I-75 ENGINEERING REPORT

South of 12 Mile Road to South of M-59
Oakland County, Michigan
CS 63174 JN 88168

VOLUME 1: SECTIONS 1 THROUGH 6

Prepared For

MDOT
Michigan Department of Transportation

Prepared By

URS

In Association With

CORRADINO
ENGINEERS • PLANNERS

Bergmann associates
architects // engineers // planners

T-Concepts Corp

sme

ROWE Professional Services Company

December 2009

VOLUME 1: I-75 ENGINEERING REPORT
From South of 12 Mile Road to South of M-59

OAKLAND COUNTY, MICHIGAN
CS-63174 JN-88168

Prepared For:

MDOT
Michigan Department of Transportation

Prepared By:

URS
DETROIT –SOUTHFIELD – GRAND RAPIDS – TRAVERSE CITY

December 2009

TABLE OF CONTENTS

Executive Summary ..... E 1

Section 1. Introduction and Project Overview 1-1
1.1 Project Location or Study Area 1-1
1.2 Project Background 1-3
1.3 Project Scope and Engineering Report Organization 1-3
Section 2. Existing Conditions 2-1
2.1 Existing Traffic Conditions and Crash Data 2-1
2.1.1 Capacity Analysis 2-1
2.1.2 Crash Analysis 2-3
2.2 Existing Roadway Conditions 2-3
2.2.1 Typical Sections 2-3
2.2.2 Freeway Alignment 2-4
2.2.3 Interchange Alignment 2-4
2.2.4 Drainage 2-4
2.2.5 Geotechnical 2-6
2.2.6 Utilities 2-9
2.2.7 Bridges and Structures 2-9
2.2.8 Non-Motorized Facilities 2-11
2.2.9 Environmental Characteristics 2-12
Section 3. Design Criteria 3-1
3.1 Design Criteria 3-1
Section 4. Preliminary Design Analysis 4-1
4.1 Design Traffic Volumes 4-1
4.2 HOV Implementation and Enforcement Overview 4-2
4.2.1 HOV Implementation 4-2
4.2.2 HOV Facility Design Overview 4-4
4.2.3 HOV Enforcement 4-7
4.3 Carpool Lots 4-11
4.4 Typical Sections 4-13
4.5 Freeway Alignment 4-14
4.6 Interchange Alignment 4-14
4.6.1 12 Mile Road Interchange 4-15
4.6.2 14 Mile Road Interchange 4-21
4.6.3 Rochester Road Interchange 4-27
4.6.4 Big Beaver Road Interchange 4-32
4.6.5 Crooks Road Interchange 4-38
4.6.6 Adams Road Interchange 4-41
4.6.7 Square Lake Road Interchange 4-44
4.7 Design Exceptions 4-50
4.8 Drainage 4-53
4.9 Utilities 4-63
4.10 Bridge and Structures 4-66
4.11 Right of Way 4-70
4.12 Non-Motorized 4-70
4.13 Corridor Construction Phasing 4-71
4.13.1 Corridor Construction Segments 4-71
4.13.2 Construction Duration for Project Segments 4-74
4.14 Maintenance of Traffic 4-78
4.14.1 Factors Considered During Alternative Development 4-78
4.14.2 Maintenance of Traffic Design Criteria 4-79
4.14.3 Conceptual MOT Alternatives 4-80
4.15 Summary of Traffic Modeling Results 4-175
4.15.1 Preferred MOT Concept 4-177
4.16 Develop ITS Initiatives and Strategies 4-180
4.16.1 Incident Management Routes 4-183
4.16.2 Dynamic Message Signs 4-184
4.16.3 Freeway Surveillance 4-184
4.16.4 Vehicle Detection Stations 4-185
4.16.5 Communication System 4-185
4.16.6 Operational Requirements 4-185
4.17 Environmental Impacts 4-185
4.18 Cost Estimates 4-185
Section 5. Public Involvement Plan 5-1
Section 6. Project Implementation 6-1
6.1 Funding Alternatives 6-1
6.2 Construction Contracting 6-1
6.3 FEIS Commitments 6-1
6.4 Utility Coordination 6-2

LIST OF APPENDICES

APPENDIX A: UTILITY MATRIX CONFLICT
APPENDIX B: OAKLAND COUNTY TRAIL MAP
APPENDIX C: SQUARE LAKE ROAD (I-75BL) INTERCHANGE ACCESS JUSTIFICATION REPORT
APPENDIX D: HOV QUESTIONNAIRE
APPENDIX E: HOV SUMMARY TABLE AND PLAN SHEETS
APPENDIX F: T-CONCEPTS TRAFFIC MODELING
APPENDIX G: COST ESTIMATES

LIST OF TABLES

Table 2-1 Peak Hour Level of Service Ranges 2-1
Table 2-2 Existing (2002) Peak Hour Volumes & LOS for I-75 Basic Freeway Segments 2-1
Table 2-3 Existing (2002) Peak Hour Volumes & LOS for I-75 Ramp Junctions & Weaves (NB) 2-2
Table 2-4 Existing (2002) Peak Hour Volumes & LOS for I-75 Ramp Junctions & Weave Sections (SB) 2-2
Table 2-5 Geotechnical Summary of Bridge Structures 2-6
Table 2-6 Summary of Existing Mainline Pavements 2-7
Table 2-7 Summary of Existing Pavement at the 12 Mile Road Interchange 2-7
Table 2-8 Summary of Existing Pavement at the 14 Mile Road Interchange 2-7
Table 2-9 Summary of Existing Pavement at the Rochester Road Interchange 2-8
Table 2-10 Summary of Existing Pavement at the Big Beaver Road Interchange 2-8
Table 2-11 Summary of Existing Pavement at the Crooks Road Interchange 2-8
Table 2-12 Summary of Existing Pavement at the Adams Road Interchange 2-8
Table 2-13 Summary of Existing Pavement at the Square Lake Road Interchange 2-9
Table 3-1 Summary of Geometric Design Criteria 3-2
Table 4-1 Design Year (2025) Peak Hour Volumes & LOS for I-75 Basic Freeway Segments 4-1
Table 4-2 Design Year (2025) Peak Hour Volumes & LOS for I-75 Ramp Jct. & Weave Sections (NB) 4-1
Table 4-3 Design Year (2025) Peak Hour Volumes & LOS for I-75 Ramp Jct. & Weave Sections (SB) 4-2
Table 4-4 Summary of Design Exceptions 4-51
Table 4-5 Structure Summary 4-68
Table 4-6 Proposed Maintenance of Traffic Design Criteria 4-80
Table 4-7 MOTSIM Alternatives 4-175
Table 4-8 Uniform Daily AM + PM User Costs per Segment 4-176
Table 4-9 Maintenance of Traffic Construction Cost per Segment 4-178
Table 4-10 Total Construction Estimates by Segment 4-186
Table 4-11 Construction Year Estimates by Segment 4-187
Table 4-12 FEIS Green Sheet: Project Mitigation Status 6-2

LIST OF FIGURES

Figure 1-1 Overview of the Study Area 1-1
Figure 1-2 Vicinity Map 1-2
Figure 2-1 Existing I-75 Typical Cross Section 2-3
Figure 2-2 Existing Retention Treatment Facility Under Construction in 1972 2-5
Figure 2-3 Existing Retention Treatment Facility Under Construction in 1973 Under I-75 2-5
Figure 2-4 Existing I-75 S18 Structures at the Square Lake Road Interchange 2-11
Figure 2-5 Existing Wattles Safety/Side Path Crossing I-75 2-12
Figure 4-1 Example of HOV Lane with Striping 4-3
Figure 4-2 Sample HOV Sign at Square Lake Road Interchange 4-4
Figure 4-3 Map of Virginia HOV Lane System 4-5
Figure 4-4 Conceptual Lot Layout of I-75/12 Mile Road Interchange NW Quadrant 4-11
Figure 4-5 View of Proposed Lot at I-75/Square Lake Road East of South Opdyke Road 4-12
Figure 4-6 Conceptual Lot Layout of I-75/Square Lake Road East of South Opdyke Road 4-12
Figure 4-7 Proposed Normal Crown Typical Cross Section for I-75 4-13
Figure 4-8 Proposed Cross Section for 12 Mile Road 4-15
Figure 4-9 12 Mile Road Interchange 4-16
Figure 4-10 12 Mile Road Interchange 4-17
Figure 4-11 12 Mile Road Interchange 4-18
Figure 4-12 12 Mile Road West Side 4-19
Figure 4-13 12 Mile Road East Side 4-20
Figure 4-14 Proposed Cross Section for 14 Mile Road 4-21
Figure 4-15 14 Mile Road Interchange 4-22
Figure 4-16 14 Mile Road Interchange 4-23
Figure 4-17 14 Mile Road Interchange 4-24
Figure 4-18 14 Mile Road West Side 4-25
Figure 4-19 14 Mile Road East Side 4-26
Figure 4-20 Proposed Cross Section for Rochester Road 4-27
Figure 4-21 Rochester Road Interchange 4-28
Figure 4-22 Rochester Road Interchange 4-29
Figure 4-23 Rochester Road Interchange 4-30
Figure 4-24 Rochester Road Interchange 4-31
Figure 4-25 Proposed Cross Section for Big Beaver Road 4-32
Figure 4-26 Big Beaver Road Interchange 4-33
Figure 4-27 Big Beaver Road Interchange 4-34
Figure 4-28 Big Beaver Road Interchange 4-35
Figure 4-29 Big Beaver Road West Side 4-36
Figure 4-30 Big Beaver Road East Side 4-37
Figure 4-31 Proposed Cross Section for Crooks Road 4-38
Figure 4-32 Crooks Road Interchange 4-39
Figure 4-33 Crooks Road Interchange 4-40
Figure 4-34 Proposed Cross Section for Adams Road 4-41
Figure 4-35 Adams Road Interchange 4-42
Figure 4-36 Adams Road Interchange 4-43
Figure 4-37 Proposed Cross Section for Square Lake Road Interchange 4-44
Figure 4-38 Square Lake Road Interchange 4-45
Figure 4-39 Square Lake Road Interchange 4-46
Figure 4-40 Square Lake Road Interchange 4-47
Figure 4-41 Square Lake Road Interchange 4-48
Figure 4-42 Ramps Square Lake Road Interchange 4-49
Figure 4-43 Drainage Exhibit A 4-54
Figure 4-44 Drainage Exhibit B 4-55
Figure 4-45 Drainage Exhibit C 4-56
Figure 4-46 Drainage Exhibit D 4-57
Figure 4-47 Drainage Exhibit E 4-58
Figure 4-48 Drainage Exhibit F 4-59
Figure 4-49 Drainage Exhibit G 4-60
Figure 4-50 Drainage Exhibit H 4-61
Figure 4-51 Existing View of the Barnard Drain (Spencer Drain) Looking East 4-62
Figure 4-52 Existing View of the Northbound Culvert at the Amy Drain 4-63
Figure 4-53 Proposed Wattles Road Bridge Cross Section with Non-Motorized Path 4-70
Figure 4-54 Corridor Construction Phasing 4-73
Figure 4-55 Alternative 1: Full Closure 4-75
Figure 4-56 Alternative 2: Half Closure 4-76
Figure 4-57 Alternative 3: Part Width 4-77
Figure 4-58 Alt 1: Full Freeway Closure of I-75 4-81
Figure 4-59 Alt 1: Full Freeway Closure of I-75 4-83
Figure 4-60 Alt 2: Half Freeway Closure of I-75 in One Stage 4-85
Figure 4-61 Alt 3: Two Lane Operation Using Crossovers 4-86
Figure 4-62 Alt 3: Two Lane Operation Using Crossovers 4-87
Figure 4-63 Alt 3: Two Lane Operation Using Crossovers 4-88
Figure 4-64 Alt 2: Half Freeway Closure of I-75 in One Stage 4-90
Figure 4-65 Alt 2: Half Freeway Closure of I-75 in One Stage 4-91
Figure 4-66 Alt 3: Two Lane Operation Using Crossovers 4-92
Figure 4-67 Alt 3: Two Lane Operation Using Crossovers 4-93
Figure 4-68 Alt 3: Two Lane Operation Using Crossovers 4-94
Figure 4-69 Alt 3: Two Lane Operation Using Crossovers 4-95
Figure 4-70 Alt 3: Two Lane Operation Using Crossovers 4-97
Figure 4-71 Alt 3: Two Lane Operation Using Crossovers 4-98
Figure 4-72 Alt 3: Two Lane Operation Using Crossovers 4-99
Figure 4-73 Alt 3: Two Lane Operation Using Crossovers 4-100
Figure 4-74 Alt 3: Freeway Detour Plan For I-75 4-101
Figure 4-75 Alt 3: Two Lane Operation Using Crossovers 4-102
Figure 4-76 Alt 3: Two Lane Operation Using Crossovers 4-103
Figure 4-77 Alt 3: Two Lane Operation Using Crossovers 4-105
Figure 4-78 Alt 3: Stage 3 Maintaining Traffic 4-106

Figure 4-79 Alt 3: Stage 3 Maintaining Traffic 4-107
Figure 4-80 Alt 3: Stage 5 Maintaining Traffic 4-109
Figure 4-81 Alt 3: Stage 5 Maintaining Traffic (Option 1) 4-110
Figure 4-82 Alt 3: Stage 5 Maintaining Traffic (Option 2) 4-111
Figure 4-83 Alt 3: Stage 5 Maintaining Traffic (Option 2) 4-112
Figure 4-84 Alt 3: Two Lane Operation Using Crossovers 4-114
Figure 4-85 Alt 3: Stage 3 Maintaining Traffic 4-115
Figure 4-86 Alt 3: Stage 3 Maintaining Traffic 4-116
Figure 4-87 Alt 3: Stage 3 Maintaining Traffic 4-117
Figure 4-88 Alt 3: Stage 3 Maintaining Traffic 4-118
Figure 4-89 Alt 3: Stage 5 Maintaining Traffic 4-120
Figure 4-90 Alt 3: Stage 5 Maintaining Traffic 4-121
Figure 4-91 Alt 3: Stage 5 Maintaining Traffic 4-122
Figure 4-92 Alt 3: Stage 5 Maintaining Traffic (Option 1) 4-123
Figure 4-93 Alt 3: Stage 5 Maintaining Traffic (Option 2) 4-124
Figure 4-94 Alt 3: Stage 5 Maintaining Traffic (Option 2) 4-125
Figure 4-95 Alt 3: Stage 5 Maintaining Traffic (Option 2) 4-126
Figure 4-96 Alt 3: Two Lane Operation Using Crossovers 4-128
Figure 4-97 Alt 3: Stage 3 Maintaining Traffic 4-129
Figure 4-98 Alt 3: Stage 3 Maintaining Traffic 4-130
Figure 4-99 Alt 3: Stage 3 Maintaining Traffic 4-131
Figure 4-100 Alt 3: Stage 5 Maintaining Traffic 4-133
Figure 4-101 Alt 3: Stage 5 Maintaining Traffic 4-134
Figure 4-102 Alt 3: Stage 5 Maintaining Traffic 4-135
Figure 4-103 Alt 3: Two Lane Operation Using Crossovers 4-137
Figure 4-104 Alt 3: Stage 3 Maintaining Traffic 4-138
Figure 4-105 Alt 3: Stage 3 Maintaining Traffic 4-139
Figure 4-106 Alt 3: Stage 3 Maintaining Traffic 4-140
Figure 4-107 Alt 3: Stage 3 Maintaining Traffic 4-141
Figure 4-108 Alt 3: Stage 5 Maintaining Traffic 4-143
Figure 4-109 Alt 3: Stage 5 Maintaining Traffic 4-144
Figure 4-110 Alt 3: Stage 5 Maintaining Traffic 4-145
Figure 4-111 Alt 3: Stage 5 Maintaining Traffic 4-146
Figure 4-112 Alt 3: Two Lane Operation Using Crossovers 4-148
Figure 4-113 Alt 3: Two Lane Operation Using Crossovers 4-149
Figure 4-114 Alt 3: Two Lane Operation Using Crossovers 4-150
Figure 4-115 Alt 3: Two Lane Operation Using Crossovers 4-151
Figure 4-116 Alt 3: Two Lane Operation Using Crossovers 4-152
Figure 4-117 Alt 3: Two Lane Operation Using Crossovers 4-153
Figure 4-118 Alt 3: Two Lane Operation Using Crossovers 4-154
Figure 4-119 Alt 3: Two Lane Operation Using Crossovers 4-156
Figure 4-120 Alt 3: Stage 3A Maintaining Traffic 4-157
Figure 4-121 Alt 3: Stage 3A Maintaining Traffic 4-158
Figure 4-122 Alt 3: Stage 3A Maintaining Traffic 4-159
Figure 4-123 Alt 3: Stage 3A Maintaining Traffic 4-160
Figure 4-124 Alt 3: Stage 3A Maintaining Traffic 4-161
Figure 4-125 Alt 3: Stage 3B Maintaining Traffic 4-162
Figure 4-126 Alt 3: Stage 3B Maintaining Traffic 4-163
Figure 4-127 Alt 3: Stage 3B Maintaining Traffic 4-164
Figure 4-128 Alt 3: Stage 3B Maintaining Traffic 4-165
Figure 4-129 Alt 3: Stage 3B Maintaining Traffic 4-166
Figure 4-130 Alt 3: Stage 5 Maintaining Traffic 4-168
Figure 4-131 Alt 3: Stage 5 Maintaining Traffic 4-169
Figure 4-132 Alt 3: Stage 5 Maintaining Traffic 4-170
Figure 4-133 Alt 3: Stage 5 Maintaining Traffic 4-171
Figure 4-134 Alt 4: Three Lane Operation (Contra-Flow) 4-173
Figure 4-135 Alt 4: Three Lane Operation (Contra-Flow) 4-174
Figure 4-136 I-75 MOTSIM Network and Construction Segments 4-176
Figure 4-137 I-75 MOT Alternatives Evaluation Matrix 4-179

