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Michigan Department of Transportation

I-75/M-102 (8 Mile Road) Interchange

Early Preliminary Engineering Study

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Final Report

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Acronyms

CE	Civil Engineering
CZMB	Coastal Zone Management Boundary
DDI	Diverging Diamond Interchange
DDOT	Detroit Department of Transportation
DLI	Displaced Left-turn Interchange
DRI	Dual Roundabout Interchange
DWSD	Detroit Water and Sewerage Department
EGLE	Environment, Great Lakes, and Energy (Department)
EPE	Early Preliminary Engineering
GF/GP	General Fund/General Purpose
GLWA	Great Lakes Water Authority
HCM	Highway Capacity Manual
HCS	Highway Capacity Software
HMA	Hot-Mix Asphalt
HOV	High-Occupancy Vehicle
I	Interstate
IHSDM	Interactive Highway Safety Design Model
ITC	International Transmission Company
ITS	Intelligent Transportation System
KABCO	Fatal, Incapacitating Injury, Probable Injury, Possible Injury, Property Damage Only
LAC	Local Advisory Committee
LOS	Level of Service
LSUM	Lump Sum
M	Michigan State Highway
MDOT	Michigan Department of Transportation
MOE	Measure of Effectiveness
MOT	Maintenance of Traffic
MSE	Mechanically Stabilized Earth
MTCF	Michigan Traffic Crash Facts
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NLEB	Northern Long-eared Bat
PEP	Public Engagement Plan
PHB	Pedestrian Hybrid Beacon
RRFB	Rectangular Rapid Flashing Beacon
SEMCOG	Southeast Michigan Council of Governments
S-L	Straight-Line (Method)
SMART	Suburban Mobility Authority for Regional Transportation
SPUI	Single-Point Urban Interchange
TAR	Traffic Analysis Report
TDMS	Transportation Data Management System
TSC	Transportation Service Center
UDI	Urban Diamond Interchange
USFWS	United States Fish and Wildlife Service
V/C	Volume to Capacity
WRC	Water Resources Commission
WRD	Water Resources Division

1 Executive Summary

The Michigan Department of Transportation (MDOT) is conducting an Early Preliminary Engineering (EPE) study for the I-75/M-102 (8 Mile Road) interchange at the northern border of Detroit in Wayne and Oakland counties. An EPE study focuses on assessing the condition of existing infrastructure, developing preliminary concepts and evaluating their feasibility based on engineering and environmental considerations. The analysis is conducted to help MDOT determine the type, preliminary configuration and estimated cost of improvements to the existing interchange infrastructure.

The I-75/M-102 interchange was built in 1965 with a multi-level design to serve the economic growth of the area. It is now nearing the end of its useful life, requiring significant maintenance and rehabilitation. The current interchange, which narrows to three lanes between two four-lane highway sections, creates a bottleneck that contributes to traffic congestion throughout the corridor. Additionally, MDOT intends to reconnect the neighborhoods in Detroit and Hazel Park by eliminating the third level overpass bridge structure, which creates a barrier between the two communities.

The EPE study documented in this report evaluates current and future traffic demand and identifies potential improvements to reduce congestion, enhance safety and improve infrastructure. It assesses the existing interchange's ability to meet future needs, explores concepts, estimates costs and identifies funding options. Concepts that would maintain the interchange's functional objectives while improving roadway operations at a lower cost are evaluated. Safety, congestion, pedestrian and bicycle accommodations, stakeholder input, utilities and both short- and long-term solutions are considered.

1.1 Data Collection and Analysis Approach

The EPE study followed a systematic approach to data collection and analysis, concept development and planning, and configuration development. This included information gathering, data analysis, illustrative concepts, public and stakeholder engagement, and selection of the Recommended Concept.

Topographic surveys were required to develop the plan and profile for the recommended concept. Topo surveys for M-102 and sections of I-75 were available from MDOT as part of previous or current ongoing projects. This data was shared with AtkinsRéalis. Survey data for the State Fair Avenue bridge and some sections of the service drives was not available and was collected by Advanced Geomatics.

Traffic analysis included evaluating the I-75 freeway segment, freeway facilities such as ramp terminals, weave, merge and diverge areas, and the signalized intersections along the M-102 corridor within the interchange area to determine operational performance. The traffic volumes for the I-75 freeway and ramps were obtained from MDOT's Transportation Data Management System (TDMS) and the Southeast Michigan Council of Governments (SEMCOG). In addition to the freeway traffic volume data, intersection peak-hour counts were collected for capacity analysis. Traffic growth rates were generated based by Statewide and Urban Travel Analysis

(SUTA)/MDOT based on SEMCOG travel demand model for the year 2050 and provided to AtkinsRéalis for incorporation into the study.

The following tools were utilized to determine the existing traffic conditions as well as to evaluate traffic conditions under multiple concepts:

- **Highway Capacity Software (HCS)**: HCS is deterministic software based on formulas for capacity analyses. The software output is dependent upon geometry and volume inputs. The freeway segment, merge, diverge and weave analyses are performed using HCS.
- **Trafficware Synchro Software (Synchro):** Synchro is an analysis/modeling tool used to determine performance of signalized intersections. It provides a wide range of measures of effectiveness (MOE) for signalized corridors. The section of M-102 from John R Street to Dequindre Street is evaluated using Synchro program.
- **Micro-simulation VISSIM (VISSIM):** While HCS and Synchro provide individual component evaluation, a micro-simulation like VISSIM provides a random approach to evaluate the overall performance of all components combined. In addition to the geometric and traffic volume inputs, vehicle and driver behavior input are also considered to match the local condition. Measuring the performance of individual vehicles as they enter and leave the system, VISSIM generates simulation of the coded transportation network. These results are then compared to determine the best performing concept.

A review of the existing crash data for the five-year period between 2018 and 2022 was required to identify patterns that can be attributed to or corrected by geometric design and/or traffic operations. This data was obtained from the Michigan Traffic Crash Facts (MTCF) website for 1.4 miles of I-75 (Emery Street to Meyers Avenue) and 1.3 miles of M-102 (John R Road to Dequindre Street).

The environmental scope of work was limited to desktop environmental analysis, drawing from readily available online agency databases and mapping applications. Environmental resources within 500 feet of the interchange were identified. The resources considered represent both the natural and built environment and are aligned with those typically analyzed under the National Environmental Policy Act (NEPA) process: air quality, noise, socioeconomic data, hazardous materials, floodplains, biological resources, endangered species, cultural resources, parks and recreational resources, water quality and coastal zone consistency.

1.2 Stakeholder and Public Engagement

The project team reached out to stakeholders and the public to engage them in the EPE study and inform them of the project background, objectives and process. As part of this engagement, a local advisory committee (LAC) was initiated. Key members included MDOT, the City of Detroit, the City of Ferndale, the City of Hazel Park, Wayne County, Oakland County, Suburban Mobility Authority for Regional Transportation (SMART), Detroit Department of Transportation (DDOT), SEMCOG, ITC (International Transmission Company) Michigan, 8 Mile Boulevard Association, and utility companies. These stakeholders served to support outreach for public meetings and encourage engagement.

Three public meetings were held throughout the EPE study: one in December 2023 and two in 2024. A total of four LAC meetings were held to keep stakeholders informed about the EPE study progress and solicit their feedback. Feedback received from the LAC focused on the existing three-lane bottleneck along I-75, aesthetics and nonmotorized operations and safety. The LAC recommended considering an alternative interchange configuration that would accommodate a fourth lane on I-75 through the interchange. They also expressed a desire to improve lighting and landscaping around the interchange, enclose the underpass to prevent access, improve pedestrian crossing on M-102, incorporate additional signs (i.e., advanced warning signs/crossing features), and find better ways to incorporate pedestrian and bicycle access.

1.3 Concepts Evaluation

1.3.1 Initial Concept Development

To identify the preferred configuration of the I-75/ M-102 interchange, multiple concepts were developed and evaluated. Each concept incorporated the existing functionality of the interchange, input from stakeholders and the public, and nonmotorized traffic. The following eight concepts were identified as potential configurations. All reconstruct configurations assume the removal of the third level overpass bridge structure and the addition of a fourth travel lane.

- **No Build:** The No Build concept assumes routine repair/maintenance work to extend the life of the existing infrastructure.
- **Full In-kind Replacement:** This concept includes full in-kind replacement of the existing infrastructure and existing interchange configuration and accommodates a future fourth lane on the new bridges along I-75.
- **Urban Diamond Interchange (UDI):** This concept considered removing the third level overpass bridge structure, maintaining the urban diamond configuration with improved traffic operations, and relocating the direct left-turn movements on M-102 to crossovers.
- **Diverging Diamond Interchange (DDI):** This concept considered removing the third level overpass bridge structure, replacing the urban diamond configuration with a DDI configuration, and configuring the crossroad within the existing right of way.
- **Single-Point Urban Interchange (SPUI):** A SPUI converges all interchange traffic at a single intersecting point. This concept considered removing the third level overpass bridge structure, replacing the urban diamond configuration with the SPUI interchange configuration, and retaining the left-turn movements at the interchange bridge.
- **Displaced Left-turn Interchange (DLI):** This concept considered removing the third level overpass bridge structure, replacing the urban diamond configuration with the DLI configuration, and maintaining the left-turn movements at the interchange bridge. It results in two-phase signal operation and facilitates separation of left-turn from through-movements.

- **Dual Roundabout Interchange (DRI):** This concept considered removing the third level overpass bridge structure, removing the diamond interchange configuration, and replacing it with two roundabouts for service drives on either side of the I-75 freeway.
- **Single Roundabout/Traffic Circle Interchange:** This concept was based on a large single rotary intersection[1] replacing the third level overpass bridge structure and removing of diamond interchange configuration.

These initial concepts were presented to the LAC and to the public. Informed by engagement with MDOT design and operations engineers, stakeholders and the public, evaluation criteria were developed to score the concepts for screening purposes. The concepts were screened for feasibility, operational performance and against the following evaluation criteria: traffic operations, safety, the ability of the configuration to incorporate nonmotorized traffic, community cohesion, emergency access, cost, constructability, right of way impacts and business access.

Based on the evaluation, the DDI and UDI configurations were selected as practical concepts and were carried forward for more detailed evaluation based on traffic and cost.

1.3.2 Practical Concepts

The DDI and the UDI concepts both include widening I-75 from three to four lanes in each direction and incorporating the same ramp terminals and merge and diverge lanes, as well as removing the third level overpass bridge structure. Therefore, traffic analysis focused on the level of service (LOS) of the M-102 intersections, particularly the service drive intersections. The LOS results showed that the overall system performed better under DDI configuration in the AM peak hour and UDI performed better in the PM peak hour. It should be noted that this difference is only numerical and has no significance due to minor differences. However, the service drive intersections showed better LOS results under the DDI option.

High-level cost estimates for the two practical concepts were estimated based on roadway, structural components, and maintenance of traffic (MOT). The cost of drainage work, lighting, erosion control and pavement markings are put together as a lump-sum included in the estimate. Relocation of the existing pump station located just south of the I-75/M-102 interchange is also shown as a lump-sum item in the estimate. Therefore, the overall cost of the project may differ significantly from this estimate based on the drainage work. High-level costs are shown in Table 1. All costs shown include widening I-75 from three to four lanes.

Table 1. High-Level Cost Estimate (Total Cost 2031 Construction Year)

No	Performance Parameters	Cost	Includes
1	In-Kind Replacement	$176,397,476.21	Bridge replacement, including flyover structures, I-75 widening, ramps
2	Diverging Diamond Interchange	$121,949,973.70	Bridge replacement, I-75 widening, ramps
3	Urban Diamond Interchange	$123,078,063.27	Bridge replacement, I-75 widening, ramps

[1] A rotary is a type of intersection where traffic flows around a central island in a clockwise direction.

Both the DDI and the UDI configurations provide comparable LOS, with only slight cost differences between them. To determine the recommended concept, several other key factors were considered, such as incident management, the impact to adjacent land uses and nonmotorized traffic, and system wide operational performance. Ultimately, the UDI was found to:

- Perform better than the DDI at ramp terminals during the PM peak hour.
- Align with MDOT's preferences to retain the flexibility of using service drives for incident management, emergency response and detour routes along the I-75 corridor.
- Minimize access impacts to adjacent land uses.
- Provide more direct and safer access for nonmotorized traffic.

Based on these findings, the UDI configuration was selected as the recommended concept.

1.3.3 Recommended Concept

The Recommended Concept is shown in Figure 1. This concept offers improved traffic management by reducing conflict points, optimizing turn movements and enhancing capacity while maintaining efficient local access. Additionally, the UDI configuration aligns with MDOT's objectives of enhancing mobility, improving nonmotorized traffic facilities, integrating surrounding communities and replacing aging infrastructure at the lowest possible cost.

Figure 1. Recommended Concept - Urban Diamond Interchange Layout

One of the objectives of the EPE study was to identify potential financing and funding options for the recommended concept. MDOT's funding strategy ensures a diverse mix of revenue sources to support its infrastructure projects, such as highway improvements, bridge constructions and public transportation enhancements. MDOT funds its large-scale projects through a combination of the following state, federal, local and private funding sources:

- **State Funds:** MDOT funds its large-scale projects through a combination of sources, including its MDOT annual budget, funded primarily from state revenue from motor fuel taxes and vehicle registration fees, which are generally the largest sources of funding for MDOT.
- **Federal Funds:** In addition to the state revenue-based budget, federal funding is the second-largest source for supporting transportation projects.
- **State General Fund/General Purpose (GF/GP):** This includes allocations from the state's general budget to support key projects.
- **Bond Financing:** While MDOT has authority to issue bonds to finance transportation projects, MDOT has already exercised this option as part of the Rebuilding Michigan Program for raising $3.5 billion in 2020.
- **Private and Local Contributors:** These include funds from private citizens and local governments.

1.4 Summary and Recommendations

The EPE study, which was developed over the course of 18 months, reviewed existing conditions, developed multiple concepts, conducted robust public and stakeholder engagement, and maintained close coordination with multiple MDOT Transportation Service Centers (TSC) for review and approval of various study elements.

To identify a recommended concept, eight initial concepts were developed. Two (DDI and UDI) were identified as practical concepts and carried forward for additional evaluation. Both the DDI and UDI configurations provide comparable LOS, with only slight cost differences between them. However, the UDI configuration was found to perform better than the DDI when additional factors were considered, including systemwide LOS results, access along the service drives, detour and incident management functionality, and impacts to adjacent land uses. Based on the assessment, the UDI configuration is selected as the recommended concept.

2 Introduction

MDOT has initiated an EPE study for the I-75 M-102 (8 Mile Road) interchange. I-75 is a long national highway stretching from Florida to the Canadian border in the Upper Peninsula. Locally referred to as the Walter P. Chrysler Freeway, I-75 is a major thoroughfare connecting the city of Detroit with the northern and southern suburbs and is a critical commercial, commuter and tourism route moving goods and services daily. The interchange is located at the northern border of Detroit, as shown in Figure 2.

