US Route 67 (Future Interstate 57) and US Route 160 / MO Route 158 Interchange

Access Justification Report

Butler County, Missouri

MoDOT Job # J9P3663

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Abbreviations and Acronyms

AASHTO	American Association of State and Highway Transportation Officials
ADT	Average Daily Traffic
DED	Department of Economic Development
DHV	Design Hourly Volume
EIS	Environmental Impact Statement
FHWA	Federal Highway Administration
FI	Fatal or Injury Accident
HCM	Highway Capacity Manual
HOV	High Occupancy Vehicle
HSM	Highway Safety Manual
LOS	Level of Service
MERIC	Missouri Economic Research and Information Center
MoDOT	Missouri Department of Transportation
MOE	Measure of Effectiveness
MSA	Metropolitan Statistical Area
MUTCD	Manual on Uniform Traffic Control Devices
NEPA	National Environmental Policy Act
OFRPC	Ozark Foothills Regional Planning Commission
Parclo	Partial Cloverleaf
pc/mi/ln	Passenger Cars per Mile per Lane
PDO	Property Damage Only Accident
ROD	Record of Decision
Route 67	US Route 67
Route 158	MO Route 158 in Butler County
Route 160	US Route 160, which turns into Route 158 east of US Route 67
Route C	Missouri Route C in Butler County
Route V	Missouri Route V in Butler County
RPC	Regional Planning Commission
SPF	Safety Performance Functions
STIP	Statewide Transportation Improvement Program
TMA	Transportation Management Area
TSM	Traffic Systems Management

1.0 SUMMARY

This report aims to justify modification of the interstate access on US Route 67 (Future Interstate 57) at US Route 160/MO Route 158 in Butler County, southwest of Poplar Bluff, Missouri. The City of Poplar Bluff in partnership with MoDOT is proposing to convert US Route 67 to a freeway south of Route 160 for two miles to County Road 338 in order to meet local and regional transportation needs and ultimately become Interstate 57. The proposed change in access to the future interstate system is needed to completely meet the purpose of this project. Specifically, the purposes of the proposed project are to:

- **Congestion** associated with projected traffic growth, which was expected to double along the entire corridor over 21 years (up to 2042);
- **Areas of high accident rates** (above the statewide average) and, particularly, areas of high fatal accident rates (also above the statewide average);
- **Roadway deficiencies** on existing Route 67 including substandard geometrics and inadequate cross sections; and
- **System continuity** along Route 67 between I-55 in Jefferson County and the Arkansas state line.

The proposed interchange modification at US Route 160 will reduce crash frequency in the study area by improving the interchange configuration. The Highway Safety Manual (HSM) predictive models were used to demonstrate this reduction in crash frequency on Route 160 that would result based on the proposed project. The overall projected crashes for the study area are reduced with the proposed interchange with similar traffic volumes.

The interchange configuration proposed in this report as the preferred alternate is a diamond interchange with roundabout ramp terminals (dogbone interchange design). This design utilizes roundabouts that provide better traffic operations, reduces conflict points and projected crashes and minimizes the impact to the environment. The roundabouts allow for efficient operations during peak travel times that includes a morning eastbound to northbound traffic pattern.

The proposed interchange with Route 67 meets the project's needs and goals by reducing congestion, reducing crashes, addressing roadway deficiencies and supporting system continuity. The proposed interchange has the support of MoDOT, the Ozark Foothills Regional Planning Commission, and the local/state elected officials.

2.0 INTRODUCTION

2.1 Project Description and Background

The proposed interchange modification of US Route 67 (Future Interstate 57) at US Route 160/ MO Route 158 is located southwest of the City of Poplar in Butler County, Missouri. The Route 160 interchange is part of the widening of US Route 67 to four lanes and to interstate standards for 2.0 miles in Butler County from US160 to County Road 338. Butler County is located within the area of the Ozark Foothills Regional Planning Commission (OFRPC).

Route 67 improvements were first studied in 1997 when MoDOT initiated the Route 67 Environmental Impact Statement (EIS) for 71 miles in Madison, Wayne, and Butler Counties. The EIS and its Record of Decision (ROD) were approved by FHWA 2005. The purpose of the EIS was to evaluate strategies for improving Route 67 from just south of Fredericktown in Madison County to just south of Neelyville in Butler County. The EIS looked specifically at developing a four-lane, divided highway to accommodate projected traffic demands, to improve safety, and to correct roadway deficiencies.

In 2013-2014 Route 67 was improved to a four-lane, divided highway for 4.3 miles from Hawthorne Lane, just north of Cane Creek to 0.6 miles south of Route 160. This project included the construction of an interchange at Route 160. The current project includes a 5-mile portion of the 71-mile corridor. The U.S. Route 67 Environmental Impact Statement Re-evaluation was recently approved by FHWA for this project and an additional 6 miles of Route 67 to CR 274, approximately 2 miles north of the Arkansas state line.

In December 2019, the Missouri Departments of Transportation (MoDOT) and Economic Development (DED) selected the City of Poplar Bluff to receive $5,785,080 for Route 67 four-laning as part of the Governor's Cost Share program. This funding includes the modification of the proposed interchange. The project is scheduled for a December 2021 letting, with the interchange open to traffic in 2022. A design year of 2042 was used for this report.

2.1.1 Project Location

The Route 160 interchange is located approximately 10.5 miles south of Poplar Bluff, Missouri on Route 67. The location is situated in a lightly developed area and provides acceptable spacing along Route 67. It serves as an access point for several rural communities in southeast Missouri. The existing interchange is a partial cloverleaf (Parclo A2) with short radius loop ramps.

Route 67 drops from two southbound lanes to a single southbound at the Route 160 interchange. In the northbound direction a second lane is added to Route 67 at the interchange. The existing Route 67 bridge over Route 160 contains two lanes in each direction. As part of the Route 67 improvements the existing bridge will need to be widened if the Parclo A2 configuration is maintained or a new interchange configuration will be needed to avoid impacting the existing bridge.

A reconfigured interchange would allow the interchange to function more efficiently when Route 67 converts to Interstate 57. ***Figure 1*** shows the project location and study limits in relationship to the City of Poplar Bluff and the existing roadway network.

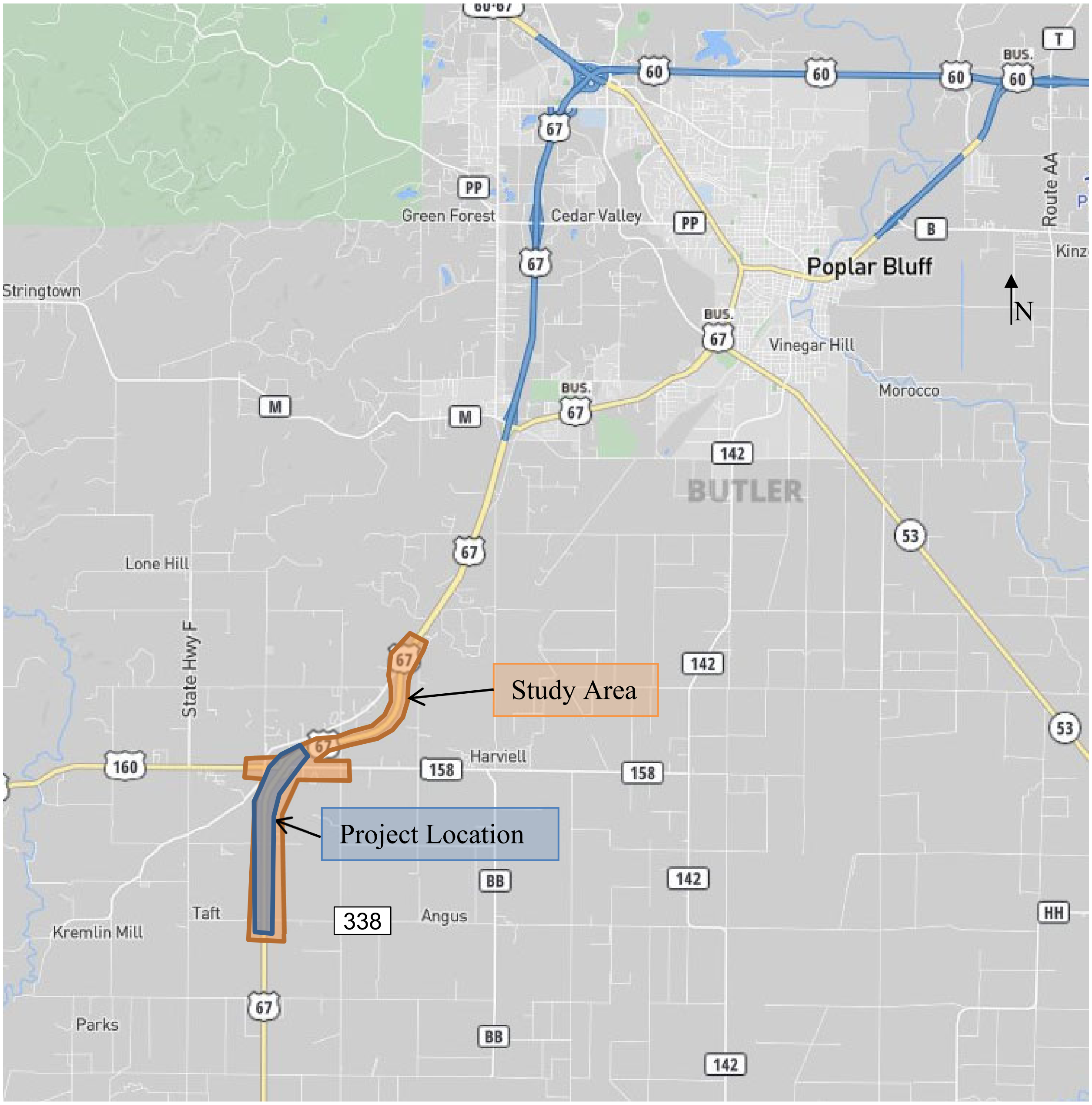


Figure 1 – Project Location

Aerial photography shown in ***Figure 2*** presents the location of development within and surrounding the interchange. A majority of the surrounding area is agricultural with some residential development to the west of the interchange along Route V and Route C.

Figure 2 – Project Location, Aerial Photo

2.1.2 Project Study Area

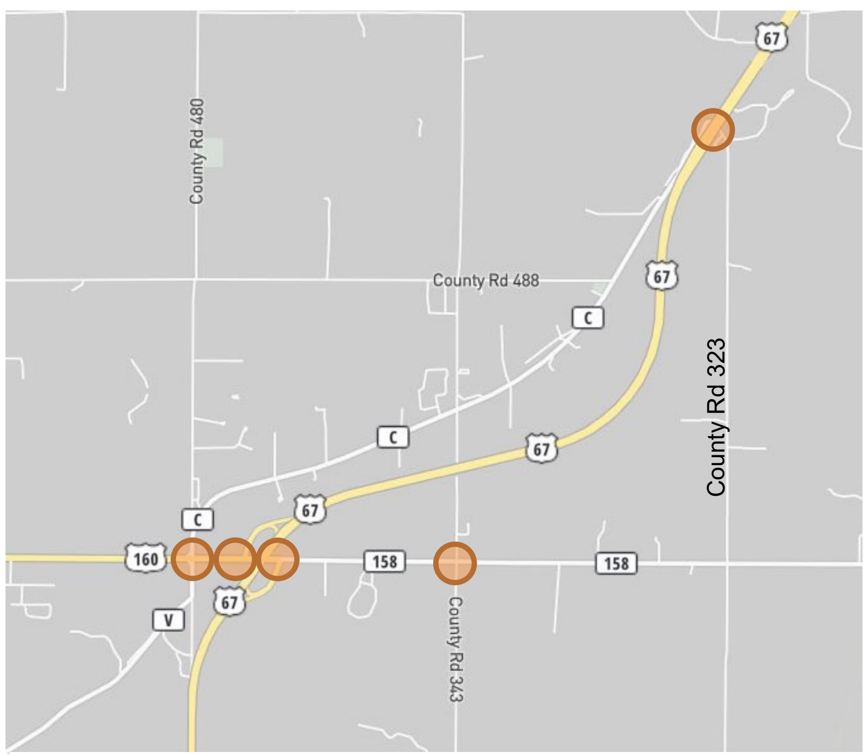


Figure 3 – Study Area Intersections

The project study area and area of influence consists of the existing interchange of US Route 67 at US Route 160/ MO Route 158 and the adjacent intersections along Route 160; the intersection of Route V / Route C to the west and County Road 343 to the east. Additionally, the study area includes the existing at-grade intersection of US Route 67 and Route C/CR 323 approximately 2.6 miles to the north. There are no signalized intersections within the study area. A map of the study area is provided in ***Figure 3***. Intersections within the study area are described further in **Section 4.1**.

South of US-160, the EIS does not propose any at-grade intersections. The interchange at MO-142 (Hart Street) near Neelyville, MO, that is shown in the EIS in Phase 3 will be covered by a subsequent AJR document at that time.

The Route 67 corridor is bounded by residential and industrial developments in the immediate study area. At the existing interchange, several commercial developments are present. The land use surrounding the area is mostly residential.

To the south there are at-grade access points at CR 360 and CR 338. Other access points at various points to the south are mostly private residential drives. Seventeen such entrances exist along Route 67 south of the Route 160 interchange and north of CR 338. The closest interchange approximately 6 miles to the north at Route 67 and MO Route M/ Business Route 67.

2.1.3 Proposed Project

The proposed project consists of widening Route 67 to a four-lane, divided section south of the Route 160 interchange. This highway expansion is planned to extend south to County Road 338. In addition to capacity improvements along mainline Route 67, the interchange at Route 160 will be reconfigured to accommodate the widening of Route 67. The preferred interchange configuration is a diamond interchange with roundabout ramp terminals. ***Figure 4*** shows the proposed Route 67 project and ***Figure 5*** shows the interchange in more detail.

Figure 4 – Proposed Project Schematic

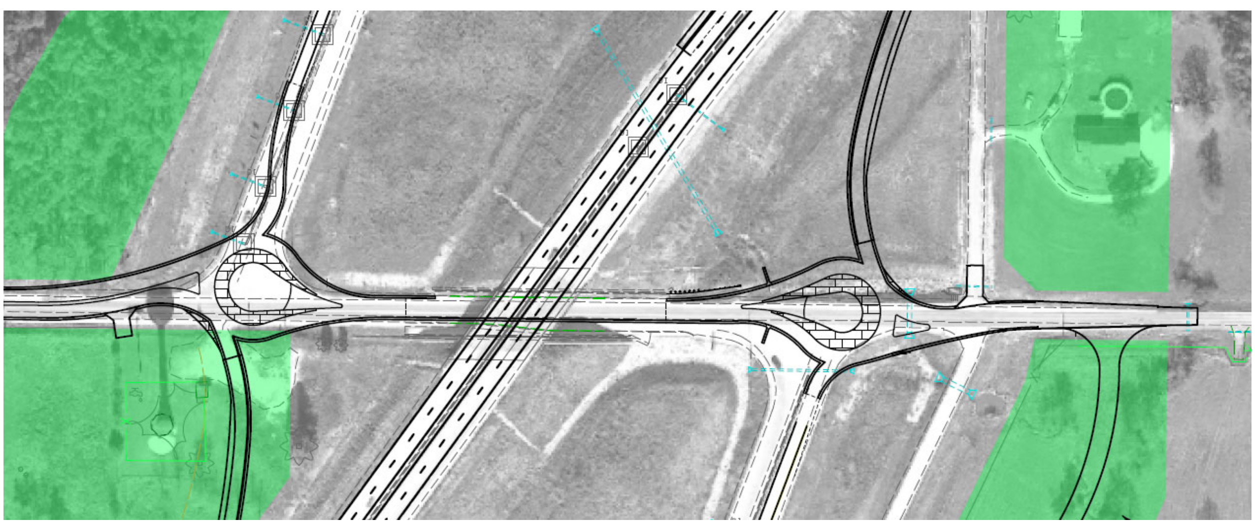


Figure 5 – Proposed Interchange Schematic

2.1.4 Project Background

In the fall of 1997, MoDOT initiated the Route 67 EIS in Madison, Wayne, and Butler Counties. The EIS and its accompanying Record of Decision (ROD) were approved by FHWA in June and August of 2005, respectively. The purpose of the EIS was to evaluate strategies for improving Route 67 from just south of Fredericktown in Madison County to just south of Neelyville in Butler

County. The EIS looked specifically at developing a four-lane, divided highway to accommodate projected traffic demands, to improve safety, and to correct roadway deficiencies.

The EIS assessed impacts of several alternatives along the 71-mile project corridor. Due to the nature and length of the project corridor, multiple build alternatives were identified in six separate locations, or subsections, of the overall corridor. These subsections varied in length from 1.9 miles to 3.7 miles and each considered two to three build alternatives. For the remainder of the project corridor (approximately 78 percent of the total length), connecting to and between the six locations, only one build alternative was developed based on a line of best fit adjacent to existing Route 67. This build alternative was identified as "common alignment" in the EIS. By breaking up the 71-mile corridor into subsections, the EIS planning team was able to direct their evaluations more specifically toward the issues at each location. For example, farmland impacts in the flat bottomland of southern Butler County were more closely analyzed compared to how they were analyzed in the rolling upland forest areas of Wayne County. Upon an extensive evaluation of these alternatives, a preferred alternative was selected for the overall EIS project corridor. The EIS re-evaluation covers a 10-mile portion of the overall selected alternative in southern Butler County.

Since the 2005 ROD, most of the improvements studied in the EIS have been completed along the 71-mile corridor, in Madison, Wayne, and parts of Butler County (as presented in ***Figure 6***). The northernmost sections of the selected alternative consisted of an upgrade from a two-lane highway to a four-lane divided access-controlled highway from just north of Cherokee Pass in Madison County (north terminus) to a point approximately 2.8 miles north of Route 60-North in Butler County (about 50.2 miles). This section was upgraded from a two-lane to a four-lane divided highway between 2007 and 2011; however, it was not constructed as a fully access-controlled highway. At-grade intersections and median breaks are permitted in various locations. The construction was funded in part by MoDOT and the Highway 67 Corporation, which raised funds for the project through the passage of a special sales tax by the voters of Poplar Bluff in 2005.

The selected alternative in the next section to the south consisted of an upgrade from a four-lane divided limited-access highway to a four-lane divided access-controlled highway from a point approximately 2.8 miles north of Route 60-North to Route 60-South at Poplar Bluff (about 7.2 miles). This consists primarily of converting some at-grade intersections to interchanges and development of some outer roads. This section has yet to be constructed.

The third section is south of Poplar Bluff and consists of a 13.1-mile upgrade from a two-lane highway to a four-lane divided access-controlled highway from approximately 0.6 miles north of Cane Creek south of Poplar Bluff to two miles north of the Arkansas line in Butler County (south terminus).

Between 2012 and 2014, a four-mile portion of the third section - from 3.5 miles north of Route 160/158 to 0.5 mile south of Route 160/158 - was upgraded from a two-lane highway to a four-lane divided access-controlled highway and included an interchange at Route 160/158 (MoDOT Project Number J0P0959). An EIS re-evaluation was conducted and approved by FHWA for this portion in 2010. However, the remaining 10-mile portion from 0.5 mile south of Route 160/158 to the south terminus remains a two-lane highway.

The EIS did not include the portion of Route 67 that bypasses Poplar Bluff to the west, which was studied as part of a separate project (MoDOT Project J0P0339). Environmental studies and design of the bypass occurred in the early 1990s. Construction of the bypass was completed in 2002.

The upgrades documented in the 2005 EIS included: several new interchanges; some realignment of Route 67; the incorporation of existing Route 67 as a frontage road in places; the incorporation of existing Route 67 as part of the four-lane divided access-controlled highway in places; and new bridges over the St. Francis River, Black River, and numerous creeks. Bypasses were considered and ultimately selected at Cherokee Pass in Madison County, Greenville in Wayne County, and at Neelyville in Butler County.

The NEPA Re-evaluation of the Route 67 EIS was developed in coordination with this Access Justification Report and was approved on January 13, 2021. Refer to *Table 8Table **1*** for a summary of the changes to environmental impact of the proposed interchange.

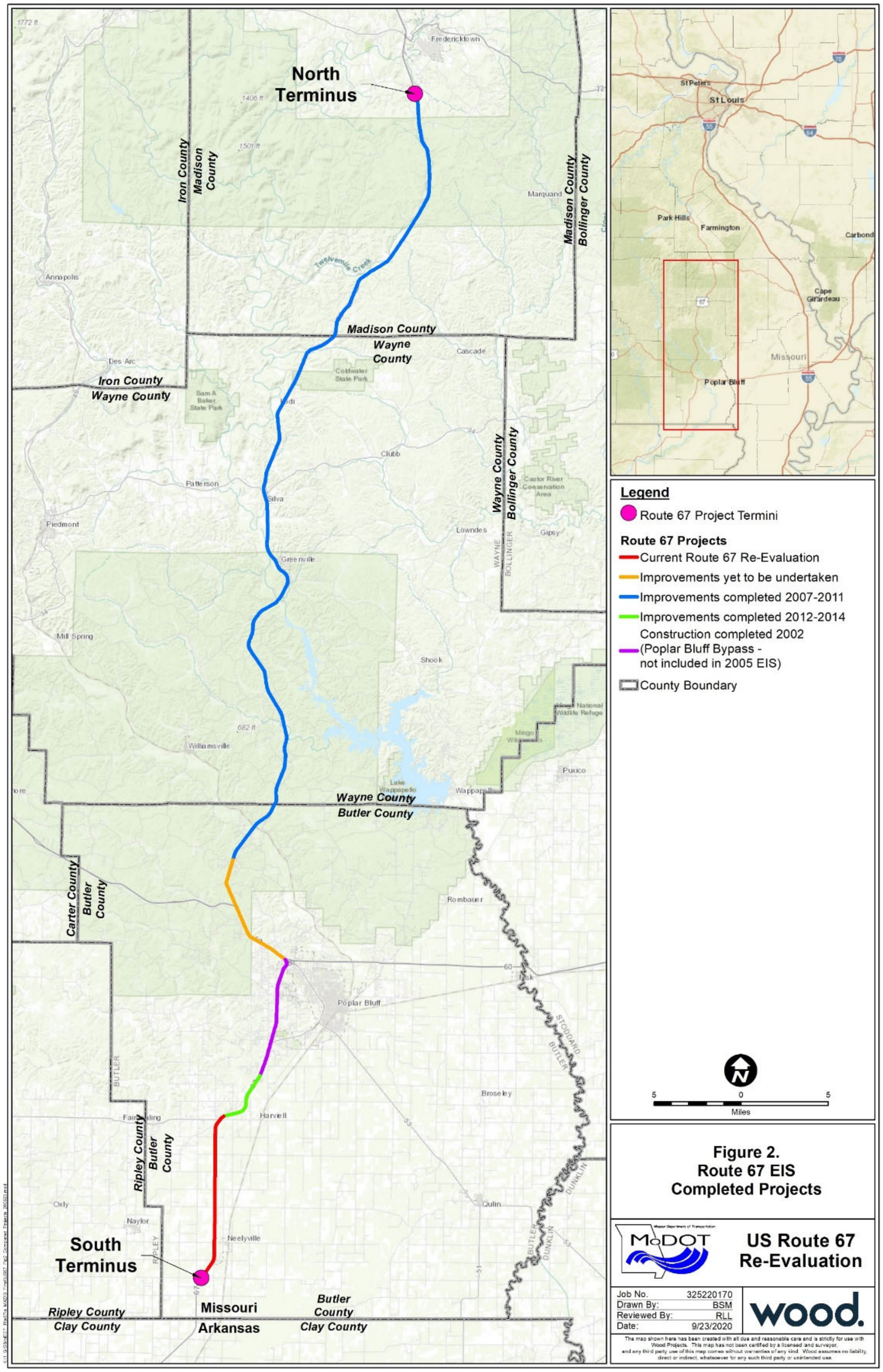


Figure 6 – Route 67 EIS Completed Projects

The improvements proposed for the segment of Route 67 from south of Poplar Bluff to two miles north of the Arkansas state line are part of a larger initiative to extend I-57 through southeast Missouri and into Arkansas to make a connection between Chicago, Illinois and Little Rock, Arkansas. In early 2019, Missouri legislators put forth an initiative to upgrade and rename Route 60 between Sikeston and Poplar Bluff, and to upgrade and rename Route 67 from Poplar Bluff to the Arkansas line. The new designation for these sections would be I-57. The legislation was put in place to improve safety on these two southeast Missouri highways and to spur economic development.

In August 2019, voters of Poplar Bluff overwhelmingly approved a measure to extend the sales tax that was established in 2005 to continue funding the Highway 67 Corporation. This enabled the city of Poplar Bluff and MoDOT to begin the process of completing the upgrade of Route 67 from Route 160/158 to two miles north of the Arkansas state line for future conversion to I-57. The first step in that process is to conduct a re-evaluation of the 2005 EIS for this stretch of Route 67. This re-evaluation was completed and approved by FHWA on January 13, 2021.

2.2 Purpose and Need

Purpose and Need refers to the transportation-related problems of a system that a project is intended to address. It identifies the needs for improvements and justification for why a project is needed.

The 2005 EIS noted that the primary purposes for the proposed action for Route 67 are to accommodate projected traffic demands, to improve safety, to correct existing roadway deficiencies, and to provide system continuity between I-55 in Jefferson County and the Arkansas state line. The specific purpose and need addressed by the proposed action includes the following:

- **Congestion** associated with projected traffic growth, which was expected to double along the entire corridor over 21 years (up to 2042);
- **Areas of high accident rates** (above the statewide average) and, particularly, areas of high fatal accident rates (also above the statewide average);
- **Roadway deficiencies** on existing Route 67 including substandard geometrics and inadequate cross sections; and
- **System continuity** along Route 67 between I-55 in Jefferson County and the Arkansas state line.

The purpose and need from the 2005 EIS was reviewed to ensure its validity for the portion of Route 67 being studied in the 2021 re-evaluation. Each purpose and need element is discussed below.

2.2.1 Congestion

The 2005 EIS noted that traffic was forecasted to increase at a rate of 2 percent per year. In the 2005 EIS, the average daily traffic (ADT) volume in 2002 on Route 67 between Route 160/158 and Route 142 was 4,450 vehicles per day (vpd). It was projected to increase to 7,790 vpd by 2025. The traffic volume south of Route 142 in 2002 was 3,510 vpd with a projected increase to 6,140 vpd by 2025. The projected increase in traffic would result in roadway levels of service (LOS) of between a LOS D and LOS E, which would be below MoDOT standards for LOS on a two-lane highway.

In 2019, the ADT on Route 67 between Route 160/158 and Route 142 was 5,863 vpd. While this indicates a slower annual increase (1.64 percent) than what was projected in the EIS, the Route 67 corridor is still experiencing notable increases in traffic levels, which will continue to decrease LOS. Traffic volume is projected to continue to grow to 7,687 vpd by the design year 2042 (an increase of 1.24 percent per year). While this level is less than the projected level in the 2005 EIS, the traffic growth on Route 67 could still see greater increases with the ultimate completion of I-57 in Missouri and Arkansas. The completion of this corridor as an interstate has the potential to attract traffic off of the I-55 corridor in Missouri and Arkansas and the I-40 corridor in Arkansas. The upgrade of Route 67 from a two-lane to a four-lane divided highway would increase the roadway capacity along this segment and improve LOS. Therefore, the congestion element of the purpose and need remains valid for this re-evaluation.

2.2.2 Accidents and Safety

Accident totals in the 2005 EIS were over a five-year period from January 1998 to December 2002. The terrain along the project length is generally flat with the exception being the vicinity of the Route 160/158 interchange, where rolling uplands transition to bottomland floodplain.

The 2005 EIS indicated two locations with an above-average accident rate. One location was at the intersection with Route 160/158 where the accident rate was 953.8 accidents per hundred million vehicle miles traveled (HMVMT) or 4.2 times the statewide average at that time. The 2005 EIS reported three fatal accidents had occurred over the five-year period, which resulted in a fatal accident rate of 55.0 per HMVMT, or 18.5 times the statewide average of 2.97 per HMVMT at that time. These accident problems were attributed to poor roadway geometry coupled with a high number of turning movements, the lack of a center turn lane, and development adjacent to the intersection.

The accident rate at Route 160/158 has dramatically declined since the construction of the Route 160/158 interchange in 2014. Over the 0.7-mile length of Route 67 between Route 160/158 and Route V, the accident rate over the five-year period from January 2014 to December 2018 was 172.3 accidents per HMVMT. This represents a decline of over 500% compared to the 1998-2002 timeframe. There were no fatal accidents through this 0.7-mile length between 2014 and 2018. Therefore, the traffic safety need at the former Route 160/158 intersection appears to no longer be valid for this re-evaluation.

The other location was the Route 142 intersection where the accident rate was 717.9 accidents per HMVMT or 3.2 times the statewide average. At Route 142, there were a total of 23 accidents between 1998 and 2002 with ten of them resulting in personal injury. The causes of accidents at this location were attributed to a high number of turning movements, the lack of a center turn lane, and driver inattentiveness. This location was characterized by excessive turning movement conflicts with existing through traffic.

The accident rate at Route 142 has been updated for the five-year period from January 2014 to December 2018. At Route 142, there were a total of 32 accidents over the more recent five-year period indicating a rise in the number of accidents compared to the 2005 EIS timeframe. Therefore, the traffic safety need at Route 142 still remains a valid component of the purpose and need for this re-evaluation.

2.2.3 Roadway Deficiencies

In the 2005 EIS, the design criteria used for the proposed action was for an interstate in rolling terrain as governed by the MoDOT Policy, Procedure and Design Manual. An interstate is defined as highway that is four lanes wide with the opposing lanes divided by a median and with fully-controlled access. This criteria required a design speed of 70 miles per hour (mph), a minimum radius of horizontal curvature of 1,641 feet, and a maximum grade of 4 percent. The design required fully paved shoulders, and each direction of traffic to be separated by a depressed grass median. In addition to meeting the design criteria, the proposed action was to maximize the use of the existing highway right of way, and to minimize impacts to environmental resources in the study area.

The 2005 EIS indicated there are no vertical curve deficiencies and one horizontal curve deficiency along Route 67 south of Poplar Bluff. The horizontal curve deficiency was immediately north of what was the intersection of Route 67 and Route 160/158. MoDOT Project J0P0959 provided an improvement to this deficiency with the construction of the Route 160/158 interchange. Therefore, the roadway design features at Route 160/158 listed in the EIS are no longer valid for this re-evaluation.

However, the interchange constructed under Project J0P0959 still has horizontal deficiencies. The EIS proposed a direct northbound on-ramp from Route 160/158 to Route 67. This was modified in Project J0P0959 and a loop ramp on the south side of Route 160/158 was constructed instead. The southbound on-ramp in the 2005 EIS was proposed as a loop ramp on the north side of Route 160/158. This was constructed under Project J0P0959; however, it is in a slightly different configuration from the proposed 2005 EIS layout. The bridge that carries Route 67 over Route 160/158 is four lanes wide; however, the outer lanes in both directions serve as acceleration lanes for the northbound and southbound on-ramp traffic, which makes the interchange deficient in meeting interstate standards. In order to meet interstate standards, this interchange needs to be modified to provide four through lanes through the interchange.

The proposed improvements as shown in the conceptual plans do not require any design exceptions to meet interstate standards.

2.2.4 System Continuity

The 2005 EIS referenced Section 1006 of the Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991, which directed development of a proposed National Highway System (NHS) in cooperation with the states and local officials. ISTEA began a series of federal surface transportation programs that provided funding for highways, highway safety, and transit. ISTEA authorized surface transportation funding for fiscal years 1992 through 1997. The current federal surface transportation funding program is the Fixing America's Surface Transportation Act, which was signed into law in 2015 by President Obama. It provides funding for surface transportation infrastructure planning and investment and is authorized from fiscal years 2016 through 2020.

The purpose of the NHS is to "provide an interconnected system of principal arterial routes, which will serve major population centers, international border crossings, ports, airports, public transportation facilities, and other major travel destinations, meet national defense requirements and serve interstate and regional travel." A primary objective of the NHS is to provide an interconnected system of arterial routes and linkage of multi-state corridors.

MoDOT has identified Route 67 as an NHS route. The selected alternative in the 2005 EIS provides an enhanced connection between the Route 67 corridor in Jefferson and St. Francois counties in Missouri and the Route 67 corridor in Arkansas. The Route 67 corridor in Jefferson and St. Francois counties in Missouri is currently a four-lane expressway. In Arkansas, much of Route 67 is already a freeway with the Arkansas Department of Transportation having a goal to upgrade those unimproved sections of Route 67 to a freeway as part of their long rang statewide highway planning strategy and to meet the goals of developing a future I-57. Therefore, the system continuity component of the purpose and need is still valid for this re-evaluation.

US67 is not part of the Department of Defense's Strategic Highway Network (STRAHNET).

3.0 CONSISTENCY WITH FHWA POLICY

FHWA policy identifies eight "Considerations and Requirements" that an interstate access request must satisfy and document for obtaining FHWA approval. These eight points are addressed as follows:

3.1 Update Existing Roadway Network

> *FHWA Point 1: The need being addressed by the request cannot be adequately satisfied by existing interchanges to the Interstate, and/or local roads and streets in the corridor can neither provide the desired access, nor can they be reasonably improved (such as access control along surface streets, improving traffic control, modifying ramp terminals and intersections, adding turn bays or lengthening storage) to satisfactorily accommodate the design-year traffic demands (23 CFR 625.2(a)).*

The existing Route 160 interchange will not be adequate to accommodate the design year volumes as shown in **Section 7.2**. Further, the widening of Route 67 will require the reconstruction of at least a portion of the Route 160 interchange. In order to keep the existing interchange configuration in place and accommodate a widened Route 67 the loop ramps will require tighter radii at the Route 67 connection points. The ramps are currently substandard and have experienced a high crash rate. Reconfiguration of the interchange is necessary to provide safe and efficient operations while meeting the purpose and need of the project.

US67 was Congressionally identified as High Priority Corridor 89 on the NHS and designated as a future interstate route. Proposed improvements will improve current substandard issues.

3.2 All Reasonable Alternatives

> *FHWA Point 2: The need being addressed by the request cannot be adequately satisfied by reasonable transportation system management (such as ramp metering, mass transit, and HOV facilities), geometric design, and alternative improvements to the Interstate without the proposed change(s) in access (23 CFR 625.2(a)).*

The current access point of Route 160 at Route 67 is a full interchange due to the existing traffic volumes at this location. Current daily traffic volumes show that more of the traffic that uses Route 67 north of the interchange comes from the west along Route 160 than along Route 67 to the south. With the ultimate completion of I-57 in Missouri and Arkansas the traffic growth along Route 67 is expected to accelerate. Elimination of the interchange at Route 160 and Route 67 is not a reasonable alternative with the existing and expected traffic patterns. Traffic at this interchange will additionally increase as existing at-grade intersections along Route 67 are closed and traffic is diverted to this interchange.

Various interchange configurations were studied at Route 160 and Route 67. These interchange types are presented in **Section 6.4**. Of the 5 interchange types that were initially screened, three proposed interchange configurations are consistent with driver expectations in the region and minimized the amount of disturbed ground and environmental impacts compared to other interchange configurations considered.

Other TSM strategies were considered and include:

- HOV Vehicle Lanes – The core problem is interstate access, not interstate capacity. HOV lanes on Route 67 or Route 160 would not be appropriate for that facility.
- Ramp Metering – Ramp metering would not address the core problems of inadequate access. Should congestion on Route 67 become a problem in the future, ramp metering can be reevaluated.
- Mass Transit – There are currently no mass transit services in Butler County, and implementation of transit is beyond the scope of this study.

The previous EIS and location study concluded that an interchange at Route 160 is the appropriate location for an interchange along Route 67. The operational analysis conducted with this project supports this conclusion. Further discussion of the alternatives considered is presented in **Section 6.**

3.3 Adverse Impacts

> *FHWA Point 3: An operational and safety analysis has concluded that the proposed change in access does not have a significant adverse impact on the safety and operation of the Interstate facility (which includes mainline lanes, existing, new, or modified ramps, ramp intersections with crossroad) or on the local street network based on both the current and the planned future traffic projections. The analysis shall, particularly in urbanized areas, include at least the first adjacent existing or proposed interchange on either side of the proposed change in access (23 CFR 625.2(a), 655.603(d) and 771.111(f)). The crossroads and the local street network, to at least the first major intersection on either side of the proposed change in access, shall be included in this analysis to the extent necessary to fully evaluate the safety and operational impacts that the proposed change in access and other transportation improvements may have on the local street network (23 CFR 625.2(a) and 655.603(d)).*
>
> *Requests for a proposed change in access must include a description and assessment of the impacts and ability of the proposed changes to safely and efficiently collect, distribute and accommodate traffic on the Interstate facility, ramps, intersection of ramps with crossroad, and local street network (23 CFR 625.2(a) and 655.603(d)). Each request must also include a conceptual plan of the type and location of the signs proposed to support each design alternative (23 U.S.C. 109(d) and 23 CFR 655.603(d)).*

Section 7.2 shows that the proposed interchange has a net positive impact on operations in the study area. The capacity improvements along Route 67 and Route 160 improves operations of both corridors and provide for the future conversion of Route 67 to Interstate 57.

Traffic projections show that the current configuration at the Route 160 interchange will eventually fail without improvements. The interchange improvements will allow for the widening of Route 67 and provide the necessary capacity at the interchange. The proposed interchange will be designed to current design standards, thereby limiting the number of drivers exposed to the substandard design of the existing ramp connections. The ramp terminals in the proposed alternate are roundabouts, an intersection type proven to reduce the severity of crashes. HSM techniques were used to estimate the impacts to safety from the proposed interchange.

The conceptual signing plan shows the advanced exit signing proposed for the modified interchange, which utilizes some of the existing signing in place for the existing interchange. No changes in signalization are recommended as part of this project. The signing plan is consistent with the practices laid out in the Manual for Uniform Traffic Control Devices (MUTCD). See **Appendix C** for the Conceptual Signing Plan.

3.4 Meet or Exceed Design Standards

> _FHWA Point 4_: *The proposed access connects to a public road only and will provide for all traffic movements. Less than "full interchanges" may be considered on a case-by-case basis for applications requiring special access for managed lanes (e.g., transit, HOVs, HOT lanes) or park and ride lots. The proposed access will be designed to meet or exceed current standards (23 CFR 625.2(a), 625.4(a)(2), and 655.603(d)).*

The proposed modification interchange will be under the jurisdiction of MoDOT and connect to Route 160 to Route 67. The conceptual design meets or exceeds current design standards. Refer to the conceptual plans in **Appendix C** for geometric information. A full set of conceptual plans including cross sections is available under a separate cover. The project's Design Criteria Memorandum is provided in **Appendix F.** The proposed improvements as shown in the conceptual plans do not require any design exceptions to meet interstate standards.

3.5 Consistent with Local and Regional Transportation Plans

> _FHWA Point 5_: *The proposal considers and is consistent with local and regional land use and transportation plans. Prior to receiving final approval, all requests for new or revised access must be included in an adopted Metropolitan Transportation Plan, in the adopted Statewide or Metropolitan Transportation Improvement Program (STIP or TIP), and the Congestion Management Process within transportation management areas, as appropriate, and as specified in 23 CFR part 450, and the transportation conformity requirements of 40 CFR parts 51 and 93.*

The Ozark Foothills Regional Planning Commission (OFRPC) has entered into a cooperative agreement with MoDOT for regional transportation planning services in the five county region. The OFRPC plays a vital role in determining the transportation needs that are of significant importance to the five-county region. This planning process includes compiling an annual prioritized listing of maintenance and construction projects that consists of suggestions submitted on behalf of local citizens and elected officials via members of a Transportation Advisory

Committee. These suggestions are then prioritized by an agreed upon method outlined in the MoDOT Practitioners Manual and ranked according to their financial and structural feasibility.

As part of OFRPC's transportation planning process they produce a priority list for the region. Top 10 Road and Bridge Priority list for the region. I-57 Corridor Upgrades with emphasis from Highway 160 to the state line is the top priority for Butler County[1].

3.6 Consistent with Master Plans

> *FHWA Point 6: In corridors where the potential exists for future multiple interchange additions, a comprehensive corridor or network study must accompany all requests for new or revised access with recommendations that address all of the proposed and desired access changes within the context of a longer-range system or network plan (23 U.S.C. 109(d), 23 CFR 625.2(a), 655.603(d), and 771.111).*

The proposed interchange improvements are part of the Route 67 corridor improvements begun by MoDOT in 1997. In the fall of 1997, MoDOT initiated the Route 67 EIS in Madison, Wayne, and Butler Counties. The EIS and its accompanying Record of Decision (ROD) were approved by FHWA in June and August of 2005, respectively. The EIS was subsequently re-evaluated and approved in 2021 in conjunction with this AJR. The purpose of the EIS was to evaluate strategies for improving Route 67 from just south of Fredericktown in Madison County to just south of Neelyville in Butler County. The EIS looked specifically at developing a four-lane, divided highway to accommodate projected traffic demands, to improve safety, and to correct roadway deficiencies. The proposed Route 160 interchange improvements are consistent with the Master Plan for Route 67 that has been followed for the last 15 years.

3.7 Coordination with Other Improvements

> *FHWA Point 7: When a new or revised access point is due to a new, expanded, or substantial change in current or planned future development or land use, requests must demonstrate appropriate coordination has occurred between the development and any proposed transportation system improvements (23 CFR 625.2(a) and 655.603(d)). The request must describe the commitments agreed upon to assure adequate collection and dispersion of the traffic resulting from the development with the adjoining local street network and Interstate access point (23 CFR 625.2(a) and 655.603(d)).*

The proposed interchange improvement at Route 160 is part of the larger Route 67 conversion to Interstate 57. There are no known developments planned along the corridor and the proposed interchange improvements are not expected to significantly change the development patterns in the area of the interchange. Additional development to the south as Route 67 is expand is possible, and traffic projections account for growth of traffic along Route 67.

[1] http://www.ofrpc.org/cmsAdmin/uploads/rtp-final-2019.pdf

3.8 Coordination with Environmental Process

> *FHWA Point 8: The proposal can be expected to be included as an alternative in the required environmental evaluation, review and processing. The proposal should include supporting information and current status of the environmental processing (23 CFR 771.111).*

The proposed Route 160 interchange improvements are part of the larger Route 67 Environmental Impact Statement. The NEPA Re-evaluation of the Route 67 EIS was developed in coordination with this Access Justification Report and was approved on January 13, 2021. *Table **1*** summarizes the changes to environmental impact of the proposed interchange.

Table 1 – Environmental Summary

Resource Evaluated	Impact Findings	
	2005 EIS	**2021 EIS Re-evaluation**
Socioeconomics	Minor impacts	Minor impacts
Land Use	Minor impacts	Minor impacts
Displacements	38 total displacements	32 total displacements
Environmental Justice	No impact	No impact
Soils and Geology	Minor impacts	Minor impacts
Surface Waters	34.63 acres wetland impacts / 1,620 linear feet stream impacts	46.81 acres wetland impacts / 11,316 linear feet stream impacts
Groundwater	No impact	No impact
Floodplains	191.6 acres	243.5 acres
Public Lands	No impact	No impact
Prime Farmland	Form NRCS-CPA-106 conversion impact rating of 118; no avoidance and/or mitigation measures required	New Form NRCS-CPA-106 not necessary; no avoidance and/or mitigation measures required
Visual Quality	Minor impacts	Minor impacts
Air Quality	No impact	No impact
Noise	Minimal impacts due to rural nature; need for abatement undetermined	3 impacted receptors; abatement measures not feasible
Threatened and Endangered Species	Impacts undetermined; MoDOT to initiate consultation prior to construction	May affect, not likely to adversely affect gray bats; no effect on other T&E species
Hazardous Materials and Waste Management	7 potential hazardous waste sites within or adjacent to corridor	4 potential hazardous waste sites; testing determined presence of contamination at only one site
Cultural and Historic Resources	1 resource potentially NRHP eligible (23BU399); would require Phase II eligibility testing if not avoided	3 resources potentially NRHP eligible (23BU399, 23BU1557, and AR-2); will require further investigation if not avoided

4.0 EXISTING CONDITIONS

4.1 Existing Facility and Transportation Network

The existing facilities impacted by the proposed interchange are Route 67, Route 160, MO Route C, MO Route V, MO Route 158, County Roads 323, 343, 338 and 360, and Hawkeye Lane. A discussion of each facility follows.

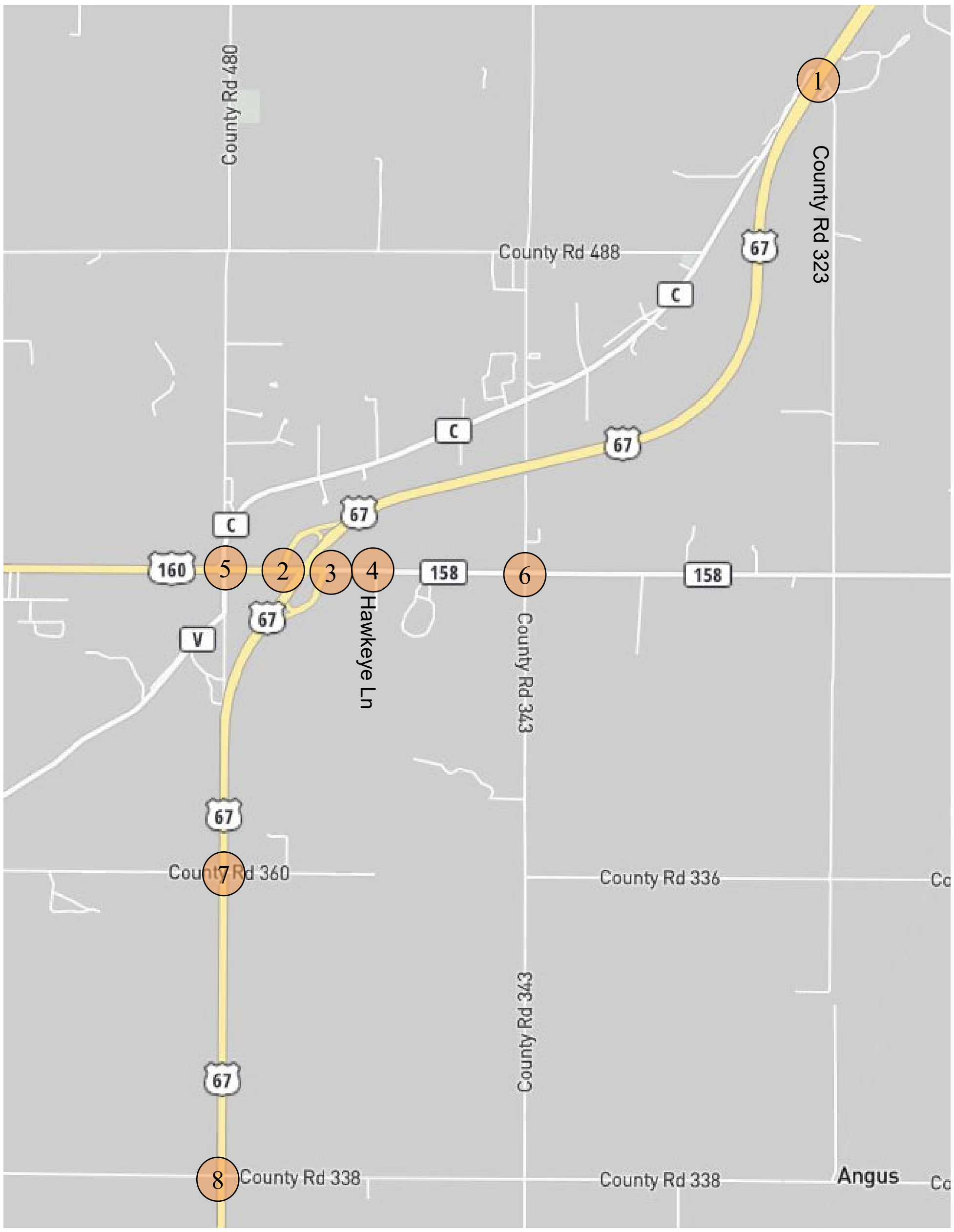


Figure 7 – Project Area Roadways and Intersections

Table 2 – Existing Facility Information

Facility (Intersections)	**Functional Classification[2]**	**No. of Primary Lanes**	**Level of Access Control**	**2019 ADT**	**Speed Limit**
US Route 67 (1), (2), (3), (7), (8)	Other Freeway and Expressway/ Principal Arterial	2	Controlled	12,000 (north of C) 9,700 (C to 160) 5,863 (south of 160)	60 mph/ 65 mph
US Route 160 (5), (2), (3)	Minor Arterial	4 / 5	Normal	7,181	55 mph
Missouri Route C (1), (5)	Major Collector	2	Normal	992 (north of 160) 1,931 (west of 67)	45 mph 55 mph
Missouri Route V (5)	Minor Collector	2	Normal	5,141	45 mph
Missouri Route 158 (3), (4), (6)	Major Collector	2	Normal	982	55 mph
County Road 323 (1)	Local Road	2	Normal	987	None Posted
County Road 343 (6)	Local Road	2	Normal	Unknown	None Posted
County Road 338 (8)	Local Road	2	Normal	Unknown	None Posted
County Road 360 (7)	Local Road	2	Normal	Unknown	None Posted
Hawkeye Lane (4)	Local Road	2	Normal	52	None Posted

Normal level of access control allows full sideroad intersections and driveways by permit.

4.1.1 Freeway System

US Route 67 is a four-lane divided freeway north of Route 160 that carries approximately 17,000 vehicles per day, 18% of which are trucks. It has 12-foot-wide lanes, 8-foot-wide outside shoulders and 4-foot-wide inside shoulders. South of Route 160, Route 67 narrows to a two-lane undivided section carrying approximately 5,800 vehicles per day, 27% of which are trucks. It has 12-foot-wide lanes with 8-foot-wide outside shoulders.

The existing interchange at Route 160 is a partial cloverleaf (Parclo A2) with short radius loop ramps and with a combination of taper-type parallel-type ramps. Route 67 between CR 323 and CR 338 is generally flat, with a maximum vertical grade of approximately 3%.

Table 3 shows that only two of the existing ramps meet current standards for acceleration / deceleration lengths.

[2] https://www.modot.org/sites/default/files/documents/ButlerCounty%5B1%5D_0.pdf

Table 3 – Existing Interstate Ramp Geometric Information

Facility	Terminal Type	Super-elevation (%)	Radius (ft)	Approximate Design Speed (mph)	Available Acceleration / Deceleration Length (ft)	Required Acceleration / Deceleration Length (ft)
Route 160 NB On Ramp	Taper	8.0%	130 ft	25 mph	Unlimited	1,420 ft
Route 160 NB Off Ramp	Parallel	8.0%	573 ft	45 mph	**495 ft**	615 ft
Route 160 SB On Ramp	Taper	8.0%	130 ft	25 mph	**350 ft**	1,420 ft
Route 160 SB Off Ramp	Parallel	8.0%	573 ft	45 mph	Unlimited	615 ft

4.1.2 Surface Roads

US Route 160:
US Route 160 is generally a two-lane rural highway with 4-foot paved shoulders. It runs from its origination at Route 67 to the west. Route 160 serves as a connector to Route 67 for communities west of the freeway. The speed limit is 55 mph.

US Route 160 Ramps:
The off ramps for Route 67 at the Route 160 interchange are single lane roadways with eight-foot outside shoulders and four-foot inside shoulders. These roadways serve as connections from Route 67 to US Route 160/ MO Route 158. The posted advisory speed limit is 40 mph.

Missouri Route C:
MO Route C is generally a two-lane rural highway with 8-foot shoulders and was formerly Route 67 before the new Route 67 was constructed in 2013-2014. It runs from its origination at a junction with Route 67 approximately 2.5 miles north of MO Route 158, south and west to Route 160 where it intersects at a two-way stop-controlled intersection. After the intersection with Route 160, MO Route C converts to MO Route V to the south. The posted speed limit is 45/55 mph.

Missouri Route V:
MO Route V is a two-lane rural highway with 8-foot shoulders. It originates at Route 160 and runs to the south, terminating approximately 2,000 feet south of Route 160. The intersection with Route 160 is two-way stop controlled. The posted speed limit is 45 mph.

Missouri Route 158:
MO Route 158 is a two-lane rural highway with no shoulders. It originates at Route 67 and runs to the east. MO Route 158 serves as a connector to Route 67 for communities east of the freeway. The posted speed limit it 55 mph.

County Road 323:
County Road 323 is a two-lane rural highway with no shoulders. This roadway originates at Route 67 and runs to the south. The roadway is paved asphalt for approximately 700 feet south of Route 67, then becomes gravel to the south. It intersects with MO Route 158 and continues south before terminating at County Road 336. There is no posted speed limit.

County Road 338:
County Road 338 is a two-lane rural highway with no shoulders. This roadway runs from west to east intersecting with Route 67 and County Road 343 at grade approximately 2 miles south of the Route 67 and Route 160 interchange. The roadway is gravel with no posted speed limit.

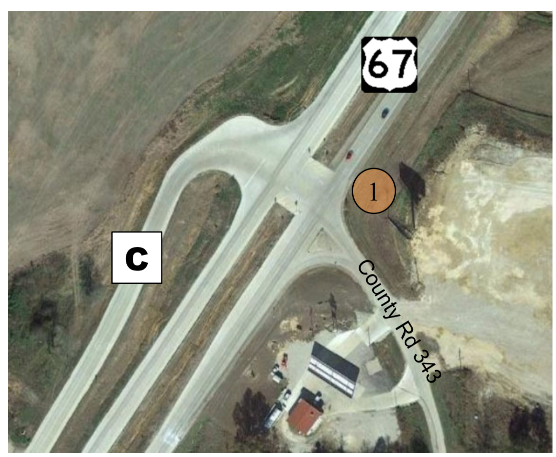
County Road 343:
This is a two-lane rural highway with no shoulders. Beginning at US Highway 65 at the north, this roadway runs to the south intersecting with MO Route 158 and County Road 338. The roadway is paved asphalt between US Highway 67 and MO Route 158, and gravel to the south. There is no connection to US Highway 67. There is no posted speed limit.

County Road 360:
This is a two-lane gravel rural highway with no shoulders. It originates at County Road 355 to the west intersecting US Highway 67 at grade approximately 1 mile south of the US Highway 76 and US Highway 160 interchange. The roadway terminates approximately ½ mile east of US Highway 67 at a dead end. There is no posted speed limit.

Hawkeye Lane:
This is a two-lane rural highway with no shoulders. Hawkeye Lane runs from MO Route 158 south approximately 2,000 feet and terminates at a dead end. This roadway has no posted speed limit.

Each of the study area intersections are described in detail below:

1 US Route 67 & MO Route C / CR 323



This is a four-way at grade, two-way stop-controlled intersection. US Route 67 runs northeast to southwest, with Country Road 323 intersecting from the southeast, and MO Route C intersecting from the northwest. US Route 67 consists of two lanes in both the northeast and southwestbound directions separated by a depressed median. Northeastbound US Route 67 has a channelized right turn lane to CR 323. Northbound CR 323 consists of shared left/thru/right lane. Southbound MO Route C consists of a widened lane with room for both left/thru traffic, and right turn traffic.

2 US Route 67 SB Ramps & US Route 160 / MO Route 158

This ramp terminal intersection is a three-way at grade intersection. The north leg consists of the southbound US Route 67 on and off ramps. The southbound movement is stop controlled with a shared left/thru/right lane. The east and westbound movements consist of one lane in each direction with no stop control.

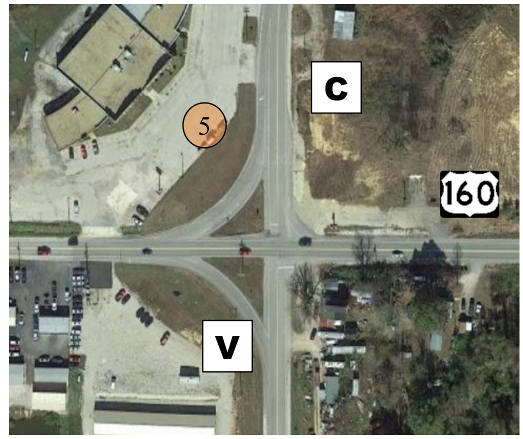
3 US Route 67 NB Ramps & US Route 160 / MO Route 158

This ramp terminal intersection is a three-way at grade intersection. The south leg consists of the northbound US Route 67 on and off ramps. The northbound movement is stop controlled with a shared left/thru/right lane. The east and westbound movements consist of one lane in each direction with no stop control.

4 MO Route 158 & Hawkeye Lane

This four-way intersection is located approximately 180 feet east of the northbound ramp terminals for US Route 67. The north leg acts as a private drive with one shared lane for all movements. The south leg of the intersection also acts as a private drive with one shared lane for all movements. The north and south legs are stop controlled. The east and west legs have one lane with no stop control.

5 US Route 160 & MO Route C/MO Route V



A four-legged two-way stop-controlled intersection located approximately 1,000 feet west of the southbound ramp terminals for US Route 67. The northbound and southbound legs are stop controlled. The southbound leg has a channelized right turn lane with approximately 400 feet of storage, and one shared left/thru lane. The northbound leg has a shared left/thru/right lane. The east and west legs have one lane with no stop control. The west leg also provides a channelized right turn with approximately 200 feet of storage. There are no stop controls on the east and west bound legs of this intersection.

6 MO Route 158 & County Road 343

A four-legged two-way stop-controlled intersection located midway between US Route 67 and County Road 323. The north and south legs are stop controlled. The south leg has a single lane for shared left/thru/right movements. The north leg has a shared lane for left/thru movements, and a channelized right turn lane with approximately 85 feet of storage. The east and west legs consist of one lane each and are not stop-controlled.

7 US Highway 67 & County Road 360

This is a four-legged intersection with stop-control for County Road 360. Each leg has one lane for shared left/thru/right movements. This intersection is located approximately 1.1 miles south of the US Route 67 and US Route 160 interchange.

8 US Highway 67 & County Road 338

This is a four-legged intersection with stop-control for County Road 338. Each leg has one lane for shared left/thru/right movements. This intersection is located approximately 2.1 miles south of the US Route 67 and Route 160 interchange.

4.2 Safety Conditions

A safety analysis was conducted to identify high crash locations within the study area and to understand the potential impact of traffic redistributions resulting from the proposed interchange. A crash rate analysis and Highway Safety Manual (HSM) analysis were conducted as part of the safety analysis. Crash rate analysis allows for comparison of crash rates, expressed in crashes per vehicle miles of travel, to statewide averages for similar type roadways. HSM procedures allow for more refined analysis of crash frequency accounting for other factors in addition to traffic volumes and roadway type, such as driveway density and basic roadway geometry. The study area for existing conditions safety analysis included the following roadways:

- US Route 67 from CR338 to Route C
- US Route 160 from Route C/V to CR 343

A five-year crash analysis was conducted from 2014 to 2018 for all roadways within the study area for which complete data was available from MoDOT. The majority of crashes in the area are on Route 67. It is also noted that the only three fatal crashes identified in the vicinity are located on Route 67.

Crash Rate Analysis

Table 4 through ***Table 6*** summarize annual crash frequency and crash rates for the study roadways. Crash rates are calculated from the following formula to determine the number of crashes per hundred million vehicle miles of travel.

$$Crash\ Rate = \frac{Number\ of\ Crashes \times 100{,}000{,}000}{Number\ of\ Years \times AADT \times Length \times 365\ days/year}$$

Crash rates were estimated using the most recently reported Average Daily Traffic (ADT) reported for each roadway as provided by the 2019 Missouri Traffic Volume Maps[3]. Average statewide crash rates were obtained from the MODOT Transportation Management System (TMS).

Table 4 – US Route 67 Crash Data (North of Route 160)

TYPE	2014	2015	2016	2017	2018
FATAL	0	1	0	0	1
DISABLING INJURY	0	2	0	1	0
MINOR INJURY	0	1	6	5	2
PDO	11	9	12	3	8
TOTAL	11	13	18	9	11
ADT	17,347				
CRASH RATE	64.34	76.04	105.29	52.65	64.34
STATEWIDE CRASH RATE	-	129.27	133.59	127.2	130.67

[3] http://www.modot.org/safety/trafficvolumemaps.htm; accessed 11/20/2020

Table 4 shows the five-year crash history of Route 67 divided expressway from Route 160 to just north of Route C. As can be seen from the table, the crash rate on this section of Route 67 is significantly lower than the average statewide crash rate for expressways. Both fatal crashes occurred at the Route C intersection. ***Table 5*** shows the crash data for the 2-lane undivided portion of Route 67 from Route 160 to CR 338. This section of Route 67 also has a crash rate lower than the statewide rate for US Routes. It should be noted that the single fatal crash occurred at CR 360 and over 16% of all crashes are due to deer. ***Table 6*** summarizes crash data for Route 160 and Route 158. Crashes on this stretch of rural highway have been relatively constant with a slight increase in 2015. Over 58% of all crashes occur at the Route C/V intersection and 20% occur at the ramp terminals to Route 67.

Table 5 – Route 67 Crash Data (South of Route 160)

TYPE	2014	2015	2016	2017	2018
FATAL	0	0	0	0	1
DISABLING INJURY	0	0	0	0	0
MINOR INJURY	1	1	1	1	3
PDO	6	3	2	5	7
TOTAL	7	4	3	6	11
ADT	5863				
CRASH RATE	50.25	28.72	21.54	43.07	78.97
STATEWIDE CRASH RATE	-	114.38	116.14	108.89	113.73

Table 6 – Route 160 / MO 158 Crash Data

TYPE	2014	2015	2016	2017	2018
FATAL	0	0	0	0	0
DISABLING INJURY	0	0	1	0	0
MINOR INJURY	3	1	2	5	3
PDO	6	10	10	10	9
TOTAL	9	11	13	15	12
ADT	7181				
CRASH RATE	129.22	157.94	186.65	215.37	172.29
STATEWIDE CRASH RATE	-	114.38	116.14	108.89	113.73

Highway Safety Manual (HSM) Predictive Methodology.
The HSM uses safety performance functions (SPFs) to predict annual crash frequency based on roadway facility type and traffic demand. Crash Modification Factors (CMFs) are used to modify the SPF prediction based on localized conditions including geometric functions, such as lane width, shoulder width and roadway curvature, as well as traffic control features such as turn lane

presence and left turn phasing at signalized intersections. Separate models have been developed for 1) Freeway segments, 2) Urban/Suburban Arterials, and 3) Rural Two-Lane roadways. HSM analysis was conducted by using the Interactive Highway Safety Design Model (IHSDM 2020) developed by Peraton for the National Cooperative Highway Research Project (NCHRP). ***Table 7*** summarizes the analysis method used for each roadway within the study area and the resultant predicted crashes and average annual crashes observed on the roadways during the 5 year analysis period.

Table 7 – HSM Summary Output

Roadway	Limits	Analysis Method	Predicted Crashes	Observed Crashes
US 67	North of 160	IHSDM Freeway	13.2	12.4
US 67	South of 160	IHSDM Rural Highway	3.7	6.2
US 160 / 158	Rt C to CR343	IHSDM Rural Highway	11.1	12.0

As can be seen from the above table, the observed annual crash frequency exceeds the predicted value for all roadways except for the northern section of Route 67. However, Route 160 is within less than one crash between the predicted and observed values. Conditions exist on the southern two-lane section of Route 67 that are not adequately accounted for within the prediction models. This may include higher levels of congestion, roadside objects, higher densities of driveways, or a more severe roadside hazard rating. The proposed project will attempt to alleviate some of these high crash locations by improving ramps, ramp terminals, and the southern two-lane undivided section of Route 67.

4.3 Existing Land Use and Demographics

The existing interchange is located approximately 10.5 miles south of the city of Poplar Bluff, Missouri. Currently the area is mostly residential and industrial with some commercial developments located near the existing interchange.

The Route 67 corridor south of the existing interchange is largely agricultural with some residential access, consisting of private drives directly off the existing highway. Route 67 connects many small rural town in southeast Missouri to Poplar Bluff, the largest city and county seat of Butler County. Route 67 also connects these same towns south to the Arkansas state line.

The population of Butler County has statistically seen no growth since 2010, and trails the statewide average. Population projections completed by the Missouri Economic Research and Information Center (MERIC) show Butler County’s population increasing by nearly less than 2 percent from 2000 to 2030, with a decline of 0.3% between 2020 and 2030 due in part to aging demographics.

4.4 Environmental Constraints

The 2005 EIS and 2020 Re-Evaluation have not identified any known major environmental issues or areas of concern within the immediate interchange area. In addition, no controversy or community concern has been identified in association with the project. The NEPA process is ongoing and more constraints may be identified, but no major constraints are expected.

4.5 Existing Operational Conditions

4.5.1 Freeway System

The existing Route 67 corridor is currently an expressway with limited access and ramps at Route 160. The current Highway Capacity Manual 6 (HCM6) procedures do not cover ramps with a single through lane. The existing operational conditions of Route 67 in the Route 160 interchange area was measured using microsimulation tools and is presented in **Section 7.2.3**. The existing at-grade intersections along Route 67 are summarized in **Section 4.5.2**.

4.5.2. Surface Roads

This section details the operation of surface roads that would be impacted by the construction of the proposed interchange. These roads include intersections along Route 67 and Route 160. The macroscopic traffic analysis software application Synchro 10 was used to analyze the operation of the major intersections along these routes for the AM and PM peaks. Synchro runs can be found in **Appendix E**.

The primary performance measure used in the HCM 6 and the Synchro model to provide a LOS for signalized and unsignalized intersections is control delay, measured in seconds per vehicle. The LOS rating system describes the operational characteristics of an intersection and ranges from A (free flow, minimal delay) to F (extreme congestion, unacceptable delay). The ranges of control delay used to define LOS are shown in ***Table 8***.

Table 8 – Intersection LOS Criteria

LOS	Signalized Intersection Control Delay (sec)	Unsignalized Intersection Control Delay (sec)
A	0-10	0-10
B	>10-20	>10-15
C	>20-35	<15-25
D	>35-55	>25-35
E	>55-80	>35-50
F	>80	>50

***Table** 9* summarizes the average intersection delay for the study intersections during the morning, and evening peak hours for 2020. This tables show the average intersection delay (seconds per vehicle), Level of Service, and 95th percentile queue (feet) for each stopped approach for unsignalized intersections.

Table 9 – Existing 2020 Intersection Analysis

Average Delay (sec/veh), LOS, 95th Percentile Queue Length (ft)

Intersection	Approach	AM Peak		PM Peak	
		Delay (LOS)	Queues 95th	Delay (LOS)	Queues 95th
Route 67 & Route C / CR 323*	EB RTE C	18.9 (C)	39	19.5 (C)	26
	WB CR 323	12.8 (B)	12	13.1 (B)	8
Route 67 & CR 360*	EB CR 360	13.1 (B)	0	13.7 (B)	0
	WB CR 360	9.7 (A)	0	9.7 (A)	0
Route 67 & CR 338*	EB CR 338	13.0 (B)	0	13.7 (B)	0
	WB CR 338	9.7 (A)	0	9.7 (A)	0
Route 160 & Route C / Route V*	NB Route V	15.6 (C)	15	17.2 (C)	20
	SB Route C	15.1 (C)	13	18.3 (C)	27
Route 160 & SB RTE 67 Ramps*	SB RTE 69 Ramps	9.8 (A)	15	11.9 (B)	52
Route 160 & NB RTE 67 Ramps*	NB RTE 69 Ramps	9.5 (A)	4	9.7 (A)	7
Route 158 & Hawkeye*	NB Hawkeye	9.2 (A)	0	9.4 (A)	0
Route 158 & CR 343*	NB CR 343	8.6 (A)	0	8.7 (A)	0
	SB CR 343	9.2 (A)	1	8.7 (A)	0

** = Unsignalized intersection, delay reported for stopped approach only.*

Results of the intersection analysis show that the Route 67 and Route 160 corridors has moderate delays during the morning and evening peak hours and on the stopped approaches and operate at LOS C or better. The highest delays are at the Route C/CR 323 intersection with Route 67 north of the proposed interchange. Additional analysis of the existing conditions utilizing microscopic simulation is presented in **Section 7.2.3**. Microsimulation tools are better equipped to model the interaction of closely spaced intersections and the interaction between freeway and surface street operations.

5.0 METHODOLOGY

5.1 Future Year Traffic Development

Traffic projections used in the analysis of future conditions were developed using a combination of historic traffic patterns, recent traffic counts and previous traffic projections. The complete methodology and results of the traffic projections are provided in the "Route 67 Design Hour Volumes Development Summary." This report is provided in **Appendix F**.

5.2 Area of Influence

The area of influence analyzed for this project consists of Route 67 from Missouri Route C/County Road 323 south to County Road 338 and US Highway 160/ MO Route 158 from Missouri Route C/V to County Road 343.

5.3 Operational Analysis Procedures

Mainline Route 67 counts (including truck percentages) were collected in February 2020 and were used to adjust counts collected later in 2020 to more typical volumes. Turning movement counts were conducted in 2020 at all study intersections during the COVID-19 pandemic. Peak Hour Factors (PHF) and truck percentages were taken from turning movement and interstate counts performed in 2020. The operational analysis presented in this report was conducted with Synchro software, SIDRA Intersection, VISSIM, and the methods laid out in the Highway Capacity Manual. The use of the VISSIM microsimulation model follows the guidelines presented in the "Protocol for VISSIM Simulation"[4]. The VISSIM model was compared to existing traffic conditions to improve the reliability of the model.

5.3.1. Freeway System

Route 67, including all merge, diverge, ramp, and mainline sections, was analyzed using the HCM 6 methods as summarized by the Highway Capacity Software (HCS) program. The Measure of Effectiveness (MOE) for freeway sections in the HCM is density, expressed as passenger cars / mile / lane. ***Table 10*** describes Level of Service thresholds for freeway segments.

[4] Protocol for VISSIM Simulation, Washington State Department of Transportation, September 2014.

Table 10 – Level of Service Characteristics from HCM6 for Freeway Segments

LOS	Description
A	Describes free-flow operations. Free flow speed (FFS) prevails on the freeway, and vehicles are almost completely unimpeded in their ability to maneuver within the traffic stream. The effects of incidents or point breakdowns are easily absorbed.
B	Represents reasonably free-flow operations, and FFS on the freeway is maintained. The ability to maneuver within the traffic stream is only slightly restricted, and the general level of physical and psychological comfort provided to drivers is still high. The effects of minor incidents and point breakdowns are still easily absorbed.
C	Provides for flow with speeds near the FFS of the freeway. Freedom to maneuver within the traffic stream is noticeably restricted, and lane changes require more care and vigilance on the part of the driver. Minor incidents may still be absorbed, but the local deterioration in service quality will be significant. Queues may be expected to form behind any significant blockages.
D	Is the level at which speeds begin to decline with increasing flows, with density increasing more quickly. Freedom to maneuver within the traffic stream is seriously limited and drivers experience reduced physical and psychological comfort levels. Even minor incidents can be expected to create queuing, because the traffic stream has little space to absorb disruptions.
E	Describes operations at capacity. Operations on the freeway at this level are highly volatile because there are virtually no usable gaps within the traffic stream, leaving little room to maneuver within the traffic stream. Any disruption to the traffic stream, such as vehicles entering from a ramp or a vehicle changing lanes, can establish a disruption wave which propagates throughout the upstream traffic flow. At capacity, the traffic stream has no ability to dissipate even the most minor disruption, and any incident can be expected to produce a serious breakdown and substantial queuing. The physical and psychological comfort afforded drivers is poor.
F	Describes breakdown, or unstable flow. Such conditions exist within queues forming behind bottlenecks.

5.3.2. Surface Roads

Unsignalized intersections were analyzed using Synchro software. The proposed roundabouts were analyzed using SIDRA Intersection, version 9. SIDRA intersection is a software model that can analyze various roundabout configurations.

LOS characteristics and criteria are slightly different for unsignalized and signalized intersections. Drivers anticipate longer delays at signalized intersections, which can carry a higher volume of traffic. In addition, there are a number of driver considerations that can affect how much delay one experiences. For example, a driver is able to relax at a red light and proceed when the light changes. A driver at an unsignalized intersection does not have the ability to passively wait, as he/she must constantly be attentive for an acceptable gap for entry onto the main street. In addition, the amount of delay a driver experiences at an unsignalized intersection can vary widely from situation to situation, often much more than at signalized intersections. LOS is only calculated for legs of an intersection that must yield to other movements at unsignalized intersections. ***Table 11*** describes Level of Service and criteria for signalized and unsignalized intersections.

Table 11 – Level of Service Characteristics from HCM6 for Intersections

LOS	Signalized Intersections	Unsignalized Intersections
A	Describes operations with very low delay, less than or equal to 10.0 sec/veh. This occurs when progression is extremely favorable and most vehicles arrive during the green phase.	Describes operations with very low levels of delay that average less than 10 sec/veh.
B	Describes operations with delay in the range of 10.1 to 20.0 sec/veh. This condition generally occurs with good progression, short cycle length or both.	Describes operations with low levels of delay in the range of 10.1 to 15.0 sec/veh.
C	Describes operations with delay in the range of 20.1 to 35.0 sec/veh. Individual cycle failures may occur, though many vehicles still pass through unimpeded.	Describes operations with average delays in the range of 15.1 to 25.0 sec/veh.
D	Describes operations with delay in the range of 35.1 to 55.0 sec/veh. The influence of congestion becomes more noticeable. Longer delays may result from unfavorable progression, longer cycle lengths, or both.	Describes operations with average delays in the range of 25.1 to 35.0 sec/veh. The influence of congestion becomes more noticeable.
E	Describes operations with delay in the range of 55.1 to 80 sec/veh. Individual cycle failures are common occurrences. This LOS is considered to be the limit of acceptable delay by most agencies.	Describes operations with average delays in the range of 35.1 to 50.0 sec/veh.
F	Describes operations with delay greater than 80.0 sec/veh. This level is considered to be unacceptable to most drivers and often occurs when vehicles entering the intersection exceed the capacity.	Describes operations with average delay greater than 50.0 sec/veh. LOS F exists where insufficient gaps exist so vehicles can enter the dominant traffic stream. Large queuing on side streets is common.

5.3.3. Microscopic Simulations

The operational analyses of the interstate system and surface roads using macroscopic tools are limited in their ability to analyze the impact of one network upon the other. A microsimulation model of the entire study area was created using VISSIM (version 2021.02). The purpose of this model was to analyze the entire study area as a whole and quantify the impacts one element in the network may have on the rest of the network. The VISSIM model is able to quantify the impacts of the intersections along Route 160 and how these intersections impact other intersections along Route 160 and on Route 67 in the existing condition as well as the construction year of 2022, and the design year of 2042.

5.4 Safety Analysis Procedures

Historical crash data were compiled from several sources to analyze existing intersections in the build and no-build scenarios.

The procedures laid out in the Highway Safety Manual (HSM) were used to estimate the impacts of the proposed interchange on Route 67 and Route 160. Calibration factors were not used to compute expected crash rates in the proposed interchange because historical crash patterns will change significantly with the added/changed roadway and ramp geometry.

6.0 ALTERNATES

6.1 No-Build Transportation Network

The No-Build Alternate includes all existing roads for the 2020, 2022, and 2042 scenarios. Minimal expected development traffic is included, but with no geometric improvements.

6.2 Improvements to Existing Interchanges and Local Road Network

Route 67 improvements to a freeway (ultimately converted to I-57) have been studied since 1997 and the conversion of Route 67 will necessitate improvements to the Route 160 interchange. In order to add additional through lanes on Route 67 over Route 160 the bridge will require either widening of the existing bridge and tightening of the existing loop ramps or a construction of a new interchange.

6.3 Transportation Systems Management Alternates

It was determined that Transportation Systems Management (TSM) solutions would not be sufficient in fulfilling the purpose and need laid out in this report. The introduction of mass transit, tolls or other measures aimed at reducing traffic on Route 67 is not feasible for this primarily rural location.

Other TSM strategies include:

- HOV Vehicle Lanes – The core problem is interstate access, not interstate capacity. HOV lanes on Route 67 or Route 160 would not be appropriate for that facility.
- Ramp Metering – Ramp metering would not address the core problems of inadequate access. Should congestion on Route 67 become a problem in the future, ramp metering can be reevaluated.
- Mass Transit – There are currently no mass transit services in Butler County, and implementation of transit is beyond the scope of this study.

6.4 Build Alternates Involving New or Modified Access

Various build interchange alternates were considered to varying degrees. Preliminary traffic operations were analyzed as part of the screening process to determine which configurations were most feasible and progress for further analysis. The configurations included:

- Partial Cloverleaf
- Diamond Interchange (unsignalized)
- Diamond Interchange (roundabouts)
- Folded Diamond (diamond ramps for southbound with folded ramps for northbound)
- One-lane Diverging Diamond Interchange

After discussions with MoDOT three build alternatives were carried forward to secondary screening. Those include the ALT 1 – Diamond Interchange, ALT 2 – Folded Diamond Interchange, and ALT 3 – Diamond Interchange with roundabouts. Additionally, the no-build alternative was carried forward to serve as a benchmark to judge the build alternatives against.

These alternatives were evaluated for their impacts to roadway safety, traffic operations on both the interstate and arterial roadway network, their impacts to the environment, conformance with existing transportation plans, and total project cost. The three alternatives are discussed in more detailed in the following paragraphs.

Alternative 1 (***Figure 8***) is a diamond interchange with unsignalized ramp terminals. This design keeps the outer ramps from the existing interchange but replaces the loop ramps with new diamond style ramps. The interchange footprint stays within the EA footprint.

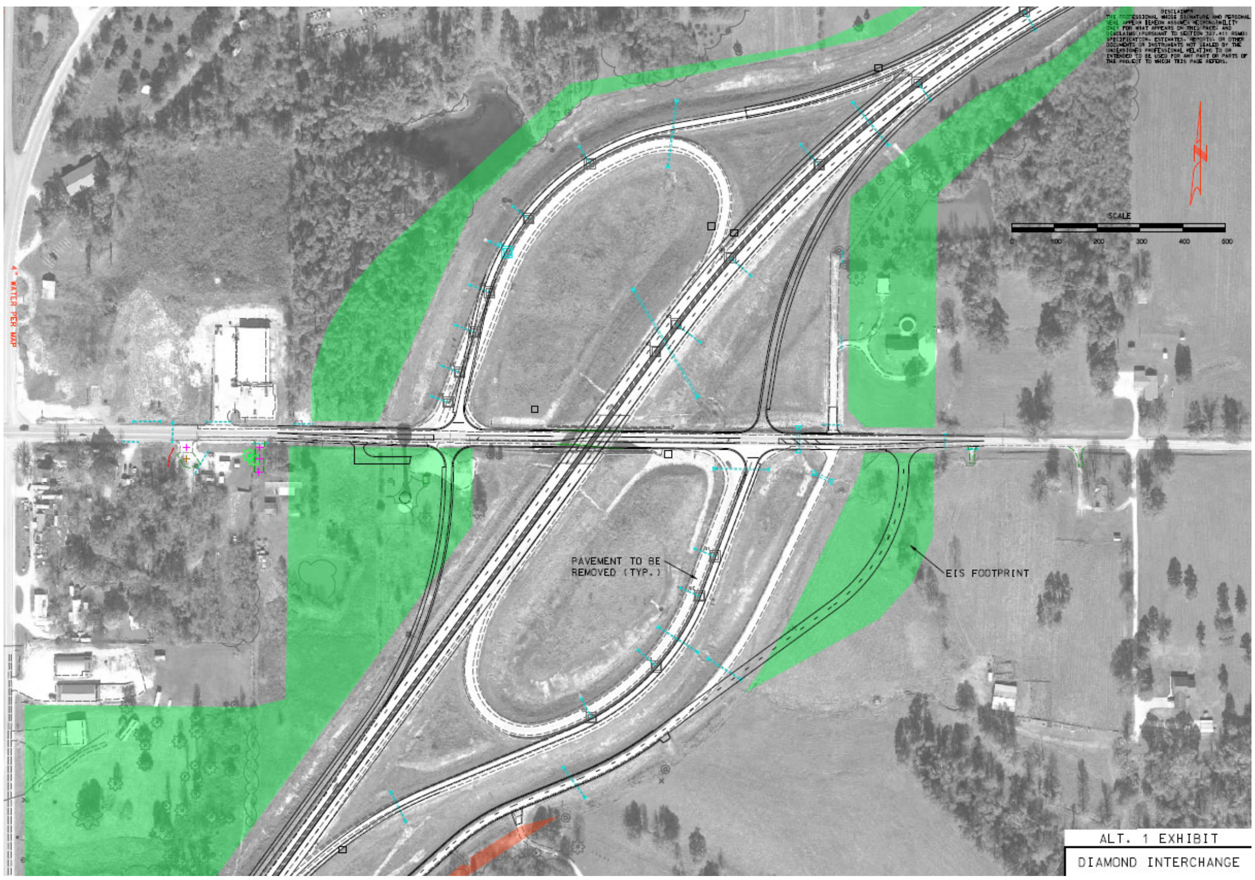


Figure 8 – Alternative 1 Conceptual Design

Alternative 2 (***Figure 9***) is a folded diamond interchange that keeps the same ramp configuration for southbound traffic as Alternative 1, but has folded ramps for northbound traffic. Due to the heavy eastbound to northbound traffic patterns, the loop ramp for this movement was kept in this alternative. The 30 mph loop ramps results in some improvements outside of the current EA limits.