LIST OF SEPERATELY BOUND VOLUMES

VOLUME 1: SECTIONS 1 THROUGH 6
VOLUME 2: FREEWAY / INTERCHANGE ROADWAY PLANS
VOLUME 3: GEOMETRIC STUDY
VOLUME 4: STRUCTURE STUDY
VOLUME 5: DRAINAGE STUDY
VOLUME 6: GEOTECHNICAL REPORT
VOLUME 7: CARPOOL LOT STUDY

Executive Summary

E 1.0 Introduction and Project Overview

I-75 is a transcontinental highway connecting Miami, Florida and Sault Ste. Marie, Michigan. It is a vital component of the overall transportation system in Michigan and the United States. In Michigan, I-75 is the major north-south highway, connecting with other freeways in 16 locations. See **Figure E 1-1** for an overview of the study area. This Engineering Report is an extension of the original planning and engineering efforts conducted with the development of the Final Environmental Impact Statement (FEIS), for Oakland County. The Engineering Report is divided into two sections. The southern section is from north of 8 Mile Road to south of 12 Mile Road. The northern section is from south of 12 Mile Road to south of M-59 and provides access to the cities of Madison Heights, Royal Oak, Troy, Auburn Hills, and Pontiac, as well as Bloomfield Township. The northern project is 13.64 miles and includes seven interchanges and ten local road crossings. Within the the northern project limits, I-75 connects with the following state trunklines: I-75BL/US-24 BL (Square Lake Road), and M-59.

Originally, I-75 was laid out in a stair-step manner following section and property lines to minimize impacts to the development which existed at the time (1960s). Built in the late 1960s, I-75 was a means for fast travel. Now I-75 is the most highly traveled freeway in Michigan and in the past 20 years has become a gateway for travel north and south. Its NW/SE orientation was designed to roughly parallel Woodward Avenue (M-1) and Dixie Highway (U.S. 24 in portions), serving destinations separated by long distances such as Flint and points north. The diagonal orientation of I-75 forces it to act, in some measure, as a local roadway. It is used by many Oakland County residents and workers for intra-county/local trips. Parallel local options are not available due to development and land features, such as lakes and wetlands which are prevalent in Oakland County. The north/south and east/west local roadway grid system does not serve I-75 travel needs well and does a poor job of providing alternative, direct access between development nodes that have been created along the diagonal of I-75. At the time that I-75 was built, development of businesses and homes were much less then they are today. Residents and businesses of Oakland County utilize I-75 for intra county/local trips as well as many other uses. There are several studies showing that a widening of I-75 is beneficial for existing and future economic growth to the county.

The purpose of the proposed project is to increase the capacity of the transportation infrastructure in the I-75 corridor to meet travel demand for personal mobility and goods movement. The project need for increased corridor capacity is driven by the growth that has occurred along I-75 since its original construction. The specific conditions creating the need are:

- Population
- Employment Growth
- Existing Traffic
- Future Traffic
- Existing Design Standards
- Physical Condition
- Safety
- Goods Movement

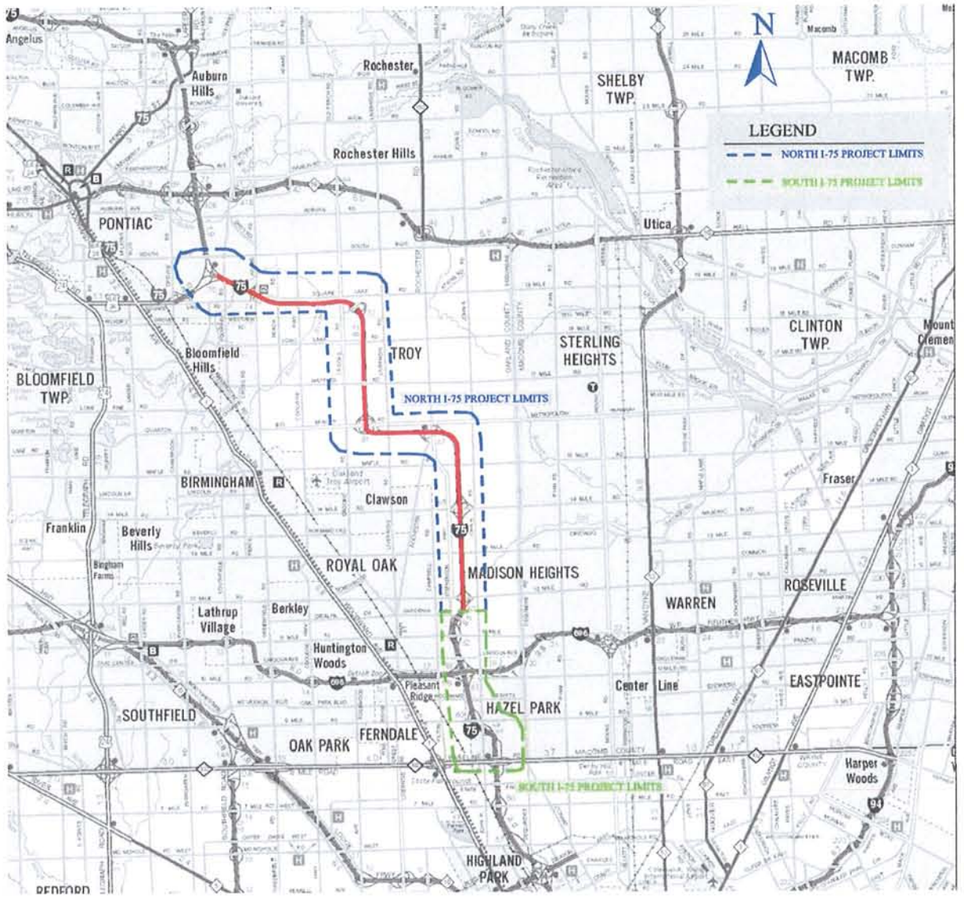


Figure E 1-1 Overview of the Study Area

This report provides the design, framework, estimates and impacts to comprehensively upgrade and provide additional capacity to the freeway.

E 1.1 Project Background

Several studies conducted by the Michigan Department of Transportation (MDOT) since 1990 have recommended adding a lane in each direction to I-75 throughout Oakland County in areas where there are fewer than four through lanes per direction in total, due to forecasted increased traffic volumes and additional development. Also recommended are improvements to interchanges, arterial streets, and ITS. A study of how the transit infrastructure could be strengthened and expanded to improve the transit's share of travel in the I-75 corridor was also completed. Those studies led to the development and approval of the I-75 Final Environmental Impact Statement (FEIS).

Development of the FEIS for I-75 began in 2003 in response to the need established in the previous studies. The Final EIS was released in 2005, and addresses the reconstruction of I-75 and the widening from three to four lanes in each direction between M-102 and just south of M-59. The preferred alternative which was recommended in the Final EIS was to construct one additional lane in each direction from M-102 and South Boulevard. The median lanes would be limited to use by High Occupancy Vehicles (HOV) during peak hours. The preferred alternative also included the reconstruction of the 12 and 14 Mile Road Interchanges.

This report details the median widening, reconstruction along I-75, upgrading of all seven interchanges and local road crossings. The report also reviewed the existing and proposed drainage, traffic analysis, HOV and Intelligent Transportation System (ITS) and work associated at each structure.

E 2.0 Design Criteria

The geometric design criteria used for the upgrade of the freeway, interchanges, ramps and local roads is detailed in the Engineering Report. The goal of the new design for the project is to meet the design criteria for all design elements within the project limits.

E 3.0 Preliminary Design Analysis

E 3.1 Traffic Operations

Existing and design year (2025) traffic operations reveal the need for additional capacity along I-75 between 12 Mile Road and South Boulevard. The peak hour Level of Service (LOS) of numerous freeway segments, ramp/freeway junctions, and freeway weave segments along I-75 operate at LOS "E" or "F" conditions under the No-Build Alternative. With the additional lane in each direction of I-75 (for HOV use), design year (2025) peak hour traffic operations are in the acceptable range for almost all freeway segments, ramp/freeway junctions, and freeway weave segments.

An Interchange Access Justification Report (IAJR) was completed for the I-75/Square Lake Road (I-75BL) Interchange. The FEIS-Approved Alternative retained the existing left-exiting and left-entering ramps along northbound I-75. A new alternative that included standard right-exiting and right-entering ramps was designed. The results of the IAJR indicate that the proposed interchange with right-entering and right-exiting ramps operated at acceptable peak hour Levels of Service, while meeting the various FHWA policy guidelines for modifications to the Interstate system.

E 3.2 Recommendations for HOV Implementation and Operation

A survey was done of the current practice of High Occupancy Vehicle (HOV) lane design used for select facilities in the United States. Specifically, HOV lane management agencies were contacted in Minnesota, Georgia, Virginia, California and Washington, related to general facility design. The following is a list of recommendations for consideration with respect to the implementation and operation of HOV facilities on I-75 based on best practices and engineering judgment.

HOV Justification – It is recommended that the HOV lane provide at least a one minute time savings per mile to HOV users over users of general purpose lanes in order to justify the need for the HOV lane.

Beginning and ending the HOV lanes – 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.

Delineating HOV lanes – Skip-dash pavement marking striping is recommended for transfer facilities (locations designated for ingress/egress from the HOV facility) with solid double pavement marking stripes between transfer facilities. This configuration should reduce the opportunities for violation.

What constitutes an HOV vehicle - 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 MDOT 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 – It is recommended HOV lanes be in effect a minimum of two hours each in the morning and afternoon peak hours each weekday.

Design Criteria – 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.

Recommendations for HOV Enforcement. The following are the recommendations for consideration with respect to the enforcement of the rules and regulations (hours of operation, occupancy requirements, etc.) of the HOV facilities on I-75 based on best practices and engineering judgment:

Responsibility – It is recommended that HOV enforcement be the responsibility of the enforcement agency responsible for that section of roadway.

Shoulder Width – At times of inclement weather when sufficient shoulder width does not exist violators should be directed to the far right shoulder.

Fine Collection – It is proposed that fines collected be directed towards the agency doing the enforcement to encourage their efforts. Fines should be sufficient to be a deterrent and escalate as a motorist incurs multiple violations.

Enforcement – Violators should be identified by roving patrols unless excessive violations (i.e. greater than 15%) are occurring.

E 3.3 Carpool Lots

Carpool lots support HOV lane use by providing areas where drivers can form carpools and then be eligible to use the HOV lane. Implementation of expanded Intelligent Transportation Systems (ITS) also hold potential to encourage carpool formation and HOV lane use by informing motorists of the availability of carpool parking. The existing MDOT carpool parking lots along I-75 in the Metro Region from Adams Road to Grange Hall Road were reviewed. Recommendations regarding these lots and potential new lots, were based on the findings of the *Strategic Need Plan for Metro Region Carpool Lots*.

Recommendations are made to develop, three sites along I-75 between 8 Mile Road and south of M-59: I-696, 12 Mile Road, and Square Lake Road. Each of these carpool lots would serve new areas. Development of these lots support the HOV lane. Two additional lots at University Drive and M-15/Ortonville Road are beyond the project's limits but would further reinforce HOV lane use by providing additional opportunities to carpool.

E 3.4 Freeway Alignment

The NB I-75 and SB I-75 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 are below the 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.

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. 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.

- 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

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. 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. Per MDOT Geometrics, 50% of the supertransition distribution will be within the curves which will require a design exception for superelevation distribution.

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 Road Interchange have a design speed of 70 mph. Since the design speed meets posted speed, design exceptions for documentation by MDOT are all that is required for these crest vertical curves. 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***.

E 3.5 Interchange Alignment

Consistent with the FEIS, the 12 and 14 Mile Road interchanges include significant local road reconstruction and the Square Lake Road Interchange (I-75 BL) also includes major revisions.

The proposed configuration at the 12 Mile Road Interchange, **Figure E 3-1**, 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.

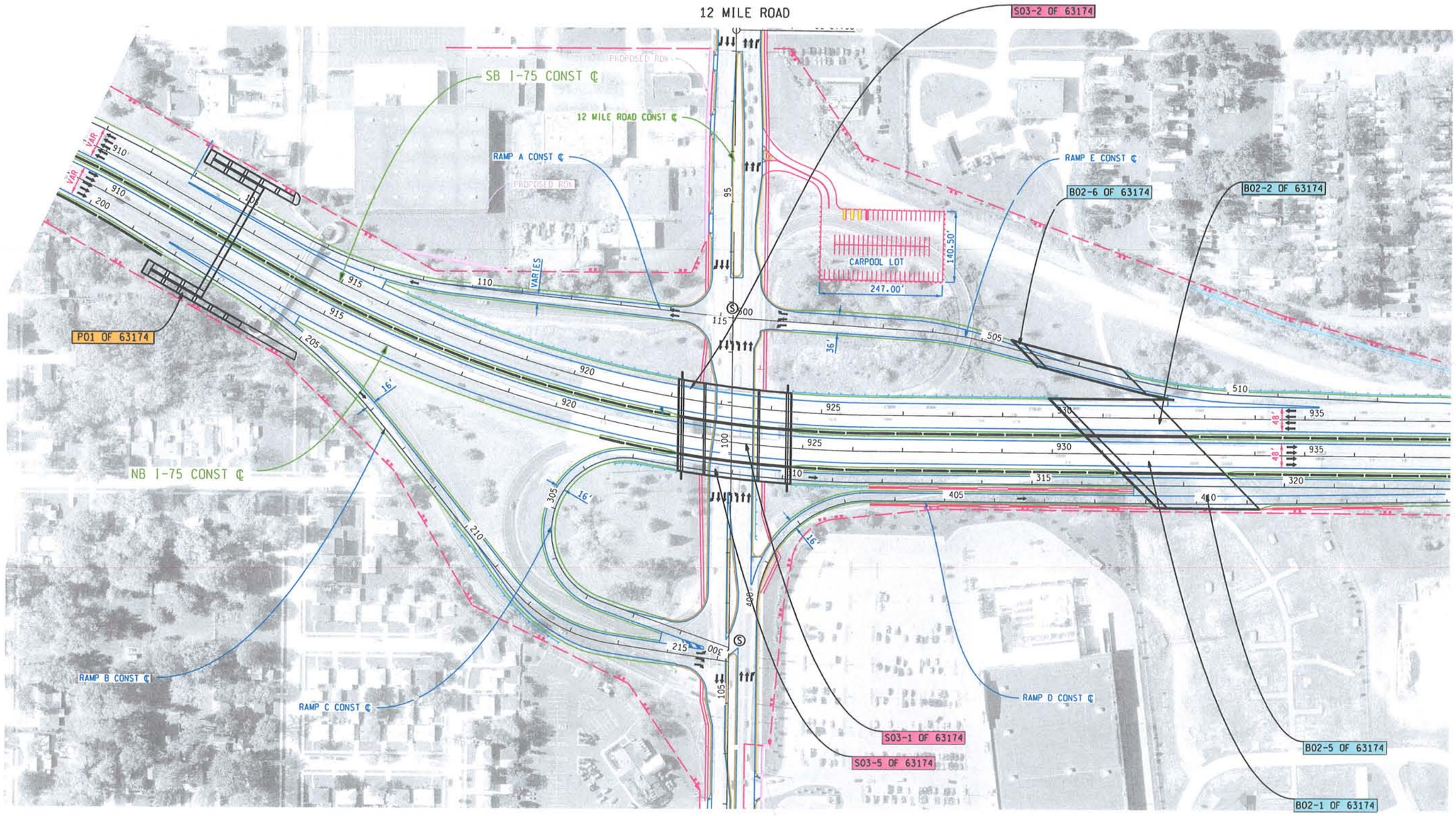
The proposed 12 Mile Road cross section adds more width to facilitate dual left turns for the WB to SB entrance ramp movement (as a result of the elimination of the loop ramp in the NW quadrant). The proposed widening occurs symmetrically over 160 feet to the east and to the west of the 12 Mile Road 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 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 an additional lane in each direction from the free-flow loop ramps directly under I-75, **Figure E 3-2**. 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. 14 Mile Road is completely within a tangent at the interchange, and therefore is in normal crown.