An EPE study evaluates the feasibility and preliminary configuration of a specific project, focusing on engineering and environmental considerations. It is conducted early in the project development phase, prior to detailed design and NEPA documentation and is focused on specific project details, including design concepts, cost estimates and potential environmental impacts. The EPE study provides a detailed analysis to support decision-making and project development, ensuring that engineering and environmental factors are considered early.

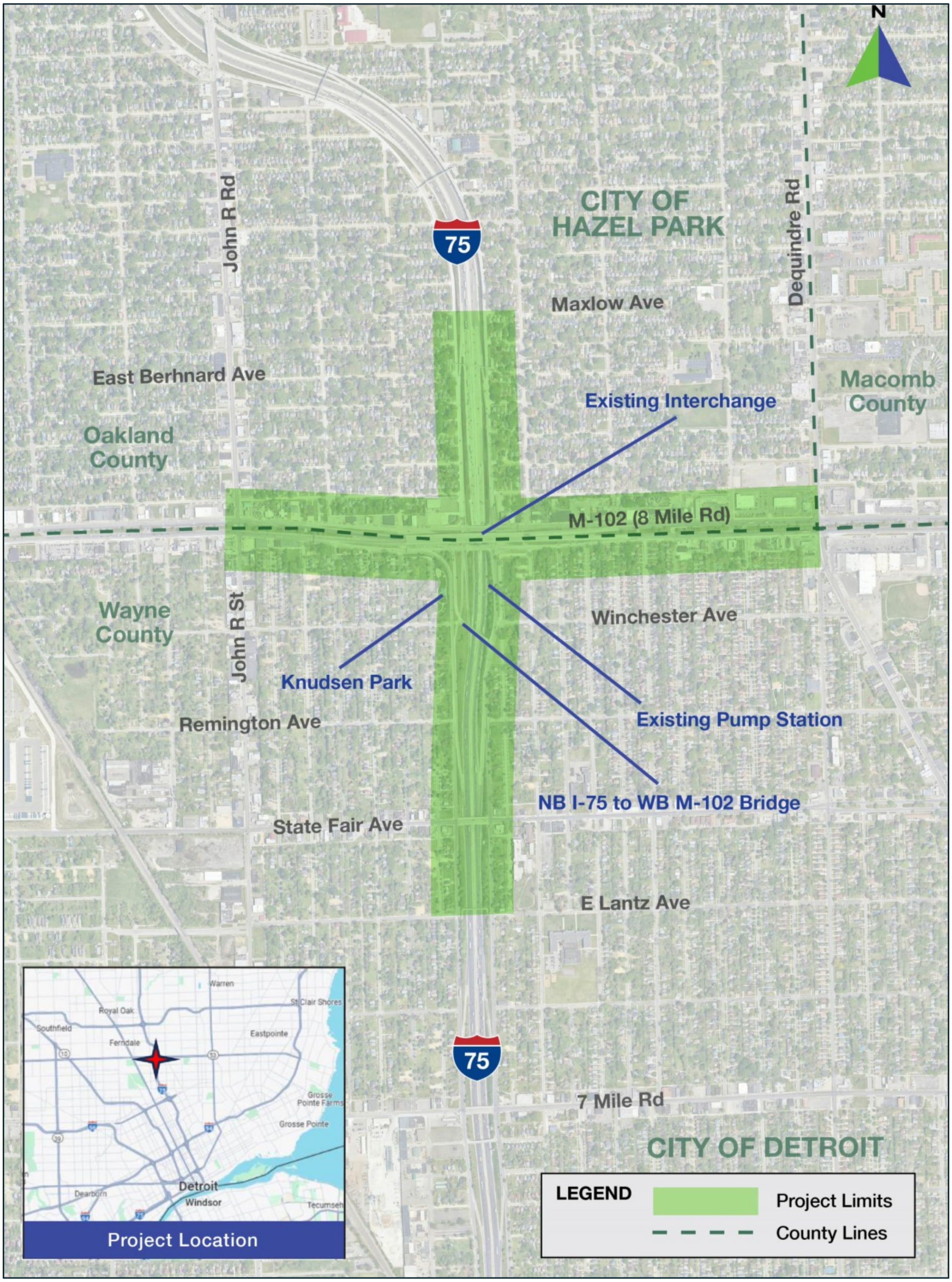
The goal of this EPE study is to evaluate concepts for the reconfiguration of the interchange and the feasibility of improvements. These include adding a fourth lane on I-75 to align with adjacent sections, addressing the transportation issues for existing and future traffic in partnership with the communities, enhancing safety, improving geometrics, improving mobility and planning for future transportation needs in an equitable manner.

This report documents the results of the EPE study, including the process undertaken to develop design concepts and evaluate alternatives, the identification and evaluation of practical concepts, MDOT's engagement with stakeholders and the public, and the recommended preferred concept.

2.1 Background

The existing I-75/M-102 interchange was built in 1965 with a multi-level design to serve the economic growth of the area. The interchange infrastructure is nearing the end of its useful life, requiring significant maintenance and rehabilitation. The overpass bridge structures are currently rated poor by MDOT. Additionally, MDOT intends to reconnect the neighborhoods in Detroit and Hazel Park by eliminating the third level overpass bridge structure, which creates a barrier between the two communities.

Figure 2. Project Location Map and Study Limits



MDOT recently rebuilt I-75 from M-102 to Joslyn Road in Oakland County. The I-75 modernization project provided four lanes of traffic (three general purpose lanes and one part-time high-occupancy vehicle [HOV] lane). The segment of I-75 to the south of the interchange also has four general purpose travel lanes. An approximately 1-mile long segment of I-75 through the M-102 interchange, from E Lantz Avenue to E Maxlow Avenue, remains a three-lane section and is a source of traffic congestion along the corridor. The limits of the project are shown in Figure 2.

2.2 Objectives

The focus of this EPE study is to evaluate current and future traffic demand and identify improvements to infrastructure, traffic operations and roadway capacity to reduce traffic congestion, facilitate community cohesion, improve roadway safety and address pedestrian and bicycle accommodations. The study objectives are to evaluate the operational capability of the existing interchange to serve future demand, evaluate alternatives to retain or replace the existing interchange configuration, conduct a broad overview of the cost for the alternatives, and identify potential financing and funding options.

The EPE study will enable MDOT, in partnership with the communities, to enhance safety, improve geometrics, improve mobility and plan for future transportation needs in an equitable manner. Removing the top-level viaduct on M-102 will remove a barrier and reconnect the neighborhoods in Detroit and Hazel Park.

To accomplish MDOT's overarching goals, it is important that the EPE study encompasses a broad overview of safety issues, congestion, stakeholders' input, utilities, MOT, construction and future maintenance to address both short- and long-term solutions that facilitate an infrastructure asset that both the public and owning agency can be proud of.

2.3 Scope

The scope of this EPE study is defined by MDOT Project Management Development/Design Manual section Early Preliminary Engineering and includes existing conditions analyses, public and stakeholder engagement, concepts development and evaluation, cost estimates, identification of a recommended concept and potential funding strategies. The scope of the study includes:

- Investigate the existing and future feasibility of a fourth lane alignment on I-75 from adjacent sections at State Fair Avenue to north of M-102.
- Investigate the existing and future operational aspects and potential improvements to the I-75/M-102 interchange, develop multiple long-term alternatives and recommend a preferred concept.
- Collect and analyze socio-economic data relevant to future interchange operations.
- Assist and attend public meetings with MDOT to present study and recommendations to various stakeholders.

- Initiate and assist with local and transit agency coordination early in the study process; utilizing a context-sensitive solutions process.
- Perform an overview of existing environmental conditions that are within the proposed study limits and identify potential impacts of the alternatives.
- Perform a traffic operation and capacity analysis of the interchange.
- Perform a crash/safety analysis of the interchange.
- Survey right of way and jurisdictional authority over the freeways, railroad, local roads and service drives.
- Gather preliminary utility information and identify conflicts for each concept.
- Evaluate interchange concepts; determine geometric configuration for reconstruct concepts, including defining design exceptions that may be required; and identify aesthetics required for the project.
- Provide cost comparisons of concepts for reconstruction, including in-kind replacement.
- Develop a final report with recommendations for a recommended concept.

3 Methodology

The EPE study followed a systematic approach of data collection and analysis, concept development and planning, and configuration development. This included information gathering, data analysis, illustrative concepts, public and stakeholder engagement, and selection of the recommended concept.

3.1 Data Collection

3.1.1 Topographic Survey

Topographic surveys were required to develop the plan and profile for the recommended concept. Topo surveys for M-102 and sections of I-75 were available from MDOT as part of previous or current ongoing projects. This data was shared with AtkinsRéalis. Survey data for the State Fair Avenue bridge and some sections of the service drives was not available and was collected by Advanced Geomatics.

3.1.2 Traffic Volumes

Traffic volumes for the I-75 freeway and ramps were obtained from MDOT's Transportation Data Management System (TDMS) and Southeast Michigan Council of Governments (SEMCOG). MDOT also provided Traffic Analysis Report (TAR) #3609 dated June 15, 2023, providing 2023 data and forecasts for 2030 and 2050 for M-102. A growth rate of 0.3 percent was used to calculate future traffic volumes.

In addition to the freeway traffic volume data, intersection peak-hour counts were collected for capacity analysis. Peak-hour turning movement data was initially collected in May 2023 but was affected by construction on M-102. Therefore, MDOT recollected this data in March 2024 to include all signalized intersections, crossovers and the M-102 overpass lanes.

3.1.3 Crash Data

A review of the existing crash data for the five-year period between 2018 and 2022 was required to identify patterns that can be attributed to or corrected by geometric design and/or traffic operations. This data was obtained from the Michigan Traffic Crash Facts (MTCF) website for 1.4 miles of I-75 (Emery Street to Meyers Avenue) and 1.3 miles of M-102 (John R Road to Dequindre Street).

3.1.4 Utilities

As part of the project, an effort was made to collect information about the existing utilities within the study limits. This compilation was limited to identification of the overhead or underground utilities that may be present within the area of potential improvements and that may require to be contacted during the engineering design phase.

3.1.5 Environmental Investigation

The environmental scope of work was limited to desktop environmental analysis, drawing from readily available online agency databases and mapping applications. Environmental resources within 500 feet of the interchange were identified. The resources considered represent both the natural and built environment and are aligned with the those typically analyzed under the NEPA process: air quality, noise, socioeconomic data, hazardous materials, floodplains, biological resources, endangered species, cultural resources, parks and recreational resources, water quality and coastal zone consistency.

3.2 Traffic Analysis Methodology

The EPE study analyzed current and projected traffic operations and crash statistics for the concepts analysis. Traffic forecasting (Year 2050) was performed by SUTA/MDOT based on SEMCOG travel demand model version E8Plus output. Traffic analyses were supported by the following tools:

- **Highway Capacity Software (HCS):** Based on the Highway Capacity Manual, HCS is a deterministic software based on formulas for capacity analyses. The software output is dependent upon geometry and volume input. The freeway segment, merge, diverge and weave analyses are performed using HCS.
- **Trafficware Synchro Software (Synchro):** Synchro is an analysis/modeling tool based on the Highway Capacity Manual to determine performance of signalized intersections. It provides a wide range of MOE for signalized corridors. The section of M-102 from John R Street to Dequindre Street is evaluated using Synchro program.
- **Micro-simulation VISSIM (VISSIM):** While HCS and Synchro provide individual component evaluation, a micro-simulation like VISSIM provides a random approach to evaluate the overall performance of all components combined. In addition to the geometric and traffic volume inputs, vehicle and driver behavior input are also considered to match the local condition. Measuring the performance of individual vehicles as they enter and leave the system, VISSIM generates simulation of the coded transportation network. These results are then compared to determine the best performing concept.

Crash statistics were summarized by the number and type of crashes, number of fatalities and injuries, contributing causes, lighting conditions, pavement conditions and crash location. Additionally, the Interactive Highway Safety Design Model (IHSDM) was used to evaluate the safety and operational effects of geometric design decisions on highways. IHSDM provides estimates of a highway design's expected safety and operational performance.

The traffic analyses evaluated the scenarios presented in Table 2:

Table 2. Traffic Analysis Scenarios

Scenario	Analysis
Existing Conditions	Reflects the existing interchange and the I-75 corridor within the study limits based on current traffic operation conditions. This includes existing traffic count data, existing geometric condition and existing traffic operations.
No Build Condition 1A – Partial Reconstruction	Assumes use of the existing roadway and interchange configuration and three lanes on I-75 under M-102. The scenario assumes routine repair/maintenance work to extend the life of the existing infrastructure and includes maintaining existing infrastructure on M-102, removal of northbound I-75 service drive to westbound M-102 bridge (structure #11861 ramp next to Winchester Avenue), reconstruction of ramp gores from/to I-75, maintaining existing structures on M-102 in place, and maintaining existing vertical clearance.
No Build Condition 1B – Full Replacement (In-Kind)	Assumes in-kind replacement of the existing infrastructure, existing interchange configuration, and accommodating a future fourth lane on the new bridges along I-75. This includes adding a fourth lane in each direction on I-75, replacing the M-102 structures to accommodate the fourth lane, removing structure #11861 ramp, removing the southbound service drive, and replacing two impacted pump stations.
Build Scenario	Includes developing two concept interchange configurations that will be compared for LOS, MOEs and other performance measures to determine a future configuration that serves project overall objectives including vehicular traffic, nonmotorized traffic, connecting communities, cost, maintenance, supporting economic activities and improving the quality of life.

The initial vetting process was primarily focused on traffic analysis of the interchange intersections, ramp terminals, freeway segments, and merge and diverge areas to determine operational performance.

3.3 Concepts Development and Screening

To identify the recommended configuration of the I-75/ M-102 interchange, multiple concepts were developed and evaluated. Each incorporated the existing functionality of the interchange, input from stakeholders and the public, and nonmotorized traffic. Maintaining the existing right of way was a key factor and the initial concept development effort was focused on concepts that can fit within the existing right of way and avoid impacts on nearby residential communities, businesses and Knudsen Playlot Park. Eight concepts were developed through a series of brainstorming sessions with the study team, MDOT and stakeholders. Evaluation criteria were established and the concepts were screened several times to identify the concepts that would best meet the project goals and objectives. The process is detailed in Section 5 of this report.