Figure 9 – Alternative 2 Conceptual Design

Alternative 3 (***Figure 10***) is a dumbbell interchange, which is a variation of a diamond interchange where roundabouts are used at the ramp terminals. The ramps remain in the same location as Alternative 1, with only the intersections changing. The roundabouts are intended to ease the eastbound to northbound movement by providing that movement to be prioritized through a roundabout for the northbound ramp terminal.

Figure 10 – Alternative 3 Conceptual Design

7.0 ALTERNATES ANALYSIS

7.1 Safety

An analysis of the safety performance of the proposed alternatives was conducted to quantify the safety impact of 1) the proposed interchange, 2) traffic redistributions on the surface street network. Safety analysis was conducted using Highway Safety Manual (HSM) procedures, as applied by IHSDM , which provide procedures for Rural Arterials, Two-lane & Multi-Lane Rural Roads, as well Freeway segments. **Appendix D** contains a detailed report of the findings summarized in this section. The limits of each roadway and applied HSM methods are listed below:

- US Route 67 North of Route 160 = IHSDM Rural Multi-lane / Freeway
- US Route 67 South of Route 160 = IHSDM Freeway
- Route 160 / MO 158 = IHSDM Rural Arterial & Rural Two-Lane

All existing roadways were evaluated in their current condition, with no identified improvements or enhancements. Roadways were segmented at major intersections and/or major changes in geometry, such as the change from freeway to rural two-lane highway for Route 67 south of Route 160. The proposed changes to Route 67 south of Route 160 was modeled as a freeway, due to the amount and type of development projected.

As noted in the existing conditions summary of crashes (**Section 4.2**), the five-year recorded crash history was found to be higher than predicted crashes on the southern section of Route 67. However, it is noted that relative trends between roadways was consistent between observed and predicted crash patterns. While a calibration factor would normally be used to adjust the SPFs to better reflect observed conditions, this was not done in order to use the same analysis parameters throughout. Also, because the changes to the interchange would cause a major change in the road network, there is an element of unpredictability in determining calibration factors for proposed roadways. Predicted crash frequency was then used to compare all alternatives and scenarios evaluated. While overall crashes may be underrepresented, the relative difference between alternatives and scenarios is expected to be consistent with predicted values and actual conditions.

Three scenarios were evaluated for both the year of opening, 2022, and the 2042 design year. These are:

1. No-build. Includes existing conditions, and forecasted traffic growth to 2022 and 2042.
2. Build. Includes the construction of interchange improvements and extension of the freeway segment to Route 67 to the south. Traffic diversions due to the new roadway network were accounted for.

HSM analysis requires the use of average annual daily traffic (AADT) volumes. For the safety analysis, AADTs were estimated from the PM peak hour traffic volumes estimated for the project and provided as exhibits. A K factor of 0.1 was used to convert peak hour trips to AADT for all roadways.

For the proposed improvements to the interchange, three alternatives were evaluated, which primarily differ in respect to their treatment of the Route 67 ramp terminals and the adjacent roadways.

For all scenarios, total crashes for Route 67 contain the multi-lane highway segment to the north at Route C, the freeway segment to Route 160, the newly constructed freeway segment south of Route 160, and all four ramp segments. Total crashes for Route 160 contain the two-lane highway segment for Route 160, intersections with Route C/V and Hawkeye Ln., and both ramp terminals.

Table 12 and ***Table 13***

Table 12 – Safety Analysis Summary for 2022 Scenarios (Predicted crashes per year)

2022 Scenarios	No-build			Alt 1 Diamond			Alt 2 Folded Dia.			Alt 3 Roundabouts		
Section	*Total*	*FI*	*PDO*	*Total*	*FI*	*PDO*	*Total*	*FI*	*PDO*	*Total*	*FI*	*PDO*
US 67	17.44	7.33	10.14	14.87	6.59	8.30	15.37	6.78	8.60	14.87	6.59	8.36
US 160 / 158	11.72	6.00	5.71	9.45	4.12	5.33	9.91	4.35	5.56	6.67	2.25	4.42
Total	29.16	13.33	15.85	24.32	10.71	13.63	25.28	11.13	14.16	21.54	8.84	12.78
Percent less than no-build				-16.6%	-	-	-13.3%	-	-	-26.1%	-	-

Table 13 – Safety Analysis Summary for 2042 Scenarios (Predicted crashes per year)

2042 Scenarios	No-build			Alt 1 Diamond			Alt 2 Folded Dia.			Alt 3 Roundabouts		
Section	*Total*	*FI*	*PDO*	*Total*	*FI*	*PDO*	*Total*	*FI*	*PDO*	*Total*	*FI*	*PDO*
US 67	22.01	9.30	12.70	18.81	8.35	10.45	19.41	8.59	10.83	18.81	8.35	10.45
US 160 / 158	17.38	9.66	7.72	13.01	6.12	6.89	13.92	6.54	7.38	8.31	2.86	5.45
Total	39.39	18.96	20.42	31.82	14.47	17.34	33.33	15.13	18.21	27.12	11.21	15.90
Percent less than no-build				-19.2%	-	-	-15.4%	-	-	-31.2%	-	-

As can be seen from the tables, with both the 2022 and 2042 design year travel demands, all three proposed alternatives are expected to reduce crashes compared to the no-build scenario. This is due in part to the improved ramp geometry, ramp terminal configuration, and the extension of the freeway segment further south along US 67.

Overall, the safety analysis indicates that the proposed modified interchange at Route 67 will reduce high crash frequencies at this interchange location. Alternative 3 delivers the lowest predicted crash frequency due to the proposed roundabout ramp terminal design and eliminating the tight partial cloverleaf on-ramps. Alternative 1 is the second lowest predicted crash frequency, with Alternative 2 performing the worst among all alternatives, due mainly to the tighter loop ramp geometry at the Northbound entrance ramp and folded diamond layout.

The methods laid out in *Missouri's Blueprint for Safer Roads* [5](State Strategic Highway Safety Plan) have been incorporated insofar as they can be at this point. As the project progresses to design, safety measures will be reevaluated for compliance.

7.2 Operational Performance

7.2.1. No-Build Alternate

Freeway System

The existing Route 67 corridor and no-build alternative is currently an expressway with limited access and ramps at Route 160. The current Highway Capacity Manual 6 (HCM6) procedures do not cover ramps with a single through lane. The existing operational conditions of Route 67 in the Route 160 interchange area was measured using microsimulation tools and is presented in **Section 7.2.3**.

Surface Roads

This section details the operation of intersections for the non-freeway surface roads within the study area. The intersections are along Route 67 and Route 160. The macroscopic traffic analysis software application Synchro 10 was used to analyze the operation of the major intersections along these routes for the AM and PM peaks. Synchro runs can be found in **Appendix E**.

The primary performance measure used in the HCM 6 and the Synchro model to provide a LOS for signalized and unsignalized intersections is control delay, measured in seconds per vehicle. The LOS rating system describes the operational characteristics of an intersection and ranges from A (free flow, minimal delay) to F (extreme congestion, unacceptable delay). The ranges of control delay used to define LOS are shown in ***Table 14***.

Table 14 – Intersection LOS Criteria

LOS	Signalized Intersection Control Delay (sec)	Unsignalized Intersection Control Delay (sec)
A	0-10	0-10
B	>10-20	>10-15
C	>20-35	<15-25
D	>35-55	>25-35
E	>55-80	>35-50
F	>80	>50

Table 15 summarizes the operations for each approach for the study intersections during the morning and evening peak hours for the projected 2022 and 2042 traffic conditions. This table shows average intersection delay (seconds per vehicle), Level of Service (LOS), average and 95th percentile queue (feet) for each approach and overall intersection for the signalized intersection and the results for the stopped approach for unsignalized intersections.

[5] http://contribute.modot.mo.gov/safety/documents/HSPFY2013.pdf

Table 15 – 2022 & 2042 No-Build Intersection Analysis
Average Delay (sec/veh), LOS, 95th Percentile Queue Length (ft)

Intersection*	Approach	2022				2042			
		AM Peak		PM Peak		AM Peak		PM Peak	
		Delay (LOS)	Queues 95th	Delay (LOS)	Queues 95th	Delay (LOS)	Queues 95th	Delay (LOS)	Queues 95th
Route 67 & Route C / CR 323	EB RTE C	19.4 (C)	42	20.0 (C)	26	39.7 (E)	39.7	30.7 (D)	57
	WB CR 323	13.0 (B)	12	13.2 (B)	8	16.0 (C)	22	15.5 (C)	13
Route 67 & CR 360	EB CR 360	13.2 (B)	0	13.9 (B)	0	15.5 (C)	0	16.5 (C)	0
	WB CR 360	9.8 (A)	0	0.0 (A)	0	10.4 (B)	0	0.0 (A)	0
Route 67 & CR 338	EB CR 338	13.2 (B)	0	13.9 (B)	0	15.4 (C)	0	16.5 (C)	0
	WB CR 338	9.8 (A)	0	0.0 (A)	0	10.4 (B)	0	0.0 (A)	0
Route 160 & RTE C/V	NB RTE V	16.0 (C)	16	17.7 (C)	21	23.2 (C)	32	28.1 (D)	45
	SB RTE C	15.3 (C)	14	18.9 (C)	29	24.2 (C)	31	32.1 (D)	65
Route 160 & SB Ramps	SB Route 67 Ramps	9.8 (A)	15	12.0 (B)	54	10.6 (B)	22	14.4 (B)	85
Route 160 & NB Ramps	NB Route 67 Ramps	9.5 (A)	4	9.7 (A)	7	9.9 (A)	6	10.2 (B)	10
Route 160 & Hawkeye	NB Hawkeye	9.2 (A)	0	9.4 (A)	0	9.4 (A)	0	9.7 (A)	0
Route 158 & CR 343	NB CR 343	9.2 (A)	1	8.7 (A)	0	9.5 (A)	1	8.8 (A)	0
	SB CR 343	8.6 (A)	0	8.7 (A)	0	8.6 (A)	0	8.8 (A)	0

** = Unsignalized intersections, delay reported for stopped approach only.*

For the 2022 and 2042 no-build scenarios, traffic growth results in increased delays with the Route C intersection with Route 67 degrading to LOS E by 2042. The microsimulation analysis presented in **Section 7.2.3** is expected to provide more reliable modeling of the interaction of these closely spaced intersections.

As part of the future I-57 conversion, the at-grade intersections along Route 67 will be closed, including Route C / CR 323, CR 360 & CR 338. Traffic that utilizes the west side of these intersections will be diverted to the Route 160 interchange via Route C/V. Traffic that utilizes the east side will access Route 160 via Hawkeye Road or CR 323. *Table **16*** shows the 2042 traffic conditions with these intersections closed.

Table 16 – 2042 No-Build Intersection Analysis with Route 67 at-grade intersections closed Average Delay (sec/veh), LOS, 95th Percentile Queue Length (ft)

Intersection*	Approach	2042			
		AM Peak		PM Peak	
		Delay (LOS)	Queues 95th	Delay (LOS)	Queues 95th
Route 160 & RTE C/V	NB RTE V	24.1 (C)	33	37.4 (D)	60
	SB RTE C	300+ (F)	566	300+ (F)	445
Route 160 & SB Ramps	SB Route 67 Ramps	19.4 (C)	77	37.0 (E)	303
Route 160 & NB Ramps	NB Route 67 Ramps	11.5 (B)	11	11.3 (B)	14
Route 160 & Hawkeye	NB Hawkeye	10.7 (B)	0	10.5 (B)	0
Route 158 & CR 343	NB CR 343	11.1 (B)	1	10.5 (B)	0
	SB CR 343	0.0 (A)	0	0.0 (A)	0

** = Unsignalized intersections, delay reported for stopped approach only.*

The 2042 results with the at-grade intersections closed show that the diverted traffic along Route C to Route 160 results in unacceptable delays at the Route 160 & Route C/V intersection at LOS F and Route 160 and the SB ramps at LOS E. The Route 160 & Route C/V intersection will need to be improved when the Route 67 & Route C intersection is closed as part of the freeway conversion, but this is not part of the proposed project.

7.2.2 Build Alternatives

Freeway System

For the three build scenarios, the macroscopic analysis of the freeway system is independent of the build interchange alternative. Route 67 was divided into basic, on-ramp, off-ramp and weaving section analyses for the build scenario. The freeway facilities module contained within the Highway Capacity Software (HCS) was used to analyze the operation of Route 67 for the morning and evening peaks. HCS runs can be found in **Appendix E**.

The primary performance measure used by the HCM to provide a Level of Service (LOS) for freeway segments is average density. Although speed is a major indicator of the quality of service to drivers, freedom to maneuver within the traffic stream and proximity to other vehicles are equally noticeable concerns. Both are related to the density of the traffic stream. The ranges of density used to define the LOS are shown in *Table **17***.

Table 17 – Freeway LOS Criteria

LOS	Basic Freeway Segment Density Range (pc/mi/ln)	Merge and Diverge Areas Density Range (pc/mi/ln)
A	0-11	0-10
B	>11-18	>10-20
C	>18-26	<20-28
D	>26-35	>28-35
E	>35-45	>35
F	>45	Demand Exceeds Capacity

For each analyzed condition, a freeway schematic was created to show segment distances along Route 67. Within each schematic, each section is numbered, which corresponds directly with the segment number listed in each of the following tables. Segment numbers increase in the direction of traffic flow. Refer to *Table **18*** for a description of the segments for the proposed Route 67 condition.

Table 18 – Route 67 Segment Description

Eastbound			Westbound		
Segment Number	Segment Type	Description	Segment Number	Segment Type	Description
1	Basic	2 Lanes	1	Basic	2 Lanes
2	Off-Ramp	To Route 160	2	Off-Ramp	To Route 160
3	Basic	2 Lanes	3	Basic	2 Lanes
4	On-Ramp	From Route 160	4	On-Ramp	From Route 160
5	Basic	2 Lanes	5	Basic	2 Lanes

The proposed Route 67 interchange was analyzed for the 2022 and 2042 peak hours for the build alternatives. The results are presented in ***Table 19***.

Table 19 – HCM Operations Analysis, Build Scenarios

SOUTHBOUND

	ALT 1 & 3 – Diamond							ALT 2 – Folded Diamond					
Segment	1	2	3	4	5	TOTAL		1	2	3	4	5	TOTAL
Seg. Type	B	OFR	B	ONR	B			B	OFR	B	ONR	B	
Length (ft)	8,500	1,500	2,070	1,500	8,000	4.09 mi		8,500	1,500	2,070	1,500	8,000	4.09 mi
Average Speed (miles/hour)													
2022 AM	65.0	56.3	64.5	59.3	65.0	63.8		65.0	56.3	64.5	59.3	65.0	63.8
2022 PM	65.0	55.8	64.5	59.2	65.0	63.7		65.0	55.8	64.5	59.2	65.0	63.7
2042 AM	65.0	56.3	63.9	59.2	65.0	63.8		65.0	56.3	63.9	59.2	65.0	63.8
2042 PM	65.0	55.7	64.5	59.2	65.0	63.7		65.0	55.7	64.5	59.2	65.0	63.7
2042 AM-I-57	65.0	56.1	64.5	59.2	65.0	63.8		65.0	56.1	64.5	59.2	65.0	63.8
2042 PM-I-57	65.0	55.2	64.5	59.2	65.0	63.6		65.0	55.2	64.5	59.2	65.0	63.6
Average Density (passenger car/mile/lane)													
2022 AM	3.0-A	3.5-A	1.7-A	2.6-A	2.4-A	2.7-A		3.0-A	3.5-A	1.7-A	2.6-A	2.4-A	2.7-A
2022 PM	5.8-A	6.8-A	2.6-A	3.1-A	2.9-A	4.3-A		5.8-A	6.8-A	2.6-A	3.1-A	2.9-A	4.3-A
2042 AM	3.7-A	4.2-A	2.1-A	3.1-A	2.9-A	3.3-A		3.7-A	4.2-A	2.1-A	3.1-A	2.9-A	3.3-A
2042 PM	7.0-A	8.2-A	3.2-A	3.8-A	3.5-A	5.2-A		7.0-A	8.2-A	3.2-A	3.8-A	3.5-A	5.2-A
2042 AM-I-57	4.4-A	5.1-A	2.1-A	3.1-A	2.9-A	3.6-A		4.4-A	5.1-A	2.1-A	3.1-A	2.9-A	3.6-A
2042 PM-I-57	8.9-A	10.4-A	3.1-A	3.8-A	3.5-A	6.1-A		8.9-A	10.4-A	3.1-A	3.8-A	3.5-A	6.1-A

NORTHBOUND

	ALT 1 & 3 – Diamond							ALT 2 – Folded Diamond					
Segment	1	2	3	4	5	TOTAL		1	2	3	4	5	TOTAL
Seg. Type	B	OFR	B	ONR	B			B	OFR	B	ONR	B	
Length (ft)	7,950	1,500	2,420	1,500	8,200	4.09 mi		7,950	1,500	1,080	1,500	9,540	4.09 mi
Average Speed (miles/hour)													
2022 AM	65.0	59.5	64.8	59.6	65.0	64.1		65.0	59.5	64.3	59.7	65.0	64.2
2022 PM	65.0	59.5	64.8	59.7	65.0	64.2		65.0	59.5	64.3	59.8	65.0	64.2
2042 AM	65.0	59.5	64.8	59.5	65.0	64.1		65.0	59.5	64.3	59.6	65.0	64.2
2042 PM	65.0	59.5	64.8	59.6	65.0	64.1		65.0	59.5	64.3	59.7	65.0	64.2
2042 AM-I-57	65.0	59.5	64.8	59.5	65.0	64.1		65.0	59.5	64.3	59.6	65.0	64.2
2042 PM-I-57	65.0	59.4	64.8	59.6	65.0	64.1		65.0	59.4	64.3	59.7	65.0	64.2
Average Density (passenger car/mile/lane)													
2022 AM	2.6-A	2.8-A	2.2-A	7.3-A	6.9-A	4.5-A		2.6-A	2.8-A	2.2-A	7.3-A	6.9-A	4.8-A
2022 PM	2.5-A	2.8-A	2.0-A	4.2-A	4.0-A	3.2-A		2.5-A	2.8-A	2.0-A	4.2-A	4.0-A	3.3-A
2042 AM	3.4-A	3.7-A	3.0-A	9.8-A	9.2-A	6.0-A		3.4-A	3.7-A	3.0-A	9.8-A	9.2-A	6.4-A
2042 PM	3.4-A	3.7-A	2.6-A	5.7-A	5.3-A	4.2-A		3.4-A	3.7-A	2.6-A	5.7-A	5.3-A	4.4-A
2042 AM-I-57	3.4-A	3.7-A	2.7-A	11.5-A	10.9-A	6.8-A		3.4-A	3.7-A	2.7-A	11.5-A	10.9-A	7.3-A
2042 PM-I-57	3.4-A	3.7-A	2.5-A	6.8-A	6.4-A	4.7-A		3.4-A	3.7-A	2.5-A	6.8-A	6.4-A	4.9-A

The proposed freeway conversion of Route 67 results in excellent freeway operations for each alternate with LOS A through the study period. There is minimal difference between the three alternatives on the operations of Route 67.

Surface Roads

7.2.2.1 Alternative 1 – Diamond Interchange

Alternative 1 is a standard diamond interchange that utilizes the existing outside ramps and has unsignalized one-way stop-controlled intersections at the ramp terminals. *Table **20*** summarizes the operations for each approach for the study intersections along the new Route 160 during the morning and evening peak hours for the projected 2022 and 2042 traffic conditions for Alternative 1. These tables show average intersection delay (seconds per vehicle), Level of Service (LOS), 95th percentile queue (feet) for each approach and overall intersection. An additional analysis was conducted for the 2042 design year which includes the ultimate conversion of Route 67 to Interstate 57 and the closure of the Route 67 and Route C intersection, shown in *Table **21***.

Table 20 – 2022 & 2042 Alternative 1 Intersection Analysis
Average Delay (sec/veh), LOS, 95th Percentile Queue Length (ft)

Intersection*	Approach	2022				2042			
		AM Peak		PM Peak		AM Peak		PM Peak	
		Delay (LOS)	Queues 95th	Delay (LOS)	Queues 95th	Delay (LOS)	Queues 95th	Delay (LOS)	Queues 95th
Route 67 & Route C / CR 323	EB RTE C	19.4 (C)	42	20.0 (C)	26	39.7 (E)	111	30.7 (D)	57
	WB CR 323	13.0 (B)	12	13.2 (B)	8	16.0 (C)	22	15.5 (C)	13
Route 160 & RTE C/V	NB RTE V	16.0 (C)	17	17.7 (C)	22	23.4 (C)	33	28.3 (D)	47
	SB RTE C	15.4 (C)	14	19.1(C)	29	24.8 (C)	32	32.7 (D)	66
Route 160 & SB Ramps	SB Route 67 Ramps	9.8 (A)	16	12.1 (B)	55	10.5 (B)	22	14.5 (B)	87
Route 160 & NB Ramps	NB Route 67 Ramps	46.7 (E)	31	16.1 (C)	16	211.6 (F)	106	24.2 (C)	36
Route 160 & Hawkeye	NB Hawkeye	9.2 (A)	0	9.4 (A)	0	9.4 (A)	0	9.7 (A)	0
Route 158 & CR 343	NB CR 343	9.2 (A)	1	8.7 (A)	0	9.5 (A)	1	8.8 (A)	0
	SB CR 343	8.6 (A)	0	8.7 (A)	0	8.6 (A)	0	8.8 (A)	0

** = Unsignalized intersections, delay reported for stopped approach only.*

Table 21 – 2042 Alternative 1 Intersection Analysis with Route 67 at-grade intersections closed
Average Delay (sec/veh), LOS, 95th Percentile Queue Length (ft)

Intersection*	Approach	2042			
		AM Peak		PM Peak	
		Delay (LOS)	Queues 95th	Delay (LOS)	Queues 95th
Route 160 & RTE C/V	NB RTE V	24.3 (C)	35	37.8 (E)	62
	SB RTE C	617.9 (F)	575	397.4 (F)	451
Route 160 & SB Ramps	SB Route 67 Ramps	19.5 (C)	78	40.5 (E)	324
Route 160 & NB Ramps	NB Route 67 Ramps	1,008.7 (F)	244	52.3 (F)	82
Route 160 & Hawkeye	NB Hawkeye	10.7 (B)	0	10.5 (B)	0
Route 158 & CR 343	NB CR 343	11.1 (B)	1	9.0 (A)	0
	SB CR 343	9.2 (A)	0	9.1 (A)	0

** = Unsignalized intersections, delay reported for stopped approach only.*

The analysis of the Route 160 corridor for Alternative 1 shows that the corridor experiences delays by 2042 if all intersections remain unsignalized. These delays are further increased when Route

67 becomes a freeway and additional traffic is diverted to Route 160. In order to operate efficiently the Route 67 northbound ramp terminal intersections will require signalization by 2042 and when Route 67 is converted to a freeway the Route C/V and southbound ramp terminal will also require signalization. *Table **22*** shows the 2042 operations with these intersections signalized. With these additional future improvements, Alternative 1 would provide adequate traffic operations with the study period.

Table 22 – 2042 Alternative 1 Intersection Analysis with Improvements
Average Delay (sec/veh), LOS, 95th Percentile Queue Length (ft)

Intersection*	Approach	2042				2042-Freeway			
		AM Peak		PM Peak		AM Peak		PM Peak	
		Delay (LOS)	Queues 95th	Delay (LOS)	Queues 95th	Delay (LOS)	Queues 95th	Delay (LOS)	Queues 95th
Route 160 & RTE C/V	EB Route 160					20.4 (C)	453	7.9 (A)	128
	WB Route 160					10.2 (B)	161	12.1 (B)	354
	NB RTE V	23.4 (C)	33	28.3 (D)	47	12.5 (B)	42	18.2 (B)	61
	SB RTE C	24.8 (C)	32	32.7 (D)	66	40.8 (D)	200	34.5 (C)	151
	Overall					**21.2 (C)**		**14.9 (B)**	
Route 160 & SB Ramps	EB Route 160					11.2 (B)	259	18.6 (B)	278
	WB Route 160					11.2 (B)	90	14.1 (B)	82
	SB Ramps	10.5 (B)	22	14.5 (B)	87	22.6 (C)	113	6.0 (A)	72
	Overall					**13.3 (B)**		**11.9 (B)**	
Route 160 & NB Ramps	EB Route 160	19.2 (B)	250	11.6 (B)	100	9.0 (A)	82	6.0 (A)	59
	WB Route 160	18.3 (B)	51	16.0 (B)	59	30.4 (C)	142	18.0 (B)	108
	NB Ramps	1.2 (A)	0	2.0 (A)	10	13.9 (B)	38	8.8 (A)	39
	Overall	**18.1 (B)**		**10.9 (B)**		**12.3 (B)**		**8.9 (A)**	

** = Unsignalized intersections, delay reported for stopped approach only.*

7.2.2.2 Alternative 2 – Folded Diamond Interchange

Alternative 2 is a folded diamond interchange with standard diamond ramps for southbound Route 67 and a folded diamond on the northbound side with the eastbound to northbound movement served through a loop ramp. *Table **23*** summarizes the operations for each approach for the study intersections along the new Route 160 during the morning and evening peak hours for the projected 2022 and 2042 traffic conditions for Alternative 2. These tables show average intersection delay (seconds per vehicle), Level of Service (LOS), 95^{th} percentile queue (feet) for each approach and overall intersection. An additional analysis was conducted for the 2042 design year which includes the ultimate conversion of Route 67 to Interstate 57 and the closure of the Route 67 and Route C intersection, shown in *Table **24***.

Table 23 – 2022 & 2042 Alternative 2 Intersection Analysis
Average Delay (sec/veh), LOS, 95th Percentile Queue Length (ft)

Intersection*	Approach	2022				2042			
		AM Peak		PM Peak		AM Peak		PM Peak	
		Delay (LOS)	Queues 95th	Delay (LOS)	Queues 95th	Delay (LOS)	Queues 95th	Delay (LOS)	Queues 95th
Route 67 & Route C / CR 323	EB RTE C	19.4 (C)	42	20.0 (C)	26	39.7 (E)	111	30.7 (D)	57
	WB CR 323	13.0 (B)	12	13.2 (B)	8	16.0 (C)	22	15.5 (C)	13
Route 160 & RTE C/V	NB RTE V	16.0 (C)	16	17.7 (C)	22	23.4 (C)	33	28.3 (D)	47
	SB RTE C	15.4 (C)	14	19.1(C)	29	24.8 (C)	32	32.7 (D)	66
Route 160 & SB Ramps	SB Route 67 Ramps	9.8 (A)	16	12.1 (B)	55	10.5 (B)	22	14.5 (B)	87
Route 160 & NB Ramps	NB Route 67 Ramps	9.6 (A)	4	9.7 (A)	7	10.0 (A)	6	10.2 (B)	10
Route 160 & Hawkeye	NB Hawkeye	9.2 (A)	0	9.4 (A)	0	9.4 (A)	0	9.7 (A)	0
Route 158 & CR 343	NB CR 343	9.2 (A)	1	8.7 (A)	0	9.5 (A)	1	8.8 (A)	0
	SB CR 343	8.6 (A)	0	8.7 (A)	0	8.6 (A)	0	8.8 (A)	0

** = Unsignalized intersections, delay reported for stopped approach only.*

Table 24 – 2042 Alternative 2 Intersection Analysis with Route 67 at-grade intersections closed
Average Delay (sec/veh), LOS, 95th Percentile Queue Length (ft)

Intersection*	Approach	2042			
		AM Peak		PM Peak	
		Delay (LOS)	Queues 95th	Delay (LOS)	Queues 95th
Route 160 & RTE C/V	NB RTE V	24.3 (C)	35	37.8 (E)	62
	SB RTE C	617.9 (F)	575	397.4 (F)	451
Route 160 & SB Ramps	SB Route 67 Ramps	19.5 (C)	78	40.5 (E)	324
Route 160 & NB Ramps	NB Route 67 Ramps	11.6 (B)	11	11.3 (B)	14
Route 160 & Hawkeye	NB Hawkeye	10.7 (B)	0	10.5 (B)	0
Route 158 & CR 343	NB CR 343	11.1 (B)	1	9.0 (A)	0
	SB CR 343	9.2 (A)	0	9.1 (A)	0

** = Unsignalized intersections, delay reported for stopped approach only.*

The analysis of the Route 160 corridor for Alternative 2 shows that the corridor operates efficiently in 2042 with the base project. When Route 67 becomes a freeway and additional traffic is diverted to Route 160 the intersection of Route 160 & Route C/V fails with LOS F and the southbound ramps near capacity with LOS E. In order to operate efficiently the Route C/V intersection will require signalization when the Route 67 and Route C intersection is closed as part of the freeway conversion. *Table* ***25*** shows the 2042 operations with this intersection signalized. With these additional future improvement, Alternative 2 would provide adequate traffic operations with the study period.

Table 25 – 2042 Alternative 1 Intersection Analysis with Improvements
Average Delay (sec/veh), LOS, 95th Percentile Queue Length (ft)

Intersection*	Approach	2042-Freeway			
		AM Peak		PM Peak	
		Delay (LOS)	Queues 95th	Delay (LOS)	Queues 95th
Route 160 & RTE C/V	EB Route 160	26.2 (C)	359	10.0 (A)	137
	WB Route 160	8.7 (A)	96	24.2 (C)	463
	NB RTE V	9.1 (A)	31	12.9 (B)	47
	SB RTE C	37.6 (D)	157	33.3 (C)	147
	Overall	**23.3 (C)**		**21.3 (C)**	
Route 160 & SB Ramps	SB Route 67 Ramps	19.5 (C)	78	40.5 (E)	324
Route 160 & NB Ramps	NB Route 67 Ramps	11.6 (B)	11	11.3 (B)	14

** = Unsignalized intersections, delay reported for stopped approach only.*

7.2.2.3 Alternative 3 – Dumbbell Interchange

Alternative 3 is a dumbbell interchange with roundabouts at the diamond ramp terminals. Both roundabouts have single lanes. *Table **26*** summarizes the operations for each approach for the study intersections along the new Route 160 during the morning and evening peak hours for the projected 2022 and 2042 traffic conditions for Alternative 3. These tables show average intersection delay (seconds per vehicle), Level of Service (LOS), 95th percentile queue (feet) for each approach and overall intersection. An additional analysis was conducted for the 2042 design year which includes the ultimate conversion of Route 67 to Interstate 57 and the closure of the Route 67 and Route C intersection, shown in *Table **27***.

Table 26 – 2022 & 2042 Alternative 3 Intersection Analysis
Average Delay (sec/veh), LOS, 95th Percentile Queue Length (ft)

Intersection*	Approach	2022				2042			
		AM Peak		PM Peak		AM Peak		PM Peak	
		Delay (LOS)	Queues 95th	Delay (LOS)	Queues 95th	Delay (LOS)	Queues 95th	Delay (LOS)	Queues 95th
Route 67 & Route C / CR 323	EB RTE C	19.4 (C)	42	20.0 (C)	26	39.7 (E)	111	30.7 (D)	57
	WB CR 323	13.0 (B)	12	13.2 (B)	8	16.0 (C)	22	15.5 (C)	13
Route 160 & RTE C/V	NB RTE V	16.0 (C)	16	17.7 (C)	22	23.4 (C)	33	28.3 (D)	47
	SB RTE C	15.4 (C)	14	19.1(C)	29	24.8 (C)	32	32.7 (D)	66
Route 160 & SB Ramps	EB Route 160	8.5 (A)	106	5.0 (A)	34	12.4 (B)	203	5.9 (A)	50
	WB Route 160	3.2 (A)	0	3.6 (A)	0	3.4 (A)	0	3.9 (A)	0
	SB Ramps	4.1 (A)	15	6.5 (A)	48	4.5 (A)	20	7.9 (A)	65
	Overall	**7.2 (A)**		**5.5 (A)**		**10.3 (B)**		**6.4 (A)**	
Route 160 & NB Ramps	EB Route 160	7.4 (A)	0	4.7 (A)	0	10.1 (B)	0	5.5 (A)	0
	WB Route 160	6.1 (A)	10	4.6 (A)	10	8.2 (A)	15	5.5 (A)	14
	NB Ramps	6.2 (A)	6	4.7 (A)	8	8.1 (A)	10	5.6 (A)	12
	Overall	**7.2 (A)**		**4.7 (A)**		**9.8 (A)**		**5.5 (A)**	
Route 160 & Hawkeye	NB Hawkeye	9.2 (A)	0	9.4 (A)	0	9.4 (A)	0	9.7 (A)	0
Route 158 & CR 343	NB CR 343	9.2 (A)	1	8.7 (A)	0	9.5 (A)	1	8.8 (A)	0
	SB CR 343	8.6 (A)	0	8.7 (A)	0	8.6 (A)	0	8.8 (A)	0

** = Unsignalized intersections, delay reported for stopped approach only.*

Table 27 – 2042 Alternative 3 Intersection Analysis with Route 67 at-grade intersections closed
Average Delay (sec/veh), LOS, 95th Percentile Queue Length (ft)

Intersection*	Approach	2042			
		AM Peak		PM Peak	
		Delay (LOS)	Queues 95th	Delay (LOS)	Queues 95th
Route 160 & RTE C/V	NB RTE V	24.3 (C)	35	37.8 (E)	62
	SB RTE C	617.9 (F)	575	397.4 (F)	451
Route 160 & SB Ramps	EB Route 160	23.8 (C)	418	7.6 (A)	75
	WB Route 160	3.5 (A)	0	4.1 (A)	0
	SB Ramps	5.4 (A)	31	13.3 (B)	215
	Overall	**18.6 (C)**		**9.8 (A)**	
Route 160 & NB Ramps	EB Route 160	15.9 (C)	0	6.9 (A)	0
	WB Route 160	14.0 (B)	45	7.2 (A)	25
	NB Ramps	11.9 (B)	19	6.9 (A)	16
	Overall	**15.4 (C)**		**7.0 (A)**	
Route 160 & Hawkeye	NB Hawkeye	9.4 (A)	0	9.7 (A)	0
Route 158 & CR 343	NB CR 343	9.5 (A)	1	8.8 (A)	0
	SB CR 343	8.6 (A)	0	8.8 (A)	0

** = Unsignalized intersections, delay reported for stopped approach only.*

The analysis of the Route 160 corridor for Alternative 3 shows that the corridor operates efficiently in 2042 with the base project. When Route 67 becomes a freeway and additional traffic is diverted to Route 160 the intersection of Route 160 & Route C/V fails with LOS F. In order to operate efficiently the Route C/V intersection will require improvements and in Alternate 3 a roundabout is proposed when the Route 67 and Route C intersection is closed as part of the freeway conversion. *Table **28*** shows the 2042 operations with this intersection converted to a roundabout. With this additional future improvement, Alternative 3 would provide adequate traffic operations with the study period.

Table 28 – 2042 Alternative 3 Intersection Analysis with Improvements
Average Delay (sec/veh), LOS, 95^{th} Percentile Queue Length (ft)

Intersection*	**Approach**	**2042-Freeway**			
		AM Peak		**PM Peak**	
		Delay (LOS)	**Queues 95th**	**Delay (LOS)**	**Queues 95th**
Route 160 & RTE C/V	EB Route 160	23.1 (C)	614	7.7 (A)	56
	WB Route 160	5.5 (A)	39	13.5 (B)	183
	NB RTE V	11.4 (B)	20	6.2 (A)	14
	SB RTE C	6.2 (A)	34	9.7 (A)	43
	Overall	**15.5 (C)**		**11.0 (B)**	

** = Unsignalized intersections, delay reported for stopped approach only.*

*Table **29*** provides the macroscopic comparison of the Route 160 alternatives and shows that Alternative 3 provides the best traffic operations for the corridor and provides good operations for the interchange. Further analysis utilizing microsimulation in **Section 7.2.3** validates these conclusions.

Table 29 – Route 160 Performance Summary

			Route 160 & Route C/V	Route 160 & SB Ramps	Route 160 & NB Ramps
2022	AM	ALT 1	16.0 (C)	9.8 (A)	46.7 (E)
		ALT 2	16.0 (C)	9.8 (A)	9.6 (A)
		ALT 3	16.0 (C)	7.2 (A)	7.2 (A)
	PM	ALT 1	19.1 (C)	12.1 (B)	16.1 (C)
		ALT 2	19.1 (C)	12.1 (B)	9.7 (A)
		ALT 3	19.1 (C)	5.5 (A)	4.7 (A)
2042	AM	ALT 1	24.8 (C)	10.5 (B)	211.6 (F)
		ALT 1 - Imp	24.8 (C)	10.5 (B)	18.1 (B)
		ALT 2	24.8 (C)	10.5 (B)	10.0 (A)
		ALT 3	24.8 (C)	10.3 (B)	9.8 (A)
	PM	ALT 1	32.7 (D)	14.5 (B)	24.2 (C)
		ALT 1 - Imp	32.7 (D)	14.5 (B)	10.9 (B)
		ALT 2	32.7 (D)	14.5 (B)	10.2 (B)
		ALT 3	32.7 (D)	6.4 (A)	5.5 (A)
2042 with Freeway Conversion with Improvements	AM	ALT 1	21.2 (C)	13.3 (B)	12.3 (B)
		ALT 2	23.3 (C)	19.5 (C)	11.6 (B)
		ALT 3	15.5 (C)	18.6 (C)	15.4 (C)
	PM	ALT 1	14.9 (B)	11.9 (B)	8.9 (A)
		ALT 2	21.3 (C)	40.5 (E)	11.3 (B)
		ALT 3	11.0 (B)	9.8 (A)	7.0 (A)

7.2.3 Microsimulation Analysis

The previous sections analyzed the freeway and signalized intersections independent of each other using HCM methodologies. A microsimulation model of the entire study area was created using VISSIM (version 2021.03). The purpose of this model was to analyze the entire study area as a whole and quantify the impacts one element in the network may have on the rest of the network. The single existing through lane along Route 67 at the Route 160 interchange is particularly challenging to accurately model without microsimulation due to the inability of HCM procedures to analyze this type of facility. Results are presented for the no-build and build alternatives in order to determine if the build alternatives would operate more efficiently for Route 67 and the surface streets.

VISSIM was used to determine the average delay at each signalized intersection and the average speed of Route 67 between each ramp or intersection for the peak hour in the morning and evening. This VISSIM model was calibrated using the speeds observed along Route 67 and intersection delays in 2020. VISSIM results provided within this report are the average of 10 runs of the VISSIM model. Multiple runs were conducted due to the stochastic nature of the model and reflect the variations in travel demand and behavior.

Table 30 shows the operations for each approach for the study intersections during the morning and evening peak hours for existing traffic conditions as estimated by VISSIM. This and the subsequent tables show average intersection delay (seconds per vehicle), Level of Service (LOS), average and maximum queue (feet) for each approach and overall intersection. More detailed summaries of the VISSIM runs are provided in **Appendix E.**

Table 30 – 2020 Existing Intersection Analysis - VISSIM
Average Delay (sec/veh), LOS, Avg and Maximum Queue Length (ft)

Intersection	Approach	2020			
		AM Peak		PM Peak	
		Delay (LOS)	Queues Avg/95th	Delay (LOS)	Queues Avg/95th
Route 160 & Route C / V	NB Route V	11.6 (B)	2/68	18.3 (C)	5/96
	SB Route C	11.2 (B)	2/59	19.5 (C)	8/97
	EB Route 160	0.5 (A)	0/60	0.8 (A)	0/60
	WB Route 160	1.2 (A)	1/71	0.8 (A)	0/80
	Intersection	**2.0 (A)**		**4.1 (A)**	
Route 160 & SB Route 67 Ramps	EB Route 160	1.0 (A)	0/94	0.6 (A)	0/34
	WB Route 160	0.2 (A)	0/6	0.3 (A)	0/0
	SB Ramps	8.8 (A)	8/164	16.0 (C)	43/321
	Intersection	**2.3 (A)**		**7.7 (A)**	
Route 160 & NB Route 67 Ramps	EB Route 160	0.8 (A)	0/0	0.5 (A)	0/0
	WB Route 160	0.0 (A)	0/0	0.0 (A)	0/0
	NB Ramps	8.2 (A)	0/2	8.4 (A)	0/2
	Intersection	**1.1 (A)**		**1.6 (A)**	
Route 158 & Hawkeye	EB Route 160	0.0 (A)	0/0	0.0 (A)	0/0
	WB Route 160	0.4 (A)	0/0	0.1 (A)	0/0
	NB Hawkeye	6.0 (A)	0/29	6.3 (A)	0/23
	Intersection	**0.3 (A)**		**0.2 (A)**	
Route 158 & CR 343	EB Route 158	0.5 (A)	0/0	0.5 (A)	0/2
	WB Route 158	0.7 (A)	0/0	0.7 (A)	0/0
	NB CR 343	5.3 (A)	0/58	0.0 (A)	0/0
	SB CR 343	5.7 (A)	0/57	6.5 (A)	0/24
	Intersection	**1.1 (A)**		**0.6 (A)**	
US Route 67 & Route C / CR 323	NB Route 67	0.2 (A)	0/37	0.1 (A)	0/34
	SB Route 67	1.7 (A)	7/208	1.6 (A)	4/159
	EB Route C	23.5 (C)	10/158	39.8 (E)	16/168
	WB CR 323	8.4 (A)	1/53	11.6 (B)	1/49
	Intersection	**3.4 (A)**		**3.9 (A)**	
US Route 67 & CR 360	NB Route 67	0.0 (A)	0/0	0.0 (A)	0/0
	SB Route 67	0.0 (A)	0/0	0.1 (A)	0/0
	EB CR 360	0.0 (A)	0/0	0.0 (A)	0/0
	WB CR 360	0.0 (A)	0/0	0.0 (A)	0/0
	Intersection	**0.0 (A)**		**0.0 (A)**	
US Route 67 & CR 338	NB Route 67	1.2 (A)	0/7	1.1 (A)	0/0
	SB Route 67	1.0 (A)	0/0	1.1 (A)	0/4
	EB CR 338	1.8 (A)	0/6	2.3 (A)	0/10
	WB CR 338	0.3 (A)	0/0	0.0 (A)	0/0
	Intersection	**1.1 (A)**		**1.1 (A)**	

The existing VISSM models replicate the traffic conditions that were observed, which includes delays during the evening peak hour for eastbound Route C approach at Route 67. With the current traffic volumes the delays are reasonable, but as traffic grows delays at some stopped approaches will increase. ***Table 31*** shows the results of the 2022 and 2042 analysis of the existing conditions with background growth of traffic.

Table 31 – 2022 & 2042 Existing Intersection Analysis - VISSIM
Average Delay (sec/veh), LOS, Avg and Maximum Queue Length (ft)

Intersection	Approach	2022				2042			
		AM Peak		PM Peak		AM Peak		PM Peak	
		Delay (LOS)	Queues Avg/Max	Delay (LOS)	Queues Avg/Max	Delay (LOS)	Queues Avg/95th	Delay (LOS)	Queues Avg/95th
Route 160 & Route C / V	NB Route V	11.3 (B)	2/65	20.3 (C)	6/102	18.8 (C)	5/108	56.8 (F)	27/212
	SB Route C	11.1 (B)	2/54	19.6 (C)	9/100	15.8 (C)	5/58	62.4 (F)	45/205
	EB Route 160	0.6 (A)	0/33	1.0 (A)	0/72	0.8 (A)	0/105	1.3 (A)	1/102
	WB Route 160	1.1 (A)	0/79	0.9 (A)	1/102	1.9 (A)	1/100	1.3 (A)	1/124
	Intersection	**2.0 (A)**		**4.4 (A)**		**3.1 (A)**		**12.3 (B)**	
Route 160 & SB Route 67 Ramps	EB Route 160	0.9 (A)	0/59	0.6 (A)	0/30	1.6 (A)	1/176	1.1 (A)	0/55
	WB Route 160	0.2 (A)	0/8	0.3 (A)	0/2	0.2 (A)	0/19	0.4 (A)	0/8
	SB Ramps	8.4 (A)	8/155	17.4 (C)	49/354	10.8 (B)	12/177	38.8 (E)	148/560
	Intersection	**2.2 (A)**		**8.4 (A)**		**2.9 (A)**		**17.6 (C)**	
Route 160 & NB Route 67 Ramps	EB Route 160	0.8 (A)	0/0	0.5 (A)	0/0	1.1 (A)	0/0	0.6 (A)	0/0
	WB Route 160	0.0 (A)	0/0	0.0 (A)	0/0	0.1 (A)	0/0	0.0 (A)	0/0
	NB Ramps	8.5 (A)	0/2	8.6 (A)	0/4	8.8 (A)	0/13	9.3 (A)	0/4
	Intersection	**1.2 (A)**		**1.6 (A)**		**1.4 (A)**		**1.8 (A)**	
Route 158 & Hawkeye	EB Route 160	0.0 (A)	0/0	0.0 (A)	0/0	0.0 (A)	0/0	0.0 (A)	0/0
	WB Route 160	0.4 (A)	0/0	0.1 (A)	0/0	0.4 (A)	0/0	0.1 (A)	0/0
	NB Hawkeye	6.1 (A)	0/29	5.8 (A)	0/23	6.2 (A)	0/32	5.9 (A)	0/23
	Intersection	**0.3 (A)**		**0.2 (A)**		**0.4 (A)**		**0.1 (A)**	
Route 158 & CR 343	EB Route 158	0.5 (A)	0/0	0.4 (A)	0/2	0.5 (A)	0/0	0.4 (A)	0/0
	WB Route 158	0.7 (A)	0/2	0.7 (A)	0/2	0.7 (A)	0/0	0.7 (A)	0/2
	NB CR 343	5.4 (A)	0/58	4.4 (A)	0/14	5.6 (A)	0/58	4.4 (A)	0/14
	SB CR 343	5.6 (A)	0/57	5.4 (A)	0/24	5.9 (A)	0/63	5.4 (A)	0/24
	Intersection	**1.0 (A)**		**0.6 (A)**		**1.1 (A)**		**0.6 (A)**	
US Route 67 & Route C / CR 323	NB Route 67	0.2 (A)	0/37	0.1 (A)	0/35	0.2 (A)	0/59	0.1 (A)	1/61
	SB Route 67	1.8 (A)	9/231	1.6 (A)	6/192	2.5 (A)	96/405	1.8 (A)	85/378
	EB Route C	24.6 (C)	11/162	37.0 (E)	16/156	70.3 (F)	67/328	127.9 (F)	91/329
	WB CR 323	8.4 (A)	1/60	12.0 (B)	1/39	14.7 (B)	3/102	15.4 (C)	2/74
	Intersection	**3.5 (A)**		**3.7 (A)**		**8.7 (A)**		**10.2 (B)**	
US Route 67 & CR 360	NB Route 67	0.0 (A)	0/0	0.0 (A)	0/0	0.0 (A)	0/0	0.0 (A)	0/0
	SB Route 67	0.1 (A)	0/0	0.1 (A)	0/2	0.1 (A)	0/0	0.1 (A)	0/15
	EB CR 360	0.0 (A)	0/0	0.0 (A)	0/0	0.0 (A)	0/0	0.0 (A)	0/0
	WB CR 360	0.0 (A)	0/0	0.0 (A)	0/0	0.0 (A)	0/0	0.0 (A)	0/0
	Intersection	**0.1 (A)**		**0.1 (A)**		**0.0 (A)**		**0.1 (A)**	
US Route 67 & CR 338	NB Route 67	1.1 (A)	0/7	1.1 (A)	0/0	1.2 (A)	0/2	1.2 (A)	0/0
	SB Route 67	1.0 (A)	0/0	1.0 (A)	0/0	1.0 (A)	0/4	1.2 (A)	0/0
	EB CR 338	1.2 (A)	0/2	1.1 (A)	0/0	1.6 (A)	0/8	1.5 (A)	0/4
	WB CR 338	0.2 (A)	0/0	0.0 (A)	0/0	0.2 (A)	0/0	0.0 (A)	0/0
	Intersection	**1.1 (A)**		**1.1 (A)**		**1.1 (A)**		**1.2 (A)**	

The analysis of the existing conditions without development traffic shows that the existing Route 160 corridor will operate efficiently in 2022 without geometric improvements, but by 2042 general traffic growth in the area will put additional strains on the existing roadway network. In particular, the Route C intersection with Route 67 becomes congested in both peak hours and the Route C and southbound ramp terminal intersections have LOS E or F during the evening peak hour.

With the future conversion of Route 67 to Interstate 57 the intersection of Route C and Route 67 is expected to be closed by 2042. *Table **32*** shows the results of the VISSIM analysis where Route existing at-grade intersections are closed and traffic is diverted to Route 160.

Table 32 –2042 Existing Intersection Analysis – VISSIM – Freeway Conversion Average Delay (sec/veh), LOS, Avg and Maximum Queue Length (ft)

Intersection	Approach	2042			
		AM Peak		PM Peak	
		Delay (LOS)	Queues Avg/95th	Delay (LOS)	Queues Avg/95th
Route 160 & Route C / V	NB Route V	19.6 (C)	6/102	43 (E)	19/156
	SB Route C	624.4 (F)	513/587	665.9 (F)	504/582
	EB Route 160	1.0 (A)	1/99	1.4 (A)	1/101
	WB Route 160	5.2 (A)	8/220	3.6 (A)	8/217
	Intersection	**65.0 (F)**		**67.1 (F)**	
Route 160 & SB Route 67 Ramps	EB Route 160	1.9 (A)	2/157	1.5 (A)	1/110
	WB Route 160	0.3 (A)	0/8	0.5 (A)	0/33
	SB Ramps	97.5 (F)	230/715	112.3 (F)	1529/1714
	Intersection	**20.4 (C)**		**47.9 (E)**	
Route 160 & NB Route 67 Ramps	EB Route 160	1.7 (A)	0/0	0.7 (A)	0/0
	WB Route 160	0.4 (A)	0/0	0.1 (A)	0/0
	NB Ramps	11.2 (B)	0/53	11.4 (B)	0/21
	Intersection	**2.2 (A)**		**2.0 (A)**	
Route 158 & Hawkeye	EB Route 160	0.0 (A)	0/0	0.0 (A)	0/0
	WB Route 160	0.9 (A)	0/0	0.4 (A)	0/0
	NB Hawkeye	6.4 (A)	0/32	5.5 (A)	0/0
	Intersection	**0.5 (A)**		**0.2 (A)**	
Route 158 & CR 343	EB Route 158	0.5 (A)	0/0	0.5 (A)	0/0
	WB Route 158	0.7 (A)	0/0	0.7 (A)	0/0
	NB CR 343	0.1 (A)	0/0	0.1 (A)	0/0
	SB CR 343	0.1 (A)	0/0	0.1 (A)	0/0
	Intersection	**0.6 (A)**		**0.6 (A)**	

The additional traffic along Route 160 results in significant delays at the Route C/V and southbound ramp intersections and results in queues on the southbound Route 67 off-ramp spilling back onto the mainline. These existing capacity constraints on Route 160 are similar to those estimated by the previous Synchro analysis, although the delays and queues are higher due to VISSIM properly analyzing the interaction of these intersections.

Alternative 1

The proposed Alternative 1 of the Route 160 interchange was modeled in VISSIM for the 2022 and 2042 scenarios. ***Table 33*** shows the results of these VISSIM models with the modified Route 160 interchange.

Table 33 – Proposed Alternative 1 Intersection Analysis – VISSIM
Average Delay (sec/veh), LOS, Avg and Maximum Queue Length (ft)

Intersection	Approach	2022				2042			
		AM Peak		PM Peak		AM Peak		PM Peak	
		Delay (LOS)	Queues Avg/Max	Delay (LOS)	Queues Avg/Max	Delay (LOS)	Queues Avg/95th	Delay (LOS)	Queues Avg/95th
Route 160 & Route C / V	NB Route V	14.2 (B)	2/82	24.6 (C)	7/104	32.6 (D)	11/151	78.7 (F)	40/206
	SB Route C	12.0 (B)	3/54	18.0 (C)	8/91	20.8 (C)	6/76	45.1 (E)	29/145
	EB Route 160	0.7 (A)	0/83	0.9 (A)	0/66	0.8 (A)	0/68	1.3 (A)	1/98
	WB Route 160	1.1 (A)	0/77	0.9 (A)	1/91	1.7 (A)	1/94	1.3 (A)	1/126
	Intersection	**2.3 (A)**		**4.6 (A)**		**4.2 (A)**		**12.3 (B)**	
Route 160 & SB Route 67 Ramps	EB Route 160	0.8 (A)	0/0	0.2 (A)	0/0	1.1 (A)	0/0	0.3 (A)	0/0
	WB Route 160	0.6 (A)	0/22	0.7 (A)	0/13	1.0 (A)	0/34	0.9 (A)	0/21
	SB Ramps	8.4 (A)	6/132	21.0 (C)	56/388	11.3 (B)	12/187	69.1 (F)	347/837
	Intersection	**2.1 (A)**		**9.9 (A)**		**2.8 (A)**		**30.7 (D)**	
Route 160 & NB Route 67 Ramps	EB Route 160	3.5 (A)	1/109	2.3 (A)	0/34	4.7 (A)	3/230	2.8 (A)	1/81
	WB Route 160	0.0 (A)	0/0	0.0 (A)	0/0	0.0 (A)	0/0	0.0 (A)	0/0
	NB Ramps	20.0 (C)	3/101	11.9 (B)	4/99	32.3 (D)	8/121	16.7 (C)	8/139
	Intersection	**4.1 (A)**		**3.3 (A)**		**5.8 (A)**		**4.4 (A)**	
Route 158 & Hawkeye	EB Route 160	0.0 (A)	0/0	0.0 (A)	0/0	0.0 (A)	0/0	0.0 (A)	0/0
	WB Route 160	0.7 (A)	0/0	0.2 (A)	0/0	0.8 (A)	0/0	0.2 (A)	0/0
	NB Hawkeye	6.1 (A)	0/31	6.0 (A)	0/19	6.8 (A)	0/31	6.1 (A)	0/19
	Intersection	**0.5 (A)**		**0.2 (A)**		**0.6 (A)**		**0.2 (A)**	
Route 158 & CR 343	EB Route 158	0.5 (A)	0/0	0.4 (A)	0/0	0.5 (A)	0/0	0.5 (A)	0/11
	WB Route 158	0.7 (A)	0/0	0.7 (A)	0/0	0.7 (A)	0/2	0.6 (A)	0/0
	NB CR 343	5.4 (A)	0/58	4.5 (A)	0/14	5.6 (A)	0/58	4.4 (A)	0/14
	SB CR 343	5.6 (A)	0/57	5.4 (A)	0/24	6.0 (A)	0/63	5.4 (A)	0/24
	Intersection	**1.0 (A)**		**0.6 (A)**		**1.1 (A)**		**0.6 (A)**	
US Route 67 & Route C / CR 323	NB Route 67	0.1 (A)	0/42	0.1 (A)	0/35	0.2 (A)	0/43	0.1 (A)	1/64
	SB Route 67	1.9 (A)	6/227	1.6 (A)	3/157	2.4 (A)	78/376	1.8 (A)	65/342
	EB Route C	22.5 (C)	10/159	35.1 (E)	15/153	60.5 (F)	59/314	102 (F)	71/289
	WB CR 323	12.1 (B)	2/64	13.0 (B)	1/40	19.4 (C)	6/118	17.1 (C)	2/73
	Intersection	**3.5 (A)**		**3.6 (A)**		**8.0 (A)**		**8.4 (A)**	

With the proposed diamond interchange the Route 160 corridor operates efficiently initially in 2022, but as traffic volumes increase longer delays occur by 2042. During the 2042 evening peak hour the Route 160 & Route C/V and southbound ramp intersections have long delays (LOS E or F) for the stop controlled approaches. The Route C intersection with Route 67 continues to have long delays as traffic increase along Route 67.

The Route C intersection with Route 67 will eventually be closed when Route 67 becomes a freeway in this area. ***Table 34*** provides the results of the VISSIM models with the future conversion of Route 67 to a freeway and closure of the Route C intersection and the associated diversion of traffic to the Route 160 interchange. The following table includes a scenario with the unsignalized intersections along Route 160 and a scenario with the improvements previously identified **Section 7.2.2** (signalization of the Route C/V and ramp intersections).

Table 34 – 2042 Proposed Alternative 1 Intersection Analysis – VISSIM – Freeway Conversion Average Delay (sec/veh), LOS, Avg and Maximum Queue Length (ft)

Intersection	Approach	2042-Freeway (Unsignalized Intersections)				2042-Freeway (Signalized Route 160 & Ramps and Route 160 & Route C)			
		AM Peak		PM Peak		AM Peak		PM Peak	
		Delay (LOS)	Queues Avg/Max	Delay (LOS)	Queues Avg/Max	Delay (LOS)	Queues Avg/95th	Delay (LOS)	Queues Avg/95th
Route 160 & Route C / V	NB Route V	33.9 (D)	11/141	52.9 (F)	24/168	18.8 (B)	5/102	19.9 (B)	7/132
	SB Route C	644 (F)	511/590	594.7 (F)	501/585	36.5 (D)	50/295	30.1 (C)	36/211
	EB Route 160	1.0 (A)	1/120	1.6 (A)	1/102	14.3 (B)	55/583	12.5 (B)	20/292
	WB Route 160	4.3 (A)	5/170	3.2 (A)	6/185	14.5 (B)	21/331	17.0 (B)	78/696
	Intersection	**65 (F)**		**68.7 (F)**		**18.6 (B)**		**18.2 (B)**	
Route 160 & SB Route 67 Ramps	EB Route 160	1.5 (A)	1/47	0.3 (A)	0/0	9.1 (A)	31/529	15.6 (B)	39/410
	WB Route 160	1.7 (A)	1/33	1.0 (A)	0/38	8.5 (A)	3/108	18.5 (B)	14/219
	SB Ramps	87.9 (F)	207/684	127.3 (F)	1567/1714	24.5 (C)	36/373	14.7 (B)	47/571
	Intersection	**18.4 (C)**		**51.0 (F)**		**11.9 (B)**		**15.6 (B)**	
Route 160 & NB Route 67 Ramps	EB Route 160	9.1 (A)	33/469	3.4 (A)	2/114	20.5 (C)	102/721	14.9 (B)	32/348
	WB Route 160	0.0 (A)	0/0	0.0 (A)	0/0	13.4 (B)	14/201	9.7 (A)	8/171
	NB Ramps	40.5 (E)	18/180	24.0 (C)	14/150	29.7 (C)	13/160	21.8 (C)	12/169
	Intersection	**9.8 (A)**		**5.4 (A)**		**20.1 (C)**		**14.7 (B)**	
Route 158 & Hawkeye	EB Route 160	0.1 (A)	0/0	0.0 (A)	0/0	0.2 (A)	0/0	0.2 (A)	0/0
	WB Route 160	1.7 (A)	0/0	0.8 (A)	0/0	5.6 (A)	1/83	2.1 (A)	0/8
	NB Hawkeye	6.7 (A)	0/31	6.4 (A)	0/19	14.9 (B)	0/31	6.2 (A)	0/19
	Intersection	**1.0 (A)**		**0.5 (A)**		**3.2 (A)**		**1.2 (A)**	
Route 158 & CR 343	EB Route 158	0.6 (A)	0/0	0.6 (A)	0/0	0.8 (A)	0/2	0.7 (A)	0/0
	WB Route 158	0.8 (A)	0/0	0.7 (A)	0/0	0.8 (A)	0/5	0.7 (A)	0/2
	NB CR 343	6.1 (A)	0/58	4.4 (A)	0/14	5.9 (A)	0/58	4.4 (A)	0/14
	SB CR 343	0.7 (A)	0/0	0.6 (A)	0/0	0.7 (A)	0/0	0.6 (A)	0/0
	Intersection	**0.8 (A)**		**0.7 (A)**		**0.9 (A)**		**0.7 (A)**	

With the additional traffic on Route 160 from the closure of the Route C/Route 67 intersection the critical stop-controlled movements grow to have excessive delays. With the signalization of the three intersections along Route 160 the intersections operate with acceptable delays (LOS C or better for the intersection with each approach being LOS D or better). The full VISSM results are provided in **Appendix E**

Alternative 2

Alternative 2 is a folded diamond interchange folded diamond interchange with standard diamond ramps for southbound Route 67 and a folded diamond on the northbound side with the eastbound to northbound movement served through a loop ramp. ***Table 35*** shows the results of the VISSIM model for the base project with Alternate 2.

Table 35 – Proposed Alternative 2 Intersection Analysis – VISSIM
Average Delay (sec/veh), LOS, Avg and Maximum Queue Length (ft)

Intersection	Approach	2022				2042			
		AM Peak		PM Peak		AM Peak		PM Peak	
		Delay (LOS)	Queues Avg/Max	Delay (LOS)	Queues Avg/Max	Delay (LOS)	Queues Avg/95th	Delay (LOS)	Queues Avg/95th
Route 160 & Route C / V	NB Route V	14.4 (B)	2/82	30.8 (D)	10/130	31.2 (D)	10/146	94.9 (F)	52/232
	SB Route C	11.3 (B)	2/52	17.1 (C)	7/91	20.9 (C)	6/75	46.7 (E)	31/151
	EB Route 160	0.6 (A)	0/58	1 (A)	0/66	0.8 (A)	0/92	1.4 (A)	1/110
	WB Route 160	1.0 (A)	0/80	0.9 (A)	1/81	1.5 (A)	1/99	1.1 (A)	1/106
	Intersection	**2.3 (A)**		**4.9 (A)**		**4.1 (A)**		**13.8 (B)**	
Route 160 & SB Route 67 Ramps	EB Route 160	0.7 (A)	0/0	0.2 (A)	0/0	1.0 (A)	0/0	0.3 (A)	0/0
	WB Route 160	0.6 (A)	0/22	0.7 (A)	0/11	1.0 (A)	0/34	1.0 (A)	0/23
	SB Ramps	8.6 (A)	7/138	21.2 (C)	55/388	11.7 (B)	12/203	67.6 (F)	338/822
	Intersection	**2.1 (A)**		**10.1 (B)**		**2.7 (A)**		**30 (D)**	
Route 160 & NB Route 67 Ramps	EB Route 160	4.4 (A)	1/77	0.2 (A)	0/19	10.5 (B)	4/90	0.4 (A)	0/37
	WB Route 160	0.9 (A)	0/9	0.6 (A)	0/0	1.2 (A)	0/26	0.7 (A)	0/0
	NB Ramps	3.5 (A)	0/40	3.5 (A)	1/69	14.6 (B)	4/109	4.9 (A)	2/94
	Intersection	**1.3 (A)**		**1.0 (A)**		**2.7 (A)**		**1.3 (A)**	
Route 158 & Hawkeye	EB Route 160	0.0 (A)	0/40	0.0 (A)	0/44	0.0 (A)	0/21	0.0 (A)	0/79
	WB Route 160	0.5 (A)	0/0	0.2 (A)	0/0	1.2 (A)	0/8	0.2 (A)	0/0
	NB Hawkeye	2.8 (A)	0/25	0.5 (A)	0/4	2.5 (A)	0/23	0.3 (A)	0/2
	Intersection	**0.3 (A)**		**0.0 (A)**		**0.6 (A)**		**0.1 (A)**	
Route 158 & CR 343	EB Route 158	0.5 (A)	0/0	0.4 (A)	0/0	0.5 (A)	0/0	0.5 (A)	0/0
	WB Route 158	0.7 (A)	0/0	0.7 (A)	0/0	0.7 (A)	0/4	0.7 (A)	0/2
	NB CR 343	5.3 (A)	0/58	4.5 (A)	0/14	5.6 (A)	0/58	4.4 (A)	0/14
	SB CR 343	5.7 (A)	0/57	6.5 (A)	0/24	5.8 (A)	0/63	5.5 (A)	0/24
	Intersection	**1.0 (A)**		**0.6 (A)**		**1.1 (A)**		**0.6 (A)**	
US Route 67 & Route C / CR 323	NB Route 67	0.2 (A)	0/53	0.1 (A)	0/33	0.2 (A)	0/53	0.1 (A)	1/52
	SB Route 67	1.8 (A)	6/217	1.6 (A)	4/161	2.3 (A)	63/377	1.8 (A)	72/336
	EB Route C	22.4 (C)	11/166	34.3 (D)	14/153	53.2 (F)	50/299	101.7 (F)	71/287
	WB CR 323	11 (B)	1/66	12.5 (B)	1/38	18.3 (C)	5/111	15.9 (C)	2/65
	Intersection	**3.4 (A)**		**3.5 (A)**		**7.1 (A)**		**8.4 (A)**	

With the proposed folded diamond interchange the Route 160 corridor operates efficiently initially in 2022, but as traffic volumes increase longer delays occur by 2042. During the 2042 evening peak hour the Route 160 & Route C/V and southbound ramp intersections have long delays (LOS

E or F) for the stop-controlled approaches. The Route C intersection with Route 67 also has long delays as traffic increase along Route 67.

The Route C intersection with Route 67 will eventually be closed when Route 67 becomes a freeway in this area. *Table **36*** provides the results of the VISSIM models with the future conversion of Route 67 to a freeway and closure of the Route C intersection and the associated diversion of traffic to the Route 160 interchange. The following table includes a scenario with the unsignalized intersections along Route 160 and a scenario with the improvements previously identified **Section 7.2.2** (signalization of the Route C/V and ramp intersections).

Table 36 – 2042 Proposed Alternative 2 Intersection Analysis – VISSIM – Freeway Conversion Average Delay (sec/veh), LOS, Avg and Maximum Queue Length (ft)

Intersection	Approach	2042-Freeway (Unsignalized Intersections)				2042-Freeway (Signalized Route 160 & Ramps and Route 160 & Route C)			
		AM Peak		PM Peak		AM Peak		PM Peak	
		Delay (LOS)	Queues Avg/Max	Delay (LOS)	Queues Avg/Max	Delay (LOS)	Queues Avg/95th	Delay (LOS)	Queues Avg/95th
Route 160 & Route C / V	NB Route V	32.6 (D)	22/171	52.5 (F)	25/168	17.5 (B)	5/96	17.8 (B)	6/124
	SB Route C	598.1 (F)	510/575	581.2 (F)	496/578	36.3 (D)	48/282	24.8 (C)	28/197
	EB Route 160	0.9 (A)	53/276	1.7 (A)	2/111	9.7 (A)	30/495	12.4 (B)	19/278
	WB Route 160	3.9 (A)	4/159	3.6 (A)	8/233	8.8 (A)	9/249	16.2 (B)	75/719
	Intersection	**64.3 (F)**		**68.7 (F)**		**14.7 (B)**		**16.7 (B)**	
Route 160 & SB Route 67 Ramps	EB Route 160	1.0 (A)	46/119	0.2 (A)	0/0	8.7 (A)	31/594	6.3 (A)	10/225
	WB Route 160	1.4 (A)	0/36	1.1 (A)	0/40	11.5 (B)	5/114	7.3 (A)	4/114
	SB Ramps	59.1 (F)	160/613	124.8 (F)	1565/1713	14.3 (B)	20/269	23.5 (C)	113/771
	Intersection	**12.7 (B)**		**50.2 (F)**		**10 (B)**		**14.7 (B)**	
Route 160 & NB Route 67 Ramps	EB Route 160	62.1 (F)	141/235	3 (A)	3/78	18.2 (B)	17/166	8.8 (A)	6/123
	WB Route 160	1.6 (A)	38/86	0.9 (A)	0/0	6.7 (A)	13/367	3.8 (A)	4/186
	NB Ramps	1710.8 (F)	907/1528	21.2 (C)	12/183	18.3 (B)	7/129	14.1 (B)	7/134
	Intersection	**19.4 (C)**		**4.2 (A)**		**9 (A)**		**6.1 (A)**	
Route 158 & Hawkeye	EB Route 160	0.2 (A)	15/67	0.3 (A)	0/84	0.4 (A)	0/93	0.3 (A)	0/78
	WB Route 160	194.3 (F)	317/774	0.5 (A)	0/0	3.7 (A)	1/55	1.4 (A)	0/16
	NB Hawkeye	178.4 (F)	6/45	1.5 (A)	0/9	7.9 (A)	0/26	1.7 (A)	0/9
	Intersection	**111.1 (F)**		**0.3 (A)**		**2.2 (A)**		**0.9 (A)**	
Route 158 & CR 343	EB Route 158	0.5 (A)	0/0	0.6 (A)	0/0	0.8 (A)	0/0	0.7 (A)	0/0
	WB Route 158	0.8 (A)	0/0	0.7 (A)	0/0	0.8 (A)	0/5	0.7 (A)	0/0
	NB CR 343	6.0 (A)	0/58	4.5 (A)	0/14	6.0 (A)	0/58	4.5 (A)	0/14
	SB CR 343	0.7 (A)	0/0	0.6 (A)	0/0	0.7 (A)	0/0	0.6 (A)	0/0
	Intersection	**0.8 (A)**		**0.7 (A)**		**0.9 (A)**		**0.7 (A)**	

With the additional traffic on Route 160 from the closure of the Route C/Route 67 intersection the critical stop-controlled movements grow to have excessive delays. The queues for the left turns onto the northbound ramp spill back and impact the closely spaced Hawkeye intersection during the morning peak hour. With the signalization of the three intersections along Route 160 the intersections operate with acceptable delays (LOS B or better for the intersection with each approach being LOS D or better). The full VISSM results are provided in **Appendix E.**

Alternative 3

The final Alternative 3 is a dumbbell interchange, a diamond interchange with roundabouts at the ramp terminals. ***Table 37*** shows the results of the VISSIM model for the base project with Alternate 2.

Table 37 – Proposed Alternative 3 Intersection Analysis – VISSIM
Average Delay (sec/veh), LOS, Avg and Maximum Queue Length (ft)

Intersection	Approach	2022				2042			
		AM Peak		PM Peak		AM Peak		PM Peak	
		Delay (LOS)	Queues Avg/Max	Delay (LOS)	Queues Avg/Max	Delay (LOS)	Queues Avg/95th	Delay (LOS)	Queues Avg/95th
Route 160 & Route C / V	NB Route V	14.8 (B)	2/73	16.4 (C)	4/89	27.4 (D)	9/130	32.2 (D)	13/146
	SB Route C	10.9 (B)	2/54	14.3 (B)	5/80	16.3 (C)	5/69	24.5 (C)	14/129
	EB Route 160	0.6 (A)	0/66	1.1 (A)	1/79	0.8 (A)	0/92	1.6 (A)	1/112
	WB Route 160	1.2 (A)	0/65	1.3 (A)	1/94	1.9 (A)	1/129	2.0 (A)	2/172
	Intersection	**2.3 (A)**		**3.8 (A)**		**3.6 (A)**		**6.6 (A)**	
Route 160 & SB Route 67 Ramps	EB Route 160	1.5 (A)	0/81	1.2 (A)	0/56	2.0 (A)	1/145	1.4 (A)	0/69
	WB Route 160	0.7 (A)	0/14	0.8 (A)	0/30	0.9 (A)	0/40	0.9 (A)	0/32
	SB Ramps	0.9 (A)	0/49	1.5 (A)	1/82	1.1 (A)	0/69	2.1 (A)	1/128
	Intersection	**1.3 (A)**		**1.3 (A)**		**1.8 (A)**		**1.6 (A)**	
Route 160 & NB Route 67 Ramps	EB Route 160	1.6 (A)	0/29	1.2 (A)	0/20	1.9 (A)	0/17	1.4 (A)	0/21
	WB Route 160	2.8 (A)	0/67	1.5 (A)	0/62	5.1 (A)	2/86	2.0 (A)	1/62
	NB Ramps	5.4 (A)	1/80	2.6 (A)	1/70	10.1 (B)	2/104	4.1 (A)	1/90
	Intersection	**1.9 (A)**		**1.4 (A)**		**2.6 (A)**		**1.9 (A)**	
Route 158 & Hawkeye	EB Route 160	0.2 (A)	0/0	0.2 (A)	0/0	0.2 (A)	0/0	0.2 (A)	0/8
	WB Route 160	1.1 (A)	0/0	1.1 (A)	0/0	1.3 (A)	0/0	1.1 (A)	0/0
	NB Hawkeye	5.8 (A)	0/32	5.5 (A)	0/20	6.6 (A)	0/32	5.7 (A)	0/20
	Intersection	**0.8 (A)**		**0.7 (A)**		**0.9 (A)**		**0.7 (A)**	
Route 158 & CR 343	EB Route 158	0.4 (A)	0/0	0.4 (A)	0/0	0.5 (A)	0/0	0.5 (A)	0/2
	WB Route 158	0.7 (A)	0/0	0.7 (A)	0/0	0.7 (A)	0/7	0.7 (A)	0/4
	NB CR 343	5.3 (A)	0/58	4.4 (A)	0/14	5.7 (A)	0/58	4.4 (A)	0/14
	SB CR 343	5.9 (A)	0/57	5.6 (A)	0/24	6 (A)	0/63	5.4 (A)	0/24
	Intersection	**1 (A)**		**0.6 (A)**		**1.1 (A)**		**0.6 (A)**	
US Route 67 & Route C / CR 323	NB Route 67	0.1 (A)	0/39	0.1 (A)	0/36	0.2 (A)	0/38	0.1 (A)	1/66
	SB Route 67	1.8 (A)	7/224	1.6 (A)	4/147	2.4 (A)	66/364	1.8 (A)	53/336
	EB Route C	22.2 (C)	10/153	34.0 (D)	14/151	53.2 (F)	48/276	96.3 (F)	66/282
	WB CR 323	12.0 (B)	2/67	13.2 (B)	1/38	19.9 (C)	6/111	16.9 (C)	2/64
	Intersection	**3.4 (A)**		**3.5 (A)**		**7.2 (A)**		**8 (A)**	

With the proposed dumbbell interchange the Route 160 corridor operates efficiently throughout the study period in 2022 and 2042. The roundabouts at the Route 160 interchange operate with all approaches at LOS A or B. The Route C intersection with Route 67 continues to have long delays as traffic increase along Route 67 by 2042.

The Route C intersection with Route 67 will eventually be closed when Route 67 becomes a freeway in this area. *Table **38*** provides the results of the VISSIM models with the future conversion of Route 67 to a freeway and closure of the Route C intersection and the associated diversion of traffic to the Route 160 interchange. The following table includes a scenario with the roundabouts at the interchange and Route C remaining a two-way stopped controlled intersection and a scenario with the improvement previously identified **Section 7.2.2** (a roundabout at the Route 160 & Route C/V intersection).

Table 38 – 2042 Proposed Alternative 3 Intersection Analysis – VISSIM – Freeway Conversion Average Delay (sec/veh), LOS, Avg and Maximum Queue Length (ft)

Intersection	Approach	2042-Freeway (Roundabout Ramps & Two-way top Route C/V Intersection)				2042-Freeway (Roundabouts at Route C/V and Ramps)			
		AM Peak		PM Peak		AM Peak		PM Peak	
		Delay (LOS)	Queues Avg/Max	Delay (LOS)	Queues Avg/Max	Delay (LOS)	Queues Avg/95th	Delay (LOS)	Queues Avg/95th
Route 160 & Route C / V	NB Route V	35.3 (E)	12/158	62.4 (F)	31/197	11.8 (B)	3/77	4.8 (A)	1/70
	SB Route C	587 (F)	514/591	600.5 (F)	505/587	3.3 (A)	1/132	8.9 (A)	8/167
	EB Route 160	1.0 (A)	0/100	3.1 (A)	4/163	7.2 (A)	25/549	4.0 (A)	4/169
	WB Route 160	4.8 (A)	6/199	8.0 (A)	35/738	9.0 (A)	15/299	10.5 (B)	55/734
	Intersection	**65.8 (F)**		**64.6 (F)**		**7.1 (A)**		**8.2 (A)**	
Route 160 & SB Route 67 Ramps	EB Route 160	2.5 (A)	2/176	1.9 (A)	1/110	2.5 (A)	2/181	2.0 (A)	1/110
	WB Route 160	1.1 (A)	0/69	1.2 (A)	0/68	1.1 (A)	0/64	1.2 (A)	0/58
	SB Ramps	1.4 (A)	0/97	3.8 (A)	7/304	1.4 (A)	1/105	4.1 (A)	9/337
	Intersection	**2.1 (A)**		**2.7 (A)**		**2.2 (A)**		**2.9 (A)**	
Route 160 & NB Route 67 Ramps	EB Route 160	2.0 (A)	0/28	1.5 (A)	0/51	2.3 (A)	0/91	1.7 (A)	0/51
	WB Route 160	6.9 (A)	8/144	2.7 (A)	2/132	9.2 (A)	14/183	3.3 (A)	3/130
	NB Ramps	15.6 (C)	7/155	5.1 (A)	2/117	20.2 (C)	9/158	7.3 (A)	4/119
	Intersection	**3.7 (A)**		**2.3 (A)**		**4.4 (A)**		**2.7 (A)**	
Route 158 & Hawkeye	EB Route 160	0.2 (A)	0/3	0.2 (A)	0/16	0.2 (A)	0/8	0.2 (A)	0/4
	WB Route 160	4.2 (A)	1/51	1.6 (A)	0/13	7.8 (A)	3/130	1.8 (A)	0/18
	NB Hawkeye	8.7 (A)	0/32	5.8 (A)	0/20	17 (C)	0/33	6.1 (A)	0/20
	Intersection	**2.4 (A)**		**1 (A)**		**4.3 (A)**		**1.1 (A)**	
Route 158 & CR 343	EB Route 158	0.5 (A)	0/0	0.6 (A)	0/0	0.5 (A)	0/0	0.6 (A)	0/0
	WB Route 158	0.7 (A)	0/0	0.7 (A)	0/0	0.7 (A)	0/0	0.7 (A)	0/0
	NB CR 343	6.6 (A)	0/25	6.3 (A)	0/14	6.6 (A)	0/25	6.2 (A)	0/14
	SB CR 343	5.8 (A)	0/10	5.8 (A)	0/12	5.8 (A)	0/10	5.8 (A)	0/12
	Intersection	**0.7 (A)**		**0.7 (A)**		**0.7 (A)**		**0.7 (A)**	

With the additional traffic on Route 160 from the closure of the Route C/Route 67 intersection the stopped approaches on Route C/V grow to have excessive delays, but the roundabouts at the ramp terminals continue to operate effectively. With the addition of a roundabout at the Route C/V intersection all intersections along Route 160 operate with acceptable delays (LOS C or better for the intersection with each approach being LOS D or better). The full VISSM results are provided in **Appendix E**

Table 39 provides a comparison of the estimated performance for the stopped controlled approach with the highest delay for each intersection between the three alternatives for the intersections along Route 160. For improved 2042 scenario, overall intersection delays are reported.

Table 39 – VISSIM Route 160 Performance Summary

			Route 160 & Route C/V	Route 160 & SB 67	Route 160 & NB 67	Route 160 & Hawkeye	Route 158 & CR 343
2022	AM	ALT 1	14.2 (B)	8.4 (A)	20 (C)	6.1 (A)	5.6 (A)
		ALT 2	14.4 (B)	8.6 (A)	3.5 (A)	2.8 (A)	5.7 (A)
		ALT 3	14.8 (B)	1.5 (A)	5.4 (A)	5.8 (A)	5.9 (A)
	PM	ALT 1	24.6 (C)	21 (C)	11.9 (B)	6 (A)	5.4 (A)
		ALT 2	30.8 (D)	21.2 (C)	3.5 (A)	0.5 (A)	6.5 (A)
		ALT 3	16.4 (C)	1.5 (A)	2.6 (A)	5.5 (A)	5.6 (A)
2042	AM	ALT 1	32.6 (D)	11.3 (B)	32.3 (D)	6.8 (A)	6 (A)
		ALT 2	31.2 (D)	11.7 (B)	14.6 (B)	2.5 (A)	5.8 (A)
		ALT 3	27.4 (D)	1.1 (A)	10.1 (B)	6.6 (A)	6 (A)
	PM	ALT 1	78.7 (F)	69.1 (F)	16.7 (C)	6.1 (A)	5.4 (A)
		ALT 2	94.9 (F)	67.6 (F)	4.9 (A)	0.3 (A)	5.5 (A)
		ALT 3	32.2 (D)	2.1 (A)	4.1 (A)	5.7 (A)	5.4 (A)
2042with Freeway Conversion and Improvements	AM	ALT 1	18.6 (B)	11.9 (B)	20.1 (C)	14.9 (B)	5.9 (A)
		ALT 2	14.7 (B)	10 (B)	9 (A)	7.9 (A)	6 (A)
		ALT 3	7.1 (A)	2.2 (A)	4.4 (A)	17 (C)	6.1 (A)
	PM	ALT 1	18.2 (B)	15.6 (B)	14.7 (B)	6.2 (A)	4.4 (A)
		ALT 2	16.7 (B)	14.7 (B)	6.1 (A)	1.7 (A)	4.5 (A)
		ALT 3	8.2 (A)	2.9 (A)	2.7 (A)	6.6 (A)	6.2 (A)

The Route 160 corridor would operate well with all of the three proposed alternatives in 2022, but in 2042 the unsignalized southbound ramps in Alternative 1 and 2 will have large delays. The proposed roundabouts at the interchange in Alternative 3 result in less delays than the other alternatives for all scenarios. The delays and queues reported by VISSIM for the Route 160 interchange are consistent with the results of the Synchro and SIDRA analyses.

Freeway Comparison

Table 40 shows the average freeway speeds for various sections of Route 67 for the freeway analysis for the no-build scenario. The VISSIM analysis was able to analyze the existing single lane interchange with Route 160 that HCM procedures are unable to. Overall Route 67 operates effectively, but as Route 67 converts to a two-lane highway on the south end average speeds are lower.