The proposed configuration at the Square Lake Road Interchange, **Figure E 3-3**, eliminates the free-flow left entrance and exit ramps along NB I-75. NB I-75 has been realigned horizontally to parallel SB I-75 within the limits of the interchange, which results in sufficient real estate to achieve the desired right entrance and exit ramps along NB I-75. To reduce the number of proposed structures within the interchange, both NB and SB I-75 make up the lowest level of the tri-level interchange and have a median separation of approximately 20 feet which allows sufficient space for the placement of the proposed piers supporting the two fly-over structures. The NB I-75 to WB I-75 BL ramp is the mid-level, while the EB I-75 BL to NB I-75 is the highest level of the tri-level interchange. Weave merge lanes have been continued to the Adams Road Interchange to the south. The only work anticipated along the I-75 BL (Square Lake Road) at this location is the work required to reconstruct and upgrade the ramps to current standards.

FIGURE 3-1
12 MILE ROAD INTERCHANGE



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

URS
Surface Transportation
Grand Rapids . Southfield .
Traverse City

MDOT
Michigan Department of Transportation

MDOT JOB NO.
88168

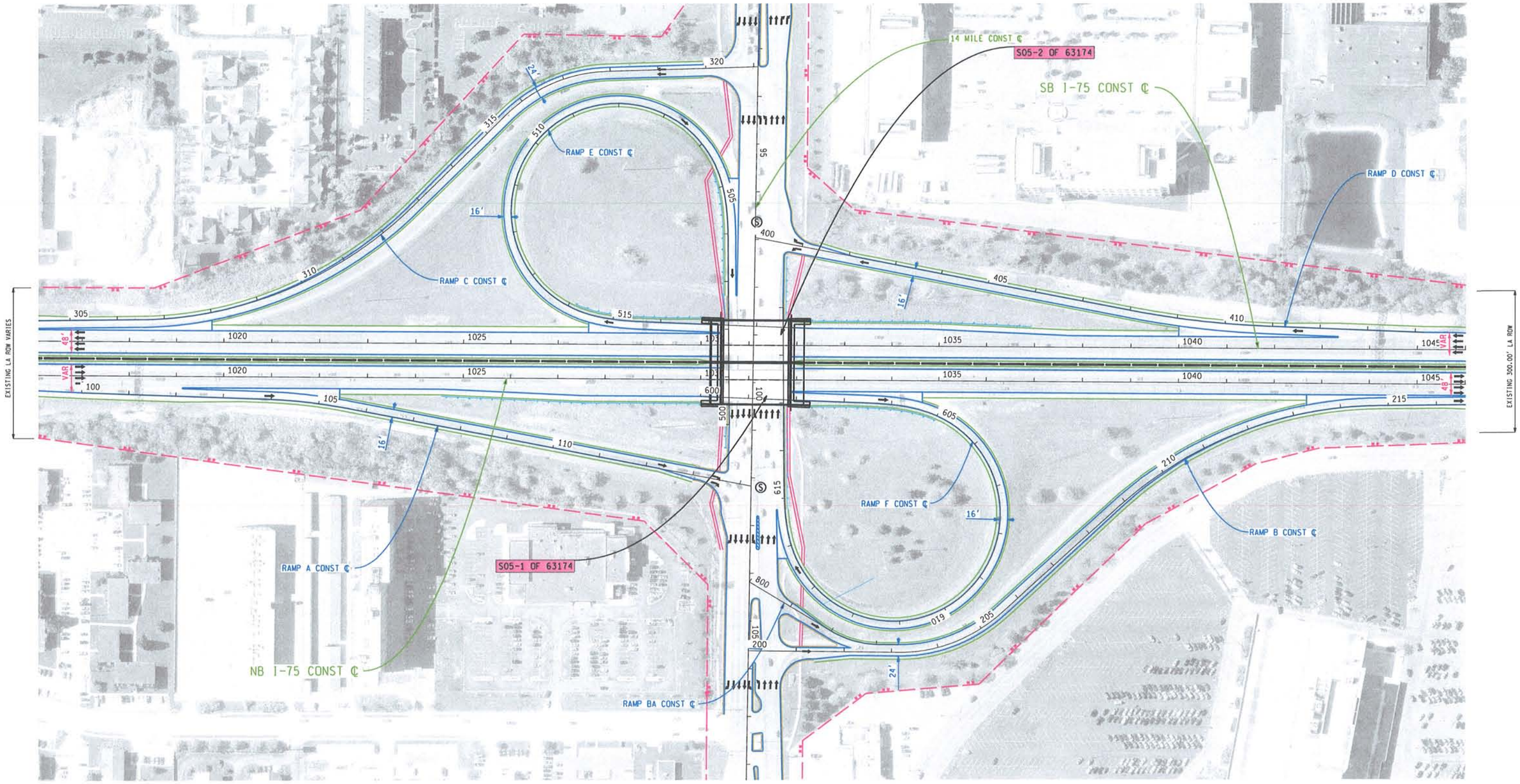
MDOT CONTROL SECTION
63174

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

12 MILE ROAD INTERCHANGE

FIGURE 3-2
14 MILE ROAD INTERCHANGE

14 MILE ROAD



SCALE
100' 50' 0' 100'

LEGEND

GAS LINE
ELECTRIC LINE
FIBER OPTIC
WATERMAIN
MISC 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

URS
Surface Transportation
Grand Rapids . Southfield .
Traverse City

MDOT
Michigan Department of Transportation

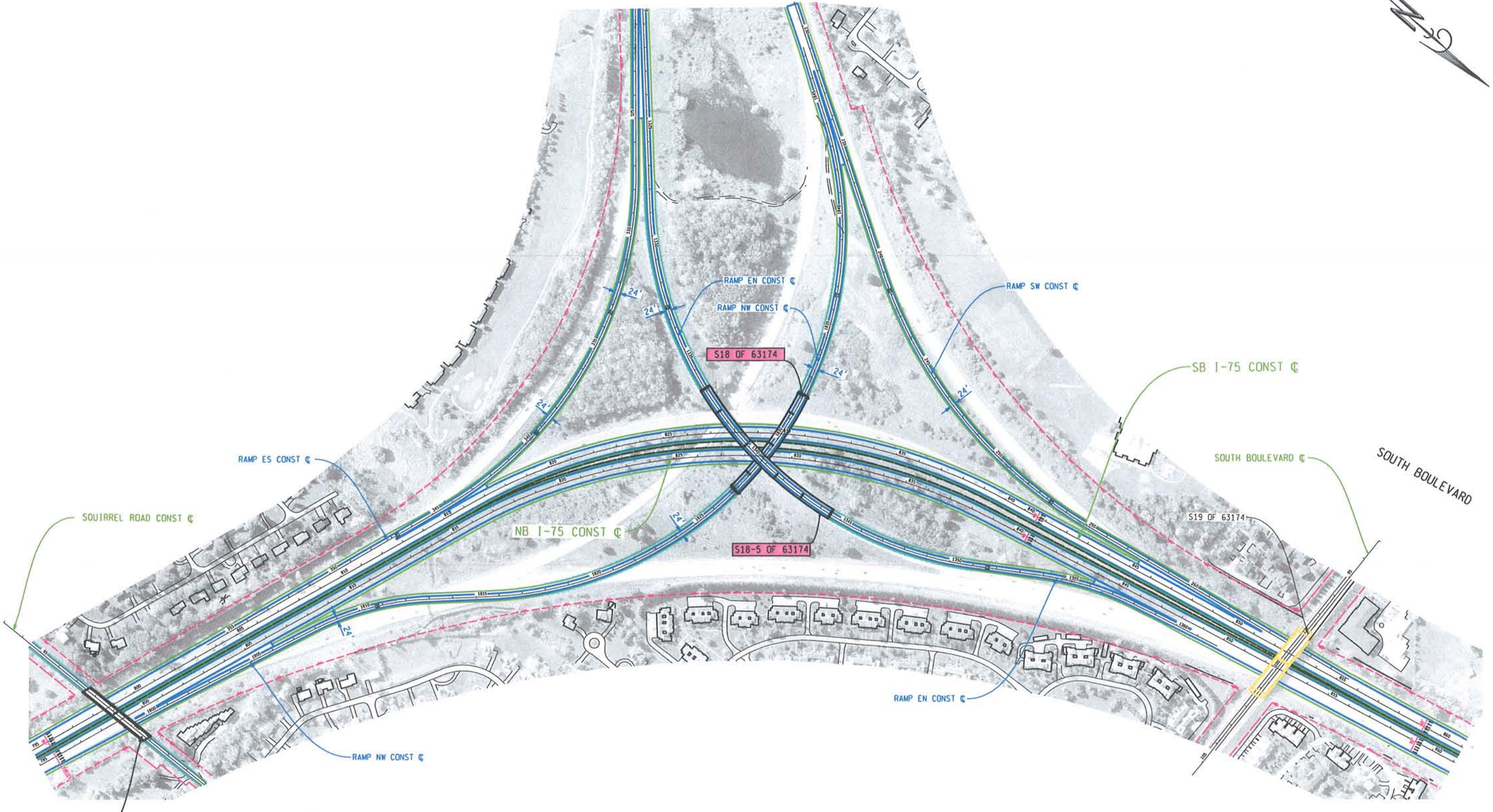
MDOT JOB NO.
88168

MDOT CONTROL SECTION
63174

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

14 MILE ROAD INTERCHANGE

FIGURE 3-3
SQUARE LAKE ROAD INTERCHANGE



SCALE
200' 100' 0' 200'

LEGEND
GAS LINE
ELECTRIC UTILITY LINE
POWER TRANS LINE
FIBER OPTICS
EXISTING R-O-W
SANITARY LINE
WATERMAIN
CABLE

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

URS
Surface Transportation
Grand Rapids . Southfield .
Traverse City

MDOT
Michigan Department of Transportation

MDOT JOB NO.
88168

MDOT CONTROL SECTION
63174

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

SQUARE LAKE ROAD
INTERCHANGE

A minimum underclearance of 16.25 feet has been maintained for all roadways within this interchange. Due to the horizontal alignment changes and reordering of the levels within the tri-level interchange, significant vertical changes were necessary. NB I-75 will require approximately 20 feet of excavation through the existing NW Ramp embankment to construct, while SB I-75 will require approximately 15 feet of excavation through the existing NW Ramp embankment. The NB I-75 to EB I-75 BL profile has been raised approximately 14 feet, while the EB I-75 BL to NB I-75 ramp profile has been raised approximately 11 feet.

No additional ROW is anticipated to construct this interchange.

E 3.6 Design Exceptions

Design criteria were created and set forth to meet both the current Michigan Department of Transportation standards and the Federal Highway Administration standards. This design criteria is detailed in **Table 3-1** of the **Engineering Report**. In some locations throughout the project, some of the criteria was unattainable due to physical and socioeconomic constraints, and ROW limitations.

Locations of design elements that have not met the required standard have been documented and attached in **Table 3-2** of the **Engineering Report** as design exceptions. Each design exception has a list of the design elements that are not to standard, the location of the design exception, the existing element design value, the proposed element design value, and the standard design value required. Each location also has a brief explanation of the cause of the design exception.

E 3.7 Drainage

A significant component of the proposed freeway reconstruction will be the replacement and improvement of the drainage system. The existing freeway from south of 12 Mile Road to south of M-59 is comprised of open roadway sections with median and roadside ditches. These ditches convey the storm water to one of the 34 crossings along the I-75 corridor. Due to the addition of the HOV lane, the median ditch is being eliminated and replaced with barrier and valley gutter. The runoff in the median will now be collected and conveyed to the roadside ditches with proposed storm sewer. All of the culverts along the corridor will be replaced and upgraded to meet current standards. Where the proposed roadway improvements will generate additional runoff, detention is being proposed to mitigate flows to existing conditions. The detailed analysis and design can be found in ***VOLUME 5: DRAINAGE REPORT.***

E 3.8 Utilities

A preliminary utility investigation was completed for the I-75 corridor area. During the study, various alternatives were considered and utility impact was a factor in determining the best options. The utility companies were contacted and sent requests for utility locations within the study limits. Preliminary plans show the underground utilities and significant aerial wires and high transmission lines. Any major utility concerns along the project limits were detailed within the **Engineering Report** in **Section 4.9**.

E 3.9 Bridges and Structures

The reconstruction work associated with this project is from south of 12 Mile Road to south of M-59 and affects the majority of the existing bridges along the corridor. The structures associated with this project require replacement due to:

- Freeway reconstruction
- Improvements to local roads and ramps
- Upgrading the design loading for the bridges to meet the new AASHTO LRFD Bridge Design Specifications
- Providing the required underclearance
- Meeting the required road geometrics

The recommended scope of work for each bridge was determined taking the required geometry and construction cost as well as the conditions of the existing bridge into consideration.

A preliminary beam design was completed for each superstructure alternative utilizing the AASHTO LRFD Bridge Design Specifications. The MDOT HL-93 Modified live loading was used for the design loading for each alternative.

There are seven interchanges and associated ramps, eight local road crossings, a crossing at the Red Run Drain and a pedestrian bridge within the project limits. Two local road crossings, Crooks Road (S13 and S32) and South Boulevard (S19), do not have any structure work associated with them. See **Table E 3-1** for structure study and cost estimates. A more in depth discussion of the design can be found in the ***VOLUME 4: STRUCTURE STUDY*** and the **Engineering Report Section 4.10**.