4 Existing Conditions

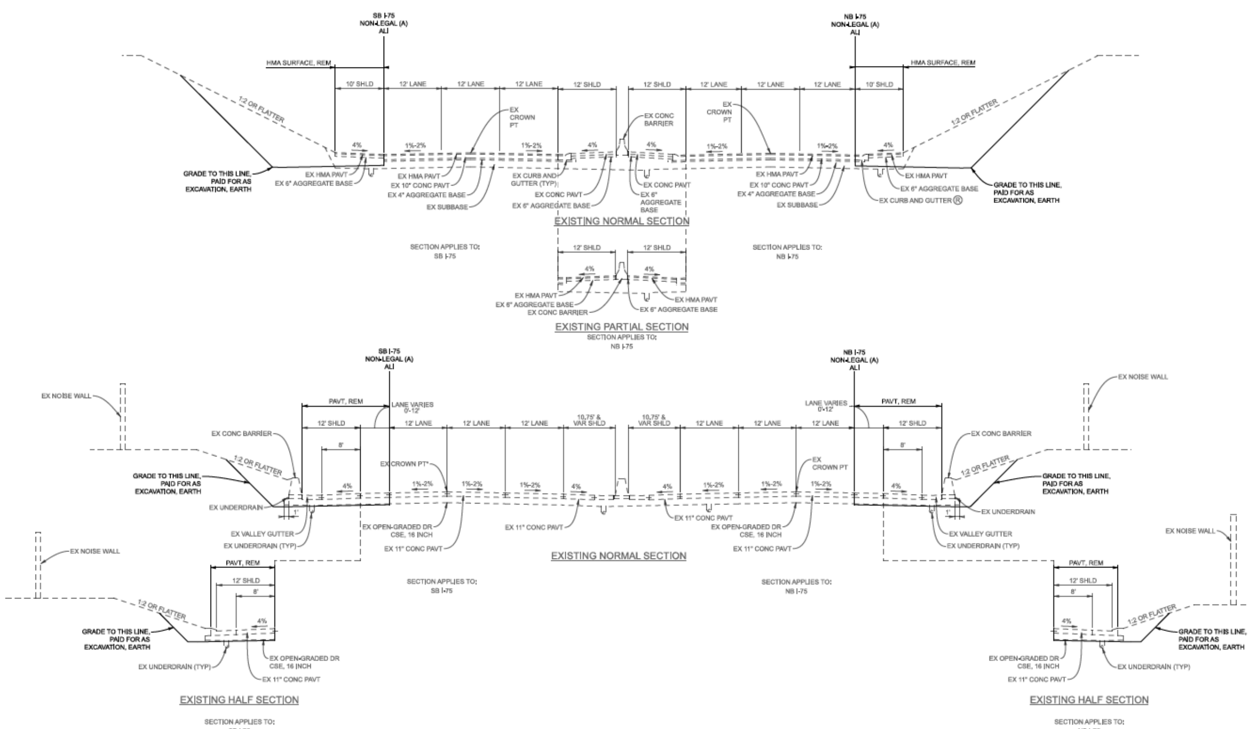
Existing conditions document the existing geometric, roadway and bridges conditions, traffic data and current traffic operations on I-75, M-102 and the interchange to establish a baseline for concept comparison.

4.1 Roadway

I-75 is a major thoroughfare connecting the city of Detroit with the northern and southern suburbs and is a critical commercial and commuter route moving goods and services daily. MDOT data shows it carried 109,064 vehicles per day in 2022.

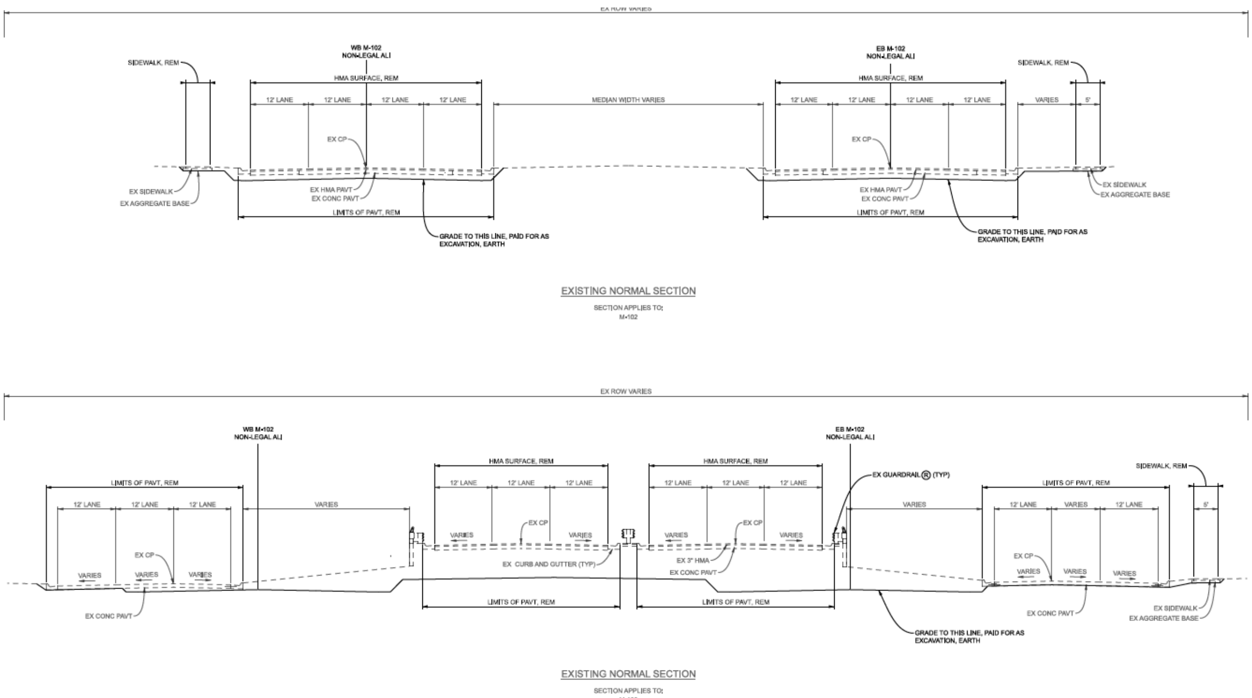
The approximately 1.1-mile segment of I-75 from E Lantz Avenue in the south to E Maxlow Avenue is being evaluated in this study. The existing interchange consists of a diamond configuration with a grade separated, third-level viaduct for M-102 through-traffic. The interchange has full directional access to and from M-102. While the interstate has four travel lanes in general, it reduces to three travel lanes in each direction within the study limits and is a source of recurring congestion daily. I-75 also includes northbound and southbound service drives. The existing inside shoulders vary between 12 and 13 feet while outside shoulder width varies between 11 and 12.7 feet on both sides. In addition to the vehicular bridge at M-102, there are two pedestrian bridges crossing over I-75 north and south of the interchange. Existing typical sections for I-75 are shown in Figure 3.

Figure 3. I-75 Existing Typical Section



M-102 is a major arterial with a posted speed limit of 40 mph within the study limits. M-102 consists of four lanes in each direction with ramps on both sides at the interchange. Posted speed limits are 40 mph at ramps. M-102 is a divided highway with an existing 45- to 60-foot median. At the interchange, direct left-turn movements are permitted; however, indirect left-turns (Michigan Lefts) are utilized on either side of the interchange. The existing typical section for M-102 is shown in Figure 4.

Figure 4. M-102 Existing Typical Section



Dequindre Street and John R Street are north-south arterials that serve as the eastern and western study limits, respectively. Left-turn movements are facilitated via indirect left turns at signalized crossovers east and west of the intersections.

Existing and posted speed limits and design speeds are detailed in Table 3:

Table 3. Existing Design Speed Information

Location	Posted Speed (mph)	Design Speed (mph)
I-75	70 mph	70 mph
Ramp B	N/A	55 mph
Ramp C	N/A	55 mph
Northbound I-75 service drive	40 mph	40 mph
Southbound I-75 service drive	40 mph	40 mph
M-102	40 mph	40 mph

4.2 Existing Bridges and Major Structures

The I-75/M-102 interchange includes four bridges: one carrying M-102 over the freeway, one for northbound traffic heading for westbound M-102 and two structures that carry the service drives along M-102 (Figure 5). The service drive bridges and ramp bridge are built on cantilever abutments adjacent to the roadway. It is a multi-span bridge with piers built adjacent to the freeway with integral retaining walls between the pier columns and footings under the I-75 shoulders. There is insufficient width under each of these bridges (due to the close proximity of the piers and retaining walls) to allow widening of I-75 at this time. The bridge identification numbers and associated geometric data are provided in Table 4.

Table 4. Existing Structure Data

ID No	Bridge	Condition	Horizontal Clearance (feet)	Vertical Clearance (feet)	Year Built/Rebuilt
11849	State Fair Avenue over I-75	Fair	81 feet L	15 feet L	1967
11849	State Fair Avenue over I-75	Fair	86 feet, 7 inches R	15 feet, 3 inches R	1997
11851	Eastbound M-102 service drive over I-75	Fair	60 feet L	15 feet, 2 inches L	1969
11851	Eastbound M-102 service drive over I-75	Fair	60 feet R	15 feet, 1 inch R	2007
11850	M-102 over I-75	Poor	60 feet L	20 feet L	1969
11850	M-102 over I-75	Poor	60 feet R	20 feet R	-
11852	Westbound M-102 service drive over I-75	Fair	60 feet L	15 feet, 1 inch L	1969
11852	Westbound M-102 service drive over I-75	Fair	60 feet R	15 feet, 1 inch R	2007
11861	I-75 ramp over I-75 at Winchester Avenue	Fair	60 feet L	15 feet L	1967
11861	I-75 ramp over I-75 at Winchester Avenue	Fair	60 feet R	14 feet, 5 inches R	2003

* MDOT Report 44

Figure 5. MDOT Bridge Structure Identification Numbers

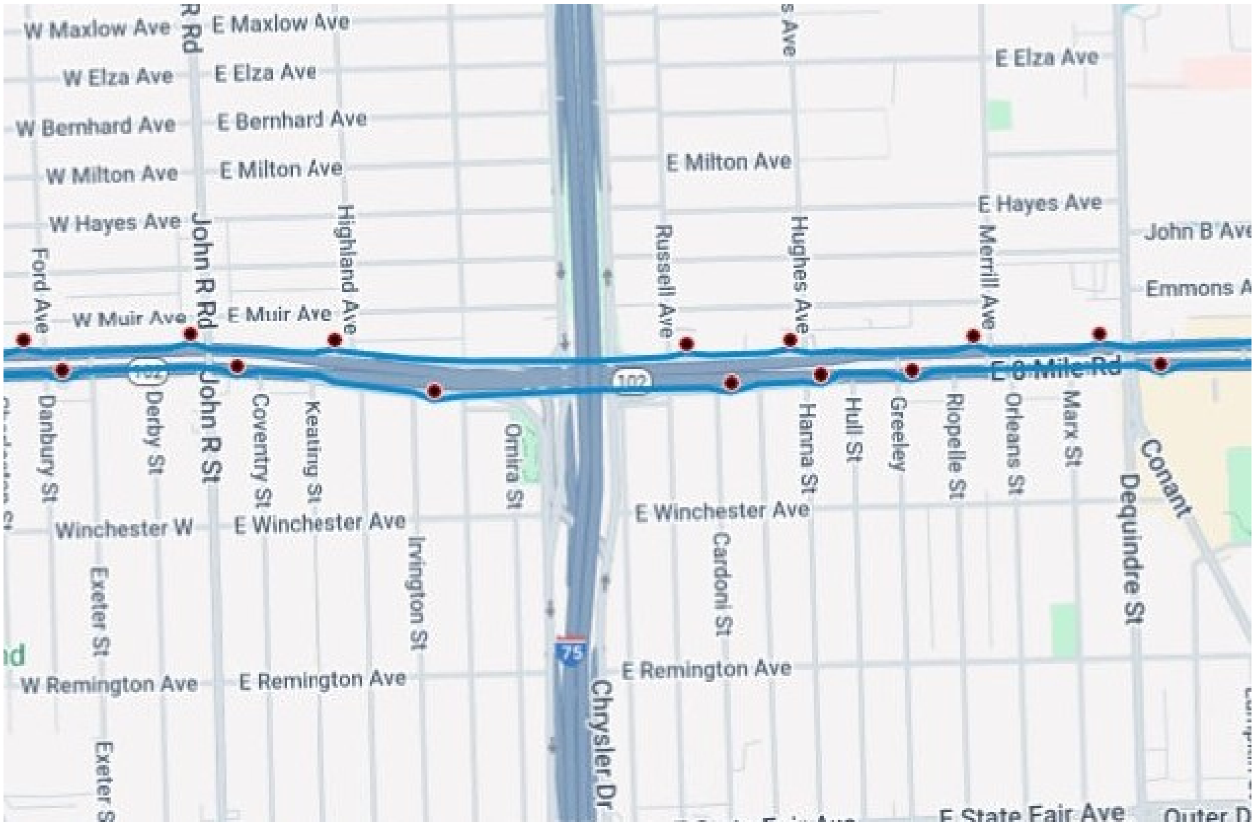
4.3 Nonmotorized and Transit Facilities

There is a fully connected 6-foot existing sidewalk on each M-102 service drive connecting the communities across the interchange. This sidewalk continues from John R Road to Dequindre Street within the study limits. Sections of the sidewalk have been rebuilt as part of the I-75 Modernization Project to the north of M-102. Sidewalk networks also exist in all four quadrants, connecting the residential area, including Knudsen Playlot Park in the southwest quadrant.

No bicycle facility exists within the study limits. The City of Detroit bike map shows potential facility along John R Road south of M-102.

M-102 corridor is served by both City of Detroit Department of Transportation (DDOT) route #17 and Suburban Mobility Authority for Regional Transportation (SMART) route 494. Other routes serve Dequindre Street and John R Road. West of the study limits, Jason Hargrove Transit Center offers transfer between DDOT and SMART buses. Non-sheltered bus stops are located adjacent to the interchange marked by bus stop signs.

Figure 6. DDOT (Route 17)/SMART (Route 494) Bus Stops Along M-102 Corridor



4.4 Environmental Conditions

The I-75/ M-102 interchange provides critical access to those living and working within the study area. The majority of the study area consists of single-family, residential neighborhoods. Commercial businesses are located along John R. Road, M-102, E State Fair Street and Dequindre Street.

Knudsen Playlot Park is in the southwest quadrant of the interchange along Chrysler Drive. This park offers basketball courts, picnic areas, a play area and a walking path. Because it is publicly owned, open to the public and important for recreation, it is considered a Section 4(f) resource and has certain protections from conversion to transportation uses under Section 4(f) of the Department of Transportation Act of 1966.

The interchange is in an area defined as being in attainment of National Ambient Air Quality Standards (NAAQS). When the 500-foot buffer is included, the study area extends to include Macomb County. Oakland, Macomb and Wayne counties are required to monitor ozone due to prior exceedances of the NAAQS. Although portions of Wayne County exceed NAAQS for sulfur dioxide, the study area is not located within the non-attainment area.