Table 40 – VISSIM No-Build Freeway Analysis

Southbound 67

	2020		2022		2042	
	AM	**PM**	**AM**	**PM**	**AM**	**PM**
Average Speed (miles/hour)						
North of Route C	*59.8*	*58.9*	*59.8*	*59.0*	*59.6*	*58.6*
Route C to Route 160 Off-Ramp	*63.9*	*63.8*	*63.9*	*63.8*	*63.9*	*63.7*
Route 160 Off to Route 160 On	*63.9*	*63.3*	*63.8*	*62.9*	*63.6*	*62.9*
Route 160 On to CR 360	*60.1*	*61.0*	*60.1*	*60.7*	*60.0*	*60.6*
CR 360 to CR 338	*58.4*	*58.2*	*58.3*	*58.2*	*58.3*	*58.1*
South of CR 338	*56.0*	*55.8*	*56.2*	*56.0*	*56.1*	*55.1*
TOTAL	***61.6***	***61.6***	***61.6***	***61.5***	***61.5***	***61.4***
Average Density (vehicles/mile/lane)						
North of Route C	*2.3-A*	*5.1-A*	*2.3-A*	*5.1-A*	*2.9-A*	*6.3-A*
Route C to Route 160 Off-Ramp	*2.5-A*	*5.6-A*	*2.6-A*	*5.7-A*	*3.2-A*	*6.9-A*
Route 160 Off to Route 160 On	*2.1-A*	*4.4-A*	*2.2-A*	*4.5-A*	*2.7-A*	*5.4-A*
Route 160 On to CR 360	*3.6-A*	*4.2-A*	*3.7-A*	*4.6-A*	*4.5-A*	*5.7-A*
CR 360 to CR 338	*3.3-A*	*3.8-A*	*3.3-A*	*4.2-A*	*4.1-A*	*5.1-A*
South of CR 338	*3.7-A*	*4.4-A*	*3.8-A*	*4.8-A*	*4.6-A*	*5.9-A*
TOTAL	***2.6-A***	***4.4-A***	***2.6-A***	***4.5-A***	***3.2-A***	***5.5-A***

Northbound 67

	2020		2022		2042	
	AM	**PM**	**AM**	**PM**	**AM**	**PM**
Average Speed (miles/hour)						
South of CR 338	*56.6*	*56.7*	*56.6*	*56.6*	*56.5*	*56.5*
CR 338 to CR 360	*58.5*	*58.6*	*58.5*	*58.6*	*58.4*	*58.4*
CR 360 to Route 160 Off	*59.3*	*59.2*	*59.3*	*59.2*	*59.2*	*59.1*
Route 160 Off to Route 160 On	*59.1*	*59.2*	*59.1*	*59.2*	*59.0*	*59.1*
Route 160 On to Route C	*63.2*	*63.5*	*63.1*	*63.5*	*63.1*	*63.5*
North of Route C	*59.1*	*59.3*	*59.2*	*59.2*	*58.9*	*59.2*
TOTAL	***61.0***	***61.2***	***61.0***	***61.2***	***60.9***	***61.1***
Average Density (vehicles/mile/lane)						
North of Route C	*3.9-A*	*4.1-A*	*4.1-A*	*4.3-A*	*5.6-A*	*5.8-A*
Route C to Route 160 Off-Ramp	*3.9-A*	*4-A*	*4-A*	*4.1-A*	*5.4-A*	*5.7-A*
Route 160 Off to Route 160 On	*3.5-A*	*3.6-A*	*3.6-A*	*3.7-A*	*4.9-A*	*5.1-A*
Route 160 On to CR 360	*3.4-A*	*3.1-A*	*3.5-A*	*3.2-A*	*4.7-A*	*4.3-A*
CR 360 to CR 338	*4.9-A*	*3-A*	*5.1-A*	*3-A*	*6.9-A*	*4.1-A*
South of CR 338	*6.3-A*	*4-A*	*6.5-A*	*4-A*	*8.9-A*	*5.4-A*
TOTAL	***4.6-A***	***3.3-A***	***4.8-A***	***3.3-A***	***6.5-A***	***4.5-A***

*Table **41*** through *Table **43*** show the projected Route 67 performance in the VISSIM models for the three build alternatives. The results include two scenarios where Route 67 is converted to a freeway, one scenario with the proposed Route 160 corridors and a second with additional improvements made along Route 160.

Table 41 – VISSIM Proposed Alternative 1 Freeway Analysis

Southbound 67

	2022		2042		2042-Freeway		2042-Freeway-imp	
	AM	PM	AM	PM	AM	PM	AM	PM
Average Speed (miles/hour)								
North of Route C	*59.8*	*59.0*	*59.7*	*58.6*	*64.4*	*64.4*	*64.4*	*64.4*
Route C to Route 160 Off-Ramp	*63.9*	*63.8*	*63.9*	*63.8*	*64.3*	*19.3*	*64.3*	*64.2*
Route 160 Off to Route 160 On	*64.3*	*64.4*	*64.3*	*64.4*	*64.3*	*55.4*	*64.3*	*64.3*
Route 160 to CR 338	*63.6*	*63.7*	*63.6*	*63.7*	*63.6*	*63.4*	*63.6*	*63.7*
South of CR 338	*58.0*	*57.9*	*57.9*	*57.6*	*58.1*	*57.7*	*58.1*	*57.6*
TOTAL	***63.4***	***63.3***	***63.3***	***63.2***	***63.8***	***43.1***	***63.8***	***63.7***
Average Density (vehicles/mile/lane)								
North of Route C	*2.6-A*	*5.7-A*	*3.2-A*	*6.9-A*	*3.1-A*	*6.7-A*	*3.1-A*	*6.7-A*
Route C to Route 160 Off-Ramp	*2.1-A*	*4.4-A*	*2.6-A*	*5.3-A*	*3.1-A*	*29.3-D*	*3.1-A*	*6.6-A*
Route 160 Off to Route 160 On	*1.2-A*	*2-A*	*1.5-A*	*2.4-A*	*1.5-A*	*2-A*	*1.5-A*	*2.3-A*
Route 160 to CR 338	*1.7-A*	*2.1-A*	*2-A*	*2.6-A*	*2-A*	*1.9-A*	*2-A*	*2.6-A*
South of CR 338	*3.8-A*	*4.8-A*	*4.7-A*	*5.9-A*	*4.6-A*	*4.4-A*	*4.7-A*	*5.9-A*
TOTAL	***1.9-A***	***3.4-A***	***2.4-A***	***4.1-A***	***2.6-A***	***14.6-B***	***2.6-A***	***4.7-A***

Northbound 67

	2022		2042		2042-Freeway		2042-Freeway-imp	
	AM	PM	AM	PM	AM	PM	AM	PM
Average Speed (miles/hour)								
South of CR 338	*59.9*	*59.9*	*59.8*	*59.8*	*59.8*	*59.8*	*59.8*	*59.8*
CR 338 to Route 160 Off	*63.7*	*63.7*	*63.6*	*63.6*	*63.6*	*63.6*	*63.6*	*63.6*
Route 160 Off to Route 160 On	*63.4*	*63.4*	*63.1*	*63.0*	*63.1*	*63.1*	*63.1*	*63.1*
Route 160 On to Route C	*63.9*	*64.2*	*63.9*	*64.1*	*63.9*	*64.1*	*63.8*	*64.0*
North of Route C	*59.3*	*59.4*	*59.1*	*59.3*	*64.2*	*64.3*	*64.1*	*64.2*
TOTAL	***63.2***	***63.3***	***63.1***	***63.2***	***63.4***	***63.4***	***63.3***	***63.4***
Average Density (vehicles/mile/lane)								
South of CR 338	*3.9-A*	*4.1-A*	*5.4-A*	*5.6-A*	*5.4-A*	*5.6-A*	*5.4-A*	*5.6-A*
CR 338 to Route 160 Off	*1.8-A*	*1.9-A*	*2.5-A*	*2.6-A*	*2.5-A*	*2.6-A*	*2.5-A*	*2.6-A*
Route 160 Off to Route 160 On	*1.6-A*	*1.5-A*	*2.2-A*	*2-A*	*2-A*	*2-A*	*2-A*	*2-A*
Route 160 On to Route C	*4.8-A*	*2.9-A*	*6.6-A*	*3.9-A*	*7.5-A*	*4.4-A*	*8-A*	*4.8-A*
North of Route C	*6.5-A*	*4-A*	*8.9-A*	*5.4-A*	*7.7-A*	*4.6-A*	*8.3-A*	*5-A*
TOTAL	***3.5-A***	***2.5-A***	***4.8-A***	***3.4-A***	***5.2-A***	***3.6-A***	***5.5-A***	***3.8-A***

Table 42 – VISSIM Proposed Alternative 2 Freeway Analysis

Southbound 67

	2022		2042		2042-Freeway		2042-Freeway-imp	
	AM	**PM**	**AM**	**PM**	**AM**	**PM**	**AM**	**PM**
Average Speed (miles/hour)								
North of Route C	*59.8*	*59.0*	*59.7*	*58.6*	*64.4*	*64.4*	*64.4*	*64.4*
Route C to Route 160 Off-Ramp	*63.9*	*63.8*	*63.9*	*63.8*	*64.0*	*19.6*	*64.3*	*64.2*
Route 160 Off to Route 160 On	*64.3*	*64.4*	*64.3*	*64.4*	*64.2*	*55.5*	*64.3*	*64.3*
Route 160 to CR 338	*63.6*	*63.7*	*63.6*	*63.7*	*63.6*	*63.4*	*63.6*	*63.7*
South of CR 338	*58.0*	*57.9*	*57.9*	*57.6*	*58.1*	*57.6*	*58.1*	*57.7*
TOTAL	***63.4***	***63.3***	***63.3***	***63.2***	***63.6***	***43.3***	***63.8***	***63.7***
Average Density (vehicles/mile/lane)								
North of Route C	*2.6-A*	*5.7-A*	*3.2-A*	*6.9-A*	*3.1-A*	*6.7-A*	*3.1-A*	*6.7-A*
Route C to Route 160 Off-Ramp	*2.1-A*	*4.4-A*	*2.6-A*	*5.3-A*	*3.2-A*	*29.1-D*	*3.1-A*	*6.6-A*
Route 160 Off to Route 160 On	*1.2-A*	*2-A*	*1.5-A*	*2.4-A*	*1.5-A*	*2-A*	*1.5-A*	*2.3-A*
Route 160 to CR 338	*1.7-A*	*2.1-A*	*2-A*	*2.6-A*	*2-A*	*2-A*	*2-A*	*2.6-A*
South of CR 338	*3.8-A*	*4.8-A*	*4.7-A*	*5.9-A*	*4.5-A*	*4.5-A*	*4.7-A*	*5.9-A*
TOTAL	***1.9-A***	***3.4-A***	***2.4-A***	***4.1-A***	***2.6-A***	***14.5-B***	***2.6-A***	***4.7-A***

Northbound 67

	2022		2042		2042-Freeway		2042-Freeway-imp	
	AM	**PM**	**AM**	**PM**	**AM**	**PM**	**AM**	**PM**
Average Speed (miles/hour)								
South of CR 338	*59.9*	*59.9*	*59.8*	*59.8*	*59.8*	*59.8*	*59.8*	*59.8*
CR 338 to Route 160 Off	*63.7*	*63.7*	*63.6*	*63.6*	*63.3*	*63.6*	*63.6*	*63.6*
Route 160 Off to Route 160 On	*63.4*	*63.4*	*63.1*	*63.0*	*63.1*	*63.0*	*63.1*	*63.0*
Route 160 On to Route C	*63.9*	*64.2*	*63.9*	*64.1*	*63.5*	*63.8*	*63.5*	*63.7*
North of Route C	*59.3*	*59.4*	*59.1*	*59.3*	*64.2*	*64.3*	*64.1*	*64.2*
TOTAL	***63.2***	***63.3***	***63.1***	***63.2***	***63.1***	***63.3***	***63.2***	***63.3***
Average Density (vehicles/mile/lane)								
South of CR 338	*3.9-A*	*4.1-A*	*5.4-A*	*5.6-A*	*5.4-A*	*5.6-A*	*5.4-A*	*5.6-A*
CR 338 to Route 160 Off	*1.8-A*	*1.9-A*	*2.5-A*	*2.6-A*	*2.5-A*	*2.6-A*	*2.5-A*	*2.6-A*
Route 160 Off to Route 160 On	*1.6-A*	*1.5-A*	*2.2-A*	*2-A*	*2-A*	*2-A*	*2-A*	*2-A*
Route 160 On to Route C	*4.8-A*	*2.9-A*	*6.6-A*	*3.9-A*	*7.1-A*	*4.4-A*	*7.9-A*	*4.8-A*
North of Route C	*6.5-A*	*4-A*	*8.9-A*	*5.4-A*	*7.5-A*	*4.6-A*	*8.3-A*	*5-A*
TOTAL	***3.5-A***	***2.5-A***	***4.8-A***	***3.4-A***	***5.3-A***	***3.7-A***	***5.7-A***	***3.9-A***

Table 43 – VISSIM Proposed Alternative 3 Freeway Analysis
Southbound 67

	2022		2042		2042-Freeway		2042-Freeway-imp	
	AM	**PM**	**AM**	**PM**	**AM**	**PM**	**AM**	**PM**
Average Speed (miles/hour)								
North of Route C	*59.8*	*59.0*	*59.7*	*58.6*	*61.3*	*61.2*	*64.4*	*64.5*
Route C to Route 160 Off-Ramp	*63.9*	*63.8*	*63.9*	*63.8*	*63.9*	*63.8*	*64.3*	*64.2*
Route 160 Off to Route 160 On	*64.3*	*64.4*	*64.4*	*64.4*	*64.3*	*64.3*	*64.3*	*64.3*
Route 160 to CR 338	*63.6*	*63.7*	*63.6*	*63.7*	*63.6*	*63.6*	*63.6*	*63.7*
South of CR 338	*57.9*	*58.0*	*57.9*	*57.7*	*58.0*	*57.6*	*58.1*	*57.7*
TOTAL	***63.4***	***63.3***	***63.3***	***63.2***	***63.5***	***63.4***	***63.8***	***63.7***
Average Density (vehicles/mile/lane)								
North of Route C	*2.6-A*	*5.7-A*	*3.2-A*	*6.9-A*	*3.3-A*	*7.2-A*	*3.1-A*	*6.7-A*
Route C to Route 160 Off-Ramp	*2.1-A*	*4.4-A*	*2.6-A*	*5.3-A*	*3.1-A*	*6.7-A*	*3.1-A*	*6.6-A*
Route 160 Off to Route 160 On	*1.2-A*	*2-A*	*1.5-A*	*2.4-A*	*1.5-A*	*2.3-A*	*1.5-A*	*2.3-A*
Route 160 to CR 338	*1.7-A*	*2.1-A*	*2-A*	*2.6-A*	*2-A*	*2.5-A*	*2-A*	*2.6-A*
South of CR 338	*3.8-A*	*4.8-A*	*4.7-A*	*5.9-A*	*4.6-A*	*5.8-A*	*4.7-A*	*5.9-A*
TOTAL	***1.9-A***	***3.4-A***	***2.4-A***	***4.1-A***	***2.6-A***	***4.7-A***	***2.6-A***	***4.7-A***

Northbound 67

	2022		2042		2042-Freeway		2042-Freeway-imp	
	AM	**PM**	**AM**	**PM**	**AM**	**PM**	**AM**	**PM**
Average Speed (miles/hour)								
South of CR 338	*59.9*	*59.9*	*59.8*	*59.8*	*59.8*	*59.8*	*59.8*	*59.8*
CR 338 to Route 160 Off	*63.7*	*63.7*	*63.6*	*63.6*	*63.6*	*63.6*	*63.6*	*63.6*
Route 160 Off to Route 160 On	*63.4*	*63.4*	*63.1*	*63.0*	*63.1*	*63.1*	*63.1*	*63.1*
Route 160 On to Route C	*63.9*	*64.1*	*63.9*	*64.1*	*63.9*	*64.1*	*63.8*	*64.0*
North of Route C	*59.3*	*59.4*	*59.1*	*59.3*	*64.4*	*64.4*	*64.2*	*64.3*
TOTAL	***63.2***	***63.3***	***63.1***	***63.2***	***63.3***	***63.4***	***63.3***	***63.4***
Average Density (vehicles/mile/lane)								
South of CR 338	*3.9-A*	*4.1-A*	*5.4-A*	*5.6-A*	*5.4-A*	*5.6-A*	*5.4-A*	*5.6-A*
CR 338 to Route 160 Off	*1.8-A*	*1.9-A*	*2.5-A*	*2.6-A*	*2.5-A*	*2.6-A*	*2.5-A*	*2.6-A*
Route 160 Off to Route 160 On	*1.6-A*	*1.5-A*	*2.2-A*	*2-A*	*2-A*	*2-A*	*2-A*	*2-A*
Route 160 On to Route C	*4.8-A*	*2.9-A*	*6.6-A*	*4-A*	*7.5-A*	*4.5-A*	*8-A*	*4.8-A*
North of Route C	*6.5-A*	*4-A*	*8.9-A*	*5.4-A*	*7.8-A*	*4.6-A*	*8.3-A*	*5-A*
TOTAL	***3.5-A***	***2.5-A***	***4.8-A***	***3.5-A***	***5.2-A***	***3.7-A***	***5.5-A***	***3.8-A***

The build scenarios provide very efficient operations with LOS A throughout, with the exception of when the Route C & Route 67 intersection is closed as part of the ultimate freeway conversion. This closure detours additional traffic to the Route 160 corridor. This diversion requires improvements to the Route 160 corridor for Alternatives 1 and 2, otherwise queues from the Route 160 interchange will spill back onto southbound Route 67 during the 2042 evening peak hour resulting in significant congestion.

A comparison between the three build alternatives shows little difference between the options on the operations of US-67. ***Table 44*** provides a side-by-side comparison of the estimated freeway performance of the no-build and proposed alternatives. With the proposed interchange alternatives and development traffic, US-67 is estimated to operate with speeds, density and LOS very similar to the no-build condition without the new development traffic.

Table 44 – Route 67 Performance VISSIM Summary

			Southbound Route 67			***Northbound Route 67***		
			Average Speed	**Facility LOS**	**Worst LOS**	**Average Speed**	**Facility LOS**	**Worst LOS**
2020	**AM**	**Ex**	61.6	2.6-A	3.8-A	61.0	4.6-A	6.3-A
	PM	**Ex**	61.6	4.4-A	5.6-A	61.2	3.3-A	4.1-A
2022	**AM**	**Ex**	61.6	2.6-A	3.8-A	61.0	4.8-A	6.5-A
		ALT 1	63.4	1.9-A	3.8-A	63.2	3.5-A	6.5-A
		ALT 2	63.4	1.9-A	3.8-A	63.2	3.5-A	6.5-A
		ALT 3	63.4	1.9-A	3.8-A	63.2	3.5-A	6.5-A
	PM	**Ex**	61.5	4.5-A	5.7-A	61.2	3.3-A	4.3-A
		ALT 1	63.3	3.4-A	5.7-A	63.3	2.5-A	4.1-A
		ALT 2	63.3	3.4-A	5.7-A	63.3	2.5-A	4.1-A
		ALT 3	63.3	3.4-A	5.7-A	63.3	2.5-A	4.1-A
2042	**AM**	**Ex**	61.5	3.2-A	4.6-A	60.9	6.5-A	8.9-A
		ALT 1	63.3	2.4-A	4.7-A	63.1	4.8-A	8.9-A
		ALT 2	63.3	2.4-A	4.7-A	63.1	4.8-A	8.9-A
		ALT 3	63.3	2.4-A	4.7-A	63.1	4.8-A	8.9-A
	PM	**Ex**	61.4	5.5-A	6.9-A	61.1	4.5-A	5.8-A
		ALT 1	63.2	4.1-A	6.9-A	63.2	3.4-A	5.6-A
		ALT 2	63.2	4.1-A	6.9-A	63.2	3.4-A	5.6-A
		ALT 3	63.2	4.1-A	6.9-A	63.2	3.5-A	5.6-A
2042 – Freeway Conversion	**AM**	**ALT 1**	63.8	2.6-A	4.7-A	63.3	5.5-A	8.3-A
		ALT 2	63.8	2.6-A	4.7-A	63.2	5.7-A	8.3-A
		ALT 3	63.8	2.6-A	4.7-A	63.3	5.5-A	8.3-A
	PM	**ALT 1**	63.7	4.7-A	6.7-A	63.4	3.8-A	5.6-A
		ALT 2	63.7	4.7-A	6.7-A	63.3	3.9-A	5.6-A
		ALT 3	63.7	4.7-A	6.7-A	63.4	3.8-A	5.6-A

The VISSIM models show very little difference between the three build alternatives, although they each show improvements over the existing/no-build alternative. The most significant difference between the alternatives are the additional improvements (signalization) that is need for Alternatives 1 and 2 when the Route 67/Route C intersection is closed as part of the Route 67 freeway conversion. At the expected traffic volumes, the proposed Route 160 interchange configuration is projected to operate at an acceptable Level of Service for both surface streets and US-67.

7.3 Stakeholder and Environmental Concerns

The project has strong support from the City of Poplar Bluff as evidenced by the passage of a special sales tax to fund the project. Additional public meetings will occur as the project advances, including a Design Public Hearing upon the approval of the Preliminary Plans.

Discussions with stakeholders have not revealed any outstanding concerns. The impacted property owners will be contacted. The NEPA process is ongoing, but environmental impacts are not expected to be a major concern in the design.

7.4 Conformance with Transportation Plans

I-57 Corridor Upgrades with emphasis from Route 160 to the state line is the top priority for Butler County in the 2019 Ozark Foothills Regional Transportation Plan. The expansion of Route 67 to a four-lane freeway has been ongoing since 1997 and this project is consistent with the planning efforts and the 2005 Environmental Impact Statement, and subsequent re-evaluation.

7.5 Cost Estimate

A conceptual cost estimate has been performed for Alternative 3. The construction cost estimate is $16,481,000 and is provided in **Appendix F**. The total interchange cost is $19,401,000 and is summarized in ***Table 45***.

Table 45 – Interchange Cost Estimate

Construction (widening)	**$11,911,000**
Construction (interchange)	**$4,940,000**
Construction Contingency	**$1,554,800**
Right of Way	**$360,000**
Utilities	**$1,005,000**
Total	**$19,771,000**

7.6 Evaluation Matrix

Analysis of the three retained interchange configurations was presented in Section 7.1 and 7.2. The analysis included quantifying the differences in safety and traffic operations for the Route 67 and Route 160 corridors. Each of the interchange configurations has been developed to a conceptual level in order to determine the footprint and approximate cost of the interchange. Based upon the footprint of the interchange, the different right of way and environmental impacts have been quantified. Results of these analyses are summarized in the evaluation matrix shown ***Table 46***.

Table 46 – Evaluation Matrix – Base Project

Evaluation Matrix		No-Build	ALT 1 Diamond	ALT 2 Parclo	ALT 3 Roundabouts
Engineering Considerations	Cost	$0	$19,810,000	$20,970,000	$19,770,000
	Route 67 LOS (2042)	N/A	LOS A	LOS A	LOS A
	Route 160 LOS (2042)	LOS F	LOS C	LOS E*	LOS C
	Predicted Crash Frequency (crash / year)	39.39	31.82	33.33	27.12
	Number of Creek / Stream Crossings	0	0	0	0
	Number of Bridge Impacts	0	1	2	1
Right-of-Way Impacts	Parcels Impacted	0	25	26	25
	Displacements	0	8	8	8
	Residential Impacts	0	5	5	5
	Commercial Impacts	0	4	4	4
	New Right-of-Way	0 AC	51.4 AC	51.9 AC	51.4 AC
Environmental Impacts	Community Impacts	N/A	Expected Positive Impact On Community	Expected Positive Impact On Community	Expected Positive Impact On Community
	Farmlands	N/A	29.05 acres	29.05 acres	29.05 acres
	Wetlands	N/A	0.45 acres	0.45 acres	0.45 acres
	Water Quality	N/A	SWPPP will be required.	SWPPP will be required.	SWPPP will be required.
	Floodplain	N/A	None	None	None
	Noise	N/A	No sensitive noise receptors	No sensitive noise receptors	No sensitive noise receptors
	Cultural Resources	N/A	3	3	3
	Parkland Impacts	N/A	None	None	None
	Threatened and Endangered Species	N/A	No known records. Tree clearing restrictions will be required.	No known records. Tree clearing restrictions will be required.	No known records. Tree clearing restrictions will be required.
	Hazardous Waste Sites	N/A	2	2	2
Purpose & Need	Reduce Congestion	No	Yes	Yes	Yes
	Reduce Crashes	No	Yes	Yes	Yes
	Improve Roadway deficiencies	No	Yes	Yes	Yes
	System Continuity	No	Yes	Yes	Yes

*without signalization, LOS C if signalized

Table 46 shows that the no-build option results in poor operational and safety performance at the Route 160 interchange that is likely to have operational and safety impacts on Route 67. The no-build option does not meet the stated purpose and need of the project. All three build alternatives provide adequate traffic operations and improved safety performance over the no-build. Alternative 3 provides better operational and safety performance of the three alternatives that were evaluated.

6 FUNDING AND SCHEDULE

In 2019 MoDOT selected the City of Poplar Bluff to receive $5,700,000 of cost share money to widen US Route 67 and improve the interchange at Route 160. The local match was met by the City of Poplar Bluff's one-half cent sales tax passed in April 2005.

The following is the proposed design and construction schedule for the project:

Design Schedule (September 2020 – April 2022)
Preliminary Plans submitted: March 1, 2021
Preliminary Plan comments addressed and approved: March 21, 2021
Advertise Public Meeting: March 21, 2021
Public Meeting: April 8, 2021
Right of Way Plans submitted: April 23, 2021
Comment Period Closes: April 22, 2021
Right-of-Way Plan comments addressed and approved: May 6, 2021
Commission Meeting: June 2, 2021
A-date: June 2021
Phase 1 Final PS&E: September 7, 2021
Phase 2 Final PS&E:

Construction Schedule (March 2022 – December 2023)
Phase 1
- Advertisement: November 10, 2021
- Letting: December 17, 2021
- Construction Notice to Proceed: March 7, 2022
- Construction Completion – December 2022

Phase 2
- Advertisement: September 2022
- Letting: October 2022
- Construction Notice to Proceed: January 2022
- Construction Completion – December 2023

7 SUMMARY AND RECOMMENDATIONS

The finding of this report is that the conversion of Route 67 to a freeway and the modified access at Route 160 will have limited environmental impacts and positive operational and safety impacts to the local and regional roadway network. This project is supported by the regional planning commission and consistent with long-term land use plans developed by the Ozark Foothills Regional Planning Commission. The project will meet the purpose and need of the project to reduce congestion, reduce crashes, address roadway deficiencies and support system continuity.

The preferred alternate is the replacement of the Route 160 interchange with a diamond interchange with roundabouts at the ramp terminals. In order to minimize environmental and cost impacts the existing off ramps will be utilized. The replacement of the existing loop on ramps with new ramps will improve traffic and safety performance.

In 2005, voters in the City of Poplar Bluff passed a proposition authorizing a special sales tax to improve Route 67 to a freeway. In 2019 MoDOT selected the City of Poplar Bluff to receive $5,700,000 of cost share money to widen US Route 67 and improve the interchange at Route 160. The project is schedule for a December 2021 letting, with the first phase complete in 2022. A re-evaluation of the EIS document for the project was approved by FHWA on January 13, 2021 in order to meet the NEPA requirements.

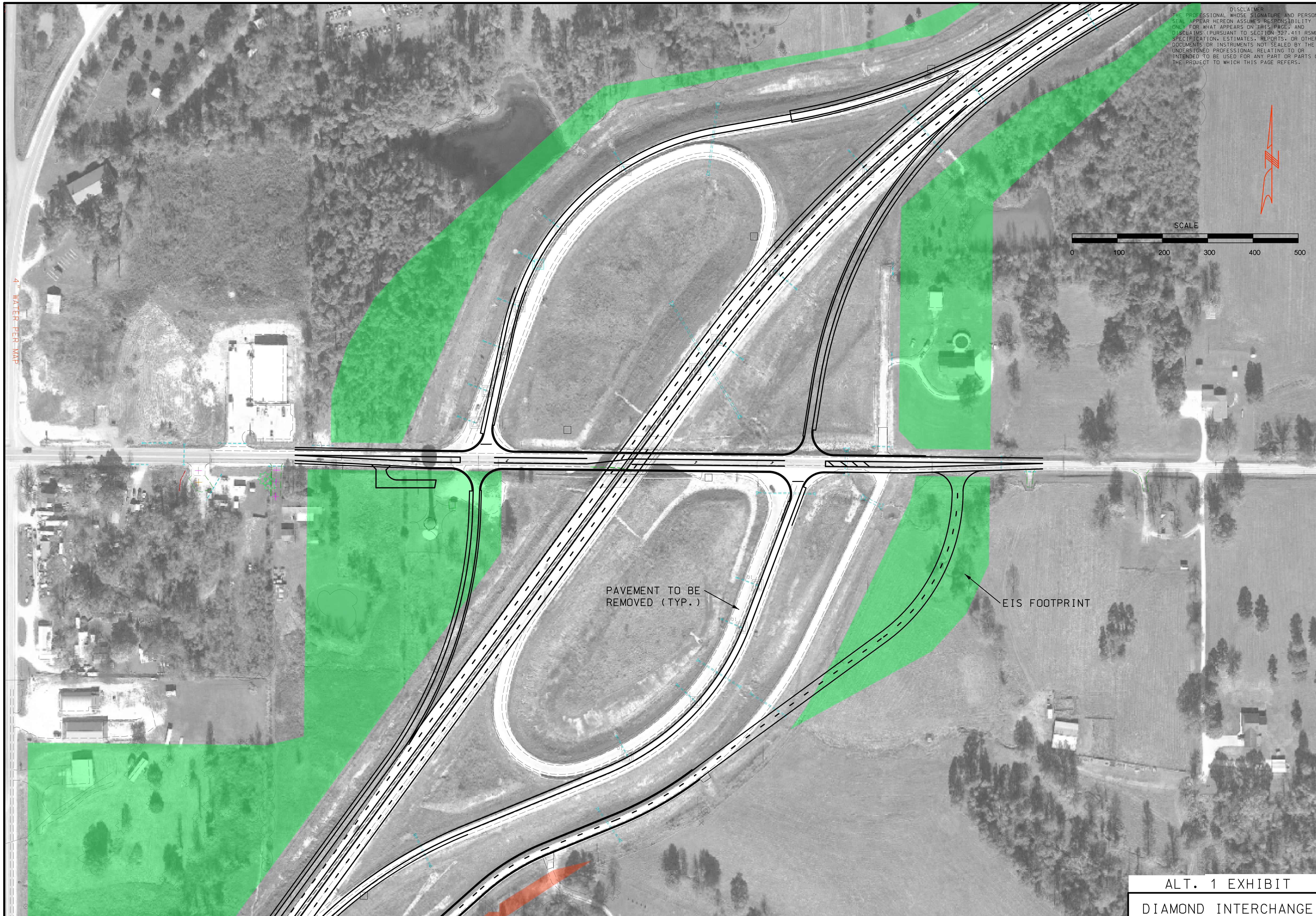
In conclusion, the revised access point at Route 160 does not have an adverse impact on safety or operations of Route 67. The improvements associated with the proposed freeway modifications will improve operational performance along Route 67 by increasing the average speed and reducing the number of predicted crashes. The project substantially improves upon the no-build alternative by extending the Route 67 freeway south of Route 160 and completing the proposed interchange improvements.

Therefore, FHWA approval of the proposed US Route 67 corridor improvements is requested.

Appendix A

- Exhibit A1 – Alternative 1 Conceptual Design
- Exhibit A2 – Alternative 2 Conceptual Design
- Exhibit A3 – Alternative 3 Conceptual Design

PRELIMINARY - NOT FOR CONSTRUCTION



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DATE PREPARED	
3/23/2021	
ROUTE: 67	STATE: MO
DISTRICT: SE	SHEET NO.
COUNTY: BUTLER	
JOB NO.: J9P3663/J9P3764	
CONTRACT ID.	
PROJECT NO.	
BRIDGE NO.	

DATE	DESCRIPTION

MISSOURI HIGHWAYS AND TRANSPORTATION COMMISSION
105 WEST CAPITOL
JEFFERSON CITY, MO 65102
1-888-ASK-MODOT (1-888-275-6636)

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ENGINEERING CORPORATION - 000631

ALT. 1 EXHIBIT
DIAMOND INTERCHANGE

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DATE PREPARED 3/23/2021	
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DISTRICT SE	SHEET NO.
COUNTY BUTLER	
JOB NO. J9P3663/J9P3764	
CONTRACT ID.	
PROJECT NO.	
BRIDGE NO.	

DATE | DESCRIPTION

MISSOURI HIGHWAYS AND TRANSPORTATION COMMISSION

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JEFFERSON CITY, MO 65102
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ALT. 2 EXHIBIT

FOLDED DIAMOND INTERCHANGE

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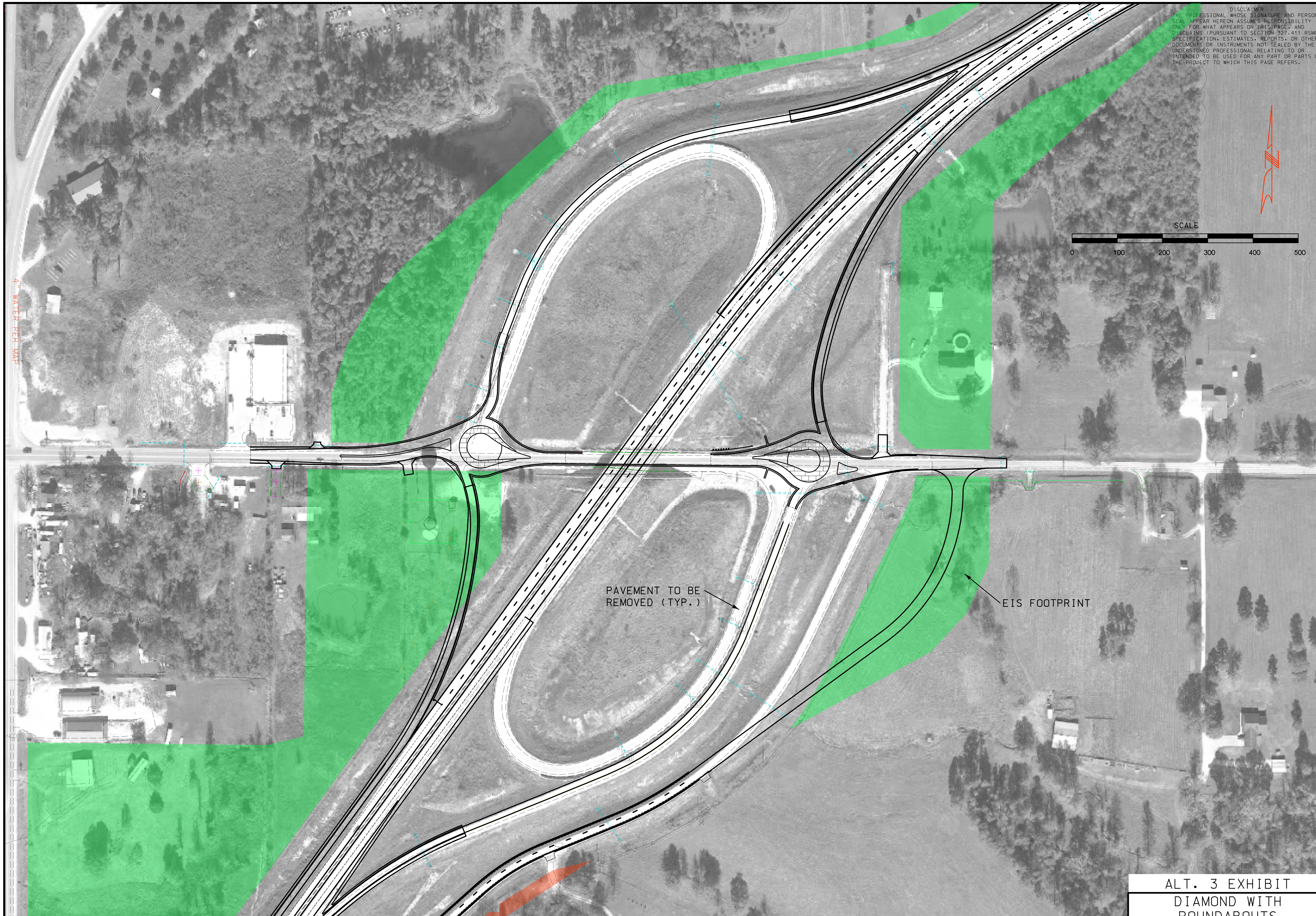

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ROUTE 67	STATE MO
DISTRICT SE	SHEET NO.
COUNTY BUTLER	
JOB NO. J9P3663/J9P3764	
CONTRACT ID.	
PROJECT NO.	
BRIDGE NO.	

DATE	DESCRIPTION

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ALT. 3 EXHIBIT

DIAMOND WITH ROUNDABOUTS

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Appendix B

- Exhibit B1 – 2020 Existing Traffic Volumes
- Exhibit B2 – 2022 Traffic Volumes
- Exhibit B3 – 2042 Traffic Volumes
- Exhibit B4 – 2042 Traffic Volumes with Route 67 Freeway Conversion

MODOT

ROUTE 67

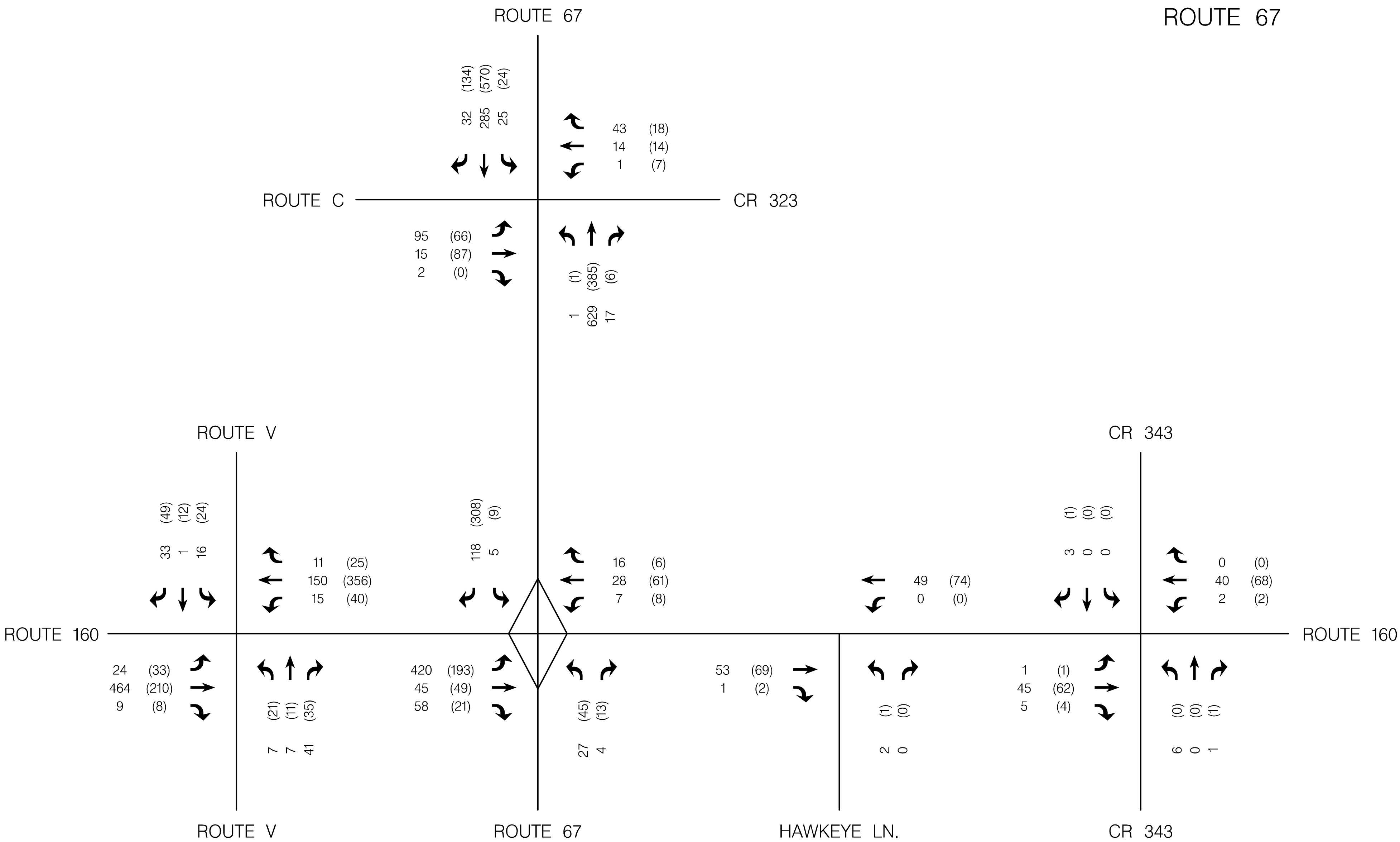
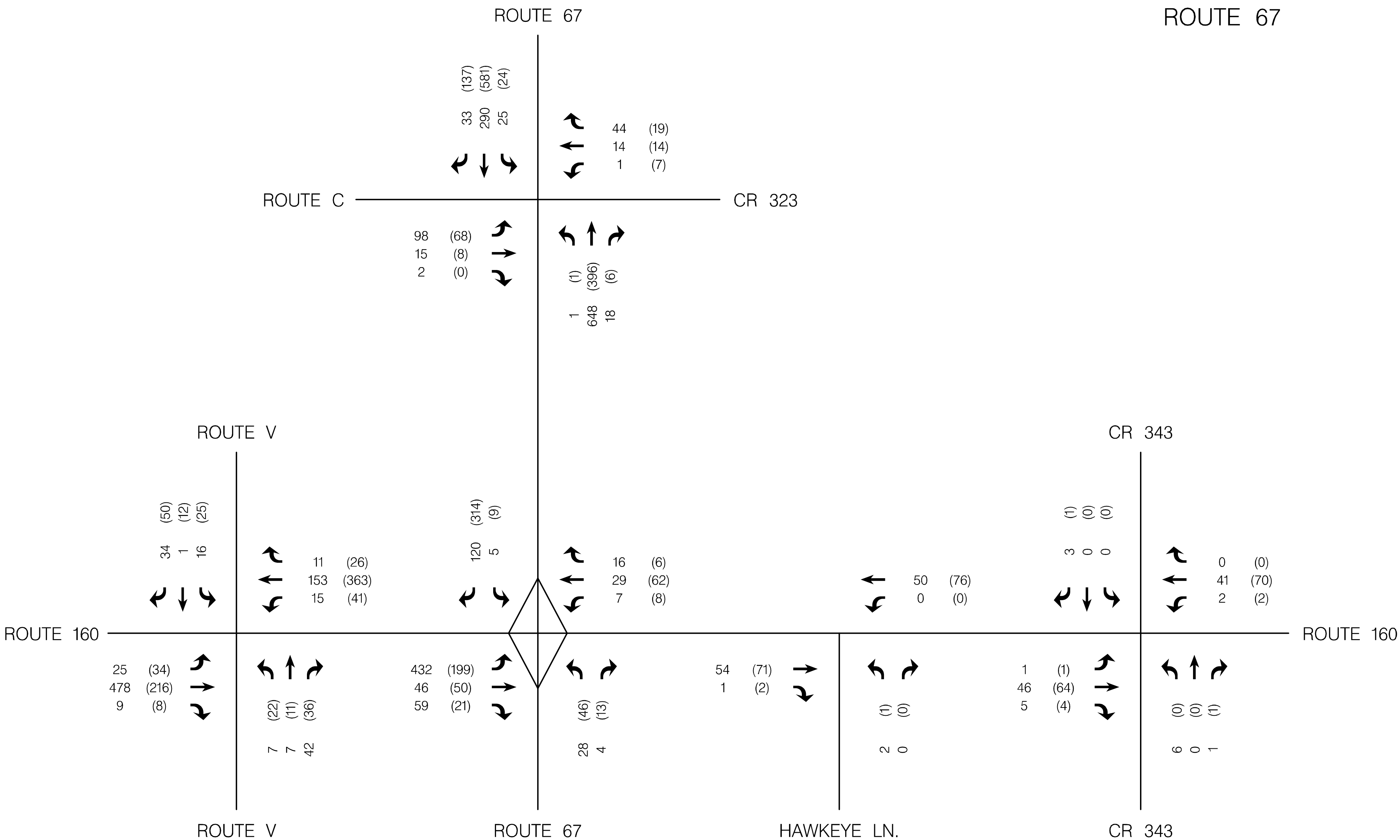


EXHIBIT B1
EXISTING TRAFFIC VOLUMES
2020

XXX (XXX) = AM (PM) PEAK HOUR VOLUME

MODOT

ROUTE 67



XXX (XXX) = AM (PM) PEAK HOUR VOLUME

EXHIBIT B2
2022 TRAFFIC VOLUMES

MODOT

ROUTE 67

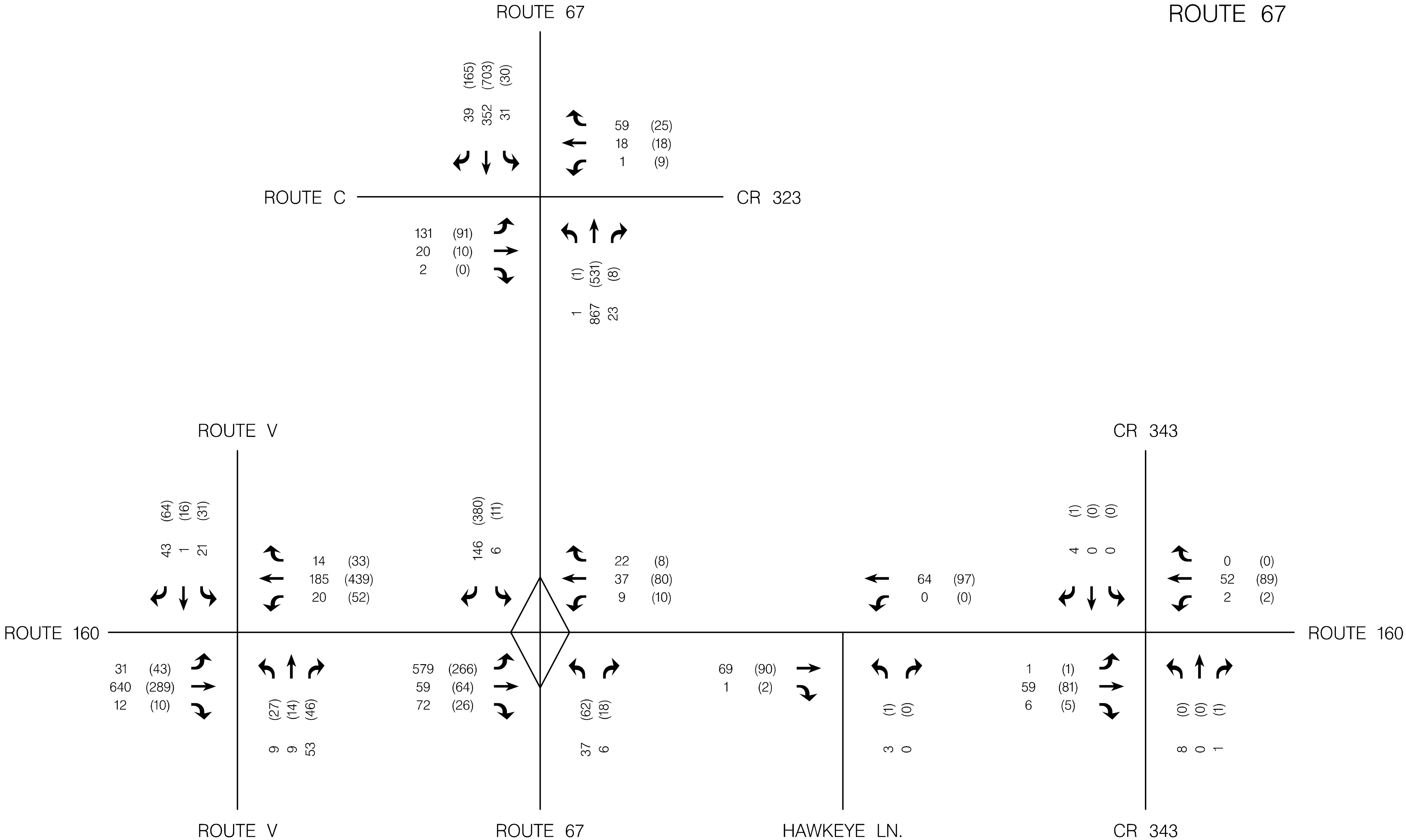


EXHIBIT B3
2042 TRAFFIC VOLUMES

XXX (XXX) = AM (PM) PEAK HOUR VOLUME

MODOT

ROUTE 67

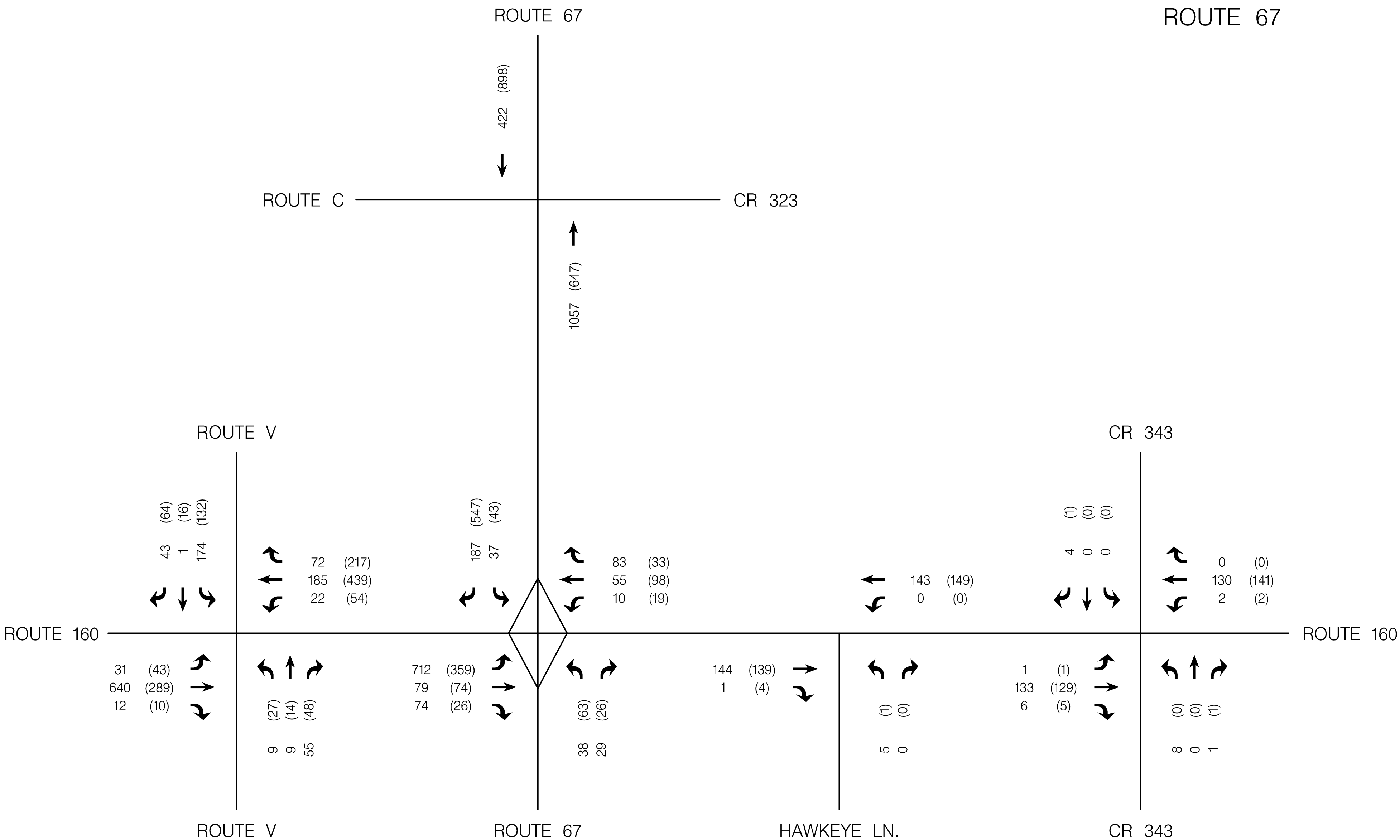


EXHIBIT B4
2042 TRAFFIC VOLUMES
WITH ROUTE 67
FREEWAY CONVERSION

XXX (XXX) = AM (PM) PEAK HOUR VOLUME

Appendix C

- Conceptual Plan and Profile Sheets
- Conceptual Signing Plan

MISSOURI HIGHWAYS AND TRANSPORTATION COMMISSION
PLANS FOR PROPOSED
STATE HIGHWAY

BUTLER COUNTY

TOWNSHIP 23 NORTH, RANGE 5 EAST
SECTIONS 3, 9, 10, 15, 16, 21 & 22

DESIGN DESIGNATION

A.A.D.T. - 20XX = XXXX
A.A.D.T. - 20XX = XXXX
D.H.V. = XX%
T = XX%
V = XX M.P.H.
D = XX%

FUNCTIONAL CLASSIFICATION-

FULLY CONTROLLED ACCESS HIGHWAY

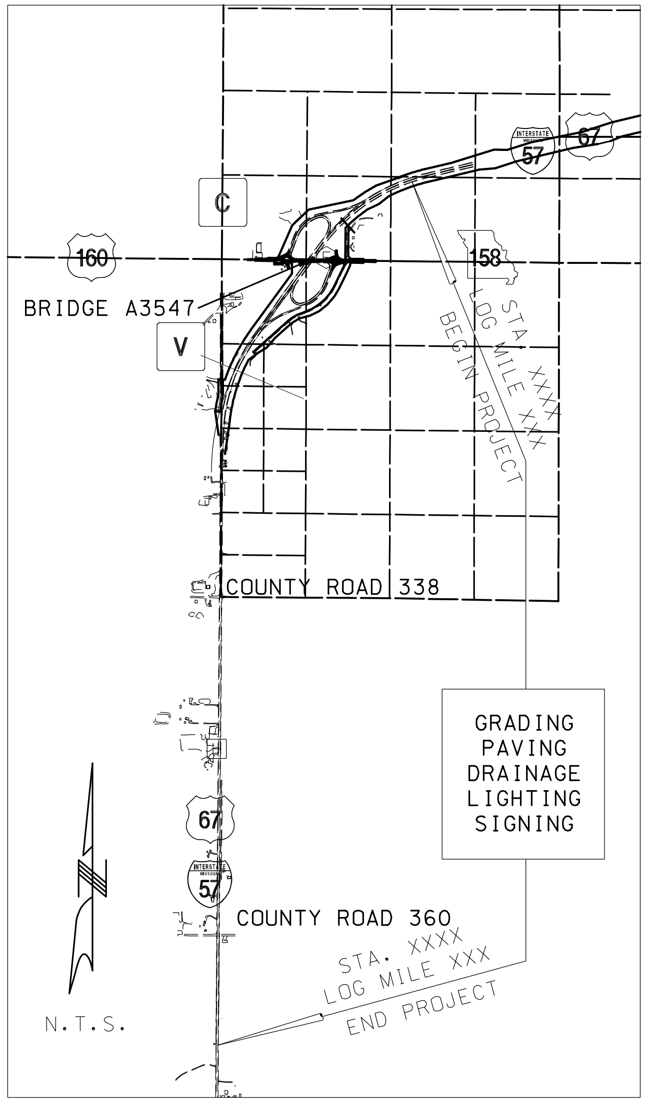
THIS SHALL BE A FULLY CONTROLLED ACCESS HIGHWAY BETWEEN STA. + AND STA. + . NO ABUTTING OWNER SHALL HAVE THE RIGHT OF DIRECT ACCESS TO SAID HIGHWAY OR ITS RIGHT-OF-WAY EXCEPT THAT ACCESS WILL BE PERMITTED TO ANY ADJACENT OUTER ROADWAY OR SERVICE ROAD TO WHICH ACCESS IS NOT SPECIFICALLY PROHIBITED BY THE SPECIAL SYMBOL DENOTING "NO RIGHT OF ACCESS" AS SHOWN ON THE PLANS. NO ACCESS WILL BE PERMITTED FROM OUTER ROADWAYS AND SERVICE ROADS TO THROUGHWAYS EXCEPT ALONG ROUTES CONSTRUCTED FOR THAT PURPOSE. OUTER ROADWAYS AND SERVICE ROADS, AS THE CASE MAY BE, ARE SO DESIGNATED ON THE PLANS.

- BEGINNING AND ENDING OF CONTROLLED ACCESS
- CONTROLLED ACCESS
- NO RIGHT OF ACCESS OR CROSSING OF LINES BEARING THIS SYMBOL WILL BE PERMITTED UNDER ANY CIRCUMSTANCES.
- TEMPORARY ACCESS THROUGH FUTURE NO RIGHT OF ACCESS

CONVENTIONAL SYMBOLS
(USED IN PLANS)

	EXISTING	NEW
BUILDINGS AND STRUCTURES		
GUARD RAIL		
GUARD CABLE		
CONCRETE RIGHT-OF-WAY MARKER		
STEEL RIGHT-OF-WAY MARKER		
LOCATION SURVEY MARKER		
UTILITIES		
FIBER OPTICS	FO	FO
OVERHEAD CABLE TV	OTV	OTV
UNDERGROUND CABLE TV	UTV	UTV
OVERHEAD TELEPHONE	OT	OT
UNDERGROUND TELEPHONE	UT	UT
OVERHEAD POWER	OE	OE
UNDERGROUND POWER	UE	UE
SANITARY SEWER	S	S
STORM SEWER	SS	SS
GAS	G	G
WATER	W	W
MANHOLE	SAN	
FIRE HYDRANT	HYD	
WATER VALVE	WV	
WATER METER	WM	
DROP INLET		
DITCH BLOCK		
GROUND MOUNTED SIGN	SIGN	
LIGHT POLE		
H-FRAME POWER POLE		
TELEPHONE PEDESTAL	PED	
FENCE		
CHAIN LINK	V	
WOVEN WIRE	X	
GATE POST		
BENCHMARK	BM	

NOTE: DASHED OR OPEN SYMBOLS INDICATE EXISTING FEATURES



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INDEX OF SHEETS

LENGTH OF PROJECT

BEGINNING OF PROJECT	STA. XXX + XX.XX	
END OF PROJECT	STA. XXX + XX.XX	
APPARENT LENGTH	XXXXX.XX	FEET
EQUATIONS AND EXCEPTIONS:		
TOTAL CORRECTIONS	XXXXX.XX	FEET
NET LENGTH OF PROJECT	XXXXX.XX	FEET
STATE LENGTH	XX.XXX	MILES
FOR INFORMATION ONLY ESTIMATED DISTURBED ACRES	XX	ACRES

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DATE PREPARED	12/22/2020
ROUTE	67
STATE	MO
DISTRICT	SE
SHEET NO.	1
COUNTY	BUTLER
JOB NO.	J9P3663
CONTRACT ID.	
PROJECT NO.	
BRIDGE NO.	

DESCRIPTION

DATE

MISSOURI HIGHWAYS AND TRANSPORTATION COMMISSION

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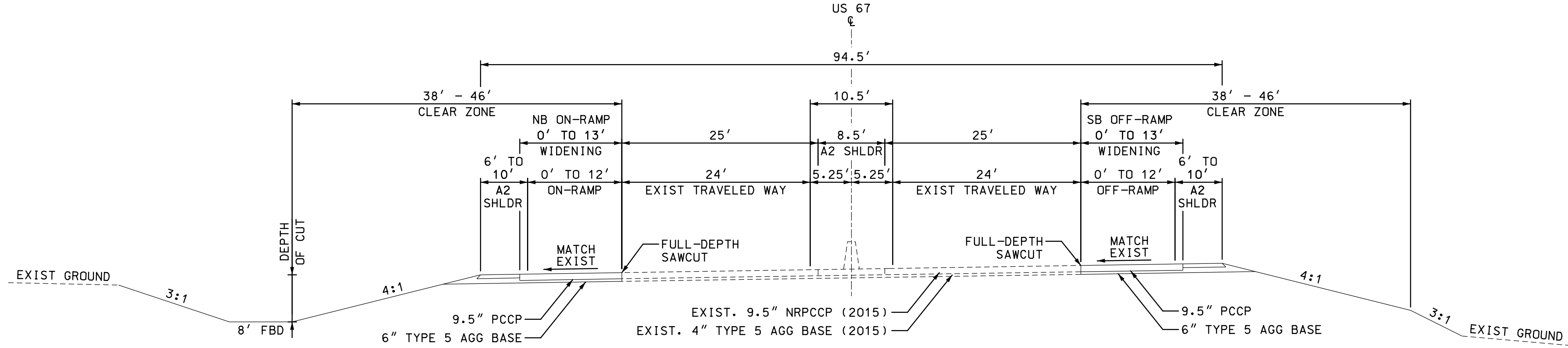
SECTION A-A

ROUTE 67 WIDENING



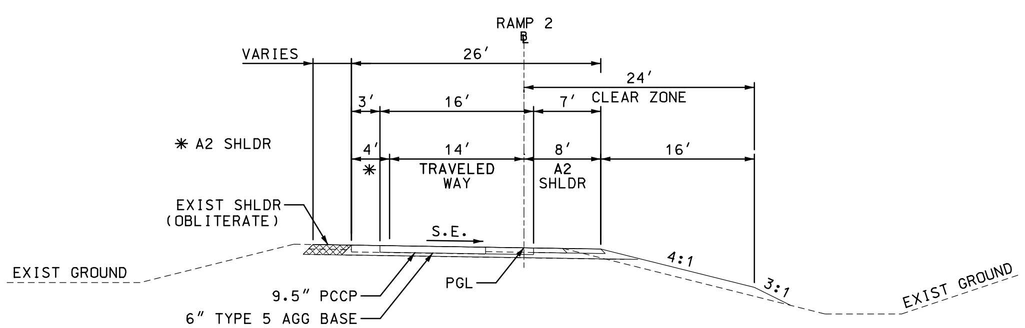
SECTION ON SUPERELEVATED CURVE
ROUTE 67

NORTHBOUND ACCELERATION LANE
STA 530+78.71 LT TO STA 539+58.71 LT (=STA 18+13.37 RAMP 4)

SOUTHBOUND DECELERATION LANE
STA 531+98.00 RT TO STA 537+80.82 RT (=STA 0+00.00 RAMP 2)

SECTION B-B

RAMP 2
SOUTHBOUND OFF-RAMP

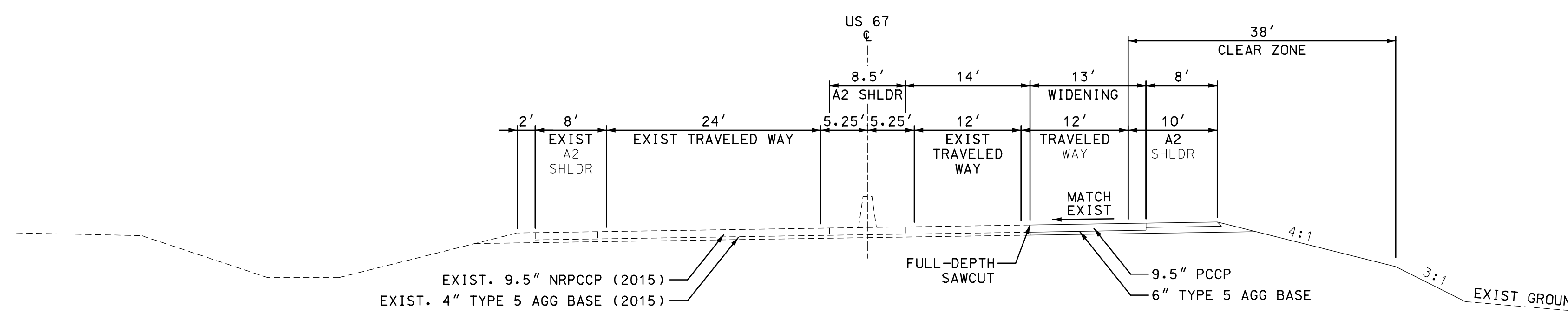


SECTION ON SUPERELEVATED CURVE
RAMP 2

STA 0+00.00 (=STA 537+80.82 EXIST RTE 67) TO STA 6+08.92

SECTION C-C

SOUTHBOUND ROUTE 67 WIDENING



SECTION ON SUPERELEVATED CURVE
ROUTE 67

STA 537+80.82 RT (=STA 0+00.00 RAMP 2) TO STA 547+51.43 RT

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TYPICAL SECTIONS
SHEET 1 OF 6

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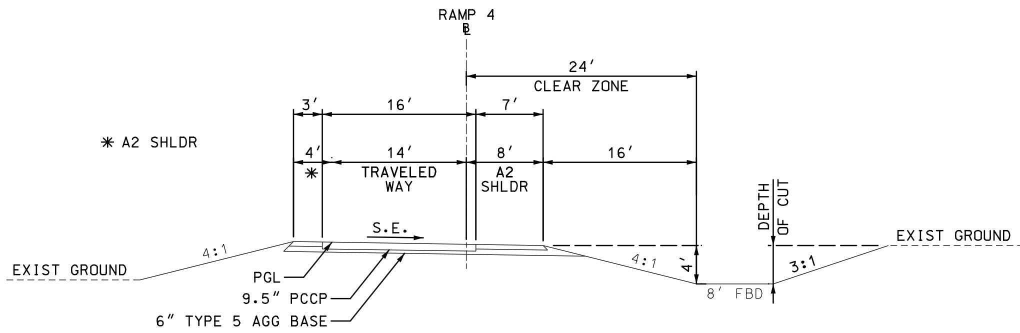
SECTION D-D

RAMP 4
PROPOSED NORTHBOUND ON-RAMP

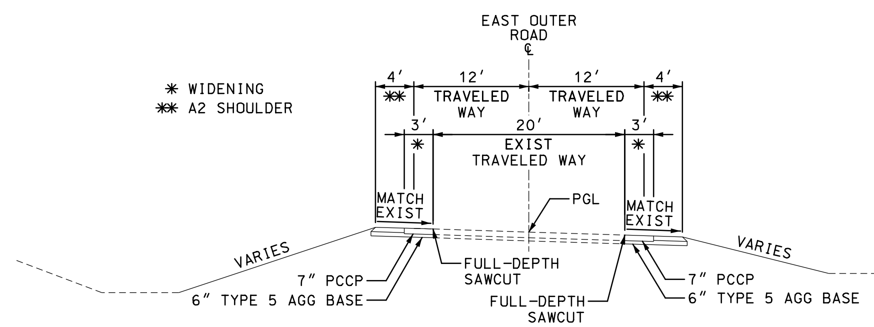


SECTION ON SUPERELEVATED CURVE
RAMP 4

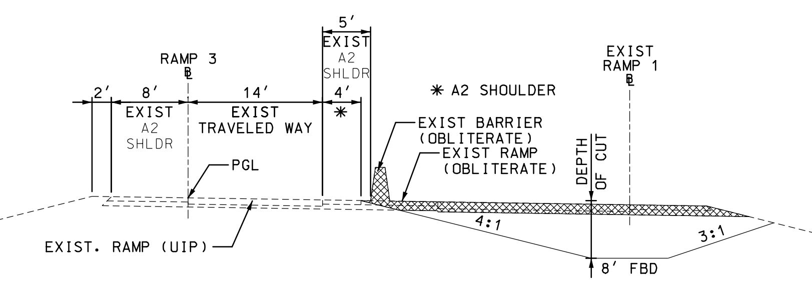
STA 10+00.00 TO STA 18+13.37 (=STA 539+58.71 EXIST RTE 67)

SECTION E-E

EAST OUTER ROAD
& RAMP REMOVAL



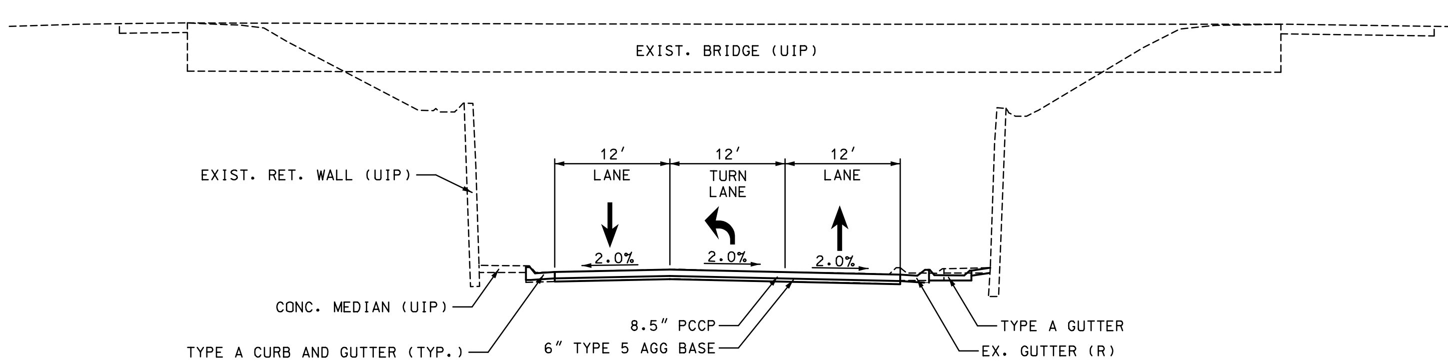
SECTION ON SUPERELEVATED CURVE
EAST OUTER ROAD
STA 0+00.00 TO STA 20+57.58



SECTION ON SUPERELEVATED CURVE
EXISTING RAMP 4
(OBLITERATE)

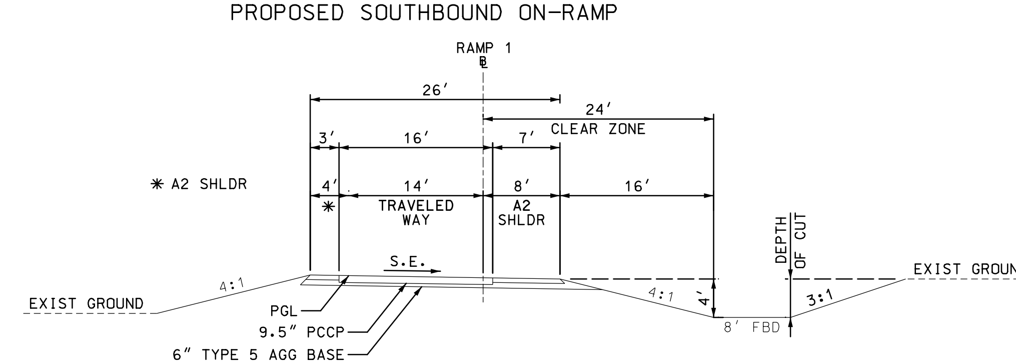
SECTION F-F

EXIST ROUTE 158



SECTION G-G

RAMP 1
PROPOSED SOUTHBOUND ON-RAMP



SECTION ON SUPERELEVATED CURVE
RAMP 1

STA 10+00.00 TO STA 16+02.07 (=STA 559+88.33 EXIST RTE 67)

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TYPICAL SECTIONS
SHEET 2 OF 6

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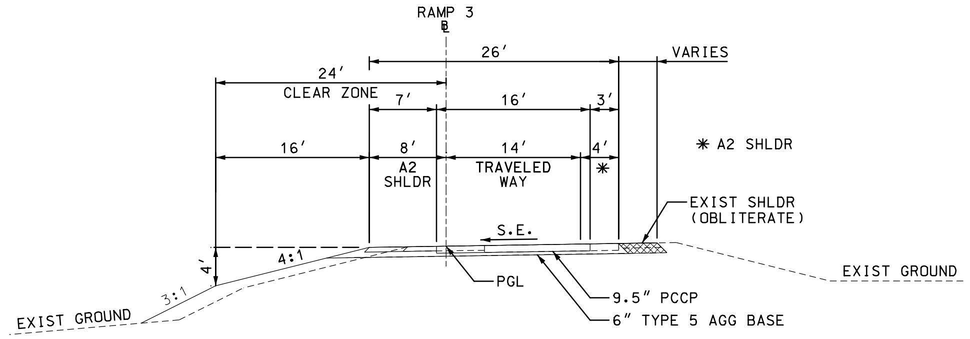
SECTION H-H

RAMP 3
NORTHBOUND OFF-RAMP

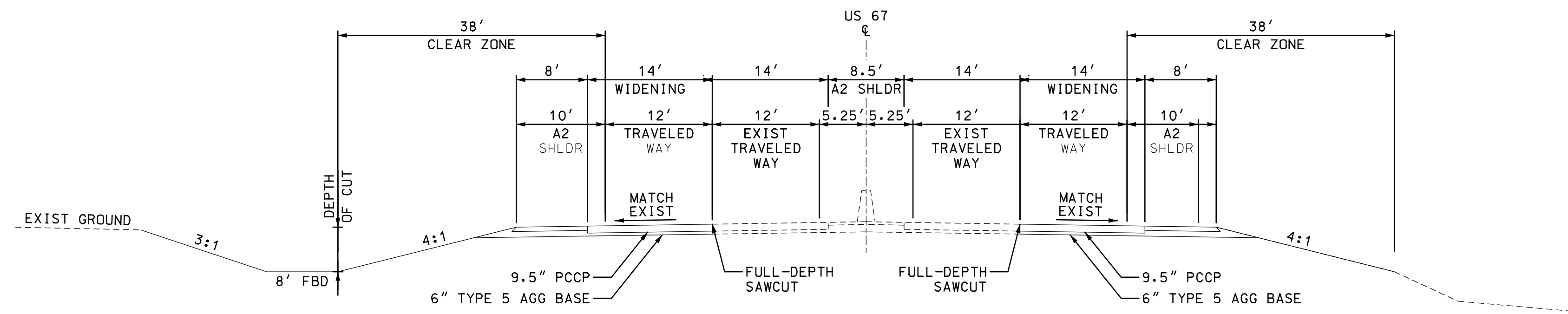


SECTION ON SUPERELEVATED CURVE
RAMP 3

STA 11+99.25 TO STA 17+59.09 (=STA 565+40.72 EXIST RTE 67)

SECTION I-I

NORTHBOUND ROUTE 67 WIDENING



SECTION ON TANGENT
ROUTE 67

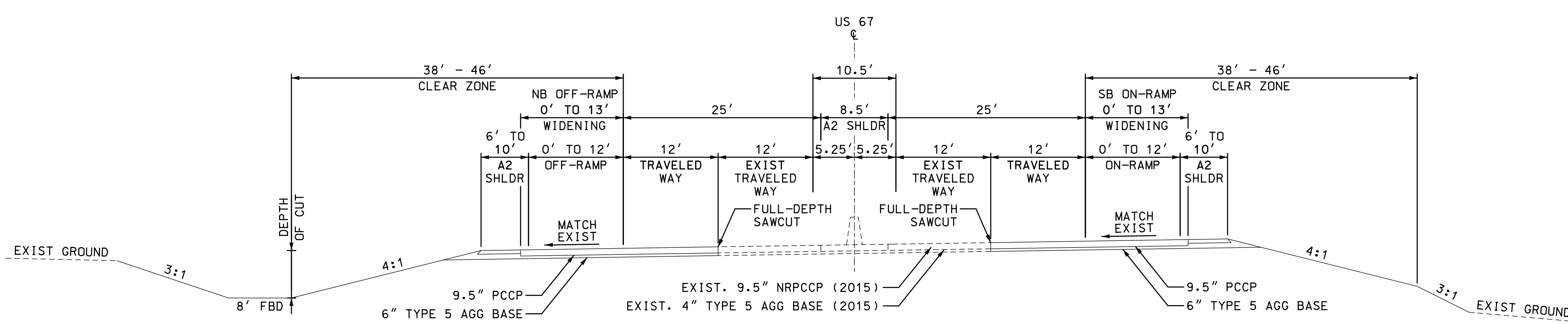
STA 555+43.96 LT TO STA 565+40.72 LT (=STA 17+59.09 RAMP 3)

STA 558+09.86 RT TO STA 559+88.33 RT (=STA 16+20.07 RAMP 1)

SOUTHBOUND ACCELERATION LANE
STA 559+88.33 RT (=STA 16+20.07 RAMP 1)TO STA 565+40.72 RT

SECTION J-J

ROUTE 67 WIDENING



SECTION ON SUPERELEVATED CURVE
ROUTE 67

SOUTHBOUND ACCELERATION LANE
STA 565+40.72 RT TO STA 568+68.33 RT

NORTHBOUND DECELERATION LANE
STA 565+40.72 LT (=17+59.09 RAMP 3) TO STA 571+81.51 LT

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TYPICAL SECTIONS
SHEET 3 OF 6

REV.

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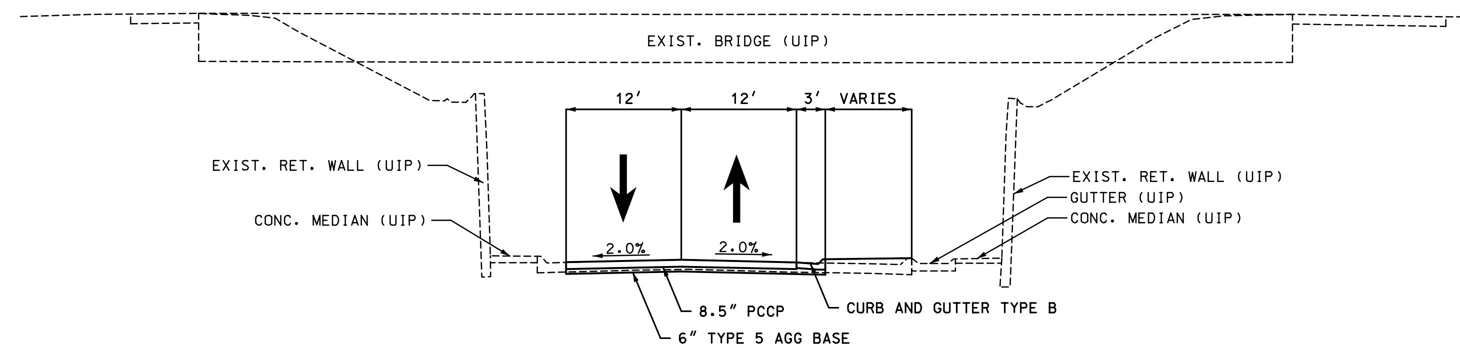
EQUIVALENT PAVEMENT DESIGNS			
CATEGORY	BASE TYPE**		PCCP DESIGN
US 60 MAINLINE	6" TYPE 5 AGGREGATE BASE WITH GEOGRID BASE REINFORCEMENT	12.5" HMA 1-3/4" SP125C W/PG 70-22 OVER 3" SP250C W/PG 70-22 OVER 7-3/4" SP250C W/PG 64-22	9.5" PCCP 15 FT. JOINTS AND 1-1/4" DOWELS
	12" ROCK BASE	11.5" HMA 1-3/4" SP125C W/PG 70-22 OVER 3" SP250C W/PG 70-22 OVER 6-3/4" SP250C W/PG 64-22	9.5" PCCP 15 FT. JOINTS AND 1-1/4" DOWELS
	18" ROCK BASE	11.0" HMA 1-3/4" SP125C W/PG 70-22 OVER 3" SP250C W/PG 70-22 OVER 6-1/4" SP250C W/PG 64-22	9.5" PCCP 15 FT. JOINTS AND 1-1/4" DOWELS
MO 158 AND US 160	6" TYPE 5 AGGREGATE BASE	10.5" HMA 1-3/4" SP125C W/PG 70-22 OVER 3" SP250C W/PG 70-22 OVER 5-3/4" SP250C W/PG 64-22	8.5" PCCP 15 FT. JOINTS AND 1-1/4" DOWELS
OUTER ROADS	6" TYPE 5 AGGREGATE BASE	7.0" HMA 1-3/4" BP W/PG 64-22 OVER 5-1/4" BB W/PG 64-22	7.0" PCCP JOINT SPACING SHOULD MATCH LANE WIDTH; 1-1/4" DOWELS

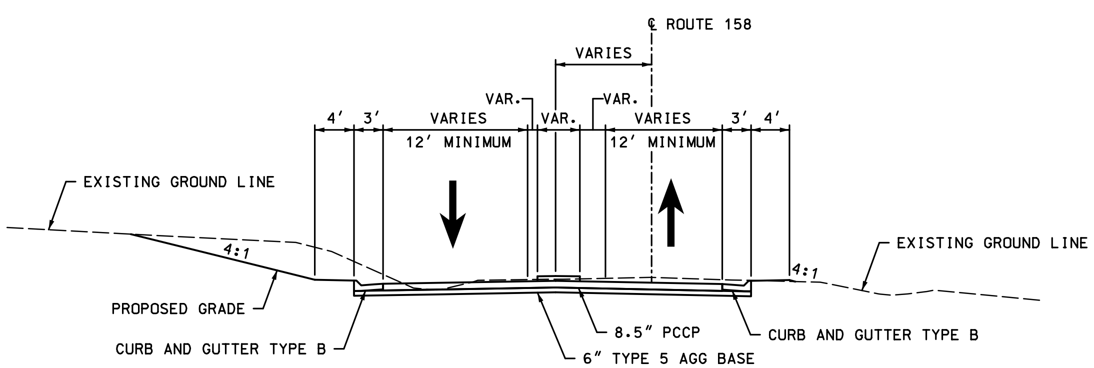
** SECTION 205 - MODIFIED SUBGRADE SHALL BE USED ON ALL PAVEMENT DESIGNS IN ADDITION TO THE BASE REQUIREMENTS.