Table E 3-1 Structure Summary Table

CONSTRUCTION SEGMENT AND ANTICIPATED CONSTRUCTION START DATE	STRUCTURE NUMBER	DESCRIPTION	EXISTING STRUCTURE	RECOMMENDED STRUCTURE	GRADE RAISE (FT)	2009 ESTIMATED COST
Construction Segment 1 - 2026	P01 of 63174	Pedestrian Bridge Crossing I-75 South Of 12 Mile Rd.	Two Span steel	Two-span cont. steel beams	-	$ 2,663,000
	S03-1 of 63174	NB I-75 Over 12 Mile Road	Four span prestressed concrete beams	Three-span cont. curved steel girders	2.5	$ 3,581,000
	S03-2 of 63174	SB I-75 Over 12 Mile Road			2.0	$ 3,598,000
	S03-5 of 63174	NB I-75 On-Ramp 12 Mile Road-New Bridge	N/A		-	$ 1,310,000
	B02-1 of 63174	NB I-75 Over Red Run Drain	Three span steel girders	One span steel girders	6.0	$ 3,570,000
	B02-2 of 63174	SB I-75 Over Red Run Drain			4.5	$ 3,388,000
	B02-5 of 63174	NB I-75 On-Ramp Over Read Run Drain-New Bridge	N/A		-	$ 2,924,000
	B02-6 of 63174	SB I-75 Off-Ramp Over Read Run Drain-New Bridge	N/A		-	$ 1,728,000
		Retaining Walls	N/A			$ 1,405,000
	S04-1 of 63174	NB I-75 Over 13 Mile Road	Three span prestressed concrete beams	Three span prestressed concrete beams, LL cont.	0.5	$ 2,434,000
	S04-2 of 63174	SB I-75 Over 13 Mile Road			1.0	$ 2,317,000
					Segment Subtotal	**$ 28,918,000**
Construction Segment 2 - 2028	S05-1 of 63174	NB I-75 Over 14 Mile Road	Three span steel girders	One span MI 1800 girders	3.3	$ 3,211,000
	S05-2 of 63174	SB I-75 Over 14 Mile Road			3.8	$ 3,211,000
	S21-1 of 63174	NB I-75 Over 15 Mile Road	Three span prestressed concrete beams	Three-span cont. steel beams	1.0	$ 2,749,000
	S21-2 of 63174	SB I-75 Over 15 Mile Road			1.5	$ 2,295,000
	S06-1 of 63174	NB I-75 Over M-150/Rochester Road	Four span prestressed concrete beams	Four-span cont. steel beams	0.4	$ 4,826,000
	S06-2 of 63174	SB I-75 Over M-150/Rochester Road			1.0	$ 4,234,000
					Segment Subtotal	**$ 20,526,000**
Construction Segment 3 - 2029	S08-1 of 63174	NB I-75 Over Livernois Ave.	Three span prestressed concrete beams	Three-span cont. steel beams	0.4	$ 2,932,000
	S08-2 of 63174	SB I-75 Over Livernois Ave.			1.0	$ 2,581,000
	S09-1 of 63174	NB I-75 Over Big Beaver Road	Four simple span steel beams	Four-span cont. curved steel girders	2.2	$ 6,038,000
	S09-2 of 63174	SB I-75 Over Big Beaver Road			3.6	$ 5,289,000
	S09-5 of 63174	NB I-75 CD Over Big Beaver Road			3.1	$ 3,363,000
	S09-6 of 63174	SB I-75 CD Over Big Beaver Road			3.8	$ 3,398,000
	S10 of 63174	Wattles Road Over I-75	Four span prestressed concrete beams	Two-span cont. steel girders	0.0	$ 4,832,000
	P07 of 63174	Pedestrian Bridge Over I-75 At Wattles Road-To Be Removed	Two span prestressed concrete beams	Removed	-	
					Segment Subtotal	**$ 28,433,000**
Construction Segment 4 - 2030	S11-1 of 63174	NB I-75 Over East Long Lake Road	Three span prestressed concrete beams	Three-span cont. steel beams	0.6	$ 2,878,000
	S11-2 of 63174	SB I-75 Over East Long Lake Road			0.5	$ 2,562,000

CONSTRUCTION SEGMENT AND ANTICIPATED CONSTRUCTION START DATE	STRUCTURE NUMBER	DESCRIPTION	EXISTING STRUCTURE	RECOMMENDED STRUCTURE	GRADE RAISE (FT)	2009 ESTIMATED COST
	S12 of 63174	Corporate Drive Over I-75	Four simple span steel beams	Two-span cont. steel girders	0.7	$ 3,120,000
	S14-1 of 63174	NB I-75 Over Coolidge Road	Three span prestressed concrete beams	Three-span cont. steel beams	0.4	$ 2,486,000
	S14-2 of 63174	SB I-75 Over Coolidge Road			0.5	$ 2,244,000
	S15-1 of 63174	NB I-75 Over Square Lake Road	Three simple span steel beams	Three span prestressed concrete beams, LL cont.	3.3	$ 2,402,000
	S15-2 of 63174	SB I-75 Over Square Lake Road			2.3	$ 2,622,000
	S16-1 of 63174	NB I-75 Over Adams Road	Three span prestressed concrete beams	Three-span cont. steel beams	1.0	$ 3,246,000
	S16-2 of 63174	SB I-75 Over Adams Road			1.0	$ 3,226,000
					Segment Subtotal	**$ 24,786,000**
Construction Segment 5 - 2031	S17 of 63174	Squirrel Road Over I-75	Four simple span steel beams	Two-span cont. steel girders	1.3	$ 2,856,000
	S18 of 63174	Square Lake Road (I-75 BL) Interchange	Three span steel beams	Four-span cont. steel girders	6.5 *	$ 5,645,000
	S18-5 of 63174	Square Lake Road (I-75 BL) Interchange	Three span steel girders	Five-span cont. steel girders	10.7	$ 8,424,000
					Segment Subtotal	**$ 16,925,000**

* Denotes grade raise from existing mid-level crossing

E 3.10 Corridor Construction Phasing

The 13.64 miles of I-75 were broken into multiple construction segments, based on a combination of design issues, construction dollars and maintenance of traffic.

The I-75 Freeway contains the following construction elements:

- Addition of a lane to I-75 in each direction and to dedicate the median lane in the morning and afternoon peak traffic periods to High Occupancy Vehicle (HOV) traffic.
- Reconstruction of the 12 Mile Road Interchange as detailed in the I-75 EIS.
- Reconstruction of the Square Lake Road Interchange that brings the NB I-75 freeway and HOV lane adjacent to the SB I-75 alignment and upgrades all existing left-hand entrance and exit ramps to right-hand entrance and exit ramps.
- Reconstruction of the 14 Mile Road Interchange, including capacity improvements along 14 Mile Road at the interchange.
- Reconstruction of the ramps and lengthening at all interchanges within the project limits (Rochester Road, Big Beaver Road, Crooks Road, and Adams Road) to accommodate current MDOT and FHWA design standards.
- Upgrade of the drainage system, including cross culverts and installation of an enclosed median drainage system.
- Improvements to the local roadway corridors at 12 Mile and 14 Mile Roads.
- Major utility modifications or relocations required for the interchange and ramp reconstruction.

The following priorities were identified prior to setting the construction staging and project sequencing.

- Minimize the disruption of traffic in the construction area along I-75.
- Two lanes will be maintained in each direction on I-75 except during the placement of the bridge beams which will require I-75 traffic to shift to the other direction of travel.
- Maintain local access across I-75 during construction.
- Provide multiple local access points to and from I-75 along the corridor during construction.

The closure of local crossroads at I-75 while under construction will require traffic to find alternate routes across I-75. Detour routes will be established to direct the traffic to an alternate route.

Construction phasing of the northern section was broken into five segments as described below and as shown in **Figure E 3-4**.

Segment 1:
Roadway Project limits: **From south of 12 Mile Road to north of 13 Mile Road**
Total length: 1.74 miles (Sta 907+00 to Sta 999+00)
Interchange Construction: Includes 12 Mile Road Interchange
Bridge Project limits: Includes replacement of ten bridges

Segment 2:
Roadway Project limits: **From north of 13 Mile Road to north of Rochester Road**
Total length: 3.33 miles (Sta 999+00 to Sta 1175+00)
Interchange Construction: Includes 14 Mile Road and Rochester Road Interchanges
Bridge Project limits: Includes replacement of six bridges

Segment 3:
Roadway Project limits: **From north of Rochester Road to north of Wattles Road**
Total length is 2.62 miles (Sta 1175+00 to Sta 1313+50)
Interchange Construction: Includes Big Beaver Road Interchange
Bridge Project limits: Includes replacement of seven bridges

Segment 4:
Roadway Project limits: **From north of Wattles Road to north of Adams Road**
Total length is 4.14 miles (Sta 1313+50 to Sta 787+50)
Interchange Construction: Includes Crooks Road and Adams Road Interchanges
Bridge Project limits: Includes replacement of ten bridges (including Squirrel Road)

Segment 5:
Roadway Project limits: **From north of Adams Road to south of M-59**
Total length is 1.81 miles (Sta 787+50 to Sta 882+82.61)
Interchange Construction: Includes Square Lake Road Interchange (not including Squirrel Road)
Bridge Project limits: Includes replacement/new construction of two bridges

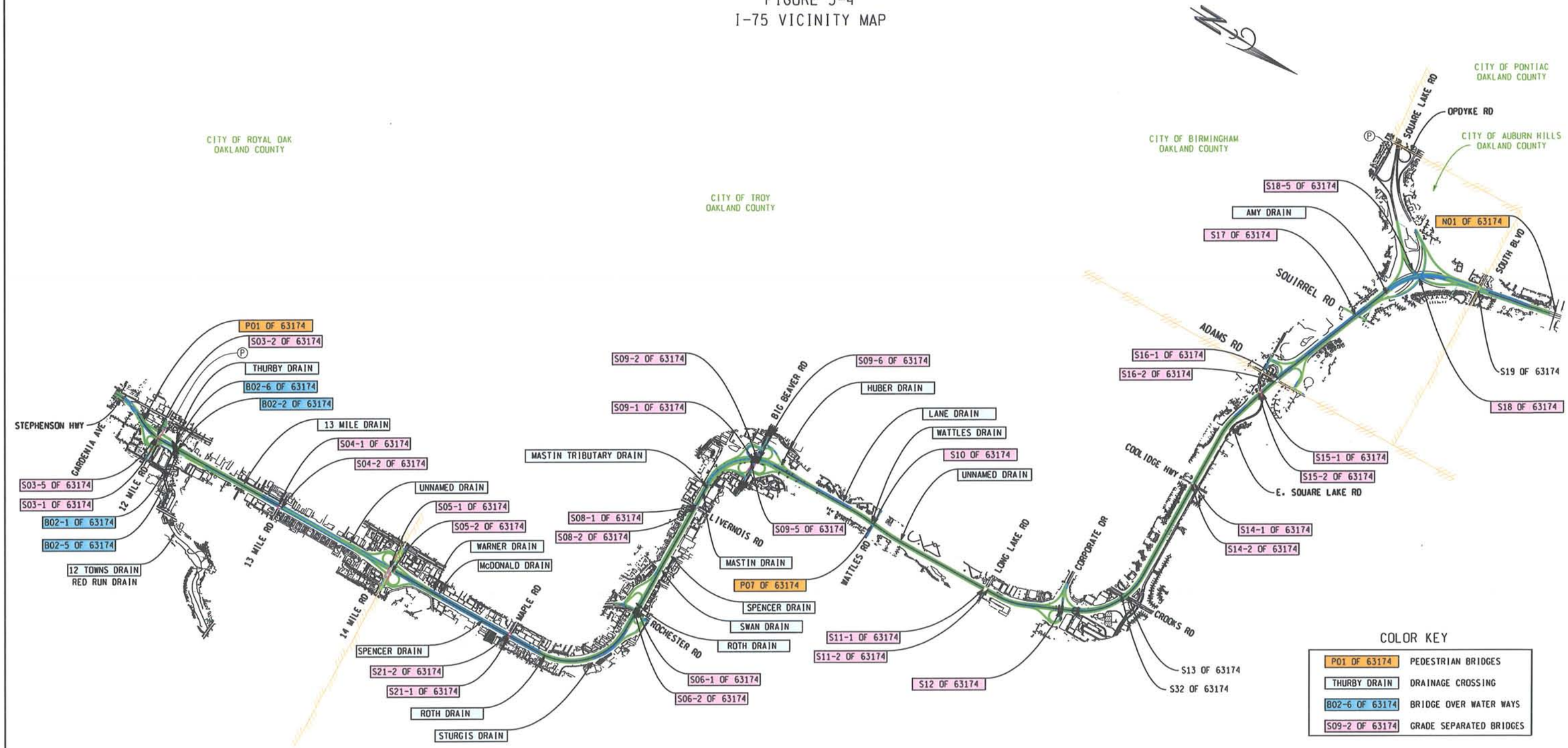
E 3.11 Construction Duration for Project Segment

The construction duration for each project segment was developed for MOT Alternatives 1 to 3. The MDOT Critical Path Construction Time Estimates were used for the individual operation rates based individually on quantities calculated by project segment. Use of these estimates provides a conservative approximation for the potential duration of a construction activity. Accelerated schedules may ultimately be used when constructing certain portions of this project. More detailed construction schedules will be developed for each project segment and the selected MOT alternative during the final design phase. The following general assumptions were used in developing these construction schedules:

- The work will proceed from south to north
- November Letting Date
- Award takes one month
- A single crew for a specific work element
- Average six work days per week
- Average 25 work days per month
- Tasks overlap whenever feasible
- No construction work will occur during the Seasonal Suspension, November 14 to April 16 as defined by the Standard Specifications for Construction

The projected construction duration for Segment 1 is two years while the remaining segments are fourteen months using the recommended part width MOT alternative.

FIGURE 3-4
I-75 VICINITY MAP



SCALE

2000' 1000' 0' 2000'

LEGEND

GAS LINE
ELECTRIC UTILITY LINE
POWER TRANS LINE
FIBER OPTICS
EXISTING R-O-W
SANITARY LINE
WATERMAIN
CABLE

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
CITY LIMITS

URS
Surface Transportation
Grand Rapids . Southfield . Traverse City

MDOT
Michigan Department of Transportation

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 VICINITY MAP

E 3.12 Maintenance of Traffic

The maintenance of traffic section evaluates the design and constructability issues associated with the widening and reconstruction of the I-75 corridor from 8 Mile Road to south of M-59.

The existing southern section of I-75 from 8 Mile Road to south of 12 Mile Road is a total length of 4.02 miles and consists of a six lane urban depressed freeway, with auxiliary lanes in each direction from north of 8 Mile Road to south of I-696, and from north of I-696 to 11 Mile Road. There are 20 bridges within this section, all of which serve local roads that carry vehicular or pedestrian traffic over I-75. Service drives exist along the NB and SB I-75 directions, connecting I-75 to the local roads via ramps at 8 Mile Road, 9 Mile Road, and 11 Mile Road. The most critical access in this section is at the interchange of I-75 and I-696, located between 9 Mile Road and 11 Mile Road. The existing drainage is maintained using an enclosed storm sewer system that outlets to the Red Run Drain north of 12 Mile Road.

The existing northern section of I-75 from south of 12 Mile Road to south of M-59 is a total length of 13.64 miles and consists of a six lane rural raised freeway with seven interchanges. There are 36 bridges within this section, of which 26 structures carry I-75 traffic over local roads. Unlike the southern section of I-75, there are no service drives within this section and existing drainage is maintained using open ditches in the median and outside.

MOT concepts have been developed for both sections, using the criteria set forth in the 2005 FEIS for the project and recent mobility criteria. The MOT concepts incorporate the proposed I-75 improvements described in the geometric, bridge, drainage and traffic studies, while considering mobility and constructability as outlined in the Michigan Department of Transportation's (MDOT's) policy for Transportation Management Plans (TMP's). The southern section of I-75 is discussed in a separate Engineering Report.

The engineering approach taken for the development of MOT concepts is specific to the characteristics of their respective sections. The southern section is an urban depressed freeway with enclosed drainage, while the northern section is a rural raised freeway with an enclosed median and open outside freeway ditch. Coordination of the MOT concepts between the two sections was performed to identify a seamless project that will tie together the two sections.

Several factors were considered when developing the various MOT conceptual alternatives and identifying the construction phasing of the corridor. Existing and proposed geometrics, bridge clearance widths, and drainage were evaluated to determine constructability impacts and to aid in the development of the proposed staging alternatives. Freeway and local access for vehicular traffic, as well as pedestrian traffic, were evaluated to identify impacts to mobility.

Construction of the northern section of I-75 from south of 12 Mile Road to south of M-59 has been broken down into five constructible segments as described above in **Section E 3.10.**.

Each segment can be let as separate individual contracts or can be combined into fewer contracts. Advance contracts that can be let to shorten the construction duration and cost of each segment have been identified.

The combination of Segment 1 of the northern section of I-75 (from south of 12 Mile Road to north of 13 Mile Road) and the southern section of I-75 (from I-696 to south of 12 Mile Road) is identified as the first construction contract for the entire I-75 corridor.

Once the first construction contract has been completed, construction of the remainder of the northern section may commence starting with Segment 2, 3, 4 and 5.

The following MOT conceptual alternatives are discussed for each of the five segments in the northern section of the I-75 corridor:

- Alternative 1: Full Freeway Closure
- Alternative 2: Half Freeway Closure in One Stage
- Alternative 3: Two-Lane Operation Minimum in Each Direction Using Crossovers

In addition, the alternative to maintain a three lane operation in each direction (contra-flow) is discussed but has not been fully evaluated for each segment from a traffic perspective.

Traffic modeling and simulation of the corridor and nearby road network has been completed for all three alternatives, as well as for the baseline existing conditions. Advantages and disadvantages of each MOT conceptual alternative, including construction duration, temporary construction costs, and user delay costs. The overall criteria used as justification for the selection of a preferred MOT concept is discussed and summarized in a decision matrix.

E 3.13 Modeling

The I-75 Engineering Report intends to develop the framework for the preliminary design of 13.64 miles of freeway section between south of 12 Mile Road and South of M-59. This section of I-75 has high traffic volumes throughout the day. Traffic demand during the AM and PM peak periods usually exceeds capacity, causing significant delays.

Using the given roadway segments, construction staging and closure options, many CS/MOT scenarios are possible. Based on practical considerations such as constructability and mobility, a total of twelve scenarios were created for operational analysis. See **Table E 3-2**.

MOT Alternative 1, the Full Freeway Closure construction option, has failed to provide necessary work zone mobility especially at the I-75/M-59 Interchange area. The LOS analysis shows that one weaving segment is expected to double its density, which already has LOS D and F during the base conditions.

MOT Alternative 2, related to the Half Freeway Closure construction option, is also expected to have severe congestion in a slightly less severe, but similar manner to the Full Closure construction option.

