to continuous access in some locations in southern California. The first continuous

access facility to open in the region, SR-22 in Orange County, originally had violation rates exceeding 20%, but the violation rate is now down to approximately 13%.

5. Washington

Washington–Facility Enforcement Overview The Washington State Patrol (WSP) is responsible for freeway HOV enforcement. The WSP utilizes a combination of routine enforcement, special enforcement, and selective enforcement techniques, and relies upon self-enforcement as well. WSP has allocated considerable resources to HOV enforcement, since their experience has been that through HOV enforcement the WSP usually catch other violators such as aggressive drivers, speeders, those driving without licenses, and those that have other outstanding warrants.

The Washington HOV facilities are set up as concurrent flow, one lane in each direction in general. By and large, freeway HOV lanes are not barrier-separated; they are denoted by delineation and signing only, and users can enter and exit the HOV lanes anywhere they choose. The exceptions are the SR 167 HOT lanes, a buffer-separated facility using double solid white pavement marking stripes to separate the general purpose lanes from the HOV lanes with designated access points provided approximately 1½ to 2 miles apart, and the I-5 & I-90 Express Lanes, which are a barrier-separated, multi-lane, mixed use facilities, with no mainline access points provided except at either end of the HOV facility.

The WSP uses a combination of solitary enforcement (stationary and mobile patrols) and enforcement in pairs for identifying violators and issuing citations to violators. Additionally, WSDOT manages the HERO program, which is set up for motorists to call or email info regarding observed violations. The HERO program does not directly result in tickets being issued. The HERO program helps educate HOV and HOT lane violators on the purpose, rules and benefits of these lanes in the central Puget Sound region. WSDOT started this program in 1984 as a way to encourage drivers to self enforce HOV lane rules. Drivers can report a HOV lane violator by email or phone. WSDOT then sends educational materials about HOV lane usage to the registered owner of the vehicle reported violating the occupancy requirement. First time violators are sent an educational brochure. Second time violators are sent a letter from WSDOT. Third time violators are sent a letter from the Washington State Patrol. Washington State does not have photo enforcement for HOV lane violations, but it is in use for toll violations.

With respect to HOV lane violations, violators receive a $124.00 fine for each violation. Drivers are pulled over and a citation is issued by the WSP. When pulling a violator over to issue a citation, the WSP will use the inside shoulder of the HOV lane to do so if sufficient shoulder width exists. Otherwise, patrol vehicles will pull violators over to the right shoulder if necessary.

Excerpt from HOV/MUL Pooled Fund Study – "HOV Enforcement Handbook"

As of 2006, funding for continuing enforcement efforts on HOV facilities is limited to that which is available through normal or special legislative appropriations and interagency agreements although the level of funding from these sources may sometimes be substantial. For example, funding for enforcement efforts by the Virginia State Patrol on the HOV facilities in northern Virginia currently reflects an additional $250,000.00 over the 2002 annual budget of $140,000.00. The 2003–2004 annual budget for Nassau County police enforcement of the Long Island Expressway HOV lanes was similarly large at $308,000.00. Well-financed enforcement programs such as these are often exceptions, however, and many HOV facilities must make do with budgets that support little more than routine enforcement.

Independent continuing sources of revenue, such as the revenue from the collection of HOV fines, are not directly available to enforcement agencies although there has been a recent legislative effort to make this source available. A 2004 bill in the Washington State Senate attempted to channel a portion of fine revenue from HOV violations back to the Washington State Patrol as a means of providing funding for expanded enforcement operations. Senate Bill 5936 would have increased the fine for HOV violations by $100.00, of which $50.00 would be provided to a new fund for HOV lane enforcement and education. This bill was not ratified, however.

For Michigan, it is recommended that enforcement be the responsibility of the enforcement agency responsible for that section of roadway. If sufficient shoulder width does not exist, such as times of inclement weather, violators should be directed to the far right shoulder. Additionally, it is proposed that fines collected be directed towards the agency doing the enforcement to encourage their efforts. Violators should be identified by roving patrols unless excessive violations (i.e. greater than 15%) are occurring. Fines should be sufficient to be a deterrent and escalate as a motorist incurs multiple violations.

4.3 Carpool Lots

Development of carpool lots supports High Occupancy Vehicle (HOV) use of I-75. MDOT's Metro Region is conducting a *Strategic Needs Plan for Metro Region Carpool Lots*. The study will identify potential sites for development of carpool lots. Preliminary analysis concludes that future carpool lots should be incorporated into planned projects where opportunities are presented. There are two potential sites along I-75 between 12 Mile Road and M-59 at 12 Mile Road and Square Lake Road.

The I-75 Interchange with 12 Mile Road at Exit 63 in Madison Heights will be reconstructed with the project (**Figure 4-4**). The loop ramp in the NW quadrant is proposed for removal. The excess right-of-way that will result from the reconstruction of the interchange offers a potential site for carpool lot development (87 spaces). The access pattern at this location is difficult. Traffic is heavy from the SB off ramp from I-75 to Stephenson Highway to the west. As a result the pattern to and from the lot would be restricted to right turns in and right turns out, unless access is acquired through private land directly to Stephenson Highway during final design.

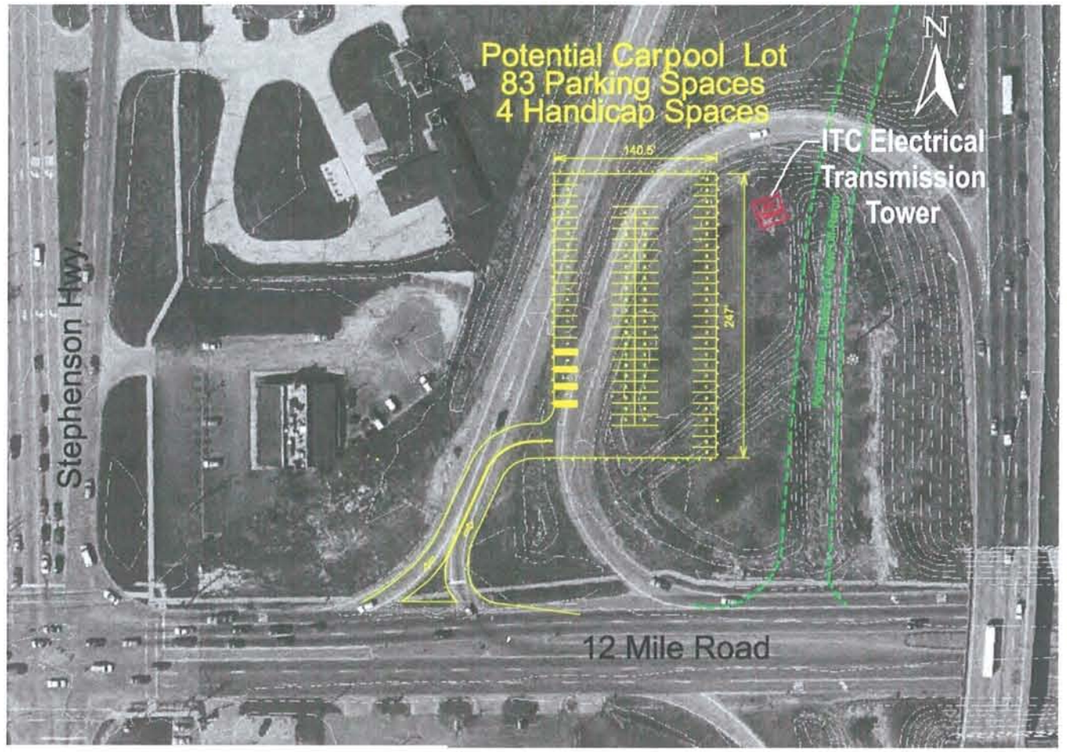

Figure 4-4 Conceptual Lot Layout of I-75/12 Mile Road Interchange NW Quadrant
Source: Strategic Needs Plan for Metro Region Carpool Lots

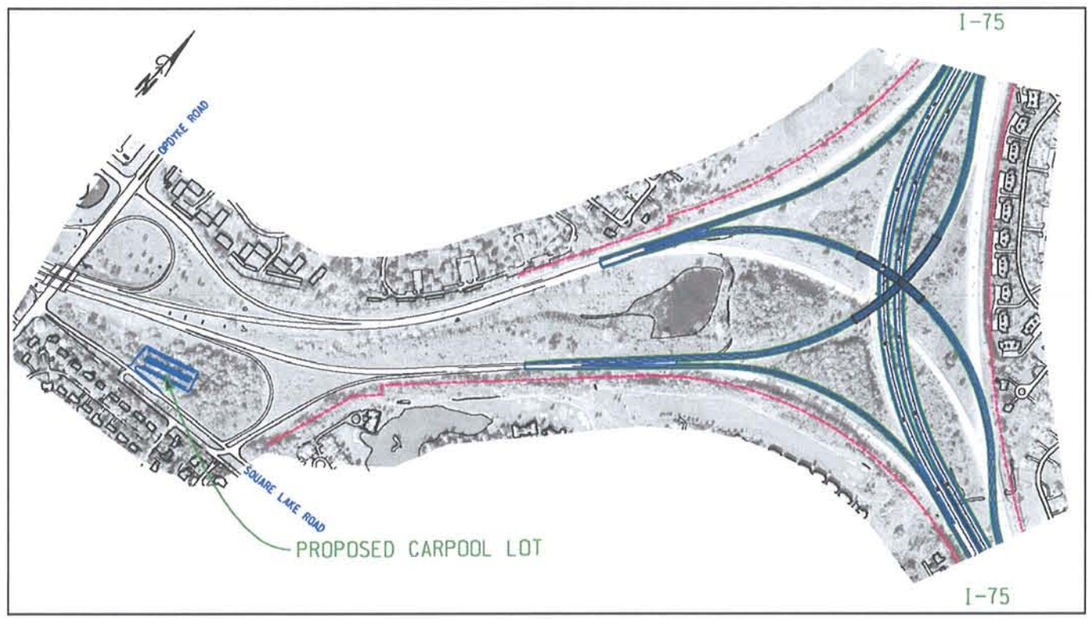

Figure 4-5 View of Proposed Lot at I-75/Square Lake Road East of South Opdyke Road