SECTION ON TANGENT

US 160/MO 158

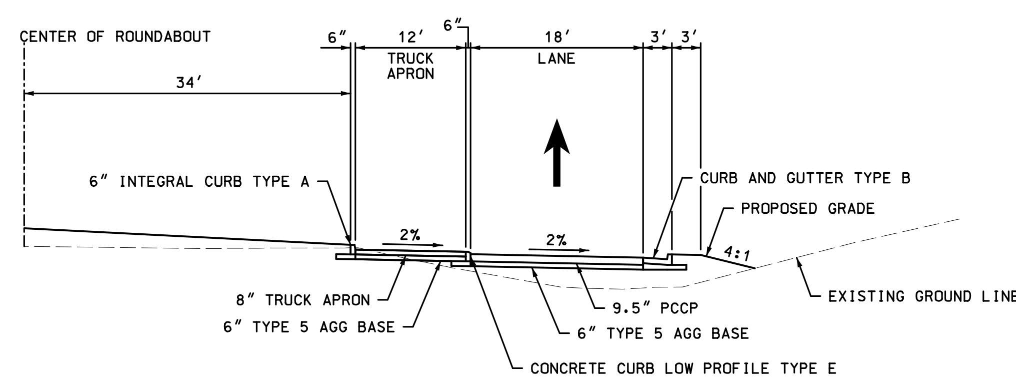
STA. 602+43.07 TO STA. 605+46.47



SECTION ON TANGENT

US 160/MO 158 ROUNDABOUT APPROACH

STA. 595+08.68 TO STA. 599+34.28
STA. 600+64.27 TO STA. 602+43.07
STA. 605+46.47 TO STA. 606+97.52
STA. 608+27.51 TO STA. 612+28.21



SECTION ON TANGENT

US 160/MO 158 ROUNDABOUT

STA. 599+34.28 TO STA. 600+64.27
STA. 606+97.52 TO STA. 608+27.51

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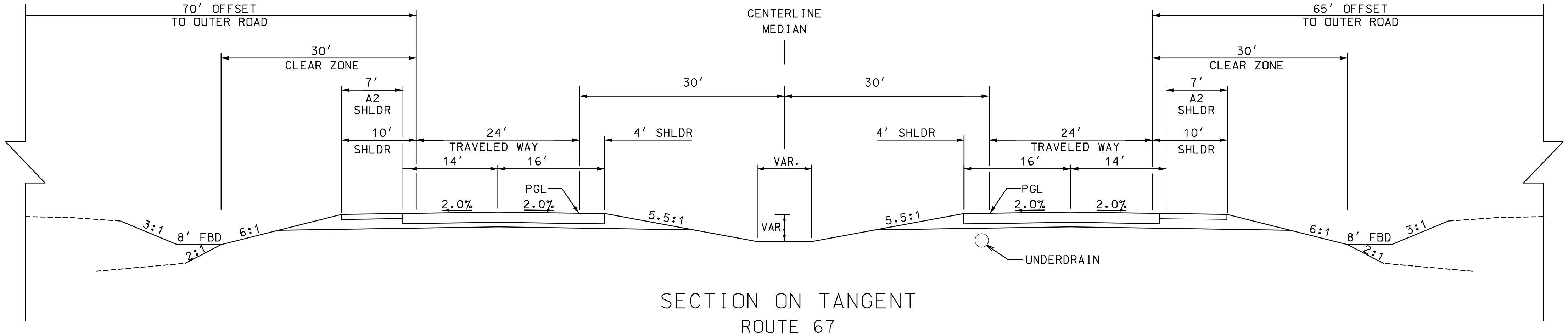
US 160/MO 158

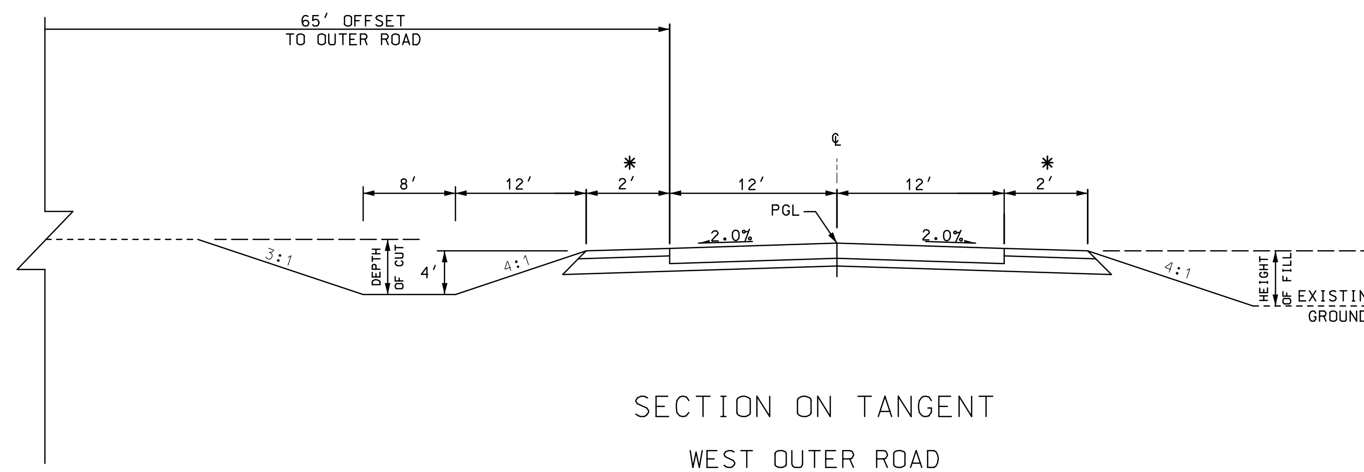
TYPICAL SECTIONS

SHEET 4 OF 6

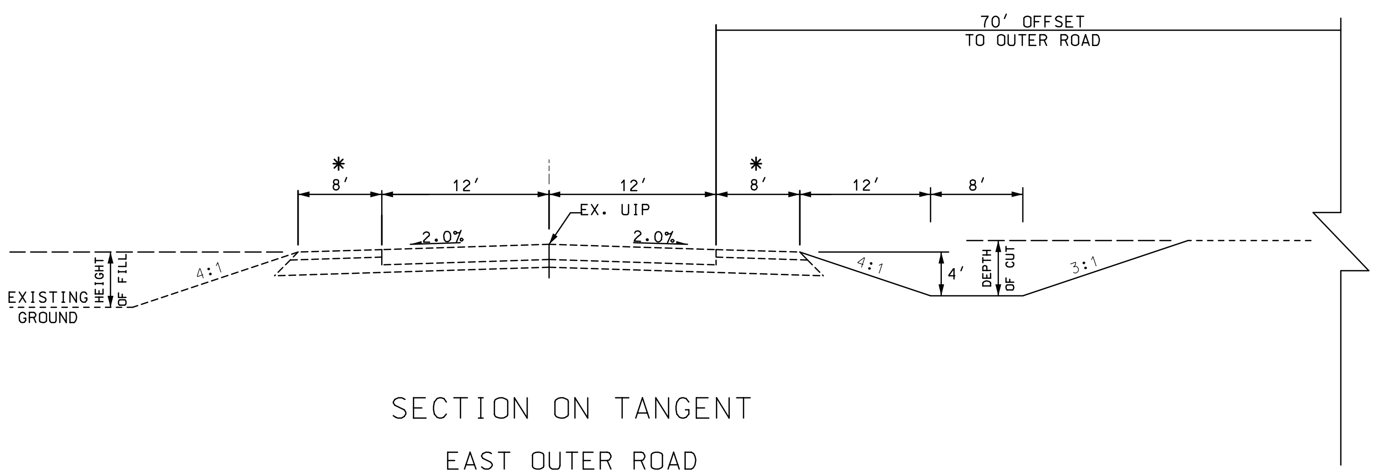
REV.



SECTION ON TANGENT
ROUTE 67
TYPICALS L-L
STA. 602+40 TO 660+76



SECTION ON TANGENT
WEST OUTER ROAD
TYPICAL SECTIONS L-L
STA. 49+30 TO 108+25



SECTION ON TANGENT
EAST OUTER ROAD
TYPICAL SECTIONS L-L
STA. 54+85 TO 114+09

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TYPICAL SECTIONS
SHEET 5 OF 6

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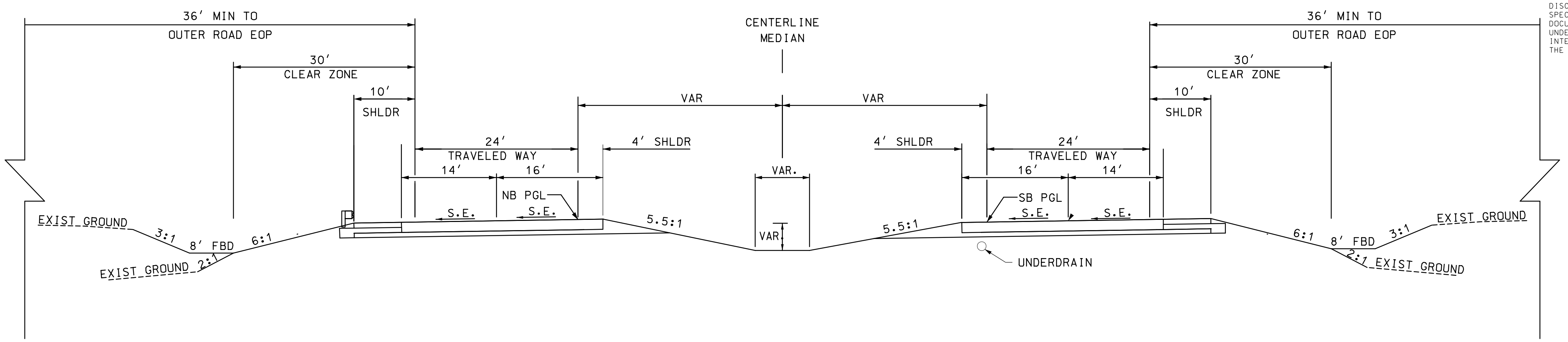
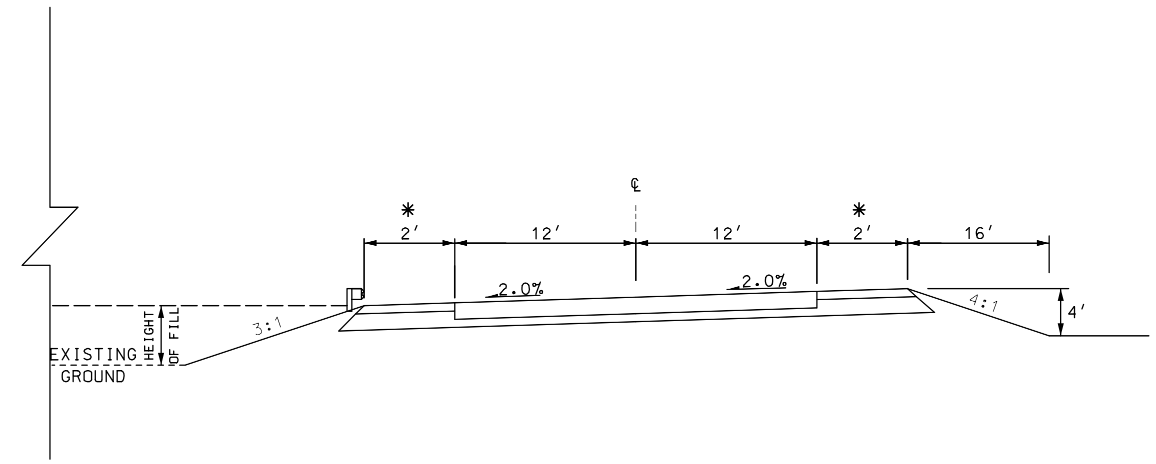


SECTION ON SUPERELEVATED CURVE

ROUTE 67

TYPICAL SECTION K-K

STA. 577+00 TO STA. 602+40

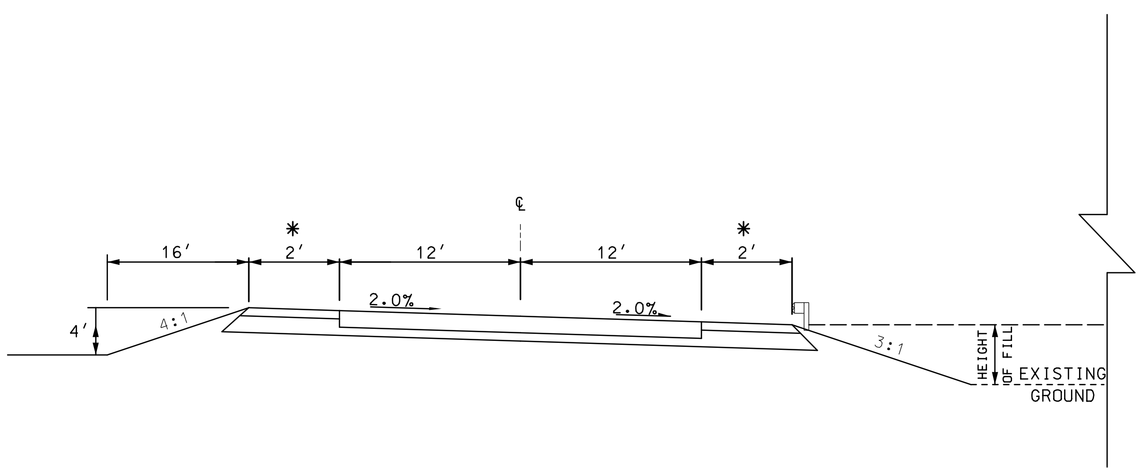


SECTION ON SUPERELEVATED CURVE

WEST OUTER ROAD

TYPICAL SECTION K-K

STA. 17+02 TO STA. 49+30



SECTION ON SUPERELEVATED CURVE

EAST OUTER ROAD

TYPICAL SECTION K-K

STA. 20+57 TO STA. 54+85

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ROUTE 67

TYPICAL SECTIONS
SHEET 6 OF 6

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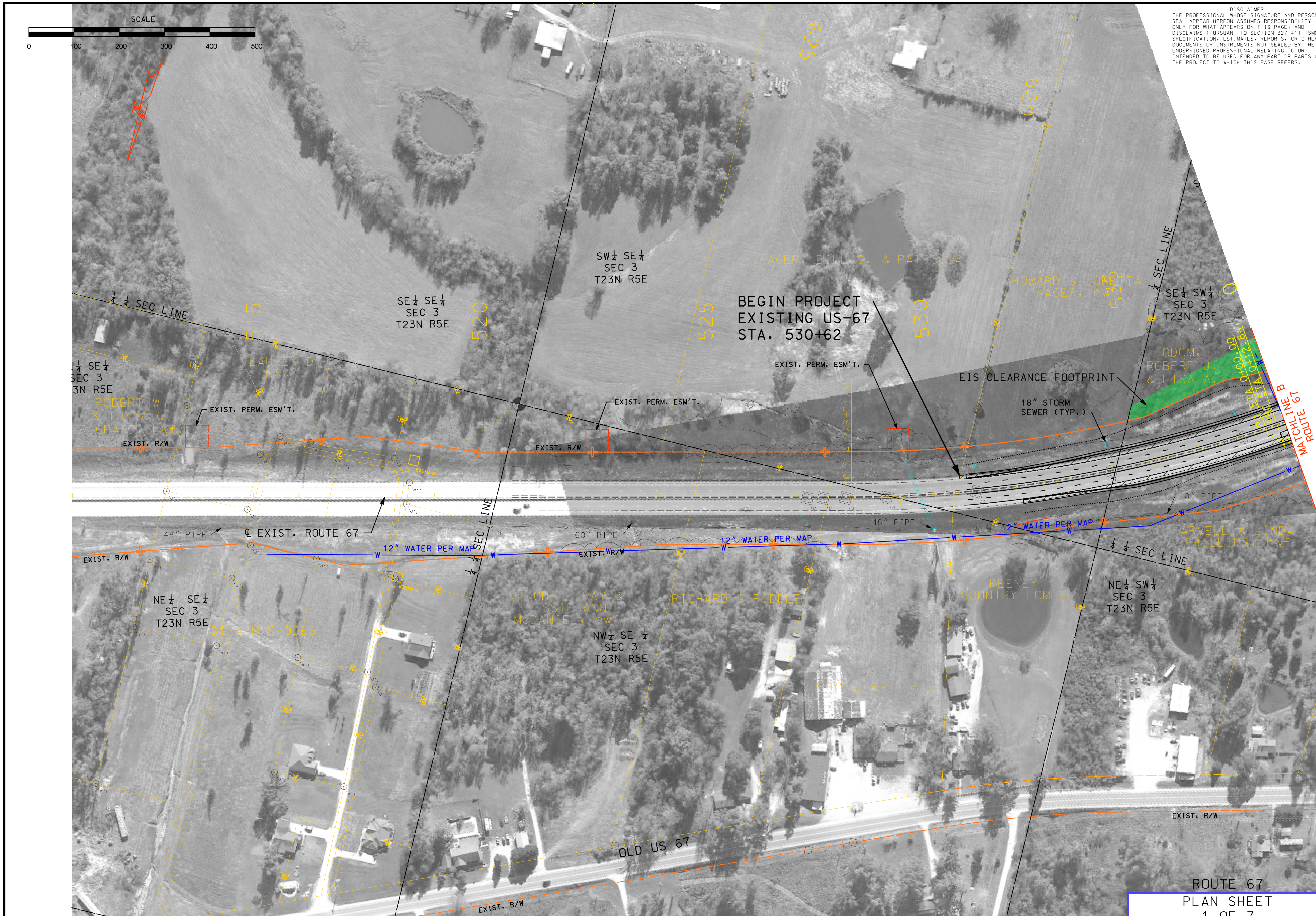

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ROUTE 67
PLAN SHEET
1 OF 7

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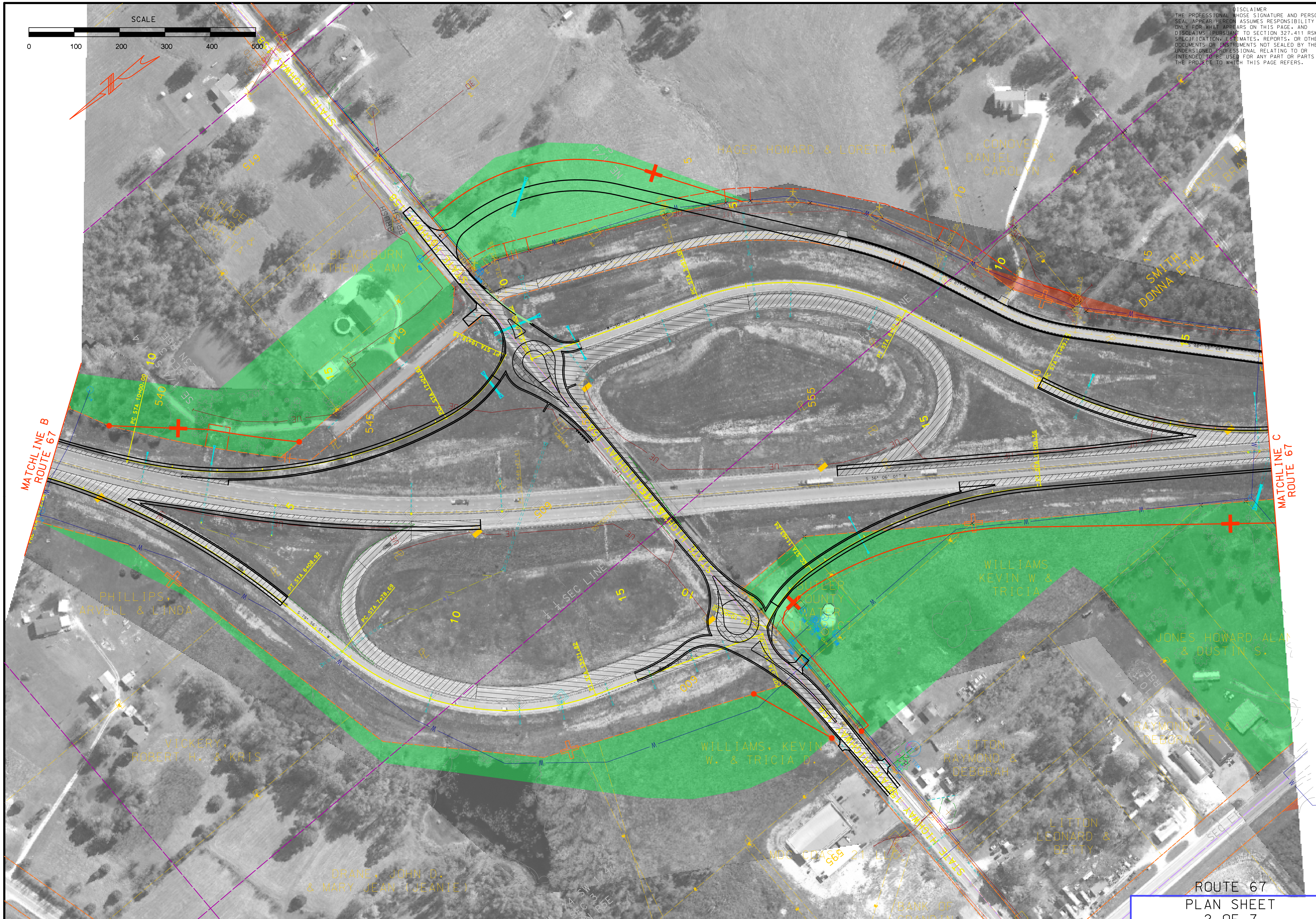

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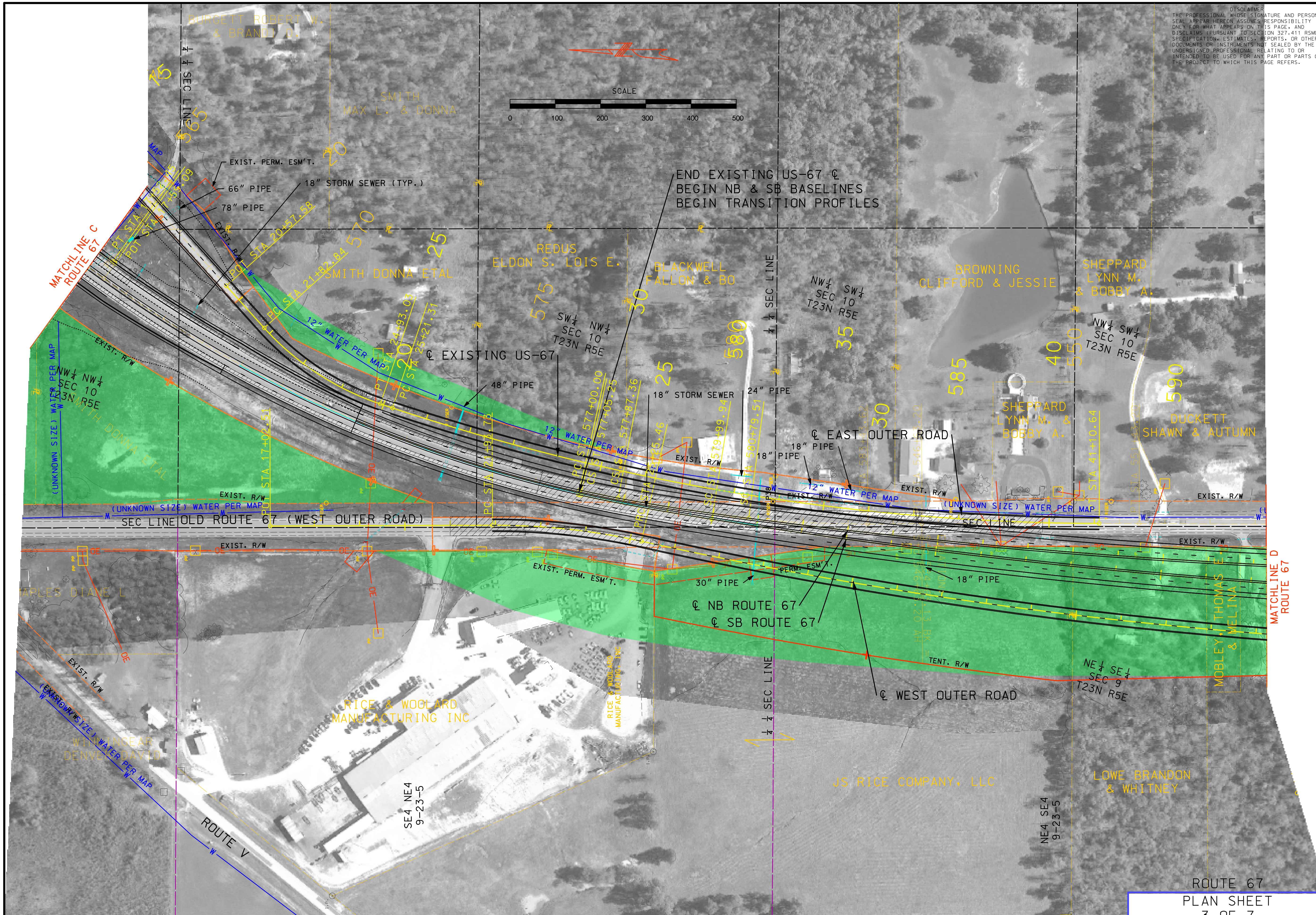
ROUTE 67
PLAN SHEET
2 OF 7



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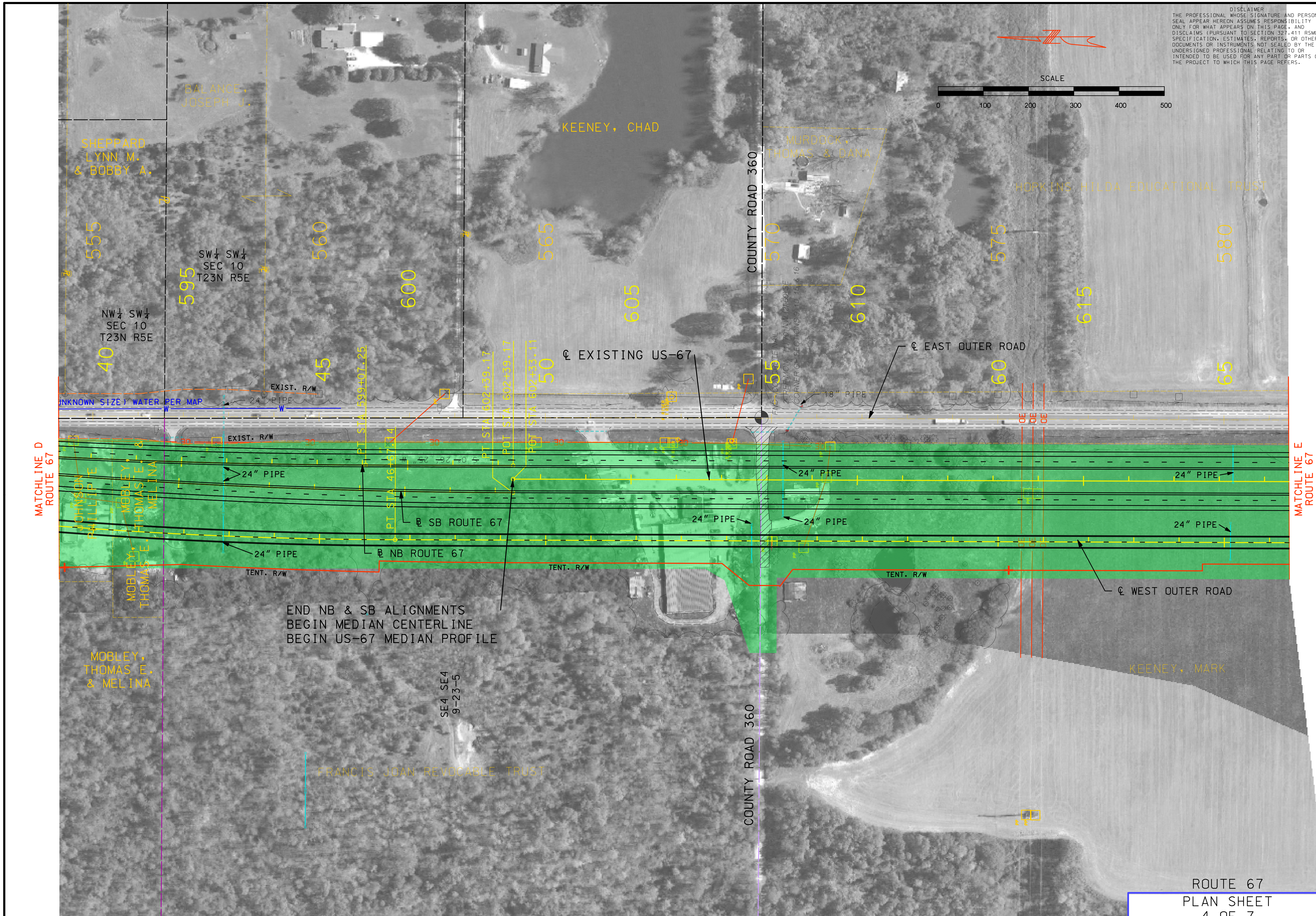

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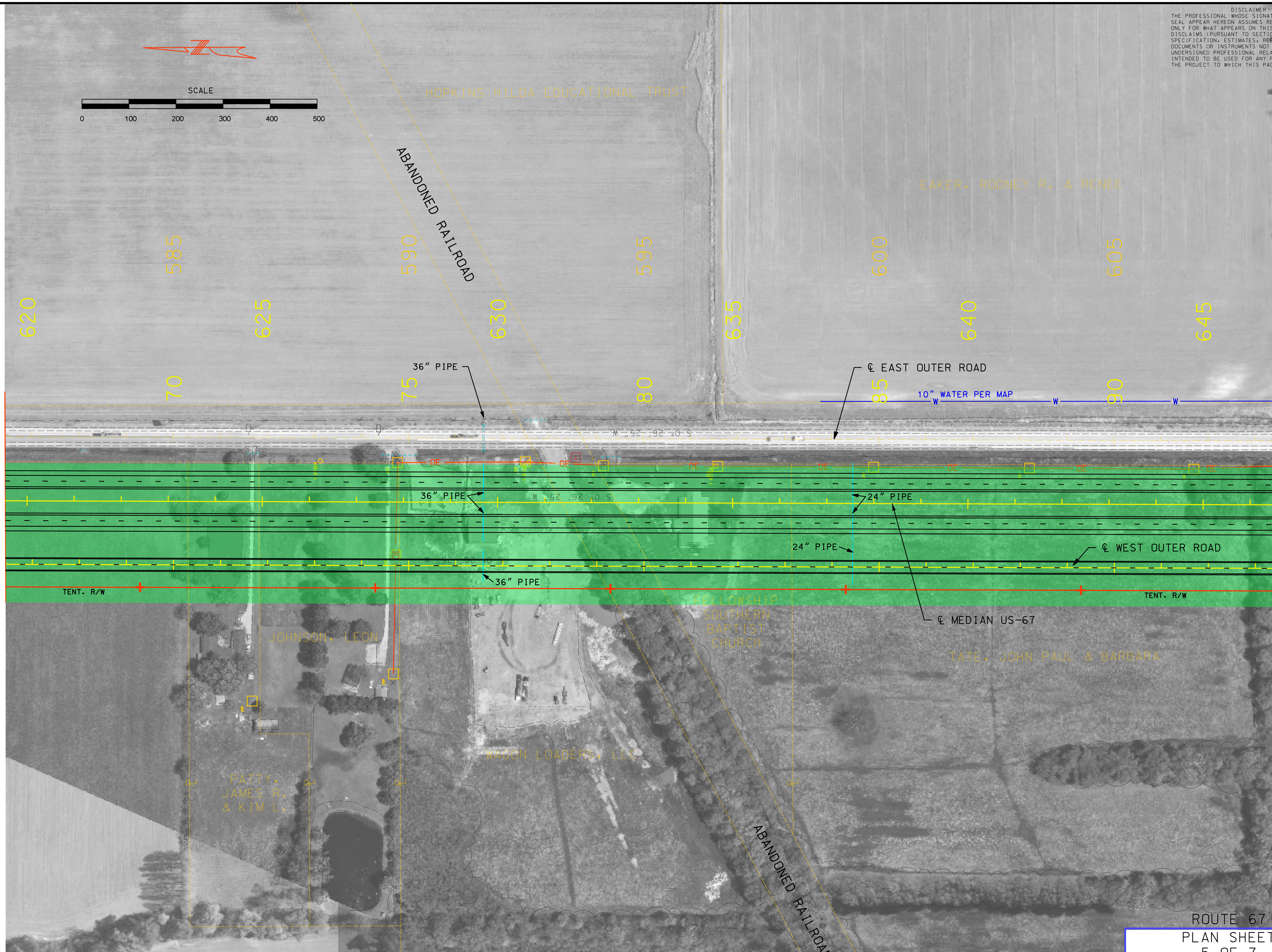

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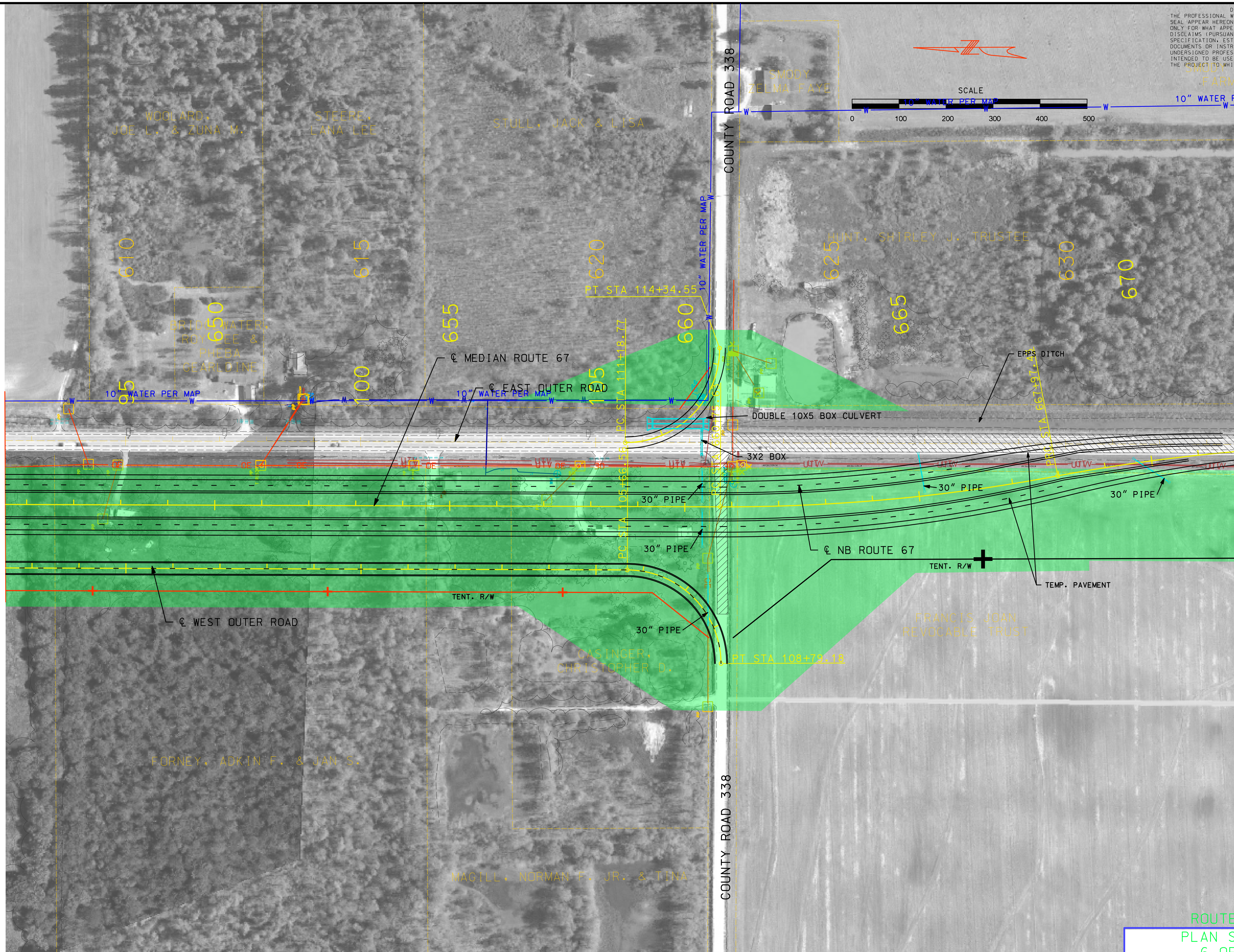

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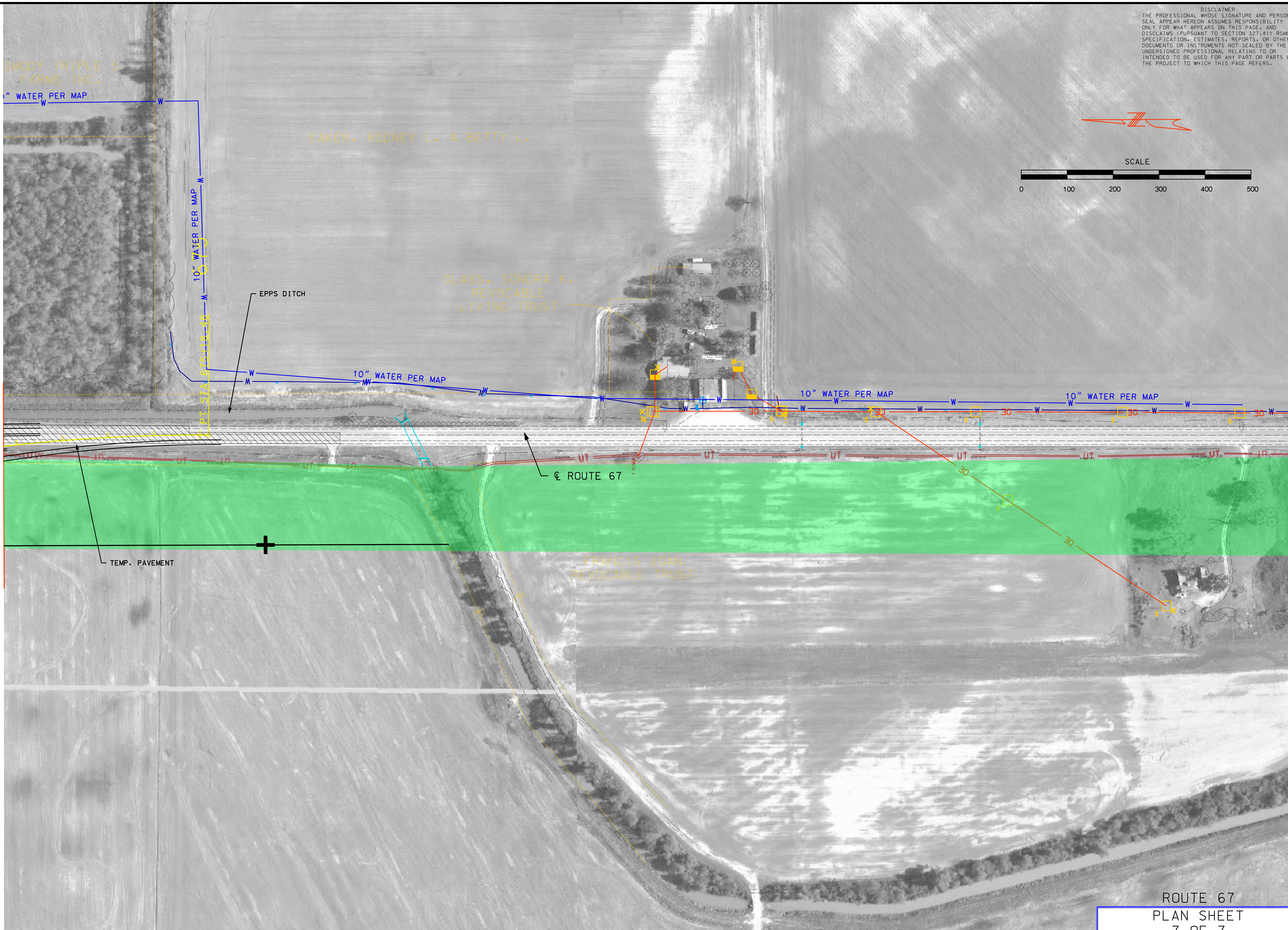

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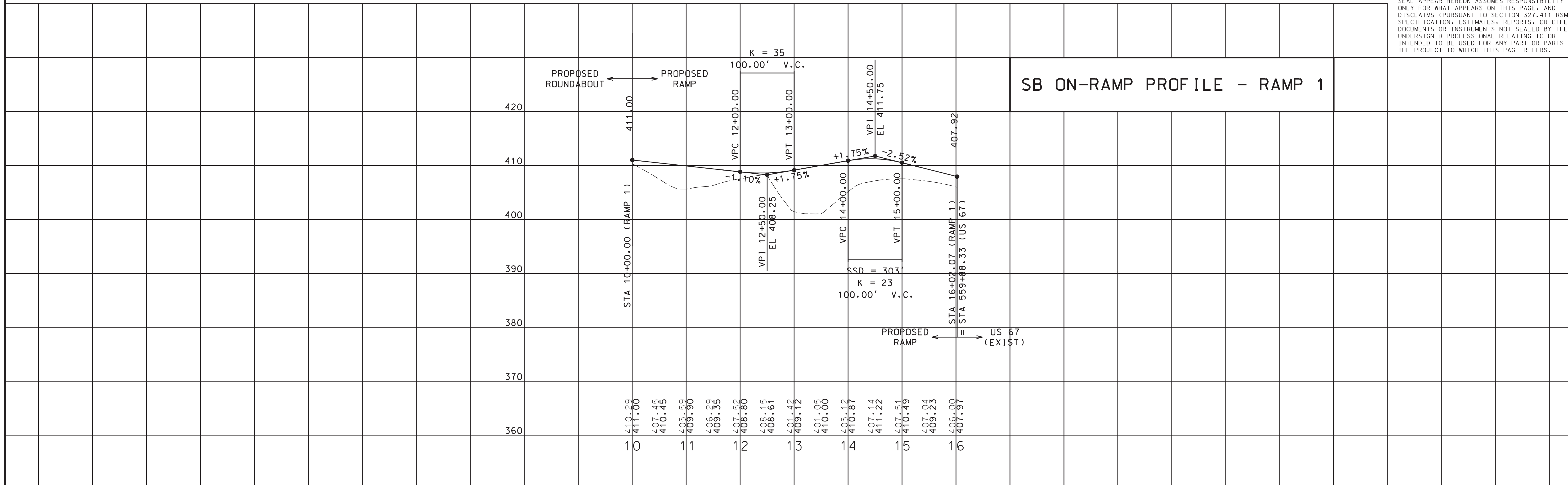

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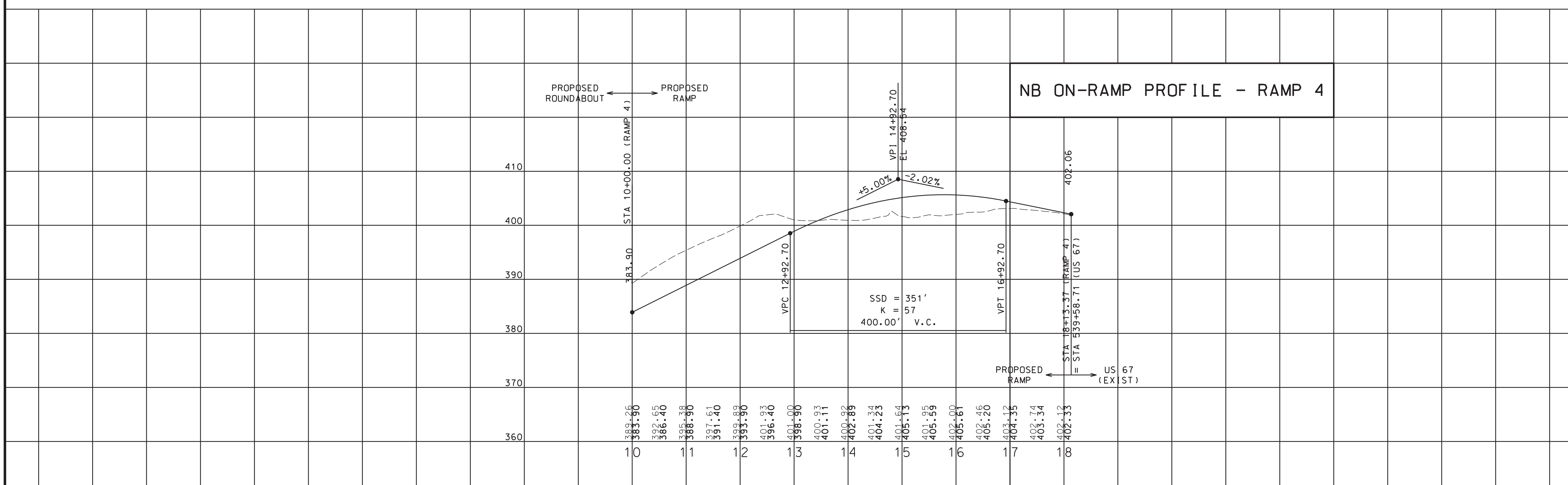

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COUNTY	BUTLER
JOB NO.	J9P3663
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BRIDGE NO.	

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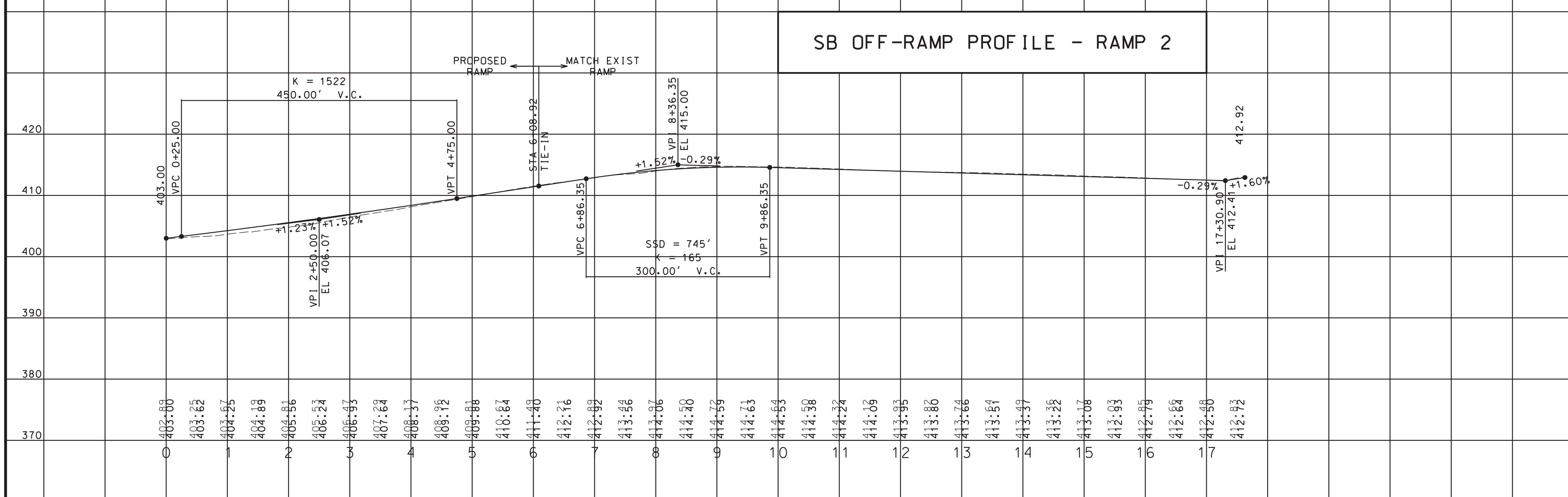

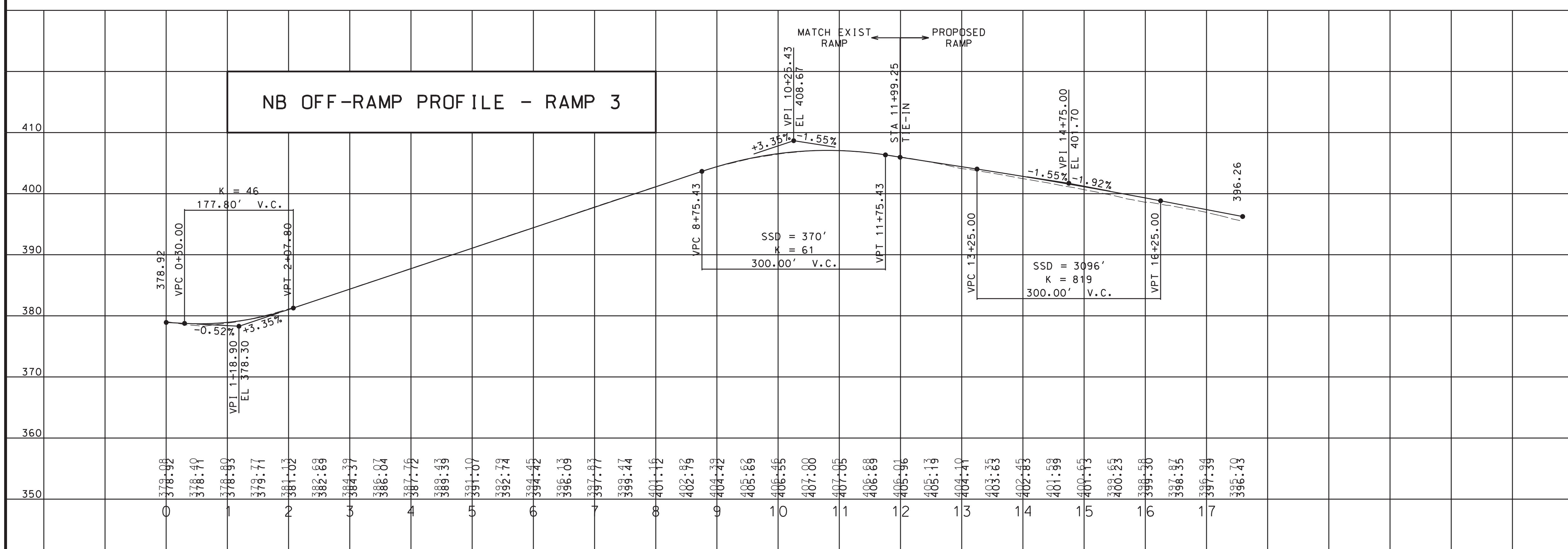

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COUNTY
BUTLER
JOB NO.
J9P3663
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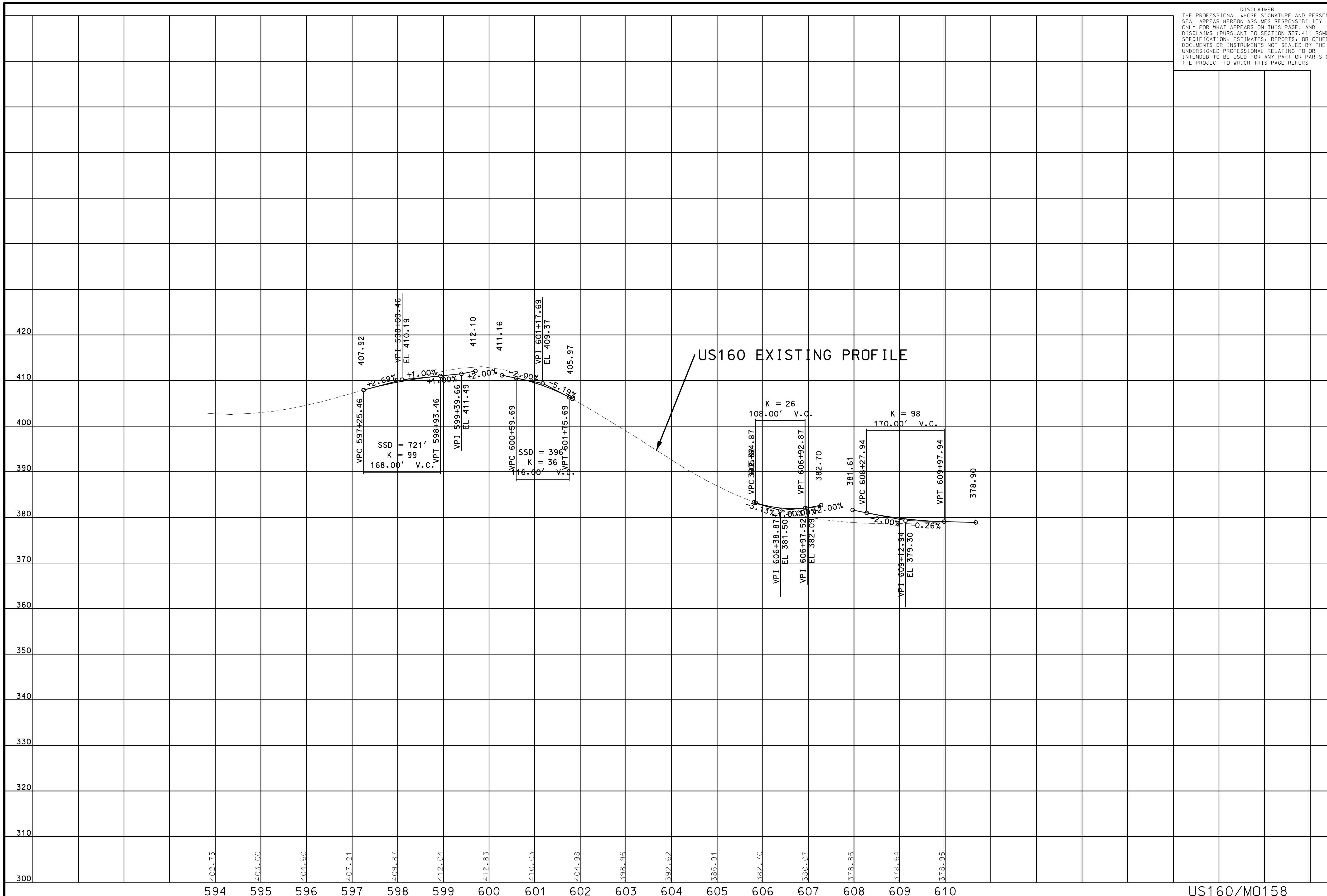

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COUNTY BUTLER	
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BRIDGE NO.	

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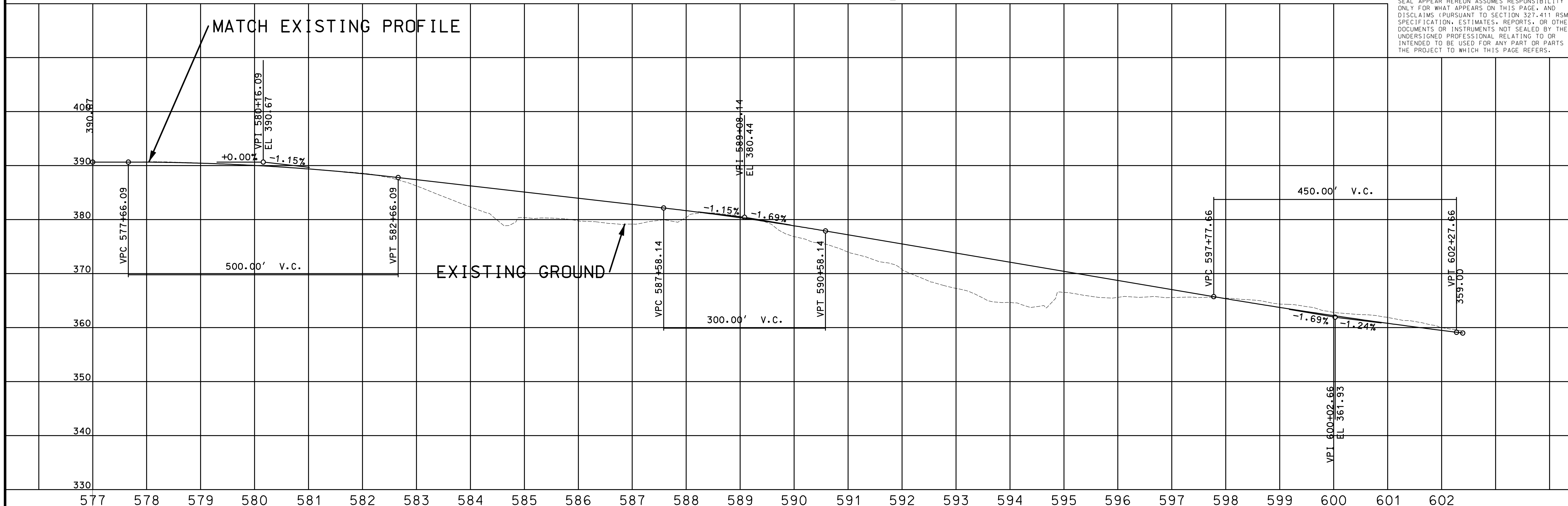
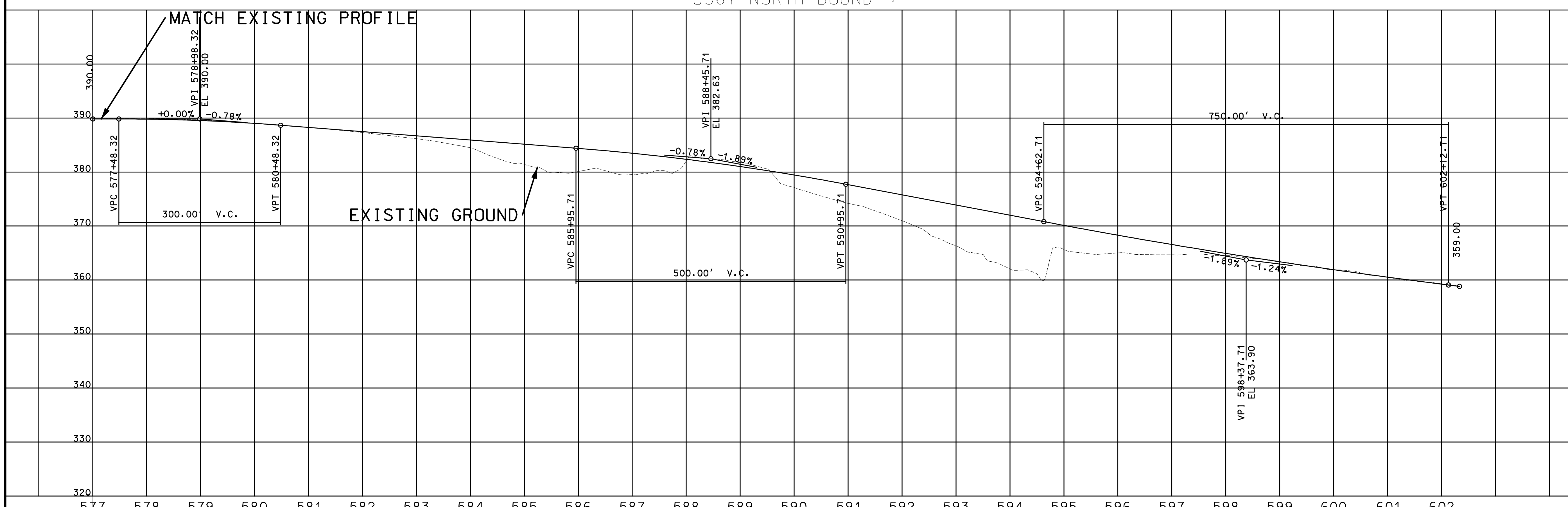
PROFILE SHEETS
SHEET 3 OF 10

US67 SOUTH BOUND ℄



US67 NORTH BOUND ℄



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BRIDGE NO.	

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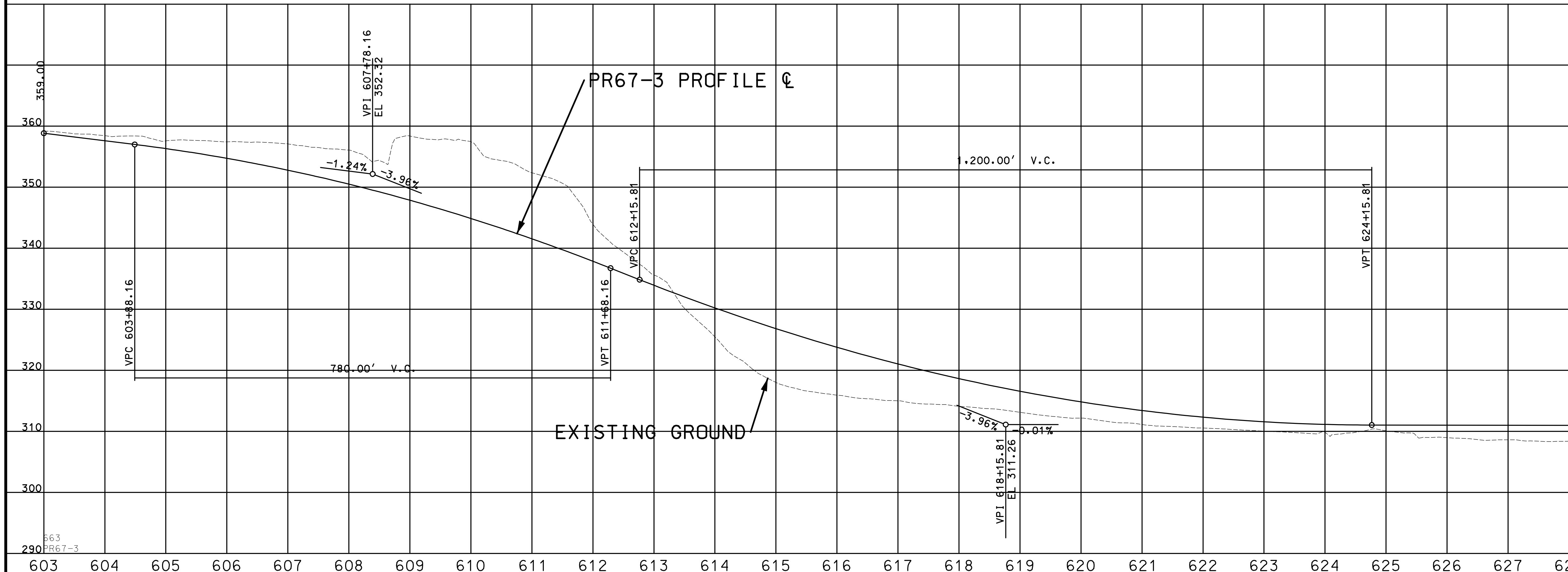
PR67-3 PROPOSED ℄



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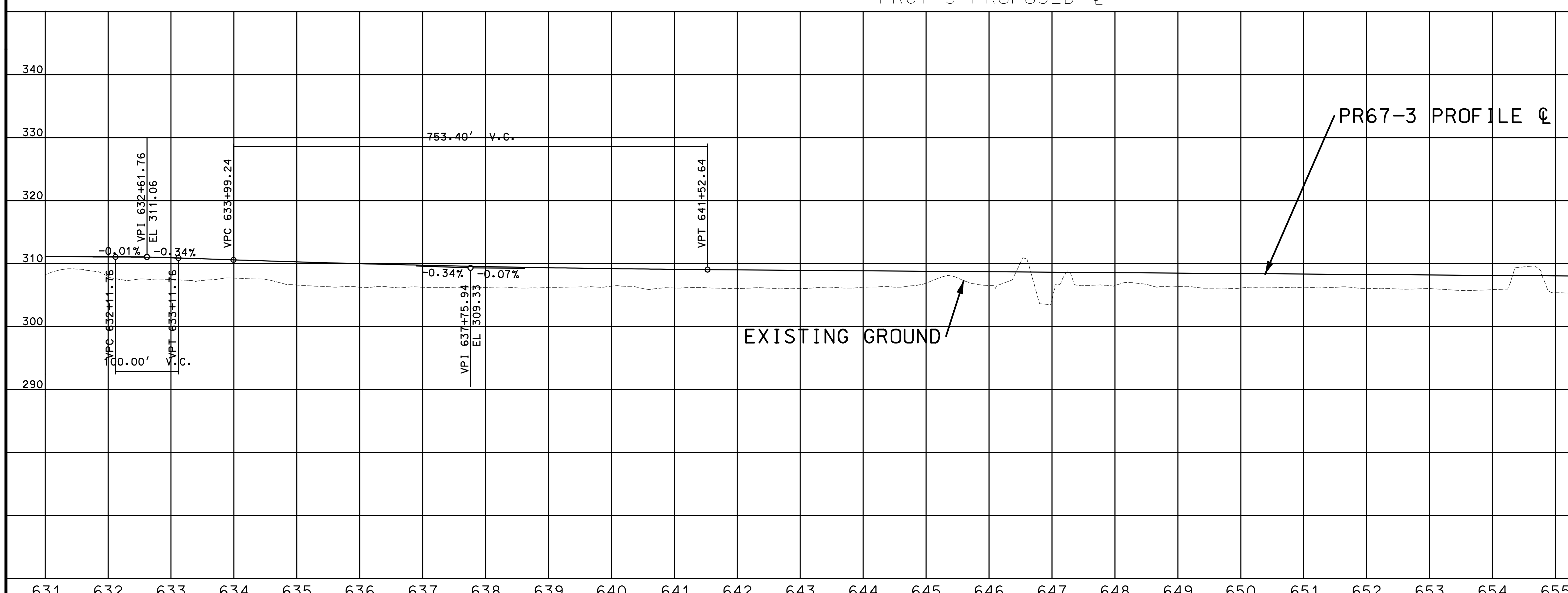

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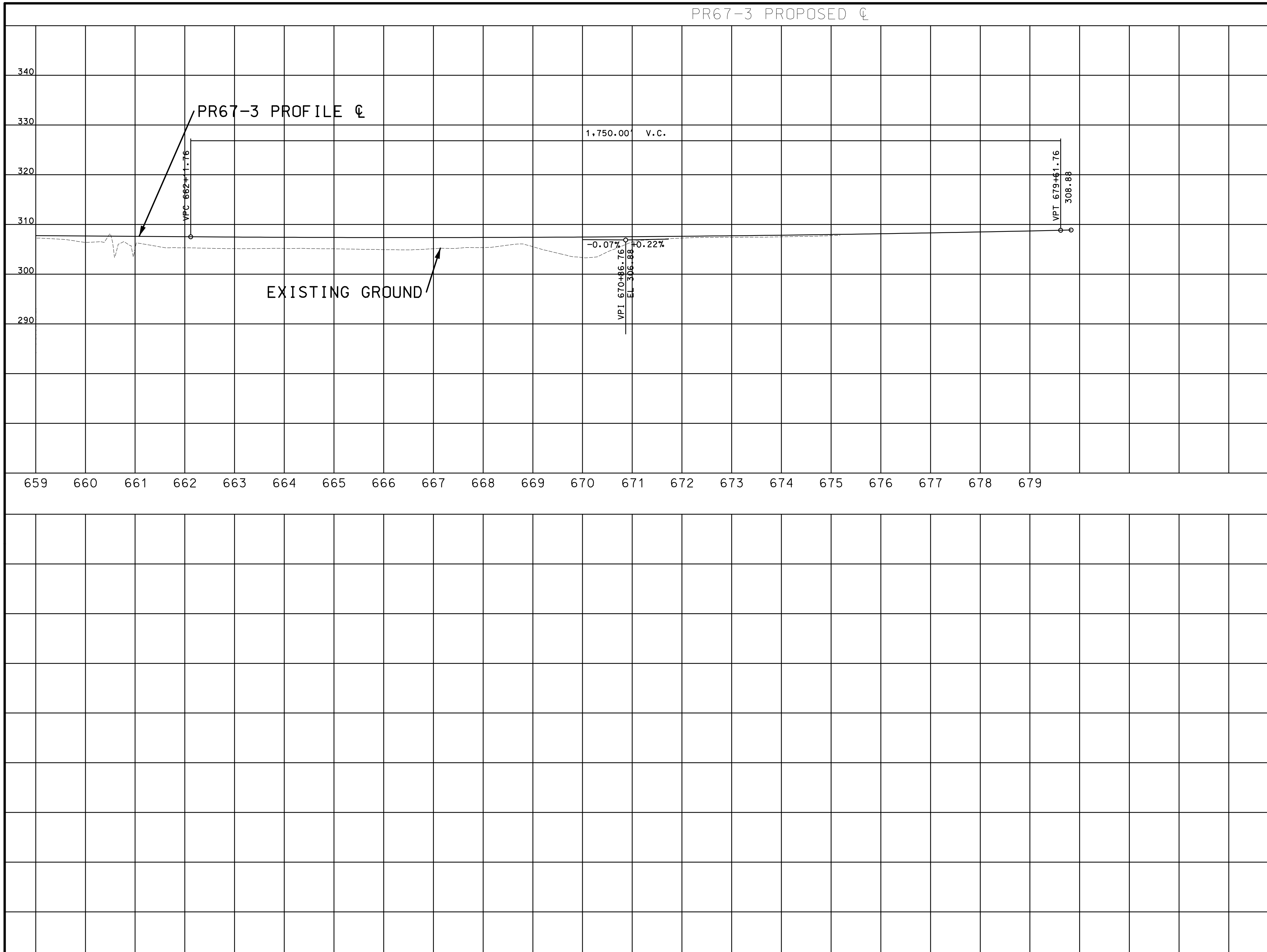

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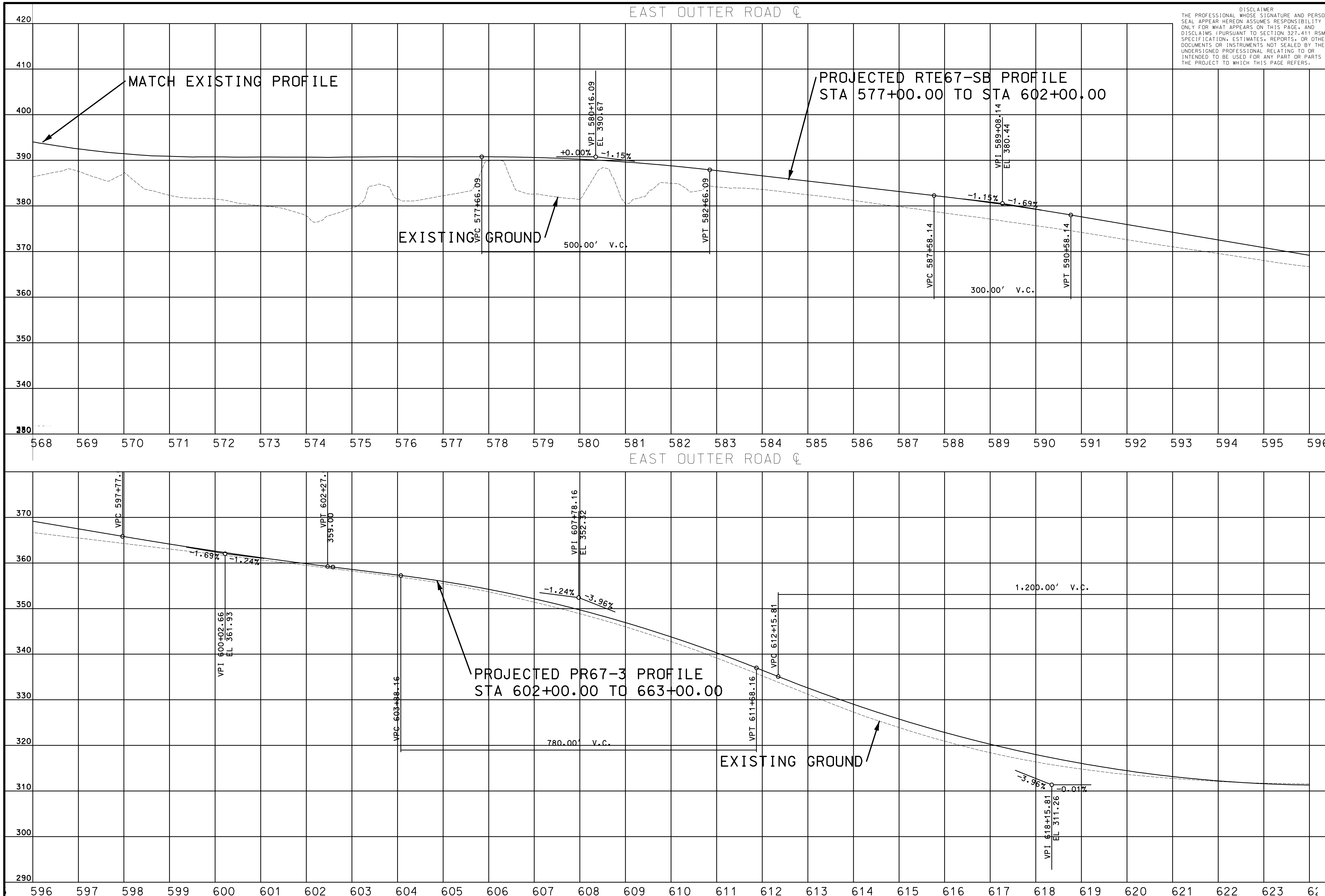

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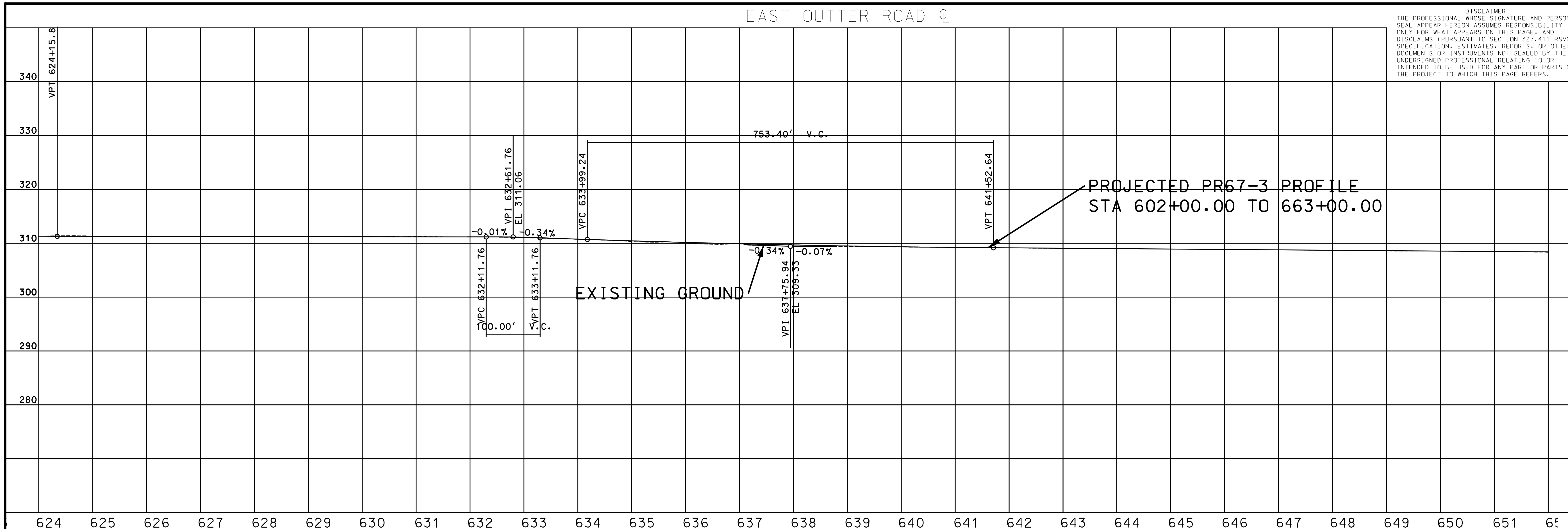

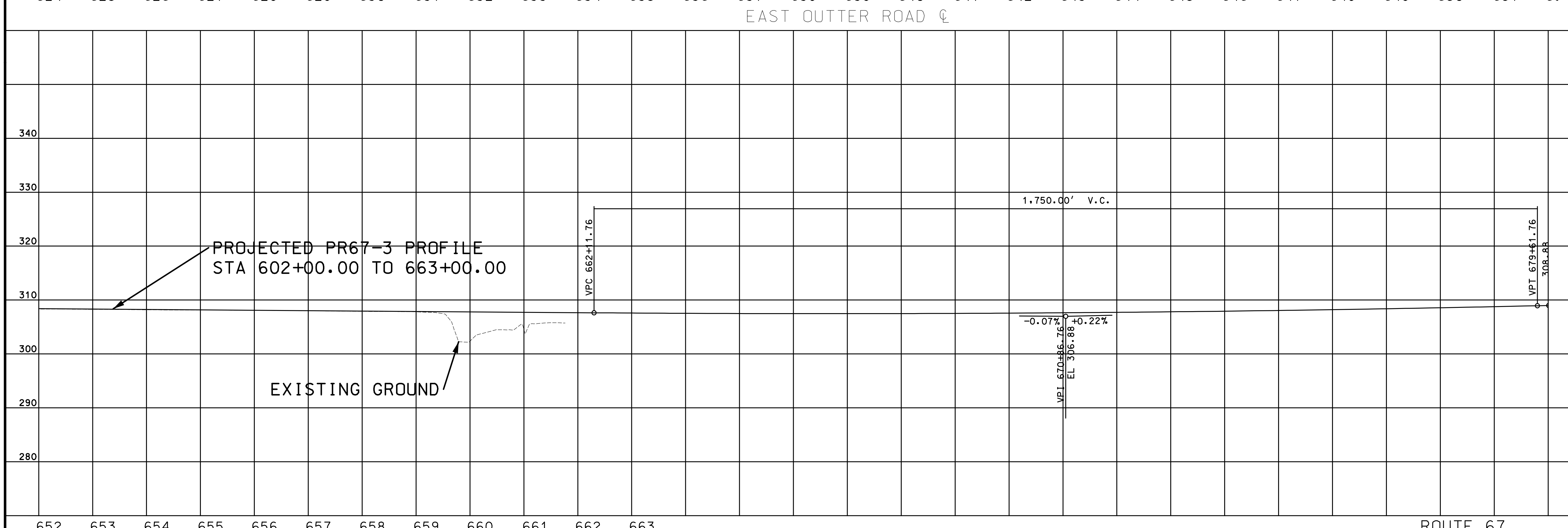

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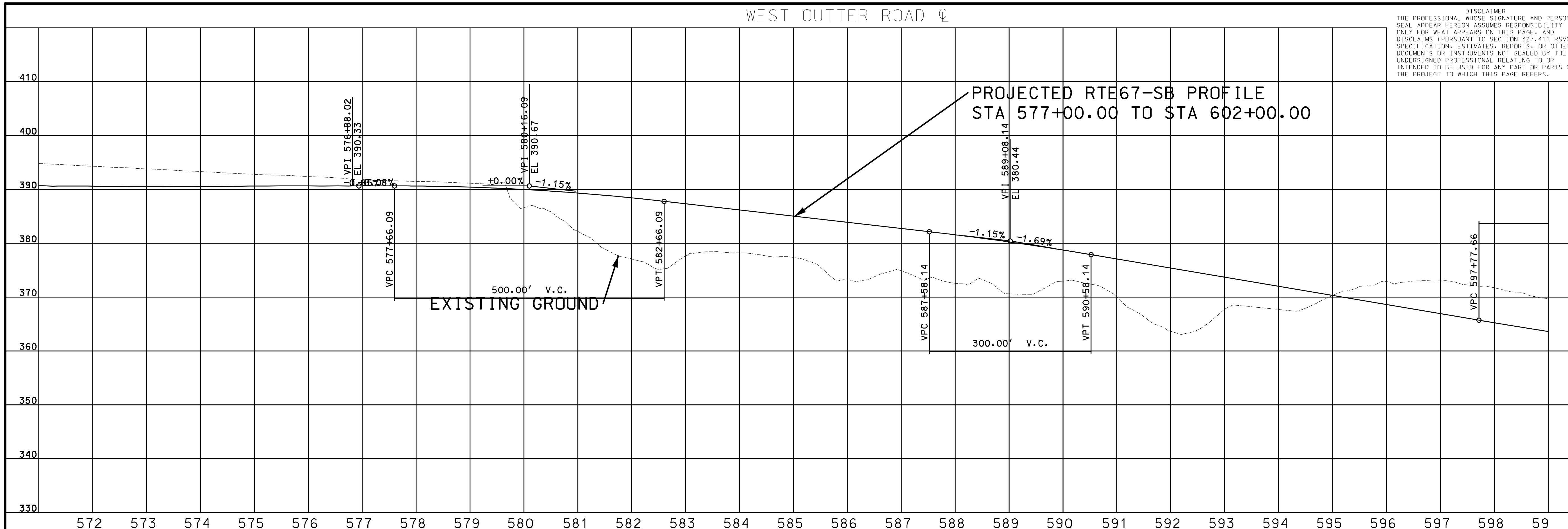

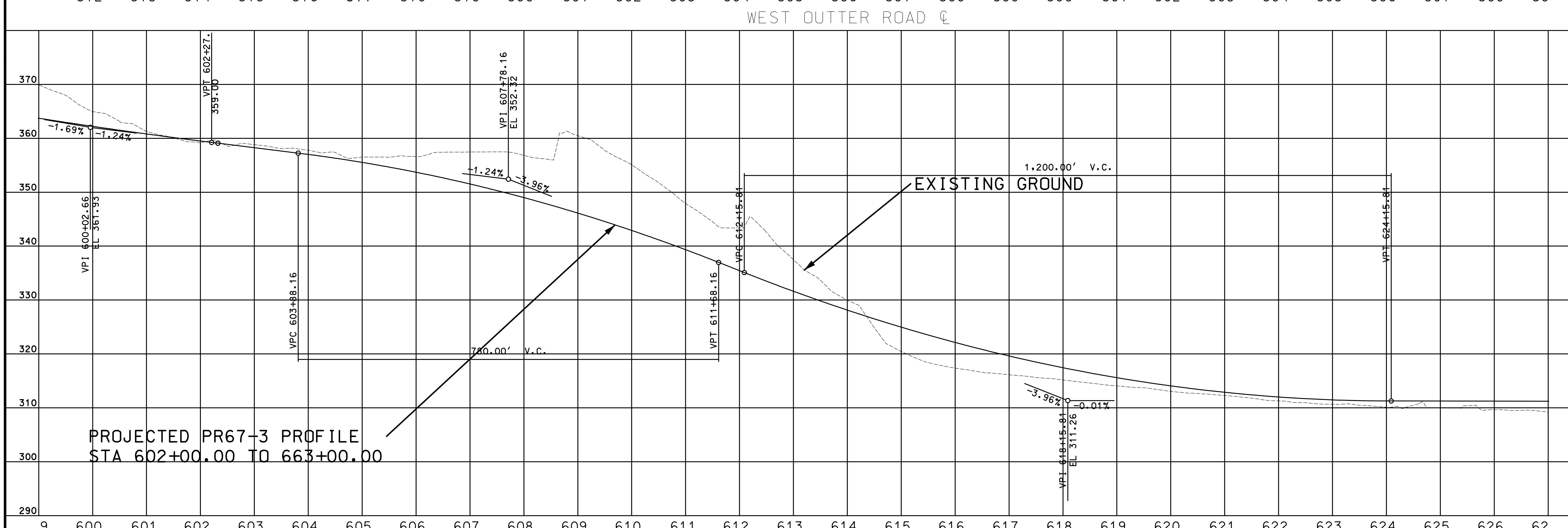

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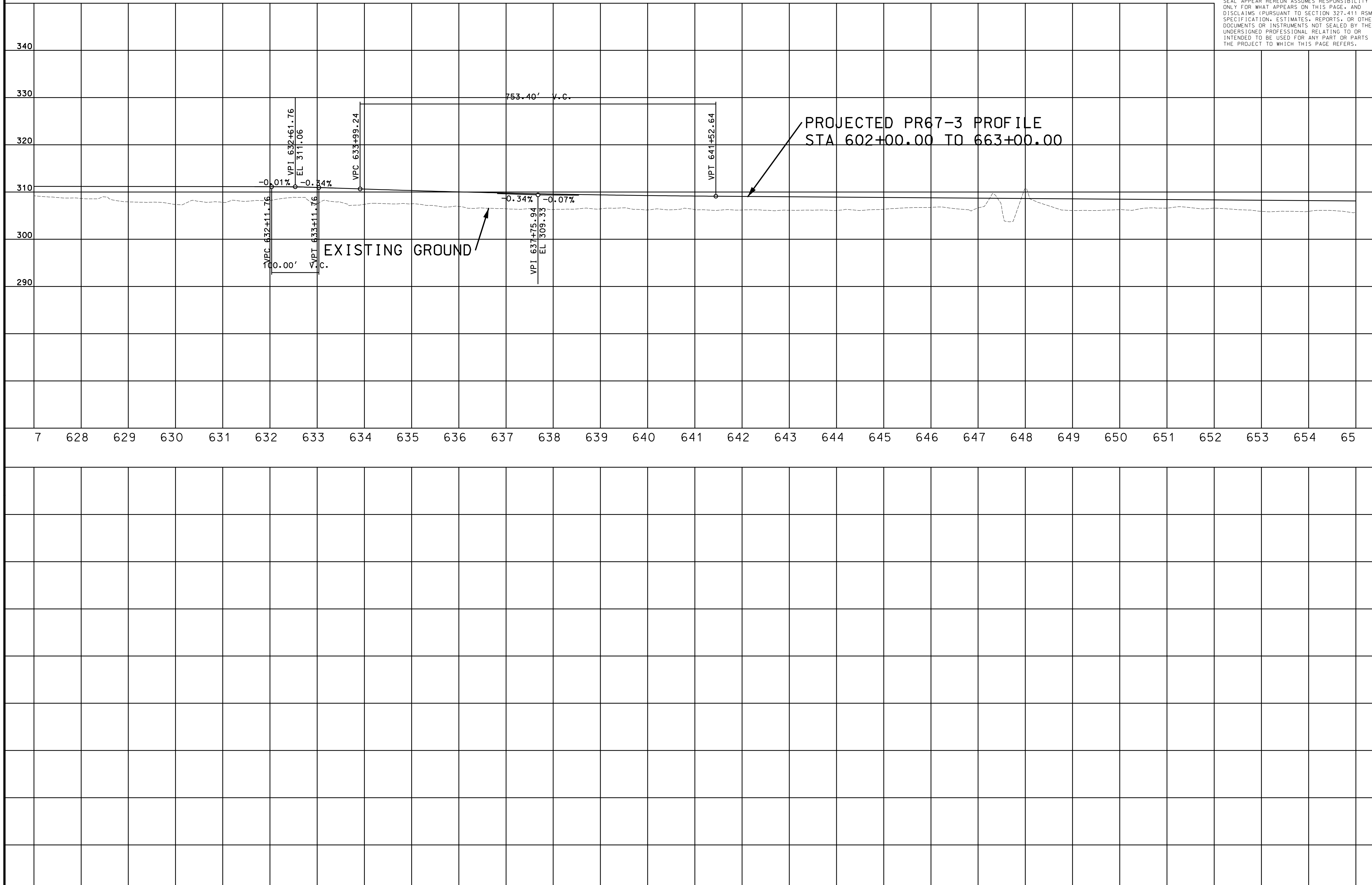
WEST OUTTER ROAD ℄



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ROUTE 67

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10 OF 10

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CONCEPTUAL SIGNING PLAN
J9P3663 - US67 WIDENING AND REALIGNMENT

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Appendix D

- Detailed Crash Analysis

Appendix D

Detailed Crash Analysis

Appendix D

D-1

Existing Conditions

Interactive Highway Safety Design Model

Crash Prediction Evaluation Report

December 10, 2020

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Report Overview

Report Generated: Dec 10, 2020 8:03 PM
Report Template: System: Multi-Page [System] (mlcpm2, Nov 27, 2020 3:23 PM)

Evaluation Date: Thu Dec 10 19:26:32 CST 2020
IHSDM Version: v16.0.0 (Sep 30, 2020)
Crash Prediction Module: v11.0.0 (Sep 30, 2020)

User Name: mhuebbe
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Project Title: Project 67
Project Comment: Created Wed Dec 09 16:11:58 CST 2020
Project Unit System: U.S. Customary

Highway Title: Highway 67
Highway Comment: Created Wed Dec 09 18:16:33 CST 2020
Highway Version: 1

Evaluation Title: Evaluation 67 Existing 2020
Evaluation Comment: Created Thu Dec 10 19:26:08 CST 2020

Minimum Location: 405+00.000
Maximum Location: 665+43.000
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: HSM Configuration
Crash Distribution: HSM Configuration
Model/CMF: HSM Configuration
First Year of Analysis: 2020
Last Year of Analysis: 2020
Empirical-Bayes Analysis: None
First Year of Observed Crashes:
Last Year of Observed Crashes:

Disclaimer Regarding Crash Prediction Method

IMPORTANT NOTICE ABOUT COMPARING RESULTS FROM HIGHWAY SAFETY MANUAL FIRST EDITION (2010) MODELS TO RESULTS FROM NEW MODELS DEVELOPED UNDER NCHRP PROJECTS 17-70 AND 17-58

Since the publication of the Highway Safety Manual - First Edition (HSM-1), in 2010 by the American Association of State Highway and Transportation Officials (AASHTO), multiple research efforts have been undertaken through the National Cooperative Highway Research Program (NCHRP) to develop safety performance models for road segment and intersection facility types that were not initially reflected in the HSM-1, in order to expand the breadth and depth of the HSM in the future.