MOT Alternative 3 is the Partial Closure construction option. (two lane operation minimum in each direction using crossovers) Many parts of the network experience persistent congestion due to closures. As traffic demand decreases towards the end of peak period, however, the network is expected to recover to normal conditions. This option is considered as the preferred alternative.

Table E 3-2 List of CS/MOT Scenarios Selected for Operational Analysis

CS/MOT SCENARIO	CONSTRUCTION OPTION	CONSTRUCTION SEGMENT	MOT ALTERNATIVE	EXPECTED WORK-ZONE MOBILITY	RECOMMENDATIONS
1	Partial Closure	Segment 2	Alternative 3	OK	Favorable
2	Partial Closure	Segment 2	Alternative 3	OK	Favorable
3	Partial Closure	Segment 3	Alternative 3	OK	Favorable
4	Partial Closure	Segment 3	Alternative 3	OK	Favorable
5	Partial Closure	Segment 4	Alternative 3	OK	Favorable
6	Partial Closure	Segment 4	Alternative 3	OK	Favorable
7	Partial Closure	Segment 5	Alternative 3	OK	Favorable
8	Partial Closure	Segment 5	Alternative 3	OK	Favorable
9	Full Closure	Segment 2	Alternative 1	Failed	Not Favorable
10	Full Closure	Segment 5	Alternative 1	Failed	Not Favorable
11	Half Closure	Segment 2	Alternative 2	Failed	Not Favorable
12	Half Closure	Segment 5	Alternative 2	Failed	Not Favorable

Note: Potential MOT concept of using different construction closure options for each segment was proposed later, but was not analytically explored due to the time constraint.

E 3.12 Proposed Intelligent Transportation System

The Intelligent Transportation System (ITS) would be deployed, operating in conjunction with the proposed I-75 High Occupancy Vehicle (HOV) lanes, to help reduce travel delay and travel time uncertainty, to enhance safety, and to reduce the costs associated with travel. An ITS will help MDOT achieve these goals through the rapid detection and response to incidents and dissemination of incident, roadway condition, and travel time information to motorists and other stakeholders including, but not limited to local communities, law enforcement and public safety agencies, commercial fleets, and broadcast media. The following ITS elements are included in this project: Dynamic Message Signs (DMS), Closed Circuit Television (CCTV) cameras, Vehicle Detector Stations (VDS) and a Communications System. The Freeway Service Patrol also operates in this area.

DMS will be used to inform motorists of slow traffic ahead/queues, incidents ahead, road closures, and to inform motorists of travel times to key locations. The CCTV cameras of the Surveillance System will be used to monitor the roadway operations with cameras positioned to provide full coverage of the roadway along the corridor. Vehicle detectors will be placed at regular intervals on the roadway to determine congestion levels and the occurrence of incidents. The communications system will connect all ITS elements within the project area and connect these elements to the Michigan Intelligent Transportation System Center (MITSC) in Detroit. The field devices will be operated and monitored by operators at MITSC.

E 3.13 Cost Estimates

The cost estimate for this project was broken down by the five construction project segments and completed using standard MDOT estimating procedures.

The unit cost items are a compilation of various MDOT pay item average unit prices. For the freeway, ramp and local road work the MDOT "Weighted Average Item Price Cost Report" for 2009. While the bridge estimating was performed utilizing the procedures outlined in the MDOT Bridge Repair Cost Estimating. In addition, bid prices from recent construction projects were consulted and used to adjust some of the higher unit price items.

The individual quantity values were calculated based on the current design level of detail. These values were then applied to the unit cost values to develop grand total project cost estimates in 2009 construction year dollars for all five construction segments.

Table E 3-3 summarizes the probable opinions of cost for each segment (2009 dollars). The Segment 1 dollars will need to be combined with the southern project, as it is recommended that this project be built together. Detailed cost estimate spreadsheets are included in ***APPENDIX G: COST ESTIMATES***.

Table E 3-3 Total Construction Estimates By Segment

CONSTRUCTION SEGMENT	2009 CONSTRUCTION COST	PE	CE	ROW	TOTAL
Construction Segment 1	$76,140,297	$4,568,418	$7,614,030	$500,000	$88,822,744
Construction Segment 2	$70,885,972	$4,253,158	$7,088,597	--	$82,410,998
Construction Segment 3	$68,735,506	$4,124,130	$6,873,551	--	$79,916,672
Construction Segment 4	$72,107,052	$4,326,423	$7,210,705	--	$83,644,180
Construction Segment 5	$50,017,021	$3,001,021	$5,001,702	--	$58,019,744
				Total	**$392,814,340**

Federal guidelines require construction estimates to be shown for the year of incurrence. This was achieved by using an inflation factor. A 4% inflation growth factor per year was assumed to determine the cost escalation for each segment estimate.

Table E 3-4 shows the total construction segment cost and anticipated construction start date for each segment within the project limits. For more detailed analysis refer to **Section 4.18** in the **Engineering Report** and ***APPENDIX G: COST ESTIMATES***.

Table E 3-4 Construction Year Estimates by Segment

CONSTRUCTION SEGMENT AND ANTICIPATED CONSTRUCTION START DATE	CONSTRUCTION COST	PE	CE	ROW	TOTAL
Construction Segment 1 - 2026	$148,313,722	$8,898,823	$14,831,372	$500,000	$172,543,918
Construction Segment 2 - 2028	$149,678,917	$8,980,735	$14,967,892	--	$173,627,544
Construction Segment 3 - 2029	$150,954,543	$9,057,273	$15,095,454	--	$175,107,270
Construction Segment 4 - 2030	$164,315,248	$9,858,915	$16,431,525	--	$190,605,687
Construction Segment 5 - 2031	$118,536,278	$7,112,177	$11,853,628	--	$137,502,082

E 3.14 Summary

The reconstruction of the I-75 freeway from south of 12 Mile Road to south of M-59 will include the geometric upgrade of the freeway alignment and cross-section within these limits, the addition of a fourth median HOV lane, the installation of a center median barrier, enclosed median drainage system outletting to upgraded freeway ditches, seven interchanges, and ten local road crossings. Of the seven interchanges being upgraded, the 12 Mile Road and 14 Mile Road interchanges will be upgraded to the recommended alternative provided in the FEIS, while the recommendation for the Square Lake Road Interchange (I-75BL) will be to upgrade the interchange to a traditional right entrance and exit ramp configuration. The reconstruction of the freeway and the interchanges will require the removal of one bridge (P07 of 63174) which will be combined with the Wattles structure (S10-63174), total reconstruction of 32 existing structures and three new structures (S03-5, B02-5, B02-6). Included with the freeway reconstruction will be the installation of two carpool lots (12 Mile Road and Square Lake Road Interchange areas), upgrade of the ITS, freeway and local road signing and pavement markings and the additional signing and pavement markings necessary for the implementation of an HOV program.

The project will impact approximately 1.2 acres of wetland which is an increase from the 0.4 acres suggested in the FEIS. Additional noise analysis will be required during the final design phase which will determine the final locations of the project sound walls. In addition, the project will require ROW, however these impacts are consistent with the areas listed in the FEIS.

For project implementation, it is recommended the project be divided into five segments, with each project segment maintaining a construction cost estimate between $137 million and $190 million.

Section 1. Introduction and Project Overview

I-75 is a transcontinental highway connecting Miami, Florida and Sault Ste. Marie, Michigan. It is a vital component of the overall transportation system in Michigan and the United States. In Michigan, I-75 is the major north-south highway, connecting with other freeways in 16 locations. This Engineering Report is an extension of the original planning and engineering efforts conducted with the development of the Final Environmental Impact Statement (FEIS), for Oakland County. The Engineering Report is divided into two sections. The southern section is from north of 8 Mile Road to south of 12 Mile Road. The northern section is from south of 12 Mile Road to south of M-59 and provides access to the cities of Madison Heights, Royal Oak, Troy, Auburn Hills, and Pontiac, as well as Bloomfield Township. The northern project is 13.64 miles and includes seven interchanges and ten local road crossings. Within the vicinity of the northern project limits, I-75 connects with the following state trunklines: I-75BL/US-24 BL (Square Lake Road), and M-59. See **Figure 1-1** for an overview of the study area

Originally, I-75 was laid out in a stair-step manner following section and property lines to minimize impacts to the development which existed at the time (1960s). Built in the late 1960s, I-75 was a means for fast travel. Now I-75 is the most highly traveled freeway in Michigan and in the past 20 years has become a gateway for travel north and south. Its NW/SE orientation was designed to roughly parallel Woodward Avenue (M-1) and Dixie Highway (U.S. 24 in portions), serving destinations separated by long distances such as Flint and points north. The diagonal orientation of I-75 forces it to act, in some measure, as a local roadway. It is used by many Oakland County residents and workers for intra-county/local trips. Parallel local options are not available due to development and land features, such as lakes and wetlands which are prevalent in Oakland County. The north/south and east/west local roadway grid system does not serve I-75 travel needs well and does a poor job of providing alternative, direct access between development nodes that have been created along the diagonal of I-75. At the time that I-75 was built, development of businesses and homes were much less then they are today. Residents and businesses of Oakland County utilize I-75 for intra county/local trips as well as many other uses. There are several studies showing that a widening of I-75 is beneficial for existing and future economic growth to the county.

This Engineering Report is an extension of the original planning and engineering efforts conducted with the development of the Final Environmental Impact Statement (FEIS), for Oakland County. The project limits are south of 12 Mile Road to south of M-59 a distance of 13.64 miles that includes seven interchanges and ten local road crossings.

The purpose of the proposed project is to increase the capacity of the transportation infrastructure in the I-75 corridor to meet travel demand for personal mobility and goods movement.

The project need for increased corridor capacity is driven by the growth that has occurred along I-75 since its original construction. The specific conditions creating the need are:

- Population
- Employment Growth
- Existing Traffic
- Future Traffic
- Existing Design Standards
- Physical Condition
- Safety
- Goods Movement

1.1 Project Location or Study Area

I-75 was built in the 1960s meeting the design standards of that time. Numerous improvements to the freeway, additional interchanges and eight local road crossings have been added and upgraded over the past 50 years. Therefore, the geometrics of I-75 are fragmented and reflect the standards in existence at the time of each reconstruction or rehabilitation project. This report provides the design, framework, estimates and impacts to comprehensively upgrade and provide additional capacity to the freeway.

The I-75 Corridor within the study area is in southeast Michigan approximately 12 miles north of downtown Detroit. The Vicinity Map in **Figure1-2** details the project limits.

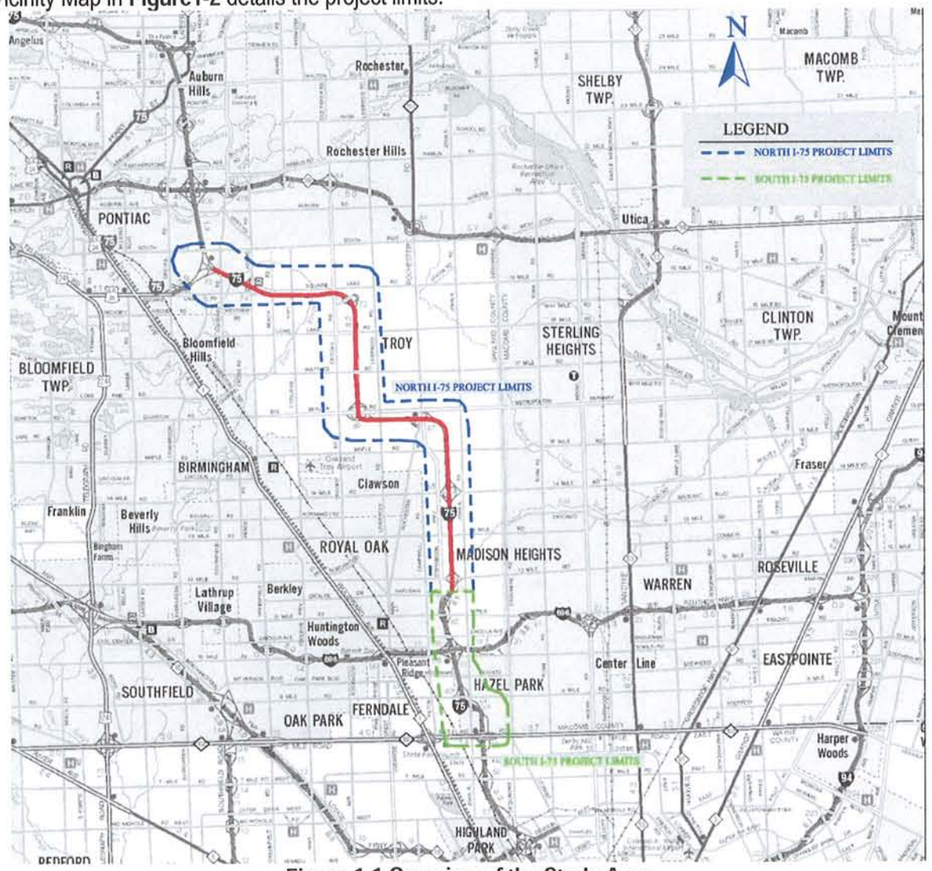


Figure 1-1 Overview of the Study Area

CITY OF ROYAL OAK
OAKLAND COUNTY

CITY OF TROY
OAKLAND COUNTY

CITY OF BIRMINGHAM
OAKLAND COUNTY

CITY OF PONTIAC
OAKLAND COUNTY

CITY OF AUBURN HILLS
OAKLAND COUNTY

CITY OF MADISON HEIGHTS
OAKLAND COUNTY

CITY OF TROY
OAKLAND COUNTY

P01 OF 63174
S03-2 OF 63174
THURBY DRAIN
B02-6 OF 63174
B02-2 OF 63174
13 MILE DRAIN
S04-1 OF 63174
S04-2 OF 63174
UNNAMED DRAIN
S05-1 OF 63174
S05-2 OF 63174
WARNER DRAIN
McDONALD DRAIN
STEPHENSON HWY
GARDENIA AVE
12 MILE RD
S03-5 OF 63174
S03-1 OF 63174
B02-1 OF 63174
B02-5 OF 63174
12 TOWNS DRAIN
RED RUN DRAIN
13 MILE RD
14 MILE RD
MAPLE RD
SPENCER DRAIN
S21-2 OF 63174
S21-1 OF 63174
ROTH DRAIN
STURGIS DRAIN

S09-2 OF 63174
S09-1 OF 63174
MASTIN TRIBUTARY DRAIN
S08-1 OF 63174
S08-2 OF 63174
BIG BEAVER RD
S09-6 OF 63174
HUBER DRAIN
LANE DRAIN
WATTLES DRAIN
S10 OF 63174
UNNAMED DRAIN
S09-5 OF 63174
LIVERNOIS RD
MASTIN DRAIN
P07 OF 63174
SPENCER DRAIN
SWAN DRAIN
ROTH DRAIN
ROCHESTER RD
S06-1 OF 63174
S06-2 OF 63174
WATTLES RD
LONG LAKE RD
CORPORATE DR
CROOKS RD
S11-1 OF 63174
S11-2 OF 63174
S12 OF 63174
S13 OF 63174
S32 OF 63174

S18-5 OF 63174
AMY DRAIN
S17 OF 63174
N01 OF 63174
SQUARE LAKE RD
OPDYKE RD
SOUTH BLVD
SQUIRREL RD
ADAMS RD
S16-1 OF 63174
S16-2 OF 63174
S19 OF 63174
S18 OF 63174
COOLIDGE HWY
S15-1 OF 63174
S15-2 OF 63174
E. SQUARE LAKE RD
S14-1 OF 63174
S14-2 OF 63174

COLOR KEY

P01 OF 63174	PEDESTRIAN BRIDGES
THURBY DRAIN	DRAINAGE CROSSING
B02-6 OF 63174	BRIDGE OVER WATER WAYS
S09-2 OF 63174	GRADE SEPARATED BRIDGES

SCALE
2000' 1000' 0' 2000'

LEGEND
GAS LINE
ELECTRIC UTILITY LINE
POWER TRANS LINE
FIBER OPTICS
EXISTING R-O-W
SANITARY LINE
WATERMAIN
CABLE
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
CITY LIMITS

URS
Surface Transportation
Grand Rapids . Southfield . Traverse City

MDOT
Michigan Department of Transportation

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 VICINITY MAP

FIGURE 1-2

The study area for this project includes the reconstruction of the existing six lane (three lanes in each direction) I-75 freeway to an eight lane (four lanes in each direction) freeway from south of the 12 Mile Road Interchange to south of M-59 Interchange, including the upgrade of all interchanges contained within these limits and addition of HOV lanes. From south to north, there are seven interchanges and associated ramps within the 13.64 mile study area:

- 12 Mile Road Interchange (Exit 63)
- 14 Mile Road Interchange (Exit 65)
- Rochester Road Interchange (Exit 67)
- Big Beaver Road Interchange (Exit 69)
- Crooks Road Interchange (Exit 72)
- Adams Road Interchange (Exit 74)
- Square Lake Road Interchange (with right ramps) (Exit 75)

Also contained within the project limits are eight local road crossings and a crossing at the Red Run Drain that include structure work. They are as follows:

- Red Run Drain (B02) (I-75 over)
- 13 Mile Road (S04) (I-75 over)
- Maple Road (S21)(I-75 over)
- Livernois Road (S08) (I-75 over)
- Wattles Road (S10)(local road over)
- Long Lake Road (S11)(I-75 over)
- Coolidge Highway (S14)(I-75 over)
- Square Lake Road (S15)(I-75 over)
- Squirrel Road (S17)(local road over)

In addition there are two local road crossings that will not have any structure work associated with them, they are as follows:

- Crooks Road (S13 and S32) (local road over)
- South Boulevard (S19) (local road over)

1.2 Project Background

Several studies conducted by the Michigan Department of Transportation (MDOT) since 1990 have recommended adding a lane in each direction to I-75 throughout Oakland County in areas where there are fewer than four through lanes per direction in total, due to forecasted increased traffic volumes and additional development. Also recommended are improvements to interchanges, arterial streets, and ITS. A study of how the transit infrastructure could be strengthened and expanded to improve the transit's share of travel in the I-75 corridor was also completed. Those studies, led to the development and approval of the I-75 Environmental Impact Statement (EIS).