Records reviewed from MDOT and the Michigan Department of Environment, Great Lakes, and Energy (EGLE) indicate the presence of both historic and active contaminated sites within the study area. Sites include regulated storage tanks, environmental remediation sites and brownfield property (property for which redevelopment is complicated by long-standing or historic contamination). Structures within the study area are impacted by lead-based paint.

No streams, surface waters or wetlands are located within the study area, and the study area is not located within a regulated floodplain. Data from the United States Fish and Wildlife Service (USFWS) does not identify any threatened and endangered species critical habitat located within 0.5 miles of the study limits. The study area is located within the range for the federally listed (endangered) northern long-eared bat (NLEB) (*Myotis septentrionalis*) and Indiana bat (*Myotis sodalis*), as well as the proposed endangered, tricolored bat (*Perimyotis subflavus*). There are no known roosts for the NLEB or Indiana bat and no known occurrences of the tricolored bat within Oakland, Macomb or Wayne counties. Potential suitable roost habitat, including bridge structures, exist within the study area for these species. Trees are present in the project area; however, they appear to be sparse and surrounded by urban development (no forest stands within 1,000 feet) making them unsuitable roost trees.

There are nine overlapping jurisdiction agencies that regulate stormwater management within the study area: EGLE's Water Resources Division (WRD), the Great Lakes Water Authority (GLWA), MDOT, the Wayne County Soil and Water Conservation District, Oakland County Water Resources Commission (WRC), the Macomb County Public Works Office, the Detroit Water and Sewerage Department (DWSD), the Hazel Park Water and Sewer Department, and the Warren Engineering Division. Existing drainage facilities convey stormwater runoff through a series of stormwater drains along and within the roadways. There are two pump stations within the study area that pump water from the highways into the pump house and into the local drainage system following heavy rain events, as needed. Per MDOT, one is a decommissioned pump station, while the other is still active. Both pump stations are located south of M-102 (Pump IDs: 1063 and 1064A).

The study area is highly disturbed by urban development. There are no known historic or archaeological resources or farmland within the study area. Coastal Zone consistency review is not required as the project is outside the limits of a Coastal Zone Management Boundary (CZMB).

The interchange includes large areas of impervious surfaces, including pavement, bridges, curb and gutter, and sidewalks. In its existing condition, the interchange study area consists of approximately 71 percent impervious surfaces, with the remaining 29 percent being of pervious surfaces. The Desktop Environmental Analysis Review Report can be found in Appendix B.

4.5 Existing Traffic Conditions

The traffic analysis component of this EPE study is summarized in this section. It evaluated existing (2024) weekday AM and PM peak hours and considered the influence of existing traffic volumes and movements, existing geometric configurations and traffic controls, and heavy vehicles currently on the roadway network.

4.5.1 Traffic Volumes

Traffic volumes for the I-75 freeway are presented in Table 5. The traffic count data is included in the Existing Conditions Report, Appendix A.

Table 5. Existing Average Daily Traffic (AADT) Data

Route	ADT	Year
I-75 at Meyers Avenue	152,200	2023
I-75 at State Fair Avenue	172,323	2023
I-75 south of 7 Mile Road	174,348	2023
Eastbound M-102 (Viaduct/Bridge)	13,651	2024
Westbound M-102 (Viaduct/Bridge)	12,397	2024
Northbound I-75 Service Drive	10,349	2024
Southbound I-75 Service Drive	12,953	2024
Eastbound M-102 Service Drive	4,220	2024
Westbound M-102 Service Drive	8,235	2024
Northbound I-75 Service Drive to Westbound M-102 Bridge	4,268	2024
Northbound I-75 Off Ramp to M-102 (South of M-102)	12,093	2022
Southbound I-75 On Ramp to I-75 (South of M-102)	5,665	2023
Northbound I-75 On Ramp to I-75 (North of M-102)	2,419	2023
Southbound I-75 Off Ramp to M-102 (North of M-102)	7,473	2023

4.5.2 Level of Service

LOS measures a driver's experience on the road and at intersections based on speed and traffic volume. It is designated by a letter grade from A (free flow) to F (near gridlock). A, B or C represent free-flowing conditions. The LOS analysis provides an evaluation of a transportation facility in terms of its operational capability based on the traffic volumes and capacity of the facility. It is a simple way to compare different operational features.

The interchange area consists of multiple components of transportation facilities, including limited access roadway, freeway ramps and signalized intersections. Traffic engineers employ both deterministic and random methods to perform traffic analysis. The LOS analysis is conducted at three levels: for the I-75 freeway (using HCS), at signalized intersections (using Synchro), and the overall performance of all components combined (using VISSIM). The results are summarized below.

I-75 Freeway Analysis - HCS

A freeway is defined as a divided highway facility with two or more lanes in each direction and full control of access and egress. It has no at-grade intersections, and access and egress are provided by ramps at interchanges. Within the influence area of the interchange and the study limits, mainline freeway, ramps, merging and diverging areas were analyzed for the existing (2023) traffic conditions to determine operational performance of the interchange and I-75. The data show that the roadway segments are operating at an acceptable LOS in terms of deterministic evaluation. The Highway Capacity Manual (HCM)-based results show that the freeway and the components are operating at LOS C or better under current traffic volumes.

M-102 Corridor Analysis - Trafficware Synchro Software

The section of M-102 from John R Street to Dequindre Street was evaluated using Synchro. The analysis was focused on the signalized intersections along the M-102 corridor. The LOS results confirmed the current interchange configuration operation with multiple signalized intersections and short storage lengths within the boulevard configuration.

Multilane highways have traffic control interruptions at intersections or driveways. The LOS, based on density, determines the operational capacity of a roadway. Under ideal conditions, the maximum lane capacity for a multilane highway segment is 2,200 vehicles per hour. Based on the HCS analysis for the M-102 corridor, the segment is operating at LOS C or better during the PM peak hour.

A signalized intersection's LOS is based on control delay. The Synchro outputs for the corridor show that the system is operating at an acceptable LOS during the peak hours. However, the closely spaced, staggered interchange intersections show poor operations due to short segments and intermittent stop-and-go conditions caused by the four signals on the service drives.

The LOS analysis indicates that most intersections are operating at LOS C or better. It is important to note, however, that the interchange intersections in the existing condition are absent the traffic using the flyover bridge. However, the majority of the M-102 traffic passes through Dequindre Street and John R Street intersections.

The LOS results for freeway facilities and signalized intersections are shown in Figure 7 and Figure 8. For data specific to each component of a segment (e.g., ramps), refer to the Existing Conditions Report included in Appendix A.

I-75 Freeway VISSIM Analysis - Micro-simulation VISSIM

While HCS and Synchro provide individual component evaluation, a micro-simulation like VISSIM provides a random approach to evaluate the overall performance of all components combined. The results of the VISSIM analysis for I-75 are presented in Table 6. The VISSIM individual freeway segment speed and density results and more detailed analysis are available in the Existing Conditions Report included in Appendix A.

The average corridor speed is more than 60 mph during peak periods. The vehicular density along various segments of the project area is less than 12.7 vehicles/mile/lane, reflecting a good LOS. The transition from four lanes to three lanes did not show any significant queue buildup under normal traffic conditions. These results, however, reflect operations under the 2023 traffic volumes.

Table 6. I-75 Density/Speed VISSIM Results Summary

Parameter	AM Peak	PM Peak
Network Average Speed [mph]	48.4	46.8
Network Total Delay Time [hr]	29.3	33.2
M-102 Ramp Terminal Delay [sec]	134,878	262,221
I-75 Average Corridor Speed [mph]	57.8	60.3
I-75 Vehicles Processed [veh]	11,003	16,417

Figure 7. Existing Conditions AM Peak LOS Results

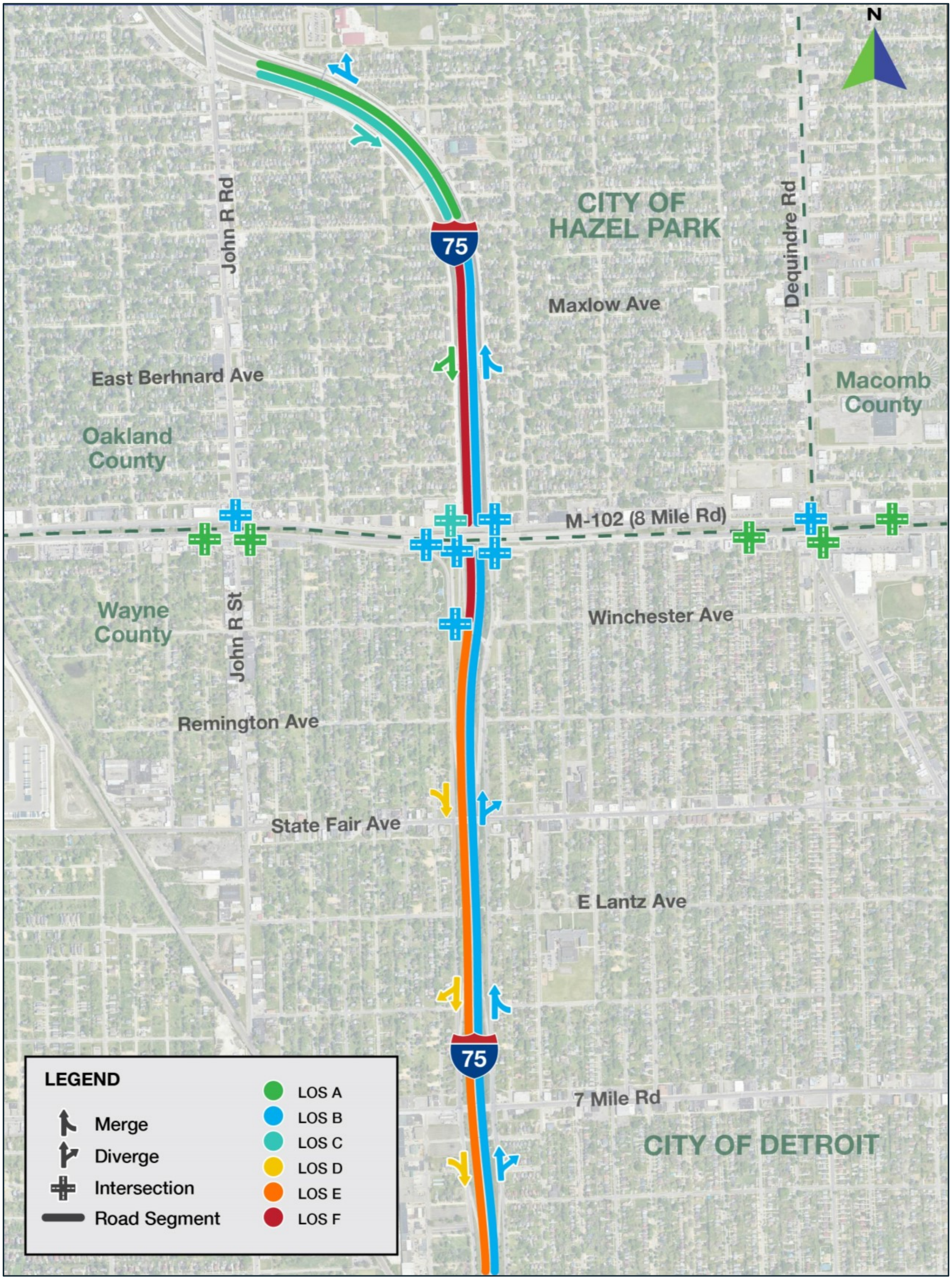
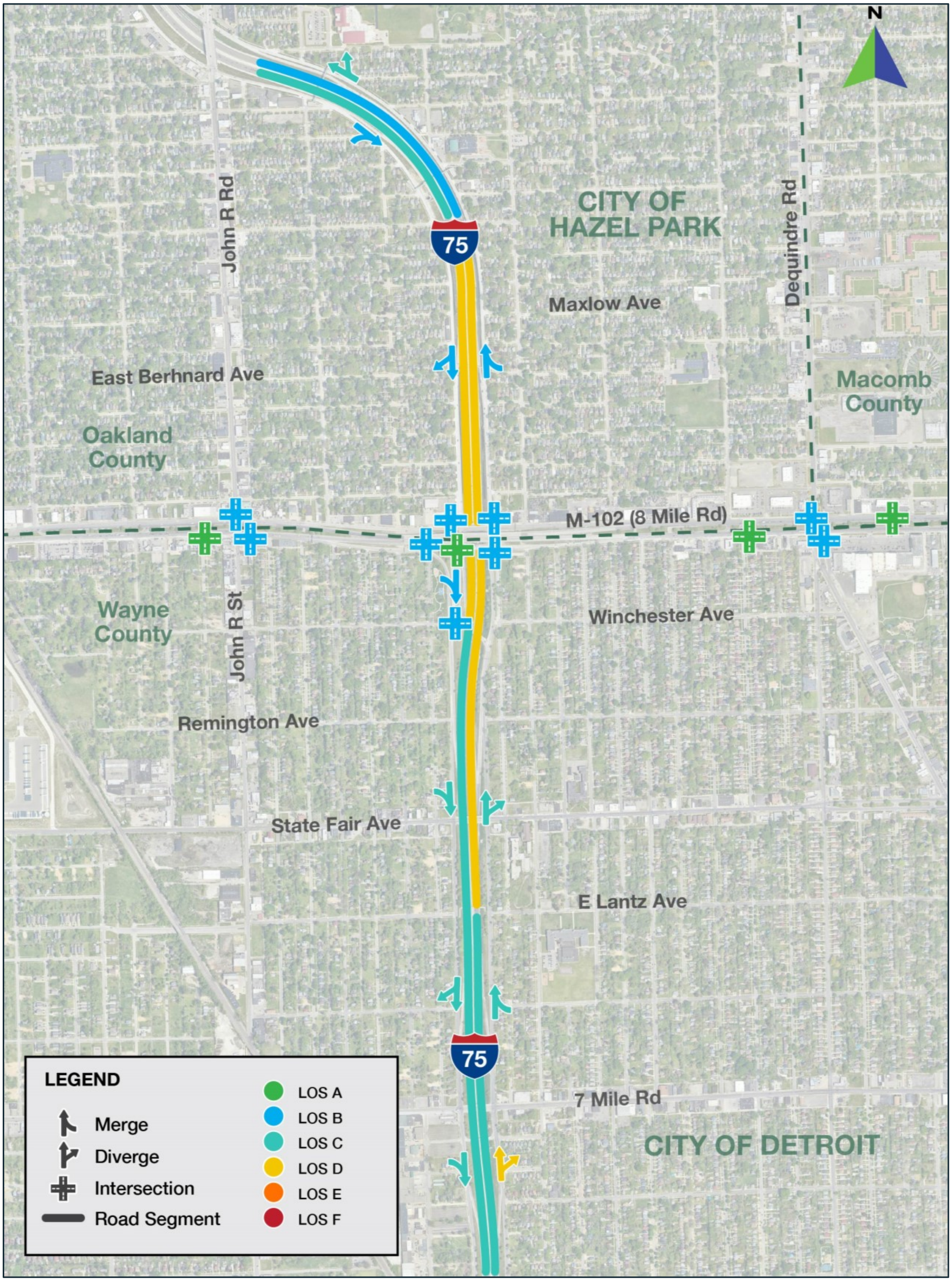


Figure 8. Existing Conditions PM Peak LOS Results



4.6 Crash Analysis

Crash reports along 1.4 miles of I-75 (Emery Street to Meyers Avenue) and 1.3 miles of M-102 (John R Road to Dequindre Street) for the last five-year period, starting from 2018, were analyzed based on severity, crash type, road surface condition and lighting condition. Crash data for the I-75 segment within the study limits is summarized in Table 7. The KABCO scale was created by the Federal Highway Administration to evaluate the severity of a car crash and measure the injury severity for any person involved. It consists of five codes:

K for fatal,

A for incapacitating injury,

B for probable injury,

C for possible injury, and

O for property damage only with no injury.