The IHSDM Crash Prediction Module (CPM) is intended as a faithful implementation of HSM Part C predictive methods. As NCHRP projects to develop new predictive methods for the HSM are completed, FHWA works to incorporate the new methods into IHSDM, sometimes in advance of publication in the HSM. The following new crash predictive methods have been accepted by NCHRP project panels and incorporated into IHSDM, while pending AASHTO's approval for incorporation into a future edition of the HSM:

- Roundabouts: completed in 2018 under NCHRP Project 17-70, the new methods will provide improved outcomes for the safety analysis of roundabouts.
- 6+ lane and one-way urban/suburban arterials (including models for segments and intersections): completed under NCHRP Project 17-58.

However, in the absence of local calibration factors (see HSM-1 Part C, Appendix A for guidance on calibration of the predictive models), it is neither appropriate nor advisable to directly compare the results from new models (from NCHRP Projects 17-58 and 17-70) to results from HSM-1 models, as the models were not calibrated to the same base state data sets, and consequently can produce unexpected results. If local calibration factors are available and applied to both new models and HSM-1 models, then it may be appropriate to directly compare the results.*[Note: Work being performed under NCHRP Project 17-72 (Update of Crash Modification Factors for the Highway Safety Manual) is expected to re-calibrate many of the old (HSM-1) and new (e.g., NCHRP 17-70) models to data from a single (or small number of) states, that would allow results from all models to be directly compared.]*

The models produced for NCHRP Project 17-70 have independent value in terms of informing the design of a roundabout and assessing the effects of different design characteristics on the expected safety performance of a roundabout.

The HSM-1 interim method previously included in IHSDM for evaluating roundabouts on urban/suburban arterials (i.e., evaluating an existing intersection and then applying a Crash Modification Factor for replacing the existing intersection with a roundabout) has been deactivated in IHSDM, to minimize any confusion with the new roundabout methodology.

Section Types

Section 3 Evaluation

Section: Section 3
Evaluation Start Location: 570+00.000
Evaluation End Location: 665+43.000
Area Type: Rural
Functional Class: Arterial
Type of Alignment: Undivided, Two Lane
Model Category: Rural, Two Lane
Calibration Factor: 2U=1.0; 4ST=1.0;

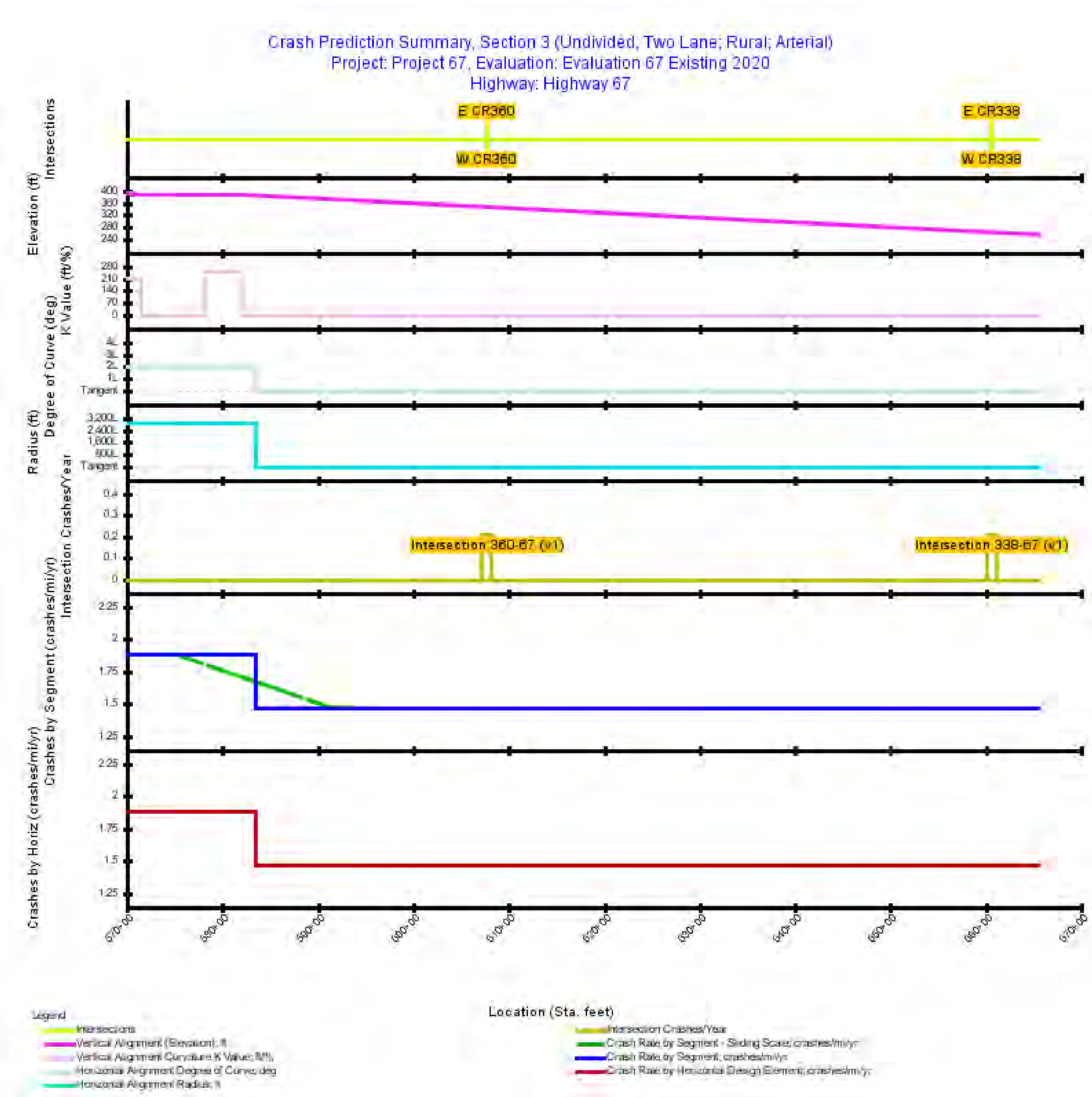

Figure 1. Crash Prediction Summary (Section 3)

Table 1. Evaluation Highway - Homogeneous Segments (Section 3)

Seg. No.	Type	Start Location (Sta. ft)	End Location (Sta. ft)	Length (ft)	Length (mi)	AADT	Left Lane Widt h (ft)	Right Lane Widt h (ft)	Left Shoulder Width (ft)	Right Shoulder Width (ft)	Grad e (%)	Driveway Density (driveways/ mi)	Hazard Rating	Centerline Rumble Strip	Passing Lanes	TWL T Lane	Lighting	Automated Speed Enforcement	Radius (ft)	Superelevation (%)	Adverse	Design Speed (mph)
11	Rural Two-Lane Segment Two-lane Undivided	570+00.000	580+00.000	1,000.00	0.1894	2020: 5,400	11.00	11.00	9.00	9.00	0.00	12.0	3	true	0	false	false	false	2,864.73	2.0	true	60
12	Rural Two-Lane Segment Two-lane Undivided	580+00.000	583+43.830	343.83	0.0651	2020: 5,400	11.00	11.00	9.00	9.00	-1.57	12.0	3	true	0	false	false	false	2,864.73	2.0	true	60
13	Rural Two-Lane Segment Two-lane Undivided	583+43.830	665+43.000	8,199.17	1.5529	2020: 5,400	11.00	11.00	9.00	9.00	-1.57	12.0	3	true	0	false	false	false				

Table 2. Evaluation Intersection - Section 3

Inter. No.	Title	Type	Location (Sta. ft)	Major AADT	Minor AADT	Legs	Traffic Control	Major road approaches w/Left Turn Lanes	Major road approaches w/Right Turn Lanes	Skew1	Skew2	Lighted at Night
2	Intersection 360-67 (v1)	Rural Two-Lane Intersection Four-Legged w/STOP control	607+70.000	2020: 5,400	2020: 20	4	Stop-Controlled	0	0	0.04	0.04	false
3	Intersection 338-67 (v1)	Rural Two-Lane Intersection Four-Legged w/STOP control	660+60.000	2020: 5,400	2020: 20	4	Stop-Controlled	0	0	0.04	0.04	false

Table 3. Predicted Highway Crash Rates and Frequencies Summary (Section 3)

First Year of Analysis	**2020**
Last Year of Analysis	**2020**
Evaluated Length (mi)	**1.8074**
Average Future Road AADT (vpd)	**5,400**
Predicted Crashes	
Total Crashes	**3.17**
Fatal and Injury Crashes	**1.06**
Property-Damage-Only Crashes	**2.11**
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	**34**
Percent Property-Damage-Only Crashes (%)	**66**
Predicted Crash Rate	
Crash Rate (crashes/mi/yr)	**1.7557**
FI Crash Rate (crashes/mi/yr)	**0.5888**
PDO Crash Rate (crashes/mi/yr)	**1.1669**
Predicted Travel Crash Rate	
Total Travel (million veh-mi)	**3.56**
Travel Crash Rate (crashes/million veh-mi)	**0.89**
Travel FI Crash Rate (crashes/million veh-mi)	**0.30**
Travel PDO Crash Rate (crashes/million veh-mi)	**0.59**

Table 4. Predicted Crash Frequencies and Rates by Highway Segment/Intersection (Section 3)

Segment Number/Intersection Name/Cross Road	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)	Predicted Intersection Travel Crash Rate (crashes/million veh)
11	570+00.000	580+00.000	0.1894	0.356	0.3562	0.1143	0.2418	1.8806	0.95	
12	580+00.000	583+43.830	0.0651	0.122	0.1225	0.0393	0.0832	1.8806	0.95	
13	583+43.830	665+43.000	1.5529	2.281	2.2809	0.7322	1.5488	1.4689	0.74	
Intersection 360-67 (v1)	607+70.000			0.207	0.2068	0.0891	0.1177			0.10
Intersection 338-67 (v1)	660+60.000			0.207	0.2068	0.0891	0.1177			0.10
All Segments			1.8074	2.760	2.7596	0.8858	1.8738	1.5268	0.78	
All Intersections				0.414	0.4136	0.1783	0.2354			0.10
Total			1.8074	3.173	3.1732	1.0641	2.1091	1.7557		

Table 5. Predicted Crash Frequencies and Rates by Horizontal Design Element (Section 3)

Title	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
Simple Curve 1	570+00.000	583+43.830	0.2545	0.479	0.4786	0.1536	0.3250	1.8806	0.95
Tangent	583+43.830	665+43.000	1.5529	2.281	2.2809	0.7322	1.5488	1.4689	0.74

Table 6. Predicted Crash Frequencies by Year (Section 3)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2020	3.17	1.06	33.534	2.11	66.466
Total	3.17	1.06	33.534	2.11	66.466
Average	3.17	1.06	33.534	2.11	66.466

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 7. Predicted Crash Type Distribution (Section 3)

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Highway Segment	Collision with Animal	0.03	1.1	0.34	10.9	0.33	10.5
Highway Segment	Collision with Bicycle	0.00	0.1	0.00	0.1	0.01	0.2
Highway Segment	Other Single-vehicle Collision	0.01	0.2	0.05	1.7	0.06	1.8
Highway Segment	Overturned	0.03	1.0	0.03	0.9	0.07	2.2
Highway Segment	Collision with Pedestrian	0.01	0.2	0.00	0.1	0.01	0.3
Highway Segment	Run Off Road	0.48	15.2	0.95	29.8	1.44	45.3
Highway Segment	Total Single Vehicle Crashes	0.56	17.8	1.38	43.4	1.91	60.3
Highway Segment	Angle Collision	0.09	2.8	0.14	4.3	0.23	7.4
Highway Segment	Head-on Collision	0.03	0.9	0.01	0.2	0.04	1.4
Highway Segment	Other Multiple-vehicle Collision	0.02	0.7	0.06	1.8	0.07	2.3
Highway Segment	Rear-end Collision	0.15	4.6	0.23	7.2	0.39	12.3
Highway Segment	Sideswipe	0.03	1.1	0.07	2.2	0.10	3.2
Highway Segment	Total Multiple Vehicle Crashes	0.32	10.2	0.50	15.6	0.85	26.7
Highway Segment	Total Highway Segment Crashes	0.89	28.0	1.87	59.0	2.76	87.0
Intersection	Collision with Animal	0.00	0.0	0.00	0.1	0.00	0.1
Intersection	Collision with Bicycle	0.00	0.0	0.00	0.0	0.00	0.0
Intersection	Other Single-vehicle Collision	0.00	0.0	0.00	0.1	0.00	0.1
Intersection	Overturned	0.00	0.0	0.00	0.0	0.00	0.1
Intersection	Collision with Pedestrian	0.00	0.0	0.00	0.0	0.00	0.0
Intersection	Run Off Road	0.02	0.5	0.03	1.1	0.05	1.6
Intersection	Total Single Vehicle Crashes	0.02	0.6	0.04	1.3	0.06	1.9
Intersection	Angle Collision	0.10	3.0	0.08	2.6	0.18	5.6
Intersection	Head-on Collision	0.01	0.3	0.01	0.2	0.02	0.5
Intersection	Other Multiple-vehicle Collision	0.01	0.2	0.01	0.3	0.02	0.5
Intersection	Rear-end Collision	0.04	1.2	0.06	2.0	0.10	3.2
Intersection	Sideswipe	0.01	0.2	0.03	1.1	0.04	1.3
Intersection	Total Multiple Vehicle Crashes	0.16	5.0	0.19	6.1	0.35	11.1
Intersection	Total Intersection Crashes	0.18	5.6	0.23	7.4	0.41	13.0
	Total Crashes	1.07	33.6	2.11	66.5	3.17	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Section 1 Evaluation

Section: Section 1
Evaluation Start Location: 405+00.000
Evaluation End Location: 425+00.000
Area Type: Rural

Functional Class: Arterial
Type of Alignment: Divided, Multilane
Model Category: Rural, Multilane
Calibration Factor: 4D=1.0; 4ST=1.0;

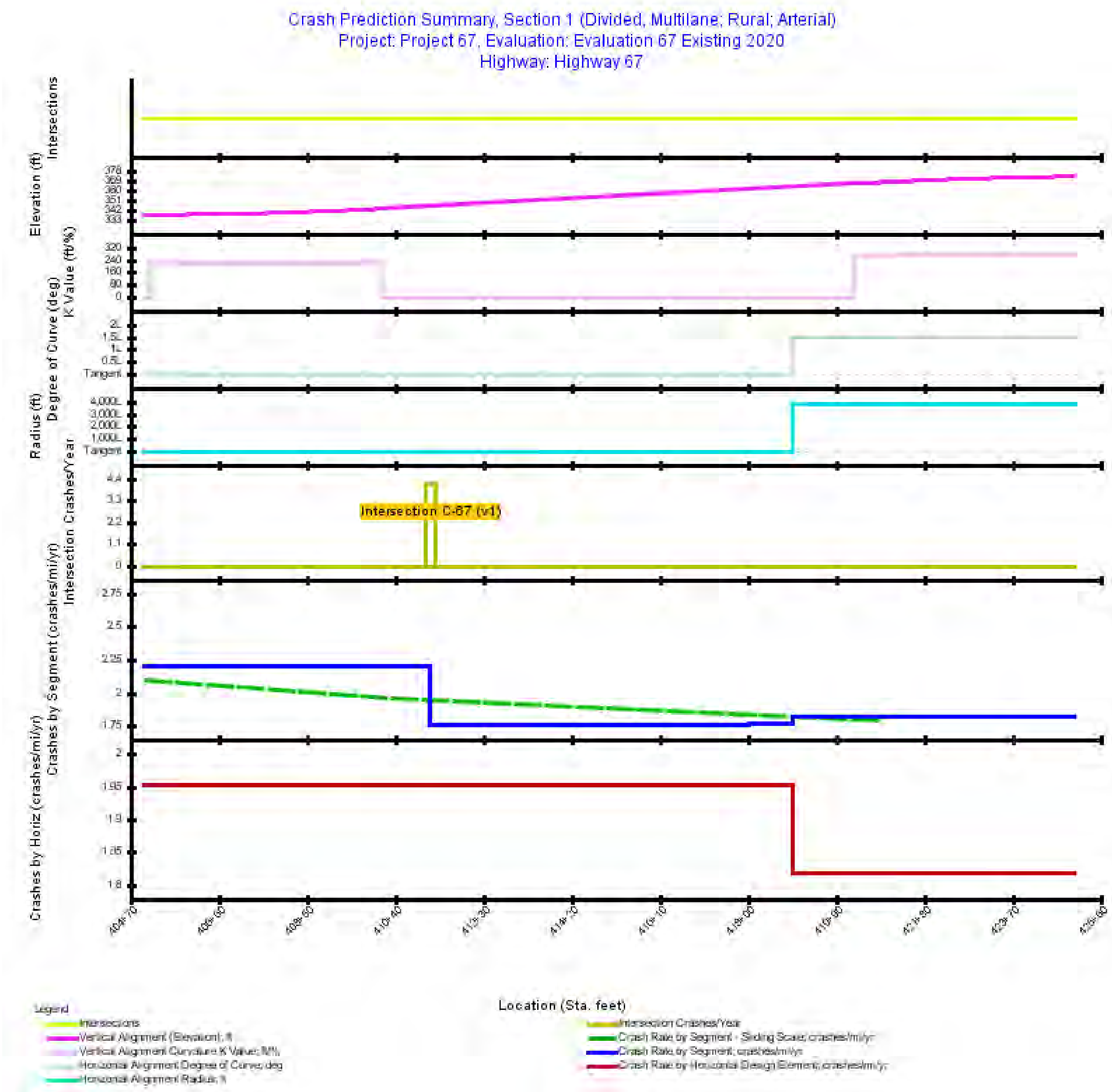

Figure 2. Crash Prediction Summary (Section 1)

Table 8. Evaluation Highway - Homogeneous Segments (Section 1)

Seg. No.	Type	Start Location (Sta. ft)	End Location (Sta. ft)	Length (ft)	Length (mi)	AADT	Left Lane Width (ft)	Right Lane Width (ft)	Left Shoulder Width (ft)	Right Shoulder Width (ft)	Median Width (ft)	Median Type	Effective Median Width (ft)	Lighting	Automated Speed Enforcement	Left Side Slope	Right Side Slope
1	Rural Multi-Lane Segment Four-lane Divided	405+00.000	411+15.000	615.00	0.1165	2020: 12,000	12.00	12.00	8.00	8.00	52.00	Traversable Median	60.00	false	false		
2	Rural Multi-Lane Segment Four-lane Divided	411+15.000	418+00.000	685.00	0.1297	2020: 9,700	12.00	12.00	8.00	8.00	52.00	Traversable Median	60.00	false	false		
3	Rural Multi-Lane Segment Four-lane Divided	418+00.000	418+95.990	95.99	0.0182	2020: 9,700	12.00	12.00	8.00	8.00	49.15	Traversable Median	57.15	false	false		
4	Rural Multi-Lane Segment Four-lane Divided	418+95.990	425+00.000	604.01	0.1144	2020: 9,700	12.00	12.00	8.00	8.00	28.40	Traversable Median	36.40	false	false		

Table 9. Evaluation Intersection (Section 1)

Inter. No.	Title	Type	Location (Sta. ft)	Major AADT	Minor AADT	Legs	Traffic Control	Major road approaches w/Left Turn Lanes	Major road approaches w/Right Turn Lanes	Skew1	Skew2	Lighted at Night
1	Intersection C-67 (v1)	Rural Multi-Lane Intersection Four-Legged w/STOP control	411+14.900	2020: 12,000	2020: 1,500	4	Stop-Controlled	0	0	20.00	0.01	false

Table 10. Predicted Highway Crash Rates and Frequencies Summary (Section 1)

First Year of Analysis	**2020**
Last Year of Analysis	**2020**
Evaluated Length (mi)	**0.3788**
Average Future Road AADT (vpd)	**10,407**
Predicted Crashes	
Total Crashes	**4.89**
Fatal and Injury Crashes	**2.78**
Fatal and Serious Injury Crashes	**1.60**
Property-Damage-Only Crashes	**2.11**
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	**57**
Percent Fatal and Serious Injury Crashes (%)	**33**
Percent Property-Damage-Only Crashes (%)	**43**
Predicted Crash Rate	
Crash Rate (crashes/mi/yr)	**12.9038**
FI Crash Rate (crashes/mi/yr)	**7.3438**
FI no/C Crash Rate (crashes/mi/yr)	**4.2279**
PDO Crash Rate (crashes/mi/yr)	**5.5600**
Predicted Travel Crash Rate	
Total Travel (million veh-mi)	**1.44**
Travel Crash Rate (crashes/million veh-mi)	**3.40**
Travel FI Crash Rate (crashes/million veh-mi)	**1.93**
Travel FI no/C Crash Rate (crashes/million veh-mi)	**1.11**
Travel PDO Crash Rate (crashes/million veh-mi)	**1.46**

Table 11. Predicted Crash Frequencies and Rates by Highway Segment/Intersection (Section 1)

Segment Number/Intersection Name/Cross Road	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted FI no/C Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)	Predicted Intersection Travel Crash Rate (crashes/million veh)
1	405+00.000	411+15.000	0.1165	0.256	0.2559	0.1314	0.0832	0.1245	2.1970	0.50	
Intersection C-67 (v1)	411+14.900			4.164	4.1638	2.4053	1.3603	1.7584			0.92
2	411+15.000	418+00.000	0.1297	0.228	0.2280	0.1193	0.0769	0.1087	1.7575	0.50	
3	418+00.000	418+95.990	0.0182	0.032	0.0320	0.0168	0.0108	0.0153	1.7627	0.50	
4	418+95.990	425+00.000	0.1144	0.208	0.2081	0.1089	0.0702	0.0992	1.8190	0.51	
All Segments			0.3788	0.724	0.7240	0.3764	0.2411	0.3476	1.9114	0.50	
All Intersections				4.164	4.1638	2.4053	1.3603	1.7584			0.92
Total			0.3788	4.888	4.8878	2.7818	1.6015	2.1061	12.9038		

Table 12. Predicted Crash Frequencies and Rates by Horizontal Design Element (Section 1)

Title	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted FI no/C Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
Tangent	405+00.000	418+95.990	0.2644	0.516	0.5159	0.2675	0.1709	0.2485	1.9514	0.50
Simple Curve 1	418+95.990	425+00.000	0.1144	0.208	0.2081	0.1089	0.0702	0.0992	1.8190	0.51

Table 13. Predicted Crash Frequencies by Year (Section 1)

Year	Total Crashes	FI Crashes	Percent FI (%)	FI/no C Crashes	Percent FI/no C (%)	PDO Crashes	Percent PDO (%)
2020	4.89	2.78	56.912	1.60	32.765	2.11	43.088
Total	4.89	2.78	56.912	1.60	32.765	2.11	43.088
Average	4.89	2.78	56.912	1.60	32.765	2.11	43.088

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 14. Predicted Crash Type Distribution (Section 1)

Element Type	Crash Type	Fatal and Injury		Fatal and Serious Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Highway Segment	Single	0.27	5.6	0.19	3.8	0.28	5.6	0.56	11.4
Highway Segment	Total Single Vehicle Crashes	0.27	5.6	0.19	3.8	0.28	5.6	0.56	11.4
Highway Segment	Angle Collision	0.02	0.4	0.01	0.2	0.01	0.3	0.03	0.6
Highway Segment	Head-on Collision	0.01	0.1	0.00	0.1	0.00	0.0	0.00	0.1
Highway Segment	Rear-end Collision	0.06	1.3	0.03	0.6	0.03	0.6	0.08	1.7
Highway Segment	Sideswipe	0.01	0.2	0.01	0.1	0.02	0.4	0.03	0.6
Highway Segment	Total Multiple Vehicle Crashes	0.09	1.9	0.05	1.0	0.06	1.3	0.15	3.1
Highway Segment	Total Highway Segment Crashes	0.38	7.7	0.24	4.9	0.35	7.1	0.72	14.8
Highway Segment	Other Collision	0.01	0.2	0.01	0.1	0.01	0.2	0.02	0.4
Intersection	Single	0.36	7.3	0.27	5.5	0.43	8.8	0.84	17.2
Intersection	Total Single Vehicle Crashes	0.36	7.3	0.27	5.5	0.43	8.8	0.84	17.2
Intersection	Angle Collision	1.28	26.3	0.78	15.9	0.51	10.5	1.65	33.7
Intersection	Head-on Collision	0.04	0.9	0.03	0.6	0.03	0.5	0.07	1.4
Intersection	Rear-end Collision	0.51	10.5	0.15	3.0	0.42	8.6	0.95	19.4
Intersection	Sideswipe	0.10	2.1	0.05	1.1	0.27	5.6	0.45	9.1
Intersection	Total Multiple Vehicle Crashes	1.94	39.7	1.01	20.7	1.24	25.3	3.11	63.6
Intersection	Total Intersection Crashes	2.41	49.3	1.36	27.9	1.76	36.0	4.16	85.2
Intersection	Other Collision	0.11	2.3	0.08	1.6	0.10	2.0	0.21	4.3
	Total Crashes	2.78	57.0	1.60	32.8	2.11	43.2	4.88	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Section 2 Evaluation

Section: Section 2
Evaluation Start Location: 425+00.000
Evaluation End Location: 570+00.000
Functional Class: Freeway
Type of Alignment: Divided, Multilane
Model Category: Freeway Segment
Calibration Factor: FI_EN=1.0; FI_MV=1.0; FI_SV=1.0; PDO_EN=1.0; PDO_MV=1.0; PDO_SV=1.0;

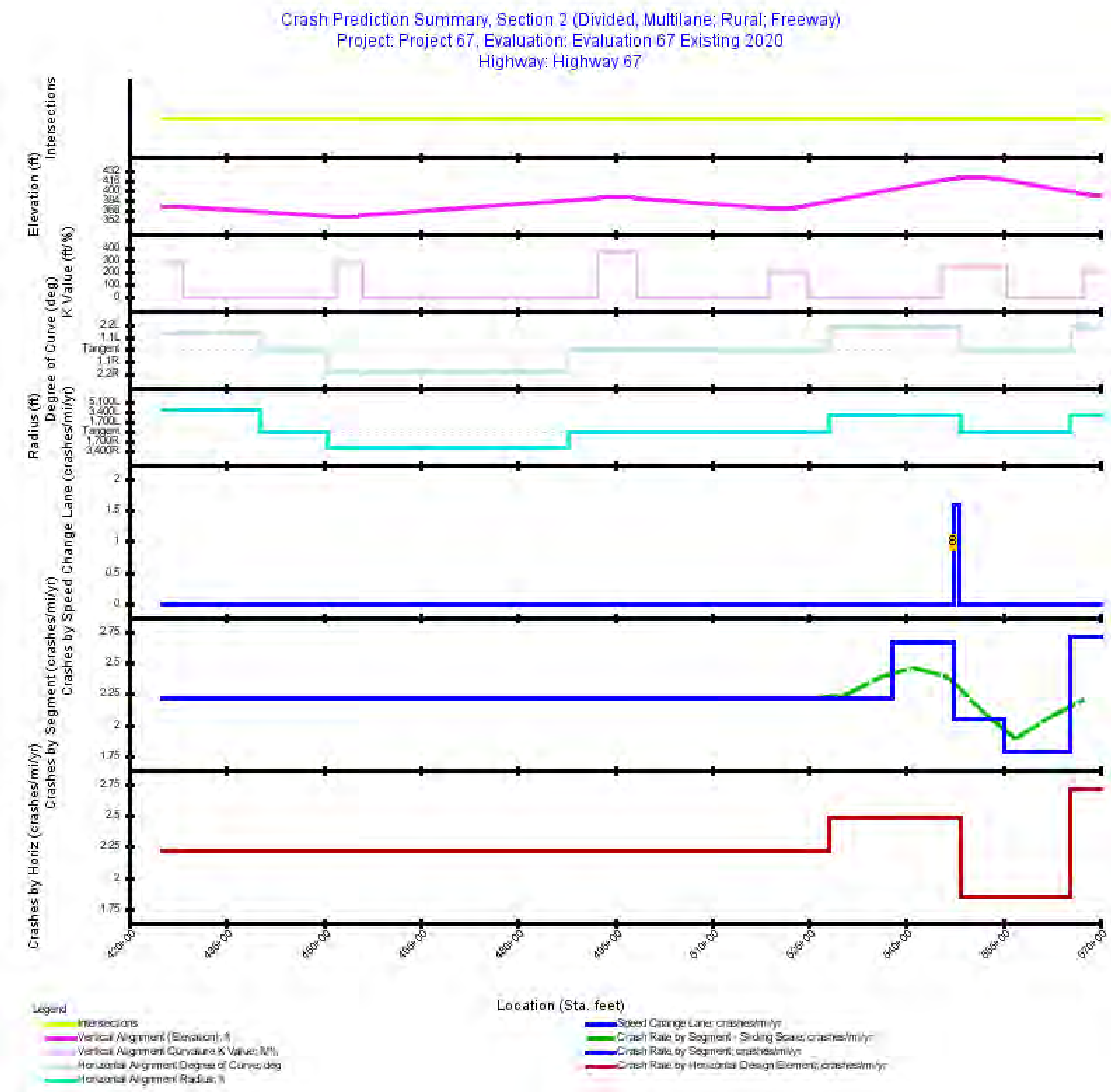

Figure 3. Crash Prediction Summary (Section 2)

Table 15. Evaluation Freeway - Homogeneous Segments (Section 2)

Seg. No.	Type	Area Type	Start Location (Sta. ft)	End Location (Sta. ft)	Length (ft)	Length (mi)	AADT	Median Width (ft)	Type	Effective Median Width (ft)
5	Four-lane Freeway	Rural	425+00.000	537+84.000	11,284.00	2.1371	2020: 9,700	10.50	Traversable Median	18.50
6	Four-lane Freeway	Rural	537+84.000	547+32.000	948.00	0.1795	2020: 9,700	10.50	Traversable Median	18.50
7	Four-lane Freeway	Rural	547+32.000	555+11.680	779.68	0.1477	2020: 9,700	10.50	Traversable Median	18.50
9	Four-lane Freeway	Rural	555+11.680	565+40.830	1,029.15	0.1949	2020: 9,700	10.50	Traversable Median	18.50
10	Four-lane Freeway	Rural	565+40.830	570+00.000	459.17	0.0870	2020: 9,700	10.50	Traversable Median	18.50

Table 16. Evaluation Freeway - Speed Change Lanes (Speed Change)

Seg. No.	Type	Ramp Type	Start Location (Sta. ft)	End Location (Sta. ft)	Length (ft)	Length (mi)	AADT	Median Width (ft)	Type	Effective Median Width (ft)
8	Four-lane Freeway Speed Change	Entrance	547+32.000	548+23.000	91.00	0.0172	2020: 9,700	10.50	Traversable Median	18.50

Table 17. Predicted Freeway Crash Rates and Frequencies Summary (Section 2)

First Year of Analysis	**2020**
Last Year of Analysis	**2020**
Effective Length (mi)	**2.7376**
Average Future Road AADT (vpd)	**9,700**
Predicted Crashes	
Total Crashes	**6.08**
Fatal and Injury Crashes	**2.18**
Property-Damage-Only Crashes	**3.91**
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	**36**
Percent Property-Damage-Only Crashes (%)	**64**
Predicted Crash Rate	
Crash Rate (crashes/mi/yr)	**2.2225**
FI Crash Rate (crashes/mi/yr)	**0.7957**
PDO Crash Rate (crashes/mi/yr)	**1.4268**
Predicted Travel Crash Rate	
Total Travel (million veh-mi)	**9.69**
Travel Crash Rate (crashes/million veh-mi)	**0.63**
Travel FI Crash Rate (crashes/million veh-mi)	**0.23**
Travel PDO Crash Rate (crashes/million veh-mi)	**0.40**

Note: *Effective Length* is the *segment length* minus the length of the *speed change lanes* if present.

Table 18. Predicted Freeway Speed Change Lane Crash Rates and Frequencies Summary (Speed Change)

First Year of Analysis	**2020**
Last Year of Analysis	**2020**
Length (mi)	**0.0172**
Average Future Road AADT (vpd)	**4,850**
Predicted Crashes	
Total Crashes	**0.03**
Fatal and Injury Crashes	**0.01**
Property-Damage-Only Crashes	**0.02**
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	**32**
Percent Property-Damage-Only Crashes (%)	**68**
Predicted Crash Rate	
Crash Rate (crashes/mi/yr)	**1.5825**
FI Crash Rate (crashes/mi/yr)	**0.5001**
PDO Crash Rate (crashes/mi/yr)	**1.0824**
Predicted Travel Crash Rate	
Total Travel (million veh-mi)	**0.03**
Travel Crash Rate (crashes/million veh-mi)	**0.89**
Travel FI Crash Rate (crashes/million veh-mi)	**0.28**
Travel PDO Crash Rate (crashes/million veh-mi)	**0.61**

Note: *Total Travel and Crash Rates/Million Vehicle Miles* for *Speed Change Lanes* reflect AADTs that are **half of the Freeway Segment AADTs** based on the assumption of 50/50 directional distribution.

Table 19. Predicted Crash Frequencies and Rates by Freeway Segment/Intersection (Section 2)

Segment Number/Intersection Name/Cross Road	Start Location (Sta. ft)	End Location (Sta. ft)	Effective Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
5	425+00.000	537+84.000	2.1371	4.736	4.7363	1.6924	3.0438	2.2162	0.63
6	537+84.000	547+32.000	0.1795	0.479	0.4786	0.1752	0.3033	2.6655	0.75
7	547+32.000	555+11.680	0.1390	0.284	0.2843	0.1025	0.1817	2.0443	0.58
9	555+11.680	565+40.830	0.1949	0.349	0.3489	0.1211	0.2278	1.7901	0.51
10	565+40.830	570+00.000	0.0870	0.236	0.2362	0.0869	0.1493	2.7159	0.77
Total			2.7376	6.084	6.0842	2.1782	3.9060	2.2225	0.63

Note: *Effective Length* is the *segment length* minus the length of the *speed change lanes* if present. This may create Freeway segments with zero effective length and zero crashes.

Table 20. Predicted Crash Frequencies and Rates by Freeway Speed Change Lane (Speed Change)

Segment Number/Intersection Name/Cross Road	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
8	547+32.000	548+23.000	0.0172	0.027	0.0273	0.0086	0.0187	1.5825	0.89
Total			0.0172	0.027	0.0273	0.0086	0.0187	1.5825	0.89

Note: *Travel Crash Rates/Million Vehicle Miles* for *Speed Change Lanes* reflect AADTs that are **half of the Freeway Segment AADTs** based on the assumption of 50/50 directional distribution.

Table 21. Predicted Crash Frequencies and Rates by Horizontal Design Element (Section 2)

Title	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi /yr)	Predicted Travel Crash Rate (crashes/mi llion veh-mi)
Simple Curve 1	425+00.000	440+15.580	0.2870	0.636	0.6361	0.2273	0.4088	2.2162	0.63
Tangent	440+15.580	450+69.500	0.1996	0.442	0.4424	0.1581	0.2843	2.2162	0.63
Simple Curve 2	450+69.500	487+95.230	0.7056	1.564	1.5638	0.5588	1.0050	2.2162	0.63
Tangent	487+95.230	528+21.950	0.7626	1.690	1.6901	0.6039	1.0862	2.2162	0.63
Simple Curve 3	528+21.950	548+47.520	0.3836	0.952	0.9518	0.3433	0.6084	2.4809	0.72
Tangent	548+47.520	565+40.830	0.3207	0.591	0.5911	0.2084	0.3826	1.8430	0.53
Simple Curve 4	565+40.830	570+00.000	0.0870	0.236	0.2362	0.0869	0.1493	2.7159	0.77

Table 22. Predicted Crash Frequencies by Year (Section 2)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2020	6.11	2.19	35.782	3.92	64.218
Total	6.11	2.19	35.782	3.92	64.218
Average	6.11	2.19	35.782	3.92	64.218

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 23. Predicted Crash Severity by Freeway Segment (Section 2)

Seg. No.	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)
5	0.0657	0.1620	0.6617	0.8030	3.0438
6	0.0072	0.0180	0.0700	0.0801	0.3033
7	0.0035	0.0086	0.0378	0.0526	0.1817
9	0.0044	0.0106	0.0461	0.0601	0.2278
10	0.0036	0.0089	0.0347	0.0397	0.1493
Total	0.0843	0.2081	0.8503	1.0355	3.9060

Table 24. Predicted Crash Severity by Speed Change Lane (Speed Change)

Seg. No.	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)
8	0.0003	0.0009	0.0034	0.0040	0.0187

Table 25. Predicted Freeway Crash Type Distribution (Section 2)

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Highway Segment	Collision with Animal	0.02	0.3	0.23	3.8	0.25	4.1
Highway Segment	Collision with Fixed Object	1.07	17.6	2.23	36.6	3.30	54.2
Highway Segment	Collision with Other Object	0.06	1.0	0.45	7.3	0.50	8.3
Highway Segment	Other Single-vehicle Collision	0.69	11.4	0.58	9.5	1.27	20.9
Highway Segment	Collision with Parked Vehicle	0.04	0.7	0.08	1.3	0.13	2.1
Highway Segment	Total Single Vehicle Crashes	1.89	31.0	3.57	58.6	5.45	89.6
Highway Segment	Right-Angle Collision	0.02	0.3	0.01	0.2	0.03	0.4
Highway Segment	Head-on Collision	0.01	0.1	0.00	0.0	0.01	0.1
Highway Segment	Other Multi-vehicle Collision	0.02	0.3	0.03	0.4	0.04	0.7
Highway Segment	Rear-end Collision	0.18	3.0	0.17	2.8	0.36	5.9
Highway Segment	Sideswipe, Same Direction Collision	0.07	1.1	0.13	2.1	0.20	3.3
Highway Segment	Total Multiple Vehicle Crashes	0.29	4.8	0.34	5.6	0.63	10.4
Highway Segment	Total Highway Segment Crashes	2.18	35.8	3.91	64.2	6.08	100.0
	Total Crashes	2.18	35.8	3.91	64.2	6.08	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 26. Predicted Entrance Speed Change Lane Crash Type Distribution (Speed Change)

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Highway Segment	Collision with Animal	0.00	0.0	0.00	0.6	0.00	0.6
Highway Segment	Collision with Fixed Object	0.00	7.7	0.01	20.2	0.01	28.0
Highway Segment	Collision with Other Object	0.00	0.7	0.00	4.8	0.00	5.5
Highway Segment	Other Single-vehicle Collision	0.00	5.4	0.00	4.5	0.00	9.9
Highway Segment	Collision with Parked Vehicle	0.00	0.7	0.00	0.0	0.00	0.7
Highway Segment	Total Single Vehicle Crashes	0.00	14.4	0.01	30.2	0.01	44.6
Highway Segment	Right-Angle Collision	0.00	1.0	0.00	0.9	0.00	1.9
Highway Segment	Head-on Collision	0.00	0.7	0.00	0.3	0.00	0.9
Highway Segment	Other Multi-vehicle Collision	0.00	0.3	0.00	2.7	0.00	3.1
Highway Segment	Rear-end Collision	0.00	11.1	0.01	17.8	0.01	28.9
Highway Segment	Sideswipe, Same Direction Collision	0.00	4.0	0.01	16.6	0.01	20.6
Highway Segment	Total Multiple Vehicle Crashes	0.01	17.2	0.01	38.2	0.01	55.4
Highway Segment	Total Highway Segment Crashes	0.01	31.6	0.02	68.4	0.03	100.0
	Total Crashes	0.01	31.6	0.02	68.4	0.03	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 27. Evaluation Message

Start Location (Sta. ft)	End Location (Sta. ft)	Message
547+32.000	548+23.000	for segment #8 (547+32.000 to 548+23.000), distance to taper (91.00 feet) is less than specified entrance ramp boundaries 211.20 feet; adjusted in CMF calculations.

Interactive Highway Safety Design Model

Crash Prediction Evaluation Report

December 10, 2020

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Combined Report

Combined Report Overview

Report Generated: Dec 10, 2020 8:37 PM
Report Template: System: Multi-Page [System] (mlcpm2, Nov 27, 2020 3:23 PM)

Evaluation Title: Evaluation Interchange Existing 2020
Evaluation Comment: Created Thu Dec 10 17:23:55 CST 2020
Evaluation Date: Thu Dec 10 17:28:23 CST 2020

User Name: mhuebbe
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Project Title: Project 67
Project Comment: Created Wed Dec 09 16:11:58 CST 2020
Project Unit System: U.S. Customary

Interchange Title: Interchange 160-67
Interchange Comment: Created Thu Dec 10 08:43:05 CST 2020

Report Overview

Disclaimer Regarding Crash Prediction Method

IMPORTANT NOTICE ABOUT COMPARING RESULTS FROM HIGHWAY SAFETY MANUAL FIRST EDITION (2010) MODELS TO RESULTS FROM NEW MODELS DEVELOPED UNDER NCHRP PROJECTS 17-70 AND 17-58

Since the publication of the Highway Safety Manual - First Edition (HSM-1), in 2010 by the American Association of State Highway and Transportation Officials (AASHTO), multiple research efforts have been undertaken through the National Cooperative Highway Research Program (NCHRP) to develop safety performance models for road segment and intersection facility types that were not initially reflected in the HSM-1, in order to expand the breadth and depth of the HSM in the future.

The IHSDM Crash Prediction Module (CPM) is intended as a faithful implementation of HSM Part C predictive methods. As NCHRP projects to develop new predictive methods for the HSM are completed, FHWA works to incorporate the new methods into IHSDM, sometimes in advance of publication in the HSM. The following new crash predictive methods have been accepted by NCHRP project panels and incorporated into IHSDM, while pending AASHTO's approval for incorporation into a future edition of the HSM:

- Roundabouts: completed in 2018 under NCHRP Project 17-70, the new methods will provide improved outcomes for the safety analysis of roundabouts.
- 6+ lane and one-way urban/suburban arterials (including models for segments and intersections): completed under NCHRP Project 17-58.

However, in the absence of local calibration factors (see HSM-1 Part C, Appendix A for guidance on calibration of the predictive models), it is neither appropriate nor advisable to directly compare the results from new models (from NCHRP Projects 17-58 and 17-70) to results from HSM-1 models, as the models were not calibrated to the same base state data sets, and consequently can produce unexpected results. If local calibration factors are available and applied to both new models and HSM-1 models, then it may be appropriate to directly compare the results.*[Note: Work being performed under NCHRP Project 17-72 (Update of Crash Modification Factors for the Highway Safety Manual) is expected to re-calibrate many of the old (HSM-1) and new (e.g., NCHRP 17-70) models to data from a single (or small number of) states, that would allow results from all models to be directly compared.]*

The models produced for NCHRP Project 17-70 have independent value in terms of informing the design of a roundabout and assessing the effects of different design characteristics on the expected safety performance of a roundabout.

The HSM-1 interim method previously included in IHSDM for evaluating roundabouts on urban/suburban arterials (i.e., evaluating an existing intersection and then applying a Crash Modification Factor for replacing the existing intersection with a roundabout) has been deactivated in IHSDM, to minimize any confusion with the new roundabout methodology.

Section Types

Interchange 160-67 : Evaluation Interchange Existing 2020 : Ramp SB Enter Evaluation

Report Overview

Report Generated: Dec 10, 2020 8:37 PM
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Evaluation Date: Thu Dec 10 17:24:41 CST 2020
IHSDM Version: v16.0.0 (Sep 30, 2020)
Crash Prediction Module: v11.0.0 (Sep 30, 2020)

User Name: mhuebbe
Organization Name: EFK Moen, LLC
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Project Title: Interchange 160-67
Project Comment: Created Thu Dec 10 08:43:05 CST 2020
Project Unit System: U.S. Customary

Highway Title: Ramp SB Enter
Highway Comment: Created Thu Dec 10 11:12:22 CST 2020
Highway Version: 1

Evaluation Title: Interchange 160-67 : Evaluation Interchange Existing 2020 : Ramp SB Enter
Evaluation Comment: Created Thu Dec 10 17:24:16 CST 2020

Minimum Location: 0.000
Maximum Location: 13+31.900
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: HSM Configuration
Crash Distribution: HSM Configuration
Model/CMF: HSM Configuration
First Year of Analysis: 2020
Last Year of Analysis: 2020
Empirical-Bayes Analysis: None
First Year of Observed Crashes:
Last Year of Observed Crashes:

Disclaimer Regarding Crash Prediction Method

IMPORTANT NOTICE ABOUT COMPARING RESULTS FROM HIGHWAY SAFETY MANUAL FIRST EDITION (2010) MODELS TO RESULTS FROM NEW MODELS DEVELOPED UNDER NCHRP PROJECTS 17-70 AND 17-58

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Freeway Ramp Evaluation

Section: Section 1
Evaluation Start Location: 0.000
Evaluation End Location: 13+31.900
Functional Class: Freeway Service Ramp
Type of Alignment: One Direction
Model Category: Freeway Service Ramp

Calibration Factor: ENT_RAMP_MV_FI=1.0; ENT_RAMP_MV_PDO=1.0; ENT_RAMP_SV_FI=1.0; ENT_RAMP_SV_PDO=1.0;

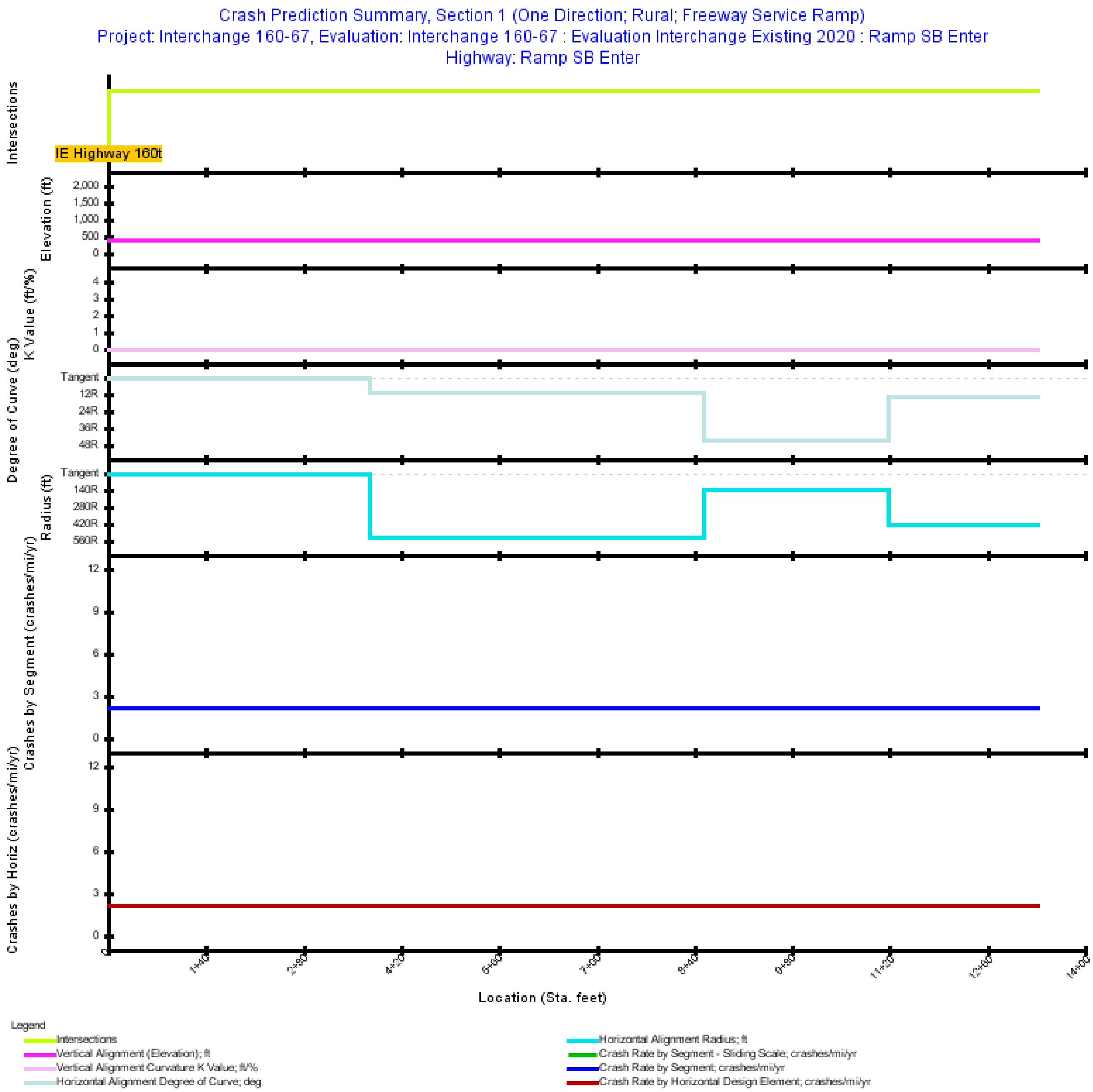

Figure 1. Crash Prediction Summary (Freeway Ramp Sections)

Table 1. Evaluation Freeway - Homogeneous Segments (Freeway Ramp Sections)

Seg. No.	Type	Area Type	Start Location (Sta. ft)	End Location (Sta. ft)	Length (ft)	Length (mi)	AADT
1	Freeway Ramp and C-D Road One-lane Ramp Entrance	Rural	0.000	13+31.900	1,331.90	0.2523	2020: 2,900

Table 2. Predicted Ramp Crash Rates and Frequencies Summary (Freeway Ramp Sections)

First Year of Analysis	**2020**
Last Year of Analysis	**2020**
Evaluated Length (mi)	**0.2523**
Average Future Road AADT (vpd)	**2,900**
Predicted Crashes	
Total Crashes	**0.54**
Fatal and Injury Crashes	**0.20**
Property-Damage-Only Crashes	**0.35**
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	**36**
Percent Property-Damage-Only Crashes (%)	**64**
Predicted Crash Rate	
Crash Rate (crashes/mi/yr)	**2.1466**
FI Crash Rate (crashes/mi/yr)	**0.7724**
PDO Crash Rate (crashes/mi/yr)	**1.3742**
Predicted Travel Crash Rate	
Total Travel (million veh-mi)	**0.27**
Travel Crash Rate (crashes/million veh-mi)	**2.03**
Travel FI Crash Rate (crashes/million veh-mi)	**0.73**
Travel PDO Crash Rate (crashes/million veh-mi)	**1.30**

Table 3. Predicted Crash Frequencies and Rates by Ramp Segment/Intersection (Freeway Ramp Sections)

Segment Number/Intersection Name/Cross Road	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
1	0.000	13+31.900	0.2523	0.541	0.5415	0.1948	0.3467	2.1466	2.03
Total			0.2523	0.541	0.5415	0.1948	0.3467	2.1466	

Table 4. Predicted Crash Frequencies and Rates by Horizontal Design Element (Freeway Ramp Sections)

Title	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
Tangent	0.000	3+74.260	0.0709	0.152	0.1522	0.0547	0.0974	2.1466	2.03
Simple Curve 1	3+74.260	8+53.580	0.0908	0.195	0.1949	0.0701	0.1248	2.1466	2.03
Simple Curve 2	8+53.580	11+18.810	0.0502	0.108	0.1078	0.0388	0.0690	2.1466	2.03
Simple Curve 3	11+18.810	13+31.900	0.0404	0.087	0.0866	0.0312	0.0555	2.1466	2.03

Table 5. Predicted Crash Frequencies by Year (Freeway Ramp Sections)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2020	0.54	0.20	35.981	0.35	64.019
Total	0.54	0.20	35.981	0.35	64.019
Average	0.54	0.20	35.981	0.35	64.019

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 6. Predicted Crash Severity by Ramp Segment (Freeway Ramp Sections)

Seg. No.	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)
1	0.0051	0.0154	0.1025	0.0719	0.3467

Table 7. Predicted Freeway Ramp Crash Type Distribution (Freeway Ramp Sections)

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Highway Segment	Collision with Animal	0.00	0.4	0.02	3.7	0.02	4.1
Highway Segment	Collision with Fixed Object	0.11	19.9	0.19	35.9	0.30	55.8
Highway Segment	Collision with Other Object	0.01	1.1	0.04	7.2	0.04	8.3
Highway Segment	Other Single-vehicle Collision	0.07	12.9	0.05	9.3	0.12	22.2
Highway Segment	Collision with Parked Vehicle	0.01	0.8	0.01	1.3	0.01	2.2
Highway Segment	Total Single Vehicle Crashes	0.19	35.1	0.31	57.4	0.50	92.5
Highway Segment	Right-Angle Collision	0.00	0.0	0.00	0.2	0.00	0.2
Highway Segment	Head-on Collision	0.00	0.0	0.00	0.0	0.00	0.0
Highway Segment	Other Multi-vehicle Collision	0.00	0.1	0.00	0.5	0.00	0.6
Highway Segment	Rear-end Collision	0.00	0.6	0.02	3.4	0.02	3.9
Highway Segment	Sideswipe, Same Direction Collision	0.00	0.2	0.01	2.5	0.01	2.7
Highway Segment	Total Multiple Vehicle Crashes	0.01	0.9	0.04	6.6	0.04	7.5
Highway Segment	Total Highway Segment Crashes	0.20	36.0	0.35	64.0	0.54	100.0
	Total Crashes	0.20	36.0	0.35	64.0	0.54	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Interchange 160-67 : Evaluation Interchange Existing 2020 : Ramp SB Exit Evaluation

Report Overview

Report Generated: Dec 10, 2020 8:37 PM
Report Template: System: Multi-Page [System] (mlcpm2, Nov 27, 2020 3:23 PM)

Evaluation Date: Thu Dec 10 17:26:52 CST 2020
IHSDM Version: v16.0.0 (Sep 30, 2020)
Crash Prediction Module: v11.0.0 (Sep 30, 2020)

User Name: mhuebbe
Organization Name: EFK Moen, LLC
Phone: 314-394-3133
E-Mail: mhuebbe@efkmoen.com

Project Title: Interchange 160-67
Project Comment: Created Thu Dec 10 08:43:05 CST 2020
Project Unit System: U.S. Customary

Highway Title: Ramp SB Exit
Highway Comment: Created Thu Dec 10 11:42:40 CST 2020
Highway Version: 1

Evaluation Title: Interchange 160-67 : Evaluation Interchange Existing 2020 : Ramp SB Exit
Evaluation Comment: Created Thu Dec 10 17:26:37 CST 2020

Minimum Location: 0.000
Maximum Location: 17+62.820
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: HSM Configuration
Crash Distribution: HSM Configuration
Model/CMF: HSM Configuration
First Year of Analysis: 2020
Last Year of Analysis: 2020
Empirical-Bayes Analysis: None
First Year of Observed Crashes:
Last Year of Observed Crashes:

Disclaimer Regarding Crash Prediction Method

IMPORTANT NOTICE ABOUT COMPARING RESULTS FROM HIGHWAY SAFETY MANUAL FIRST EDITION (2010) MODELS TO RESULTS FROM NEW MODELS DEVELOPED UNDER NCHRP PROJECTS 17-70 AND 17-58

Since the publication of the Highway Safety Manual - First Edition (HSM-1), in 2010 by the American Association of State Highway and Transportation Officials (AASHTO), multiple research efforts have been undertaken through the National Cooperative Highway Research Program (NCHRP) to develop safety performance models for road segment and intersection facility types that were not initially reflected in the HSM-1, in order to expand the breadth and depth of the HSM in the future.

The IHSDM Crash Prediction Module (CPM) is intended as a faithful implementation of HSM Part C predictive methods. As NCHRP projects to develop new predictive methods for the HSM are completed, FHWA works to incorporate the new methods into IHSDM, sometimes in advance of publication in the HSM. The following new crash predictive methods have been accepted by NCHRP project panels and incorporated into IHSDM, while pending AASHTO's approval for incorporation into a future edition of the HSM:

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- 6+ lane and one-way urban/suburban arterials (including models for segments and intersections): completed under NCHRP Project 17-58.

However, in the absence of local calibration factors (see HSM-1 Part C, Appendix A for guidance on calibration of the predictive models), it is neither appropriate nor advisable to directly compare the results from new models (from NCHRP Projects 17-58 and 17-70) to results from HSM-1 models, as the models were not calibrated to the same base state data sets, and consequently can produce unexpected results. If local calibration factors are available and applied to both new models and HSM-1 models, then it may be appropriate to directly compare the results.*[Note: Work being performed under NCHRP Project 17-72 (Update of Crash Modification Factors for the Highway Safety Manual) is expected to re-calibrate many of the old (HSM-1) and new (e.g., NCHRP 17-70) models to data from a single (or small number of) states, that would allow results from all models to be directly compared.]*

The models produced for NCHRP Project 17-70 have independent value in terms of informing the design of a roundabout and assessing the effects of different design characteristics on the expected safety performance of a roundabout.

The HSM-1 interim method previously included in IHSDM for evaluating roundabouts on urban/suburban arterials (i.e., evaluating an existing intersection and then applying a Crash Modification Factor for replacing the existing intersection with a roundabout) has been deactivated in IHSDM, to minimize any confusion with the new roundabout methodology.

Freeway Ramp Evaluation

Section: Section 1
Evaluation Start Location: 0.000
Evaluation End Location: 17+62.820
Functional Class: Freeway Service Ramp
Type of Alignment: One Direction
Model Category: Freeway Service Ramp

Calibration Factor: EX_RAMP_MV_FI=1.0; EX_RAMP_MV_PDO=1.0; EX_RAMP_SV_FI=1.0; EX_RAMP_SV_PDO=1.0;

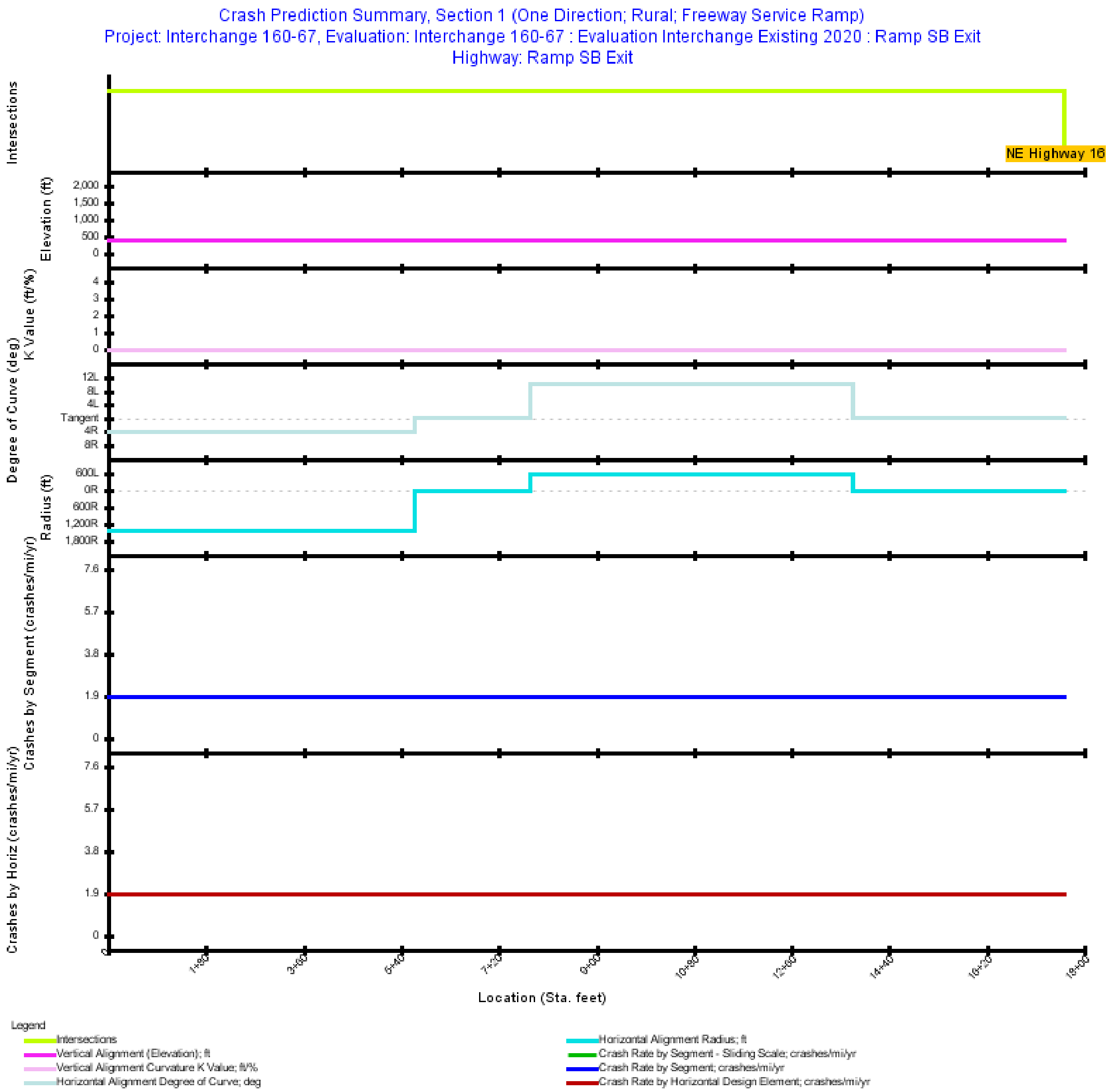

Figure 2. Crash Prediction Summary (Freeway Ramp Sections)

Table 8. Evaluation Freeway - Homogeneous Segments (Freeway Ramp Sections)

Seg. No.	Type	Area Type	Start Location (Sta. ft)	End Location (Sta. ft)	Length (ft)	Length (mi)	AADT
1	Freeway Ramp and C-D Road One-lane Ramp Exit	Rural	0.000	17+62.820	1,762.82	0.3339	2020: 5,800

Table 9. Predicted Ramp Crash Rates and Frequencies Summary (Freeway Ramp Sections)

First Year of Analysis	2020
Last Year of Analysis	2020
Evaluated Length (mi)	0.3339
Average Future Road AADT (vpd)	5,800
Predicted Crashes	
Total Crashes	0.63
Fatal and Injury Crashes	0.26
Property-Damage-Only Crashes	0.37
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	42
Percent Property-Damage-Only Crashes (%)	58
Predicted Crash Rate	
Crash Rate (crashes/mi/yr)	1.8757
FI Crash Rate (crashes/mi/yr)	0.7807
PDO Crash Rate (crashes/mi/yr)	1.0950
Predicted Travel Crash Rate	
Total Travel (million veh-mi)	0.71
Travel Crash Rate (crashes/million veh-mi)	0.89
Travel FI Crash Rate (crashes/million veh-mi)	0.37
Travel PDO Crash Rate (crashes/million veh-mi)	0.52

Table 10. Predicted Crash Frequencies and Rates by Ramp Segment/Intersection (Freeway Ramp Sections)

Segment Number/Intersection Name/Cross Road	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
1	0.000	17+62.820	0.3339	0.626	0.6262	0.2607	0.3656	1.8757	0.89
Total			0.3339	0.626	0.6262	0.2607	0.3656	1.8757	

Table 11. Predicted Crash Frequencies and Rates by Horizontal Design Element (Freeway Ramp Sections)

Title	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
Simple Curve 1	0.000	5+64.230	0.1069	0.200	0.2004	0.0834	0.1170	1.8757	0.89
Tangent	5+64.230	7+78.690	0.0406	0.076	0.0762	0.0317	0.0445	1.8757	0.89
Simple Curve 2	7+78.690	13+71.820	0.1123	0.211	0.2107	0.0877	0.1230	1.8757	0.89
Tangent	13+71.820	17+62.820	0.0741	0.139	0.1389	0.0578	0.0811	1.8757	0.89

Table 12. Predicted Crash Frequencies by Year (Freeway Ramp Sections)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2020	0.63	0.26	41.624	0.37	58.376
Total	0.63	0.26	41.624	0.37	58.376
Average	0.63	0.26	41.624	0.37	58.376

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 13. Predicted Crash Severity by Ramp Segment (Freeway Ramp Sections)

Seg. No.	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)
1	0.0100	0.0304	0.1316	0.0886	0.3656

Table 14. Predicted Freeway Ramp Crash Type Distribution (Freeway Ramp Sections)

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Highway Segment	Collision with Animal	0.00	0.4	0.02	3.5	0.02	3.9
Highway Segment	Collision with Fixed Object	0.15	23.4	0.21	33.6	0.36	57.0
Highway Segment	Collision with Other Object	0.01	1.3	0.04	6.7	0.05	8.0
Highway Segment	Other Single-vehicle Collision	0.10	15.2	0.05	8.7	0.15	23.9
Highway Segment	Collision with Parked Vehicle	0.01	1.0	0.01	1.2	0.01	2.2
Highway Segment	Total Single Vehicle Crashes	0.26	41.4	0.34	53.7	0.59	95.0
Highway Segment	Right-Angle Collision	0.00	0.0	0.00	0.1	0.00	0.2
Highway Segment	Head-on Collision	0.00	0.0	0.00	0.0	0.00	0.0
Highway Segment	Other Multi-vehicle Collision	0.00	0.0	0.00	0.4	0.00	0.4
Highway Segment	Rear-end Collision	0.00	0.2	0.01	2.4	0.02	2.6
Highway Segment	Sideswipe, Same Direction Collision	0.00	0.1	0.01	1.8	0.01	1.8
Highway Segment	Total Multiple Vehicle Crashes	0.00	0.3	0.03	4.7	0.03	5.0
Highway Segment	Total Highway Segment Crashes	0.26	41.6	0.37	58.4	0.63	100.0
	Total Crashes	0.26	41.6	0.37	58.4	0.63	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Interchange 160-67 : Evaluation Interchange Existing 2020 : RampTerminal 160 SB Evaluation

Report Overview

Report Generated: Dec 10, 2020 8:37 PM
Report Template: System: Multi-Page [System] (mlcpm2, Nov 27, 2020 3:23 PM)

Evaluation Date: Thu Dec 10 17:27:09 CST 2020
IHSDM Version: v16.0.0 (Sep 30, 2020)
Crash Prediction Module: v11.0.0 (Sep 30, 2020)

User Name: mhuebbe
Organization Name: EFK Moen, LLC
Phone: 314-394-3133
E-Mail: mhuebbe@efkmoen.com

Project Title: Interchange 160-67
Project Comment: Created Thu Dec 10 08:43:05 CST 2020
Project Unit System: U.S. Customary

Intersection Title: RampTerminal 160 SB
Intersection Comment: Created Thu Dec 10 12:35:13 CST 2020
Intersection Version: v1

Evaluation Title: Interchange 160-67 : Evaluation Interchange Existing 2020 : RampTerminal 160 SB
Evaluation Comment: Created Thu Dec 10 17:27:02 CST 2020

Minimum Location: 534+24.000
Maximum Location: 596+34.000
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: HSM Configuration
Crash Distribution: HSM Configuration
Model/CMF: HSM Configuration
First Year of Analysis: 2020
Last Year of Analysis: 2020
Empirical-Bayes Analysis: None
First Year of Observed Crashes:
Last Year of Observed Crashes:

Disclaimer Regarding Crash Prediction Method

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- 6+ lane and one-way urban/suburban arterials (including models for segments and intersections): completed under NCHRP Project 17-58.

However, in the absence of local calibration factors (see HSM-1 Part C, Appendix A for guidance on calibration of the predictive models), it is neither appropriate nor advisable to directly compare the results from new models (from NCHRP Projects 17-58 and 17-70) to results from HSM-1 models, as the models were not calibrated to the same base state data sets, and consequently can produce unexpected results. If local calibration factors are available and applied to both new models and HSM-1 models, then it may be appropriate to directly compare the results.*[Note: Work being performed under NCHRP Project 17-72 (Update of Crash Modification Factors for the Highway Safety Manual) is expected to re-calibrate many of the old (HSM-1) and new (e.g., NCHRP 17-70) models to data from a single (or small number of) states, that would allow results from all models to be directly compared.]*

The models produced for NCHRP Project 17-70 have independent value in terms of informing the design of a roundabout and assessing the effects of different design characteristics on the expected safety performance of a roundabout.

The HSM-1 interim method previously included in IHSDM for evaluating roundabouts on urban/suburban arterials (i.e., evaluating an existing intersection and then applying a Crash Modification Factor for replacing the existing intersection with a roundabout) has been deactivated in IHSDM, to minimize any confusion with the new roundabout methodology.

RampTerminal 160 SB Evaluation

Intersection: RampTerminal 160 SB
Evaluation Start Location: 534+24.000
Evaluation End Location: 596+34.000
Calibration Factor: RT_ST_FI=1.0; RT_ST_PDO=1.0;

Table 15. Evaluation Ramp Terminal - Site (RampTerminal 160 SB)

Inter. No.	Title	Type	Area Type	Legs	Location (Sta. ft)	Traffic Control	AADT
1	RampTerminal 160 SB (v1)	Freeway Ramp Terminal A2 - Three-Leg at Two-Quadrant Parclo A	Rural	4	580+00.000	Stop-Controlled	Inside: 2020: 6,800; Outside: 2020: 6,800 :: Entrance: 2020: 2,900; Exit: 2020: 5,800

Table 16. Predicted Ramp Terminal Crash Rates and Frequencies Summary (RampTerminal 160 SB)

First Year of Analysis	**2020**
Last Year of Analysis	**2020**
Predicted Crashes	
Total Crashes	**4.23**
Fatal and Injury Crashes	**2.84**
Property-Damage-Only Crashes	**1.39**
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	**67**
Percent Property-Damage-Only Crashes (%)	**33**

Table 17. Predicted Crash Frequencies and Rates by Ramp Terminal (RampTerminal 160 SB)

Segment Number/Intersection Name/Cross Road	Location (Sta. ft)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Travel Crash Rate (crashes/million veh)
RampTerminal 160 SB (v1)	580+00.000	4.229	4.2294	2.8437	1.3857	1.04

Table 18. Predicted Crash Frequencies by Year (RampTerminal 160 SB)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2020	4.23	2.84	67.237	1.39	32.763
Total	4.23	2.84	67.237	1.39	32.763
Average	4.23	2.84	67.237	1.39	32.763

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 19. Predicted Crash Severity by Ramp Terminal (RampTerminal 160 SB)

Seg. No.	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)
1	0.0336	0.1766	0.5842	2.0493	1.3857

Table 20. Predicted Ramp Terminal Crash Type Distribution (RampTerminal 160 SB)

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Ramp Terminal	Collision with Animal	0.00	0.0	0.00	0.0	0.00	0.0
Ramp Terminal	Collision with Fixed Object	0.22	5.2	0.22	5.2	0.44	10.4
Ramp Terminal	Collision with Other Object	0.00	0.0	0.01	0.2	0.01	0.2
Ramp Terminal	Other Single-vehicle Collision	0.18	4.4	0.04	0.9	0.22	5.2
Ramp Terminal	Collision with Parked Vehicle	0.02	0.5	0.02	0.5	0.04	1.0
Ramp Terminal	Total Single Vehicle Crashes	0.43	10.1	0.28	6.7	0.71	16.8
Ramp Terminal	Right-Angle Collision	1.48	35.1	0.52	12.2	2.00	47.3
Ramp Terminal	Head-on Collision	0.06	1.3	0.02	0.5	0.08	1.8
Ramp Terminal	Other Multi-vehicle Collision	0.04	0.9	0.04	0.9	0.07	1.7
Ramp Terminal	Rear-end Collision	0.78	18.5	0.38	9.0	1.16	27.5
Ramp Terminal	Sideswipe, Same Direction Collision	0.06	1.3	0.15	3.5	0.20	4.8
Ramp Terminal	Total Multiple Vehicle Crashes	2.42	57.2	1.10	26.1	3.52	83.2
Ramp Terminal	Total Ramp Terminal Crashes	2.84	67.2	1.39	32.8	4.23	100.0
	Total Crashes	2.84	67.2	1.39	32.8	4.23	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Interchange 160-67 : Evaluation Interchange Existing 2020 : Ramp NB Enter Evaluation

Report Overview

Report Generated: Dec 10, 2020 8:37 PM
Report Template: System: Multi-Page [System] (mlcpm2, Nov 27, 2020 3:23 PM)

Evaluation Date: Thu Dec 10 17:27:31 CST 2020
IHSDM Version: v16.0.0 (Sep 30, 2020)
Crash Prediction Module: v11.0.0 (Sep 30, 2020)

User Name: mhuebbe
Organization Name: EFK Moen, LLC
Phone: 314-394-3133
E-Mail: mhuebbe@efkmoen.com

Project Title: Interchange 160-67
Project Comment: Created Thu Dec 10 08:43:05 CST 2020
Project Unit System: U.S. Customary

Highway Title: Ramp NB Enter
Highway Comment: Created Thu Dec 10 12:44:09 CST 2020
Highway Version: 1

Evaluation Title: Interchange 160-67 : Evaluation Interchange Existing 2020 : Ramp NB Enter
Evaluation Comment: Created Thu Dec 10 17:27:18 CST 2020

Minimum Location: 0.000
Maximum Location: 13+32.250
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: HSM Configuration
Crash Distribution: HSM Configuration
Model/CMF: HSM Configuration
First Year of Analysis: 2020
Last Year of Analysis: 2020
Empirical-Bayes Analysis: None
First Year of Observed Crashes:
Last Year of Observed Crashes:

Disclaimer Regarding Crash Prediction Method

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- 6+ lane and one-way urban/suburban arterials (including models for segments and intersections): completed under NCHRP

Project 17-58.