Development of the EIS for I-75 began in 2003 in response to the need established in the previous studies. The Final EIS was released in 2005, and addresses the reconstruction of I-75 and the widening from three to four lanes in each direction between M-102 and just south of M-59. The preferred alternative which was recommended in the Final EIS was to construct one lane in each direction from M-102 and South Boulevard. The outside lanes would be limited to use by High Occupancy Vehicles (HOV) during peak hours. The preferred alternative also included the reconstruction of the 12 and 14 Mile Road Interchanges.

This report details the median widening, reconstruction along I-75, upgrading of all seven interchanges and local road crossings. The report also reviewed the existing and proposed drainage, traffic analysis, HOV and Intelligent Transportation System (ITS) and work associated at each structure.

1.3 Project Scope and Engineering Report Organization

This study is organized from south to north orientation and divided into the following sections:

Section 2: Existing Conditions – This section provides an evaluation of existing traffic operations and geometric configurations within the study area.

Section 3: Design Criteria – This section identifies the current design standards for each design element discussed in this study. The criteria adhere to MDOT and American Association of State Highway and Transportation Officials (AASHTO) guidelines and are depicted in the tables within this section.

Section 4: Preliminary Design Analysis – This section provides a description and analysis of the geometrics, design, structure and traffic developed throughout the study area.

Section 5: Public Involvement - This section provides a description of the public involvement and context sensitive solution development used for the project.

Section 6: Project Implementation – This section of the study will identify the plan of bringing the projects into construction. It is assumed that improvement projects will be divided into five construction segments for advancement through funding, construction contracts, and project coordination.

Section 2. Existing Conditions

2.1 Existing Traffic Conditions and Crash Data

A complete existing conditions (2002) traffic analysis of the I-75 corridor from M-102 to South Boulevard was completed for the FEIS/ROD. The analysis was not updated as traffic volumes are lower in 2008 than they were in 2002, making the previously-completed analysis more conservative. The results of the FEIS/ROD study are contained herein.

2.1.1 Capacity Analysis

The methods of the 2000 Highway Capacity Manual were used to perform a capacity analysis along I-75 from 12 Mile Road to South Boulevard. The Highway Capacity Software (HCS) analysis included all basic freeway segments and ramp junctions, within this study area. Conventional analysis of basic freeway segments, freeway ramps, and signalized intersections involves the determination of a "Level of Service" (LOS). Levels of Service range from "A" to "F", similar to an alphabetic grading system, with each level describing a different set of operational characteristics. LOS "A" describes operational performance under light traffic volumes (freeway segments and ramps) or with minimal delay (at intersections). LOS "F" describes a high density of freeway and ramp congestion or intersection failure with extensive delays and long vehicular queues. LOS "C" or "D" is considered acceptable for peak hour traffic operation of freeway segments, ramp junctions, and at intersections in urbanized areas according to AASHTO.

The LOS criteria defined by the HCM is described in **Table 2-1** for basic freeway segments, ramp junctions, signalized intersections, and unsignalized intersections.

Table 2-1 Peak Hour Level of Service Ranges
Highway Capacity Manual (2000)

LEVEL-OF-SERVICE	FREEWAY SEGMENTS	FREEWAY / RAMP JUNCTIONS	SIGNALIZED INTERSECTIONS	UNSIGNALIZED INTERSECTIONS
	DENSITY (PC/MI/LN) *	DENSITY (PC/MI/LN) *	CONTROL DELAY (SEC/VEH) **	CONTROL DELAY (SEC/VEH) **
A	≤11	≤10	≤10	≤10
B	11 – 18	10 – 20	10 – 20	10 – 15
C	18 – 26	20 – 28	20 – 35	15 – 25
D	26 – 35	28 – 35	35 – 55	25 – 35
E	35 – 45	>35	55 – 80	35 – 50
F	>45	Demand exceeds capacity	>80	>50

Source: 2000 Highway Capacity Manual
* - pc/mi/ln = passenger cars per mile per lane
** - sec/veh = seconds per vehicle

As shown in Table 2-1, density is the performance measure used to define the limits of each LOS for basic freeway segments and ramp junctions. Control delay is the performance measure used for signalized and unsignalized intersections. Control delay includes all delay caused by traffic control (signal or STOP-sign), including deceleration delay, time spent waiting at the traffic signal or STOP-sign, and acceleration delay.

The existing (2002) peak hour LOS for the basic freeway segments along I-75 is depicted in **Table 2-2**. As shown in the table, all freeway segments within the study area operate at acceptable peak hour LOS, except for the segment of I-75 between Adams Road and I-75BL.

Table 2-2 Existing (2002) Peak Hour Volumes & LOS for I-75 Basic Freeway Segments

SEGMENT	AM PEAK VOLUME NB	AM PEAK VOLUME SB	AM PEAK LOS NB	AM PEAK LOS SB	PM PEAK VOLUME NB	PM PEAK VOLUME SB	PM PEAK LOS NB	PM PEAK LOS SB
12 Mile Road to 14 Mile Road	5,550	4,380	E	D	5,830	4,500	E	D
14 Mile Road to Rochester Road	5,110	4,040	D	C	4,840	4,300	D	D
Rochester Road to Big Beaver Road	4,710	3,940	D	C	4,120	4,210	D	D
Big Beaver Road to Crooks Road	4,180	4,810	D	D	3,850	4,000	C	C
Crooks Road to Adams Road	3,460	4,980	C	D	3,790	3,640	C	C
Adams Road to I-75BL	3,590	5,080	F	F	4,240	3,110	F	F

Source: The Corradino Group of Michigan, Inc.
[1]Base conditions reflect mainline I-75 data from 2001 and the first three months of 2002.

The existing (2002) peak hour Levels of Service for the various ramp/freeway junctions and weave segments along I-75 are depicted in **Table 2-3** for NB I-75 and in **Table 2-4** for SB I-75. As shown in these tables, two ramp/freeway junctions operate at capacity (i.e. LOS "E") along I-75 while all others operate at acceptable Levels of Service.

Table 2-3 Existing (2002) Peak Hour Volumes & LOS for I-75 Ramp Junctions & Weaves (NB)

NORTHBOUND RAMP	AM PEAK		PM PEAK	
	RAMP VOLUME	LOS	RAMP VOLUME	LOS
Off-ramp to 12 Mile Road	280	D	660	E
On-ramp from EB 12 Mile Road	380	D	210	D
On-ramp from WB 12 Mile Road	240	D	380	E
Off-ramp to EB 14 Mile Road	660	C	1600	C
Off-ramp to WB 14 Mile Road	960	C	440	C
On-ramp from 14 Mile Road	1180	D	1050	D
Off-ramp to Rochester Road	900	A	1570	A
On-ramp from Rochester Road	500	C	850	C
Off-ramp to EB Big Beaver Road	600	C	1030	C
On-ramp loop from EB Big Beaver Road	300	weave LOS = D	470	weave LOS = D
Off-ramp loop to WB Big Beaver Road	830		720	
On-ramp from WB Big Beaver Road	600	C	1050	D
Off-ramp to Crooks Road	1080	C	800	D
On-ramp from Crooks Road	360	D	740	C
Off-ramp to Adams Road	220	C	100	C
On-ramp from Adams Road	350	C	550	C
Off-ramp to Square Lake Rd (I-75BL) (Left)	990	A	920	B
On-ramp from Square Lake Rd (I-75BL) (Left)	2120	n/a	2770	n/a

Source: The Corradino Group of Michigan, Inc.
[1]Base conditions reflect mainline I-75 data from 2001 and the first three months of 2002.

Table 2-4 Existing (2002) Peak Hour Volumes & LOS for I-75 Ramp Junctions & Weave Sections (SB)

SOUTHBOUND RAMP	AM PEAK		PM PEAK	
	RAMP VOLUME	LOS	RAMP VOLUME	LOS
Off-ramp to Square Lake Rd (I-75BL)	2240	n/a	1970	n/a
On-ramp from Square Lake Rd (I-75BL)	1180	B	930	A
Off-ramp to Adams Road	460	D	370	C
On-ramp from Adams Road	360	D	900	C
Off-ramp to Crooks Road	900	D	500	C
On-ramp from Crooks Road	730	D	860	C
Off-ramp to WB Big Beaver Road	1000	D	650	D
On-ramp loop from WB Big Beaver Road	100	weave LOS = B	170	weave LOS = A
Off-ramp loop to EB Big Beaver Road	600		310	
On-ramp from EB Big Beaver Road	630	C	1000	D
Off-ramp to Rochester Road	1000	D	850	D
On-ramp from Rochester Road	1100	C	940	C
Off-ramp to WB 14 Mile Road	130	C	200	D
Off-ramp to EB 14 Mile Road	750	C	800	C
On-ramp from 14 Mile Road	1220	D	1200	D
Off-ramp to 12 Mile Road	400	D	380	D
On-ramp from WB 12 Mile Road	470	D	430	D
On-ramp from EB 12 Mile Road	350	D	335	D

Source: The Corradino Group of Michigan, Inc.
[1]Base conditions reflect mainline I-75 data from 2001 and the first three months of 2002.

2.1.2 Crash Analysis

A crash analysis was prepared for the FEIS/ROD. From January 1, 2004 through December 31, 2006, 2,633 crashes were reported on I-75 from south of 12 Mile Road to south of M-59. The average crash rate for the entire corridor during this time period is 1.23 crashes per million vehicle miles. The state average for urban freeways is 1.77 crashes per million vehicle miles (per a "Comparison of Crash Rates and Characteristics in Eight States by Roadway Class"; Transportation Research Board, Paper Number 97, 1997). Rear-end crashes were most common (46%), followed by fixed object (19%) and sideswipe (16%) crashes. There were 630 crashes with injuries, and seven (7) with fatalities. Alcohol was involved in five (5) of the seven (7) fatal crashes and one (1) pedestrian was killed. Fatal crash types included two (2) rear-end, two (2) fixed object, one (1) angle, and one (1) pedestrian.

2.2 Existing Roadway Conditions

2.2.1 Typical Sections

The existing I-75 freeway is a suburban freeway originally built in the 1960s. The existing cross section consists of three, 12 foot lanes, with an approximate 10 foot outside shoulder and a median shoulder which varies between 5 feet and 10 feet in each direction. The existing I-75 freeway pavement predominantly consists of an HMA overlay on Portland Cement Concrete pavement (PCC) with some sections of only PCC. The I-75 freeway shoulder surface varies, and includes both HMA and PCC pavement sections. An existing open ditch median, approximately 31 feet wide (with TD guardrail primarily along the SB inside shoulder) separating the two bounds are depicted in **Figure 2-1**

The existing ramps are primarily single lane rural entrance and exit ramps with 16 foot travel lanes, and approximately 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 approximately 8 foot outside and 4 foot inside shoulders. The existing interchange ramps consist of an HMA overlay on Portland Cement Concrete pavement (PCC) with some sections of only PCC.

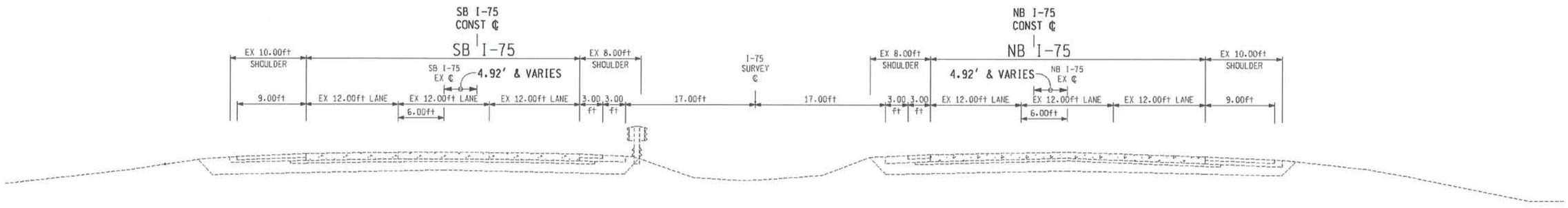


Figure 2-1 Existing I-75 Typical Cross Section

2.2.2 Freeway Alignment

The existing SB I-75 horizontal alignment contains 12 curves ranging from 1,827.86 feet to 30,000.00 feet in radii, while the existing NB I-75 horizontal alignment contains 11 curves ranging from 1,909.86 feet to 22,918.32 feet. Several of these existing curves, including the NB and SB I-75 reverse curves at the 12-Mile Road Interchange, the Big Beaver Interchange, and the SB I-75 curve at the Square Lake Road Interchange have radii below the required R-107-G minimum of 2,344.00 feet for a 75 mph design speed.

2.2.3 Interchange Alignment

2.2.3.1 12 Mile Road Interchange

The existing 12 Mile Road Interchange is a combination par-clo interchange with diamond ramps. The current configuration at the 12 Mile Road Interchange is a tight diamond with single lane entrance ramps in the NE and SW quadrants as well as single lane loop entrance ramps with single lane diamond exit ramps in the NW and SE quadrants. The existing 12 Mile Road cross section is a four lane boulevard section with two lanes in each direction and variable median width. In addition to the through traffic lanes, right turn lanes are provided at all ramp terminals, as well as two median acceleration lanes for left turns onto 12 Mile Road from the I-75 exit ramps. The existing interchange maintains one signalized intersection of the NB exit ramp to the east of I-75.

2.2.3.2 14 Mile Road Interchange

The existing 14 Mile Road Interchange is a combination par-clo interchange with diamond ramps. The current configuration at the 14 Mile Road Interchange is a tight diamond with single lane exit ramps in the SE and NW quadrants as well as single lane loop exit ramps with single lane diamond entrance ramps in the NE and SW quadrants. The existing 14 Mile Road cross section varies from a six to eight lane boulevard section with a variable median width. In addition to the two to three through traffic lanes in each direction, right turn lanes are provided at all ramp terminals.

2.2.3.3 Rochester Road Interchange

The existing Rochester Road Interchange is a two-quadrant cloverleaf with ramps in the NE and SW quadrants. 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. All ramps have split island terminals allowing simultaneous free-flow and left turn movements, with the exception of the NB I-75 exit ramp. The existing Rochester Road cross section varies from a five to six lane boulevard section with variable median width. In addition to the two through lanes in each direction, periodic left and right turn lanes are provided near each ramp terminal.

2.2.3.4 Big Beaver Road Interchange

The existing Big Beaver Road Interchange is a Full Cloverleaf Interchange with par-clo terminal layouts in the NE and SW quadrants and full loop ramps in the NW and SE quadrants. All eight of the ramps within the interchange are single lane ramps and connect to collector distributor (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 existing Big Beaver Road cross section varies from a six to seven lane boulevard section with variable median width. In addition to the three through lanes in each direction, right turn lanes are provided to each of the four entrance ramps.

2.2.3.5 Crooks Road Interchange

The existing Crooks Road Interchange is a three-leg trumpet type A interchange with single lane exit and entrance ramps located in the NW and SW quadrants, respectively. East of I-75 is a single lane loop entrance ramp and single lane diamond exit ramp. The four Crooks Road Interchange ramps converge to the west of I-75 to create Corporate Drive which is a four lane boulevard section with a variable median width.