The interchange of I-75 with Square Lake Road at Exit 75 in Bloomfield Township has available right-of-way east of South Opdyke Road between East Square Lake Road and the ramps to I-75 (**Figure 4-5**). The site could accommodate more than 130 carpool spaces (**Figure 4-6**). This Square Lake Road location is positioned well to capture a substantial population whose next opportunity for a carpool lot along I-75 in the SB/inbound direction is Adams Road, which requires exiting I-75 and crossing north over I-75. A lot at Square Lake Road could also serve those with destinations east on M-59. Entrance and exit would be to the boulevard section of East Square Lake Road. Additional detail for the traffic and design of these carpool lots can be found in ***VOLUME 7: CARPOOL LOT STUDY.***

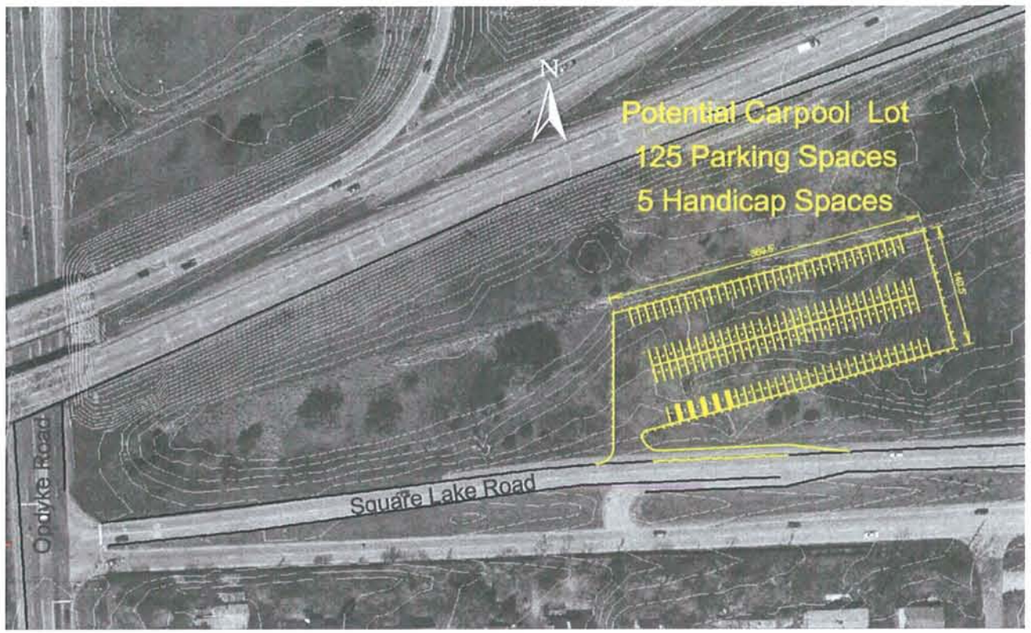

Figure 4-6 Conceptual Lot Layout of I-75/Square Lake Road East of South Opdyke Road
Source: Strategic Needs Plan for Metro Region Carpool Lots

4.4 Typical Sections

The proposed cross section for the freeway will be widened towards the median and will include four 12 foot lanes in each direction. During the four AM and PM peak hours, the median lane will be utilized as a High Occupancy Vehicle (HOV) lane and as a general purpose lane during the remaining 20 hours a day. The proposed median shoulder consists of 6.83 feet of paved shoulder and a 4 foot valley gutter. The bounds will be separated by a double faced median barrier of varying height. This median width will ensure that all locations (including sign trusses, bridges, etc) maintain a shoulder width at or above the minimum current standard of 10 feet. Twelve foot paved outside shoulders will be used throughout the I-75 corridor. The proposed normal crown typical cross section for I-75 is detailed in **Figure 4-7**.

The proposed ramps are primarily single lane rural entrance and exit ramps with 16 foot travel lanes, and 7 foot outside and 4 foot inside shoulders. In addition, there are several two lane entrance and exit ramps with two 12 foot travel lanes and 7 foot outside and 4 foot inside shoulders. The NB I-75 entrance and exit ramps at the Square Lake Interchange which are the high and mid-levels of the interchange, respectively have 7 foot outside shoulders and 12 foot inside shoulders for improved sight distance.

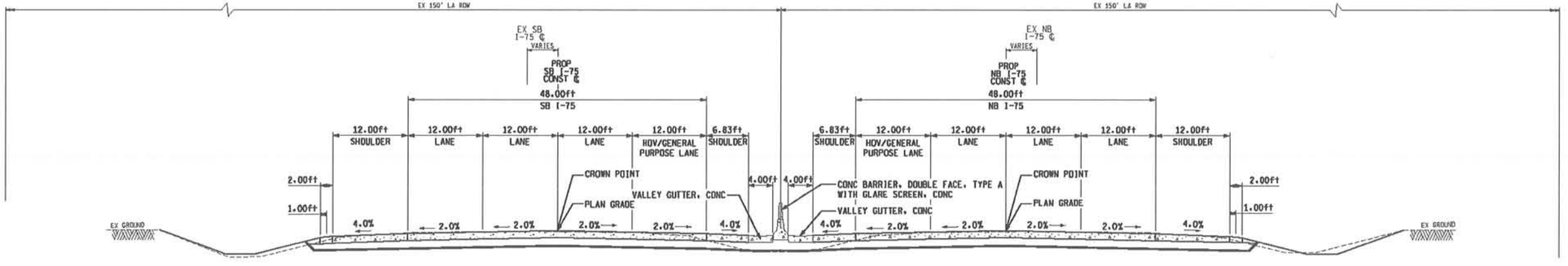

Figure 4-7 Proposed Normal Crown Typical Cross Section for I-75

4.5 Freeway Alignment

The SB I-75 horizontal alignment contains 11 curves ranging from 1,994.17 feet to 22,995.40 feet in radii, while NB I-75 contains 14 curves ranging from 1,922.00 feet to 22,923.24 feet (including three 17,000 foot radii curves at north end of the project to salvage the existing South Boulevard bridge (S19 of 63174) and meet the minimum median shoulder width prior to tying back into the existing horizontal alignment south of M-59. All horizontal curves have been upgraded to meet a 70 mph design speed with corresponding minimum radii of 1,922.00 feet. The NB and SB I-75 curves at the Big Beaver Interchange (NB PI 1226+13.48 and SB PI 1226+85.65) are below the 2,344.00 foot horizontal curve radii required for a 75 mph design speed, however, since the design speed meets posted speed, design exceptions for documentation by MDOT are all that is required for these curves.

These alignments meet the design standards established in the FEIS and in several locations are further upgraded to avoid additional design exceptions anticipated with the FEIS.

Although the majority of the curves meet or exceed the minimum curve radii for a 75 mph design speed, there are five NB I-75 and four SB I-75 locations where design exceptions will be necessary for horizontal stopping sight distance:

- NB PI 920+36.39
- NB PI 1125+51.56
- NB PI 1226+13.48
- NB PI 603+44.78
- NB PI 647+40.79
- SB PI 904+98.75
- SB PI 1226+85.65
- SB PI 730+99.23
- SB PI 829+29.56

In each of these locations, the median barrier and/or glare screen obstructs the line of sight necessary to achieve the 75 mph stopping sight distance of 820 feet.

All curves along NB and SB I-75 will be superelevated according to MDOT standard plan R-107-G using a 1/3-2/3 distribution, with the exception of the set of reverse curves just south of the 12 Mile Interchange (NB PI 904+79.48 and 920+36.39 and SB PI 904+98.75 and 920+17.78). In this location, the tangent between the curves is too short to apply the standard superelevation distribution and ROW constraints prevent the necessary realignment to meet this standard. As a result, a design exception for superelevation distribution will be required for this location where, per a request from MDOT, Geometrics 50% of the supertransition distribution will be within the curves.

The vertical alignment of I-75 is generally rolling with no grades in excess of 3% or less than 0.30%. The elevation at the north end of the project is approximately 300 feet above the elevation just south of the 12-Mile Interchange. The NB and SB I-75 crest vertical curves at the 12-Mile Interchange (NB and SB I-75 PVI stations of 922+90.00 and 923+80.00, respectively) have a K value of 247 corresponding to a design speed of 70 mph (SSD = 730 feet). Since the design speed meets posted speed, design exceptions for documentation by MDOT are all that is required for these crest vertical curves. It is also anticipated that the sag vertical curve immediately to the south of the 12-Mile Interchange will require an MDOT only design exception due to insufficient K value. However, this location will require continued coordination with the project immediately to the south as it will impact the proposed underclearance at the Stephenson Highway and Gardenia Avenue bridges over I-75, which are both outside of the limits of this project. A minimum of 16.25 feet of underclearance is maintained for I-75 under the local roads. A minimum of 14.75 feet of underclearance is maintained for I-75 over the local roads.

Detailed plans including typical sections, horizontal and vertical alignments as well as drainage improvements are contained in ***VOLUME 2: FREEWAY / INTERCHANGE ROADWAY PLANS*** and ***VOLUME 3: GEOMETRIC STUDY***.

4.6 Interchange Alignment

The reconstruction of I-75 and associated interchanges and local road crossings build on the recommendations of the FEIS requirements of the ROD and current MDOT Design Standards. Following is a detailed description of the design features of each interchange.

4.6.1 12 Mile Road Interchange

The proposed configuration at the 12 Mile Road Interchange is a combination par-clo with tight diamond. In the NE and SW quadrants are single lane and two lane entrance ramps, respectively. In the SE quadrant is a single lane entrance loop ramp with single lane diamond exit ramp. In the NW quadrant, the existing single lane entrance loop ramp was eliminated and the SB I-75 exit ramp was realigned closer to I-75 to provide more separation and storage between the ramp terminal and Stephenson Highway to the west.