However, in the absence of local calibration factors (see HSM-1 Part C, Appendix A for guidance on calibration of the predictive models), it is neither appropriate nor advisable to directly compare the results from new models (from NCHRP Projects 17-58 and 17-70) to results from HSM-1 models, as the models were not calibrated to the same base state data sets, and consequently can produce unexpected results. If local calibration factors are available and applied to both new models and HSM-1 models, then it may be appropriate to directly compare the results.*[Note: Work being performed under NCHRP Project 17-72 (Update of Crash Modification Factors for the Highway Safety Manual) is expected to re-calibrate many of the old (HSM-1) and new (e.g., NCHRP 17-70) models to data from a single (or small number of) states, that would allow results from all models to be directly compared.]*

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Freeway Ramp Evaluation

Section: Section 1
Evaluation Start Location: 0.000
Evaluation End Location: 13+32.250
Functional Class: Freeway Service Ramp
Type of Alignment: One Direction
Model Category: Freeway Service Ramp
Calibration Factor: ENT_RAMP_MV_FI=1.0; ENT_RAMP_MV_PDO=1.0; ENT_RAMP_SV_FI=1.0; ENT_RAMP_SV_PDO=1.0;

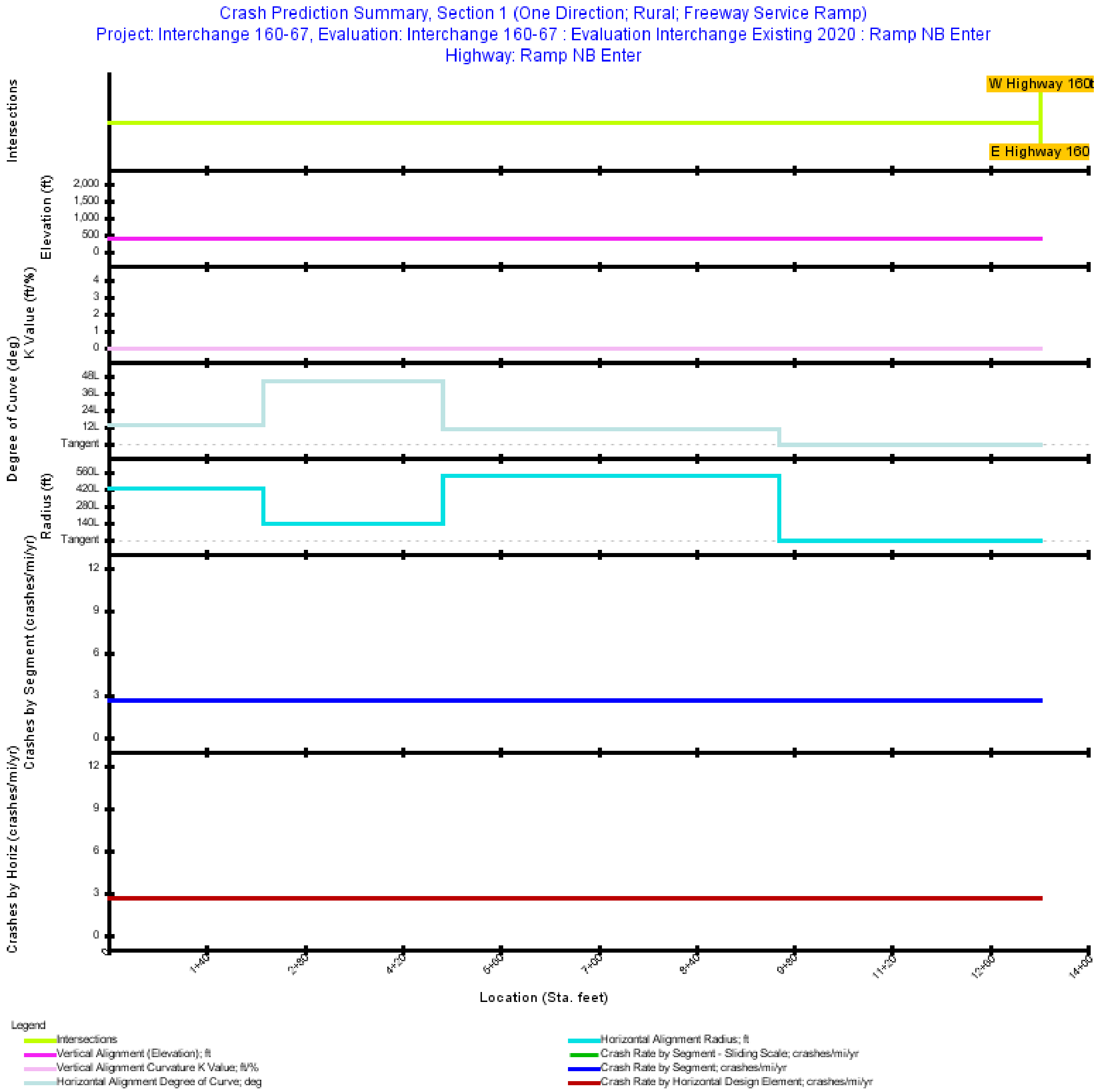

Figure 3. Crash Prediction Summary (Freeway Ramp Sections)

Table 21. Evaluation Freeway - Homogeneous Segments (Freeway Ramp Sections)

Seg. No.	Type	Area Type	Start Location (Sta. ft)	End Location (Sta. ft)	Length (ft)	Length (mi)	AADT
1	Freeway Ramp and C-D Road One-lane Ramp Entrance	Rural	0.000	13+32.250	1,332.25	0.2523	2020: 3,900

Table 22. Predicted Ramp Crash Rates and Frequencies Summary (Freeway Ramp Sections)

First Year of Analysis	2020
Last Year of Analysis	2020
Evaluated Length (mi)	0.2523
Average Future Road AADT (vpd)	3,900
Predicted Crashes	
Total Crashes	0.67
Fatal and Injury Crashes	0.24
Property-Damage-Only Crashes	0.43
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	36
Percent Property-Damage-Only Crashes (%)	64
Predicted Crash Rate	
Crash Rate (crashes/mi/yr)	2.6410
FI Crash Rate (crashes/mi/yr)	0.9442
PDO Crash Rate (crashes/mi/yr)	1.6969
Predicted Travel Crash Rate	
Total Travel (million veh-mi)	0.36
Travel Crash Rate (crashes/million veh-mi)	1.85
Travel FI Crash Rate (crashes/million veh-mi)	0.66
Travel PDO Crash Rate (crashes/million veh-mi)	1.19

Table 23. Predicted Crash Frequencies and Rates by Ramp Segment/Intersection (Freeway Ramp Sections)

Segment Number/Intersection Name/Cross Road	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
1	0.000	13+32.250	0.2523	0.666	0.6664	0.2382	0.4282	2.6410	1.85
Total			0.2523	0.666	0.6664	0.2382	0.4282	2.6410	

Table 24. Predicted Crash Frequencies and Rates by Horizontal Design Element (Freeway Ramp Sections)

Title	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
Simple Curve 1	0.000	2+21.030	0.0419	0.111	0.1106	0.0395	0.0710	2.6410	1.85
Simple Curve 2	2+21.030	4+78.670	0.0488	0.129	0.1289	0.0461	0.0828	2.6410	1.85
Simple Curve 3	4+78.670	9+57.980	0.0908	0.240	0.2397	0.0857	0.1540	2.6410	1.85
Tangent	9+57.980	13+32.250	0.0709	0.187	0.1872	0.0669	0.1203	2.6410	1.85

Table 25. Predicted Crash Frequencies by Year (Freeway Ramp Sections)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2020	0.67	0.24	35.750	0.43	64.250
Total	0.67	0.24	35.750	0.43	64.250
Average	0.67	0.24	35.750	0.43	64.250

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 26. Predicted Crash Severity by Ramp Segment (Freeway Ramp Sections)

Seg. No.	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)
1	0.0062	0.0189	0.1255	0.0877	0.4282

Table 27. Predicted Freeway Ramp Crash Type Distribution (Freeway Ramp Sections)

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Highway Segment	Collision with Animal	0.00	0.3	0.02	3.7	0.03	4.0
Highway Segment	Collision with Fixed Object	0.13	19.8	0.23	35.3	0.37	55.1
Highway Segment	Collision with Other Object	0.01	1.1	0.05	7.1	0.05	8.1
Highway Segment	Other Single-vehicle Collision	0.09	12.8	0.06	9.1	0.15	22.0
Highway Segment	Collision with Parked Vehicle	0.01	0.8	0.01	1.3	0.01	2.1
Highway Segment	Total Single Vehicle Crashes	0.23	34.9	0.38	56.5	0.61	91.3
Highway Segment	Right-Angle Collision	0.00	0.0	0.00	0.2	0.00	0.3
Highway Segment	Head-on Collision	0.00	0.0	0.00	0.0	0.00	0.0
Highway Segment	Other Multi-vehicle Collision	0.00	0.1	0.00	0.6	0.00	0.7
Highway Segment	Rear-end Collision	0.00	0.6	0.03	4.0	0.03	4.5
Highway Segment	Sideswipe, Same Direction Collision	0.00	0.2	0.02	3.0	0.02	3.2
Highway Segment	Total Multiple Vehicle Crashes	0.01	0.9	0.05	7.8	0.06	8.7
Highway Segment	Total Highway Segment Crashes	0.24	35.8	0.43	64.2	0.67	100.0
	Total Crashes	0.24	35.8	0.43	64.2	0.67	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Interchange 160-67 : Evaluation Interchange Existing 2020 : Ramp NB Exit Evaluation

Report Overview

Report Generated: Dec 10, 2020 8:37 PM
Report Template: System: Multi-Page [System] (mlcpm2, Nov 27, 2020 3:23 PM)

Evaluation Date: Thu Dec 10 17:27:54 CST 2020
IHSDM Version: v16.0.0 (Sep 30, 2020)
Crash Prediction Module: v11.0.0 (Sep 30, 2020)

User Name: mhuebbe
Organization Name: EFK Moen, LLC
Phone: 314-394-3133
E-Mail: mhuebbe@efkmoen.com

Project Title: Interchange 160-67
Project Comment: Created Thu Dec 10 08:43:05 CST 2020
Project Unit System: U.S. Customary

Highway Title: Ramp NB Exit
Highway Comment: Created Thu Dec 10 13:04:40 CST 2020
Highway Version: 1

Evaluation Title: Interchange 160-67 : Evaluation Interchange Existing 2020 : Ramp NB Exit
Evaluation Comment: Created Thu Dec 10 17:27:38 CST 2020

Minimum Location: 0.000
Maximum Location: 17+63.150
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: HSM Configuration
Crash Distribution: HSM Configuration
Model/CMF: HSM Configuration
First Year of Analysis: 2020
Last Year of Analysis: 2020
Empirical-Bayes Analysis: None
First Year of Observed Crashes:
Last Year of Observed Crashes:

Disclaimer Regarding Crash Prediction Method

IMPORTANT NOTICE ABOUT COMPARING RESULTS FROM HIGHWAY SAFETY MANUAL FIRST EDITION (2010) MODELS TO RESULTS FROM NEW MODELS DEVELOPED UNDER NCHRP PROJECTS 17-70 AND 17-58

Since the publication of the Highway Safety Manual - First Edition (HSM-1), in 2010 by the American Association of State Highway and Transportation Officials (AASHTO), multiple research efforts have been undertaken through the National Cooperative Highway Research Program (NCHRP) to develop safety performance models for road segment and intersection facility types that were not initially reflected in the HSM-1, in order to expand the breadth and depth of the HSM in the future.

The IHSDM Crash Prediction Module (CPM) is intended as a faithful implementation of HSM Part C predictive methods. As NCHRP projects to develop new predictive methods for the HSM are completed, FHWA works to incorporate the new methods into IHSDM, sometimes in advance of publication in the HSM. The following new crash predictive methods have been accepted by NCHRP project panels and incorporated into IHSDM, while pending AASHTO's approval for incorporation into a future edition of the HSM:

- Roundabouts: completed in 2018 under NCHRP Project 17-70, the new methods will provide improved outcomes for the safety analysis of roundabouts.
- 6+ lane and one-way urban/suburban arterials (including models for segments and intersections): completed under NCHRP Project 17-58.

However, in the absence of local calibration factors (see HSM-1 Part C, Appendix A for guidance on calibration of the predictive models), it is neither appropriate nor advisable to directly compare the results from new models (from NCHRP Projects 17-58 and 17-70) to results from HSM-1 models, as the models were not calibrated to the same base state data sets, and consequently can produce unexpected results. If local calibration factors are available and applied to both new models and HSM-1 models, then it may be appropriate to directly compare the results.*[Note: Work being performed under NCHRP Project 17-72 (Update of Crash Modification Factors for the Highway Safety Manual) is expected to re-calibrate many of the old (HSM-1) and new (e.g., NCHRP 17-70) models to data from a single (or small number of) states, that would allow results from all models to be directly compared.]*

The models produced for NCHRP Project 17-70 have independent value in terms of informing the design of a roundabout and assessing the effects of different design characteristics on the expected safety performance of a roundabout.

The HSM-1 interim method previously included in IHSDM for evaluating roundabouts on urban/suburban arterials (i.e., evaluating an existing intersection and then applying a Crash Modification Factor for replacing the existing intersection with a roundabout) has been deactivated in IHSDM, to minimize any confusion with the new roundabout methodology.

Freeway Ramp Evaluation

Section: Section 1
Evaluation Start Location: 0.000
Evaluation End Location: 17+63.150
Functional Class: Freeway Service Ramp
Type of Alignment: One Direction
Model Category: Freeway Service Ramp

Calibration Factor: EX_RAMP_MV_FI=1.0; EX_RAMP_MV_PDO=1.0; EX_RAMP_SV_FI=1.0; EX_RAMP_SV_PDO=1.0;

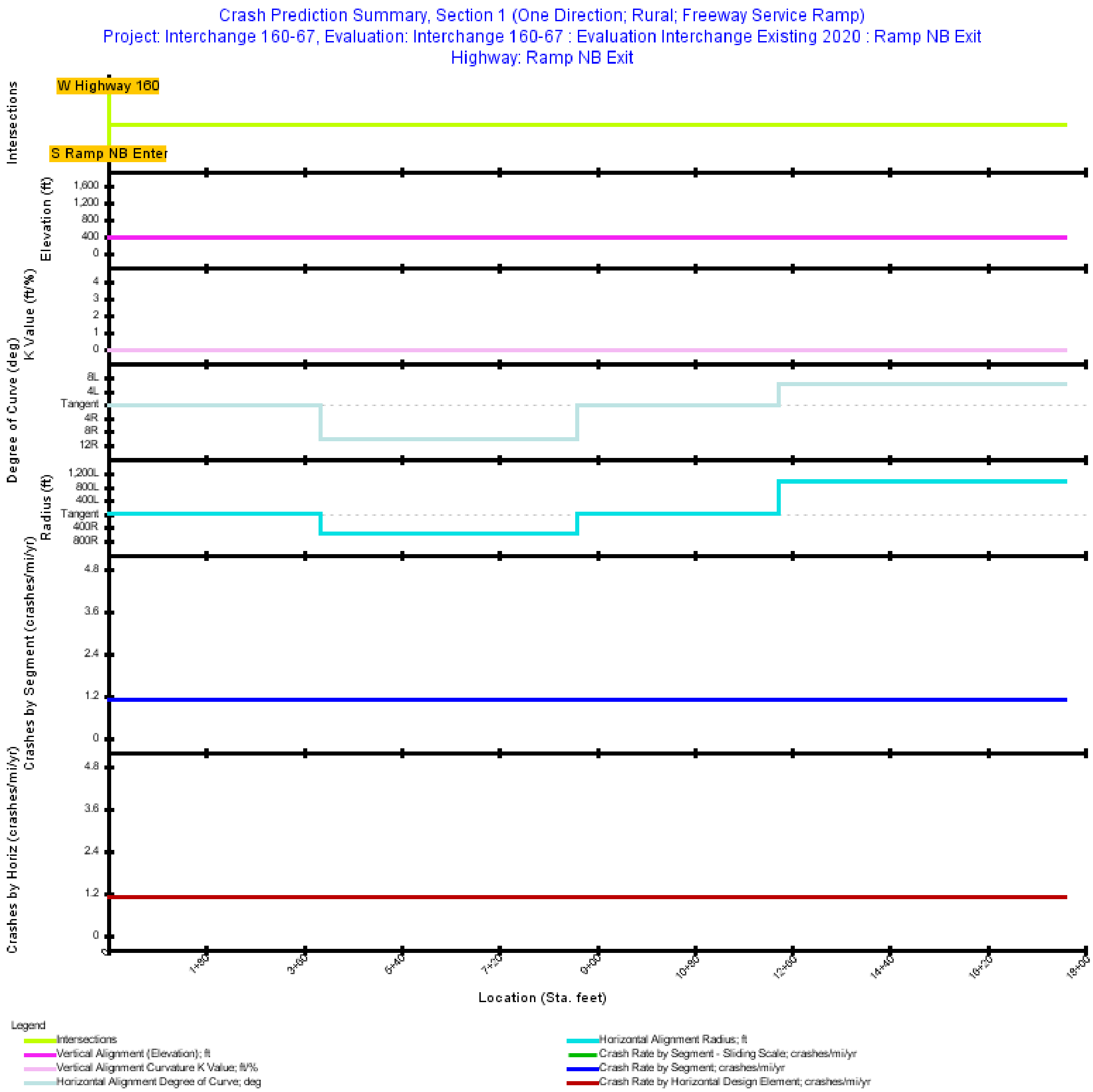

Figure 4. Crash Prediction Summary (Freeway Ramp Sections)

Table 28. Evaluation Freeway - Homogeneous Segments (Freeway Ramp Sections)

Seg. No.	Type	Area Type	Start Location (Sta. ft)	End Location (Sta. ft)	Length (ft)	Length (mi)	AADT
1	Freeway Ramp and C-D Road One-lane Ramp Exit	Rural	0.000	17+63.150	1,763.15	0.3339	2020: 2,500

Table 29. Predicted Ramp Crash Rates and Frequencies Summary (Freeway Ramp Sections)

First Year of Analysis	**2020**
Last Year of Analysis	**2020**
Evaluated Length (mi)	**0.3339**
Average Future Road AADT (vpd)	**2,500**
Predicted Crashes	
Total Crashes	**0.37**
Fatal and Injury Crashes	**0.17**
Property-Damage-Only Crashes	**0.20**
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	**46**
Percent Property-Damage-Only Crashes (%)	**54**
Predicted Crash Rate	
Crash Rate (crashes/mi/yr)	**1.1103**
FI Crash Rate (crashes/mi/yr)	**0.5146**
PDO Crash Rate (crashes/mi/yr)	**0.5957**
Predicted Travel Crash Rate	
Total Travel (million veh-mi)	**0.30**
Travel Crash Rate (crashes/million veh-mi)	**1.22**
Travel FI Crash Rate (crashes/million veh-mi)	**0.56**
Travel PDO Crash Rate (crashes/million veh-mi)	**0.65**

Table 30. Predicted Crash Frequencies and Rates by Ramp Segment/Intersection (Freeway Ramp Sections)

Segment Number/Intersection Name/Cross Road	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
1	0.000	17+63.150	0.3339	0.371	0.3708	0.1718	0.1989	1.1103	1.22
Total			0.3339	0.371	0.3708	0.1718	0.1989	1.1103	

Table 31. Predicted Crash Frequencies and Rates by Horizontal Design Element (Freeway Ramp Sections)

Title	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
Tangent	0.000	3+91.000	0.0741	0.082	0.0822	0.0381	0.0441	1.1103	1.22
Simple Curve 1	3+91.000	8+62.620	0.0893	0.099	0.0992	0.0460	0.0532	1.1103	1.22
Tangent	8+62.620	12+34.880	0.0705	0.078	0.0783	0.0363	0.0420	1.1103	1.22
Simple Curve 2	12+34.880	17+63.150	0.1001	0.111	0.1111	0.0515	0.0596	1.1103	1.22

Table 32. Predicted Crash Frequencies by Year (Freeway Ramp Sections)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2020	0.37	0.17	46.346	0.20	53.654
Total	0.37	0.17	46.346	0.20	53.654
Average	0.37	0.17	46.346	0.20	53.654

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 33. Predicted Crash Severity by Ramp Segment (Freeway Ramp Sections)

Seg. No.	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)
1	0.0066	0.0200	0.0865	0.0588	0.1989

Table 34. Predicted Freeway Ramp Crash Type Distribution (Freeway Ramp Sections)

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Highway Segment	Collision with Animal	0.00	0.5	0.01	3.3	0.01	3.8
Highway Segment	Collision with Fixed Object	0.10	26.1	0.12	31.8	0.21	57.9
Highway Segment	Collision with Other Object	0.01	1.4	0.02	6.4	0.03	7.8
Highway Segment	Other Single-vehicle Collision	0.06	17.0	0.03	8.2	0.09	25.2
Highway Segment	Collision with Parked Vehicle	0.00	1.1	0.00	1.2	0.01	2.3
Highway Segment	Total Single Vehicle Crashes	0.17	46.1	0.19	50.9	0.36	96.9
Highway Segment	Right-Angle Collision	0.00	0.0	0.00	0.1	0.00	0.1
Highway Segment	Head-on Collision	0.00	0.0	0.00	0.0	0.00	0.0
Highway Segment	Other Multi-vehicle Collision	0.00	0.0	0.00	0.2	0.00	0.2
Highway Segment	Rear-end Collision	0.00	0.2	0.01	1.4	0.01	1.6
Highway Segment	Sideswipe, Same Direction Collision	0.00	0.1	0.00	1.1	0.00	1.1
Highway Segment	Total Multiple Vehicle Crashes	0.00	0.3	0.01	2.8	0.01	3.1
Highway Segment	Total Highway Segment Crashes	0.17	46.3	0.20	53.7	0.37	100.0
	Total Crashes	0.17	46.3	0.20	53.7	0.37	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Interchange 160-67 : Evaluation Interchange Existing 2020 : RampTerminal NB Evaluation

Report Overview

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Evaluation Date: Thu Dec 10 17:28:07 CST 2020
IHSDM Version: v16.0.0 (Sep 30, 2020)
Crash Prediction Module: v11.0.0 (Sep 30, 2020)

User Name: mhuebbe
Organization Name: EFK Moen, LLC
Phone: 314-394-3133
E-Mail: mhuebbe@efkmoen.com

Project Title: Interchange 160-67
Project Comment: Created Thu Dec 10 08:43:05 CST 2020
Project Unit System: U.S. Customary

Intersection Title: RampTerminal NB
Intersection Comment: Created Thu Dec 10 13:23:03 CST 2020
Intersection Version: v1

Evaluation Title: Interchange 160-67 : Evaluation Interchange Existing 2020 : RampTerminal NB
Evaluation Comment: Created Thu Dec 10 17:28:00 CST 2020

Minimum Location: 534+24.000
Maximum Location: 596+34.000
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: HSM Configuration
Crash Distribution: HSM Configuration
Model/CMF: HSM Configuration
First Year of Analysis: 2020
Last Year of Analysis: 2020
Empirical-Bayes Analysis: None
First Year of Observed Crashes:
Last Year of Observed Crashes:

Disclaimer Regarding Crash Prediction Method

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- 6+ lane and one-way urban/suburban arterials (including models for segments and intersections): completed under NCHRP Project 17-58.

However, in the absence of local calibration factors (see HSM-1 Part C, Appendix A for guidance on calibration of the predictive models), it is neither appropriate nor advisable to directly compare the results from new models (from NCHRP Projects 17-58 and 17-70) to results from HSM-1 models, as the models were not calibrated to the same base state data sets, and consequently can produce unexpected results. If local calibration factors are available and applied to both new models and HSM-1 models, then it may be appropriate to directly compare the results.*[Note: Work being performed under NCHRP Project 17-72 (Update of Crash Modification Factors for the Highway Safety Manual) is expected to re-calibrate many of the old (HSM-1) and new (e.g., NCHRP 17-70) models to data from a single (or small number of) states, that would allow results from all models to be directly compared.]*

The models produced for NCHRP Project 17-70 have independent value in terms of informing the design of a roundabout and assessing the effects of different design characteristics on the expected safety performance of a roundabout.

The HSM-1 interim method previously included in IHSDM for evaluating roundabouts on urban/suburban arterials (i.e., evaluating an existing intersection and then applying a Crash Modification Factor for replacing the existing intersection with a roundabout) has been deactivated in IHSDM, to minimize any confusion with the new roundabout methodology.

RampTerminal NB Evaluation

Intersection: RampTerminal NB
Evaluation Start Location: 534+24.000
Evaluation End Location: 596+34.000
Calibration Factor: RT_ST_FI=1.0; RT_ST_PDO=1.0;

Table 35. Evaluation Ramp Terminal - Site (RampTerminal NB)

Inter. No.	Title	Type	Area Type	Legs	Location (Sta. ft)	Traffic Control	AADT
1	RampTerminal NB (v1)	Freeway Ramp Terminal A2 - Three-Leg at Two-Quadrant Parclo A	Rural	4	572+50.000	Stop-Controlled	Inside: 2020: 6,800; Outside: 2020: 6,800 :: Entrance: 2020: 2,500; Exit: 2020: 3,900

Table 36. Predicted Ramp Terminal Crash Rates and Frequencies Summary (RampTerminal NB)

First Year of Analysis	**2020**
Last Year of Analysis	**2020**
Predicted Crashes	
Total Crashes	**1.91**
Fatal and Injury Crashes	**0.85**
Property-Damage-Only Crashes	**1.06**
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	**45**
Percent Property-Damage-Only Crashes (%)	**55**

Table 37. Predicted Crash Frequencies and Rates by Ramp Terminal (RampTerminal NB)

Segment Number/Intersection Name/Cross Road	Location (Sta. ft)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Travel Crash Rate (crashes/million veh)
RampTerminal NB (v1)	572+50.000	1.908	1.9080	0.8498	1.0582	0.52

Table 38. Predicted Crash Frequencies by Year (RampTerminal NB)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2020	1.91	0.85	44.537	1.06	55.463
Total	1.91	0.85	44.537	1.06	55.463
Average	1.91	0.85	44.537	1.06	55.463

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 39. Predicted Crash Severity by Ramp Terminal (RampTerminal NB)

Seg. No.	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)
1	0.0101	0.0528	0.1746	0.6124	1.0582

Table 40. Predicted Ramp Terminal Crash Type Distribution (RampTerminal NB)

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Ramp Terminal	Collision with Animal	0.00	0.0	0.00	0.0	0.00	0.0
Ramp Terminal	Collision with Fixed Object	0.07	3.5	0.17	8.8	0.23	12.2
Ramp Terminal	Collision with Other Object	0.00	0.0	0.01	0.3	0.01	0.3
Ramp Terminal	Other Single-vehicle Collision	0.06	2.9	0.03	1.4	0.08	4.3
Ramp Terminal	Collision with Parked Vehicle	0.01	0.3	0.02	0.8	0.02	1.1
Ramp Terminal	Total Single Vehicle Crashes	0.13	6.7	0.22	11.3	0.34	18.0
Ramp Terminal	Right-Angle Collision	0.44	23.2	0.39	20.6	0.84	43.9
Ramp Terminal	Head-on Collision	0.02	0.9	0.02	0.8	0.03	1.7
Ramp Terminal	Other Multi-vehicle Collision	0.01	0.6	0.03	1.4	0.04	2.0
Ramp Terminal	Rear-end Collision	0.23	12.2	0.29	15.3	0.53	27.6
Ramp Terminal	Sideswipe, Same Direction Collision	0.02	0.9	0.11	5.9	0.13	6.8
Ramp Terminal	Total Multiple Vehicle Crashes	0.72	37.9	0.84	44.1	1.56	82.0
Ramp Terminal	Total Ramp Terminal Crashes	0.85	44.5	1.06	55.5	1.91	100.0
	Total Crashes	0.85	44.5	1.06	55.5	1.91	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Interactive Highway Safety Design Model

Crash Prediction Evaluation Report

December 10, 2020

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Report Overview

Report Generated: Dec 10, 2020 8:20 PM
Report Template: System: Multi-Page [System] (mlcpm2, Nov 27, 2020 3:23 PM)

Evaluation Date: Thu Dec 10 19:01:25 CST 2020
IHSDM Version: v16.0.0 (Sep 30, 2020)
Crash Prediction Module: v11.0.0 (Sep 30, 2020)

User Name: mhuebbe
Organization Name: EFK Moen, LLC
Phone: 314-394-3133
E-Mail: mhuebbe@efkmoen.com

Project Title: Project 67
Project Comment: Created Wed Dec 09 16:11:58 CST 2020
Project Unit System: U.S. Customary

Highway Title: Highway 160
Highway Comment: Created Wed Dec 09 22:20:13 CST 2020
Highway Version: 1

Evaluation Title: Evaluation 160 Existing 2020
Evaluation Comment: Created Thu Dec 10 19:00:29 CST 2020

Minimum Location: 534+24.000
Maximum Location: 596+34.000
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: HSM Configuration
Crash Distribution: HSM Configuration
Model/CMF: HSM Configuration
First Year of Analysis: 2020
Last Year of Analysis: 2020
Empirical-Bayes Analysis: None
First Year of Observed Crashes:
Last Year of Observed Crashes:

Disclaimer Regarding Crash Prediction Method

IMPORTANT NOTICE ABOUT COMPARING RESULTS FROM HIGHWAY SAFETY MANUAL FIRST EDITION (2010) MODELS TO RESULTS FROM NEW MODELS DEVELOPED UNDER NCHRP PROJECTS 17-70 AND 17-58

Since the publication of the Highway Safety Manual - First Edition (HSM-1), in 2010 by the American Association of State Highway and Transportation Officials (AASHTO), multiple research efforts have been undertaken through the National Cooperative Highway Research Program (NCHRP) to develop safety performance models for road segment and intersection facility types that were not initially reflected in the HSM-1, in order to expand the breadth and depth of the HSM in the future.

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- Roundabouts: completed in 2018 under NCHRP Project 17-70, the new methods will provide improved outcomes for the safety analysis of roundabouts.
- 6+ lane and one-way urban/suburban arterials (including models for segments and intersections): completed under NCHRP Project 17-58.

However, in the absence of local calibration factors (see HSM-1 Part C, Appendix A for guidance on calibration of the predictive models), it is neither appropriate nor advisable to directly compare the results from new models (from NCHRP Projects 17-58 and 17-70) to results from HSM-1 models, as the models were not calibrated to the same base state data sets, and consequently can produce unexpected results. If local calibration factors are available and applied to both new models and HSM-1 models, then it may be appropriate to directly compare the results.*[Note: Work being performed under NCHRP Project 17-72 (Update of Crash Modification Factors for the Highway Safety Manual) is expected to re-calibrate many of the old (HSM-1) and new (e.g., NCHRP 17-70) models to data from a single (or small number of) states, that would allow results from all models to be directly compared.]*

The models produced for NCHRP Project 17-70 have independent value in terms of informing the design of a roundabout and assessing the effects of different design characteristics on the expected safety performance of a roundabout.

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Section Types

Section 1 Evaluation

Section: Section 1
Evaluation Start Location: 534+24.000
Evaluation End Location: 596+34.000
Area Type: Rural
Functional Class: Multiple
Type of Alignment: Undivided, Two Lane
Model Category: Rural, Two Lane
Calibration Factor: 2U=1.0; 4ST=1.0; RT_ST_FI=1.0; RT_ST_PDO=1.0;

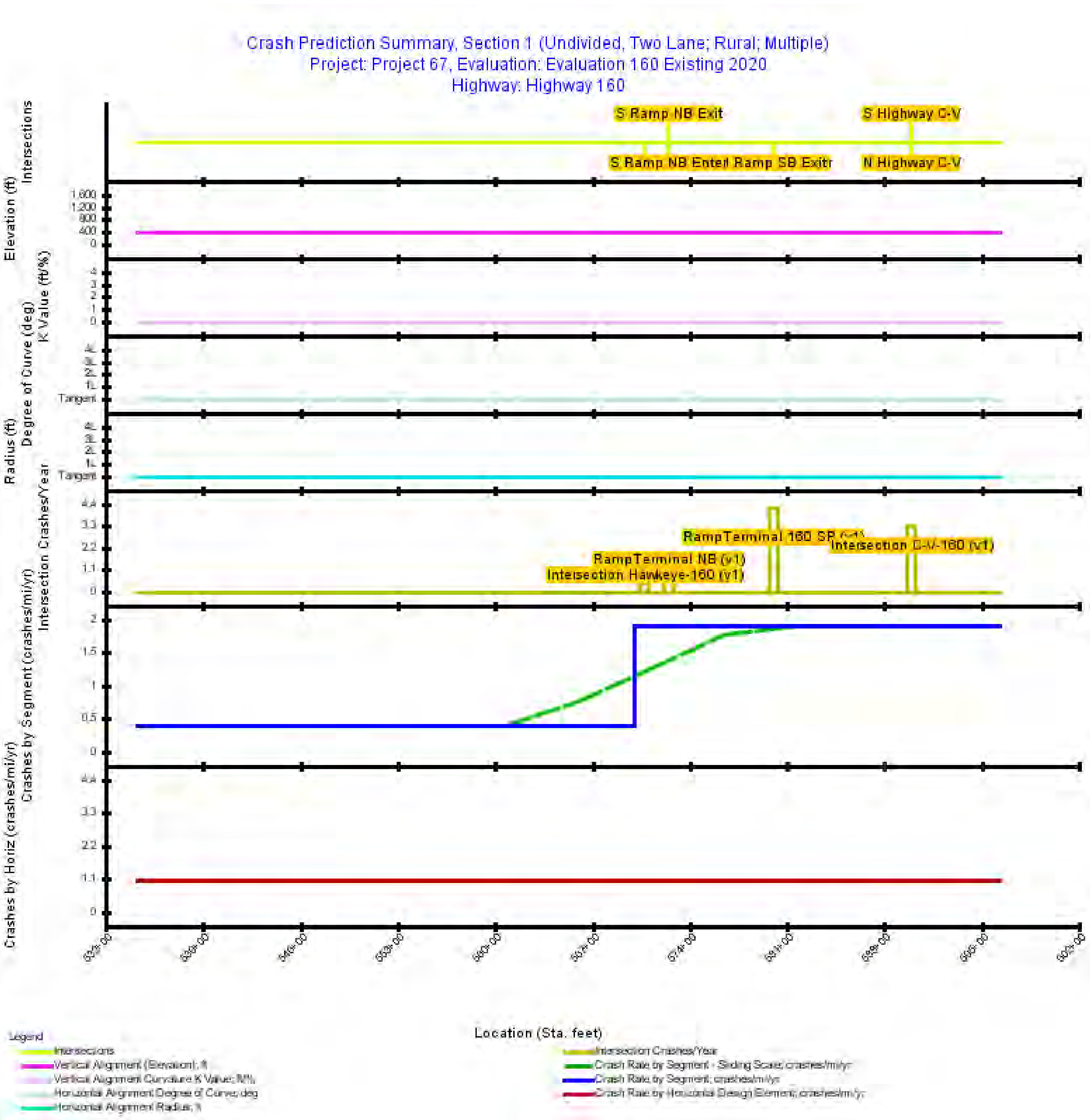

Figure 1. Crash Prediction Summary (Section 1)

Table 1. Evaluation Highway - Homogeneous Segments (Section 1)

Seg. No.	Type	Start Location (Sta. ft)	End Location (Sta. ft)	Length (ft)	Length (mi)	AADT	Left Lane Width (ft)	Right Lane Width (ft)	Left Shoulder Width (ft)	Right Shoulder Width (ft)	Grade (%)	Driveway Density (driveways/mi)	Hazard Rating	Centerline Rumble Strip	Passing Lanes	TWLT Lane	Lighting	Automated Speed Enforcement
1	Rural Two-Lane Segment Two-lane Undivided	534+24.000	570+00.000	3,576.00	0.6773	2020: 985	12.00	12.00	4.00	4.00	0.00	13.0	4	false	0	false	false	false
2	Rural Two-Lane Segment Two-lane Undivided	570+00.000	596+34.000	2,634.00	0.4989	2020: 6,800	12.00	12.00	6.00	6.00	0.00	8.0	3	false	0	false	false	false

Table 2. Evaluation Intersection - Section 1

Inter. No.	Title	Type	Location (Sta. ft)	Major AADT	Minor AADT	Legs	Traffic Control	Major road approaches w/Left Turn Lanes	Major road approaches w/Right Turn Lanes	Skew1	Skew2	Lighted at Night
1	Intersection Hawkeye-160 (v1)	Rural Two-Lane Intersection Four-Legged w/STOP control	570+75.000	2020: 6,800	2020: 55	4	Stop-Controlled	0	0	0.00	0.00	false

Table 3. Evaluation Intersection - Section 1

Inter. No.	Title	Type	Location (Sta. ft)	Major AADT	Minor AADT	Legs	Traffic Control	Major road approaches w/Left Turn Lanes	Major road approaches w/Right Turn Lanes	Skew1	Skew2	Lighted at Night
4	Intersection C-V-160 (v1)	Rural Two-Lane Intersection Four-Legged w/STOP control	589+95.000	2020: 6,800	2020: 1,500	4	Stop-Controlled	0	0	0.63	0.63	false

Table 4. Evaluation Ramp Terminal - Site (Section 1)

Inter. No.	Title	Type	Area Type	Legs	Location (Sta. ft)	Traffic Control	AADT
2	RampTerminal NB (v1)	Freeway Ramp Terminal A2 - Three-Leg at Two-Quadrant Parclo A	Rural	4	572+50.000	Stop-Controlled	Inside: 2020: 6,800; Outside: 2020: 6,800 :: Entrance: 2020: 2,500; Exit: 2020: 3,900
3	RampTerminal 160 SB (v1)	Freeway Ramp Terminal A2 - Three-Leg at Two-Quadrant Parclo A	Rural	4	580+00.000	Stop-Controlled	Inside: 2020: 6,800; Outside: 2020: 6,800 :: Entrance: 2020: 2,900; Exit: 2020: 5,800

Table 5. Predicted Highway Crash Rates and Frequencies Summary (Section 1)

First Year of Analysis	**2020**
Last Year of Analysis	**2020**
Evaluated Length (mi)	**1.1761**
Average Future Road AADT (vpd)	**3,451**
Predicted Crashes	
Total Crashes	**11.11**
Fatal and Injury Crashes	**5.70**
Property-Damage-Only Crashes	**5.41**
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	**51**
Percent Property-Damage-Only Crashes (%)	**49**
Predicted Crash Rate	
Crash Rate (crashes/mi/yr)	**9.4497**
FI Crash Rate (crashes/mi/yr)	**4.8501**
PDO Crash Rate (crashes/mi/yr)	**4.5996**
Predicted Travel Crash Rate	
Total Travel (million veh-mi)	**1.48**
Travel Crash Rate (crashes/million veh-mi)	**7.50**
Travel FI Crash Rate (crashes/million veh-mi)	**3.85**
Travel PDO Crash Rate (crashes/million veh-mi)	**3.65**

Table 6. Predicted Crash Frequencies and Rates by Highway Segment/Intersection (Section 1)

Segment Number/Intersection Name/Cross Road	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/millio n veh-mi)	Predicted Intersection Travel Crash Rate (crashes/million veh)
1	534+24.000	570+00.000	0.6773	0.267	0.2671	0.0858	0.1814	0.3944	1.10	
2	570+00.000	596+34.000	0.4989	0.952	0.9518	0.3055	0.6463	1.9079	0.77	
Intersection Hawkeye-160 (v1)	570+75.000			0.440	0.4401	0.1897	0.2504			0.18
RampTerminal NB (v1)	572+50.000			1.908	1.9080	0.8498	1.0582			0.52
RampTerminal 160 SB (v1)	580+00.000			4.229	4.2294	2.8437	1.3857			1.04
Intersection C-V-160 (v1)	589+95.000			3.318	3.3177	1.4299	1.8878			1.11
All Segments			1.1761	1.219	1.2189	0.3913	0.8277	1.0364	0.82	
All Intersections				9.895	9.8952	5.3131	4.5821			0.75
Total			1.1761	11.114	11.1142	5.7044	5.4098	9.4497		

Table 7. Predicted Crash Frequencies and Rates by Horizontal Design Element (Section 1)

Title	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
Tangent	534+24.000	596+34.000	1.1761	1.219	1.2189	0.3913	0.8277	1.0364	0.96

Table 8. Predicted Crash Frequencies by Year (Section 1)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2020	11.11	5.70	51.325	5.41	48.675
Total	11.11	5.70	51.325	5.41	48.675
Average	11.11	5.70	51.325	5.41	48.675

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 9. Predicted Crash Severity by Ramp Terminal or Roundabout (Section 1)

Seg. No.	Type	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)
2	FRERampTerminal	0.0101	0.0528	0.1746	0.6124	1.0582
3	FRERampTerminal	0.0336	0.1766	0.5842	2.0493	1.3857

Table 10. Predicted Crash Type Distribution (Section 1)

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Highway Segment	Collision with Animal	0.01	0.1	0.15	1.4	0.15	1.3
Highway Segment	Collision with Bicycle	0.00	0.0	0.00	0.0	0.00	0.0
Highway Segment	Other Single-vehicle Collision	0.00	0.0	0.02	0.2	0.03	0.2
Highway Segment	Overturned	0.01	0.1	0.01	0.1	0.03	0.3
Highway Segment	Collision with Pedestrian	0.00	0.0	0.00	0.0	0.00	0.0
Highway Segment	Run Off Road	0.21	1.9	0.42	3.8	0.64	5.7
Highway Segment	Total Single Vehicle Crashes	0.25	2.2	0.61	5.5	0.84	7.6
Highway Segment	Angle Collision	0.04	0.4	0.06	0.5	0.10	0.9
Highway Segment	Head-on Collision	0.01	0.1	0.00	0.0	0.02	0.2
Highway Segment	Other Multiple-vehicle Collision	0.01	0.1	0.03	0.2	0.03	0.3
Highway Segment	Rear-end Collision	0.07	0.6	0.10	0.9	0.17	1.6
Highway Segment	Sideswipe	0.01	0.1	0.03	0.3	0.04	0.4
Highway Segment	Total Multiple Vehicle Crashes	0.14	1.3	0.22	2.0	0.37	3.4
Highway Segment	Total Highway Segment Crashes	0.39	3.5	0.83	7.4	1.22	11.0
Intersection	Collision with Animal	0.01	0.1	0.03	0.3	0.04	0.3
Intersection	Collision with Bicycle	0.00	0.0	0.00	0.0	0.00	0.0
Intersection	Other Single-vehicle Collision	0.01	0.1	0.02	0.2	0.03	0.3
Intersection	Overturned	0.01	0.1	0.01	0.1	0.02	0.2
Intersection	Collision with Pedestrian	0.00	0.0	0.00	0.0	0.00	0.0
Intersection	Run Off Road	0.15	1.4	0.31	2.8	0.46	4.1
Intersection	Total Single Vehicle Crashes	0.18	1.6	0.37	3.3	0.55	5.0
Intersection	Angle Collision	0.86	7.8	0.76	6.8	1.62	14.6
Intersection	Head-on Collision	0.10	0.9	0.05	0.5	0.15	1.4
Intersection	Other Multiple-vehicle Collision	0.07	0.6	0.08	0.7	0.15	1.3
Intersection	Rear-end Collision	0.34	3.1	0.57	5.1	0.91	8.2
Intersection	Sideswipe	0.07	0.6	0.31	2.8	0.38	3.4
Intersection	Total Multiple Vehicle Crashes	1.44	12.9	1.77	15.9	3.21	28.8
Intersection	Total Intersection Crashes	1.62	14.6	2.14	19.2	3.76	33.8
Ramp Terminal	Collision with Animal	0.00	0.0	0.00	0.0	0.00	0.0
Ramp Terminal	Collision with Fixed Object	0.29	2.6	0.39	3.5	0.67	6.1
Ramp Terminal	Collision with Other Object	0.00	0.0	0.01	0.1	0.01	0.1
Ramp Terminal	Other Single-vehicle Collision	0.24	2.2	0.06	0.6	0.30	2.7
Ramp Terminal	Collision with Parked Vehicle	0.03	0.2	0.04	0.3	0.06	0.6
Ramp Terminal	Total Single Vehicle Crashes	0.55	5.0	0.50	4.5	1.05	9.5
Ramp Terminal	Angle Collision	1.93	17.3	0.91	8.2	2.84	25.5
Ramp Terminal	Head-on Collision	0.07	0.7	0.04	0.3	0.11	1.0
Ramp Terminal	Other Multiple-vehicle Collision	0.05	0.4	0.06	0.6	0.11	1.0
Ramp Terminal	Rear-end Collision	1.02	9.1	0.68	6.1	1.69	15.2
Ramp Terminal	Sideswipe, Same Direction Collision	0.07	0.7	0.26	2.4	0.34	3.0
Ramp Terminal	Total Multiple Vehicle Crashes	3.14	28.2	1.95	17.5	5.08	45.8
Ramp Terminal	Total Ramp Terminal Crashes	3.69	33.2	2.44	22.0	6.14	55.2
	Total Crashes	5.71	51.3	5.41	48.7	11.11	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Appendix D

D-2

No-build Conditions

2022 - 2042

Interactive Highway Safety Design Model

Crash Prediction Evaluation Report

Highway 67

No-build 2022

December 11, 2020

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Report Overview

Report Generated: Dec 11, 2020 5:03 PM
Report Template: System: Multi-Page [System] (mlcpm2, Nov 27, 2020 3:23 PM)

Evaluation Date: Fri Dec 11 10:49:27 CST 2020
IHSDM Version: v16.0.0 (Sep 30, 2020)
Crash Prediction Module: v11.0.0 (Sep 30, 2020)

User Name: mhuebbe
Organization Name: EFK Moen, LLC
Phone: 314-394-3133
E-Mail: mhuebbe@efkmoen.com

Project Title: Project 67
Project Comment: Created Wed Dec 09 16:11:58 CST 2020
Project Unit System: U.S. Customary

Highway Title: Highway 67
Highway Comment: Created Wed Dec 09 18:16:33 CST 2020
Highway Version: 1

Evaluation Title: Evaluation 67 No Build 2022
Evaluation Comment: Created Fri Dec 11 10:48:55 CST 2020

Minimum Location: 405+00.000
Maximum Location: 665+43.000
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: HSM Configuration
Crash Distribution: HSM Configuration
Model/CMF: HSM Configuration
First Year of Analysis: 2022
Last Year of Analysis: 2022
Empirical-Bayes Analysis: None
First Year of Observed Crashes:
Last Year of Observed Crashes:

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Section Types

Section 3 Evaluation

Section: Section 3
Evaluation Start Location: 570+00.000
Evaluation End Location: 665+43.000
Area Type: Rural
Functional Class: Arterial
Type of Alignment: Undivided, Two Lane
Model Category: Rural, Two Lane
Calibration Factor: 2U=1.0; 4ST=1.0;

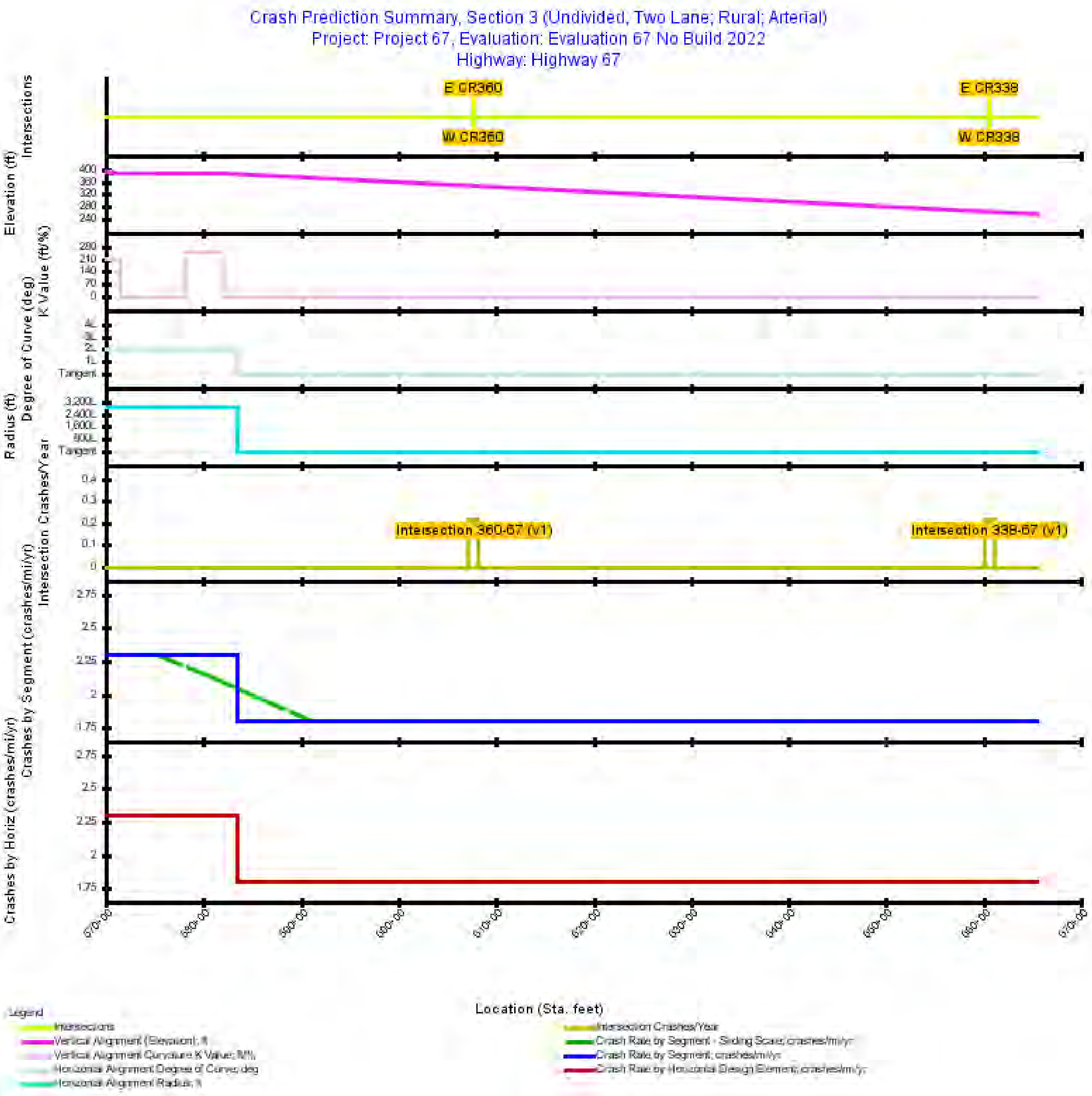

Figure 1. Crash Prediction Summary (Section 3)

Table 1. Evaluation Highway - Homogeneous Segments (Section 3)

Seg. No.	Type	Start Location (Sta. ft)	End Location (Sta. ft)	Length (ft)	Length (mi)	AADT	Left Lane Width (ft)	Right Lane Width (ft)	Left Shoulder Width (ft)	Right Shoulder Width (ft)	Grade (%)	Driveway Density (driveways/ mi)	Hazard Rating	Centerline Rumble Strip	Passing Lanes	TWLT Lane	Lighting	Automated Speed Enforcement	Radius (ft)	Superelevation (%)	Adverse	Design Speed (mph)
11	Rural Two-Lane Segment Two-lane Undivided	570+00.000	580+00.000	1,000.00	0.1894	2022: 5,500	11.00	11.00	9.00	9.00	0.00	15.0	5	true	0	false	false	false	2,864.73	2.0	true	60
12	Rural Two-Lane Segment Two-lane Undivided	580+00.000	583+43.830	343.83	0.0651	2022: 5,500	11.00	11.00	9.00	9.00	-1.57	15.0	5	true	0	false	false	false	2,864.73	2.0	true	60
13	Rural Two-Lane Segment Two-lane Undivided	583+43.830	665+43.000	8,199.17	1.5529	2022: 5,500	11.00	11.00	9.00	9.00	-1.57	15.0	5	true	0	false	false	false				

Table 2. Evaluation Intersection - Section 3

Inter. No.	Title	Type	Location (Sta. ft)	Major AADT	Minor AADT	Legs	Traffic Control	Major road approaches w/Left Turn Lanes	Major road approaches w/Right Turn Lanes	Skew1	Skew2	Lighted at Night
2	Intersection 360-67 (v1)	Rural Two-Lane Intersection Four-Legged w/STOP control	607+70.000	2022: 5,500	2022: 21	4	Stop-Controlled	0	0	0.04	0.04	false
3	Intersection 338-67 (v1)	Rural Two-Lane Intersection Four-Legged w/STOP control	660+60.000	2022: 5,500	2022: 21	4	Stop-Controlled	0	0	0.04	0.04	false

Table 3. Predicted Highway Crash Rates and Frequencies Summary (Section 3)

First Year of Analysis	**2022**
Last Year of Analysis	**2022**
Evaluated Length (mi)	**1.8074**
Average Future Road AADT (vpd)	**5,500**
Predicted Crashes	
Total Crashes	**3.80**
Fatal and Injury Crashes	**1.27**
Property-Damage-Only Crashes	**2.54**
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	**33**
Percent Property-Damage-Only Crashes (%)	**67**
Predicted Crash Rate	
Crash Rate (crashes/mi/yr)	**2.1044**
FI Crash Rate (crashes/mi/yr)	**0.7017**
PDO Crash Rate (crashes/mi/yr)	**1.4027**
Predicted Travel Crash Rate	
Total Travel (million veh-mi)	**3.63**
Travel Crash Rate (crashes/million veh-mi)	**1.05**
Travel FI Crash Rate (crashes/million veh-mi)	**0.35**
Travel PDO Crash Rate (crashes/million veh-mi)	**0.70**

Table 4. Predicted Crash Frequencies and Rates by Highway Segment/Intersection (Section 3)

Segment Number/Intersection Name/Cross Road	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)	Predicted Intersection Travel Crash Rate (crashes/million veh)
11	570+00.000	580+00.000	0.1894	0.435	0.4353	0.1397	0.2956	2.2984	1.15	
12	580+00.000	583+43.830	0.0651	0.150	0.1497	0.0480	0.1016	2.2984	1.15	
13	583+43.830	665+43.000	1.5529	2.788	2.7876	0.8948	1.8928	1.7951	0.89	
Intersection 360-67 (v1)	607+70.000			0.215	0.2154	0.0928	0.1226			0.11
Intersection 338-67 (v1)	660+60.000			0.215	0.2154	0.0928	0.1226			0.11
All Segments			1.8074	3.373	3.3726	1.0826	2.2900	1.8660	0.93	
All Intersections				0.431	0.4309	0.1857	0.2452			0.11
Total			1.8074	3.803	3.8034	1.2683	2.5351	2.1044		

Table 5. Predicted Crash Frequencies and Rates by Horizontal Design Element (Section 3)

Title	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
Simple Curve 1	570+00.000	583+43.830	0.2545	0.585	0.5850	0.1878	0.3972	2.2984	1.15
Tangent	583+43.830	665+43.000	1.5529	2.788	2.7876	0.8948	1.8928	1.7951	0.89

Table 6. Predicted Crash Frequencies by Year (Section 3)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2022	3.80	1.27	33.346	2.54	66.654
Total	3.80	1.27	33.346	2.54	66.654
Average	3.80	1.27	33.346	2.54	66.654

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 7. Predicted Crash Type Distribution (Section 3)

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Highway Segment	Collision with Animal	0.04	1.1	0.42	11.1	0.41	10.7
Highway Segment	Collision with Bicycle	0.00	0.1	0.00	0.1	0.01	0.2
Highway Segment	Other Single-vehicle Collision	0.01	0.2	0.07	1.7	0.07	1.9
Highway Segment	Overturned	0.04	1.1	0.03	0.9	0.08	2.2
Highway Segment	Collision with Pedestrian	0.01	0.2	0.00	0.1	0.01	0.3
Highway Segment	Run Off Road	0.59	15.5	1.16	30.4	1.76	46.2
Highway Segment	Total Single Vehicle Crashes	0.69	18.2	1.68	44.3	2.34	61.5
Highway Segment	Angle Collision	0.11	2.9	0.17	4.3	0.29	7.5
Highway Segment	Head-on Collision	0.04	1.0	0.01	0.2	0.05	1.4
Highway Segment	Other Multiple-vehicle Collision	0.03	0.7	0.07	1.8	0.09	2.4
Highway Segment	Rear-end Collision	0.18	4.7	0.28	7.3	0.48	12.6
Highway Segment	Sideswipe	0.04	1.1	0.09	2.3	0.12	3.3
Highway Segment	Total Multiple Vehicle Crashes	0.39	10.4	0.61	16.0	1.03	27.2
Highway Segment	Total Highway Segment Crashes	1.08	28.5	2.29	60.2	3.37	88.7
Intersection	Collision with Animal	0.00	0.0	0.00	0.1	0.00	0.1
Intersection	Collision with Bicycle	0.00	0.0	0.00	0.0	0.00	0.0
Intersection	Other Single-vehicle Collision	0.00	0.0	0.00	0.1	0.00	0.1
Intersection	Overturned	0.00	0.0	0.00	0.0	0.00	0.1
Intersection	Collision with Pedestrian	0.00	0.0	0.00	0.0	0.00	0.0
Intersection	Run Off Road	0.02	0.5	0.04	0.9	0.05	1.4
Intersection	Total Single Vehicle Crashes	0.02	0.5	0.04	1.1	0.06	1.7
Intersection	Angle Collision	0.10	2.6	0.09	2.3	0.19	4.9
Intersection	Head-on Collision	0.01	0.3	0.01	0.2	0.02	0.5
Intersection	Other Multiple-vehicle Collision	0.01	0.2	0.01	0.2	0.02	0.4
Intersection	Rear-end Collision	0.04	1.0	0.07	1.7	0.10	2.7
Intersection	Sideswipe	0.01	0.2	0.04	0.9	0.04	1.1
Intersection	Total Multiple Vehicle Crashes	0.17	4.3	0.20	5.3	0.37	9.7
Intersection	Total Intersection Crashes	0.19	4.9	0.24	6.4	0.43	11.3
	Total Crashes	1.27	33.4	2.54	66.7	3.80	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Section 1 Evaluation

Section: Section 1
Evaluation Start Location: 405+00.000
Evaluation End Location: 425+00.000
Area Type: Rural

Functional Class: Arterial
Type of Alignment: Divided, Multilane
Model Category: Rural, Multilane
Calibration Factor: 4D=1.0; 4ST=1.0;

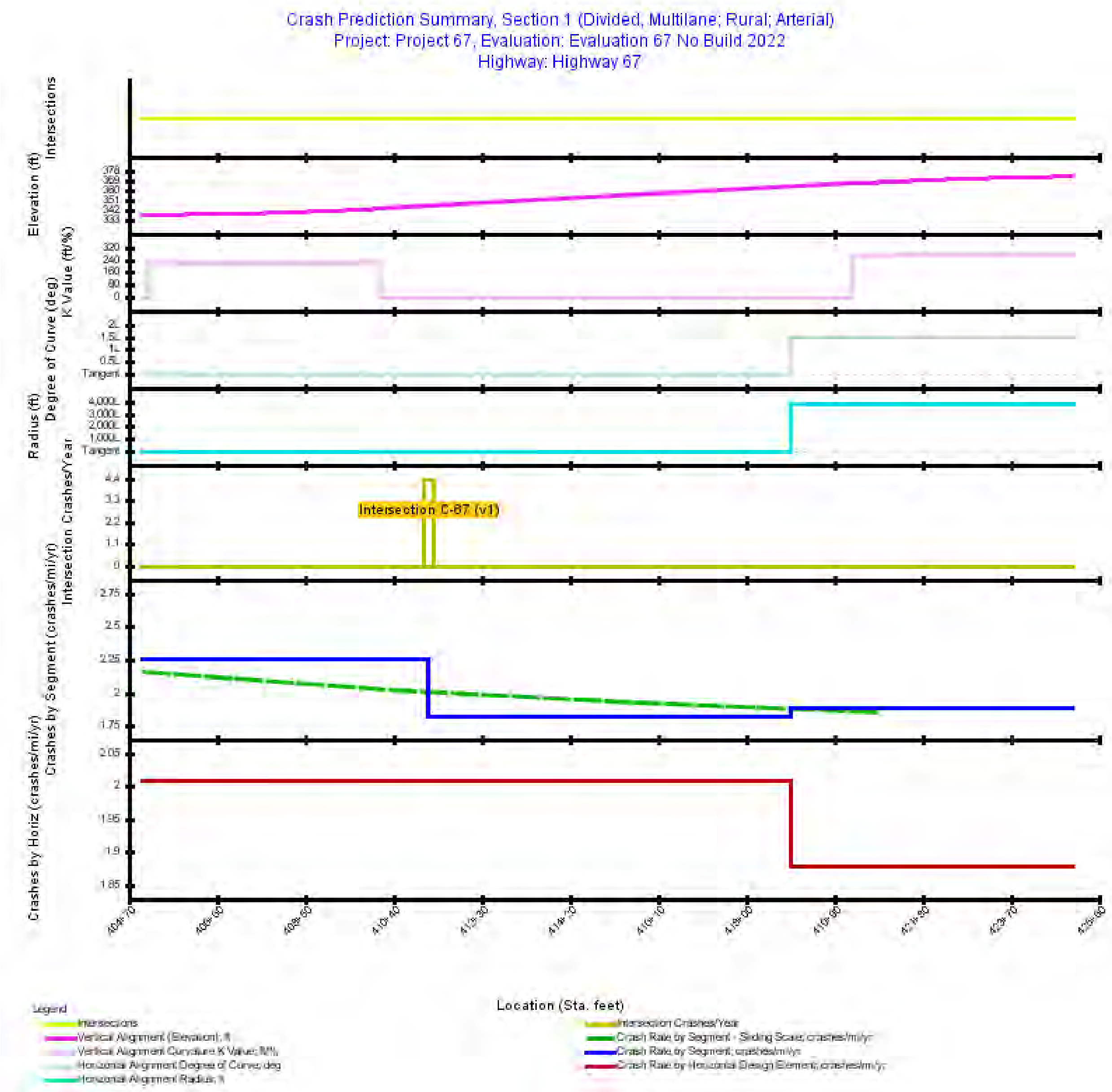

Figure 2. Crash Prediction Summary (Section 1)

Table 8. Evaluation Highway - Homogeneous Segments (Section 1)

Seg. No.	Type	Start Location (Sta. ft)	End Location (Sta. ft)	Length (ft)	Length (mi)	AADT	Left Lane Width (ft)	Right Lane Width (ft)	Left Shoulder Width (ft)	Right Shoulder Width (ft)	Median Width (ft)	Median Type	Effective Median Width (ft)	Lighting	Automated Speed Enforcement	Left Side Slope	Right Side Slope
1	Rural Multi-Lane Segment Four-lane Divided	405+00.000	411+15.000	615.00	0.1165	2022: 12,300	12.00	12.00	8.00	8.00	52.00	Traversable Median	60.00	false	false		
2	Rural Multi-Lane Segment Four-lane Divided	411+15.000	418+00.000	685.00	0.1297	2022: 10,000	12.00	12.00	8.00	8.00	52.00	Traversable Median	60.00	false	false		
3	Rural Multi-Lane Segment Four-lane Divided	418+00.000	418+95.990	95.99	0.0182	2022: 10,000	12.00	12.00	8.00	8.00	49.15	Traversable Median	57.15	false	false		
4	Rural Multi-Lane Segment Four-lane Divided	418+95.990	425+00.000	604.01	0.1144	2022: 10,000	12.00	12.00	8.00	8.00	28.40	Traversable Median	36.40	false	false		

Table 9. Evaluation Intersection (Section 1)

Inter. No.	Title	Type	Location (Sta. ft)	Major AADT	Minor AADT	Legs	Traffic Control	Major road approaches w/Left Turn Lanes	Major road approaches w/Right Turn Lanes	Skew1	Skew2	Lighted at Night
1	Intersection C-67 (v1)	Rural Multi-Lane Intersection Four-Legged w/STOP control	411+14.900	2022: 12,300	2022: 1,600	4	Stop-Controlled	0	0	20.00	0.01	false

Table 10. Predicted Highway Crash Rates and Frequencies Summary (Section 1)

First Year of Analysis	2022
Last Year of Analysis	2022
Evaluated Length (mi)	0.3788
Average Future Road AADT (vpd)	10,707
Predicted Crashes	
Total Crashes	5.12
Fatal and Injury Crashes	2.93
Fatal and Serious Injury Crashes	1.67
Property-Damage-Only Crashes	2.19
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	57
Percent Fatal and Serious Injury Crashes (%)	33
Percent Property-Damage-Only Crashes (%)	43
Predicted Crash Rate	
Crash Rate (crashes/mi/yr)	13.5236
FI Crash Rate (crashes/mi/yr)	7.7358
FI no/C Crash Rate (crashes/mi/yr)	4.4169
PDO Crash Rate (crashes/mi/yr)	5.7878
Predicted Travel Crash Rate	
Total Travel (million veh-mi)	1.48
Travel Crash Rate (crashes/million veh-mi)	3.46
Travel FI Crash Rate (crashes/million veh-mi)	1.98
Travel FI no/C Crash Rate (crashes/million veh-mi)	1.13
Travel PDO Crash Rate (crashes/million veh-mi)	1.48

Table 11. Predicted Crash Frequencies and Rates by Highway Segment/Intersection (Section 1)

Segment Number/Intersection Name/Cross Road	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted FI no/C Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/milli on veh-mi)	Predicted Intersection Travel Crash Rate (crashes/million veh)
1	405+00.000	411+15.000	0.1165	0.263	0.2626	0.1345	0.0850	0.1281	2.2546	0.50	
Intersection C-67 (v1)	411+14.900			4.377	4.3766	2.5434	1.4259	1.8332			0.94
2	411+15.000	418+00.000	0.1297	0.235	0.2354	0.1229	0.0790	0.1125	1.8145	0.50	
3	418+00.000	418+95.990	0.0182	0.033	0.0331	0.0173	0.0111	0.0158	1.8199	0.50	
4	418+95.990	425+00.000	0.1144	0.215	0.2148	0.1121	0.0721	0.1027	1.8780	0.52	
All Segments			0.3788	0.746	0.7459	0.3868	0.2472	0.3591	1.9693	0.50	
All Intersections				4.377	4.3766	2.5434	1.4259	1.8332			0.94
Total			0.3788	5.123	5.1226	2.9302	1.6731	2.1924	13.5236		

Table 12. Predicted Crash Frequencies and Rates by Horizontal Design Element (Section 1)

Title	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted FI no/C Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
Tangent	405+00.000	418+95.990	0.2644	0.531	0.5311	0.2747	0.1751	0.2564	2.0088	0.50
Simple Curve 1	418+95.990	425+00.000	0.1144	0.215	0.2148	0.1121	0.0721	0.1027	1.8780	0.52

Table 13. Predicted Crash Frequencies by Year (Section 1)

Year	Total Crashes	FI Crashes	Percent FI (%)	FI/no C Crashes	Percent FI/no C (%)	PDO Crashes	Percent PDO (%)
2022	5.12	2.93	57.202	1.67	32.661	2.19	42.798
Total	5.12	2.93	57.202	1.67	32.661	2.19	42.798
Average	5.12	2.93	57.202	1.67	32.661	2.19	42.798

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 14. Predicted Crash Type Distribution (Section 1)

Element Type	Crash Type	Fatal and Injury		Fatal and Serious Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Highway Segment	Single	0.28	5.5	0.19	3.8	0.28	5.6	0.57	11.2
Highway Segment	Total Single Vehicle Crashes	0.28	5.5	0.19	3.8	0.28	5.6	0.57	11.2
Highway Segment	Angle Collision	0.02	0.4	0.01	0.2	0.01	0.3	0.03	0.6
Highway Segment	Head-on Collision	0.01	0.1	0.00	0.1	0.00	0.0	0.00	0.1
Highway Segment	Rear-end Collision	0.06	1.2	0.03	0.6	0.03	0.6	0.09	1.7
Highway Segment	Sideswipe	0.01	0.2	0.01	0.1	0.02	0.4	0.03	0.6
Highway Segment	Total Multiple Vehicle Crashes	0.10	1.9	0.05	1.0	0.07	1.3	0.15	3.0
Highway Segment	Total Highway Segment Crashes	0.39	7.6	0.25	4.8	0.36	7.0	0.75	14.6
Highway Segment	Other Collision	0.01	0.2	0.01	0.1	0.01	0.2	0.02	0.3
Intersection	Single	0.38	7.4	0.28	5.5	0.45	8.7	0.88	17.3
Intersection	Total Single Vehicle Crashes	0.38	7.4	0.28	5.5	0.45	8.7	0.88	17.3
Intersection	Angle Collision	1.36	26.5	0.81	15.9	0.54	10.5	1.73	33.8
Intersection	Head-on Collision	0.05	0.9	0.03	0.6	0.03	0.5	0.07	1.4
Intersection	Rear-end Collision	0.54	10.6	0.15	3.0	0.44	8.6	1.00	19.5
Intersection	Sideswipe	0.11	2.1	0.06	1.1	0.29	5.6	0.47	9.2
Intersection	Total Multiple Vehicle Crashes	2.05	40.1	1.06	20.7	1.29	25.2	3.27	63.8
Intersection	Total Intersection Crashes	2.55	49.7	1.43	27.9	1.83	35.9	4.37	85.4
Intersection	Other Collision	0.12	2.3	0.08	1.6	0.10	2.0	0.22	4.4
	Total Crashes	2.93	57.3	1.67	32.7	2.19	42.9	5.12	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Section 2 Evaluation

Section: Section 2
Evaluation Start Location: 425+00.000
Evaluation End Location: 570+00.000
Functional Class: Freeway
Type of Alignment: Divided, Multilane
Model Category: Freeway Segment
Calibration Factor: FI_EN=1.0; FI_MV=1.0; FI_SV=1.0; PDO_EN=1.0; PDO_MV=1.0; PDO_SV=1.0;

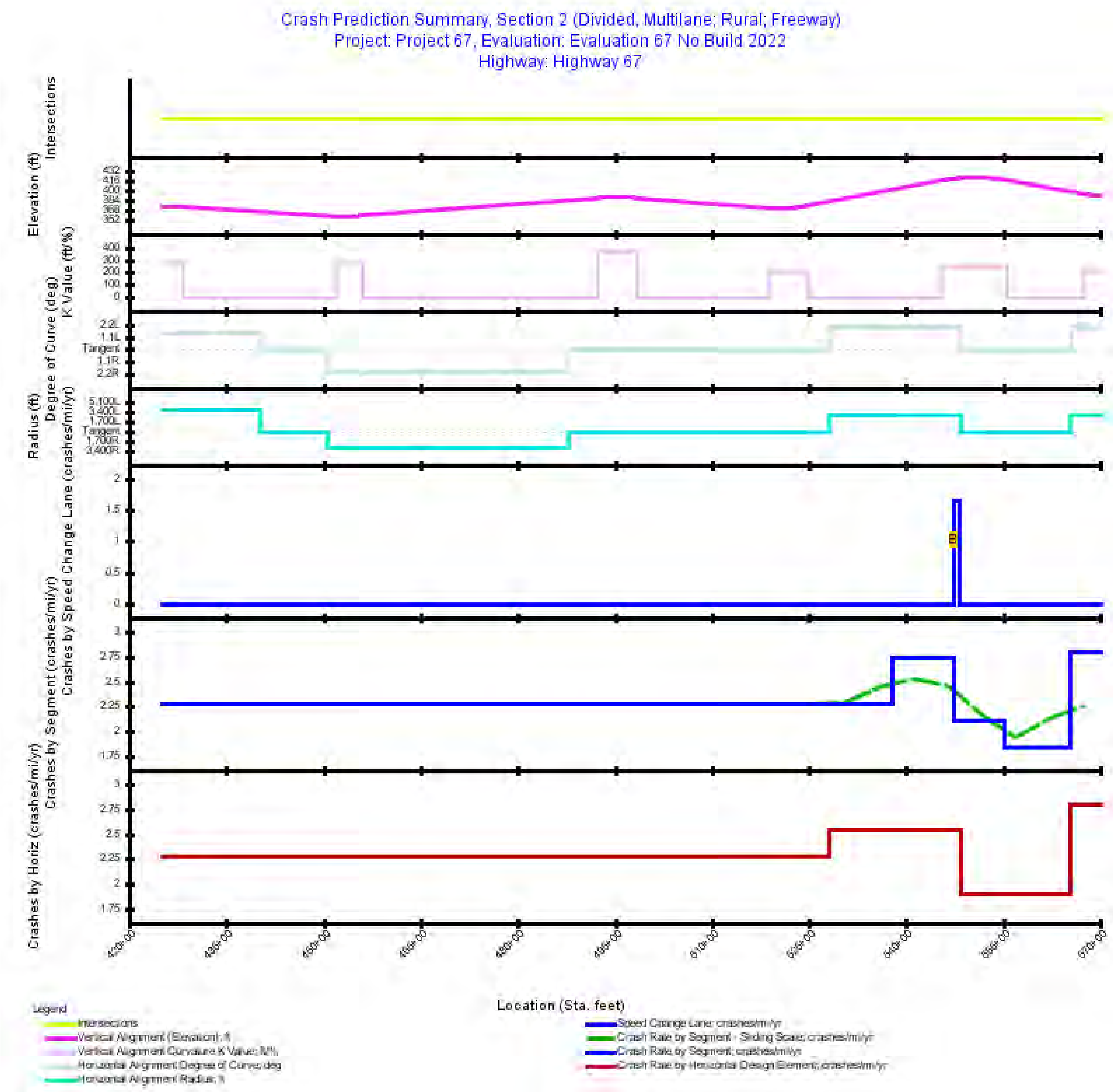

Figure 3. Crash Prediction Summary (Section 2)

Table 15. Evaluation Freeway - Homogeneous Segments (Section 2)

Seg. No.	Type	Area Type	Start Location (Sta. ft)	End Location (Sta. ft)	Length (ft)	Length (mi)	AADT	Median Width (ft)	Type	Effective Median Width (ft)
5	Four-lane Freeway	Rural	425+00.000	537+84.000	11,284.00	2.1371	2022: 10,000	10.50	Traversable Median	18.50
6	Four-lane Freeway	Rural	537+84.000	547+32.000	948.00	0.1795	2022: 10,000	10.50	Traversable Median	18.50
7	Four-lane Freeway	Rural	547+32.000	555+11.680	779.68	0.1477	2022: 10,000	10.50	Traversable Median	18.50
9	Four-lane Freeway	Rural	555+11.680	565+40.830	1,029.15	0.1949	2022: 10,000	10.50	Traversable Median	18.50
10	Four-lane Freeway	Rural	565+40.830	570+00.000	459.17	0.0870	2022: 10,000	10.50	Traversable Median	18.50

Table 16. Evaluation Freeway - Speed Change Lanes (Speed Change)

Seg. No.	Type	Ramp Type	Start Location (Sta. ft)	End Location (Sta. ft)	Length (ft)	Length (mi)	AADT	Median Width (ft)	Type	Effective Median Width (ft)
8	Four-lane Freeway Speed Change	Entrance	547+32.000	548+23.000	91.00	0.0172	2022: 10,000	10.50	Traversable Median	18.50

Table 17. Predicted Freeway Crash Rates and Frequencies Summary (Section 2)

First Year of Analysis	**2022**
Last Year of Analysis	**2022**
Effective Length (mi)	**2.7376**
Average Future Road AADT (vpd)	**10,000**
Predicted Crashes	
Total Crashes	**6.25**
Fatal and Injury Crashes	**2.23**
Property-Damage-Only Crashes	**4.02**
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	**36**
Percent Property-Damage-Only Crashes (%)	**64**
Predicted Crash Rate	
Crash Rate (crashes/mi/yr)	**2.2838**
FI Crash Rate (crashes/mi/yr)	**0.8143**
PDO Crash Rate (crashes/mi/yr)	**1.4695**
Predicted Travel Crash Rate	
Total Travel (million veh-mi)	**9.99**
Travel Crash Rate (crashes/million veh-mi)	**0.63**
Travel FI Crash Rate (crashes/million veh-mi)	**0.22**
Travel PDO Crash Rate (crashes/million veh-mi)	**0.40**

Note: *Effective Length* is the *segment length* minus the length of the *speed change lanes* if present.

Table 18. Predicted Freeway Speed Change Lane Crash Rates and Frequencies Summary (Speed Change)

First Year of Analysis	**2022**
Last Year of Analysis	**2022**
Length (mi)	**0.0172**
Average Future Road AADT (vpd)	**5,000**
Predicted Crashes	
Total Crashes	**0.03**
Fatal and Injury Crashes	**0.01**
Property-Damage-Only Crashes	**0.02**
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	**32**
Percent Property-Damage-Only Crashes (%)	**68**
Predicted Crash Rate	
Crash Rate (crashes/mi/yr)	**1.6415**
FI Crash Rate (crashes/mi/yr)	**0.5183**
PDO Crash Rate (crashes/mi/yr)	**1.1232**
Predicted Travel Crash Rate	
Total Travel (million veh-mi)	**0.03**
Travel Crash Rate (crashes/million veh-mi)	**0.90**
Travel FI Crash Rate (crashes/million veh-mi)	**0.28**
Travel PDO Crash Rate (crashes/million veh-mi)	**0.61**

Note: *Total Travel and Crash Rates/Million Vehicle Miles* for *Speed Change Lanes* reflect AADTs that are **half of the Freeway Segment AADTs** based on the assumption of 50/50 directional distribution.

Table 19. Predicted Crash Frequencies and Rates by Freeway Segment/Intersection (Section 2)

Segment Number/Intersection Name/Cross Road	Start Location (Sta. ft)	End Location (Sta. ft)	Effective Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
5	425+00.000	537+84.000	2.1371	4.867	4.8668	1.7320	3.1349	2.2773	0.62
6	537+84.000	547+32.000	0.1795	0.492	0.4916	0.1792	0.3123	2.7377	0.75
7	547+32.000	555+11.680	0.1390	0.292	0.2923	0.1050	0.1873	2.1024	0.58
9	555+11.680	565+40.830	0.1949	0.359	0.3588	0.1240	0.2347	1.8406	0.50
10	565+40.830	570+00.000	0.0870	0.243	0.2427	0.0889	0.1538	2.7903	0.76
Total			2.7376	6.252	6.2521	2.2291	4.0230	2.2838	0.63

Note: *Effective Length* is the *segment length* minus the length of the *speed change lanes* if present. This may create Freeway segments with zero effective length and zero crashes.

Table 20. Predicted Crash Frequencies and Rates by Freeway Speed Change Lane (Speed Change)

Segment Number/Intersection Name/Cross Road	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
8	547+32.000	548+23.000	0.0172	0.028	0.0283	0.0089	0.0194	1.6415	0.90
Total			0.0172	0.028	0.0283	0.0089	0.0194	1.6415	0.90

Note: *Travel Crash Rates/Million Vehicle Miles* for *Speed Change Lanes* reflect AADTs that are **half of the Freeway Segment AADTs** based on the assumption of 50/50 directional distribution.

Table 21. Predicted Crash Frequencies and Rates by Horizontal Design Element (Section 2)

Title	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi /yr)	Predicted Travel Crash Rate (crashes/mi llion veh-mi)
Simple Curve 1	425+00.000	440+15.580	0.2870	0.654	0.6537	0.2326	0.4211	2.2773	0.62
Tangent	440+15.580	450+69.500	0.1996	0.455	0.4546	0.1618	0.2928	2.2773	0.62
Simple Curve 2	450+69.500	487+95.230	0.7056	1.607	1.6069	0.5719	1.0351	2.2773	0.62
Tangent	487+95.230	528+21.950	0.7626	1.737	1.7367	0.6181	1.1187	2.2773	0.62
Simple Curve 3	528+21.950	548+47.520	0.3836	0.978	0.9781	0.3514	0.6267	2.5496	0.72
Tangent	548+47.520	565+40.830	0.3207	0.608	0.6078	0.2135	0.3943	1.8952	0.53
Simple Curve 4	565+40.830	570+00.000	0.0870	0.243	0.2427	0.0889	0.1538	2.7903	0.76

Table 22. Predicted Crash Frequencies by Year (Section 2)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2022	6.28	2.24	35.636	4.04	64.364
Total	6.28	2.24	35.636	4.04	64.364
Average	6.28	2.24	35.636	4.04	64.364

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 23. Predicted Crash Severity by Freeway Segment (Section 2)

Seg. No.	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)
5	0.0672	0.1658	0.6772	0.8218	3.1349
6	0.0074	0.0184	0.0716	0.0819	0.3123
7	0.0036	0.0088	0.0388	0.0539	0.1873
9	0.0045	0.0109	0.0472	0.0615	0.2347
10	0.0036	0.0091	0.0355	0.0406	0.1538
Total	0.0863	0.2130	0.8702	1.0597	4.0230

Table 24. Predicted Crash Severity by Speed Change Lane (Speed Change)

Seg. No.	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)
8	0.0004	0.0009	0.0035	0.0042	0.0194

Table 25. Predicted Freeway Crash Type Distribution (Section 2)

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Highway Segment	Collision with Animal	0.02	0.3	0.24	3.8	0.26	4.1
Highway Segment	Collision with Fixed Object	1.09	17.4	2.29	36.6	3.38	54.1
Highway Segment	Collision with Other Object	0.06	1.0	0.46	7.3	0.52	8.3
Highway Segment	Other Single-vehicle Collision	0.71	11.3	0.59	9.5	1.30	20.8
Highway Segment	Collision with Parked Vehicle	0.05	0.7	0.08	1.3	0.13	2.1
Highway Segment	Total Single Vehicle Crashes	1.92	30.8	3.66	58.6	5.59	89.4
Highway Segment	Right-Angle Collision	0.02	0.3	0.01	0.2	0.03	0.4
Highway Segment	Head-on Collision	0.01	0.1	0.00	0.0	0.01	0.1
Highway Segment	Other Multi-vehicle Collision	0.02	0.3	0.03	0.5	0.05	0.7
Highway Segment	Rear-end Collision	0.19	3.1	0.18	2.9	0.38	6.0
Highway Segment	Sideswipe, Same Direction Collision	0.07	1.2	0.14	2.2	0.21	3.3
Highway Segment	Total Multiple Vehicle Crashes	0.30	4.9	0.36	5.8	0.67	10.6
Highway Segment	Total Highway Segment Crashes	2.23	35.7	4.02	64.3	6.25	100.0
	Total Crashes	2.23	35.7	4.02	64.3	6.25	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 26. Predicted Entrance Speed Change Lane Crash Type Distribution (Speed Change)

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Highway Segment	Collision with Animal	0.00	0.0	0.00	0.6	0.00	0.6
Highway Segment	Collision with Fixed Object	0.00	7.7	0.01	20.3	0.01	28.0
Highway Segment	Collision with Other Object	0.00	0.7	0.00	4.8	0.00	5.5
Highway Segment	Other Single-vehicle Collision	0.00	5.4	0.00	4.5	0.00	9.9
Highway Segment	Collision with Parked Vehicle	0.00	0.7	0.00	0.0	0.00	0.7
Highway Segment	Total Single Vehicle Crashes	0.00	14.4	0.01	30.2	0.01	44.6
Highway Segment	Right-Angle Collision	0.00	1.0	0.00	0.9	0.00	1.9
Highway Segment	Head-on Collision	0.00	0.7	0.00	0.3	0.00	0.9
Highway Segment	Other Multi-vehicle Collision	0.00	0.3	0.00	2.7	0.00	3.1
Highway Segment	Rear-end Collision	0.00	11.1	0.01	17.8	0.01	28.9
Highway Segment	Sideswipe, Same Direction Collision	0.00	4.0	0.01	16.6	0.01	20.6
Highway Segment	Total Multiple Vehicle Crashes	0.01	17.1	0.01	38.2	0.02	55.4
Highway Segment	Total Highway Segment Crashes	0.01	31.6	0.02	68.4	0.03	100.0
	Total Crashes	0.01	31.6	0.02	68.4	0.03	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 27. Evaluation Message

Start Location (Sta. ft)	End Location (Sta. ft)	Message
547+32.000	548+23.000	for segment #8 (547+32.000 to 548+23.000), distance to taper (91.00 feet) is less than specified entrance ramp boundaries 211.20 feet; adjusted in CMF calculations.