2.2.3.6 Adams Road Interchange

The existing Adams Road Interchange is a Two-Quadrant Cloverleaf Interchange, with ramps in the NW and SW quadrants. The NW quadrant consists of a single lane diamond entrance ramp and a single lane loop exit ramp, while the SW quadrant consists of a single lane loop entrance ramp and single lane diamond exit ramp. The NB ramps terminate at Adams Road, while the SB ramps terminate at Square Lake Road.

2.2.3.7 Square Lake Road Interchange

The existing Square Lake Road Interchange is a tri-level service interchange connecting I-75 to I-75 BL (Square Lake Road) containing four, two lane free-flow ramps. The existing NB I-75 ramps are left exit and entrance ramps. The NB I-75 exit ramp to WB I-75 BL forms the lowest level of the tri-level interchange, while SB I-75 forms the mid-level and EB I-75 BL to NB I-75 is the highest level. To create the necessary median separation for these ramps, the NB and SB I-75 alignments diverge just north of the existing Squirrel Road structure and re-converge in the vicinity of the existing South Boulevard structure. The WB I-75 BL (Square Lake Road) originates at the convergence of the NB and SB I-75 exit ramps, while the EB I-75 BL (Square Lake Road) terminates when the NB and SB I-75 entrance ramps diverge.

2.2.4 Drainage

The existing freeway from 12 Mile Road to south of M-59 is comprised of open roadway section with median and roadside ditches. The median is currently drained by culverts that outlet to the roadside ditches. These ditches convey the storm water to one of the 34 crossings along the I-75 corridor. The crossings are made up of county drains and the local road storm sewer systems. The specific details of the crossings are further discussed in section 4.9 as well as in ***VOLUME 5: DRAINAGE STUDY***.

South of 12 Mile Road, the freeway is depressed, with storm sewer discharging to pump stations. This portion of the corridor is being designed by Parsons Brinkerhoff. The outfall for I-75 south of 12 Mile Road is the Twelve Towns Relief Drain. This combined sewer system discharges to the Twelve Towns Retention Treatment Facility (RTF), which is a 60 foot by 25 foot box culvert that runs along county drain easement to the northeast, where it outlets to the sewer trunk line at Dequindre Road. Currently, there are frequent overflows from the RTF into the Red Run drain. Therefore, no additional runoff can be directed to the RTF. **Figure 2-2** and **Figure 2-3** details the construction and location of the RTF relative to the Red Run Drain structure B02 of 63174 along with the accompanying adjacent utilities.

Further discussion on the existing conditions and the analysis of the existing crossings can be found in ***VOLUME 5: DRAINAGE STUDY***.

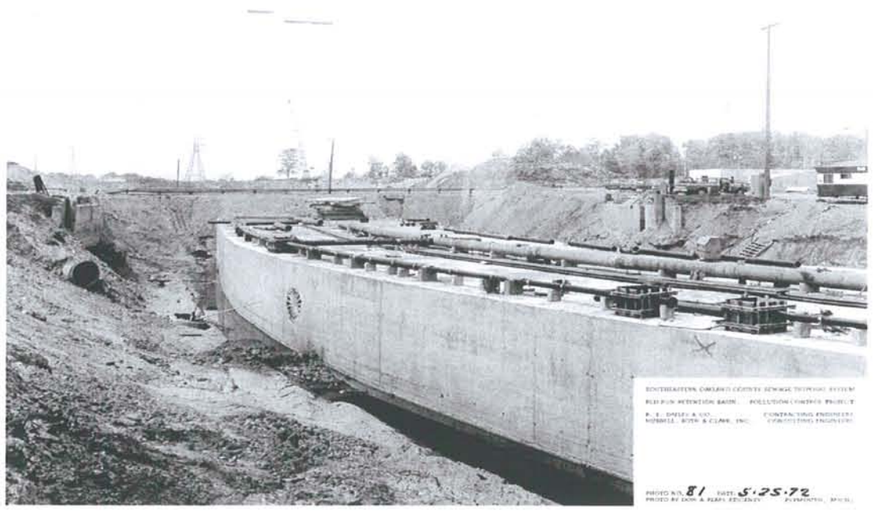


Figure 2-2 Existing Retention Treatment Facility Under Construction in 1972

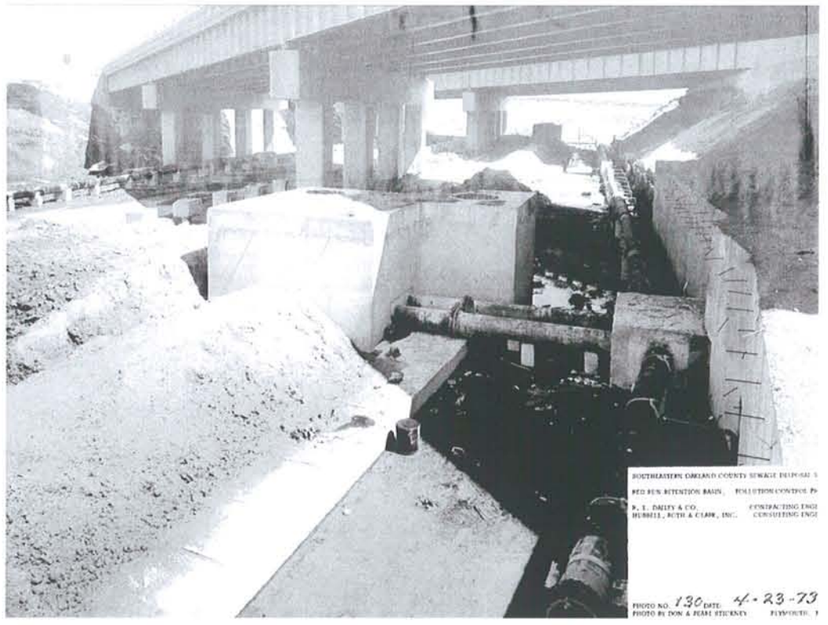


Figure 2-3 Existing Retention Treatment Facility Under Construction in 1973 Under I-75

2.2.5 Geotechnical

This section provides summarizes the existing conditions and recommendations for this project. Services for this project were provided in two phases, with pavement evaluation services provided in 2007 and 2008, and services related to the bridge evaluation provided in 2009. The results of our evaluations can be found in ***VOLUME 6: GEOTECHNICAL REPORT***. Please refer to this volume for detailed and complete recommendations. This summary should not be considered apart from the entire text of the referenced reports.

2.2.5.1 Bridges and Embankments

A preliminary geotechnical evaluation was performed to review subsurface conditions related to future bridge widening/replacement and embankment construction. Additional borings will be required to provide final design recommendations should the project move forward.

A single boring was performed at each of nine bridge structures originally identified in the FEIS as being replaced. These borings were performed along the referenced alignment for future widening or demolition and reconstruction. One boring was advanced at each structure, extending to depths of 30 to 110 feet below the ground surface.

Borings were provided only at select bridge locations. However, based on the borings and our experience along the project alignment, swamp treatments were identified as likely to be required at the following locations:

- Clinton River crossing and associated wetlands between M-59 and the Tri-Level connector to Square Lake Road (I-75 BL).
- Drain crossings and wetlands between Squirrel and Adams Roads.
- Drain crossings and wetlands between Coolidge Highway and Crooks Road.
- Wetlands along east side of I-75 south of Long Lake Road.
- Red Run Drain and former drain alignment.

Preliminary recommendations for the structures evaluated are summarized in tabular form below, and are based on the following assumptions:

- Bearing pressures discussed for shallow/spread footings are based on limiting estimated total settlement to less than one inch, and/or allowable bearing pressures based on the SPT blow count data, moisture content data, and estimated shear strengths for the site soils. Bearing pressures assume dead plus live loads, unless indicated otherwise.
- Pile lengths or estimated penetration depths noted are based on typical static pile capacity analyses for HP 12x53 (unless noted otherwise), Grade 50 pile sections and a factored nominal resistance (R_R) of 160 kips per pile. Where standard H-piles may not be the best option, alternates are discussed.

Table 2-5 Geotechnical Summary of Bridge Structures

STRUCTURE	RECOMMENDED FOUNDATIONS (*PRIMARY*/SECONDARY)	EST. BEARING ELEV. (SHALLOW FOUNDATIONS)/PILE LENGTHS[A,B]	OTHER/COMMENTS
B02 of 63174 – I-75 over Red Run Drain	*Pile-Supported*	80 to 120 feet	Marginal factor of safety – lateral squeeze is a concern and additional analysis is required. Drilling through debris should be anticipated.
S05 of 63174 – I-75 over 14 Mile Road	*Spread Footings* or Pile-Supported	Existing/ 90 to 105 feet	May be feasible to increase DL bearing pressure to 4,000 psf and reuse existing foundations. Additional deep borings required if pile foundations are considered.
S06 of 63174 – I-75 over Rochester Road (M-150)	*Spread Footings* or Pile-Supported	Existing/ 100 feet +	3,500 psf max. bearing pressure recommended for new foundations. May be feasible to increase DL bearing pressures to 3,500 psf and reuse existing foundations. Deeper borings will be required to evaluate piles.
S09 of 63174 – I-75 over Big Beaver Road	*Spread Footings* or Pile-Supported	Existing/ 80 feet +	Detailed review of lateral loads required if foundations will be reused. May be feasible to increase DL bearing pressures to 3,500 psf and reuse existing foundations. New foundations should be sized for 3,500 psf. Additional deep borings required if pile foundations are considered.
S10 of 63174 – Wattles Road over I-75	*Spread Footings* or Pile-Supported	Existing/ 80 feet +	Recommended bearing pressures of 3,000 to 4,300. Existing footings cannot support added loads. Additional deep borings required if pile foundations are considered.
S12 of 63174 – Corporate Drive (Crooks Road Connector) over I-75	*Spread Footings* or Pile-Supported	Existing/ 80 feet +	Existing footings cannot support added loads. 3,750 psf recommended bearing pressure for new foundations. Additional deep borings required if pile foundations are considered.
S15 of 63174 – I-75 over Square Lake Road	*Spread Footings*	Existing	Existing footings could be evaluated for DL+LL of 6,000 psf. No increase in loads is recommended for Abutment B. New foundations can be designed for 6,000 psf. Piles are not recommended due to very dense soils – predrilling would be required or drilled piers should be considered.
S17 of 63174 – Squirrel Road over I-75	*Spread Footings* or Pile-Supported	Existing/ 60 to 80 feet	In-situ testing will be required to evaluate increased bearing capacity of existing footings, as undercut of loose sands encountered at boring is suspected beneath foundations. Recommended bearing pressure of 3,500 psf. Due to granular soils, pipe piles or monotube piles are recommended.
Tri-Level Structure at I-75/M-24 Business Loop	*Spread Footings*, Pile-Supported, or Drilled Piers	Existing/ 20 to 55 feet See comment for drilled piers.	Existing footings can not support added loads. Recommended bearing pressure of 3,500 psf. Clay till (hardpan) was encountered at about 19 feet (elevation 852 feet). If heavy or lateral loads are expected, drilled piers are recommended.

[A] Lengths are rounded to the nearest 5 ft increment. [B] "Existing" indicates spread footings can be constructed at existing foundation levels.

Additional borings and stability analyses will be required at final design to provide detailed recommendations for the above structures and any additional structures and embankments located within the project limits. Review of available pile-driving records (if any), in-situ pressure meter testing and/or additional structural analyses will be required if additional loads are to be added to existing structures.

2.2.5.2 Pavements

Two hundred fifty-seven (257) cores and soil probes were performed by SME in October and November of 2007 and performed all of geotechnical evaluation for the project. Soil probes were generally advanced to depths of 10 feet below the ground surface, and the pavement cores were retained for analyses. Bulk samples of the sand subbase were collected from the trunkline borings and were submitted for gradation analyses.

- **Mainline Pavements:** The general pavement structure of the traffic lanes consisted of a composite section comprised of asphalt concrete over Portland cement concrete, with PCC riding surfaces observed at some segments. The general pavement structure in shoulder areas consisted of asphalt concrete, although composite and PCC pavements were observed at some locations. Pavement information is summarized in **Table 2-6** below:

Table 2-6 Summary of Existing Mainline Pavements

TRAFFIC LANES	
HMA	1.5 to 4.0 inches
PCC	8.75 to 11.5 inches (Composite) 9.5 to 12.75 inches (PCC Riding Surface)
Aggregate Base	1.8 to 15.5 inches
Sand Subbase	3.7 to 37.2 inches
Paser Ratings	8 (Northbound north of South Boulevard) 7 (Elsewhere)
Distress Indices	6 to 24 (Northbound) 23 to 31 (Southbound)
Service Life Estimate	5 to 9 years
SHOULDERS	
HMA	4.5 to 12.8 inches 1.5 to 4.0 inches (Composite)
PCC	8.5 to 10.25 inches (Composite) 9.0 to 10.5 inches (PCC Riding Surface)
Aggregate Base	4.0 to 14.8 inches
Sand Subbase	4.4 to 34.0 inches
Paser Ratings	7 (HMA and Composite) 9 (PCC)

- **12 Mile Road Interchange:** The pavement structure in the traffic lanes generally consisted of a composite HMA surface overlying PCC. A PCC riding surface was observed at one of the core locations. Shoulders generally consisted of hot mixed asphalt (HMA) pavements, with PCC observed at one location. Pavement conditions are summarized below:

Table 2-7 Summary of Existing Pavement at the 12 Mile Road Interchange

TRAFFIC LANES	
HMA	2.25 to 11.0 inches
PCC	2.0 to 9.5 inches (Composite) 9.75 inches (PCC Riding Surface)
Aggregate Base	4.0 to 6.5 inches
Sand Subbase	5.3 to 20.3 inches
Paser Ratings	9 to 10 (Composite) 3 (PCC Riding Surface)
SHOULDERS	
HMA	3.5 to 11.0 inches
PCC	6.5 inches (Riding Surface)
Aggregate Base	6.0 to 17.0 inches
Sand Subbase	9.0 to 43.0 inches
Paser Ratings	9 to 10 (HMA, recently overlaid) 3 to 5 (HMA, no overlay) 8 (PCC)

- **14 Mile Road Interchange:** The pavement structure generally consisted of a composite asphalt surface overlying PCC in traffic lanes and HMA or composite shoulders. Pavement conditions are summarized below:

Table 2-8 Summary of Existing Pavement at the 14 Mile Road Interchange

TRAFFIC LANES	
HMA	1.5 to 5.25 inches
PCC	8.25 to 10.0 inches
Aggregate Base	6.5 inches
Sand Subbase	10.0 to 16.4 inches
Paser Ratings	6 to 7 4 to 5 (Acceleration/Deceleration Portions)
SHOULDERS	
HMA	3.25 to 6.5 inches (HMA) 4.0 to 4.25 inches (Composite)
PCC	7.25 to 9.0 inches
Aggregate Base	6.5 to 15.75 inches
Sand Subbase	6.0 to 19.2 inches
Paser Ratings	6 to7 (Recently Overlaid) 3 to 4 (Acceleration/Deceleration Portions)

- **Rochester Road Interchange:** The pavement structure generally consisted of a composite section in traffic lanes and HMA in shoulder areas. Pavement conditions are summarized below:

Table 2-9 Summary of Existing Pavement at the Rochester Road Interchange

TRAFFIC LANES	
HMA	2.0 to 2.5 inches
PCC	8.5 to 10.5 inches
Aggregate Base	19.5 to 44.9inches
Sand Subbase	16.4 to 44.5 inches
Paser Ratings	10 (Recently Overlaid) 6 (NB I-75 Ramp to Rochester Road)
SHOULDERS	
HMA	3.25 to 11.75 inches
PCC	None
Aggregate Base	None
Sand Subbase	10.9 to 23.8 inches
Paser Ratings	10 (Recently Overlaid) 6 (NB I-75 Ramp to Rochester Road) 1 to 4 (Outside Shoulder, Not Overlaid) 3 to 4 (Acceleration/Deceleration Portions)

- **Big Beaver Road Interchange:** The pavement structure generally consisted of a composite section or PCC pavements in the traffic lanes and shoulders. Pavement conditions are summarized below:

Table 2-10 Summary of Existing Pavement at the Big Beaver Road Interchange

TRAFFIC LANES	
HMA	2.5 to 4.0 inches
PCC	8.0 to 10.0 inches (Composite) 9.0 to 9.5 inches (PCC Riding Surface)
Aggregate Base	4.3 to 7.4inches
Sand Subbase	8.4 to 19.4 inches
Paser Ratings	10 (SB I-75 to WB Big Beaver) 7 (Elsewhere)
SHOULDERS	
HMA	2.0 to 2.75 inches
PCC	6.75 to 8.75 inches (Composite) 6.0 to 7.75 inches (PCC Riding Surface)
Aggregate Base	5.4 to 5.5 inches
Sand Subbase	5.75 to 53.5 inches
Paser Ratings	7 to10 (Recently Overlaid) 6 (Outside Shoulder, Not Overlaid) 5 to 6 (Acceleration/Deceleration Portions) 7 (PCC) 5 (Acceleration/Deceleration Portions of PCC)