The proposed 12 Mile Road cross section adds more width to facilitate dual left turns for the WB to SB entrance ramp movement (as a result of the elimination of the loop ramp in the NW quadrant). The proposed widening occurs symmetrically over 160 feet to the east and to the west of the 12 Mile Road Interchange. The remainder of 12 Mile Road matches the existing normal crown cross section, consisting of two lanes of traffic in each direction divided by a raised median. In addition to the through lanes, dedicated right turn lanes are provided for each entrance ramp. Twelve Mile Road is completely within a tangent at the interchange, and therefore is in normal crown. The proposed cross section for 12 Mile Road is shown in **Figure 4-8.**

In order to achieve the desired underclearance of 14.75 feet, the NB and SB I-75 profiles were raised by approximately 2.5 feet over 12 Mile Road. To reduce the underclearance differential between the NB and SB roadways due to supereleavtion, the east side of 12-Mile Road near NB I-75 was raised approximately 6.5 feet. Retaining walls will be required on each side of the WB 12-Mile to NB I-75 entrance ramp due to the tight diamond ramp configuration and limited distance available to overcome the elevation distance between the roadways.

Additional right of way (ROW) and grading permits will be required between the SB I-75 entrance ramp and Stephenson Highway for the placement of proposed sidewalk and for driveway consolidation, as well as, on the north side of 12 Mile Road between station 105+00 and 110+00 since the existing curb line is outside of the existing ROW. In addition, ROW will be required for the realignment of the SB I-75 entrance ramp.

The proposed 12 Mile Road Interchange and local road is detailed in **Figures 4-9** through **4-13.**

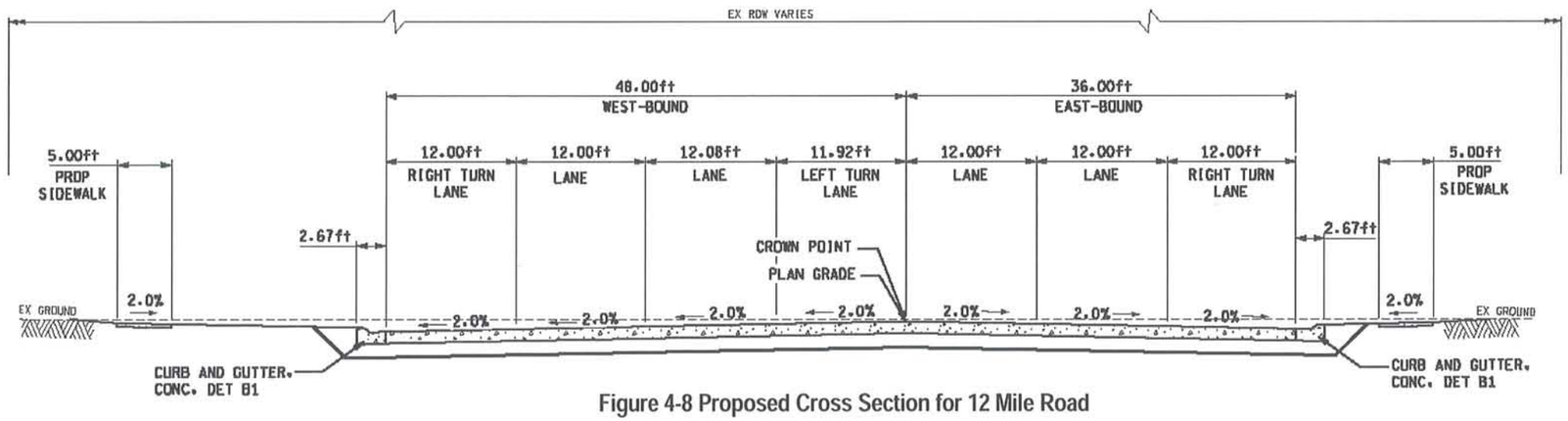

Figure 4-8 Proposed Cross Section for 12 Mile Road

STEPHENSON HWY

12 MILE ROAD

300' TAPER

C = 260'

Lo = 780'

GEO-101-E
DESIGN SPEED = 50 MPH

B = 390'

R 2516.15'

2" PT +37.30

R 818.51'

22' PT +77.06

POT = 91+57.90

SB I-75 CONST ℄

RAMP A CONST ℄

12 MILE ROAD CONST ℄

499.5' TAPER

PROPOSED DOUBLE FACE CONCRETE BARRIER WITH GLARE SCREEN

PROPOSED GUARDRAIL (TYP)

PROPOSED ROW

N 87° 35' 36" E

S03-2 OF 63174

RAMP E CONST ℄

320' STORAGE

300' TAPER

B02-6 OF 63174

CARPOOL LOT

247.00'

140.50'

R 60.00'

R 65.00'

R 70.00'

R 716.20'

35'

NB I-75 CONST ℄

PROPOSED SINGLE FACE CONCRETE BARRIER

P.O.B.
NB I-75
STA 907+00
SB I-75
STA 907+26.06

300' TAPER

Ld = 390'

GEO-131-D
DESIGN SPEED = 55 MPH

R 2344.00'

2" PT +62.58

P01 OF 63174

D = 21.0'

R 1145.92'

22' PT +60.36'

EXISTING
P01 OF 63174

EXISTING LA ROW VARIES

MATCH LINE 930+00

PROPOSED SIDEWALK (TYP)

R 147.00'

R 60.00'

R 2478.67'

R 222'

PROPOSED DOUBLE FACE CONCRETE BARRIER

PROPOSED RETAINING WALL (TYP)

RAMP D CONST ℄

RAMP B CONST ℄

RAMP C CONST ℄

GEO-101-E
DESIGN SPEED = 25 MPH
LOOP RAMP CREATES A CD ROAD PARALLEL TO NB I-75.

R 327.00'

300' TAPER

250' STORAGE

N 86° 32' 07" E

S03-1 OF 63174

S03-5 OF 63174

UG STREET LIGHTING (DTE) (TO)

2" GAS CONSUMERS ENERGY

6" GAS CONSUMERS ENERGY

12" WATERMAIN (CITY OF ROYAL OAK) (O)

SCALE

100' 50' 0' 100'

LEGEND

GAS LINE
ELECTRIC LINE
WATERMAIN
EXISTING WETLAND
EXISTING DRAINAGE FLOW
PROP PAVEMENT EDGE
PROP SHOULDER EDGE
PROP BARRIER
PROP RETAINING WALL
PROPOSED CUL-DE-SAC
PROP WETLAND
EXISTING LA R-O-W
EXISTING R-O-W
PROP R-O-W
PROP LA R-O-W
NOISE WALL
PROP BRIDGE
PROP SIDEWALK
PROP CONSTRUCTION ℄
PROP BRIDGE REPAIR
PROP PARK & RIDE
SIGNALIZED INTERSECTION

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Traverse City

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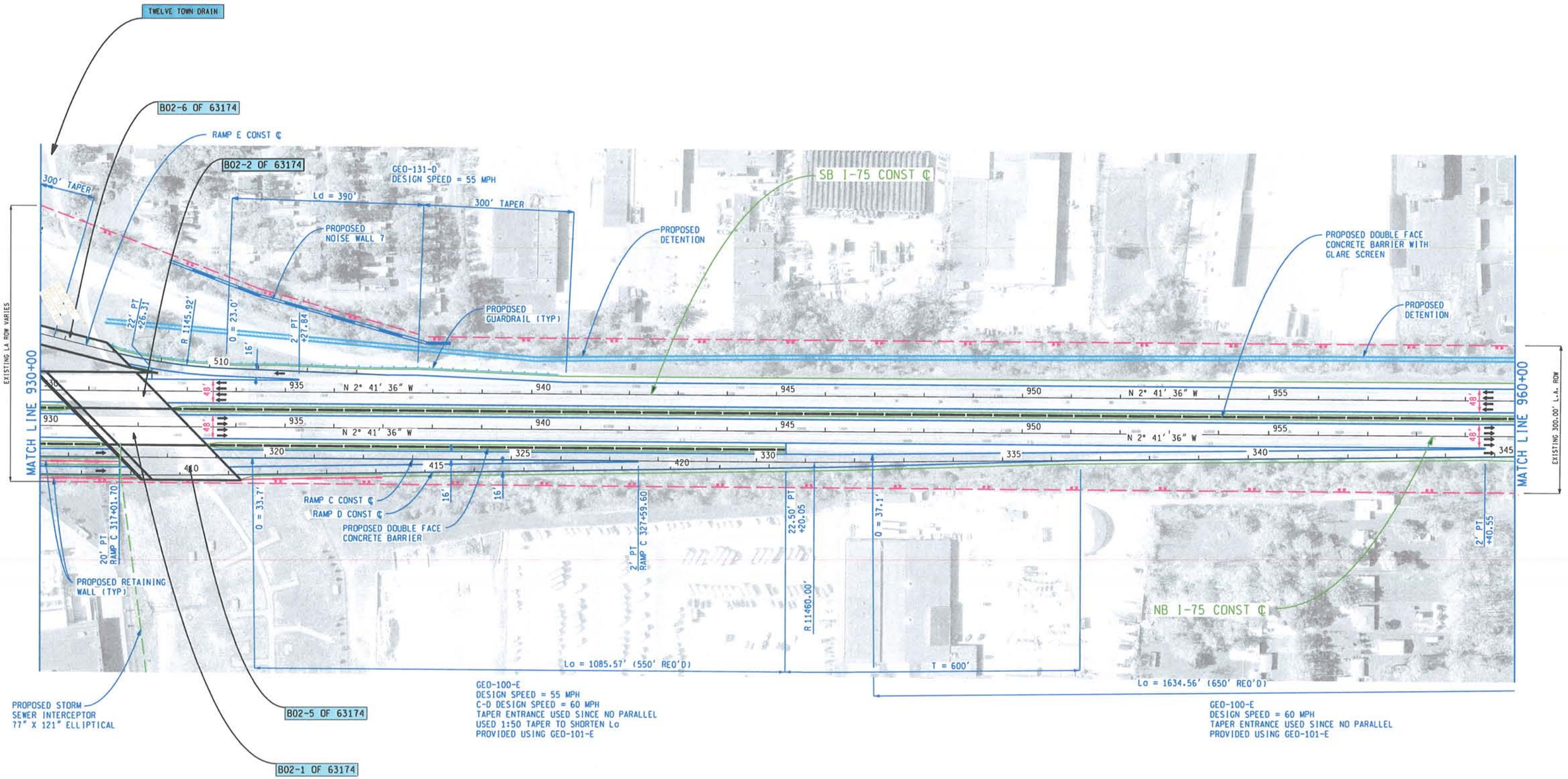
MDOT JOB NO.
88168