Interactive Highway Safety Design Model

Crash Prediction Evaluation Report

Highway 67

No-build 2042

December 11, 2020

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Report Overview

Report Generated: Dec 11, 2020 5:05 PM
Report Template: System: Multi-Page [System] (mlcpm2, Nov 27, 2020 3:23 PM)

Evaluation Date: Fri Dec 11 10:51:11 CST 2020
IHSDM Version: v16.0.0 (Sep 30, 2020)
Crash Prediction Module: v11.0.0 (Sep 30, 2020)

User Name: mhuebbe
Organization Name: EFK Moen, LLC
Phone: 314-394-3133
E-Mail: mhuebbe@efkmoen.com

Project Title: Project 67
Project Comment: Created Wed Dec 09 16:11:58 CST 2020
Project Unit System: U.S. Customary

Highway Title: Highway 67
Highway Comment: Created Wed Dec 09 18:16:33 CST 2020
Highway Version: 1

Evaluation Title: Evaluation No Build 2042
Evaluation Comment: Created Fri Dec 11 10:50:44 CST 2020

Minimum Location: 405+00.000
Maximum Location: 665+43.000
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: HSM Configuration
Crash Distribution: HSM Configuration
Model/CMF: HSM Configuration
First Year of Analysis: 2042
Last Year of Analysis: 2042
Empirical-Bayes Analysis: None
First Year of Observed Crashes:
Last Year of Observed Crashes:

Disclaimer Regarding Crash Prediction Method

IMPORTANT NOTICE ABOUT COMPARING RESULTS FROM HIGHWAY SAFETY MANUAL FIRST EDITION (2010) MODELS TO RESULTS FROM NEW MODELS DEVELOPED UNDER NCHRP PROJECTS 17-70 AND 17-58

Since the publication of the Highway Safety Manual - First Edition (HSM-1), in 2010 by the American Association of State Highway and Transportation Officials (AASHTO), multiple research efforts have been undertaken through the National Cooperative Highway Research Program (NCHRP) to develop safety performance models for road segment and intersection facility types that were not initially reflected in the HSM-1, in order to expand the breadth and depth of the HSM in the future.

The IHSDM Crash Prediction Module (CPM) is intended as a faithful implementation of HSM Part C predictive methods. As NCHRP projects to develop new predictive methods for the HSM are completed, FHWA works to incorporate the new methods into IHSDM, sometimes in advance of publication in the HSM. The following new crash predictive methods have been accepted by NCHRP project panels and incorporated into IHSDM, while pending AASHTO's approval for incorporation into a future edition of the HSM:

- Roundabouts: completed in 2018 under NCHRP Project 17-70, the new methods will provide improved outcomes for the safety analysis of roundabouts.
- 6+ lane and one-way urban/suburban arterials (including models for segments and intersections): completed under NCHRP Project 17-58.

However, in the absence of local calibration factors (see HSM-1 Part C, Appendix A for guidance on calibration of the predictive models), it is neither appropriate nor advisable to directly compare the results from new models (from NCHRP Projects 17-58 and 17-70) to results from HSM-1 models, as the models were not calibrated to the same base state data sets, and consequently can produce unexpected results. If local calibration factors are available and applied to both new models and HSM-1 models, then it may be appropriate to directly compare the results.*[Note: Work being performed under NCHRP Project 17-72 (Update of Crash Modification Factors for the Highway Safety Manual) is expected to re-calibrate many of the old (HSM-1) and new (e.g., NCHRP 17-70) models to data from a single (or small number of) states, that would allow results from all models to be directly compared.]*

The models produced for NCHRP Project 17-70 have independent value in terms of informing the design of a roundabout and assessing the effects of different design characteristics on the expected safety performance of a roundabout.

The HSM-1 interim method previously included in IHSDM for evaluating roundabouts on urban/suburban arterials (i.e., evaluating an existing intersection and then applying a Crash Modification Factor for replacing the existing intersection with a roundabout) has been deactivated in IHSDM, to minimize any confusion with the new roundabout methodology.

Section Types

Section 3 Evaluation

Section: Section 3
Evaluation Start Location: 570+00.000
Evaluation End Location: 665+43.000
Area Type: Rural
Functional Class: Arterial
Type of Alignment: Undivided, Two Lane
Model Category: Rural, Two Lane
Calibration Factor: 2U=1.0; 4ST=1.0;

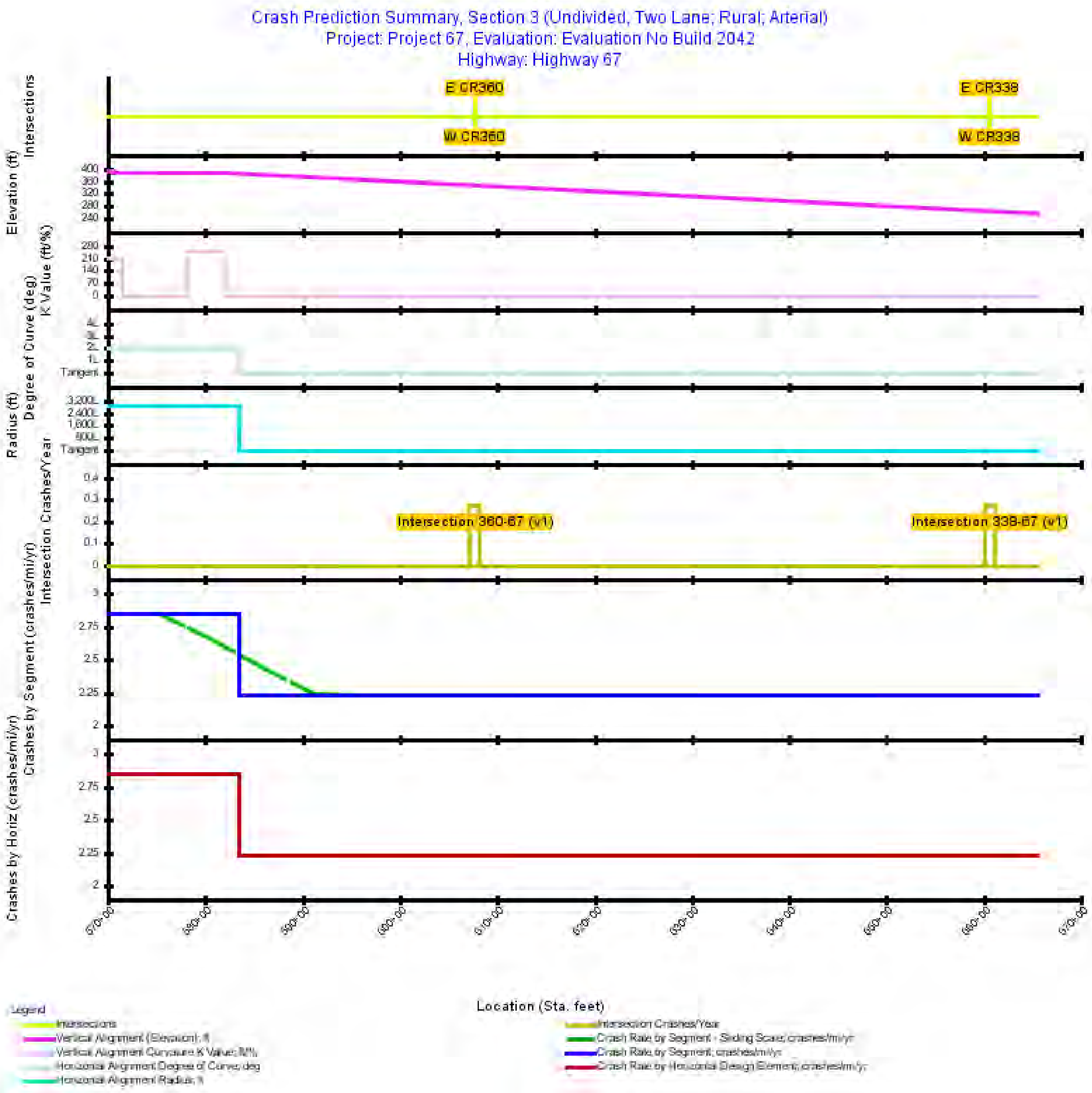

Figure 1. Crash Prediction Summary (Section 3)

Table 1. Evaluation Highway - Homogeneous Segments (Section 3)

Seg. No.	Type	Start Location (Sta. ft)	End Location (Sta. ft)	Length (ft)	Length (mi)	AADT	Left Lane Width (ft)	Right Lane Width (ft)	Left Shoulder Width (ft)	Right Shoulder Width (ft)	Grade (%)	Driveway Density (driveways/mi)	Hazard Rating	Centerline Rumble Strip	Passing Lanes	TWLT Lane	Lighting	Automated Speed Enforcement	Radius (ft)	Superelevation (%)	Adverse	Design Speed (mph)
11	Rural Two-Lane Segment Two-lane Undivided	570+00.000	580+00.000	1,000.00	0.1894	2042: 7,000	11.00	11.00	9.00	9.00	0.00	15.0	5	true	0	false	false	false	2,864.73	2.0	true	60
12	Rural Two-Lane Segment Two-lane Undivided	580+00.000	583+43.830	343.83	0.0651	2042: 7,000	11.00	11.00	9.00	9.00	-1.57	15.0	5	true	0	false	false	false	2,864.73	2.0	true	60
13	Rural Two-Lane Segment Two-lane Undivided	583+43.830	665+43.000	8,199.17	1.5529	2042: 7,000	11.00	11.00	9.00	9.00	-1.57	15.0	5	true	0	false	false	false				

Table 2. Evaluation Intersection - Section 3

Inter. No.	Title	Type	Location (Sta. ft)	Major AADT	Minor AADT	Legs	Traffic Control	Major road approaches w/Left Turn Lanes	Major road approaches w/Right Turn Lanes	Skew1	Skew2	Lighted at Night
2	Intersection 360-67 (v1)	Rural Two-Lane Intersection Four-Legged w/STOP control	607+70.000	2042: 7,000	2042: 25	4	Stop-Controlled	0	0	0.04	0.04	false
3	Intersection 338-67 (v1)	Rural Two-Lane Intersection Four-Legged w/STOP control	660+60.000	2042: 7,000	2042: 25	4	Stop-Controlled	0	0	0.04	0.04	false

Table 3. Predicted Highway Crash Rates and Frequencies Summary (Section 3)

First Year of Analysis	**2042**
Last Year of Analysis	**2042**
Evaluated Length (mi)	**1.8074**
Average Future Road AADT (vpd)	**7,000**
Predicted Crashes	
Total Crashes	**4.74**
Fatal and Injury Crashes	**1.58**
Property-Damage-Only Crashes	**3.15**
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	**33**
Percent Property-Damage-Only Crashes (%)	**67**
Predicted Crash Rate	
Crash Rate (crashes/mi/yr)	**2.6196**
FI Crash Rate (crashes/mi/yr)	**0.8746**
PDO Crash Rate (crashes/mi/yr)	**1.7450**
Predicted Travel Crash Rate	
Total Travel (million veh-mi)	**4.62**
Travel Crash Rate (crashes/million veh-mi)	**1.02**
Travel FI Crash Rate (crashes/million veh-mi)	**0.34**
Travel PDO Crash Rate (crashes/million veh-mi)	**0.68**

Table 4. Predicted Crash Frequencies and Rates by Highway Segment/Intersection (Section 3)

Segment Number/Intersection Name/Cross Road	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)	Predicted Intersection Travel Crash Rate (crashes/million veh)
11	570+00.000	580+00.000	0.1894	0.540	0.5396	0.1732	0.3664	2.8492	1.11	
12	580+00.000	583+43.830	0.0651	0.185	0.1855	0.0596	0.1260	2.8492	1.11	
13	583+43.830	665+43.000	1.5529	3.456	3.4557	1.1093	2.3464	2.2254	0.87	
Intersection 360-67 (v1)	607+70.000			0.277	0.2769	0.1193	0.1576			0.11
Intersection 338-67 (v1)	660+60.000			0.277	0.2769	0.1193	0.1576			0.11
All Segments			1.8074	4.181	4.1808	1.3420	2.8388	2.3132	0.91	
All Intersections				0.554	0.5538	0.2387	0.3151			0.11
Total			1.8074	4.735	4.7347	1.5807	3.1539	2.6196		

Table 5. Predicted Crash Frequencies and Rates by Horizontal Design Element (Section 3)

Title	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
Simple Curve 1	570+00.000	583+43.830	0.2545	0.725	0.7251	0.2328	0.4924	2.8492	1.11
Tangent	583+43.830	665+43.000	1.5529	3.456	3.4557	1.1093	2.3464	2.2254	0.87

Table 6. Predicted Crash Frequencies by Year (Section 3)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2042	4.74	1.58	33.387	3.15	66.613
Total	4.74	1.58	33.387	3.15	66.613
Average	4.74	1.58	33.387	3.15	66.613

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 7. Predicted Crash Type Distribution (Section 3)

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Highway Segment	Collision with Animal	0.05	1.1	0.52	11.0	0.51	10.7
Highway Segment	Collision with Bicycle	0.01	0.1	0.00	0.1	0.01	0.2
Highway Segment	Other Single-vehicle Collision	0.01	0.2	0.08	1.7	0.09	1.9
Highway Segment	Overturned	0.05	1.0	0.04	0.9	0.10	2.2
Highway Segment	Collision with Pedestrian	0.01	0.2	0.00	0.1	0.01	0.3
Highway Segment	Run Off Road	0.73	15.4	1.43	30.3	2.18	46.0
Highway Segment	Total Single Vehicle Crashes	0.86	18.1	2.09	44.1	2.90	61.2
Highway Segment	Angle Collision	0.14	2.9	0.20	4.3	0.35	7.5
Highway Segment	Head-on Collision	0.05	1.0	0.01	0.2	0.07	1.4
Highway Segment	Other Multiple-vehicle Collision	0.04	0.7	0.09	1.8	0.11	2.4
Highway Segment	Rear-end Collision	0.22	4.7	0.35	7.3	0.59	12.5
Highway Segment	Sideswipe	0.05	1.1	0.11	2.3	0.15	3.3
Highway Segment	Total Multiple Vehicle Crashes	0.49	10.3	0.75	15.9	1.28	27.1
Highway Segment	Total Highway Segment Crashes	1.34	28.4	2.84	60.0	4.18	88.3
Intersection	Collision with Animal	0.00	0.0	0.00	0.1	0.01	0.1
Intersection	Collision with Bicycle	0.00	0.0	0.00	0.0	0.00	0.0
Intersection	Other Single-vehicle Collision	0.00	0.0	0.00	0.1	0.00	0.1
Intersection	Overturned	0.00	0.0	0.00	0.0	0.00	0.1
Intersection	Collision with Pedestrian	0.00	0.0	0.00	0.0	0.00	0.0
Intersection	Run Off Road	0.02	0.5	0.04	1.0	0.07	1.4
Intersection	Total Single Vehicle Crashes	0.03	0.6	0.06	1.2	0.08	1.7
Intersection	Angle Collision	0.13	2.7	0.11	2.4	0.24	5.0
Intersection	Head-on Collision	0.01	0.3	0.01	0.2	0.02	0.5
Intersection	Other Multiple-vehicle Collision	0.01	0.2	0.01	0.2	0.02	0.5
Intersection	Rear-end Collision	0.05	1.1	0.08	1.8	0.13	2.8
Intersection	Sideswipe	0.01	0.2	0.04	1.0	0.06	1.2
Intersection	Total Multiple Vehicle Crashes	0.21	4.5	0.26	5.5	0.47	10.0
Intersection	Total Intersection Crashes	0.24	5.0	0.32	6.7	0.55	11.7
	Total Crashes	1.58	33.4	3.15	66.6	4.74	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Section 1 Evaluation

Section: Section 1
Evaluation Start Location: 405+00.000
Evaluation End Location: 425+00.000
Area Type: Rural

Functional Class: Arterial
Type of Alignment: Divided, Multilane
Model Category: Rural, Multilane
Calibration Factor: 4D=1.0; 4ST=1.0;

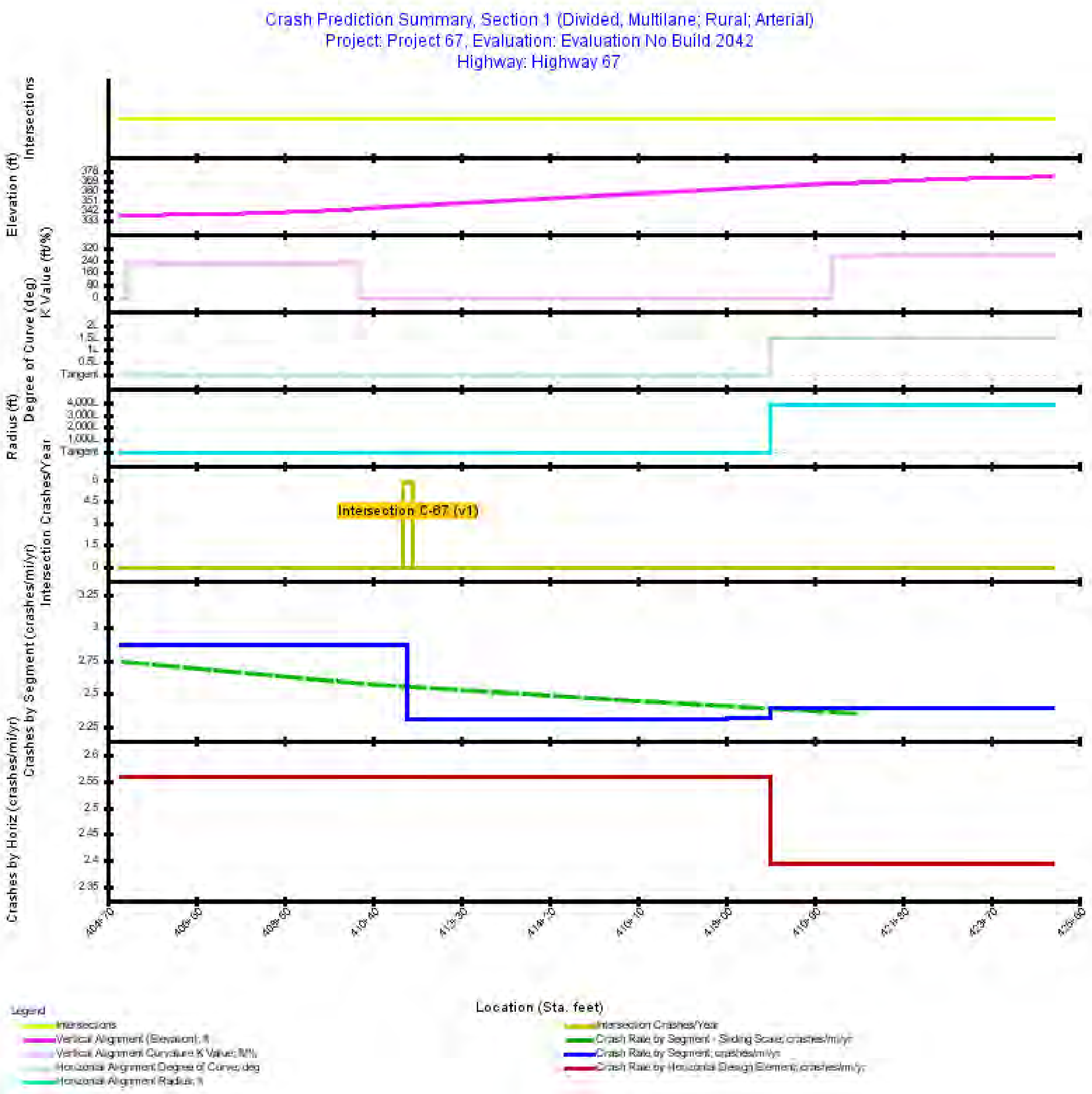

Figure 2. Crash Prediction Summary (Section 1)

Table 8. Evaluation Highway - Homogeneous Segments (Section 1)

Seg. No.	Type	Start Location (Sta. ft)	End Location (Sta. ft)	Length (ft)	Length (mi)	AADT	Left Lane Width (ft)	Right Lane Width (ft)	Left Shoulder Width (ft)	Right Shoulder Width (ft)	Median Width (ft)	Median Type	Effective Median Width (ft)	Lighting	Automated Speed Enforcement	Left Side Slope	Right Side Slope
1	Rural Multi-Lane Segment Four-lane Divided	405+00.000	411+15.000	615.00	0.1165	2042: 15,500	12.00	12.00	8.00	8.00	52.00	Traversable Median	60.00	false	false		
2	Rural Multi-Lane Segment Four-lane Divided	411+15.000	418+00.000	685.00	0.1297	2042: 12,600	12.00	12.00	8.00	8.00	52.00	Traversable Median	60.00	false	false		
3	Rural Multi-Lane Segment Four-lane Divided	418+00.000	418+95.990	95.99	0.0182	2042: 12,600	12.00	12.00	8.00	8.00	49.15	Traversable Median	57.15	false	false		
4	Rural Multi-Lane Segment Four-lane Divided	418+95.990	425+00.000	604.01	0.1144	2042: 12,600	12.00	12.00	8.00	8.00	28.40	Traversable Median	36.40	false	false		

Table 9. Evaluation Intersection (Section 1)

Inter. No.	Title	Type	Location (Sta. ft)	Major AADT	Minor AADT	Legs	Traffic Control	Major road approaches w/Left Turn Lanes	Major road approaches w/Right Turn Lanes	Skew1	Skew2	Lighted at Night
1	Intersection C-67 (v1)	Rural Multi-Lane Intersection Four-Legged w/STOP control	411+14.900	2042: 15,500	2042: 2,000	4	Stop-Controlled	0	0	20.00	0.01	false

Table 10. Predicted Highway Crash Rates and Frequencies Summary (Section 1)

First Year of Analysis	2042
Last Year of Analysis	2042
Evaluated Length (mi)	0.3788
Average Future Road AADT (vpd)	13,492
Predicted Crashes	
Total Crashes	6.83
Fatal and Injury Crashes	3.99
Fatal and Serious Injury Crashes	2.20
Property-Damage-Only Crashes	2.84
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	58
Percent Fatal and Serious Injury Crashes (%)	32
Percent Property-Damage-Only Crashes (%)	42
Predicted Crash Rate	
Crash Rate (crashes/mi/yr)	18.0450
FI Crash Rate (crashes/mi/yr)	10.5442
FI no/C Crash Rate (crashes/mi/yr)	5.7963
PDO Crash Rate (crashes/mi/yr)	7.5008
Predicted Travel Crash Rate	
Total Travel (million veh-mi)	1.87
Travel Crash Rate (crashes/million veh-mi)	3.66
Travel FI Crash Rate (crashes/million veh-mi)	2.14
Travel FI no/C Crash Rate (crashes/million veh-mi)	1.18
Travel PDO Crash Rate (crashes/million veh-mi)	1.52

Table 11. Predicted Crash Frequencies and Rates by Highway Segment/Intersection (Section 1)

Segment Number/Intersection Name/Cross Road	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted FI no/C Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/milli on veh-mi)	Predicted Intersection Travel Crash Rate (crashes/million veh)
1	405+00.000	411+15.000	0.1165	0.335	0.3347	0.1679	0.1040	0.1668	2.8736	0.51	
Intersection C-67 (v1)	411+14.900			5.885	5.8846	3.5113	1.8930	2.3733			1.00
2	411+15.000	418+00.000	0.1297	0.300	0.3000	0.1533	0.0967	0.1467	2.3123	0.50	
3	418+00.000	418+95.990	0.0182	0.042	0.0422	0.0215	0.0136	0.0206	2.3192	0.50	
4	418+95.990	425+00.000	0.1144	0.274	0.2738	0.1399	0.0882	0.1338	2.3933	0.52	
All Segments			0.3788	0.951	0.9506	0.4827	0.3026	0.4680	2.5097	0.51	
All Intersections				5.885	5.8846	3.5113	1.8930	2.3733			1.00
Total			0.3788	6.835	6.8352	3.9940	2.1956	2.8412	18.0450		

Table 12. Predicted Crash Frequencies and Rates by Horizontal Design Element (Section 1)

Title	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted FI no/C Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
Tangent	405+00.000	418+95.990	0.2644	0.677	0.6769	0.3428	0.2143	0.3341	2.5601	0.51
Simple Curve 1	418+95.990	425+00.000	0.1144	0.274	0.2738	0.1399	0.0882	0.1338	2.3933	0.52

Table 13. Predicted Crash Frequencies by Year (Section 1)

Year	Total Crashes	FI Crashes	Percent FI (%)	FI/no C Crashes	Percent FI/no C (%)	PDO Crashes	Percent PDO (%)
2042	6.83	3.99	58.433	2.20	32.122	2.84	41.567
Total	6.83	3.99	58.433	2.20	32.122	2.84	41.567
Average	6.83	3.99	58.433	2.20	32.122	2.84	41.567

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 14. Predicted Crash Type Distribution (Section 1)

Element Type	Crash Type	Fatal and Injury		Fatal and Serious Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Highway Segment	Single	0.35	5.1	0.23	3.4	0.37	5.4	0.73	10.7
Highway Segment	Total Single Vehicle Crashes	0.35	5.1	0.23	3.4	0.37	5.4	0.73	10.7
Highway Segment	Angle Collision	0.02	0.3	0.01	0.2	0.02	0.3	0.04	0.6
Highway Segment	Head-on Collision	0.01	0.1	0.01	0.1	0.00	0.0	0.01	0.1
Highway Segment	Rear-end Collision	0.08	1.2	0.03	0.5	0.04	0.6	0.11	1.6
Highway Segment	Sideswipe	0.01	0.2	0.01	0.1	0.03	0.4	0.04	0.6
Highway Segment	Total Multiple Vehicle Crashes	0.12	1.8	0.06	0.9	0.09	1.3	0.20	2.9
Highway Segment	Total Highway Segment Crashes	0.48	7.1	0.30	4.4	0.47	6.9	0.95	13.9
Highway Segment	Other Collision	0.01	0.2	0.01	0.1	0.01	0.2	0.02	0.3
Intersection	Single	0.52	7.6	0.38	5.5	0.58	8.4	1.19	17.4
Intersection	Total Single Vehicle Crashes	0.52	7.6	0.38	5.5	0.58	8.4	1.19	17.4
Intersection	Angle Collision	1.88	27.5	1.08	15.8	0.69	10.1	2.32	34.0
Intersection	Head-on Collision	0.06	0.9	0.04	0.6	0.04	0.5	0.09	1.4
Intersection	Rear-end Collision	0.75	11.0	0.20	3.0	0.57	8.3	1.34	19.6
Intersection	Sideswipe	0.15	2.2	0.08	1.1	0.37	5.4	0.63	9.2
Intersection	Total Multiple Vehicle Crashes	2.83	41.5	1.41	20.6	1.67	24.4	4.39	64.3
Intersection	Total Intersection Crashes	3.52	51.5	1.89	27.7	2.38	34.8	5.88	86.1
Intersection	Other Collision	0.16	2.4	0.11	1.6	0.13	1.9	0.30	4.4
	Total Crashes	4.00	58.5	2.20	32.1	2.84	41.6	6.83	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Section 2 Evaluation

Section: Section 2
Evaluation Start Location: 425+00.000
Evaluation End Location: 570+00.000
Functional Class: Freeway
Type of Alignment: Divided, Multilane
Model Category: Freeway Segment
Calibration Factor: FI_EN=1.0; FI_MV=1.0; FI_SV=1.0; PDO_EN=1.0; PDO_MV=1.0; PDO_SV=1.0;

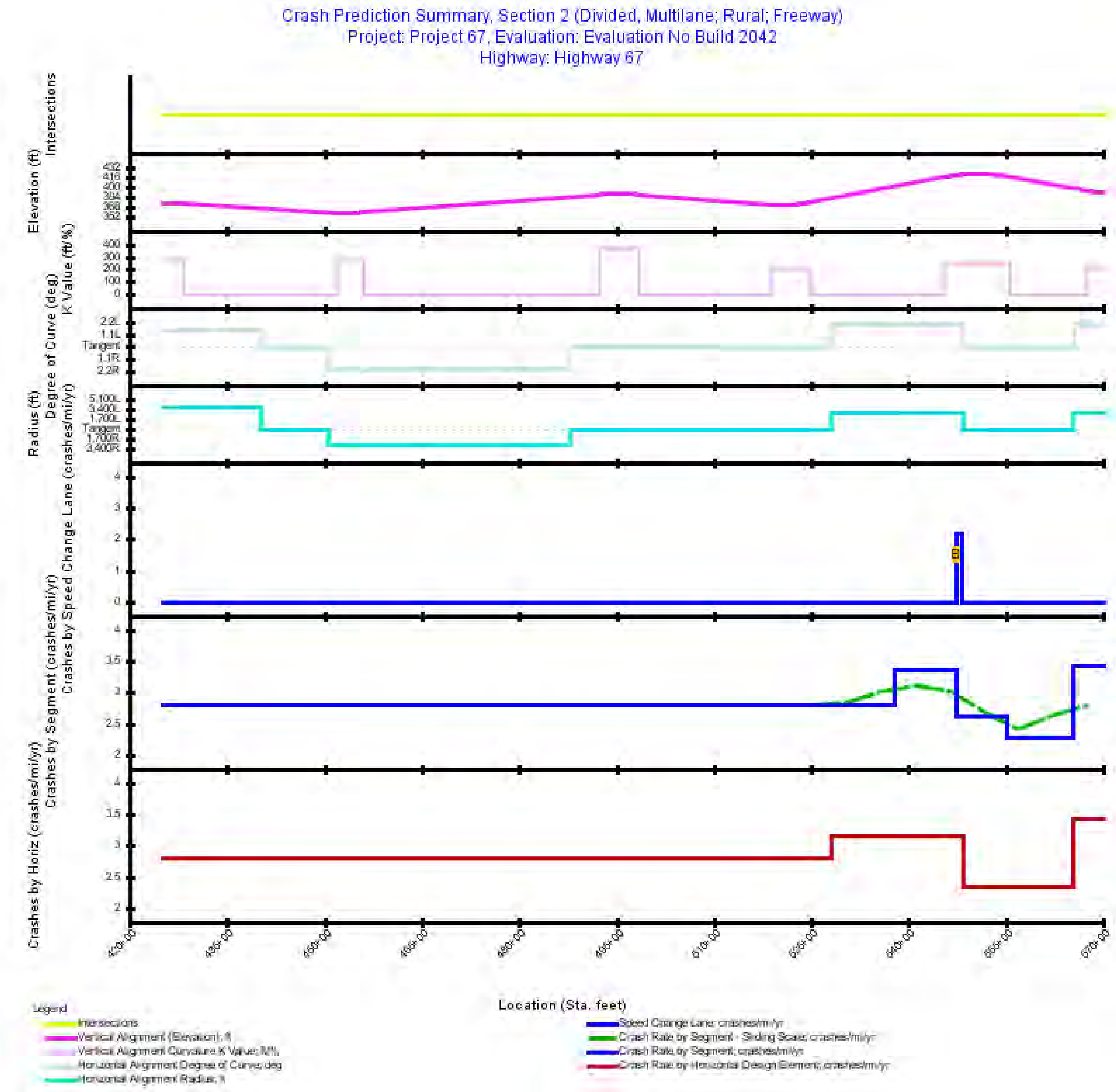

Figure 3. Crash Prediction Summary (Section 2)

Table 15. Evaluation Freeway - Homogeneous Segments (Section 2)

Seg. No.	Type	Area Type	Start Location (Sta. ft)	End Location (Sta. ft)	Length (ft)	Length (mi)	AADT	Median Width (ft)	Type	Effective Median Width (ft)
5	Four-lane Freeway	Rural	425+00.000	537+84.000	11,284.00	2.1371	2042: 12,600	10.50	Traversable Median	18.50
6	Four-lane Freeway	Rural	537+84.000	547+32.000	948.00	0.1795	2042: 12,600	10.50	Traversable Median	18.50
7	Four-lane Freeway	Rural	547+32.000	555+11.680	779.68	0.1477	2042: 12,600	10.50	Traversable Median	18.50
9	Four-lane Freeway	Rural	555+11.680	565+40.830	1,029.15	0.1949	2042: 12,600	10.50	Traversable Median	18.50
10	Four-lane Freeway	Rural	565+40.830	570+00.000	459.17	0.0870	2042: 12,600	10.50	Traversable Median	18.50

Table 16. Evaluation Freeway - Speed Change Lanes (Speed Change)

Seg. No.	Type	Ramp Type	Start Location (Sta. ft)	End Location (Sta. ft)	Length (ft)	Length (mi)	AADT	Median Width (ft)	Type	Effective Median Width (ft)
8	Four-lane Freeway Speed Change	Entrance	547+32.000	548+23.000	91.00	0.0172	2042: 12,600	10.50	Traversable Median	18.50

Table 17. Predicted Freeway Crash Rates and Frequencies Summary (Section 2)

First Year of Analysis	**2042**
Last Year of Analysis	**2042**
Effective Length (mi)	**2.7376**
Average Future Road AADT (vpd)	**12,600**
Predicted Crashes	
Total Crashes	**7.71**
Fatal and Injury Crashes	**2.66**
Property-Damage-Only Crashes	**5.05**
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	**35**
Percent Property-Damage-Only Crashes (%)	**65**
Predicted Crash Rate	
Crash Rate (crashes/mi/yr)	**2.8166**
FI Crash Rate (crashes/mi/yr)	**0.9730**
PDO Crash Rate (crashes/mi/yr)	**1.8436**
Predicted Travel Crash Rate	
Total Travel (million veh-mi)	**12.59**
Travel Crash Rate (crashes/million veh-mi)	**0.61**
Travel FI Crash Rate (crashes/million veh-mi)	**0.21**
Travel PDO Crash Rate (crashes/million veh-mi)	**0.40**

Note: *Effective Length* is the *segment length* minus the length of the *speed change lanes* if present.

Table 18. Predicted Freeway Speed Change Lane Crash Rates and Frequencies Summary (Speed Change)

First Year of Analysis	**2042**
Last Year of Analysis	**2042**
Length (mi)	**0.0172**
Average Future Road AADT (vpd)	**6,300**
Predicted Crashes	
Total Crashes	**0.04**
Fatal and Injury Crashes	**0.01**
Property-Damage-Only Crashes	**0.03**
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	**32**
Percent Property-Damage-Only Crashes (%)	**68**
Predicted Crash Rate	
Crash Rate (crashes/mi/yr)	**2.1968**
FI Crash Rate (crashes/mi/yr)	**0.7095**
PDO Crash Rate (crashes/mi/yr)	**1.4874**
Predicted Travel Crash Rate	
Total Travel (million veh-mi)	**0.04**
Travel Crash Rate (crashes/million veh-mi)	**0.95**
Travel FI Crash Rate (crashes/million veh-mi)	**0.31**
Travel PDO Crash Rate (crashes/million veh-mi)	**0.65**

Note: *Total Travel and Crash Rates/Million Vehicle Miles* for *Speed Change Lanes* reflect AADTs that are **half of the Freeway Segment AADTs** based on the assumption of 50/50 directional distribution.

Table 19. Predicted Crash Frequencies and Rates by Freeway Segment/Intersection (Section 2)

Segment Number/Intersection Name/Cross Road	Start Location (Sta. ft)	End Location (Sta. ft)	Effective Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
5	425+00.000	537+84.000	2.1371	6.001	6.0007	2.0689	3.9317	2.8078	0.61
6	537+84.000	547+32.000	0.1795	0.604	0.6039	0.2132	0.3908	3.3638	0.73
7	547+32.000	555+11.680	0.1390	0.363	0.3626	0.1263	0.2363	2.6079	0.57
9	555+11.680	565+40.830	0.1949	0.445	0.4446	0.1492	0.2954	2.2810	0.50
10	565+40.830	570+00.000	0.0870	0.299	0.2988	0.1060	0.1928	3.4361	0.75
Total			2.7376	7.711	7.7107	2.6636	5.0471	2.8166	0.61

Note: *Effective Length* is the *segment length* minus the length of the *speed change lanes* if present. This may create Freeway segments with zero effective length and zero crashes.

Table 20. Predicted Crash Frequencies and Rates by Freeway Speed Change Lane (Speed Change)

Segment Number/Intersection Name/Cross Road	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
8	547+32.000	548+23.000	0.0172	0.038	0.0379	0.0122	0.0256	2.1968	0.95
Total			0.0172	0.038	0.0379	0.0122	0.0256	2.1968	0.95

Note: *Travel Crash Rates/Million Vehicle Miles* for *Speed Change Lanes* reflect AADTs that are **half of the Freeway Segment AADTs** based on the assumption of 50/50 directional distribution.

Table 21. Predicted Crash Frequencies and Rates by Horizontal Design Element (Section 2)

Title	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi /yr)	Predicted Travel Crash Rate (crashes/mi llion veh-mi)
Simple Curve 1	425+00.000	440+15.580	0.2870	0.806	0.8060	0.2779	0.5281	2.8078	0.61
Tangent	440+15.580	450+69.500	0.1996	0.560	0.5605	0.1932	0.3672	2.8078	0.61
Simple Curve 2	450+69.500	487+95.230	0.7056	1.981	1.9813	0.6831	1.2982	2.8078	0.61
Tangent	487+95.230	528+21.950	0.7626	2.141	2.1414	0.7383	1.4030	2.8078	0.61
Simple Curve 3	528+21.950	548+47.520	0.3836	1.207	1.2071	0.4205	0.7866	3.1466	0.71
Tangent	548+47.520	565+40.830	0.3207	0.753	0.7535	0.2568	0.4967	2.3495	0.52
Simple Curve 4	565+40.830	570+00.000	0.0870	0.299	0.2988	0.1060	0.1928	3.4361	0.75

Table 22. Predicted Crash Frequencies by Year (Section 2)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2042	7.75	2.68	34.533	5.07	65.467
Total	7.75	2.68	34.533	5.07	65.467
Average	7.75	2.68	34.533	5.07	65.467

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 23. Predicted Crash Severity by Freeway Segment (Section 2)

Seg. No.	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)
5	0.0803	0.1980	0.8089	0.9817	3.9317
6	0.0087	0.0219	0.0851	0.0974	0.3908
7	0.0043	0.0106	0.0466	0.0648	0.2363
9	0.0054	0.0131	0.0567	0.0740	0.2954
10	0.0043	0.0109	0.0423	0.0484	0.1928
Total	0.1031	0.2545	1.0397	1.2663	5.0471

Table 24. Predicted Crash Severity by Speed Change Lane (Speed Change)

Seg. No.	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)
8	0.0005	0.0012	0.0048	0.0057	0.0256

Table 25. Predicted Freeway Crash Type Distribution (Section 2)

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Highway Segment	Collision with Animal	0.02	0.3	0.29	3.8	0.31	4.1
Highway Segment	Collision with Fixed Object	1.27	16.4	2.80	36.3	4.07	52.8
Highway Segment	Collision with Other Object	0.07	0.9	0.56	7.3	0.63	8.2
Highway Segment	Other Single-vehicle Collision	0.82	10.7	0.73	9.4	1.55	20.1
Highway Segment	Collision with Parked Vehicle	0.05	0.7	0.10	1.3	0.16	2.0
Highway Segment	Total Single Vehicle Crashes	2.23	29.0	4.48	58.2	6.72	87.1
Highway Segment	Right-Angle Collision	0.02	0.3	0.02	0.2	0.04	0.5
Highway Segment	Head-on Collision	0.01	0.1	0.00	0.0	0.01	0.1
Highway Segment	Other Multi-vehicle Collision	0.03	0.3	0.04	0.6	0.07	0.9
Highway Segment	Rear-end Collision	0.27	3.5	0.29	3.7	0.56	7.2
Highway Segment	Sideswipe, Same Direction Collision	0.10	1.3	0.21	2.8	0.32	4.1
Highway Segment	Total Multiple Vehicle Crashes	0.43	5.6	0.56	7.3	0.99	12.9
Highway Segment	Total Highway Segment Crashes	2.66	34.5	5.05	65.5	7.71	100.0
	Total Crashes	2.66	34.5	5.05	65.5	7.71	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 26. Predicted Entrance Speed Change Lane Crash Type Distribution (Speed Change)

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Highway Segment	Collision with Animal	0.00	0.0	0.00	0.6	0.00	0.6
Highway Segment	Collision with Fixed Object	0.00	7.9	0.01	20.0	0.01	28.0
Highway Segment	Collision with Other Object	0.00	0.7	0.00	4.7	0.00	5.4
Highway Segment	Other Single-vehicle Collision	0.00	5.5	0.00	4.5	0.00	10.0
Highway Segment	Collision with Parked Vehicle	0.00	0.7	0.00	0.0	0.00	0.7
Highway Segment	Total Single Vehicle Crashes	0.01	14.8	0.01	29.9	0.02	44.6
Highway Segment	Right-Angle Collision	0.00	1.0	0.00	0.9	0.00	1.9
Highway Segment	Head-on Collision	0.00	0.7	0.00	0.3	0.00	0.9
Highway Segment	Other Multi-vehicle Collision	0.00	0.4	0.00	2.7	0.00	3.1
Highway Segment	Rear-end Collision	0.00	11.3	0.01	17.6	0.01	28.9
Highway Segment	Sideswipe, Same Direction Collision	0.00	4.1	0.01	16.4	0.01	20.5
Highway Segment	Total Multiple Vehicle Crashes	0.01	17.5	0.01	37.8	0.02	55.4
Highway Segment	Total Highway Segment Crashes	0.01	32.3	0.03	67.7	0.04	100.0
	Total Crashes	0.01	32.3	0.03	67.7	0.04	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 27. Evaluation Message

Start Location (Sta. ft)	End Location (Sta. ft)	Message
547+32.000	548+23.000	for segment #8 (547+32.000 to 548+23.000), distance to taper (91.00 feet) is less than specified entrance ramp boundaries 211.20 feet; adjusted in CMF calculations.

Interactive Highway Safety Design Model

Crash Prediction Evaluation Report

67-160 Interchange

No-build 2022

December 11, 2020

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Combined Report

Combined Report Overview

Report Generated: Dec 11, 2020 5:18 PM
Report Template: System: Multi-Page [System] (mlcpm2, Nov 27, 2020 3:23 PM)

Evaluation Title: Evaluation Interchange No Build 2022
Evaluation Comment: Created Thu Dec 10 19:20:03 CST 2020
Evaluation Date: Thu Dec 10 19:22:35 CST 2020

User Name: mhuebbe
Organization Name: EFK Moen, LLC
Phone: 314-394-3133
E-Mail: mhuebbe@efkmoen.com

Project Title: Project 67
Project Comment: Created Wed Dec 09 16:11:58 CST 2020
Project Unit System: U.S. Customary

Interchange Title: Interchange 160-67
Interchange Comment: Created Thu Dec 10 08:43:05 CST 2020

Report Overview

Disclaimer Regarding Crash Prediction Method

IMPORTANT NOTICE ABOUT COMPARING RESULTS FROM HIGHWAY SAFETY MANUAL FIRST EDITION (2010) MODELS TO RESULTS FROM NEW MODELS DEVELOPED UNDER NCHRP PROJECTS 17-70 AND 17-58

Since the publication of the Highway Safety Manual - First Edition (HSM-1), in 2010 by the American Association of State Highway and Transportation Officials (AASHTO), multiple research efforts have been undertaken through the National Cooperative Highway Research Program (NCHRP) to develop safety performance models for road segment and intersection facility types that were not initially reflected in the HSM-1, in order to expand the breadth and depth of the HSM in the future.

The IHSDM Crash Prediction Module (CPM) is intended as a faithful implementation of HSM Part C predictive methods. As NCHRP projects to develop new predictive methods for the HSM are completed, FHWA works to incorporate the new methods into IHSDM, sometimes in advance of publication in the HSM. The following new crash predictive methods have been accepted by NCHRP project panels and incorporated into IHSDM, while pending AASHTO's approval for incorporation into a future edition of the HSM:

- Roundabouts: completed in 2018 under NCHRP Project 17-70, the new methods will provide improved outcomes for the safety analysis of roundabouts.
- 6+ lane and one-way urban/suburban arterials (including models for segments and intersections): completed under NCHRP Project 17-58.

However, in the absence of local calibration factors (see HSM-1 Part C, Appendix A for guidance on calibration of the predictive models), it is neither appropriate nor advisable to directly compare the results from new models (from NCHRP Projects 17-58 and 17-70) to results from HSM-1 models, as the models were not calibrated to the same base state data sets, and consequently can produce unexpected results. If local calibration factors are available and applied to both new models and HSM-1 models, then it may be appropriate to directly compare the results.*[Note: Work being performed under NCHRP Project 17-72 (Update of Crash Modification Factors for the Highway Safety Manual) is expected to re-calibrate many of the old (HSM-1) and new (e.g., NCHRP 17-70) models to data from a single (or small number of) states, that would allow results from all models to be directly compared.]*

The models produced for NCHRP Project 17-70 have independent value in terms of informing the design of a roundabout and assessing the effects of different design characteristics on the expected safety performance of a roundabout.

The HSM-1 interim method previously included in IHSDM for evaluating roundabouts on urban/suburban arterials (i.e., evaluating an existing intersection and then applying a Crash Modification Factor for replacing the existing intersection with a roundabout) has been deactivated in IHSDM, to minimize any confusion with the new roundabout methodology.

Section Types

Interchange 160-67 : Evaluation Interchange No Build 2022 : Ramp SB Enter Evaluation

Report Overview

Report Generated: Dec 11, 2020 5:18 PM
Report Template: System: Multi-Page [System] (mlcpm2, Nov 27, 2020 3:23 PM)

Evaluation Date: Thu Dec 10 19:21:10 CST 2020
IHSDM Version: v16.0.0 (Sep 30, 2020)
Crash Prediction Module: v11.0.0 (Sep 30, 2020)

User Name: mhuebbe
Organization Name: EFK Moen, LLC
Phone: 314-394-3133
E-Mail: mhuebbe@efkmoen.com

Project Title: Interchange 160-67
Project Comment: Created Thu Dec 10 08:43:05 CST 2020
Project Unit System: U.S. Customary

Highway Title: Ramp SB Enter
Highway Comment: Created Thu Dec 10 11:12:22 CST 2020
Highway Version: 1

Evaluation Title: Interchange 160-67 : Evaluation Interchange No Build 2022 : Ramp SB Enter
Evaluation Comment: Created Thu Dec 10 19:20:49 CST 2020

Minimum Location: 0.000
Maximum Location: 13+31.900
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: HSM Configuration
Crash Distribution: HSM Configuration
Model/CMF: HSM Configuration
First Year of Analysis: 2022
Last Year of Analysis: 2022
Empirical-Bayes Analysis: None
First Year of Observed Crashes:
Last Year of Observed Crashes:

Disclaimer Regarding Crash Prediction Method

IMPORTANT NOTICE ABOUT COMPARING RESULTS FROM HIGHWAY SAFETY MANUAL FIRST EDITION (2010) MODELS TO RESULTS FROM NEW MODELS DEVELOPED UNDER NCHRP PROJECTS 17-70 AND 17-58

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The IHSDM Crash Prediction Module (CPM) is intended as a faithful implementation of HSM Part C predictive methods. As NCHRP projects to develop new predictive methods for the HSM are completed, FHWA works to incorporate the new methods into IHSDM, sometimes in advance of publication in the HSM. The following new crash predictive methods have been accepted by NCHRP project panels and incorporated into IHSDM, while pending AASHTO's approval for incorporation into a future edition of the HSM:

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The models produced for NCHRP Project 17-70 have independent value in terms of informing the design of a roundabout and assessing the effects of different design characteristics on the expected safety performance of a roundabout.

The HSM-1 interim method previously included in IHSDM for evaluating roundabouts on urban/suburban arterials (i.e., evaluating an existing intersection and then applying a Crash Modification Factor for replacing the existing intersection with a roundabout) has been deactivated in IHSDM, to minimize any confusion with the new roundabout methodology.

Freeway Ramp Evaluation

Section: Section 1
Evaluation Start Location: 0.000
Evaluation End Location: 13+31.900
Functional Class: Freeway Service Ramp
Type of Alignment: One Direction
Model Category: Freeway Service Ramp

Calibration Factor: ENT_RAMP_MV_FI=1.0; ENT_RAMP_MV_PDO=1.0; ENT_RAMP_SV_FI=1.0; ENT_RAMP_SV_PDO=1.0;

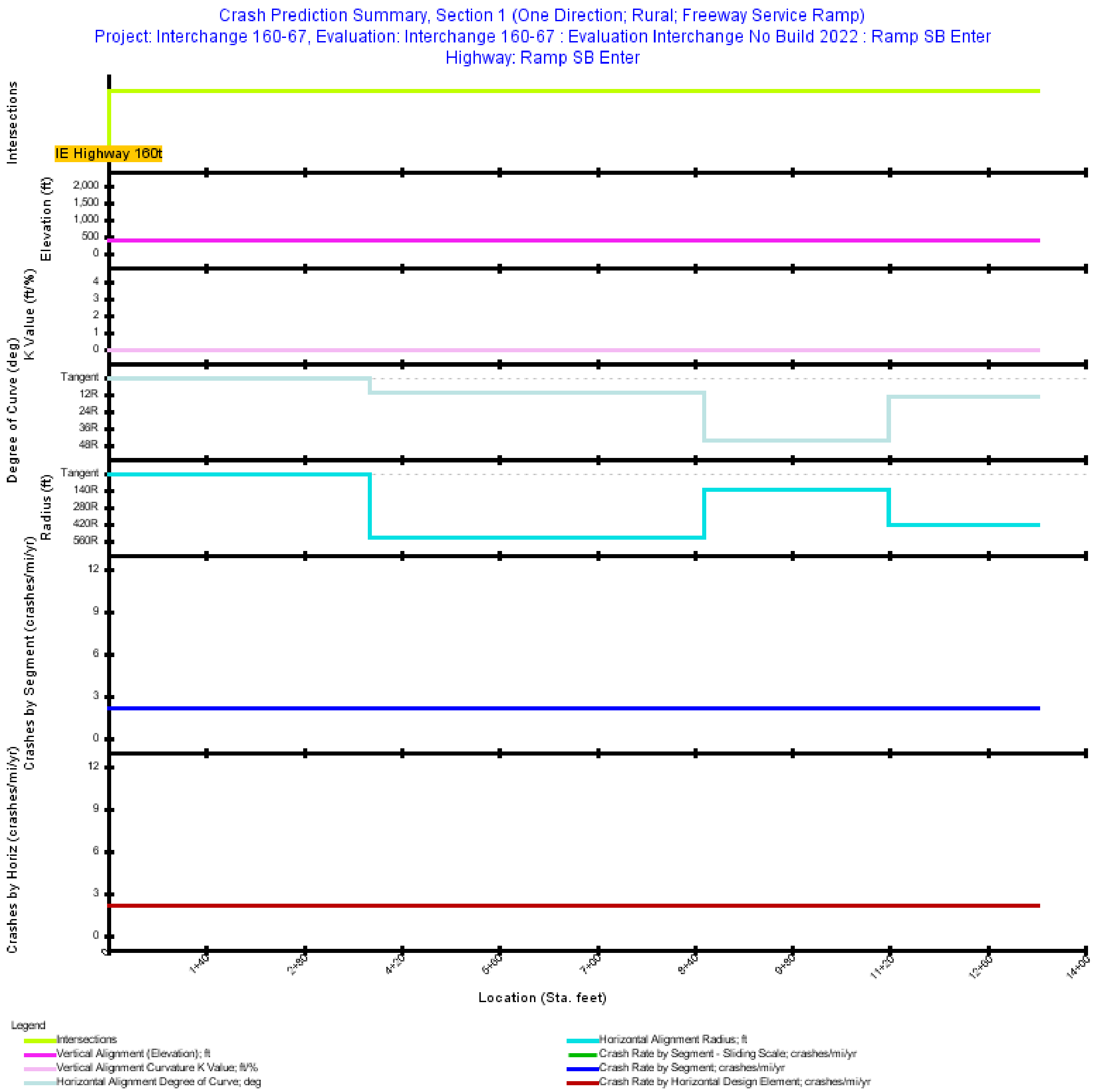

Figure 1. Crash Prediction Summary (Freeway Ramp Sections)

Table 1. Evaluation Freeway - Homogeneous Segments (Freeway Ramp Sections)

Seg. No.	Type	Area Type	Start Location (Sta. ft)	End Location (Sta. ft)	Length (ft)	Length (mi)	AADT
1	Freeway Ramp and C-D Road One-lane Ramp Entrance	Rural	0.000	13+31.900	1,331.90	0.2523	2022: 2,900

Table 2. Predicted Ramp Crash Rates and Frequencies Summary (Freeway Ramp Sections)

First Year of Analysis	**2022**
Last Year of Analysis	**2022**
Evaluated Length (mi)	**0.2523**
Average Future Road AADT (vpd)	**2,900**
Predicted Crashes	
Total Crashes	**0.54**
Fatal and Injury Crashes	**0.20**
Property-Damage-Only Crashes	**0.35**
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	**36**
Percent Property-Damage-Only Crashes (%)	**64**
Predicted Crash Rate	
Crash Rate (crashes/mi/yr)	**2.1466**
FI Crash Rate (crashes/mi/yr)	**0.7724**
PDO Crash Rate (crashes/mi/yr)	**1.3742**
Predicted Travel Crash Rate	
Total Travel (million veh-mi)	**0.27**
Travel Crash Rate (crashes/million veh-mi)	**2.03**
Travel FI Crash Rate (crashes/million veh-mi)	**0.73**
Travel PDO Crash Rate (crashes/million veh-mi)	**1.30**

Table 3. Predicted Crash Frequencies and Rates by Ramp Segment/Intersection (Freeway Ramp Sections)

Segment Number/Intersection Name/Cross Road	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
1	0.000	13+31.900	0.2523	0.541	0.5415	0.1948	0.3467	2.1466	2.03
Total			0.2523	0.541	0.5415	0.1948	0.3467	2.1466	

Table 4. Predicted Crash Frequencies and Rates by Horizontal Design Element (Freeway Ramp Sections)

Title	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
Tangent	0.000	3+74.260	0.0709	0.152	0.1522	0.0547	0.0974	2.1466	2.03
Simple Curve 1	3+74.260	8+53.580	0.0908	0.195	0.1949	0.0701	0.1248	2.1466	2.03
Simple Curve 2	8+53.580	11+18.810	0.0502	0.108	0.1078	0.0388	0.0690	2.1466	2.03
Simple Curve 3	11+18.810	13+31.900	0.0404	0.087	0.0866	0.0312	0.0555	2.1466	2.03

Table 5. Predicted Crash Frequencies by Year (Freeway Ramp Sections)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2022	0.54	0.20	35.981	0.35	64.019
Total	0.54	0.20	35.981	0.35	64.019
Average	0.54	0.20	35.981	0.35	64.019

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 6. Predicted Crash Severity by Ramp Segment (Freeway Ramp Sections)

Seg. No.	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)
1	0.0051	0.0154	0.1025	0.0719	0.3467

Table 7. Predicted Freeway Ramp Crash Type Distribution (Freeway Ramp Sections)

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Highway Segment	Collision with Animal	0.00	0.4	0.02	3.7	0.02	4.1
Highway Segment	Collision with Fixed Object	0.11	19.9	0.19	35.9	0.30	55.8
Highway Segment	Collision with Other Object	0.01	1.1	0.04	7.2	0.04	8.3
Highway Segment	Other Single-vehicle Collision	0.07	12.9	0.05	9.3	0.12	22.2
Highway Segment	Collision with Parked Vehicle	0.01	0.8	0.01	1.3	0.01	2.2
Highway Segment	Total Single Vehicle Crashes	0.19	35.1	0.31	57.4	0.50	92.5
Highway Segment	Right-Angle Collision	0.00	0.0	0.00	0.2	0.00	0.2
Highway Segment	Head-on Collision	0.00	0.0	0.00	0.0	0.00	0.0
Highway Segment	Other Multi-vehicle Collision	0.00	0.1	0.00	0.5	0.00	0.6
Highway Segment	Rear-end Collision	0.00	0.6	0.02	3.4	0.02	3.9
Highway Segment	Sideswipe, Same Direction Collision	0.00	0.2	0.01	2.5	0.01	2.7
Highway Segment	Total Multiple Vehicle Crashes	0.01	0.9	0.04	6.6	0.04	7.5
Highway Segment	Total Highway Segment Crashes	0.20	36.0	0.35	64.0	0.54	100.0
	Total Crashes	0.20	36.0	0.35	64.0	0.54	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Interchange 160-67 : Evaluation Interchange No Build 2022 : Ramp SB Exit Evaluation

Report Overview

Report Generated: Dec 11, 2020 5:18 PM
Report Template: System: Multi-Page [System] (mlcpm2, Nov 27, 2020 3:23 PM)

Evaluation Date: Thu Dec 10 19:21:30 CST 2020
IHSDM Version: v16.0.0 (Sep 30, 2020)
Crash Prediction Module: v11.0.0 (Sep 30, 2020)

User Name: mhuebbe
Organization Name: EFK Moen, LLC
Phone: 314-394-3133
E-Mail: mhuebbe@efkmoen.com

Project Title: Interchange 160-67
Project Comment: Created Thu Dec 10 08:43:05 CST 2020
Project Unit System: U.S. Customary

Highway Title: Ramp SB Exit
Highway Comment: Created Thu Dec 10 11:42:40 CST 2020
Highway Version: 1

Evaluation Title: Interchange 160-67 : Evaluation Interchange No Build 2022 : Ramp SB Exit
Evaluation Comment: Created Thu Dec 10 19:21:20 CST 2020

Minimum Location: 0.000
Maximum Location: 17+62.820
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: HSM Configuration
Crash Distribution: HSM Configuration
Model/CMF: HSM Configuration
First Year of Analysis: 2022
Last Year of Analysis: 2022
Empirical-Bayes Analysis: None
First Year of Observed Crashes:
Last Year of Observed Crashes:

Disclaimer Regarding Crash Prediction Method

IMPORTANT NOTICE ABOUT COMPARING RESULTS FROM HIGHWAY SAFETY MANUAL FIRST EDITION (2010) MODELS TO RESULTS FROM NEW MODELS DEVELOPED UNDER NCHRP PROJECTS 17-70 AND 17-58

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The IHSDM Crash Prediction Module (CPM) is intended as a faithful implementation of HSM Part C predictive methods. As NCHRP projects to develop new predictive methods for the HSM are completed, FHWA works to incorporate the new methods into IHSDM, sometimes in advance of publication in the HSM. The following new crash predictive methods have been accepted by NCHRP project panels and incorporated into IHSDM, while pending AASHTO's approval for incorporation into a future edition of the HSM:

- Roundabouts: completed in 2018 under NCHRP Project 17-70, the new methods will provide improved outcomes for the safety analysis of roundabouts.
- 6+ lane and one-way urban/suburban arterials (including models for segments and intersections): completed under NCHRP Project 17-58.

However, in the absence of local calibration factors (see HSM-1 Part C, Appendix A for guidance on calibration of the predictive models), it is neither appropriate nor advisable to directly compare the results from new models (from NCHRP Projects 17-58 and 17-70) to results from HSM-1 models, as the models were not calibrated to the same base state data sets, and consequently can produce unexpected results. If local calibration factors are available and applied to both new models and HSM-1 models, then it may be appropriate to directly compare the results.*[Note: Work being performed under NCHRP Project 17-72 (Update of Crash Modification Factors for the Highway Safety Manual) is expected to re-calibrate many of the old (HSM-1) and new (e.g., NCHRP 17-70) models to data from a single (or small number of) states, that would allow results from all models to be directly compared.]*

The models produced for NCHRP Project 17-70 have independent value in terms of informing the design of a roundabout and assessing the effects of different design characteristics on the expected safety performance of a roundabout.

The HSM-1 interim method previously included in IHSDM for evaluating roundabouts on urban/suburban arterials (i.e., evaluating an existing intersection and then applying a Crash Modification Factor for replacing the existing intersection with a roundabout) has been deactivated in IHSDM, to minimize any confusion with the new roundabout methodology.

Freeway Ramp Evaluation

Section: Section 1
Evaluation Start Location: 0.000
Evaluation End Location: 17+62.820
Functional Class: Freeway Service Ramp
Type of Alignment: One Direction
Model Category: Freeway Service Ramp

Calibration Factor: EX_RAMP_MV_FI=1.0; EX_RAMP_MV_PDO=1.0; EX_RAMP_SV_FI=1.0; EX_RAMP_SV_PDO=1.0;

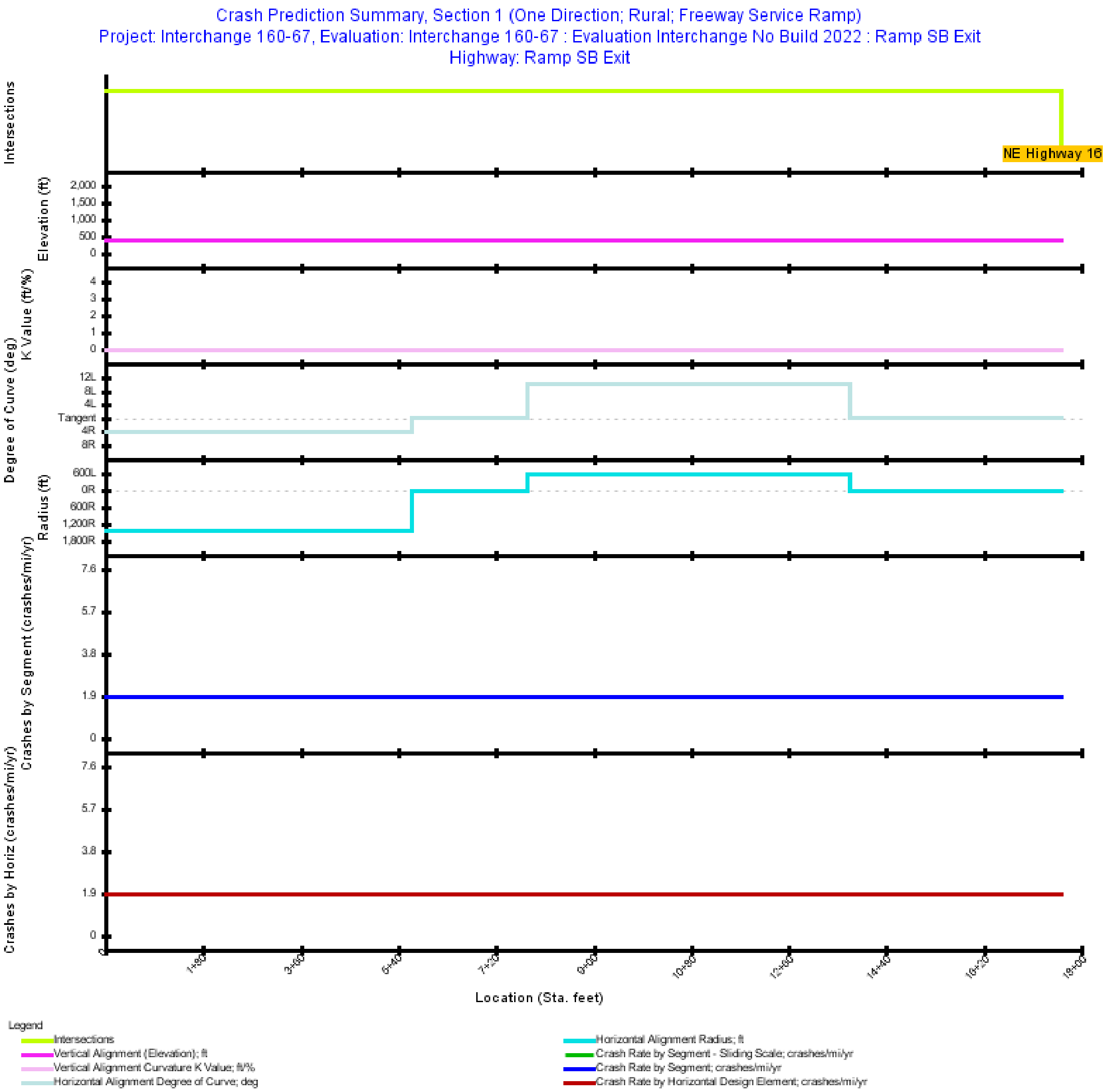

Figure 2. Crash Prediction Summary (Freeway Ramp Sections)

Table 8. Evaluation Freeway - Homogeneous Segments (Freeway Ramp Sections)

Seg. No.	Type	Area Type	Start Location (Sta. ft)	End Location (Sta. ft)	Length (ft)	Length (mi)	AADT
1	Freeway Ramp and C-D Road One-lane Ramp Exit	Rural	0.000	17+62.820	1,762.82	0.3339	2022: 5,900

Table 9. Predicted Ramp Crash Rates and Frequencies Summary (Freeway Ramp Sections)

First Year of Analysis	**2022**
Last Year of Analysis	**2022**
Evaluated Length (mi)	**0.3339**
Average Future Road AADT (vpd)	**5,900**
Predicted Crashes	
Total Crashes	**0.63**
Fatal and Injury Crashes	**0.26**
Property-Damage-Only Crashes	**0.37**
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	**42**
Percent Property-Damage-Only Crashes (%)	**58**
Predicted Crash Rate	
Crash Rate (crashes/mi/yr)	**1.8992**
FI Crash Rate (crashes/mi/yr)	**0.7904**
PDO Crash Rate (crashes/mi/yr)	**1.1088**
Predicted Travel Crash Rate	
Total Travel (million veh-mi)	**0.72**
Travel Crash Rate (crashes/million veh-mi)	**0.88**
Travel FI Crash Rate (crashes/million veh-mi)	**0.37**
Travel PDO Crash Rate (crashes/million veh-mi)	**0.52**

Table 10. Predicted Crash Frequencies and Rates by Ramp Segment/Intersection (Freeway Ramp Sections)

Segment Number/Intersection Name/Cross Road	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
1	0.000	17+62.820	0.3339	0.634	0.6341	0.2639	0.3702	1.8992	0.88
Total			0.3339	0.634	0.6341	0.2639	0.3702	1.8992	

Table 11. Predicted Crash Frequencies and Rates by Horizontal Design Element (Freeway Ramp Sections)

Title	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
Simple Curve 1	0.000	5+64.230	0.1069	0.203	0.2030	0.0845	0.1185	1.8992	0.88
Tangent	5+64.230	7+78.690	0.0406	0.077	0.0771	0.0321	0.0450	1.8992	0.88
Simple Curve 2	7+78.690	13+71.820	0.1123	0.213	0.2133	0.0888	0.1246	1.8992	0.88
Tangent	13+71.820	17+62.820	0.0741	0.141	0.1406	0.0585	0.0821	1.8992	0.88

Table 12. Predicted Crash Frequencies by Year (Freeway Ramp Sections)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2022	0.63	0.26	41.617	0.37	58.383
Total	0.63	0.26	41.617	0.37	58.383
Average	0.63	0.26	41.617	0.37	58.383

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 13. Predicted Crash Severity by Ramp Segment (Freeway Ramp Sections)

Seg. No.	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)
1	0.0102	0.0308	0.1333	0.0897	0.3702

Table 14. Predicted Freeway Ramp Crash Type Distribution (Freeway Ramp Sections)

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Highway Segment	Collision with Animal	0.00	0.4	0.02	3.5	0.03	3.9
Highway Segment	Collision with Fixed Object	0.15	23.4	0.21	33.5	0.36	57.0
Highway Segment	Collision with Other Object	0.01	1.3	0.04	6.7	0.05	8.0
Highway Segment	Other Single-vehicle Collision	0.10	15.2	0.06	8.7	0.15	23.9
Highway Segment	Collision with Parked Vehicle	0.01	1.0	0.01	1.2	0.01	2.2
Highway Segment	Total Single Vehicle Crashes	0.26	41.3	0.34	53.7	0.60	95.0
Highway Segment	Right-Angle Collision	0.00	0.0	0.00	0.1	0.00	0.2
Highway Segment	Head-on Collision	0.00	0.0	0.00	0.0	0.00	0.0
Highway Segment	Other Multi-vehicle Collision	0.00	0.0	0.00	0.4	0.00	0.4
Highway Segment	Rear-end Collision	0.00	0.2	0.01	2.4	0.02	2.6
Highway Segment	Sideswipe, Same Direction Collision	0.00	0.1	0.01	1.8	0.01	1.9
Highway Segment	Total Multiple Vehicle Crashes	0.00	0.3	0.03	4.7	0.03	5.0
Highway Segment	Total Highway Segment Crashes	0.26	41.6	0.37	58.4	0.63	100.0
	Total Crashes	0.26	41.6	0.37	58.4	0.63	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Interchange 160-67 : Evaluation Interchange No Build 2022 : RampTerminal 160 SB Evaluation

Report Overview

Report Generated: Dec 11, 2020 5:18 PM
Report Template: System: Multi-Page [System] (mlcpm2, Nov 27, 2020 3:23 PM)

Evaluation Date: Thu Dec 10 19:21:45 CST 2020
IHSDM Version: v16.0.0 (Sep 30, 2020)
Crash Prediction Module: v11.0.0 (Sep 30, 2020)

User Name: mhuebbe
Organization Name: EFK Moen, LLC
Phone: 314-394-3133
E-Mail: mhuebbe@efkmoen.com

Project Title: Interchange 160-67
Project Comment: Created Thu Dec 10 08:43:05 CST 2020
Project Unit System: U.S. Customary

Intersection Title: RampTerminal 160 SB
Intersection Comment: Created Thu Dec 10 12:35:13 CST 2020
Intersection Version: v1

Evaluation Title: Interchange 160-67 : Evaluation Interchange No Build 2022 : RampTerminal 160 SB
Evaluation Comment: Created Thu Dec 10 19:21:40 CST 2020

Minimum Location: 534+24.000
Maximum Location: 596+34.000
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: HSM Configuration
Crash Distribution: HSM Configuration
Model/CMF: HSM Configuration
First Year of Analysis: 2022
Last Year of Analysis: 2022
Empirical-Bayes Analysis: None
First Year of Observed Crashes:
Last Year of Observed Crashes:

Disclaimer Regarding Crash Prediction Method

IMPORTANT NOTICE ABOUT COMPARING RESULTS FROM HIGHWAY SAFETY MANUAL FIRST EDITION (2010) MODELS TO RESULTS FROM NEW MODELS DEVELOPED UNDER NCHRP PROJECTS 17-70 AND 17-58

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The IHSDM Crash Prediction Module (CPM) is intended as a faithful implementation of HSM Part C predictive methods. As NCHRP projects to develop new predictive methods for the HSM are completed, FHWA works to incorporate the new methods into IHSDM, sometimes in advance of publication in the HSM. The following new crash predictive methods have been accepted by NCHRP project panels and incorporated into IHSDM, while pending AASHTO's approval for incorporation into a future edition of the HSM:

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- 6+ lane and one-way urban/suburban arterials (including models for segments and intersections): completed under NCHRP Project 17-58.

However, in the absence of local calibration factors (see HSM-1 Part C, Appendix A for guidance on calibration of the predictive models), it is neither appropriate nor advisable to directly compare the results from new models (from NCHRP Projects 17-58 and 17-70) to results from HSM-1 models, as the models were not calibrated to the same base state data sets, and consequently can produce unexpected results. If local calibration factors are available and applied to both new models and HSM-1 models, then it may be appropriate to directly compare the results.*[Note: Work being performed under NCHRP Project 17-72 (Update of Crash Modification Factors for the Highway Safety Manual) is expected to re-calibrate many of the old (HSM-1) and new (e.g., NCHRP 17-70) models to data from a single (or small number of) states, that would allow results from all models to be directly compared.]*

The models produced for NCHRP Project 17-70 have independent value in terms of informing the design of a roundabout and assessing the effects of different design characteristics on the expected safety performance of a roundabout.

The HSM-1 interim method previously included in IHSDM for evaluating roundabouts on urban/suburban arterials (i.e., evaluating an existing intersection and then applying a Crash Modification Factor for replacing the existing intersection with a roundabout) has been deactivated in IHSDM, to minimize any confusion with the new roundabout methodology.

RampTerminal 160 SB Evaluation

Intersection: RampTerminal 160 SB
Evaluation Start Location: 534+24.000
Evaluation End Location: 596+34.000
Calibration Factor: RT_ST_FI=1.0; RT_ST_PDO=1.0;

Table 15. Evaluation Ramp Terminal - Site (RampTerminal 160 SB)

Inter. No.	Title	Type	Area Type	Legs	Location (Sta. ft)	Traffic Control	AADT
1	RampTerminal 160 SB (v1)	Freeway Ramp Terminal A2 - Three-Leg at Two-Quadrant Parclo A	Rural	4	580+00.000	Stop-Controlled	Inside: 2022: 7,100; Outside: 2022: 7,100 :: Entrance: 2022: 2,900; Exit: 2022: 5,900

Table 16. Predicted Ramp Terminal Crash Rates and Frequencies Summary (RampTerminal 160 SB)

First Year of Analysis	2022
Last Year of Analysis	2022
Predicted Crashes	
Total Crashes	4.40
Fatal and Injury Crashes	2.95
Property-Damage-Only Crashes	1.45
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	67
Percent Property-Damage-Only Crashes (%)	33

Table 17. Predicted Crash Frequencies and Rates by Ramp Terminal (RampTerminal 160 SB)

Segment Number/Intersection Name/Cross Road	Location (Sta. ft)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Travel Crash Rate (crashes/million veh)
RampTerminal 160 SB (v1)	580+00.000	4.397	4.3969	2.9497	1.4471	1.05

Table 18. Predicted Crash Frequencies by Year (RampTerminal 160 SB)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2022	4.40	2.95	67.087	1.45	32.913
Total	4.40	2.95	67.087	1.45	32.913
Average	4.40	2.95	67.087	1.45	32.913

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 19. Predicted Crash Severity by Ramp Terminal (RampTerminal 160 SB)

Seg. No.	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)
1	0.0349	0.1832	0.6060	2.1257	1.4471

Table 20. Predicted Ramp Terminal Crash Type Distribution (RampTerminal 160 SB)

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Ramp Terminal	Collision with Animal	0.00	0.0	0.00	0.0	0.00	0.0
Ramp Terminal	Collision with Fixed Object	0.23	5.2	0.23	5.2	0.46	10.4
Ramp Terminal	Collision with Other Object	0.00	0.0	0.01	0.2	0.01	0.2
Ramp Terminal	Other Single-vehicle Collision	0.19	4.4	0.04	0.9	0.23	5.2
Ramp Terminal	Collision with Parked Vehicle	0.02	0.5	0.02	0.5	0.04	1.0
Ramp Terminal	Total Single Vehicle Crashes	0.44	10.1	0.29	6.7	0.74	16.8
Ramp Terminal	Right-Angle Collision	1.54	35.0	0.54	12.2	2.08	47.3
Ramp Terminal	Head-on Collision	0.06	1.3	0.02	0.5	0.08	1.8
Ramp Terminal	Other Multi-vehicle Collision	0.04	0.9	0.04	0.9	0.08	1.7
Ramp Terminal	Rear-end Collision	0.81	18.4	0.40	9.1	1.21	27.5
Ramp Terminal	Sideswipe, Same Direction Collision	0.06	1.3	0.15	3.5	0.21	4.9
Ramp Terminal	Total Multiple Vehicle Crashes	2.51	57.0	1.15	26.2	3.66	83.2
Ramp Terminal	Total Ramp Terminal Crashes	2.95	67.1	1.45	32.9	4.40	100.0
	Total Crashes	2.95	67.1	1.45	32.9	4.40	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Interchange 160-67 : Evaluation Interchange No Build 2022 : Ramp NB Enter Evaluation

Report Overview

Report Generated: Dec 11, 2020 5:18 PM
Report Template: System: Multi-Page [System] (mlcpm2, Nov 27, 2020 3:23 PM)

Evaluation Date: Thu Dec 10 19:22:04 CST 2020
IHSDM Version: v16.0.0 (Sep 30, 2020)
Crash Prediction Module: v11.0.0 (Sep 30, 2020)

User Name: mhuebbe
Organization Name: EFK Moen, LLC
Phone: 314-394-3133
E-Mail: mhuebbe@efkmoen.com

Project Title: Interchange 160-67
Project Comment: Created Thu Dec 10 08:43:05 CST 2020
Project Unit System: U.S. Customary

Highway Title: Ramp NB Enter
Highway Comment: Created Thu Dec 10 12:44:09 CST 2020
Highway Version: 1

Evaluation Title: Interchange 160-67 : Evaluation Interchange No Build 2022 : Ramp NB Enter
Evaluation Comment: Created Thu Dec 10 19:21:53 CST 2020

Minimum Location: 0.000
Maximum Location: 13+32.250
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: HSM Configuration
Crash Distribution: HSM Configuration
Model/CMF: HSM Configuration
First Year of Analysis: 2022
Last Year of Analysis: 2022
Empirical-Bayes Analysis: None
First Year of Observed Crashes:
Last Year of Observed Crashes:

Disclaimer Regarding Crash Prediction Method

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- 6+ lane and one-way urban/suburban arterials (including models for segments and intersections): completed under NCHRP

Project 17-58.