- **Crooks Road Interchange:** The pavement structure generally consisted of a composite asphalt surface overlying PCC for the traffic lanes, and HMA shoulders. Pavement conditions are summarized below:

Table 2-11 Summary of Existing Pavement at the Crooks Road Interchange

TRAFFIC LANES	
HMA	1.25 to 1.75 inches
PCC	9.5 to 10.25 inches
Aggregate Base	4.0 to 7.4inches
Sand Subbase	8.0 to 21.0 inches
Paser Ratings	7
SHOULDERS	
HMA	2.5 to 8.0 inches
PCC	None
Aggregate Base	None
Sand Subbase	13.0 to 30.5 inches
Paser Ratings	7 (Recently Overlaid) 5 (Outside Shoulder, Not Overlaid) 5 (Acceleration/Deceleration Portions)

- **Adams Road Interchange:** The pavement structure generally consisted of a composite asphalt surface overlying PCC in the traffic lanes and HMA shoulders. Pavement conditions are summarized below:

Table 2-12 Summary of Existing Pavement at the Adams Road Interchange

TRAFFIC LANES	
HMA	1.25 to 2.0 inches
PCC	9.25 to 11.5 inches
Aggregate Base	None
Sand Subbase	14.4 to 20.4 inches
Paser Ratings	7
SHOULDERS	
HMA	4.5 to 8.5 inches
PCC	None
Aggregate Base	6.0 to 13.4 inches
Sand Subbase	6.5 to 33.5 inches
Paser Ratings	7 (Recently Overlaid) 5 (Acceleration/Deceleration Portions)

- **Square Lake Road Interchange:** The traffic lane pavement structure generally consisted of a composite asphalt surface overlying PCC. Shoulders consist of a combination of HMA, composite, and PCC sections. Pavement conditions are summarized below:

Table 2-13 Summary of Existing Pavement at the Square Lake Road Interchange

TRAFFIC LANES	
HMA	2.75 to 3.25 inches
PCC	9.25 to 10.25 inches
Aggregate Base	4.4 to 7.0
Sand Subbase	7.0 to 16.0 inches
Paser Ratings	7 (EB Square Lake to NB/SB I-75) 5 (Older Sections NB I-75 to WB Square Lake Road) 10 (Elsewhere)
SHOULDERS	
HMA	1.5 to 9.5 inches (HMA) 5.0 inches (Composite)
PCC	9.75 inches (Composite) 10.5 inches (PCC Riding Surface)
Aggregate Base	1.2 to 12.5 inches
Sand Subbase	18.0 to 65.0 inches
Paser Ratings	4 to 5 (HMA) 10 (PCC) 7 (Composite)

Note: the majority of the sand subbase materials submitted for gradation analyses met MDOT Class IIA criteria.

Beneath the pavement sections, soil conditions consisted of a mixture of sand and clay fill and natural sands, silts, and clays. Buried topsoil and/or soil containing construction debris (some deposits extending more than 5 feet below the ground surface) were encountered at 78 of the boring locations.

Recommendations for subgrade preparation, engineered fill, and construction considerations were provided in ***VOLUME 6: GEOTECHNICAL REPORT***. Pavement design sections will be determined at final design.

2.2.6 Utilities

Throughout the project limits there are numerous utility companies that have their facilities located within the study area, they are as follows:

- AT&T
- Bloomfield Township
- City of Auburn Hills
- City of Madison Heights
- City of Royal Oak
- City of Troy
- Comcast
- Consumers Energy
- Detroit Water and Sewer
- DTE
- ITC
- MBT
- McCloud – USA
- MDOT
- Oakland County Drain Commission
- Sunoco
- Verizon
- XO Communications

The utilities detailed in study limits were from existing plans and existing utility reports provided by the individual utility owners. See ***APPENDIX A: UTILITY MATRIX CONFLICT*** for a table summarizing utility conflicts by owner and location. Continued coordination between MDOT and the utility company in conflict will need to take place during the design phase, prior to construction. Utility companies will be provided staging plans and sequencing plans so they are aware of the project construction phasing. Service will need to be provided within the project area via temporary connections to minimize the impact or disruption to the surrounding area. See Section 4.9 for information detailing the major utility concerns within the project limits.

2.2.7 Bridges and Structures

The following is a description of the existing structures studied along I-75 from 12 Mile Road to south of M-59. See ***VOLUME 4: STRUCTURE STUDY*** for a more detailed description of the I-75 bridges.

- **P01 of 63174 (Pedestrian Bridge Crossing I-75 South of 12 Mile Road)**
  The existing P01 of 63174 bridge is a two span pedestrian bridge with steel beams which cross I-75 and is located approximately 950 feet south of the 12 Mile Road Interchange. The existing bridge conflicts with the proposed realignment of I-75 and the ramps to the 12 Mile Road Interchange. The bridge and approach loop ramps were designed with a slope of 10%, which does not meet the current ADA requirements.

- **S03-1 and 2 of 63174 (I-75 over 12 Mile Road)**
  The existing S03-1 and 2 of 63174 are four span structures with Type I and Type III prestressed concrete beams carrying four lanes in each direction of NB and SB I-75 over 12 Mile Road. The structures require replacement due to the improvements to I-75 and the ramp horizontal and vertical alignments and the reconstruction of 12 Mile Road. The I-75 shoulder widths on each structure are substandard.

- **B02-1 and 2 of 63174 (I-75 over Red Run Drain)**
  The existing B02-1 and 2 of 63174 are three span bridges with 60 inch plate girders. B02-1 carries three lanes and a NB entrance lane of NB I-75 and B02-2 carries three lanes of SB I-75 over the Red Run Drain. The existing pier footings have struts between them due to the soil conditions. The Red Run Drain was enclosed by large box culverts in 1972. Under B02, the 60 foot wide culvert splits into two smaller culverts with a 30 foot wide section in both the south span and in the center span and are approximately 25 feet high. Both are covered with earth. The structures require replacement due to the significant grade changes and widening of I-75 as well as the changes to the 12 Mile Road Interchange.

- **S04-1 and 2 of 63174 (I-75 over 13 Mile Road)**
  The existing S04-1 and 2 of 63174 are three span bridges with Type II and Type III prestressed concrete beams carrying three lanes in each direction of NB and SB I-75 over 13 Mile Road. The median shoulder widths on each structure are substandard. A "Hidden Drive" sign is located on the north pier for WB 13 Mile Road for a driveway on the west side of the structure as the sight distance is restricted by the existing pier location. The structures require replacement due to the significant reconstruction of I-75 and to provide the required substructure horizontal clearance.

- **S05-1 and 2 of 63174 (I-75 over 14 Mile Road)**
  The existing S05-1 and 2 are three span bridges with 48 inch deep steel plate girders carrying four lanes in each direction of NB and SB I-75 over 14 Mile Road. The structures require replacement due to the improvements to I-75, ramp alignments and the reconstruction of 14 Mile Road. In addition, the median shoulder and outside shoulder widths on each structure are substandard.

- **S21-1 and 2 of 63174 (I-75 over 15 Mile Road)**
  The existing S21-1 and 2 of 63174 are three span bridges with Type I and Type III prestressed concrete beams carrying three lanes in each direction of NB and SB I-75 over 15 Mile Road (Maple Road). The median shoulder widths on each structure are substandard. The structures require replacement due to the significant reconstruction of I-75 and to provide the required substructure horizontal clearance.

- **S06-1 and 2 of 63174 (I-75 over M-150/Rochester Road)**
  The existing S06-1 and 2 are four span bridges with Type I and Type III prestressed concrete beams carrying four lanes in each direction of NB and SB I-75 over Rochester Road. The reconstruction of the interchange at Rochester Road includes geometric upgrades to and the elimination of the existing free flow movements to the NB and SB I-75 entrance ramps. These upgrades create a conflict with right turn lanes on NB and SB Rochester Road and the existing S06 bridge piers which will subsequently need to be upgraded. The median shoulder widths on each structure are also substandard.

- **S08-1 and 2 of 63174 (I-75 over Livernois Avenue)**
  The existing S08-1 and 2 of 63174 are three span bridges with Type I and Type III prestressed concrete beams carrying three lanes in each direction of NB and SB I-75 over Livernois Avenue. The median shoulder widths on each structure are substandard. The structures require replacement due to the significant reconstruction of I-75 and to provide the required substructure horizontal clearance.

- **S09-1, 2, 5 and 6 of 63174 (I-75 over Big Beaver Road)**
  The existing S09-1, 2, 5 and 6 of 63174 are four span simply supported bridges with rolled steel beams (W30x99). S09-1 and 2 carries NB and SB I-75 respectively and the S09-5 and S09-6 structures carry the NB and SB CD roads, respectively. Each of the bridges has substandard shoulders. The existing bridges require replacement due the proposed improvements to I-75, the changes in profile and the realignment of the ramps under the bridges which conflicts with the existing substructure locations.

- **S10 of 63174 (Wattles Road over I-75)**
  P07 of 63174 (Pedestrian Bridge over I-75 at Wattles Road) – To Be Removed
  The existing S10 of 63174 is a four span bridge with Type I and Type III prestressed concrete beams carrying two lanes of Wattles Road over I-75. A pedestrian structure P07 of 63174 is adjacent to and south of the S10 structure. The existing P07 structure is a two span bridge with Type III prestressed concrete beams and carries a non-motorized path over I-75. The existing bridges conflict with the proposed improvements to I-75.

- **S11-1 and 2 of 63174 (I-75 over East Long Lake Road)**
  The existing S11-1 and 2 of 63174 are three span bridges with Type I and Type III prestressed concrete beams carrying three lanes in each direction of NB and SB I-75 over East Long Lake Road. The median shoulder widths on each structure are substandard. The structures require replacement due to the significant reconstruction of I-75 and to provide the required substructure horizontal clearance.

- **S12 of 63174 (Crooks Road Interchange over I-75)**
  The existing S12 of 63174 is a four span bridge with simple span steel beams carrying two lanes of Crooks Road Interchange over I-75. The existing bridge conflicts with the proposed improvements to I-75.

- **S14-1 and 2 of 63174 (I-75 over Coolidge Road)**
  The existing S14-1 and 2 of 63174 are three span bridges with Type I and Type II prestressed concrete beams carrying three lanes in each direction of NB and SB I-75 over Coolidge Road. The I-75 shoulder widths on each structure are substandard. The structures require replacement due to the significant reconstruction of I-75 and to provide the required substructure horizontal clearance.

- **S15-1 and 2 of 63174 (I-75 over Square Lake Road)**
  The existing S15-1 and 2 of 63174 are three span bridges with simple span steel rolled beams carrying three lanes in each direction of NB and SB I-75 over Square Lake Road. Each bridge has substandard shoulders. The grade change at the adjacent Adams Road Interchange required raising the I-75 profile significantly over Square Lake Road and structure replacements are required.

- **S16-1 and 2 of 63174 (I-75 over Adams Road)**
  The existing S16-1 and 2 of 63174 are three span bridges with Type I and III prestressed concrete beams. S16-1 of 63174 carries three lanes of NB I-75 and S16-2 carries three lanes and a SB I-75 ramp over Adams Road. The I-75 shoulder widths on each structure are substandard. The structures require replacement due to the significant reconstruction of I-75 and to provide the required substructure horizontal clearance.

- **S17 of 63174 (Squirrel Road over I-75)**
  The existing S17 of 63174 is a four span bridge with steel beams carrying two lanes of Squirrel Road over I-75. The existing bridge conflicts with the proposed improvements to I-75. The crossing of Squirrel Road over I-75 will be significantly longer than the existing bridge to accommodate the proposed auxiliary ramp lanes on both NB and SB I-75.

- **S18 of 63174 (Square Lake Road (I-75 BL) Interchange)**
- **S18-5 of 63174 (Square Lake Road (I-75 BL) Interchange)**
  The existing S18 of 63174 is a three span bridge with steel rolled beams carrying three lanes of SB I-75 over the NB I-75 off ramp (NW), **Figure 2-4**. The existing S18-5 of 63174 is a three span bridge with 54 inch steel plate girders carrying two lanes of NB I-75 on ramp (EN) over SB I-75 and the NB I-75 off ramp (NW). Due to the significant reconstruction of I-75 and the reconfiguration of the Square Lake Road (I-75 BL) Interchange including eliminating the left entrance and exit ramps and moving NB and SB I-75 to the lowest level of the tri-level interchange, the existing bridges will be removed and reconstructed.

Figure 2-4 Existing I-75 S18 Structures at the Square Lake Road Interchange

2.2.8 Non-Motorized Facilities

Non motorized facilities create a strong, physically active, accessible community by providing trails for pedestrian and bicycles and providing viable transportation alternatives to people of all ages. A non-motorized system must provide a safe and visually appealing diversion, but also create a connected community. Oakland County classifies their existing non-motorized pathways into six categories which the County defines as follows:

- *Trail* - Multi-use pathways which are generally separate from roadways
- *Safety/Side Path* - Multi-use pathways which are generally located within a road right-of-way but separate from the roadway surface. Side/Safety paths are generally wider than sidewalks
- *Route* - Bicycle facilities located on or directly connected to the roadway surface.
- *Park Path* - Pathways within an existing County, State, Municipal or Metropark recreation area. These pathways may be designed and designated for specific user groups or seasonal activity.
- *Bike Lane* - A portion of a roadway which has been designated by striping, signing, and pavement markings for the preferential or exclusive use of bicyclists.
- *County Pathway* Concept-The county pathway system is comprised of a vision to link pathways and greenways throughout Oakland County and Southeastern Michigan. The county concept envisions a hierarchy of pathways.

Currently, within the I-75 Study Area, there are Safety/Side Path/sidewalks located at 12 Mile Road, 13 Mile Road, 14 Mile Road, Rochester Road, Livernois Avenue, Long Lake Road and South Boulevard crossing I-75 Freeway. These paths/sidewalks which are 5 feet wide are located within the road right-of-way; however, they are separated from the roadway surface.

The paths located at Wattles Road and Big Beaver Road Interchange is also considered a Safety/Side Path however, they are much wider than the sidewalks mentioned above. Wattles Road path is 14 feet wide and the Big Beaver Road Path is 8 feet wide.

All of these Safety/Side paths are then interconnected with various routes located on the local roads. These routes are shown on the Oakland County Trail Map located in ***APPENDIX B: OAKLAND COUNTY TRAIL MAP***.

There are also two existing pedestrian bridges that extend across I-75 within the project limits. They are located south of the 12 Mile Road Interchange and just south of Wattles Road, **Figure 2-5**. These pedestrian bridges complement the sidewalks/trails that are adjacent to the local roads and facilitate pedestrian access from one side of I-75 to the other.

Figure 2-5 Existing Wattles Safety/Side Path Crossing I-75

2.2.9 Environmental Characteristics

I-75 is slightly elevated above its surrounding environment for most of its length in Oakland County north of 12 Mile Road. It is built up on fill. The most significant natural features are wetlands that predate I-75 construction. These remain at the base of the interstate's side slopes, where interstate construction encroached into them. These locations are documented in the project's *Wetlands Technical Report* (Tilton & Associates, Inc. – October 2003).

Section 3. Design Criteria

3.1 Design Criteria

The geometric design criteria used for the upgrade of the freeway, interchanges, ramps and local roads is detailed in **Table 3-1**. The goal of the new design for the project is to meet the design criteria for all design elements within the limits of the project.

The following references and abbreviations are used for the Design Criteria Table 3-1:

AASHTO - A Policy on Geometric Design of Highways and Streets 2004 by American Association of State Highway and Transportation Officials
MDOT RDM - Michigan Department of Transportation Road Design Manual English (Updated 2008
MDOT Standard Plans - Michigan Department of Transportation Road and Bridge Standard Plans English (Updated 2008)
MDOT Design Guides - Michigan Department of Transportation Geometric Design Guide English (Updated 2008)
MDOT BDM - Michigan Department of Transportation Bridge Design Manual English (Updated 2008)
AASHTO - A Policy on Design Standards - Interstate System 1991 by American Association of State Highway and Transportation Officials

Abs. = Absolute
Des.= Desirable

Max. = Maximum
Min.= Minimum
Rec.= Recommended