MDOT CONTROL SECTION
63174

MICHIGAN DEPARTMENT OF TRANSPORTATION
I-75 SOUTH OF 12 MILE RD TO SOUTH OF M-59
ENGINEERING REPORT

I-75 STA 907+00 (POB)
TO 930+00
12 MILE ROAD INTERCHANGE

FIGURE 4-9



SCALE

100' 50' 0' 100'

LEGEND

GAS LINE
ELECTRIC LINE
WATERMAIN
EXISTING WETLAND
EXISTING DRAINAGE FLOW
PROP PAVEMENT EDGE
PROP SHOULDER EDGE
PROP BARRIER
PROP RETAINING WALL
PROPOSED CUL-DE-SAC
PROP WETLAND
EXISTING LA R-O-W
EXISTING R-O-W
PROP R-O-W
PROP LA R-O-W
NOISE WALL
PROP BRIDGE
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I-75 SOUTH OF 12 MILE RD TO SOUTH OF M-59
GEOMETRIC STUDY

I-75 STA 930+00 TO 960+00
12 MILE ROAD INTERCHANGE

FIGURE 4-10

13 MILE ROAD

N

PROPOSED DETENTION

PROPOSED DOUBLE FACE CONCRETE BARRIER WITH GLARE SCREEN

SB I-75 CONST ℄

PROPOSED GUARDRAIL (TYP)

S04-2 OF 63174

UG PRIMARY CABLE (DTE) (D)

22" WATERMAIN (CITY OF MADISON HEIGHTS) (D)

UG STREET LIGHTING (DTE) (C)

24" GAS (CONSUMERS ENERGY) (D)

8" GAS (CONSUMERS ENERGY) (D)

EXISTING 300.00' L.A. ROW

MATCH LINE 960+00

960 965 970 N 2° 41' 36" W 975 980 985

48'

VARIES

100'

RAMP C CONST ℄

THURBY DRAIN 24" CULVERT

Lo = 1634.56' (650' REQ'D)

T = 780'

NB I-75 CONST ℄

MATCH LINE 990+00

PROPOSED SIDEWALK (TYP)

4" GAS (CONSUMERS ENERGY) (D)

PROPOSED NOISE WALL 8

PROPOSED NOISE WALL 9

S04-1 OF 63174

13 MILE CONST ℄

24" GAS (CONSUMERS ENERGY) (D)

6" GAS (CONSUMERS ENERGY) (D)

SCALE

100' 50' 0' 100'

LEGEND

GAS LINE
ELECTRIC LINE
FIBER OPTICS
WATERMAIN
UG CONDUIT

EXISTING WETLAND
EXISTING DRAINAGE FLOW
PROP PAVEMENT EDGE
PROP SHOULDER EDGE
PROP BARRIER
PROP RETAINING WALL
PROPOSED CUL-DE-SAC

PROP WETLAND
EXISTING LA R-O-W
EXISTING R-O-W
PROP R-O-W
PROP LA R-O-W
NOISE WALL
PROP BRIDGE

PROP SIDEWALK
PROP CONSTRUCTION ℄
PROP BRIDGE REPAIR
PROP PARK & RIDE
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MICHIGAN DEPARTMENT OF TRANSPORTATION
I-75 SOUTH OF 12 MILE RD TO SOUTH OF M-59
GEOMETRIC STUDY

I-75 STA 960+00 TO 990+00
12 MILE ROAD INTERCHANGE

FIGURE 4-11

12 MILE ROAD RAMP E SB I-75

12 MILE ROAD

RAMP E CONST ℄

SB I-75 CONST ℄

160' TRANSITION LT AND RT

100' TAPER

320' STORAGE

12 MILE ROAD CONST ℄

OH 120 KV (ITC)

OH 120 KV (ITC)

6" GAS CONSUMERS ENERGY

12" GAS CONSUMERS ENERGY

EXISTING 125.00' ROW

88 N 87° 35' 36" E 89 90 91 92 93 94 95 N 87° 12' 27" E 96 97 98 99

R 60'

R 70'

R 65'

R 60'

502 501 500 925 924 923 922 921

115 114 113

36' 24' 72'

UNKNOWN WATERMAIN (CITY OF MADISON HEIGHTS) (D)

ELEC

EX 60.00' ROW

PROPOSED SIDEWALK (TYP)

PROPOSED ROW

499.5' TAPER

291' STORAGE

+51.00

2" GAS CONSUMERS ENERGY

RAMP A CONST ℄

S03-2 OF 63174

12 MILE ROAD RAMP A SB I-75

SCALE

50' 25' 0' 50'

LEGEND

GAS LINE

ELECTRIC LINE

FIBER OPTICS

WATERMAIN

MD CONDUIT

EXISTING WETLAND

EXISTING DRAINAGE FLOW

PROP PAVEMENT EDGE

PROP SHOULDER EDGE

PROP BARRIER

PROP RETAINING WALL

PROPOSED CUL-DE-SAC

PROP WETLAND

EXISTING LA R-O-W

EXISTING R-O-W

PROP R-O-W

PROP LA R-O-W

NOISE WALL

PROP BRIDGE

PROP SIDEWALK

PROP CONSTRUCTION ℄

PROP BRIDGE REPAIR

PROP PARK & RIDE

SIGNALIZED INTERSECTION

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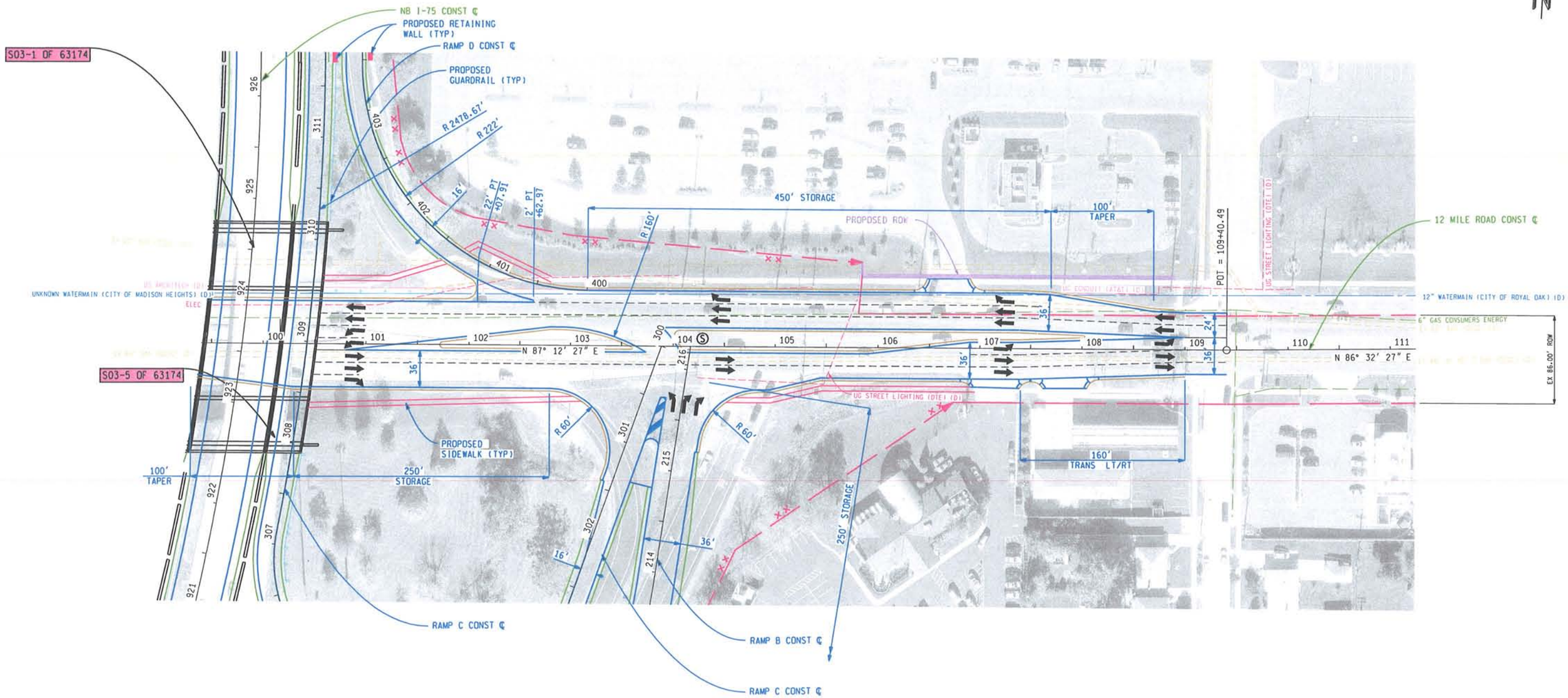
MICHIGAN DEPARTMENT OF TRANSPORTATION
I-75 SOUTH OF 12 MILE RD TO SOUTH OF M-59
ENGINEERING REPORT

12 MILE ROAD
WEST SIDE

FIGURE 4-12

NB I-75 12 MILE ROAD RAMP C | 12 MILE ROAD RAMP D



NB I-75 12 MILE ROAD RAMP C | 12 MILE ROAD RAMP C | 12 MILE ROAD RAMP B

SCALE

50' 25' 0' 50'

LEGEND

GAS LINE
ELECTRIC LINE
WATERMAIN
UG CONDUIT

EXISTING WETLAND
EXISTING DRAINAGE FLOW
PROP PAVEMENT EDGE
PROP SHOULDER EDGE
PROP BARRIER
PROP RETAINING WALL
PROPOSED CUL-DE-SAC

PROP WETLAND
EXISTING LA R-O-W
EXISTING R-O-W
PROP R-O-W
PROP LA R-O-W
NOISE WALL
PROP BRIDGE

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I-75 SOUTH OF 12 MILE RD TO SOUTH OF M-59
ENGINEERING REPORT

12 MILE ROAD
EAST SIDE

FIGURE 4-13

4.6.2 14 Mile Road Interchange

The proposed configuration at the 14 Mile Road Interchange maintains the existing combination par-clo with tight diamond ramps. The SE and NW quadrants consist of single lane exit ramps while the NE and SW quadrants contain single lane loop exit ramps with single lane diamond entrance ramps. The NB I-75 entrance ramp terminal at 14 Mile Road has a split island allowing free-flow left turn movements from EB 14 Mile to merge with the right turn movements from WB 14 Mile Road.