A total of 547 non-injury crashes were recorded. For the injury crashes, a total of 201 were reported that included two fatal (K), and seven injury types (A). One of the two fatal (K) crashes resulted from vehicle loss of control, and the second fatality was recorded when a motorist left a disabled vehicle and was struck by another vehicle.

Table 7. I-75 Crash Summary by Year

Worst Injury in Crash	2018	2019	2020	2021	2022	Total
Fatal Injury (K)	0	0	0	1	1	2
Serious Injury (A)	2	0	2	2	1	7
Minor Injury (B)	9	8	8	8	11	44
Possible Injury (C)	34	26	26	27	35	148
No Injury (O)	143	109	67	108	120	547
Total Crash Count	188	143	103	146	168	748

In general, there was no significant concentration of crashes identified for mainline I-75. However, the M-102 corridor showed concentration of crashes at the service drives and other signalized intersections. Along M-102, injury and PDO crashes accounted for 27 percent and 73 percent, respectively. Within this corridor, rear-end, angle crashes, and sideswipes in the same direction accounted for most crash types. The detailed crash analysis is included in Appendix C.

4.7 Utilities

Public utilities within the study limits were contacted to gather information about their existing facilities. A Miss Dig request was submitted to determine the presence of utilities. A number of utilities responded and are presented in Table 8.

Table 8. Utilities Contacted

Utility	Owner
Fiber	123.NET Inc. Fiber Optics East
Telecommunications	AT&T Telephone
Telecommunications	Comcast Cable TV
Water	Detroit City Water and Sewerage Potable Water
Sanitary/Storm	Detroit City Water and Sewerage Sewer (Combined Sanitary/Storm Only)
Lighting	Detroit Public Lighting
Electric and Conduit	DTE Electric
Gas	DTE Gas
Gas	Consumers
Water	Great Lakes Water Authority
Water	Hazel Park City Potable Water
Sanitary	Hazel Park City Sanitary Sewer
Storm Sewer	Hazel Park City Storm Sewer
Electric	ITC Transmission Company
Fiber	Level 3 Now Lumen Fiber Optics
Fiber	MCI/Verizon Fiber
Sewer	Oakland County Drain Commissioner Sewer
Water	Warren City Potable Water
Sanitary	Warren City Sanitary Sewer
Telecommunications	WOW Cable
ITS	MDOT
Utility	Owner
Fiber	123.NET Inc. Fiber Optics East

Overhead transmission lines owned by International Transmission Company (ITC) Michigan are located in the median, east and west of I-75 along M-102, near the interchange. ITC Michigan has provided existing plans indicating their location at the I-75/M-102 interchange and shared the location and depth details of the underground transmission line duct bank. This duct bank is situated a few hundred feet north of the bridge and does not run directly beneath the interchange structure.

The overhead transmission line transitions underground into a duct bank beginning at Highland Avenue and continuing to Hughes Avenue. Between Highland Avenue and Hughes Avenue, the duct bank extends north to Muir Avenue before traveling east beneath I-75. Underneath I-75, the duct bank is buried at a depth of approximately 8.5 feet from cover to grade. Moving further east, the underground duct bank then runs south at Hughes Avenue, eventually re-entering the median of M-102. The recommended concept is not expected to impact the duct bank.

The utility details provided are included in Appendix D. During the design phase, it will be necessary to confirm the precise locations of existing utilities. Keep in mind that utility networks could be relocated, removed or newly installed between the time of this study and the project's actual construction. As a result, a thorough review of current utilities will be essential during the design phase.

5 Development and Evaluation of Concepts

This EPE study was initiated by MDOT to explore and identify the best options for either maintaining the current interchange or replacing it with a new one. Any solution for the interchange must accommodate future traffic demands, significantly enhance safety for all users and contribute positively to the surrounding environment, infrastructure and community. By doing so, the interchange will not only meet immediate needs but also serve as a valuable asset for the next 50 years or more. This long-term vision includes considerations for sustainable development, minimizing environmental impact and fostering community growth and connectivity.

The concepts evaluated for the I-75/M-102 interchange included a no build option, which would involve ongoing maintenance of the aging infrastructure, and a complete reconstruction of the interchange. The reconstruction could either replicate the existing design or introduce a new configuration that is both cost-effective and aligned with project goals. A crucial factor in determining feasible concepts was the preservation of the existing right of way. The concept development and evaluation process is described in the following sections.

5.1 Initial Concept Development

The primary objective of the EPE study was to identify and evaluate a no build alternative, in-kind replacement concept, and two practical concepts. Several layouts and configurations were considered, and high-level reviews were conducted to screen them.

Initial concepts for alternatives were developed through a series of brainstorming sessions with the project study team, MDOT and stakeholders. Maintaining the existing right of way was a key factor; therefore, the early concept development effort was focused on concepts that can fit within the existing right of way and avoid impacts on nearby residential communities, businesses and Knudsen Playlot Park. The concepts presented in Table 9 were identified as potential configurations. All reconstruct configurations assume the removal of the third level overpass bridge structure and the addition of a fourth travel lane.

5.1.1 Evaluation Criteria

Informed by engagement with MDOT design and operations engineers, stakeholders and the public, evaluation criteria were developed to score the initial concepts for screening purposes. They were screened for feasibility, operational performance and against the following evaluation criteria:

- **Traffic Operations:** Traffic operations spearheaded the effort to evaluate multiple options to determine interchange configuration that can best serve future traffic demand. This included capacity performance of the I-75 freeway, its components, the M-102 corridor, and particularly the interchange intersections without the flyover bridge for through-traffic.
- **Safety:** While the scope of work is limited to conducting predictive safety analysis for the two practical concepts, initial assessment was conducted in terms of the number of

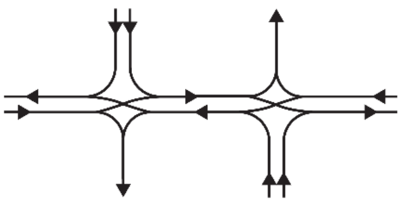
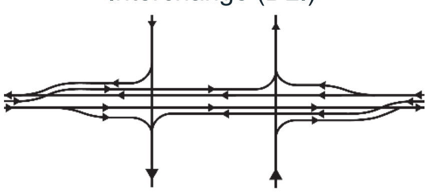
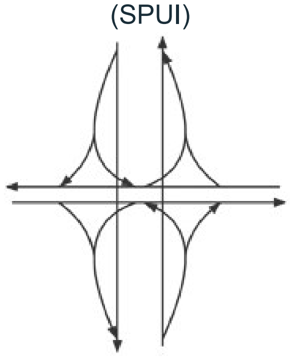
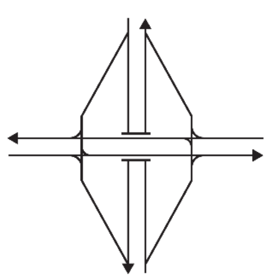
conflict points each concept was producing with an assumption that fewer number of conflict points is better.

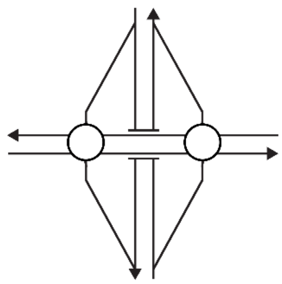
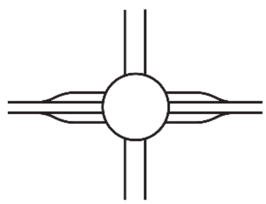
- **Active Transportation:** Active transportation was inclusive of nonmotorized traffic, safe access across the bridge, connecting the communities and providing a safe passage.
- **Community Cohesion:** The existing flyover bridge structure was cited as visual and physical obstacles between the communities divided by the I-75 freeway. Concepts that were less intrusive and provided full access to pedestrians and cyclists were considered to be better.
- **Emergency Access:** While emergency vehicles can navigate through any configuration, some geometric designs are more conducive in accommodating them.
- **Cost:** Initial cost estimates for the bridge structure were evaluated and compared. The rest of the project, widening of I-75, is consistent in all concepts and therefore assumed the same.
- **Construction Disruptions:** Constructability of each concept was considered to determine the estimated duration of construction and impact on the surroundings and commuters through the area.
- **Right of Way Impacts:** Concepts that affected the existing right of way were eliminated.
- **Business Access:** Maintaining business access during construction as well as in future roadway configuration was important to ensure that the businesses in the northeast and northwest quadrants of the interchange retain their access to the service drives and M-102.

As shown in Table 9, of the eight concepts considered (six build/reconstruct, no build, and in-kind replacement), six were found to be impractical due to various factors, including traffic operations, geometric design limitations, operational issues, agency preferences, high construction costs, right of way requirements, and feedback from the community and stakeholders. Consequently, no further traffic analysis was conducted for these concepts.

Table 9. Initial Concepts for the I-75/M-102 Interchange

Concept	Description	Initial Screening
No Build	Maintains the existing interchange assuming routine repair/ maintenance work to extend the life of the existing infrastructure.	The flyover bridge structures are nearing the end of their useful life and face costly reconstruction. This concept does not address balancing travel lanes on I-75. **ELIMINATED**

Concept	Description	Initial Screening
In-kind Replacement	Full in-kind replacement of the existing infrastructure and existing interchange configuration, and accommodates a future fourth lane on the new bridges along I-75.	While this concept provides the best overall results for traffic operations, this was significantly costly. This concept does not address the connecting communities affected by the physical barrier. **ELIMINATED**
Diverging Diamond interchange (DDI) 	Replaces the existing diamond interchange with a diamond configuration and configures the crossroad within the existing right of way.	This concept provides operational features like the existing diamond layout. Initial estimates showed that this is the most cost-effective bridge structure. **CARRIED FORWARD**
Displacement Left-Turn Interchange (DLI) 	Replaces the existing diamond interchange with a displaced left-turn configuration. Results in two-phase signal operation and facilitates separation of left-turn from through-movements.	This concept provides operational features like a DDI by eliminating multiple phases. Due to its non-conventional layout, this didn't appeal well to stakeholders and the public. **ELIMINATED**
Single-Point Urban interchange (SPUI) 	Converges all interchange traffic at a single intersecting point.	Multiple phases resulted in poor intersection operations and has a higher cost due to a wider bridge. **ELIMINATED**
Urban Diamond interchange (UDI) 	Retains the existing configuration minus the overhead flyover bridges.	Direct left-turn movements on M-102 were eliminated and rerouted through crossovers. **CARRIED FORWARD**

Concept	Description	Initial Screening
Double Roundabout interchange (DRI) 	Reconfigures the interchange to a diamond layout with roundabout intersections at the terminals.	This concept had many problems associated with multiple lanes, limited distance between the two interchange terminals, traffic operations, lack of pedestrian accommodation, and right of way impacts. **ELIMINATED**
Single Bridge Roundabout/Traffic Circle interchange 	This concept was based on a single large rotary[1] roundabout.	This concept's non-conventional configuration resulted in multiple problems associated with multiple lanes, accommodation of commercial vehicles and nonmotorized traffic, construction, cost, traffic operations, and right of way impacts. **ELIMINATED**

[1] A rotary is a type of intersection where traffic flows around a central island in a clockwise direction.

Based on the evaluation criteria, the initial screening identified Urban Diamond and Diverging Diamond as the two practical concepts that met the project objectives at the lowest cost; both concepts were carried forward for more refined evaluation.

5.2 Practical Concepts Evaluation

The practical concepts were evaluated for the 2025 baseline and the 2050 design year conditions. While the base conditions/no build scenario assumed no geometric improvements within the study limits and no widening of mainline I-75, the two practical concepts include reconfiguration of the interchange and widening of mainline I-75 to four lanes in each direction.

5.2.1 Practical Concept 1: Diverging Diamond Interchange

The first practical concept is a diverging diamond interchange (DDI) with three through-travel lanes in each direction. A DDI is an innovative road design aimed at improving traffic flow and safety at highway interchanges. In a DDI, the directions of travel on the non-freeway road cross to the opposite side at each end of the interchange. This unique configuration allows for more efficient left turns onto and off the freeway without the need for additional traffic signals or complex maneuvers. The DDI design reduces conflict points, which can lead to fewer accidents and smoother traffic operations. Due to its unique layout, it requires less space and is more suitable for urban environments with limited right of way. Its smaller footprint can be more cost-effective compared to traditional interchange designs. An illustration of the DDI at the I-75/M-102 interchange is shown in Figure 9.

Figure 9. Practical Concept 1 - DDI

5.2.2 Practical Concept 2: Urban Diamond Interchange

The second practical concept is an urban diamond interchange (UDI), similar to the existing layout without the flyover bridges for through-traffic, as shown in Figure 10. A UDI configuration efficiently manages traffic flow where a major highway intersects with a minor road or freeway service drives. Based on its layout, it can serve urban settings with limited space. One key advantage a UDI provides is to maintain through-movement along the service drives.

Figure 10. Practical Concept 2 - UDI

5.2.3 Traffic Analysis

The two practical concepts were evaluated for detailed operational analysis using HCS, Synchro or VISSIM software. The results are summarized below. Detailed report and capacity analysis printouts can be found in Appendix E.

HCS Analysis

The HCS analysis was completed for the years 2025 and 2050 for both the existing conditions and for the two practical concepts. It should be noted that the number of ramps under the proposed conditions has been reduced by consolidating the two southbound service drive on ramps into a single ramp. The HCS results confirmed that roadway capacity improvements result in improving LOS at several locations, including mainline segment, ramps and merge/diverge areas. The LOS comparison is provided in Table 10.