The proposed 14 Mile Road cross section adds more width to facilitate dual left turns for the WB to SB entrance ramp movement and a additional lane in each direction from the free-flow loop ramps directly under I-75. The remainder of 14 Mile Road matches the existing normal crown cross section, consisting of three lanes of traffic in each direction divided by a center turn lane or raised median. In addition to the through lanes, dedicated right turn lanes are provided for the SB I-75 entrance ramp, Stephenson Highway, and Concord Drive. Fourteen Mile Road is completely within a tangent at the interchange, and therefore is in normal crown. The proposed cross section for 14 Mile Road is shown in **Figure 4-14**

In order to achieve the desired underclearance of 14.75 feet, the NB and SB I-75 profiles were raised by approximately 3 feet over 14 Mile Road. The 14 Mile Road profile was maintained at or near the existing 0.19% grade throughout the limits of the project. Additional catch basins will be required to ensure adequate drainage and reduced spread.

No additional ROW is anticipated to construct this interchange.

The proposed 14 Mile Road Interchange and local road is detailed in **Figures 4-15** through **4-19.**

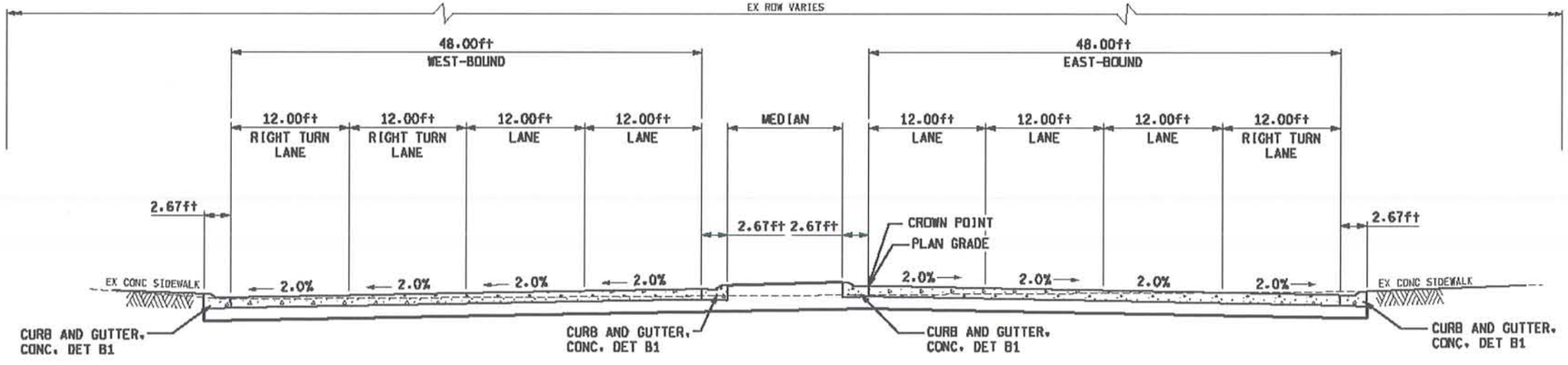
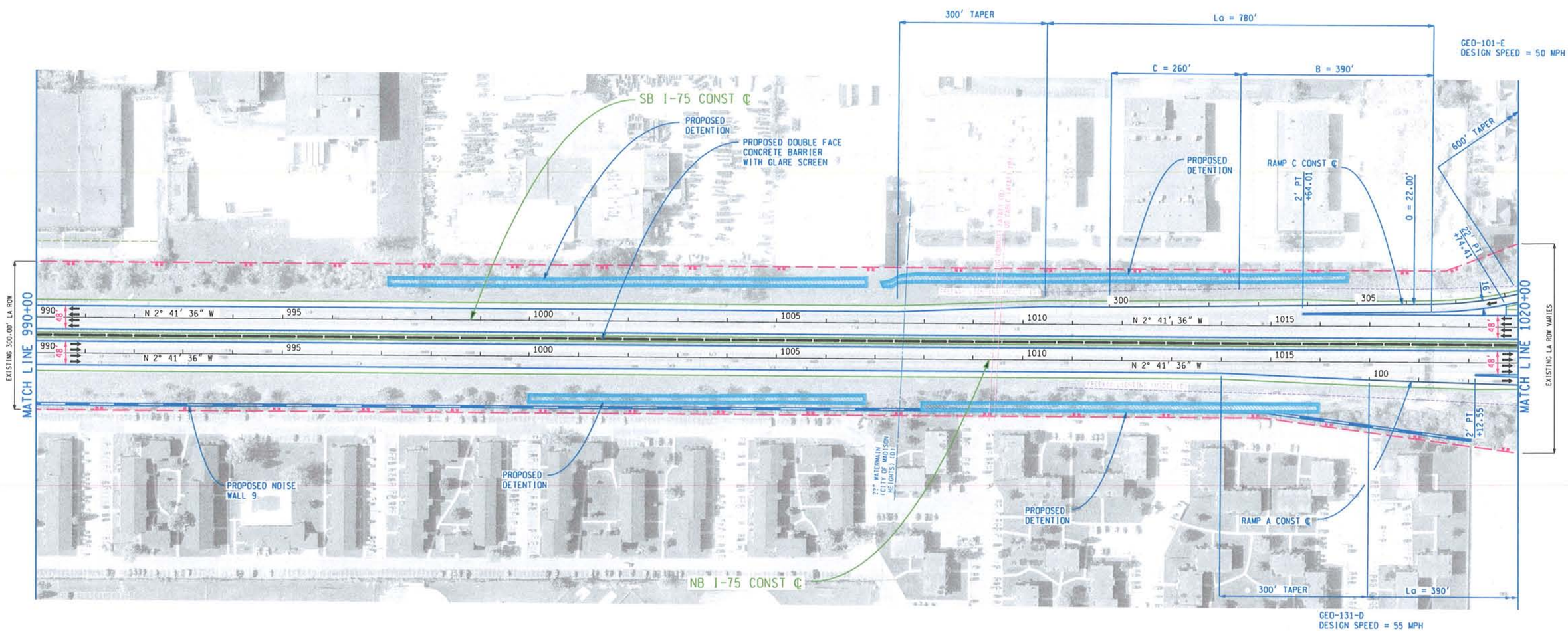


Figure 4-14 Proposed Cross Section for 14 Mile Road



SCALE

100' 50' 0' 100'

LEGEND

GAS LINE
ELECTRIC LINE
FIBER OPTICS
WATERMAIN
UG CONDUIT

EXISTING WETLAND
EXISTING DRAINAGE FLOW
PROP PAVEMENT EDGE
PROP SHOULDER EDGE
PROP BARRIER
PROP RETAINING WALL
PROPOSED CUL-DE-SAC

PROP WETLAND
EXISTING LA R-O-W
EXISTING R-O-W
PROP R-O-W
PROP LA R-O-W
NOISE WALL
PROP BRIDGE

PROP SIDEWALK
PROP CONSTRUCTION ℄
PROP BRIDGE REPAIR
PROP PARK & RIDE
SIGNALIZED INTERSECTION

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MICHIGAN DEPARTMENT OF TRANSPORTATION
I-75 SOUTH OF 12 MILE RD TO SOUTH OF M-59
GEOMETRIC STUDY

I-75 STA 990+00 TO 1020+00
14 MILE ROAD INTERCHANGE

FIGURE 4-15

14 MILE ROAD

N

14 MILE CONST ℄

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SB I-75 CONST ℄

GEO-131-E
DESIGN SPEED = 30 MPH

GEO-131-D
DESIGN SPEED = 65 MPH

Ld = 575'

300' TAPER

La = 390'

300' TAPER

600' TAPER

R 318.31'

R 818.51'

R 225.00'

R 1909.86'

O = 23.00'

O = 22.00'

22' PT +22.62

22' PT +64.73

22' PT +99.56

2' PT +34.90

2' PT +69.89

2' PT +33.86

22' PT +65.37

2' PT +80.29

2' PT +66.18

22' PT +66.68

22' PT +42.65

22' PT +67.81

2' PT +78.27

PROPOSED SIDEWALK (TYP)

RAMP E CONST ℄

PROPOSED DETENTION

RAMP C CONST ℄

RAMP D CONST ℄

PROPOSED DETENTION

PROPOSED GUARDRAIL (TYP)

PROPOSED DOUBLE FACE CONCRETE BARRIER WITH GLARE SCREEN

RAMP A CONST ℄

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PROPOSED SIDEWALK (TYP)

RAMP F CONST ℄

PROPOSED DETENTION

RAMP B CONST ℄

PROPOSED DOUBLE FACE CONCRETE BARRIER WITH GLARE SCREEN

PROPOSED DETENTION

B = 390'

C = 260'

Lo = 780'

GEO-101-E
DESIGN SPEED = 50 MPH

Lo = 390.00'

GEO-131-D
DESIGN SPEED = 55 MPH

NB I-75 CONST ℄

300' TAPER

Ld = 575.00'