Table 10. HCS Results Summary

Section	Segment	Type	AM Peak				PM Peak			
			No Build - 2025	ALT 1 and 2 - 2025	No Build - 2050	ALT 1and 2 - 2050	No Build - 2025	ALT 1and 2 - 2025	No Build - 2050	ALT 1and 2 - 2050
I-75 near John R Street	NB I-75	Basic	A	A	A	B	B	B	B	C
	NB I-75 off ramp to John R Street	Diverge	B	B	B	B	C	C	C	C
	SB I-75	Basic	C	C	C	C	C	C	C	C
	SB I-75 on ramp to John R Street	Merge	C	C	C	C	B	B	B	B
I-75 north of M-102	NB I-75	Basic	B	B	B	B	D	C	D	C
	M-102 on ramp to NB I-75	Merge[1,2]	Below Capacity	Below Capacity	Below Capacity	Below Capacity	Below Capacity	Below Capacity	Below Capacity	Below Capacity
	SB I-75	Basic	F	D	F	D	D	C	D	C
	SB I-75 off ramp to M-102	Diverge[1]	A	A	A	A	B	B	B	B
I-75 and Remington Avenue	NB I-75	Basic	B	B	B	B	D	C	D	C
	NB I-75 off ramp to Remington Avenue	Diverge	B	A	B	A	C	B	C	B
	SB I-75	Basic	E	D	E	D	C	C	C	C
	SB I-75 on ramp to Remington Avenue	Merge	D	D	E	D	C	C	C	C
I-75 and 7 Mile Road	NB I-75	Basic	B	B	B	B	C	C	D	C
	NB I-75 off ramp to 7 Mile Road	Diverge	B	B	B	B	D	D	D	D
	7 Mile Road on ramp to NB I-75	Merge	B	B	B	B	C	C	C	C
	SB I-75	Basic	E	D	E	D	C	C	D	C
	SB I-75 off ramp to 7 Mile Road	Diverge	D	C	D	D	C	C	C	C
	7 Mile Road on ramp SB I-75	Merge	D	D	D	D	C	C	C	C

1. According to the 2010 HCM, LOS cannot be determined for major merge segments. The volume to capacity (v/c) ratio was used to determine if the segment was below capacity (v/c < 0.9), at capacity (0.9 ≤ v/c ≤ 1.00), or above capacity (v/c > 1.00).
2. Single-lane segments cannot be analyzed using the 2010 HCS. Single-lane segments were analyzed using either the major merge or major diverge worksheets.

Synchro Analysis

A comparison of M-102 performance under existing and proposed concepts is provided in Table 11 for year 2025 and Table 12 for year 2050. The LOS shows that overall, the corridor operates at an acceptable LOS and will continue to operate at acceptable LOS in future years under existing or proposed geometric conditions.

Table 11. M-102 LOS Results Summary 2025 (Signalized Intersections)

No	Intersection	Ex Conditions		Concept 1		Concept 2	
		AM	PM	AM	PM	AM	PM
1	EB M-102/U-turn Exeter Street	A	A	A	A	A	A
2	WB M-102/John R Road	B	B	C	C	B	C
	EB M-102/John R Road	A	B	A	B	A	B
3	EB M-102/EB U-turn at Irvington Street	n/a	n/a	A	A	A	B
4	WB M-102 Service Drive/SB Chrysler Freeway	C	B	A	A	B	A
	WB M-102 Service Drive/NB Chrysler Freeway	B	B	B	B	A	A
	WB/EB M-102 (West DDI Intersection)	n/a	n/a	B	B	n/a	n/a
	EB M-102 Service Drive/SB Chrysler Freeway	B	A	A	B	A	A
	EB/WB M-102 (East DDI Intersection)	n/a	n/a	A	B	n/a	n/a
	EB M-102 Service Drive/NB Chrysler Freeway	B	B	A	A	A	B
5	EB M-102 Service Drive/NB Chrysler Freeway (Knudsen Playlot Park)	B	B	n/a	n/a	n/a	n/a
6	SB/NB Chrysler Freeway	B	B	n/a	n/a	n/a	n/a
7	EB M-102 U-turn/Rusell Street and WB M-102	n/a	n/a	A	A	A	A
8	Orleans Street/EB M-102	A	A	A	A	A	A
9	WB M-102/Dequindre Street	B	B	A	B	B	B
	EB M-102/Dequindre Street	A	B	A	A	A	A
10	EB M-102 U-turn/Dequindre and WB M-102	A	A	A	A	A	A

Table 12. M-102 LOS Results Summary 2050 (Signalized Intersections)

No	Intersection	Ex Conditions		Concept 1		Concept 2	
		AM	PM	AM	PM	AM	PM
1	EB M-102/U-turn Exeter Street	A	A	A	A	A	A
2	WB M-102/John R Road	B	B	A	C	B	C
	EB M-102/John R Road	B	A	C	A	A	B
3	EB M-102/EB U-Turn at Irvington Street	n/a	n/a	A	A	A	B
4	WB M-102 Service Drive/SB Chrysler Freeway	C	B	A	A	B	B
	WB M-102 Service Drive/NB Chrysler Freeway	B	B	n/a	n/a	A	B
	W/EB M-102 (West DDI Intersection)	n/a	n/a	B	B	n/a	n/a
	EB M-102 Service Drive/SB Chrysler Freeway	C	A	n/a	n/a	A	A
	EB//WB M-102 (East DDI Intersection)	n/a	n/a	A	A	n/a	n/a
	EB M-102 Service Drive/NB Chrysler Freeway	B	B	A	A	A	B
5	EB M-102 Service Drive/NB Chrysler Freeway (Knudsen Playlot Park)	B	B	n/a	n/a	n/a	n/a
6	SB/NB Chrysler Freeway	B	B	n/a	n/a	n/a	n/a
7	EB M-102/U-turn/Rusell Street and WB M-102	n/a	n/a	A	A	A	A
8	Orleans Street/EB M-102	A	A	A	A	A	A
9	WB M-102/Dequindre Street	B	B	A	A	B	B
	EB M-102/Dequindre Street	A	B	A	A	A	A
10	EB M-102/U-turn at Dequindre Street and WB M-102	A	A	A	A	A	A

It is important to note that the current M-102 capacity includes the free-flowing M-102 traffic facilitated by the existing flyover. Under the two proposed concepts, all M-102 traffic would need to pass through signalized intersections. Despite the removal of the flyover bridge structures, which are prohibitively expensive to rebuild, the LOS analyses indicate that there will be no adverse impact on M-102 traffic.

VISSIM Analysis

Microsimulation analyses were performed using VISSIM software to analyze the I-75 performance under the 2050 traffic loading for the freeway and arterial network based on the DDI geometry and widened I-75 freeway and changes to the interchange ramp terminals. The freeway network MOEs of average speed, total network delay, ramp terminal delay, average corridor speed and number of vehicles processed were reviewed and compared. MOE results are tabulated for year 2050. The data indicates that during the AM peak hour, both DDI and UDI offer average to better speeds along the I-75 corridor, as shown in Table 13.

Table 13. Density/Speed VISSIM Comparison Summary Year 2050

Peak	Parameter	No Build	DDI	UDI
AM Peak	Network Average Speed [mph]	46.9	47.3	48.1
	Network Total Delay Time [hr]	35.7	35.8	33.6
	M-102 Ramp Terminal Delay [sec]	173,487	282,551	313,401
	I-75 Average Corridor Speed [mph]	56.2	60.3	60.4
	I-75 Vehicles Processed [veh]	11,293	11,213	11,217
PM Peak	Network Average Speed [mph]	40.3	32.9	49.6
	Network Total Delay Time [hr]	66.5	119.1	24.8
	M-102 Ramp Terminal Delay [sec]	306,063	821,629	324,488
	I-75 Average Corridor Speed [mph]	55.6	53.3	63.0
	I-75 Vehicles Processed [veh]	16,826	15,787	16,717

The initial UDI configuration included free-flow right-turn slip lanes. Concerns were raised about pedestrian and bicycle traffic crossing these free right-turning movements at the slip lanes. Additional analysis was conducted, and the UDI configuration was updated by removing the slip lanes from three of the four quadrants. The eastbound right-turn movement, due to heavy demand, was retained as a free-flow/yield control slip lane. Additional analysis during detailed design may consider further mitigation measures such as rectangular rapid flashing beacons (RRFB) or pedestrian hybrid beacon (PHB) at the slip lane crosswalk location.

To assess the impact of removing slip lanes in the UDI option, capacity analysis for the interchange intersections was conducted for the horizon year 2050 for the AM and PM peak periods. The interchange was first evaluated as free flowing with slip lanes in all quadrants, followed by a comparative analysis in which slip lanes were eliminated and right-turn movement operated under signal control. The capacity results showed no significant degradation of the intersection performance for the three intersections in the northeast, southeast and northwest quadrants. The intersection in the southwest quadrant, eastbound M-102/southbound service drive, showed significant increase in delay for the right-turn movement. The results are provided in Table 14.

Table 14. UDI LOS Summary Year 2050

No	Intersection/Approach/Movement	With Slip Lane		Without Slip Lane	
		AM Peak	PM Peak	AM Peak	PM Peak
1	WB M-102 Service Drive/NB Chrysler Freeway Intersection	A	B	A	B
	WB M-102 Approach	A	B	A	B
	WB M-102 Right-turn Movement	A	A	A	B
2	WB M-102 Service Drive/SB Chrysler Freeway Intersection	B	B	B	B
	SB Chrysler Service Drive Approach	C	B	C	C
	SB Chrysler Service Drive Right-turn Movement	A	A	B	C
3	EB M-102 Service Drive/SB Chrysler Freeway Intersection	A	A	D	B

No	Intersection/Approach/Movement	With Slip Lane		Without Slip Lane	
		AM Peak	PM Peak	AM Peak	PM Peak
4	EB M-102 Approach	A	A	E	B
	EB M-102 Right-turn Movement	A	A	F	B
	EB M-102 Service Drive/Chrysler Fwy NB Intersection	A	B	B	B
	NB Chrysler Service Drive Approach	B	B	C	D
	NB Chrysler Service Drive Right-turn Movement	A	A	C	D

Based on the LOS results, slip lanes can be eliminated from all approaches except the eastbound approach at the southbound I-75 service drive.

VISSIM analyses were conducted for the UDI, evaluating scenarios both with and without slip lanes. The analysis indicated that without right-turn slip lanes, the M-102 ramp terminals are likely to experience increased delays and reduced speeds. This deterioration is due to the delays caused by right-turn movements at the signal, as opposed to the smoother flow provided by an unsignalized, channelized yield control right-turn lane. The detailed results are presented in Table 15.

Table 15. UDI Network Result Summary Year 2050

No	Performance Parameters	AM Peak		PM Peak	
		Slip Lanes	No Slip Lanes	Slip Lanes	No Slip Lanes
1	Network Average Speed [mph]	48.1	31.5	49.6	28.2
2	Network Total Delay Time [hr]	33.6	142.3	24.8	167.9
3	M-102 Ramp Terminal Delay [sec]	313,401	1,534,486	324,488	1,805,458
4	I-75 Average Corridor Speed [mph]	60.4	62.3	63.0	63.1
5	I-75 Vehicles Processed [veh]	11,217	10,999	16,717	16,433

The VISSIM microscopic analysis of overall network performance in terms of systemwide speed, network delay and terminal delay were separated by mainline I-75 and the M-102 corridor. This is to facilitate documentation of the benefit-cost analysis for adding a fourth lane to I-75. The VISSIM microscopic analysis of overall network performance, in terms of systemwide speed, network delay and terminal delay, was separated by the mainline I-75 and the M-102 corridor. If needed, this separation facilitates the documentation of the benefit-cost analysis for adding a fourth lane to I-75. A comparison of network MOEs for I-75 and M-102 are presented in Table 16 and Table 17, respectively.

Table 16. I-75 Results Summary Year 2050

Peak	Parameters	No Build	Build 3 Lanes	Build 4 Lanes
AM Peak	NB I-75 Average Corridor Speed [mph]	63.5	64.0	64.1
	NB I-75 Vehicles Processed [veh]	9,064	8,843	8,846
	SB I-75 Average Corridor Speed [mph]	52.8	42.3	61.4
	SB I-75 Vehicles Processed [veh]	16,979	15,598	16,046
PM Peak	NB I-75 Average Corridor Speed [mph]	50.7	59.7	62.5
	NB I-75 Vehicles Processed [veh]	14,180	13,929	13,877
	SB I-75 Average Corridor Speed [mph]	60.8	63.5	63.1
	SB I-75 Vehicles Processed [veh]	13,153	12,565	12,572

Table 17. M-102 Results Summary Year 2050

Peak	Parameters	No Build	DDI	UDI	
				With Slip Lanes	Without Slip Lanes
AM Peak	M-102 Ramp Terminal Delay [hr]	48.2	78.5	87.1	426.2
	M-102 Road Vehicles Processed (Ramp Terminal)	12,406	27,015	25,444	20,570
PM Peak	M-102 Ramp Terminal Delay [hr]	85.0	228.2	90.1	501.5
	M-102 Vehicles Processed (Ramp Terminal)	14,685	29,166	29,860	24,992

The analysis indicates that widening I-75 to four lanes will increase speed from a three-lane facility in both the AM and PM peaks. The number of vehicles processed along the I-75 corridor slightly decreases from the No Build conditions. This is due to the increased delay on the M-102 terminal, shown in Table 16, which is metering the traffic entering the I-75 corridor.

5.2.4 Constructability

Construction of either interchange concept in an urban area can create some unique challenges. MOT along I-75 and M-102 is critical for the community and surrounding area, and minimizing the length of closures is crucial for such an important interchange bordering the city of Detroit and Hazel Park.

Maintaining traffic and constructability was evaluated for each concept, and then solutions were developed with plans and a narrative to describe each stage. Based on the construction sequence of removing the existing structures and then building the new bridge(s) for either the DDI or UDI, it is anticipated that the bridge work for the either of the practical concepts can be completed in two construction seasons utilizing multiple stages. For the replace-in-kind concept, it is anticipated that the construction season would lengthen to one additional season for the bridge work, for a total of three seasons.

The DDI configuration would simplify and reduce the cost of MOT because the proposed DDI structure is located between the existing eastbound and westbound M-102 service drive structures. There are two main benefits of the DDI bridge location over the two UDI bridge locations:

- Allows for both M-102 service drive bridges to remain in service while the DDI bridge is built.
- The removal of the existing M-102 mainline structure (S10) does not need to be part-width, which reduces the project cost and complexity.

The DDI MOT Staging includes nine stages total. Details on each individual stage for the DDI can be found in Appendix F.

The UDI MOT Staging includes 15 stages total. The UDI interchange does require paved crossovers to be built in the median west of John R Road and east of Dequindre Road. Details on each individual stage for the UDI can be found in Appendix F.