RAMP BA CONST ℄

GEO-131-D
DESIGN SPEED = 30 MPH

N 2° 41' 36" W

EXISTING LA ROW VARIES

MATCH LINE 1020+00

MATCH LINE 1050+00

EXISTING 300.00' LA ROW

8" GAS (CONSUMERS ENERGY) (OTE)

UG STREET LIGHTING (OTE) (C)

16" WATERMAIN (CITY OF TROY) (O)

FREEWAY LIGHTING (MDOT TO)

SCALE

100' 50' 0' 100'

LEGEND

GAS LINE
ELECTRIC LINE
WATERMAIN

EXISTING WETLAND
EXISTING DRAINAGE FLOW
PROP PAVEMENT EDGE
PROP SHOULDER EDGE
PROP BARRIER
PROP RETAINING WALL
PROPOSED CUL-DE-SAC

PROP WETLAND
EXISTING LA R-O-W
EXISTING R-O-W
PROP R-O-W
PROP LA R-O-W
NOISE WALL
PROP BRIDGE

PROP SIDEWALK
PROP CONSTRUCTION ℄
PROP BRIDGE REPAIR
PROP PARK & RIDE
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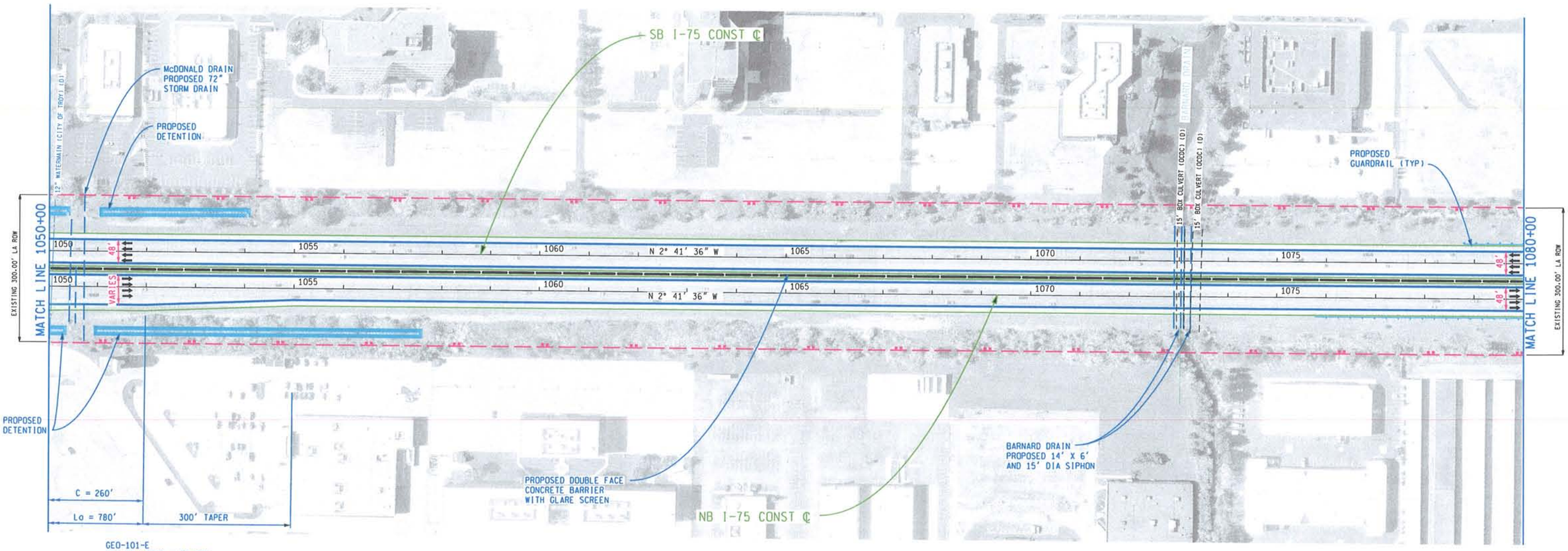
I-75 SOUTH OF 12 MILE RD TO SOUTH OF M-59
ENGINEERING REPORT

I-75 STA 1020+00
TO STA 1050+00
14 MILE ROAD INTERCHANGE

FIGURE 4-16



SCALE

100' 50' 0' 100'

LEGEND

GAS LINE
ELECTRIC LINE
WATERMAIN

EXISTING WETLAND
EXISTING DRAINAGE FLOW
PROP PAVEMENT EDGE
PROP SHOULDER EDGE
PROP BARRIER
PROP RETAINING WALL
PROPOSED CUL-DE-SAC

PROP WETLAND
EXISTING LA R-O-W
EXISTING R-O-W
PROP R-O-W
PROP LA R-O-W
NOISE WALL
PROP BRIDGE

PROP SIDEWALK
PROP CONSTRUCTION ℄
PROP BRIDGE REPAIR
PROP PARK & RIDE (P)
SIGNALIZED INTERSECTION (S)

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MICHIGAN DEPARTMENT OF TRANSPORTATION
I-75 SOUTH OF 12 MILE RD TO SOUTH OF M-59
GEOMETRIC STUDY

I-75 STA 1050+00
TO STA 1080+00
14 MILE ROAD INTERCHANGE

FIGURE 4-17

14 MILE ROAD
RAMP D

SB I-75

14 MILE ROAD

14 MILE ROAD

320' 12' SHIFT

250' STORAGE

100' TAPER

100' TAPER

50' TAPER

16" WATERMAIN (CITY OF TROY) (D)

8" GAS (CONSUMERS ENERGY) (D)

GAS (CONSUMERS ENERGY) (D)

EX 200' LA ROW

EX 66.00' ROW

N 87° 46' 15" E

SB I-75 CONST ℄

RAMP D CONST ℄

14 MILE ROAD CONST ℄

PROPOSED SIDEWALK (TYP)

PROPOSED GUARDRAIL (TYP)

R60'

R65'

R10'

R225'

22' PT +72.87

2' PT +18.53

90 91 92 93 94 95 96 97 98

400 401 402

319 320 321

503 504 505 506 507

206

516 518 519

1029 1030 1031 1032 1033

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RAMP C CONST ℄

RAMP E CONST ℄

14 MILE ROAD
RAMP C

14 MILE ROAD
RAMP E

SB I-75

SCALE

50' 25' 0' 50'

LEGEND

GAS LINE
ELECTRIC LINE
FIBER OPTICS
WATERMAIN
TELEPHONE

EXISTING WETLAND
EXISTING DRAINAGE FLOW
PROP PAVEMENT EDGE
PROP SHOULDER EDGE
PROP BARRIER
PROP RETAINING WALL
PROPOSED CUL-DE-SAC

PROP WETLAND
EXISTING LA R-O-W
EXISTING R-O-W
PROP R-O-W
PROP LA R-O-W
NOISE WALL
PROP BRIDGE

PROP SIDEWALK
PROP CONSTRUCTION ℄
PROP BRIDGE REPAIR
PROP PARK & RIDE
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MICHIGAN DEPARTMENT OF TRANSPORTATION
I-75 SOUTH OF 12 MILE RD TO SOUTH OF M-59
ENGINEERING REPORT

14 MILE ROAD
WEST SIDE

FIGURE 4-18

NB I-75

14 MILE ROAD
RAMP F

14 MILE ROAD
RAMP B

14 MILE ROAD

14 MILE ROAD

NB I-75 CONST ℄

RAMP F CONST ℄

RAMP B CONST ℄

RAMP BA CONST ℄

14 MILE ROAD CONST ℄

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PROPOSED GUARDRAIL (TYP)

PROPOSED SIDEWALK (TYP)

FREEWAY LIGHTING (MDOT) (S)

16" WATERMAIN (CITY OF TROY) (D)

8" GAS (CONSUMERS ENERGY) (D)

UG STREET LIGHTING (DTE) (C)

N 87° 46' 08" E

EX 66.00' ROW

EX 200' ROW

752.13' TRANSITION FOR 28.21' SHIFT

RAMP A CONST ℄

NB I-75

14 MILE ROAD
RAMP A

SCALE

50' 25' 0' 50'

LEGEND

GAS LINE
ELECTRIC LINE
FIBER OPTIC
WATERMAIN
UG TELEPHONE

EXISTING WETLAND
EXISTING DRAINAGE FLOW
PROP PAVEMENT EDGE
PROP SHOULDER EDGE
PROP BARRIER
PROP RETAINING WALL
PROPOSED CUL-DE-SAC

PROP WETLAND
EXISTING LA R-O-W
EXISTING R-O-W
PROP R-O-W
PROP LA R-O-W
NOISE WALL
PROP BRIDGE

PROP SIDEWALK
PROP CONSTRUCTION ℄
PROP BRIDGE REPAIR
PROP PARK & RIDE
SIGNALIZED INTERSECTION

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ENGINEERING REPORT

14 MILE ROAD
EAST SIDE

FIGURE 4-19

4.6.3 Rochester Road Interchange

The proposed configuration at the Rochester Road Interchange maintains the existing Two-Quadrant Cloverleaf interchange. The NE quadrant consists of a two lane diamond exit ramp and a single lane loop entrance ramp, while the SW quadrant consists of a single lane loop entrance ramp and single lane diamond exit ramp. The free-flow movements at Rochester Road have been eliminated and the entrance and exit ramp terminals are separated by a corrugated median with rolled curb island.

The only proposed local road work along Rochester Road consists of the reconstruction required to remove and replace the I-75 bridges and to reestablish the outside curb line after removing the existing free-flow turning movements. The proposed cross section for the I-75 bridges and the Rochester Road layout are shown in **Figure 4-20.**

In order to achieve the desired underclearance of 14.75 feet, the NB and SB I-75 profiles were raised by approximately 6 inches over Rochester Road. Due to the limited amount of reconstruction along Rochester Road, the local road will remain at the existing grade throughout the limits of the project.

No additional ROW is anticipated to construct this interchange.

The proposed Rochester Road Interchange and local road is detailed in **Figures 4-21** through **4-24.**

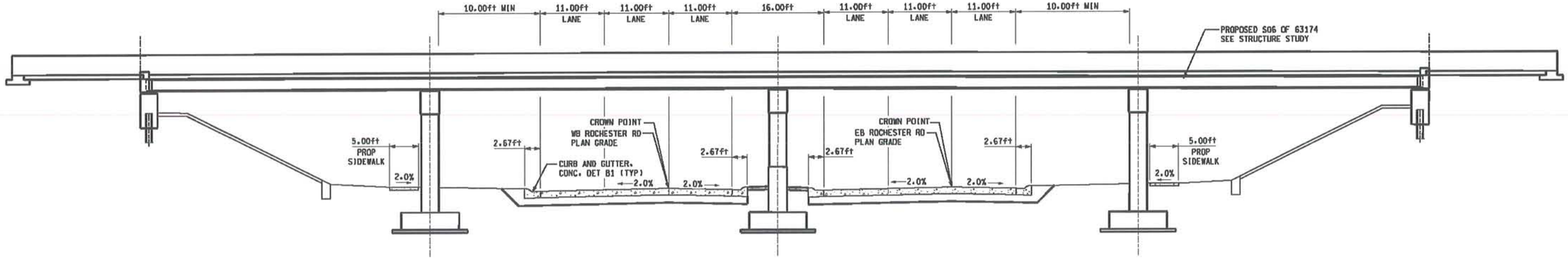

Figure 4-20 Proposed Cross Section for Rochester Road

MAPLE ROAD

MAPLE ROAD CONST ℄

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12" WATERMAIN (CITY OF TROY) (D)

6" GAS (CONSUMERS ENERGY) (D)

24" WATERMAIN (CITY OF TROY) (D)

N 8

SB I-75 CONST ℄

PROPOSED GUARDRAIL (TYP)

PROPOSED DOUBLE FACE CONCRETE BARRIER WITH GLARE SCREEN

PROPOSED DETENTION

ROTH DRAIN 90" STORM SEWER

PROPOSED NOISE WALL 10

UG PRIMARY FLEC CABLE (OTE) (D)

MATCH LINE 1110+00

EXISTING 300.00' LA ROW

MATCH LINE 1080+00

1080

1085

1090

1095

1100

1105

N 2° 41' 36" W

48'

60'

UG CONDUIT (OTE) (D)

PROPOSED SIDEWALK (TYP)

PROPOSED DETENTION

NB I-75 CONST ℄

360' TAPER

1500' PARALLEL

GEO-140-B CASE II
DESIGN SPEED = N/A

S21-1 OF 63174

SCALE

100' 50' 0' 100'

LEGEND

GAS LINE
ELECTRIC LINE
FIBER OPTIC
WATERMAIN
UG CONDUIT

EXISTING WETLAND
EXISTING DRAINAGE FLOW
PROP PAVEMENT EDGE
PROP SHOULDER EDGE
PROP BARRIER
PROP RETAINING WALL
PROPOSED CUL-DE-SAC

PROP WETLAND
EXISTING LA R-O-W
EXISTING R-O-W
PROP R-O-W
PROP LA R-O-W
NOISE WALL
PROP BRIDGE

PROP SIDEWALK
PROP CONSTRUCTION ℄
PROP BRIDGE REPAIR
PROP PARK & RIDE
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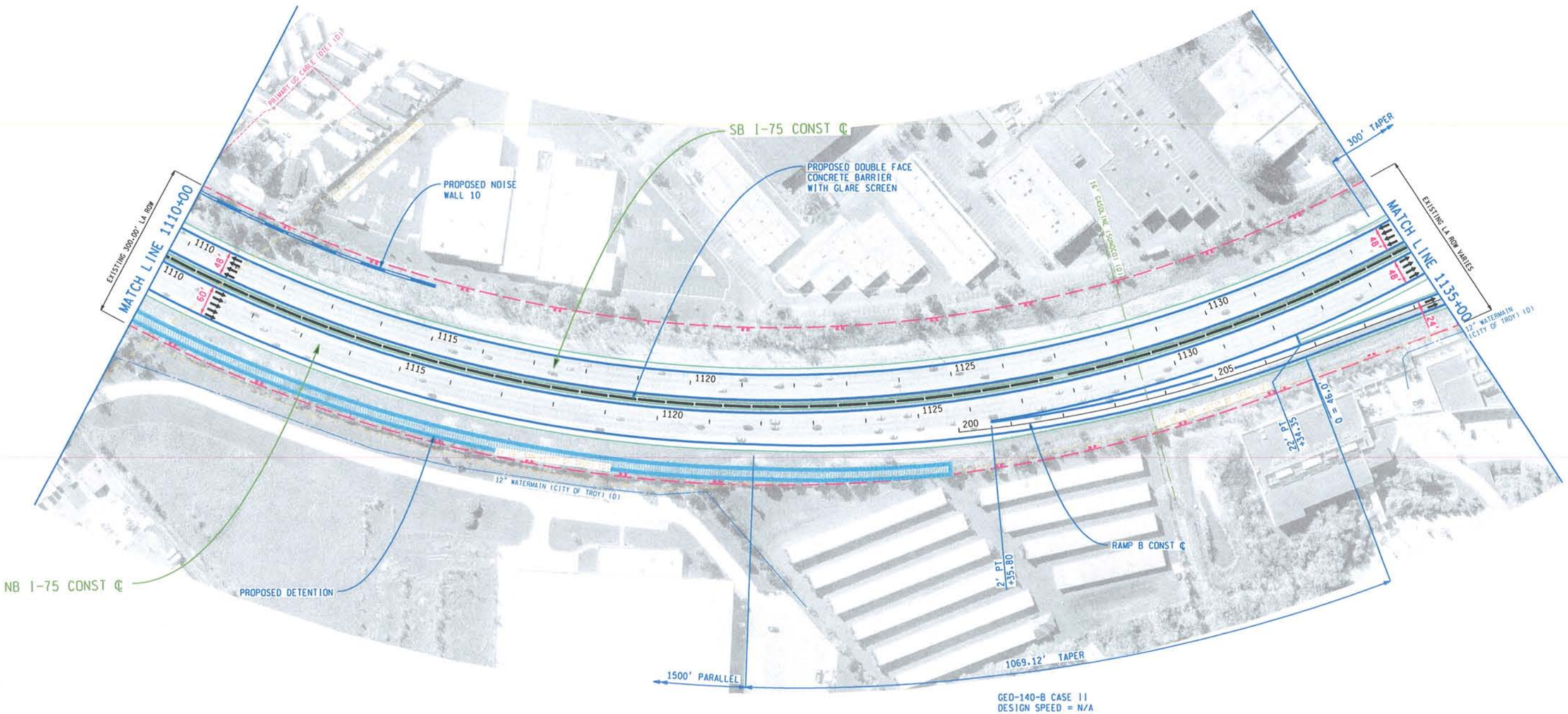
I-75 SOUTH OF 12 MILE RD TO SOUTH OF M-59
GEOMETRIC STUDY

I-75 STA 1080+00
TO STA 1110+00
ROCHESTER ROAD INTERCHANGE

FIGURE 4-21



SCALE

100' 50' 0' 100'

LEGEND

GAS LINE
ELECTRIC LINE
OTHER UTILITIES
WATERMAIN
OTHER UTILITIES

EXISTING WETLAND
EXISTING DRAINAGE FLOW
PROP PAVEMENT EDGE
PROP SHOULDER EDGE
PROP BARRIER
PROP RETAINING WALL
PROPOSED CUL-DE-SAC

PROP WETLAND
EXISTING LA R-O-W
EXISTING R-O-W
PROP R-O-W
PROP LA R-O-W
NOISE WALL
PROP BRIDGE

PROP SIDEWALK
PROP CONSTRUCTION ℄
PROP BRIDGE REPAIR
PROP PARK & RIDE
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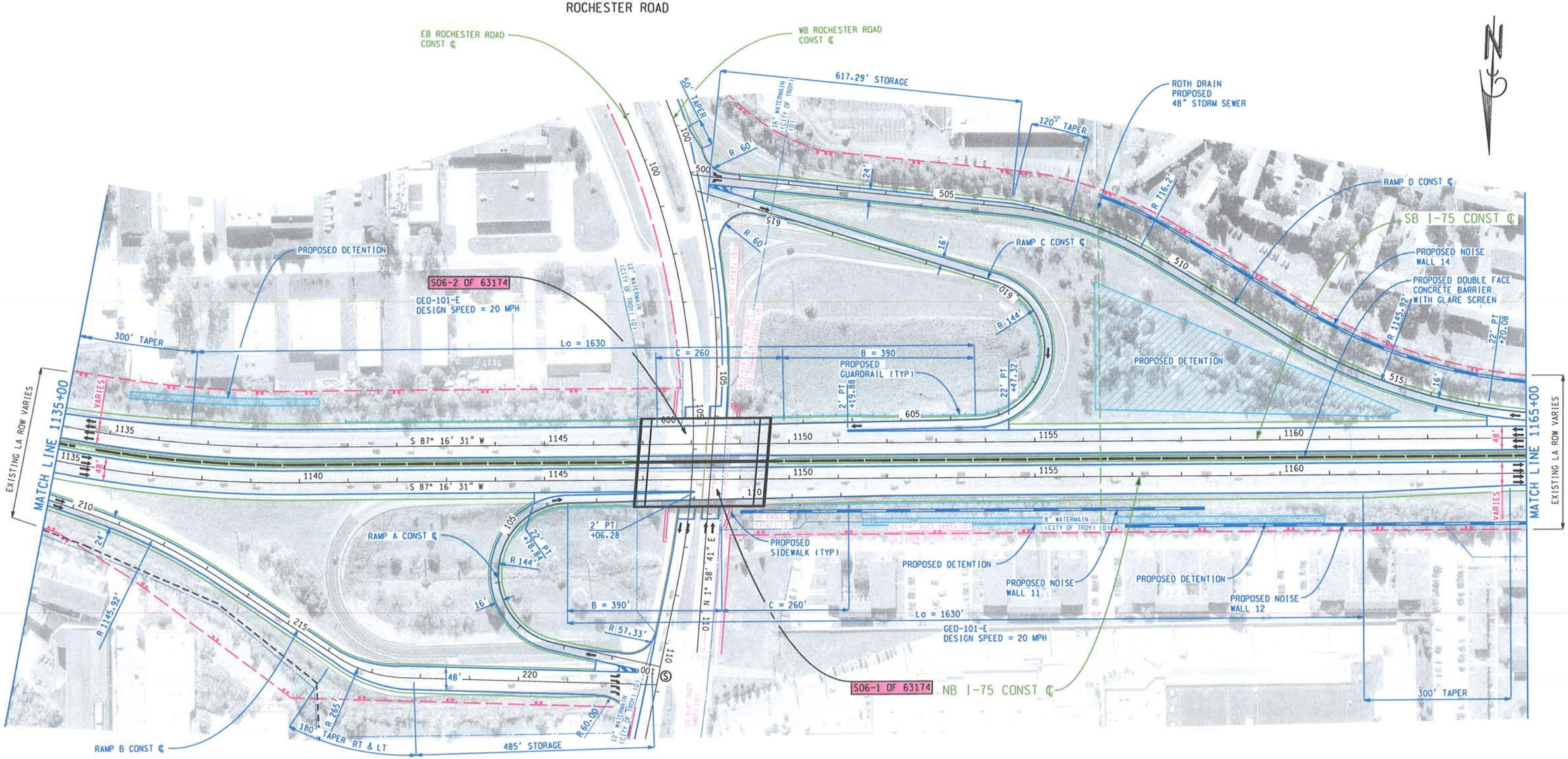
I-75 SOUTH OF 12 MILE RD TO SOUTH OF M-59
GEOMETRIC STUDY