MOT and staging along I-75 are similar for both practical concepts. Long-term single-lane closures will be required adjacent to abutment, pier and roadway widening work. Short-term dual-lane closures will be required for overhead bridge work. Weekend closures will be required for the removal of any existing structures and the placement of the proposed beams. There are limited options for detouring I-75 during weekend closures, with the preferred route utilizing a freeway-to-freeway network. This option would work well for through-traffic, but not well for local traffic. Therefore, I-75 will be closed to through-traffic between the Davison Freeway and I-696 and open to local traffic only for access.

To accommodate local traffic along I-75, it was determined that a modified “up and over” approach to detouring traffic through the interchange during construction would be the most practical. This would be possible by detouring northbound and southbound I-75 local traffic off of I-75 onto the local service drives, then utilizing the existing M-102 crossovers to continue northbound and southbound traffic through the M-102/I-75 interchange back to the northbound and southbound I-75 service drives, then detour back onto northbound and southbound I-75. To keep I-75 local traffic detouring through this area without delay, M-102 through-traffic would also be detoured around the work area. Eastbound M-102 would be detoured utilizing John R Road, State Fair Avenue, eastbound Outer Drive, and Conant Street. Westbound M-102 would be detoured utilizing Dequindre Street, 9 Mile Road, and southbound John R Road. Detouring M-102 has the added benefit of allowing the bridge beams to be removed during this time. Although MDOT typically prioritizes detouring traffic onto its highway system, this alternative approach is presented to demonstrate that the concept is both feasible and constructible. A detailed MOT plan will be developed during the preliminary design phase. Coordination and approval from local municipalities will be required to reroute traffic onto local roads.

Lane widths in the construction zone will be 11 feet minimum, with a minimum of 2 feet shy distance. Temporary signs, barrels, concrete barrier and cones should be used to separate the work area and detour traffic through the construction area. Local crossroads within the construction limits along with commercial access should be maintained during construction and should be analyzed in further detail during the design phase.

MOT will need to be reviewed in more detail during the design phase and adjusted as needed based on construction activities, scope of work and construction limits.

5.2.5 Cost Estimates

High-level cost estimates were developed for the in-kind replacement concept and two practical concepts. Utilizing MDOT pay items and the latest MDOT Average Unit Pricing, total costs were produced.

A 4 percent per year inflation rate was used to project these concept cost estimates from current 2024-year pricing to the estimated build year (2031). It should be noted that several disciplines included in the project cost are shown as lump-sum (LSUM) costs due to the nature of the study and are not defined in the scope for this project. These items are intelligent transportation system (ITS), signals, lighting, signs and pavement markings, erosion control, drainage and pump station work.

The costs for all concepts include the addition of a fourth lane for I-75. A summary of the cost is presented in Table 18.

Table 18. Summary of Cost Estimate

Concept	In-kind Replacement	Diverging Diamond Interchange	Urban Diamond Interchange
Bridge Removal and Construction	$62.0 million	$18.0 million	$18.2 million
M-102 Roadway	n/a	$16.3 million	$16.3 million
I-75 Widening: Removal and Construction	$10.5 million	$10.5 million	$10.5 million
Miscellaneous Items*	$103.9 million	$77.1 million	$78.1 million
Total	**$176.4 million**	**$121.9 million**	**$123.1 million**

* Miscellaneous items include mobilization, MOT, erosion control, drainage, pavement markings, pump station work, ITS, signals, lighting, signs, utilities, preliminary engineering (PE) and civil engineering (CE). Inflation is accounted for in the total cost (estimated at 4 percent per year, 2031 construction). See Appendix G for detailed costs.

The cost estimate details are included in Appendix G.

5.3 Recommended Concept

Both the DDI and the UDI configurations provide comparable LOS, with only slight cost differences between them. To determine the recommended concept, several other key factors were considered, such as the impact on adjacent land uses and nonmotorized traffic. These considerations are detailed below.

- **Traffic analysis:** The intersection LOS results were similar for both the DDI and UDI options. However, the VISSIM systemwide analysis projected excessive traffic delays at the ramp terminals during the PM peak hour under the DDI configuration.
- **Incident management:** One of MDOT's preferences was to retain the flexibility of using service drives for incident management along the I-75 corridor. In the event of a freeway shutdown or incident, the service drives would provide an alternative route to maintain traffic movement.

- **Detour routes:** The M-102 corridor and the I-75 service drives are major detour routes for construction in the area. Maintaining the through-movement on the I-75 service drives is highly desirable to retain detour flexibility.
- **Emergency response:** Similar to incident management for I-75, emergency vehicles such as law enforcement, fire trucks and ambulances require direct through-access to minimize response times to emergency calls.
- **Access management:** The interchange has residential and commercial land uses in all four quadrants. Under the DDI option, access to the community and commercial areas would be significantly affected. Many current direct accesses would be replaced with indirect and longer routes. Some adjacent land uses would completely lose access to their properties and would need to be acquired by MDOT due to the lack of access.
- **Nonmotorized facilities:** The DDI provides unconventional access for nonmotorized traffic. To cross I-75, nonmotorized traffic would need to cross the mainline M-102 approaches twice, increasing their exposure to traffic. Under the UDI configuration, nonmotorized traffic would not need to cross M-102 if they only intend to cross I-75.
- **Safety analysis:** The predictive crash analysis showed the UDI with fewer number of crashes than the DDI configuration; no statistical difference was determined. The Predictive Safety Evaluation Report can be found in Appendix H.

Based on the LOS results, detour and incident management functionality, maintaining access to the adjacent land uses and the neighborhoods, the UDI configuration is selected as recommended concept. The Recommended Concept is shown in Figure 11.

Figure 11. Recommended Urban Diamond Interchange Configuration

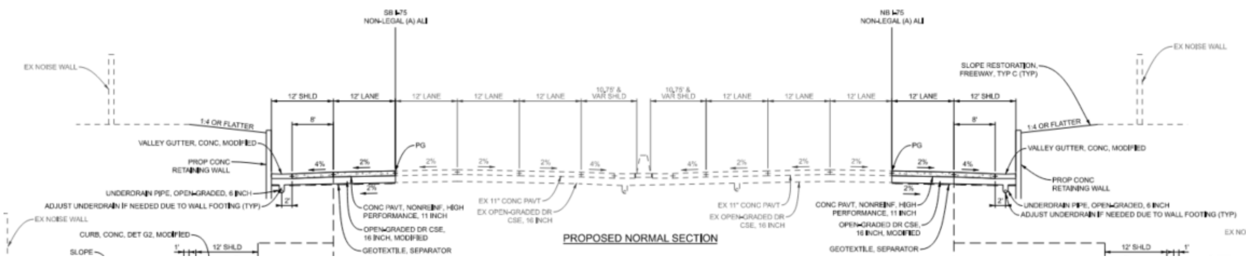
Figure 12. Recommended Urban Diamond Interchange Configuration - Streetview

5.3.1 Proposed Typical Sections

The proposed widening of I-75 consists of the addition of an outside fourth lane in both northbound and southbound directions, at a width of 12 feet. Adjacent to the 12-foot-wide lane is a 12-foot-wide paved shoulder, with either type G curb, valley gutter with barrier wall or valley gutter with retaining walls on the outside.

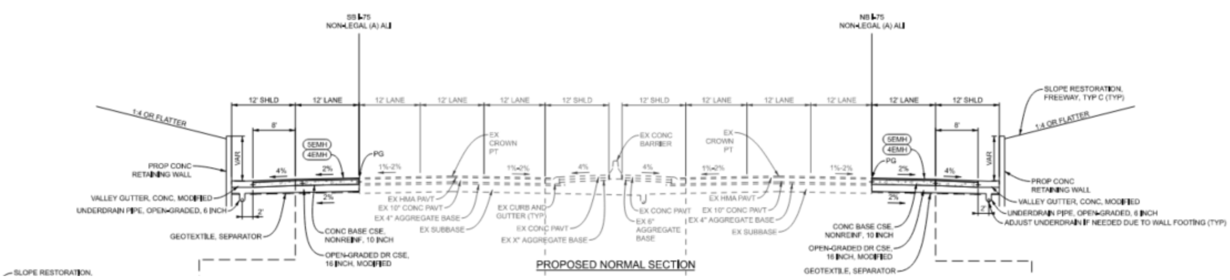
The proposed pavement sections for the I-75 widening are proposed to match the sections built during the I-75 Modernization Project to the north of M-102. These sections consist of 11-inch non-reinforced high-performance concrete pavement, 16-inch open-graded drainage course and geotextile/separator.

Figure 13. I-75 Proposed Typical Section – North of M-102



For the proposed segment of I-75 south of M-102, the proposed northbound and southbound I-75 widening includes a hot-mix asphalt (HMA) top course, with a concrete base course to match the existing mainline I-75 conditions. For the segment of I-75 north of M-102, the proposed northbound and southbound I-75 widening is concrete pavement only, matching the I-75 Modernization Project pavement section.

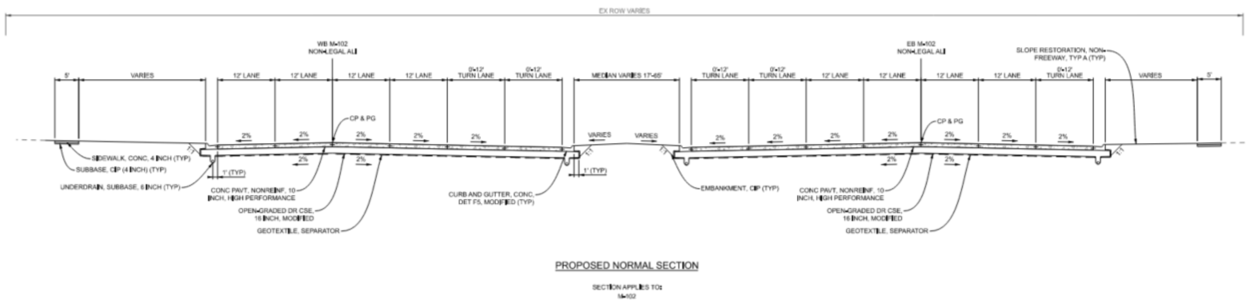
Figure 14. I-75 Proposed Typical Section – South of M-102



The proposed freeway ramps follow the MDOT standard section for urban slip ramps, as shown in the MDOT Road Design Manual. The ramps consist of a single 12-foot lane, with an 8-foot-wide outside shoulder (including the G curb). The freeway ramps pavement sections are to match what was built during the I-75 Modernization Project. These sections consist of 10-inch non-reinforced high-performance concrete pavement, 16-inch open-graded drainage course, and geotextile/separator.

The proposed M-102 section consists of primarily four 12-foot lanes (outside of interchange area), with type F curb and gutter proposed on the outside. The pavement section proposed for M-102 is to match the local roadways built during the I-75 Modernization Project (9 Mile Road and 12 Mile Road for example). These sections consist of 10-inch non-reinforced high-performance concrete pavement, 16-inch open-graded drainage course, and geotextile/separator.

Figure 15. M-102 Proposed Typical Section



The I-75 service drives are similar in nature. With the removal of the Winchester Avenue structure, a continuous three-lane section can be provided for the northbound service drive up to M-102. The roadway section for the northbound service drive is a three-lane section with 12-foot lanes and type F curb and gutter on the outside. The southbound I-75 service drive, on the other hand, has a varying number of lanes at different locations, but a three-lane configuration is shown outside of the interchange area. The roadway section for the southbound service drive is a three-lane section with 12-foot lanes and type F curb and gutter on the outside. For the I-75 service drives, the pavement section proposed is to match the local roadways and service drives built during the I-75 Modernization Project. These sections consist of 10-inch non-reinforced high-performance concrete pavement, 16-inch open-graded drainage course, and geotextile/separator.

Underdrain pipe is proposed in locations as shown in the MDOT standard plan R-80-F. Curb and gutter types vary by location but generally type G curb is represented along the freeways and type F curb and gutter is represented along the local roadways and service drives.

A single-face barrier wall with a 4-foot-wide valley gutter is proposed in locations where the full mechanically stabilized earth (MSE) walls are not required. The MSE walls vary in height from 6 feet to 12 feet in exposed height, with a 4-foot valley gutter adjacent to the wall.

A double-face barrier is proposed in median locations where median work is required. In addition to the double-face barrier, a 4-foot-wide valley gutter is proposed adjacent to the travel lane to tie into the existing flow line.

5.3.2 Horizontal Alignment

The I-75 widening is limited to the addition of the outside lane and shoulder; the existing alignment remains unchanged. The proposed design speed for I-75 is 70 mph.

I-75 has two ramps impacted by the widening for the fourth lane: M-102 Ramps B and C. M-102 Ramp B changes very minimally compared to its existing alignment, due to the widening of I-75. One ramp lane is proposed for Ramp B and is designed using the MDOT GEO-202-B guidelines provided by MDOT for an urban slip ramp. M-102 Ramp C currently has two entrance ramps onto southbound I-75. These will be merged into one single entrance ramp to southbound I-75 which will spur off the realigned southbound I-75 service drive. Similar to M-102 Ramp B, Ramp C is designed using the MDOT GEO-202-B guide provided by MDOT for an urban slip ramp.

The northbound I-75 service drive horizontal alignment remains relatively unchanged from its current condition, both north and south of M-102. The southbound I-75 service drive north of M-102 remains relatively unchanged for both concepts; however, the horizontal alignment changes significantly compared to the existing condition south of M-102 for both concepts. The existing multiple-lane configuration for the southbound I-75 service drive will be merged to a single southbound movement, which will then split off to either the M-102 Ramp C entrance ramp to southbound I-75, or a continuation of the southbound I-75 service drive to State Fair Avenue. The two existing southbound entrance ramps to southbound I-75 are to be removed and relocated to a single ramp south of Winchester Avenue, which will spur off the relocated southbound I-75 service drive. M-102 alignment remains unchanged outside the influence of the bridge reconstruction and reconfiguration or the access to ramps.

5.3.3 Vertical Alignment

With the recommended concept, the vertical alignment along northbound and southbound I-75 will remain unchanged. The proposed fourth lane and outside shoulder are widened and controlled from the existing outside edge of travel lane; therefore, any vertical adjustments cannot be made.

As for the ramp conditions, M-102 Ramp B is proposed to tie into the existing ramp prior to the gore point with the northbound I-75 service drive. M-102 Ramp C is to be rebuilt entirely and is to be tied into the widening of southbound I-75 and the realigned southbound I-75 service drive.

At the influence of the proposed bridge, the vertical profile for M-102 is raised higher than existing to improve the vertical clearance slightly for I-75 underneath M-102. The M-102 overpass at I-75 is marked exempt on the list of exempt bridges on special routes in highly urbanized areas; therefore, only the existing usable shoulder vertical clearance must be met. Outside of the bridge and interchange area, M-102 vertical alignment aligns closely with the existing grade, providing minimal vertical differences in grade with adjacent local roadways.