I-75 STA 1110+00
TO STA 1135+00
ROCHESTER ROAD INTERCHANGE

FIGURE 4-22

ROCHESTER ROAD



ROCHESTER ROAD

SCALE

100' 50' 0' 100'

LEGEND

GAS LINE
ELECTRIC LINE
FIBER OPTIC
WATERMAIN
WATER SERVICE

EXISTING WETLAND
EXISTING DRAINAGE FLOW
PROP PAVEMENT EDGE
PROP SHOULDER EDGE
PROP BARRIER
PROP RETAINING WALL
PROPOSED CUL-DE-SAC

PROP WETLAND
EXISTING LA R-O-W
EXISTING R-O-W
PROP R-O-W
PROP LA R-O-W
NOISE WALL
PROP BRIDGE

PROP SIDEWALK
PROP CONSTRUCTION ℄
PROP BRIDGE REPAIR
PROP PARK & RIDE
SIGNALIZED INTERSECTION

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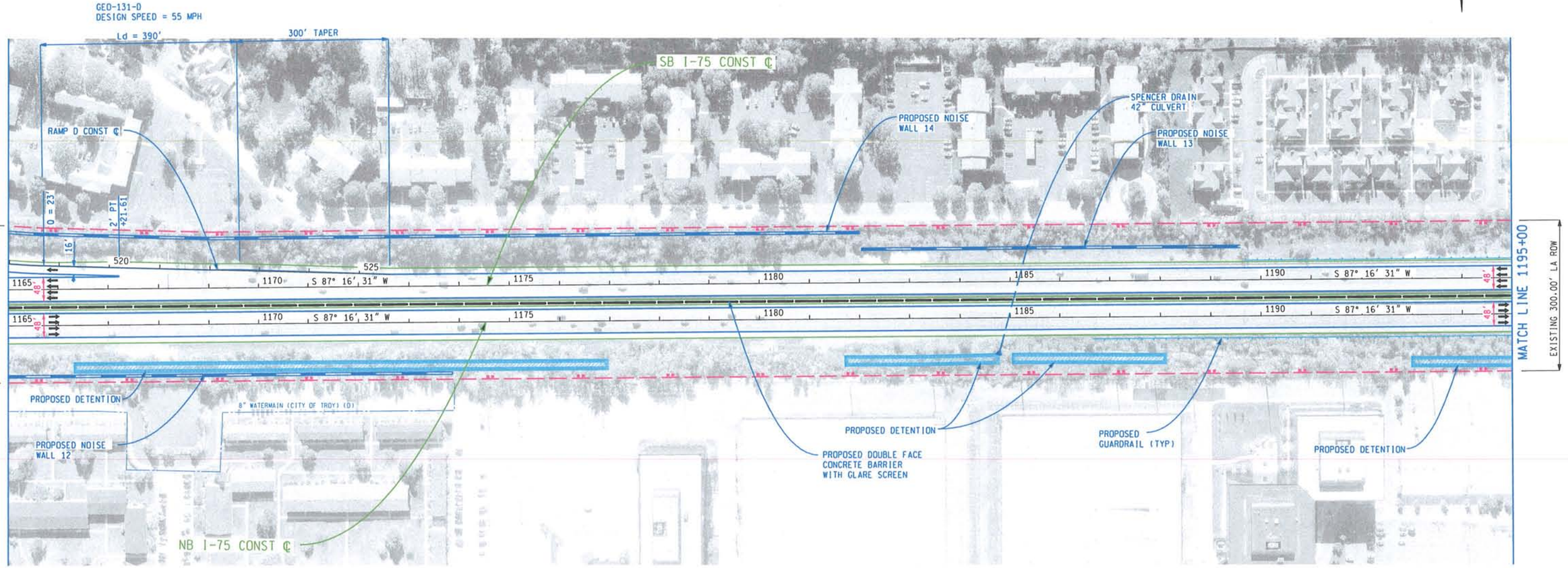
I-75 SOUTH OF 12 MILE RD TO SOUTH OF M-59
ENGINEERING REPORT

I-75 STA 1135+00
TO STA 1165+00
ROCHESTER ROAD INTERCHANGE

FIGURE 4-23



SCALE

100' 50' 0' 100'

LEGEND

GAS LINE
ELECTRIC LINE
WATERMAIN

EXISTING WETLAND
EXISTING DRAINAGE FLOW
PROP PAVEMENT EDGE
PROP SHOULDER EDGE
PROP BARRIER
PROP RETAINING WALL
PROPOSED CUL-DE-SAC

PROP WETLAND
EXISTING LA R-O-W
EXISTING R-O-W
PROP R-O-W
PROP LA R-O-W
NOISE WALL
PROP BRIDGE

PROP SIDEWALK
PROP CONSTRUCTION ℄
PROP BRIDGE REPAIR
PROP PARK & ROAD
SIGNALIZED INTERSECTION

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MICHIGAN DEPARTMENT OF TRANSPORTATION
I-75 SOUTH OF 12 MILE RD TO SOUTH OF M-59
GEOMETRIC STUDY

I-75 STA 1165+00
TO STA 1195+00
ROCHESTER ROAD INTERCHANGE

FIGURE 4-24

4.6.4 Big Beaver Road Interchange

The proposed configuration at the Big Beaver Road Interchange maintains the existing full cloverleaf interchange with par-clo terminal layouts in the NE and SW quadrants and full loop ramps in the NW and SE quadrants. The free-flow movements at the Big Beaver Road loop entrance ramps have been maintained. All eight of the ramps within the interchange are single lane ramps and connect to the CD roads rather than directly to mainline I-75. The NB and SB CD roads run parallel to mainline I-75 and are separated from I-75 by concrete barriers.

The proposed Big Beaver Road cross section matches the existing, however, the proposed outside piers for the I-75 bridges have been offset to provide adequate width for the City of Troy's future cross section, which includes a wider median (17.33 feet) and four travel lanes in each direction, while maintaining the 10 foot minimum horizontal clearance to the outside piers. In addition to the three through lanes in each direction, right turn lanes are provided to each of the four entrance ramps. The proposed cross section under the I-75 bridges are shown in **Figure 4-25.**

Big Beaver Road is classified as an exempt roadway. As a result, the desirable underclearance is 14.75 feet instead of 16.25 feet. In order to achieve the desired underclearance of 14.75 feet, the NB CD profile was raised approximately 1 foot over Big Beaver Road. However, due to the superelevation stackup between roadways, the SB CD profile will be raised approximately 3.5 feet over Big Beaver Road. Due to the limited amount of reconstruction along Big Beaver Road, the local road will remain at the existing grade throughout the limits of the project.

No additional ROW is anticipated to construct this interchange.

The proposed Big Beaver Road Interchange and local road is detailed in **Figures 4-26** through **4-30.**

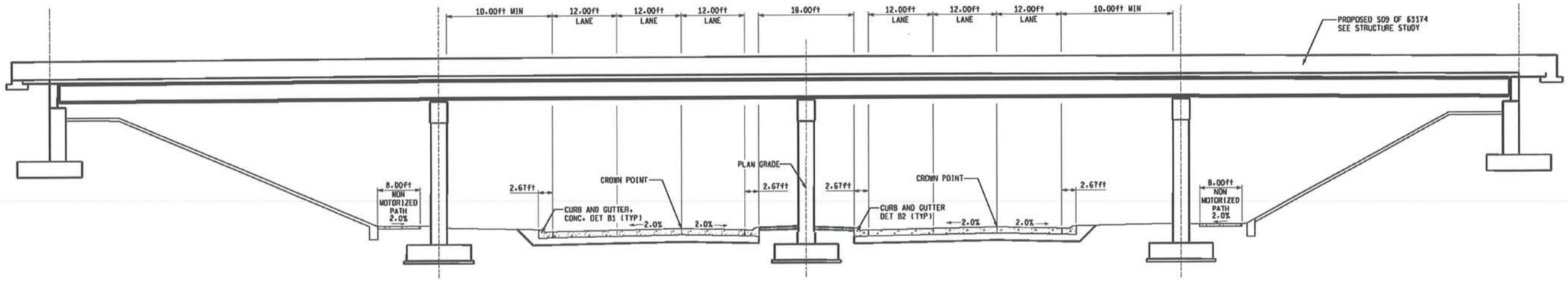

Figure 4-25 Proposed Cross Section for Big Beaver Road