The vertical alignment of the northbound and southbound I-75 service drives is designed to be as close to existing grade as possible, while still meeting the design requirements necessary for meeting a 40-mph design speed.

5.3.4 Design Exceptions

Throughout this study, substandard design elements were discovered for widening of I-75 from three lanes to four lanes. Four design exceptions are expected due to the scope of the work and the existing site conditions:

- **Shoulder Width:** With the proposed widening of I-75 from three lanes to four lanes, the proposed southbound I-75 outside shoulder width at State Fair Avenue will vary from 9.4 feet to 8.3 feet, which is less than the required minimum of 10 feet paved width and the proposed condition of 12 feet paved as shown elsewhere in the plans. The rationale to proceed with this design exception is to reduce unnecessary project costs that would occur. In pursuing this design exception, rebuilding the State Fair Avenue bridge over I-75 can be avoided, and the substructure and superstructure can remain in place. This is a significant cost savings to the project.

- **Vertical Stopping Sight Distance:** The existing northbound and southbound I-75 vertical geometry meets the K values for a design speed of 70 mph along two of the eight vertical curves along I-75 within the project area. The existing vertical curves are closer to meeting the design speeds of 50 to 60 mph. Given the nature of the proposed work (widening of I-75 from three lanes to four lanes to the outside), it is not feasible to improve and/or meet the minimum K values within the study limits without a full reconstruction of the freeway.

  M-102 Ramp B vertical geometry does not meet the required K value for the design speed of 55 mph. The proposed K values for the vertical curves are 111 (meets 50 mph), and 51 (meets 40 mph). Consideration should be noted that the design was constrained by the northbound I-75 widening vertical geometry, and the existing northbound I-75 service drive profile. Considering the site constraints for the vertical geometry of this ramp, it is not feasible to obtain the required K values without building the entire ramp and/or impacting the adjacent northbound I-75 service drive.

- **Superelevation:** Review of existing plans' topographic survey shows that northbound and southbound I-75 are in normal crown throughout the study limits. Current MDOT standards would require the curves to be superelevated by either MDOT Standard Plan R-107 or the Straight-Line (S-L) Method. The proposed values required for northbound I-75 would be 4.7 percent (R-107) or 3.1 percent (S-L) right, and 4.4 percent (R-107) or 2.9 percent (S-L) left. The proposed values required for southbound I-75 would be 4.4 percent (R-107) or 2.9 percent (S-L) right, and 4.1 percent (R-107) or 2.6 percent (S-L) left. Given the existing condition of mainline I-75 being in normal crown, it is not feasible to adjust the superelevation of the entire roadway width given the scope of this project without a full reconstruction of the freeway. Therefore, the widening proposed will be a continuation of the existing normal crown condition to the outside.

- **Cross Slope:** The cross slope of the existing shoulders within the median area is currently in the adverse direction sloping toward the inside edge of pavement. Where median shoulder work is required, the proposed design is to match the existing shoulder section to tie in appropriately. Altering the slope of the existing shoulder section to match the standard would not be feasible considering the length of the median shoulder that would need to be rebuilt.

5.3.5 Impervious Surface Area

An analysis was conducted to compare the impervious surface areas of the current interchange layout with those of the proposed urban diamond configuration. The urban diamond configuration involves removing large impervious structures such as fly-over bridges, eliminating approach pavements and reducing service drive lanes in the southwest quadrant.

The results showed a 6 percent reduction in total impervious area under the urban diamond configuration. This decrease could lead to reduced need for stormwater infrastructure and increased opportunities for green space, including landscaping, trees and other plantings.

A comparison of the impervious and the pervious surface area under existing condition and recommended concept, urban diamond interchange, is presented in Table 19.

Table 19. Surface Area Comparison: Existing Versus Preferred Concept

Concept	Surface Type	Area (sft)	Area (AC)	Percentage
Existing Condition	Impervious Area	1,631,841.02	37.46	70.91%
	Pervious Area	669,451.82	15.37	29.09%
Urban Diamond	Impervious Area	1,494,665.09	34.31	64.95%
	Pervious Area	806,627.75	18.52	35.05%

Graphics of the existing versus the recommended urban diamond concept are provided in Appendix F.

6 Public and Agency Engagement

Public and stakeholder engagement is a critical element for MDOT EPE process. From the onset of the project, a public engagement plan (PEP) was developed. Successful public involvement requires the inclusion of all voices, particularly from those groups that have been historically underrepresented in transportation planning decisions. Bringing diversity of voices to the conversation creates a rich social dialogue and can inform the interchange study in ways that create more environmentally, economically and socially sustainable outcomes for all participants.

Public involvement is a key component for the success of this project. Establishing strong lines of communication with the surrounding community will enable MDOT to inform stakeholders about the study and engage them in meaningful ways that allow the public to provide their input and perspective into project planning and design. Public involvement and feedback will help to better inform the process and create projects that accomplish transportation goals and meet community needs.

The PEP provides a framework for meaningful public engagement as well as communication and outreach strategies necessary to build awareness, trust and support among residents and other stakeholders for the EPE study. The PEP is attached in Appendix I.

The plan included in-person and virtual opportunities for the public to engage with MDOT to consider plans for improving the I-75/M-102 interchange. The project team used information during the public outreach process in developing the concepts and their evaluation.

In addition, the evaluation criteria used to review the concepts measured the concerns of the community. Polls were conducted in these public and stakeholder meetings to solicit feedback on concepts and evaluation criteria that are most important to them.

6.1 Stakeholder Engagement

An approach included both in-person and virtual engagement opportunities with stakeholders. Key stakeholders were present, including MDOT, City of Detroit, City of Ferndale, City of Hazel Park, Wayne County, Oakland County, SMART, DDOT, SEMCOG, ITC, 8 Mile Boulevard Association and utility companies. These key stakeholders served to support outreach for public meetings and encourage engagement and were part of the LAC for the project.

6.2 Public Involvement Activities

Public involvement activities coincided with ongoing stakeholder activities that began in fall 2023. Three public meetings were held throughout the EPE study, with the first in December 2023 and two in 2024. The first public meeting was an open house held at the City of Hazel Park Community Center on 620 W Woodward Heights Bouelvard, adjacent to the project area. The second open house meeting was held at the Nolan Middle/High School at 1150 E Lantz St. in Detroit.

Figure 16. Public/LAC Engagement Events

6.2.1 Public/LAC Events

As part of the public and stakeholder outreach that began in late 2023, five LAC and three public meetings were held throughout the EPE study. A brief overview of this engagement is presented in Table 20.

Table 20. Public/LAC Engagement Events

Event/Activity	Purpose/Goal	Date
Local Advisory Meeting #1 (In-person)	Introduce project, discuss schedule and outcomes. Overview of the next steps: existing conditions, determining future transportation needs, neighborhood connectivity and I-75 lane balance/bottleneck.	Oct. 3, 2023
Local Advisory Meeting #2 (Teams)	Discuss project background, goals and objectives. Reach out to various government agencies and establish link to the constituents. Plan for the public meeting and introducing social pinpoint tool to solicit feedback from the LAC and other stakeholders.	Nov. 15, 2023
8MBA Board Meeting (In-person)	To give a short project introduction/overview for the I-75/M-102 Interchange Study.	Dec. 7, 2023
Public Meeting #1 (In-person Hazel Park)	Present the project, schedule, compilation of data and plans, and solicit input from the public and stakeholders for development of the concepts.	Dec. 13, 2023
Local Advisory Meeting #3 (In-person Detroit)	Discuss project status, concepts developed.	March 21, 2024
Public Meeting #2 (In-person City of Detroit)	Present the project, schedule and multiple concepts developed for the interchange configuration.	May 22, 2024
District 3 Department of Neighborhoods Meeting (In-person Farwell Recreation Center)	Give a short project introduction/overview for the I-75/M-102 Interchange Study.	June 25, 2024

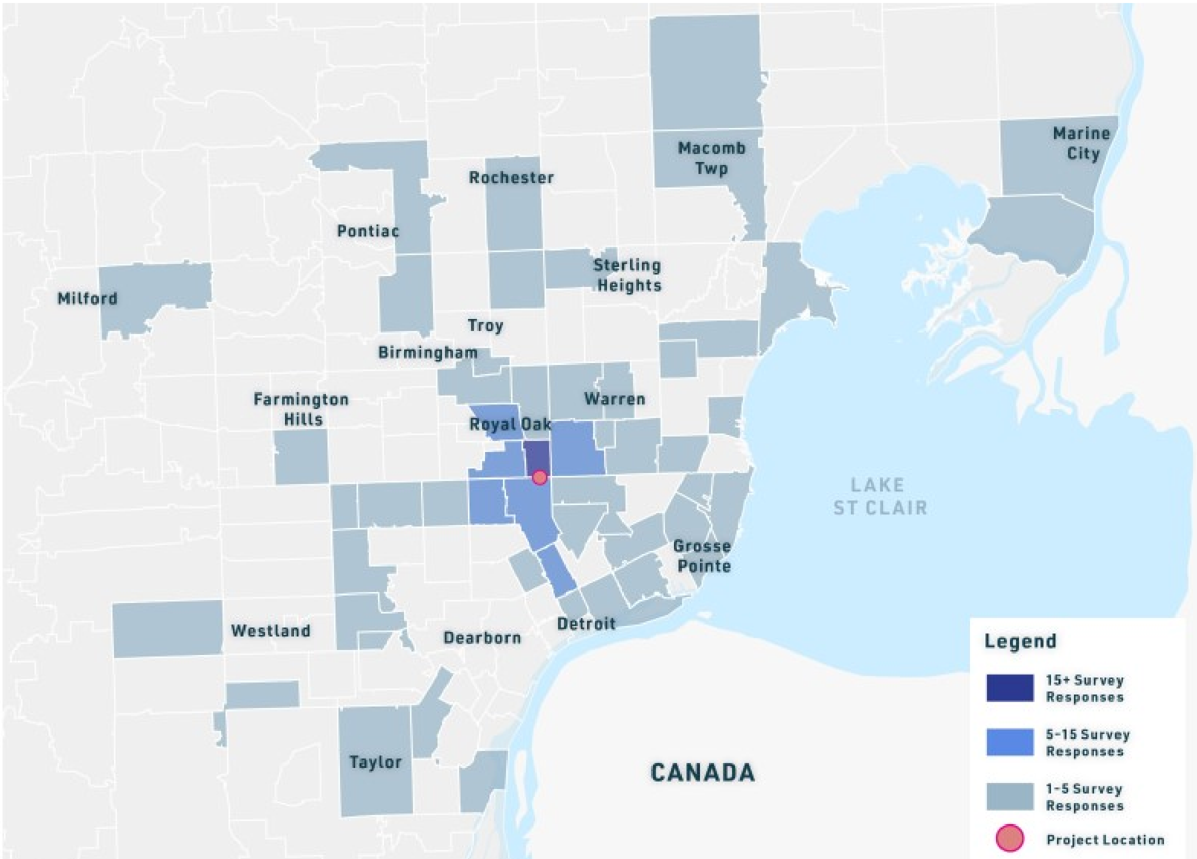
Event/Activity	Purpose/Goal	Date
Local Advisory Meeting #4 (Teams)	Provide brief introduction of the key project staff and an overview of the project and its focus area. To gather feedback from key stakeholders before presenting the selected practical concepts to the public.	Aug. 20, 2024
Local Advisory Meeting #5 (Teams)	To provide LAC members with project updates and present the two practical concepts identified. Based on feedback from the LAC, the public, MDOT design experts, and data analysis, two out of seven concepts were selected as practical and viable options.	Oct. 28, 2024
Public Meeting #3 (In-person Hazel Park)	Present study findings and recommendations.	July 29, 2025

MDOT provided communication with stakeholders through e-newsletters, media outlets, and internal channels, including media releases, distribution list, project webpage, in-person public meetings and social media.

6.2.2 Survey Feedback and Engagement

Feedback was collected from stakeholders and the public through in-person polls and online surveys. Additionally, a web-based platform, Social Pinpoint, was made available to gather input from the general public. Hundreds of stakeholders and community members provided their comments and insights through Social Pinpoint, as well as through the in-person polls and online surveys. The comments received via Social Pinpoint are included in Appendix I.

Figure 17. Public Engagement Outreach – 2024 Survey Response Density



7 Conclusions and Recommendations

A comprehensive feasibility study was conducted for the I-75/ M-102 interchange to evaluate potential improvements aimed at enhancing traffic operations, safety and efficiency. The purpose of this EPE study was to develop a long-term vision for transportation improvements for the aging interchange, eliminate bottleneck along the I-75 corridor, identify a recommended concept and provide a basis for MDOT to initiate state and federal funding processes. Given the interchange's high traffic volume, complex movements and ongoing congestion concerns, multiple concepts were assessed to determine the optimal long-term solution.

The study used MDOT input and data analysis to consider transportation alternatives to address capacity, access, mobility, and safety issues and analyzed existing conditions and community needs through extensive stakeholder involvement and public input. Issues and opportunities were gathered at public open houses, in-person and virtual meetings, an online mapping tool, and hundreds of public survey responses.

Several interchange configurations were considered and analyzed based on traffic flow, safety impacts, cost-effectiveness, constructability and environmental considerations. A total of four concepts were carried forward as viable options for detail analysis :

1. Replace In-kind
2. Single-Point Urban Interchange (SPUI)
3. Diverging Diamond Interchange (DDI)
4. Urban Diamond Interchange (UDI)

Among these, the DDI and UDI were determined practical concepts. Both concepts provide comparable LOS, with only slight cost differences. In determining the recommended concept, additional factors were considered, such as access to the adjacent land use, accommodation of nonmotorized traffic and overall functionality of the service drives for incident management and detours. Appendix J contains all project meeting minutes, including records of key decisions made.

7.1 Recommended Concept

After careful analysis of LOS results, accessibility along service drives, incident management considerations, and integration with surrounding neighborhoods, the UDI configuration was selected as the recommended concept. This design offers improved traffic management by reducing conflict points, optimizing turn movements and enhancing capacity while maintaining efficient local access. Additionally, the UDI configuration aligns with MDOT's objectives of enhancing mobility, improving nonmotorized traffic facilities, integrating surrounding communities and replacing aging infrastructure at the lowest possible cost.

Appendices

Appendix A. Existing Conditions Report

Appendix B. Desktop Environmental Review

Appendix C. Crash Analysis Report

Appendix D. Utilities Information

Appendix E. Traffic Analysis Report

Appendix F. Roadway and Structure Design Elements

Appendix G. Project Cost Estimates

Appendix H. Predictive Safety Evaluation Report

Appendix I. Agency and Public Coordination Summary

Appendix J. Project Meeting Minutes

If you require assistance accessing this information or require it in an alternative format, contact the Michigan Department of Transportation's (MDOT) Americans with Disabilities Act (ADA) coordinator at Michigan.gov/MDOT-ADA.

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