However, in the absence of local calibration factors (see HSM-1 Part C, Appendix A for guidance on calibration of the predictive models), it is neither appropriate nor advisable to directly compare the results from new models (from NCHRP Projects 17-58 and 17-70) to results from HSM-1 models, as the models were not calibrated to the same base state data sets, and consequently can produce unexpected results. If local calibration factors are available and applied to both new models and HSM-1 models, then it may be appropriate to directly compare the results.*[Note: Work being performed under NCHRP Project 17-72 (Update of Crash Modification Factors for the Highway Safety Manual) is expected to re-calibrate many of the old (HSM-1) and new (e.g., NCHRP 17-70) models to data from a single (or small number of) states, that would allow results from all models to be directly compared.]*

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Freeway Ramp Evaluation

Section: Section 1
Evaluation Start Location: 0.000
Evaluation End Location: 13+32.250
Functional Class: Freeway Service Ramp
Type of Alignment: One Direction
Model Category: Freeway Service Ramp
Calibration Factor: ENT_RAMP_MV_FI=1.0; ENT_RAMP_MV_PDO=1.0; ENT_RAMP_SV_FI=1.0; ENT_RAMP_SV_PDO=1.0;

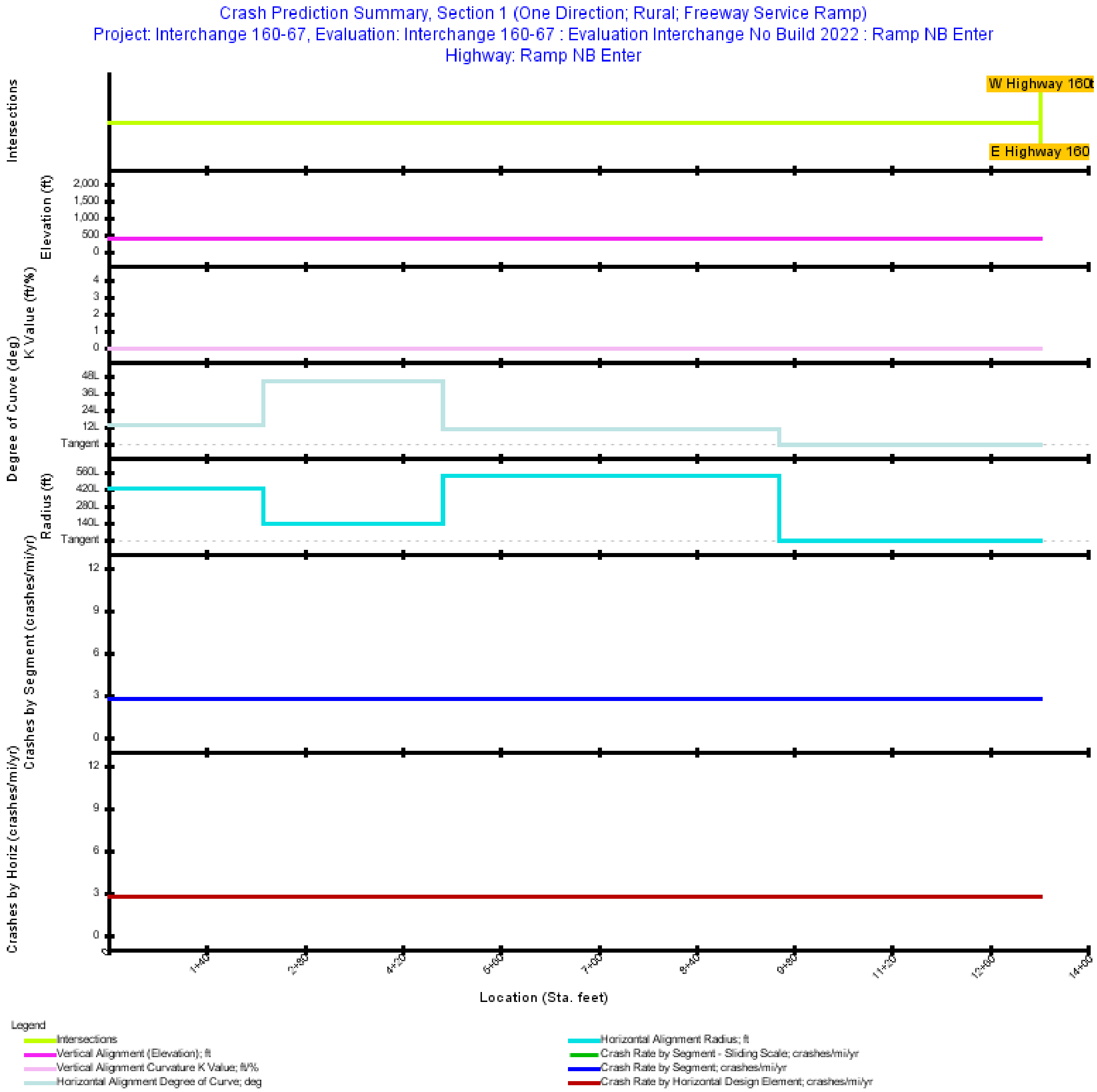

Figure 3. Crash Prediction Summary (Freeway Ramp Sections)

Table 21. Evaluation Freeway - Homogeneous Segments (Freeway Ramp Sections)

Seg. No.	Type	Area Type	Start Location (Sta. ft)	End Location (Sta. ft)	Length (ft)	Length (mi)	AADT
1	Freeway Ramp and C-D Road One-lane Ramp Entrance	Rural	0.000	13+32.250	1,332.25	0.2523	2022: 4,100

Table 22. Predicted Ramp Crash Rates and Frequencies Summary (Freeway Ramp Sections)

First Year of Analysis	**2022**
Last Year of Analysis	**2022**
Evaluated Length (mi)	**0.2523**
Average Future Road AADT (vpd)	**4,100**
Predicted Crashes	
Total Crashes	**0.69**
Fatal and Injury Crashes	**0.25**
Property-Damage-Only Crashes	**0.45**
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	**36**
Percent Property-Damage-Only Crashes (%)	**64**
Predicted Crash Rate	
Crash Rate (crashes/mi/yr)	**2.7413**
FI Crash Rate (crashes/mi/yr)	**0.9788**
PDO Crash Rate (crashes/mi/yr)	**1.7625**
Predicted Travel Crash Rate	
Total Travel (million veh-mi)	**0.38**
Travel Crash Rate (crashes/million veh-mi)	**1.83**
Travel FI Crash Rate (crashes/million veh-mi)	**0.65**
Travel PDO Crash Rate (crashes/million veh-mi)	**1.18**

Table 23. Predicted Crash Frequencies and Rates by Ramp Segment/Intersection (Freeway Ramp Sections)

Segment Number/Intersection Name/Cross Road	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
1	0.000	13+32.250	0.2523	0.692	0.6917	0.2470	0.4447	2.7413	1.83
Total			0.2523	0.692	0.6917	0.2470	0.4447	2.7413	

Table 24. Predicted Crash Frequencies and Rates by Horizontal Design Element (Freeway Ramp Sections)

Title	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
Simple Curve 1	0.000	2+21.030	0.0419	0.115	0.1148	0.0410	0.0738	2.7413	1.83
Simple Curve 2	2+21.030	4+78.670	0.0488	0.134	0.1338	0.0478	0.0860	2.7413	1.83
Simple Curve 3	4+78.670	9+57.980	0.0908	0.249	0.2488	0.0889	0.1600	2.7413	1.83
Tangent	9+57.980	13+32.250	0.0709	0.194	0.1943	0.0694	0.1249	2.7413	1.83

Table 25. Predicted Crash Frequencies by Year (Freeway Ramp Sections)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2022	0.69	0.25	35.706	0.45	64.294
Total	0.69	0.25	35.706	0.45	64.294
Average	0.69	0.25	35.706	0.45	64.294

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 26. Predicted Crash Severity by Ramp Segment (Freeway Ramp Sections)

Seg. No.	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)
1	0.0064	0.0195	0.1301	0.0909	0.4447

Table 27. Predicted Freeway Ramp Crash Type Distribution (Freeway Ramp Sections)

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Highway Segment	Collision with Animal	0.00	0.3	0.03	3.7	0.03	4.0
Highway Segment	Collision with Fixed Object	0.14	19.7	0.24	35.2	0.38	54.9
Highway Segment	Collision with Other Object	0.01	1.1	0.05	7.0	0.06	8.1
Highway Segment	Other Single-vehicle Collision	0.09	12.8	0.06	9.1	0.15	21.9
Highway Segment	Collision with Parked Vehicle	0.01	0.8	0.01	1.3	0.01	2.1
Highway Segment	Total Single Vehicle Crashes	0.24	34.8	0.39	56.3	0.63	91.1
Highway Segment	Right-Angle Collision	0.00	0.0	0.00	0.2	0.00	0.3
Highway Segment	Head-on Collision	0.00	0.0	0.00	0.0	0.00	0.0
Highway Segment	Other Multi-vehicle Collision	0.00	0.1	0.00	0.6	0.01	0.7
Highway Segment	Rear-end Collision	0.00	0.6	0.03	4.1	0.03	4.6
Highway Segment	Sideswipe, Same Direction Collision	0.00	0.2	0.02	3.0	0.02	3.2
Highway Segment	Total Multiple Vehicle Crashes	0.01	0.9	0.06	8.0	0.06	8.9
Highway Segment	Total Highway Segment Crashes	0.25	35.7	0.45	64.3	0.69	100.0
	Total Crashes	0.25	35.7	0.45	64.3	0.69	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Interchange 160-67 : Evaluation Interchange No Build 2022 : Ramp NB Exit Evaluation

Report Overview

Report Generated: Dec 11, 2020 5:18 PM
Report Template: System: Multi-Page [System] (mlcpm2, Nov 27, 2020 3:23 PM)

Evaluation Date: Thu Dec 10 19:22:18 CST 2020
IHSDM Version: v16.0.0 (Sep 30, 2020)
Crash Prediction Module: v11.0.0 (Sep 30, 2020)

User Name: mhuebbe
Organization Name: EFK Moen, LLC
Phone: 314-394-3133
E-Mail: mhuebbe@efkmoen.com

Project Title: Interchange 160-67
Project Comment: Created Thu Dec 10 08:43:05 CST 2020
Project Unit System: U.S. Customary

Highway Title: Ramp NB Exit
Highway Comment: Created Thu Dec 10 13:04:40 CST 2020
Highway Version: 1

Evaluation Title: Interchange 160-67 : Evaluation Interchange No Build 2022 : Ramp NB Exit
Evaluation Comment: Created Thu Dec 10 19:22:09 CST 2020

Minimum Location: 0.000
Maximum Location: 17+63.150
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: HSM Configuration
Crash Distribution: HSM Configuration
Model/CMF: HSM Configuration
First Year of Analysis: 2022
Last Year of Analysis: 2022
Empirical-Bayes Analysis: None
First Year of Observed Crashes:
Last Year of Observed Crashes:

Disclaimer Regarding Crash Prediction Method

IMPORTANT NOTICE ABOUT COMPARING RESULTS FROM HIGHWAY SAFETY MANUAL FIRST EDITION (2010) MODELS TO RESULTS FROM NEW MODELS DEVELOPED UNDER NCHRP PROJECTS 17-70 AND 17-58

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However, in the absence of local calibration factors (see HSM-1 Part C, Appendix A for guidance on calibration of the predictive models), it is neither appropriate nor advisable to directly compare the results from new models (from NCHRP Projects 17-58 and 17-70) to results from HSM-1 models, as the models were not calibrated to the same base state data sets, and consequently can produce unexpected results. If local calibration factors are available and applied to both new models and HSM-1 models, then it may be appropriate to directly compare the results.*[Note: Work being performed under NCHRP Project 17-72 (Update of Crash Modification Factors for the Highway Safety Manual) is expected to re-calibrate many of the old (HSM-1) and new (e.g., NCHRP 17-70) models to data from a single (or small number of) states, that would allow results from all models to be directly compared.]*

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Freeway Ramp Evaluation

Section: Section 1
Evaluation Start Location: 0.000
Evaluation End Location: 17+63.150
Functional Class: Freeway Service Ramp
Type of Alignment: One Direction
Model Category: Freeway Service Ramp

Calibration Factor: EX_RAMP_MV_FI=1.0; EX_RAMP_MV_PDO=1.0; EX_RAMP_SV_FI=1.0; EX_RAMP_SV_PDO=1.0;

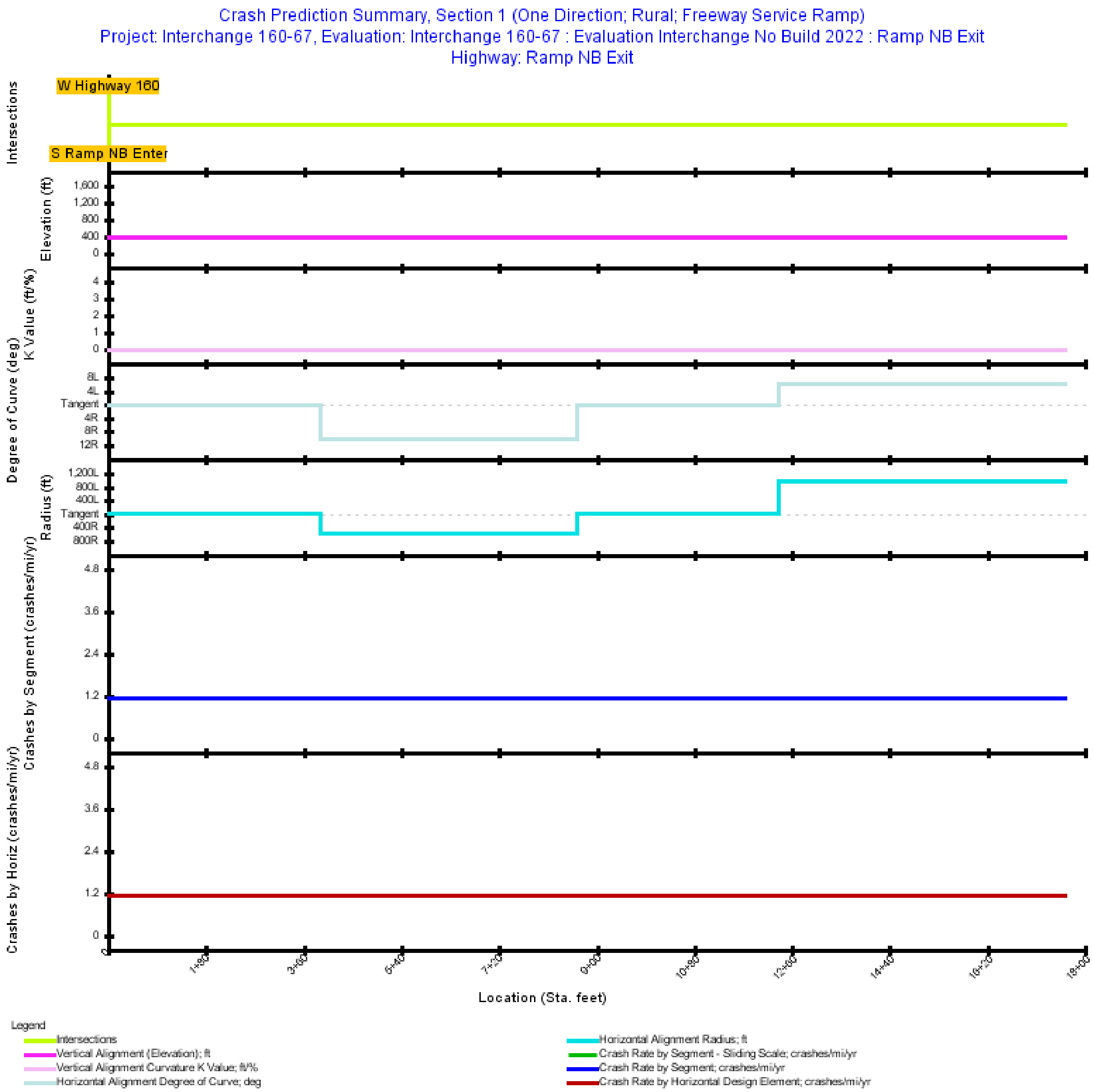

Figure 4. Crash Prediction Summary (Freeway Ramp Sections)

Table 28. Evaluation Freeway - Homogeneous Segments (Freeway Ramp Sections)

Seg. No.	Type	Area Type	Start Location (Sta. ft)	End Location (Sta. ft)	Length (ft)	Length (mi)	AADT
1	Freeway Ramp and C-D Road One-lane Ramp Exit	Rural	0.000	17+63.150	1,763.15	0.3339	2022: 2,600

Table 29. Predicted Ramp Crash Rates and Frequencies Summary (Freeway Ramp Sections)

First Year of Analysis	**2022**
Last Year of Analysis	**2022**
Evaluated Length (mi)	**0.3339**
Average Future Road AADT (vpd)	**2,600**
Predicted Crashes	
Total Crashes	**0.38**
Fatal and Injury Crashes	**0.18**
Property-Damage-Only Crashes	**0.20**
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	**46**
Percent Property-Damage-Only Crashes (%)	**54**
Predicted Crash Rate	
Crash Rate (crashes/mi/yr)	**1.1421**
FI Crash Rate (crashes/mi/yr)	**0.5293**
PDO Crash Rate (crashes/mi/yr)	**0.6128**
Predicted Travel Crash Rate	
Total Travel (million veh-mi)	**0.32**
Travel Crash Rate (crashes/million veh-mi)	**1.20**
Travel FI Crash Rate (crashes/million veh-mi)	**0.56**
Travel PDO Crash Rate (crashes/million veh-mi)	**0.65**

Table 30. Predicted Crash Frequencies and Rates by Ramp Segment/Intersection (Freeway Ramp Sections)

Segment Number/Intersection Name/Cross Road	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
1	0.000	17+63.150	0.3339	0.381	0.3814	0.1767	0.2046	1.1421	1.20
Total			0.3339	0.381	0.3814	0.1767	0.2046	1.1421	

Table 31. Predicted Crash Frequencies and Rates by Horizontal Design Element (Freeway Ramp Sections)

Title	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
Tangent	0.000	3+91.000	0.0741	0.085	0.0846	0.0392	0.0454	1.1421	1.20
Simple Curve 1	3+91.000	8+62.620	0.0893	0.102	0.1020	0.0473	0.0547	1.1421	1.20
Tangent	8+62.620	12+34.880	0.0705	0.081	0.0805	0.0373	0.0432	1.1421	1.20
Simple Curve 2	12+34.880	17+63.150	0.1001	0.114	0.1143	0.0530	0.0613	1.1421	1.20

Table 32. Predicted Crash Frequencies by Year (Freeway Ramp Sections)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2022	0.38	0.18	46.346	0.20	53.654
Total	0.38	0.18	46.346	0.20	53.654
Average	0.38	0.18	46.346	0.20	53.654

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 33. Predicted Crash Severity by Ramp Segment (Freeway Ramp Sections)

Seg. No.	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)
1	0.0068	0.0205	0.0890	0.0605	0.2046

Table 34. Predicted Freeway Ramp Crash Type Distribution (Freeway Ramp Sections)

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Highway Segment	Collision with Animal	0.00	0.5	0.01	3.3	0.01	3.8
Highway Segment	Collision with Fixed Object	0.10	26.1	0.12	31.8	0.22	57.9
Highway Segment	Collision with Other Object	0.01	1.4	0.02	6.4	0.03	7.8
Highway Segment	Other Single-vehicle Collision	0.07	17.0	0.03	8.2	0.10	25.2
Highway Segment	Collision with Parked Vehicle	0.00	1.1	0.00	1.2	0.01	2.3
Highway Segment	Total Single Vehicle Crashes	0.18	46.1	0.19	50.8	0.37	96.9
Highway Segment	Right-Angle Collision	0.00	0.0	0.00	0.1	0.00	0.1
Highway Segment	Head-on Collision	0.00	0.0	0.00	0.0	0.00	0.0
Highway Segment	Other Multi-vehicle Collision	0.00	0.0	0.00	0.2	0.00	0.2
Highway Segment	Rear-end Collision	0.00	0.2	0.01	1.4	0.01	1.6
Highway Segment	Sideswipe, Same Direction Collision	0.00	0.1	0.00	1.1	0.00	1.1
Highway Segment	Total Multiple Vehicle Crashes	0.00	0.3	0.01	2.8	0.01	3.1
Highway Segment	Total Highway Segment Crashes	0.18	46.3	0.20	53.7	0.38	100.0
	Total Crashes	0.18	46.3	0.20	53.7	0.38	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Interchange 160-67 : Evaluation Interchange No Build 2022 : RampTerminal NB Evaluation

Report Overview

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Evaluation Date: Thu Dec 10 19:22:29 CST 2020
IHSDM Version: v16.0.0 (Sep 30, 2020)
Crash Prediction Module: v11.0.0 (Sep 30, 2020)

User Name: mhuebbe
Organization Name: EFK Moen, LLC
Phone: 314-394-3133
E-Mail: mhuebbe@efkmoen.com

Project Title: Interchange 160-67
Project Comment: Created Thu Dec 10 08:43:05 CST 2020
Project Unit System: U.S. Customary

Intersection Title: RampTerminal NB
Intersection Comment: Created Thu Dec 10 13:23:03 CST 2020
Intersection Version: v1

Evaluation Title: Interchange 160-67 : Evaluation Interchange No Build 2022 : RampTerminal NB
Evaluation Comment: Created Thu Dec 10 19:22:23 CST 2020

Minimum Location: 534+24.000
Maximum Location: 596+34.000
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: HSM Configuration
Crash Distribution: HSM Configuration
Model/CMF: HSM Configuration
First Year of Analysis: 2022
Last Year of Analysis: 2022
Empirical-Bayes Analysis: None
First Year of Observed Crashes:
Last Year of Observed Crashes:

Disclaimer Regarding Crash Prediction Method

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However, in the absence of local calibration factors (see HSM-1 Part C, Appendix A for guidance on calibration of the predictive models), it is neither appropriate nor advisable to directly compare the results from new models (from NCHRP Projects 17-58 and 17-70) to results from HSM-1 models, as the models were not calibrated to the same base state data sets, and consequently can produce unexpected results. If local calibration factors are available and applied to both new models and HSM-1 models, then it may be appropriate to directly compare the results.*[Note: Work being performed under NCHRP Project 17-72 (Update of Crash Modification Factors for the Highway Safety Manual) is expected to re-calibrate many of the old (HSM-1) and new (e.g., NCHRP 17-70) models to data from a single (or small number of) states, that would allow results from all models to be directly compared.]*

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The HSM-1 interim method previously included in IHSDM for evaluating roundabouts on urban/suburban arterials (i.e., evaluating an existing intersection and then applying a Crash Modification Factor for replacing the existing intersection with a roundabout) has been deactivated in IHSDM, to minimize any confusion with the new roundabout methodology.

RampTerminal NB Evaluation

Intersection: RampTerminal NB
Evaluation Start Location: 534+24.000
Evaluation End Location: 596+34.000
Calibration Factor: RT_ST_FI=1.0; RT_ST_PDO=1.0;

Table 35. Evaluation Ramp Terminal - Site (RampTerminal NB)

Inter. No.	Title	Type	Area Type	Legs	Location (Sta. ft)	Traffic Control	AADT
1	RampTerminal NB (v1)	Freeway Ramp Terminal A2 - Three-Leg at Two-Quadrant Parclo A	Rural	4	572+50.000	Stop-Controlled	Inside: 2022: 7,100; Outside: 2022: 7,100 :: Entrance: 2022: 2,600; Exit: 2022: 4,100

Table 36. Predicted Ramp Terminal Crash Rates and Frequencies Summary (RampTerminal NB)

First Year of Analysis	2022
Last Year of Analysis	2022
Predicted Crashes	
Total Crashes	2.07
Fatal and Injury Crashes	0.93
Property-Damage-Only Crashes	1.14
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	45
Percent Property-Damage-Only Crashes (%)	55

Table 37. Predicted Crash Frequencies and Rates by Ramp Terminal (RampTerminal NB)

Segment Number/Intersection Name/Cross Road	Location (Sta. ft)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Travel Crash Rate (crashes/million veh)
RampTerminal NB (v1)	572+50.000	2.069	2.0691	0.9301	1.1391	0.54

Table 38. Predicted Crash Frequencies by Year (RampTerminal NB)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2022	2.07	0.93	44.949	1.14	55.051
Total	2.07	0.93	44.949	1.14	55.051
Average	2.07	0.93	44.949	1.14	55.051

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 39. Predicted Crash Severity by Ramp Terminal (RampTerminal NB)

Seg. No.	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)
1	0.0110	0.0578	0.1911	0.6702	1.1391

Table 40. Predicted Ramp Terminal Crash Type Distribution (RampTerminal NB)

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Ramp Terminal	Collision with Animal	0.00	0.0	0.00	0.0	0.00	0.0
Ramp Terminal	Collision with Fixed Object	0.07	3.5	0.18	8.7	0.25	12.2
Ramp Terminal	Collision with Other Object	0.00	0.0	0.01	0.3	0.01	0.3
Ramp Terminal	Other Single-vehicle Collision	0.06	2.9	0.03	1.4	0.09	4.4
Ramp Terminal	Collision with Parked Vehicle	0.01	0.3	0.02	0.8	0.02	1.1
Ramp Terminal	Total Single Vehicle Crashes	0.14	6.7	0.23	11.2	0.37	18.0
Ramp Terminal	Right-Angle Collision	0.48	23.5	0.42	20.5	0.91	43.9
Ramp Terminal	Head-on Collision	0.02	0.9	0.02	0.8	0.04	1.7
Ramp Terminal	Other Multi-vehicle Collision	0.01	0.6	0.03	1.4	0.04	2.0
Ramp Terminal	Rear-end Collision	0.26	12.4	0.31	15.2	0.57	27.6
Ramp Terminal	Sideswipe, Same Direction Collision	0.02	0.9	0.12	5.9	0.14	6.8
Ramp Terminal	Total Multiple Vehicle Crashes	0.79	38.2	0.91	43.8	1.70	82.0
Ramp Terminal	Total Ramp Terminal Crashes	0.93	44.9	1.14	55.1	2.07	100.0
	Total Crashes	0.93	44.9	1.14	55.1	2.07	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Interactive Highway Safety Design Model

Crash Prediction Evaluation Report

67-160 Interchange

No-build 2042

December 11, 2020

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Combined Report

Combined Report Overview

Report Generated: Dec 11, 2020 5:21 PM
Report Template: System: Multi-Page [System] (mlcpm2, Nov 27, 2020 3:23 PM)

Evaluation Title: Evaluation Interchange No Build 2042
Evaluation Comment: Created Thu Dec 10 19:34:50 CST 2020
Evaluation Date: Thu Dec 10 19:37:58 CST 2020

User Name: mhuebbe
Organization Name: EFK Moen, LLC
Phone: 314-394-3133
E-Mail: mhuebbe@efkmoen.com

Project Title: Project 67
Project Comment: Created Wed Dec 09 16:11:58 CST 2020
Project Unit System: U.S. Customary

Interchange Title: Interchange 160-67
Interchange Comment: Created Thu Dec 10 08:43:05 CST 2020

Report Overview

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Section Types

Interchange 160-67 : Evaluation Interchange No Build 2042 : Ramp SB Enter Evaluation

Report Overview

Report Generated: Dec 11, 2020 5:21 PM
Report Template: System: Multi-Page [System] (mlcpm2, Nov 27, 2020 3:23 PM)

Evaluation Date: Thu Dec 10 19:35:19 CST 2020
IHSDM Version: v16.0.0 (Sep 30, 2020)
Crash Prediction Module: v11.0.0 (Sep 30, 2020)

User Name: mhuebbe
Organization Name: EFK Moen, LLC
Phone: 314-394-3133
E-Mail: mhuebbe@efkmoen.com

Project Title: Interchange 160-67
Project Comment: Created Thu Dec 10 08:43:05 CST 2020
Project Unit System: U.S. Customary

Highway Title: Ramp SB Enter
Highway Comment: Created Thu Dec 10 11:12:22 CST 2020
Highway Version: 1

Evaluation Title: Interchange 160-67 : Evaluation Interchange No Build 2042 : Ramp SB Enter
Evaluation Comment: Created Thu Dec 10 19:35:10 CST 2020

Minimum Location: 0.000
Maximum Location: 13+31.900
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: HSM Configuration
Crash Distribution: HSM Configuration
Model/CMF: HSM Configuration
First Year of Analysis: 2042
Last Year of Analysis: 2042
Empirical-Bayes Analysis: None
First Year of Observed Crashes:
Last Year of Observed Crashes:

Disclaimer Regarding Crash Prediction Method

IMPORTANT NOTICE ABOUT COMPARING RESULTS FROM HIGHWAY SAFETY MANUAL FIRST EDITION (2010) MODELS TO RESULTS FROM NEW MODELS DEVELOPED UNDER NCHRP PROJECTS 17-70 AND 17-58

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- Roundabouts: completed in 2018 under NCHRP Project 17-70, the new methods will provide improved outcomes for the safety analysis of roundabouts.
- 6+ lane and one-way urban/suburban arterials (including models for segments and intersections): completed under NCHRP Project 17-58.

However, in the absence of local calibration factors (see HSM-1 Part C, Appendix A for guidance on calibration of the predictive models), it is neither appropriate nor advisable to directly compare the results from new models (from NCHRP Projects 17-58 and 17-70) to results from HSM-1 models, as the models were not calibrated to the same base state data sets, and consequently can produce unexpected results. If local calibration factors are available and applied to both new models and HSM-1 models, then it may be appropriate to directly compare the results.*[Note: Work being performed under NCHRP Project 17-72 (Update of Crash Modification Factors for the Highway Safety Manual) is expected to re-calibrate many of the old (HSM-1) and new (e.g., NCHRP 17-70) models to data from a single (or small number of) states, that would allow results from all models to be directly compared.]*

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Freeway Ramp Evaluation

Section: Section 1
Evaluation Start Location: 0.000
Evaluation End Location: 13+31.900
Functional Class: Freeway Service Ramp
Type of Alignment: One Direction
Model Category: Freeway Service Ramp

Calibration Factor: ENT_RAMP_MV_FI=1.0; ENT_RAMP_MV_PDO=1.0; ENT_RAMP_SV_FI=1.0; ENT_RAMP_SV_PDO=1.0;

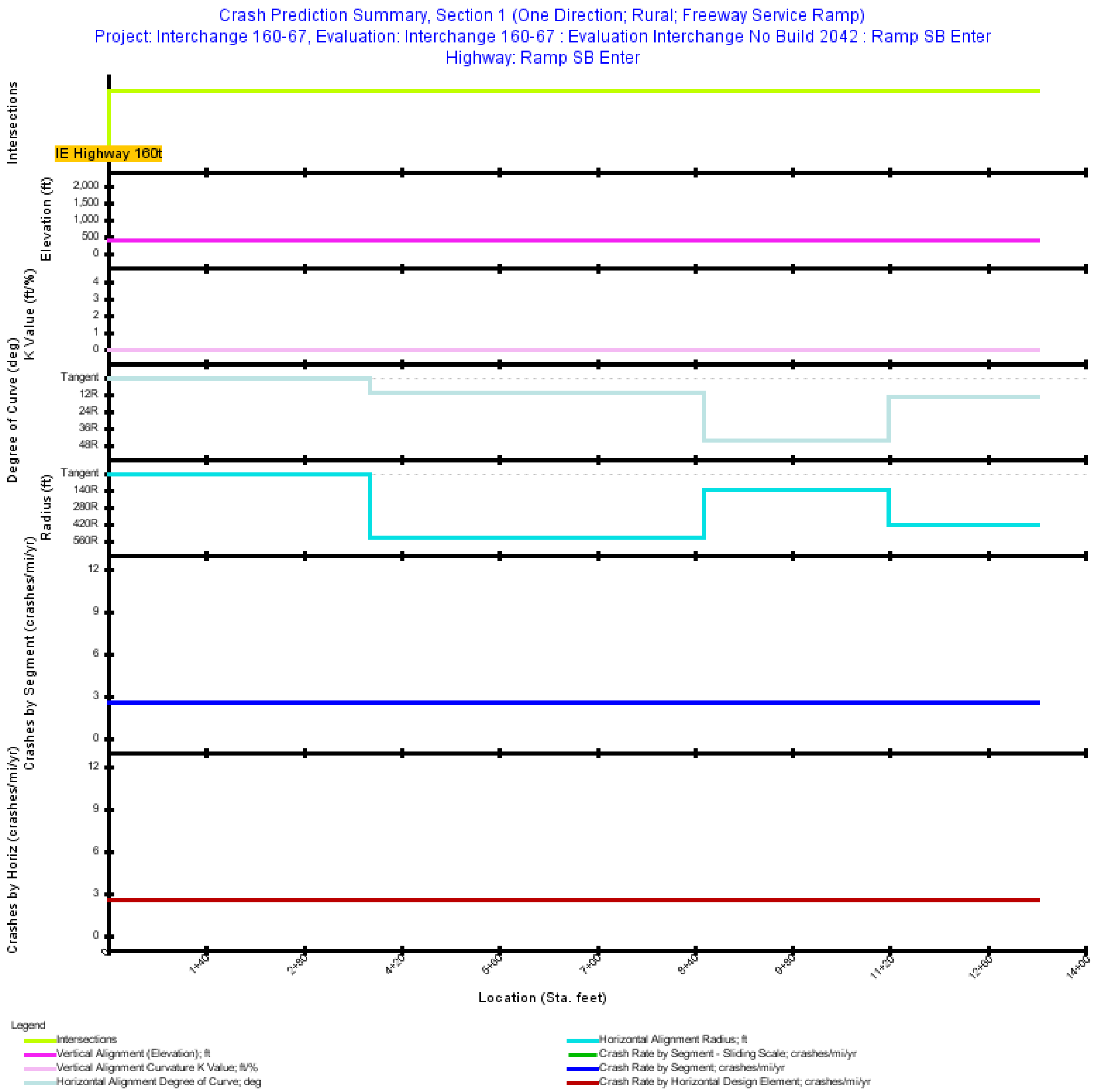

Figure 1. Crash Prediction Summary (Freeway Ramp Sections)

Table 1. Evaluation Freeway - Homogeneous Segments (Freeway Ramp Sections)

Seg. No.	Type	Area Type	Start Location (Sta. ft)	End Location (Sta. ft)	Length (ft)	Length (mi)	AADT
1	Freeway Ramp and C-D Road One-lane Ramp Entrance	Rural	0.000	13+31.900	1,331.90	0.2523	2042: 3,600

Table 2. Predicted Ramp Crash Rates and Frequencies Summary (Freeway Ramp Sections)

First Year of Analysis	**2042**
Last Year of Analysis	**2042**
Evaluated Length (mi)	**0.2523**
Average Future Road AADT (vpd)	**3,600**
Predicted Crashes	
Total Crashes	**0.64**
Fatal and Injury Crashes	**0.23**
Property-Damage-Only Crashes	**0.41**
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	**36**
Percent Property-Damage-Only Crashes (%)	**64**
Predicted Crash Rate	
Crash Rate (crashes/mi/yr)	**2.5188**
FI Crash Rate (crashes/mi/yr)	**0.9022**
PDO Crash Rate (crashes/mi/yr)	**1.6166**
Predicted Travel Crash Rate	
Total Travel (million veh-mi)	**0.33**
Travel Crash Rate (crashes/million veh-mi)	**1.92**
Travel FI Crash Rate (crashes/million veh-mi)	**0.69**
Travel PDO Crash Rate (crashes/million veh-mi)	**1.23**

Table 3. Predicted Crash Frequencies and Rates by Ramp Segment/Intersection (Freeway Ramp Sections)

Segment Number/Intersection Name/Cross Road	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
1	0.000	13+31.900	0.2523	0.635	0.6354	0.2276	0.4078	2.5188	1.92
Total			0.2523	0.635	0.6354	0.2276	0.4078	2.5188	

Table 4. Predicted Crash Frequencies and Rates by Horizontal Design Element (Freeway Ramp Sections)

Title	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
Tangent	0.000	3+74.260	0.0709	0.178	0.1785	0.0640	0.1146	2.5188	1.92
Simple Curve 1	3+74.260	8+53.580	0.0908	0.229	0.2287	0.0819	0.1468	2.5188	1.92
Simple Curve 2	8+53.580	11+18.810	0.0502	0.127	0.1265	0.0453	0.0812	2.5188	1.92
Simple Curve 3	11+18.810	13+31.900	0.0404	0.102	0.1017	0.0364	0.0652	2.5188	1.92

Table 5. Predicted Crash Frequencies by Year (Freeway Ramp Sections)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2042	0.64	0.23	35.820	0.41	64.180
Total	0.64	0.23	35.820	0.41	64.180
Average	0.64	0.23	35.820	0.41	64.180

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 6. Predicted Crash Severity by Ramp Segment (Freeway Ramp Sections)

Seg. No.	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)
1	0.0059	0.0180	0.1197	0.0840	0.4078

Table 7. Predicted Freeway Ramp Crash Type Distribution (Freeway Ramp Sections)

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Highway Segment	Collision with Animal	0.00	0.3	0.02	3.7	0.03	4.0
Highway Segment	Collision with Fixed Object	0.13	19.8	0.23	35.5	0.35	55.3
Highway Segment	Collision with Other Object	0.01	1.1	0.04	7.1	0.05	8.2
Highway Segment	Other Single-vehicle Collision	0.08	12.9	0.06	9.2	0.14	22.1
Highway Segment	Collision with Parked Vehicle	0.01	0.8	0.01	1.3	0.01	2.1
Highway Segment	Total Single Vehicle Crashes	0.22	34.9	0.36	56.8	0.58	91.7
Highway Segment	Right-Angle Collision	0.00	0.0	0.00	0.2	0.00	0.3
Highway Segment	Head-on Collision	0.00	0.0	0.00	0.0	0.00	0.0
Highway Segment	Other Multi-vehicle Collision	0.00	0.1	0.00	0.6	0.00	0.6
Highway Segment	Rear-end Collision	0.00	0.6	0.02	3.8	0.03	4.3
Highway Segment	Sideswipe, Same Direction Collision	0.00	0.2	0.02	2.8	0.02	3.0
Highway Segment	Total Multiple Vehicle Crashes	0.01	0.9	0.05	7.4	0.05	8.3
Highway Segment	Total Highway Segment Crashes	0.23	35.8	0.41	64.2	0.64	100.0
	Total Crashes	0.23	35.8	0.41	64.2	0.64	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Interchange 160-67 : Evaluation Interchange No Build 2042 : Ramp SB Exit Evaluation

Report Overview

Report Generated: Dec 11, 2020 5:21 PM
Report Template: System: Multi-Page [System] (mlcpm2, Nov 27, 2020 3:23 PM)

Evaluation Date: Thu Dec 10 19:35:32 CST 2020
IHSDM Version: v16.0.0 (Sep 30, 2020)
Crash Prediction Module: v11.0.0 (Sep 30, 2020)

User Name: mhuebbe
Organization Name: EFK Moen, LLC
Phone: 314-394-3133
E-Mail: mhuebbe@efkmoen.com

Project Title: Interchange 160-67
Project Comment: Created Thu Dec 10 08:43:05 CST 2020
Project Unit System: U.S. Customary

Highway Title: Ramp SB Exit
Highway Comment: Created Thu Dec 10 11:42:40 CST 2020
Highway Version: 1

Evaluation Title: Interchange 160-67 : Evaluation Interchange No Build 2042 : Ramp SB Exit
Evaluation Comment: Created Thu Dec 10 19:35:24 CST 2020

Minimum Location: 0.000
Maximum Location: 17+62.820
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: HSM Configuration
Crash Distribution: HSM Configuration
Model/CMF: HSM Configuration
First Year of Analysis: 2042
Last Year of Analysis: 2042
Empirical-Bayes Analysis: None
First Year of Observed Crashes:
Last Year of Observed Crashes:

Disclaimer Regarding Crash Prediction Method

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Freeway Ramp Evaluation

Section: Section 1
Evaluation Start Location: 0.000
Evaluation End Location: 17+62.820
Functional Class: Freeway Service Ramp
Type of Alignment: One Direction
Model Category: Freeway Service Ramp

Calibration Factor: EX_RAMP_MV_FI=1.0; EX_RAMP_MV_PDO=1.0; EX_RAMP_SV_FI=1.0; EX_RAMP_SV_PDO=1.0;

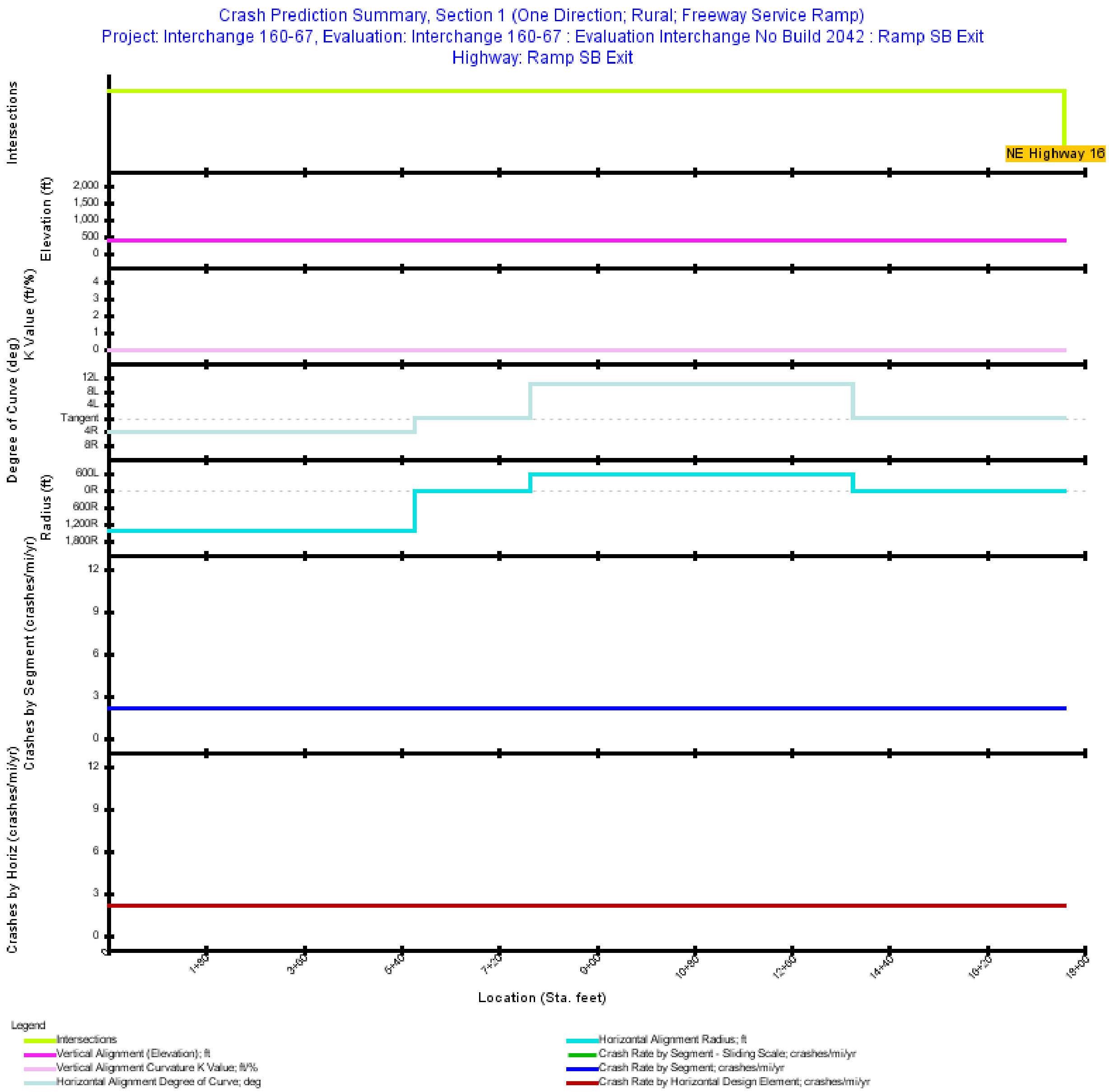

Figure 2. Crash Prediction Summary (Freeway Ramp Sections)

Table 8. Evaluation Freeway - Homogeneous Segments (Freeway Ramp Sections)

Seg. No.	Type	Area Type	Start Location (Sta. ft)	End Location (Sta. ft)	Length (ft)	Length (mi)	AADT
1	Freeway Ramp and C-D Road One-lane Ramp Exit	Rural	0.000	17+62.820	1,762.82	0.3339	2042: 7,200

Table 9. Predicted Ramp Crash Rates and Frequencies Summary (Freeway Ramp Sections)

First Year of Analysis	**2042**
Last Year of Analysis	**2042**
Evaluated Length (mi)	**0.3339**
Average Future Road AADT (vpd)	**7,200**
Predicted Crashes	
Total Crashes	**0.73**
Fatal and Injury Crashes	**0.30**
Property-Damage-Only Crashes	**0.43**
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	**42**
Percent Property-Damage-Only Crashes (%)	**58**
Predicted Crash Rate	
Crash Rate (crashes/mi/yr)	**2.1964**
FI Crash Rate (crashes/mi/yr)	**0.9122**
PDO Crash Rate (crashes/mi/yr)	**1.2842**
Predicted Travel Crash Rate	
Total Travel (million veh-mi)	**0.88**
Travel Crash Rate (crashes/million veh-mi)	**0.84**
Travel FI Crash Rate (crashes/million veh-mi)	**0.35**
Travel PDO Crash Rate (crashes/million veh-mi)	**0.49**

Table 10. Predicted Crash Frequencies and Rates by Ramp Segment/Intersection (Freeway Ramp Sections)

Segment Number/Intersection Name/Cross Road	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
1	0.000	17+62.820	0.3339	0.733	0.7333	0.3046	0.4287	2.1964	0.84
Total			0.3339	0.733	0.7333	0.3046	0.4287	2.1964	

Table 11. Predicted Crash Frequencies and Rates by Horizontal Design Element (Freeway Ramp Sections)

Title	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
Simple Curve 1	0.000	5+64.230	0.1069	0.235	0.2347	0.0975	0.1372	2.1964	0.84
Tangent	5+64.230	7+78.690	0.0406	0.089	0.0892	0.0371	0.0522	2.1964	0.84
Simple Curve 2	7+78.690	13+71.820	0.1123	0.247	0.2467	0.1025	0.1443	2.1964	0.84
Tangent	13+71.820	17+62.820	0.0741	0.163	0.1626	0.0676	0.0951	2.1964	0.84

Table 12. Predicted Crash Frequencies by Year (Freeway Ramp Sections)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2042	0.73	0.30	41.532	0.43	58.468
Total	0.73	0.30	41.532	0.43	58.468
Average	0.73	0.30	41.532	0.43	58.468

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 13. Predicted Crash Severity by Ramp Segment (Freeway Ramp Sections)

Seg. No.	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)
1	0.0117	0.0355	0.1538	0.1035	0.4287

Table 14. Predicted Freeway Ramp Crash Type Distribution (Freeway Ramp Sections)

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Highway Segment	Collision with Animal	0.00	0.4	0.03	3.5	0.03	3.9
Highway Segment	Collision with Fixed Object	0.17	23.4	0.24	33.3	0.41	56.6
Highway Segment	Collision with Other Object	0.01	1.3	0.05	6.7	0.06	7.9
Highway Segment	Other Single-vehicle Collision	0.11	15.2	0.06	8.6	0.17	23.8
Highway Segment	Collision with Parked Vehicle	0.01	1.0	0.01	1.2	0.02	2.2
Highway Segment	Total Single Vehicle Crashes	0.30	41.2	0.39	53.2	0.69	94.5
Highway Segment	Right-Angle Collision	0.00	0.0	0.00	0.2	0.00	0.2
Highway Segment	Head-on Collision	0.00	0.0	0.00	0.0	0.00	0.0
Highway Segment	Other Multi-vehicle Collision	0.00	0.0	0.00	0.4	0.00	0.4
Highway Segment	Rear-end Collision	0.00	0.2	0.02	2.7	0.02	2.8
Highway Segment	Sideswipe, Same Direction Collision	0.00	0.1	0.01	2.0	0.01	2.1
Highway Segment	Total Multiple Vehicle Crashes	0.00	0.3	0.04	5.3	0.04	5.5
Highway Segment	Total Highway Segment Crashes	0.30	41.5	0.43	58.5	0.73	100.0
	Total Crashes	0.30	41.5	0.43	58.5	0.73	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 15. Evaluation Message

Start Location (Sta. ft)	End Location (Sta. ft)	Message
0.000	17+62.820	for segment #1 (0.000 to 17+62.820), traffic volume (7,200 vpd) for 2042 is not within the model limit (7,000 vpd) for reliable results for segment type 1EX

Interchange 160-67 : Evaluation Interchange No Build 2042 : RampTerminal 160 SB Evaluation

Report Overview

Report Generated: Dec 11, 2020 5:21 PM
Report Template: System: Multi-Page [System] (mlcpm2, Nov 27, 2020 3:23 PM)

Evaluation Date: Thu Dec 10 19:35:44 CST 2020
IHSDM Version: v16.0.0 (Sep 30, 2020)
Crash Prediction Module: v11.0.0 (Sep 30, 2020)

User Name: mhuebbe
Organization Name: EFK Moen, LLC
Phone: 314-394-3133
E-Mail: mhuebbe@efkmoen.com

Project Title: Interchange 160-67
Project Comment: Created Thu Dec 10 08:43:05 CST 2020
Project Unit System: U.S. Customary

Intersection Title: RampTerminal 160 SB
Intersection Comment: Created Thu Dec 10 12:35:13 CST 2020
Intersection Version: v1

Evaluation Title: Interchange 160-67 : Evaluation Interchange No Build 2042 : RampTerminal 160 SB
Evaluation Comment: Created Thu Dec 10 19:35:38 CST 2020

Minimum Location: 534+24.000
Maximum Location: 596+34.000
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: HSM Configuration

Crash Distribution: HSM Configuration
Model/CMF: HSM Configuration
First Year of Analysis: 2042
Last Year of Analysis: 2042
Empirical-Bayes Analysis: None
First Year of Observed Crashes:
Last Year of Observed Crashes:

Disclaimer Regarding Crash Prediction Method

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However, in the absence of local calibration factors (see HSM-1 Part C, Appendix A for guidance on calibration of the predictive models), it is neither appropriate nor advisable to directly compare the results from new models (from NCHRP Projects 17-58 and 17-70) to results from HSM-1 models, as the models were not calibrated to the same base state data sets, and consequently can produce unexpected results. If local calibration factors are available and applied to both new models and HSM-1 models, then it may be appropriate to directly compare the results.*[Note: Work being performed under NCHRP Project 17-72 (Update of Crash Modification Factors for the Highway Safety Manual) is expected to re-calibrate many of the old (HSM-1) and new (e.g., NCHRP 17-70) models to data from a single (or small number of) states, that would allow results from all models to be directly compared.]*

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RampTerminal 160 SB Evaluation

Intersection: RampTerminal 160 SB
Evaluation Start Location: 534+24.000
Evaluation End Location: 596+34.000
Calibration Factor: RT_ST_FI=1.0; RT_ST_PDO=1.0;

Table 16. Evaluation Ramp Terminal - Site (RampTerminal 160 SB)

Inter. No.	Title	Type	Area Type	Legs	Location (Sta. ft)	Traffic Control	AADT
1	RampTerminal 160 SB (v1)	Freeway Ramp Terminal A2 - Three-Leg at Two-Quadrant Parclo A	Rural	4	580+00.000	Stop-Controlled	Inside: 2042: 8,800; Outside: 2042: 8,800 :: Entrance: 2042: 3,600; Exit: 2042: 7,200

Table 17. Predicted Ramp Terminal Crash Rates and Frequencies Summary (RampTerminal 160 SB)

First Year of Analysis	**2042**
Last Year of Analysis	**2042**
Predicted Crashes	
Total Crashes	**7.33**
Fatal and Injury Crashes	**5.29**
Property-Damage-Only Crashes	**2.04**
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	**72**
Percent Property-Damage-Only Crashes (%)	**28**

Table 18. Predicted Crash Frequencies and Rates by Ramp Terminal (RampTerminal 160 SB)

Segment Number/Intersection Name/Cross Road	Location (Sta. ft)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Travel Crash Rate (crashes/million veh)
RampTerminal 160 SB (v1)	580+00.000	7.332	7.3319	5.2870	2.0449	1.41

Table 19. Predicted Crash Frequencies by Year (RampTerminal 160 SB)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2042	7.33	5.29	72.110	2.04	27.890
Total	7.33	5.29	72.110	2.04	27.890
Average	7.33	5.29	72.110	2.04	27.890

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 20. Predicted Crash Severity by Ramp Terminal (RampTerminal 160 SB)

Seg. No.	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)
1	0.0625	0.3283	1.0861	3.8100	2.0449

Table 21. Predicted Ramp Terminal Crash Type Distribution (RampTerminal 160 SB)

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Ramp Terminal	Collision with Animal	0.00	0.0	0.00	0.0	0.00	0.0
Ramp Terminal	Collision with Fixed Object	0.41	5.6	0.32	4.4	0.73	10.0
Ramp Terminal	Collision with Other Object	0.00	0.0	0.01	0.1	0.01	0.1
Ramp Terminal	Other Single-vehicle Collision	0.34	4.7	0.05	0.7	0.40	5.4
Ramp Terminal	Collision with Parked Vehicle	0.04	0.5	0.03	0.4	0.07	0.9
Ramp Terminal	Total Single Vehicle Crashes	0.79	10.8	0.42	5.7	1.21	16.5
Ramp Terminal	Right-Angle Collision	2.76	37.6	0.76	10.4	3.52	48.0
Ramp Terminal	Head-on Collision	0.11	1.4	0.03	0.4	0.14	1.9
Ramp Terminal	Other Multi-vehicle Collision	0.07	0.9	0.05	0.7	0.12	1.7
Ramp Terminal	Rear-end Collision	1.45	19.8	0.56	7.7	2.02	27.5
Ramp Terminal	Sideswipe, Same Direction Collision	0.11	1.4	0.22	3.0	0.33	4.4
Ramp Terminal	Total Multiple Vehicle Crashes	4.49	61.3	1.63	22.2	6.12	83.5
Ramp Terminal	Total Ramp Terminal Crashes	5.29	72.1	2.04	27.9	7.33	100.0
	Total Crashes	5.29	72.1	2.04	27.9	7.33	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Interchange 160-67 : Evaluation Interchange No Build 2042 : Ramp NB Enter Evaluation

Report Overview

Report Generated: Dec 11, 2020 5:21 PM
Report Template: System: Multi-Page [System] (mlcpm2, Nov 27, 2020 3:23 PM)

Evaluation Date: Thu Dec 10 19:35:58 CST 2020
IHSDM Version: v16.0.0 (Sep 30, 2020)
Crash Prediction Module: v11.0.0 (Sep 30, 2020)

User Name: mhuebbe
Organization Name: EFK Moen, LLC
Phone: 314-394-3133
E-Mail: mhuebbe@efkmoen.com

Project Title: Interchange 160-67
Project Comment: Created Thu Dec 10 08:43:05 CST 2020
Project Unit System: U.S. Customary

Highway Title: Ramp NB Enter
Highway Comment: Created Thu Dec 10 12:44:09 CST 2020
Highway Version: 1

Evaluation Title: Interchange 160-67 : Evaluation Interchange No Build 2042 : Ramp NB Enter
Evaluation Comment: Created Thu Dec 10 19:35:49 CST 2020

Minimum Location: 0.000
Maximum Location: 13+32.250
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: HSM Configuration
Crash Distribution: HSM Configuration
Model/CMF: HSM Configuration
First Year of Analysis: 2042
Last Year of Analysis: 2042
Empirical-Bayes Analysis: None
First Year of Observed Crashes:
Last Year of Observed Crashes:

Disclaimer Regarding Crash Prediction Method

IMPORTANT NOTICE ABOUT COMPARING RESULTS FROM HIGHWAY SAFETY MANUAL FIRST EDITION (2010) MODELS TO RESULTS FROM NEW MODELS DEVELOPED UNDER NCHRP PROJECTS 17-70 AND 17-58

Since the publication of the Highway Safety Manual - First Edition (HSM-1), in 2010 by the American Association of State Highway and Transportation Officials (AASHTO), multiple research efforts have been undertaken through the National Cooperative Highway Research Program (NCHRP) to develop safety performance models for road segment and intersection facility types that were not initially reflected in the HSM-1, in order to expand the breadth and depth of the HSM in the future.

The IHSDM Crash Prediction Module (CPM) is intended as a faithful implementation of HSM Part C predictive methods. As NCHRP projects to develop new predictive methods for the HSM are completed, FHWA works to incorporate the new methods into IHSDM, sometimes in advance of publication in the HSM. The following new crash predictive methods have been accepted by NCHRP project panels and incorporated into IHSDM, while pending AASHTO's approval for incorporation into a future edition of the HSM:

- Roundabouts: completed in 2018 under NCHRP Project 17-70, the new methods will provide improved outcomes for the safety analysis of roundabouts.
- 6+ lane and one-way urban/suburban arterials (including models for segments and intersections): completed under NCHRP

Project 17-58.

However, in the absence of local calibration factors (see HSM-1 Part C, Appendix A for guidance on calibration of the predictive models), it is neither appropriate nor advisable to directly compare the results from new models (from NCHRP Projects 17-58 and 17-70) to results from HSM-1 models, as the models were not calibrated to the same base state data sets, and consequently can produce unexpected results. If local calibration factors are available and applied to both new models and HSM-1 models, then it may be appropriate to directly compare the results.*[Note: Work being performed under NCHRP Project 17-72 (Update of Crash Modification Factors for the Highway Safety Manual) is expected to re-calibrate many of the old (HSM-1) and new (e.g., NCHRP 17-70) models to data from a single (or small number of) states, that would allow results from all models to be directly compared.]*

The models produced for NCHRP Project 17-70 have independent value in terms of informing the design of a roundabout and assessing the effects of different design characteristics on the expected safety performance of a roundabout.

The HSM-1 interim method previously included in IHSDM for evaluating roundabouts on urban/suburban arterials (i.e., evaluating an existing intersection and then applying a Crash Modification Factor for replacing the existing intersection with a roundabout) has been deactivated in IHSDM, to minimize any confusion with the new roundabout methodology.

Freeway Ramp Evaluation

Section: Section 1
Evaluation Start Location: 0.000
Evaluation End Location: 13+32.250
Functional Class: Freeway Service Ramp
Type of Alignment: One Direction
Model Category: Freeway Service Ramp
Calibration Factor: ENT_RAMP_MV_FI=1.0; ENT_RAMP_MV_PDO=1.0; ENT_RAMP_SV_FI=1.0; ENT_RAMP_SV_PDO=1.0;

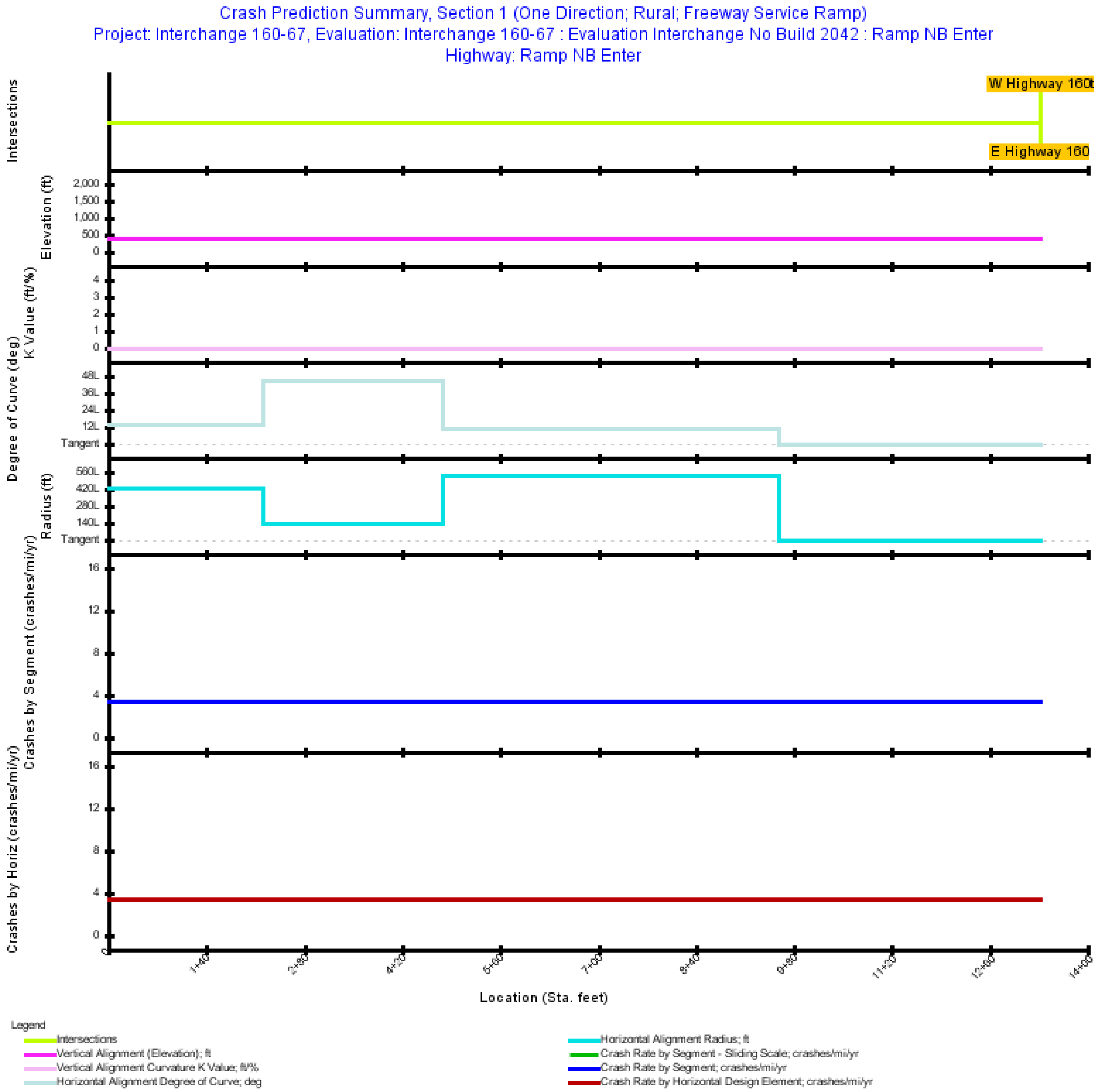

Figure 3. Crash Prediction Summary (Freeway Ramp Sections)

Table 22. Evaluation Freeway - Homogeneous Segments (Freeway Ramp Sections)

Seg. No.	Type	Area Type	Start Location (Sta. ft)	End Location (Sta. ft)	Length (ft)	Length (mi)	AADT
1	Freeway Ramp and C-D Road One-lane Ramp Entrance	Rural	0.000	13+32.250	1,332.25	0.2523	2042: 5,400

Table 23. Predicted Ramp Crash Rates and Frequencies Summary (Freeway Ramp Sections)

First Year of Analysis	2042
Last Year of Analysis	2042
Evaluated Length (mi)	0.2523
Average Future Road AADT (vpd)	5,400
Predicted Crashes	
Total Crashes	0.85
Fatal and Injury Crashes	0.30
Property-Damage-Only Crashes	0.55
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	35
Percent Property-Damage-Only Crashes (%)	65
Predicted Crash Rate	
Crash Rate (crashes/mi/yr)	3.3694
FI Crash Rate (crashes/mi/yr)	1.1940
PDO Crash Rate (crashes/mi/yr)	2.1754
Predicted Travel Crash Rate	
Total Travel (million veh-mi)	0.50
Travel Crash Rate (crashes/million veh-mi)	1.71
Travel FI Crash Rate (crashes/million veh-mi)	0.61
Travel PDO Crash Rate (crashes/million veh-mi)	1.10

Table 24. Predicted Crash Frequencies and Rates by Ramp Segment/Intersection (Freeway Ramp Sections)

Segment Number/Intersection Name/Cross Road	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
1	0.000	13+32.250	0.2523	0.850	0.8502	0.3013	0.5489	3.3694	1.71
Total			0.2523	0.850	0.8502	0.3013	0.5489	3.3694	

Table 25. Predicted Crash Frequencies and Rates by Horizontal Design Element (Freeway Ramp Sections)

Title	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
Simple Curve 1	0.000	2+21.030	0.0419	0.141	0.1410	0.0500	0.0911	3.3694	1.71
Simple Curve 2	2+21.030	4+78.670	0.0488	0.164	0.1644	0.0583	0.1062	3.3694	1.71
Simple Curve 3	4+78.670	9+57.980	0.0908	0.306	0.3059	0.1084	0.1975	3.3694	1.71
Tangent	9+57.980	13+32.250	0.0709	0.239	0.2388	0.0846	0.1542	3.3694	1.71

Table 26. Predicted Crash Frequencies by Year (Freeway Ramp Sections)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2042	0.85	0.30	35.435	0.55	64.565
Total	0.85	0.30	35.435	0.55	64.565
Average	0.85	0.30	35.435	0.55	64.565

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 27. Predicted Crash Severity by Ramp Segment (Freeway Ramp Sections)

Seg. No.	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)
1	0.0079	0.0238	0.1586	0.1109	0.5489

Table 28. Predicted Freeway Ramp Crash Type Distribution (Freeway Ramp Sections)

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Highway Segment	Collision with Animal	0.00	0.3	0.03	3.6	0.03	3.9
Highway Segment	Collision with Fixed Object	0.17	19.6	0.29	34.6	0.46	54.2
Highway Segment	Collision with Other Object	0.01	1.1	0.06	6.9	0.07	8.0
Highway Segment	Other Single-vehicle Collision	0.11	12.7	0.08	9.0	0.18	21.7
Highway Segment	Collision with Parked Vehicle	0.01	0.8	0.01	1.3	0.02	2.1
Highway Segment	Total Single Vehicle Crashes	0.29	34.5	0.47	55.4	0.76	89.9
Highway Segment	Right-Angle Collision	0.00	0.1	0.00	0.3	0.00	0.3
Highway Segment	Head-on Collision	0.00	0.0	0.00	0.0	0.00	0.1
Highway Segment	Other Multi-vehicle Collision	0.00	0.1	0.01	0.7	0.01	0.8
Highway Segment	Rear-end Collision	0.01	0.6	0.04	4.7	0.04	5.2
Highway Segment	Sideswipe, Same Direction Collision	0.00	0.2	0.03	3.5	0.03	3.7
Highway Segment	Total Multiple Vehicle Crashes	0.01	0.9	0.08	9.2	0.09	10.1
Highway Segment	Total Highway Segment Crashes	0.30	35.4	0.55	64.6	0.85	100.0
	Total Crashes	0.30	35.4	0.55	64.6	0.85	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Interchange 160-67 : Evaluation Interchange No Build 2042 : Ramp NB Exit Evaluation

Report Overview

Report Generated: Dec 11, 2020 5:21 PM
Report Template: System: Multi-Page [System] (mlcpm2, Nov 27, 2020 3:23 PM)

Evaluation Date: Thu Dec 10 19:36:13 CST 2020
IHSDM Version: v16.0.0 (Sep 30, 2020)
Crash Prediction Module: v11.0.0 (Sep 30, 2020)

User Name: mhuebbe
Organization Name: EFK Moen, LLC
Phone: 314-394-3133
E-Mail: mhuebbe@efkmoen.com

Project Title: Interchange 160-67
Project Comment: Created Thu Dec 10 08:43:05 CST 2020
Project Unit System: U.S. Customary

Highway Title: Ramp NB Exit
Highway Comment: Created Thu Dec 10 13:04:40 CST 2020
Highway Version: 1

Evaluation Title: Interchange 160-67 : Evaluation Interchange No Build 2042 : Ramp NB Exit
Evaluation Comment: Created Thu Dec 10 19:36:03 CST 2020

Minimum Location: 0.000
Maximum Location: 17+63.150
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: HSM Configuration
Crash Distribution: HSM Configuration
Model/CMF: HSM Configuration
First Year of Analysis: 2042
Last Year of Analysis: 2042
Empirical-Bayes Analysis: None
First Year of Observed Crashes:
Last Year of Observed Crashes:

Disclaimer Regarding Crash Prediction Method

IMPORTANT NOTICE ABOUT COMPARING RESULTS FROM HIGHWAY SAFETY MANUAL FIRST EDITION (2010) MODELS TO RESULTS FROM NEW MODELS DEVELOPED UNDER NCHRP PROJECTS 17-70 AND 17-58

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The IHSDM Crash Prediction Module (CPM) is intended as a faithful implementation of HSM Part C predictive methods. As NCHRP projects to develop new predictive methods for the HSM are completed, FHWA works to incorporate the new methods into IHSDM, sometimes in advance of publication in the HSM. The following new crash predictive methods have been accepted by NCHRP project panels and incorporated into IHSDM, while pending AASHTO's approval for incorporation into a future edition of the HSM:

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- 6+ lane and one-way urban/suburban arterials (including models for segments and intersections): completed under NCHRP Project 17-58.

However, in the absence of local calibration factors (see HSM-1 Part C, Appendix A for guidance on calibration of the predictive models), it is neither appropriate nor advisable to directly compare the results from new models (from NCHRP Projects 17-58 and 17-70) to results from HSM-1 models, as the models were not calibrated to the same base state data sets, and consequently can produce unexpected results. If local calibration factors are available and applied to both new models and HSM-1 models, then it may be appropriate to directly compare the results.*[Note: Work being performed under NCHRP Project 17-72 (Update of Crash Modification Factors for the Highway Safety Manual) is expected to re-calibrate many of the old (HSM-1) and new (e.g., NCHRP 17-70) models to data from a single (or small number of) states, that would allow results from all models to be directly compared.]*

The models produced for NCHRP Project 17-70 have independent value in terms of informing the design of a roundabout and assessing the effects of different design characteristics on the expected safety performance of a roundabout.

The HSM-1 interim method previously included in IHSDM for evaluating roundabouts on urban/suburban arterials (i.e., evaluating an existing intersection and then applying a Crash Modification Factor for replacing the existing intersection with a roundabout) has been deactivated in IHSDM, to minimize any confusion with the new roundabout methodology.

Freeway Ramp Evaluation

Section: Section 1
Evaluation Start Location: 0.000
Evaluation End Location: 17+63.150
Functional Class: Freeway Service Ramp
Type of Alignment: One Direction
Model Category: Freeway Service Ramp

Calibration Factor: EX_RAMP_MV_FI=1.0; EX_RAMP_MV_PDO=1.0; EX_RAMP_SV_FI=1.0; EX_RAMP_SV_PDO=1.0;

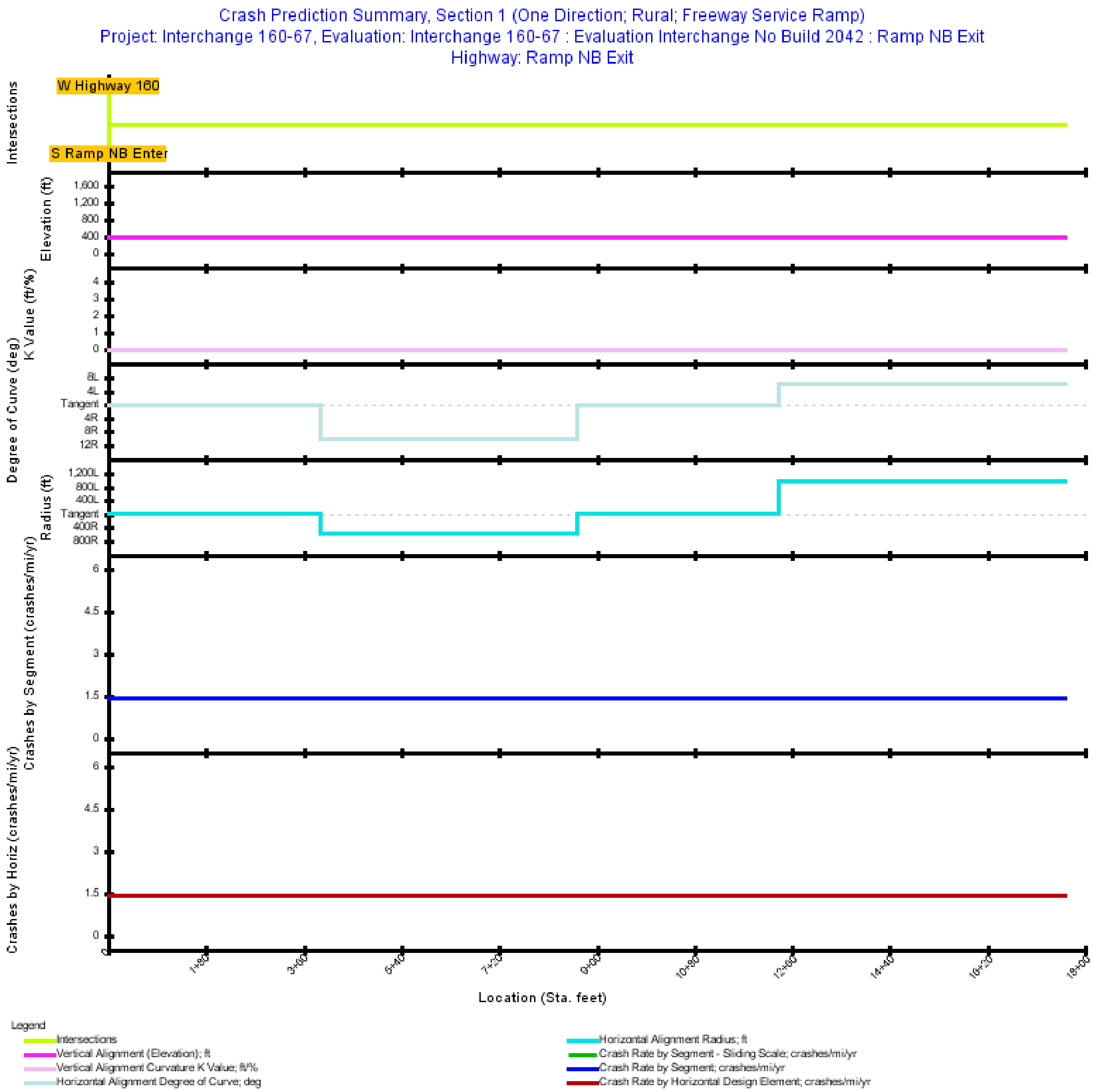

Figure 4. Crash Prediction Summary (Freeway Ramp Sections)

Table 29. Evaluation Freeway - Homogeneous Segments (Freeway Ramp Sections)

Seg. No.	Type	Area Type	Start Location (Sta. ft)	End Location (Sta. ft)	Length (ft)	Length (mi)	AADT
1	Freeway Ramp and C-D Road One-lane Ramp Exit	Rural	0.000	17+63.150	1,763.15	0.3339	2042: 3,500

Table 30. Predicted Ramp Crash Rates and Frequencies Summary (Freeway Ramp Sections)

First Year of Analysis	**2042**
Last Year of Analysis	**2042**
Evaluated Length (mi)	**0.3339**
Average Future Road AADT (vpd)	**3,500**
Predicted Crashes	
Total Crashes	**0.47**
Fatal and Injury Crashes	**0.22**
Property-Damage-Only Crashes	**0.25**
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	**46**
Percent Property-Damage-Only Crashes (%)	**54**
Predicted Crash Rate	
Crash Rate (crashes/mi/yr)	**1.4146**
FI Crash Rate (crashes/mi/yr)	**0.6552**
PDO Crash Rate (crashes/mi/yr)	**0.7594**
Predicted Travel Crash Rate	
Total Travel (million veh-mi)	**0.43**
Travel Crash Rate (crashes/million veh-mi)	**1.11**
Travel FI Crash Rate (crashes/million veh-mi)	**0.51**
Travel PDO Crash Rate (crashes/million veh-mi)	**0.59**

Table 31. Predicted Crash Frequencies and Rates by Ramp Segment/Intersection (Freeway Ramp Sections)

Segment Number/Intersection Name/Cross Road	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
1	0.000	17+63.150	0.3339	0.472	0.4724	0.2188	0.2536	1.4146	1.11
Total			0.3339	0.472	0.4724	0.2188	0.2536	1.4146	

Table 32. Predicted Crash Frequencies and Rates by Horizontal Design Element (Freeway Ramp Sections)

Title	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
Tangent	0.000	3+91.000	0.0741	0.105	0.1048	0.0485	0.0562	1.4146	1.11
Simple Curve 1	3+91.000	8+62.620	0.0893	0.126	0.1264	0.0585	0.0678	1.4146	1.11
Tangent	8+62.620	12+34.880	0.0705	0.100	0.0997	0.0462	0.0535	1.4146	1.11
Simple Curve 2	12+34.880	17+63.150	0.1001	0.141	0.1415	0.0656	0.0760	1.4146	1.11

Table 33. Predicted Crash Frequencies by Year (Freeway Ramp Sections)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2042	0.47	0.22	46.320	0.25	53.680
Total	0.47	0.22	46.320	0.25	53.680
Average	0.47	0.22	46.320	0.25	53.680

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 34. Predicted Crash Severity by Ramp Segment (Freeway Ramp Sections)

Seg. No.	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)
1	0.0084	0.0254	0.1101	0.0749	0.2536

Table 35. Predicted Freeway Ramp Crash Type Distribution (Freeway Ramp Sections)

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Highway Segment	Collision with Animal	0.00	0.5	0.01	3.3	0.02	3.7
Highway Segment	Collision with Fixed Object	0.12	26.1	0.15	31.5	0.27	57.6
Highway Segment	Collision with Other Object	0.01	1.4	0.03	6.3	0.04	7.7
Highway Segment	Other Single-vehicle Collision	0.08	16.9	0.04	8.2	0.12	25.1
Highway Segment	Collision with Parked Vehicle	0.01	1.1	0.01	1.2	0.01	2.3
Highway Segment	Total Single Vehicle Crashes	0.22	46.0	0.24	50.4	0.46	96.4
Highway Segment	Right-Angle Collision	0.00	0.0	0.00	0.1	0.00	0.1
Highway Segment	Head-on Collision	0.00	0.0	0.00	0.0	0.00	0.0
Highway Segment	Other Multi-vehicle Collision	0.00	0.0	0.00	0.3	0.00	0.3
Highway Segment	Rear-end Collision	0.00	0.2	0.01	1.7	0.01	1.9
Highway Segment	Sideswipe, Same Direction Collision	0.00	0.1	0.01	1.3	0.01	1.3
Highway Segment	Total Multiple Vehicle Crashes	0.00	0.3	0.02	3.3	0.02	3.6
Highway Segment	Total Highway Segment Crashes	0.22	46.3	0.25	53.7	0.47	100.0
	Total Crashes	0.22	46.3	0.25	53.7	0.47	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Interchange 160-67 : Evaluation Interchange No Build 2042 : RampTerminal NB (Crash Prediction) Evaluation

Report Overview

Report Generated: Dec 11, 2020 5:21 PM
Report Template: System: Multi-Page [System] (mlcpm2, Nov 27, 2020 3:23 PM)

Evaluation Date: Thu Dec 10 19:37:15 CST 2020
IHSDM Version: v16.0.0 (Sep 30, 2020)
Crash Prediction Module: v11.0.0 (Sep 30, 2020)

User Name: mhuebbe
Organization Name: EFK Moen, LLC
Phone: 314-394-3133
E-Mail: mhuebbe@efkmoen.com

Project Title: Interchange 160-67
Project Comment: Created Thu Dec 10 08:43:05 CST 2020
Project Unit System: U.S. Customary

Intersection Title: RampTerminal NB
Intersection Comment: Created Thu Dec 10 13:23:03 CST 2020
Intersection Version: v1

Evaluation Title: Interchange 160-67 : Evaluation Interchange No Build 2042 : RampTerminal NB (Crash Prediction)
Evaluation Comment: Created Thu Dec 10 19:36:19 CST 2020

Minimum Location: 534+24.000
Maximum Location: 596+34.000
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: HSM Configuration
Crash Distribution: HSM Configuration
Model/CMF: HSM Configuration
First Year of Analysis: 2042
Last Year of Analysis: 2042
Empirical-Bayes Analysis: None
First Year of Observed Crashes:
Last Year of Observed Crashes:

Disclaimer Regarding Crash Prediction Method

IMPORTANT NOTICE ABOUT COMPARING RESULTS FROM HIGHWAY SAFETY MANUAL FIRST EDITION (2010) MODELS TO RESULTS FROM NEW MODELS DEVELOPED UNDER NCHRP PROJECTS 17-70 AND 17-58

Since the publication of the Highway Safety Manual - First Edition (HSM-1), in 2010 by the American Association of State Highway and Transportation Officials (AASHTO), multiple research efforts have been undertaken through the National Cooperative Highway Research Program (NCHRP) to develop safety performance models for road segment and intersection facility types that were not initially reflected in the HSM-1, in order to expand the breadth and depth of the HSM in the future.

The IHSDM Crash Prediction Module (CPM) is intended as a faithful implementation of HSM Part C predictive methods. As NCHRP projects to develop new predictive methods for the HSM are completed, FHWA works to incorporate the new methods into IHSDM, sometimes in advance of publication in the HSM. The following new crash predictive methods have been accepted by NCHRP project panels and incorporated into IHSDM, while pending AASHTO's approval for incorporation into a future edition of the HSM:

- Roundabouts: completed in 2018 under NCHRP Project 17-70, the new methods will provide improved outcomes for the safety analysis of roundabouts.
- 6+ lane and one-way urban/suburban arterials (including models for segments and intersections): completed under NCHRP Project 17-58.

However, in the absence of local calibration factors (see HSM-1 Part C, Appendix A for guidance on calibration of the predictive models), it is neither appropriate nor advisable to directly compare the results from new models (from NCHRP Projects 17-58 and 17-70) to results from HSM-1 models, as the models were not calibrated to the same base state data sets, and consequently can produce unexpected results. If local calibration factors are available and applied to both new models and HSM-1 models, then it may be appropriate to directly compare the results.*[Note: Work being performed under NCHRP Project 17-72 (Update of Crash Modification Factors for the Highway Safety Manual) is expected to re-calibrate many of the old (HSM-1) and new (e.g., NCHRP 17-70) models to data from a single (or small number of) states, that would allow results from all models to be directly compared.]*

The models produced for NCHRP Project 17-70 have independent value in terms of informing the design of a roundabout and assessing the effects of different design characteristics on the expected safety performance of a roundabout.

The HSM-1 interim method previously included in IHSDM for evaluating roundabouts on urban/suburban arterials (i.e., evaluating an existing intersection and then applying a Crash Modification Factor for replacing the existing intersection with a roundabout) has been deactivated in IHSDM, to minimize any confusion with the new roundabout methodology.

RampTerminal NB Evaluation

Intersection: RampTerminal NB
Evaluation Start Location: 534+24.000
Evaluation End Location: 596+34.000
Calibration Factor: RT_ST_FI=1.0; RT_ST_PDO=1.0;

Table 36. Evaluation Ramp Terminal - Site (RampTerminal NB)

Inter. No.	Title	Type	Area Type	Legs	Location (Sta. ft)	Traffic Control	AADT
1	RampTerminal NB (v1)	Freeway Ramp Terminal A2 - Three-Leg at Two-Quadrant Parclo A	Rural	4	572+50.000	Stop-Controlled	Inside: 2042: 8,800; Outside: 2042: 8,800 :: Entrance: 2042: 3,500; Exit: 2042: 5,400

Table 37. Predicted Ramp Terminal Crash Rates and Frequencies Summary (RampTerminal NB)

First Year of Analysis	**2042**
Last Year of Analysis	**2042**
Predicted Crashes	
Total Crashes	**3.40**
Fatal and Injury Crashes	**1.68**
Property-Damage-Only Crashes	**1.73**
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	**49**
Percent Property-Damage-Only Crashes (%)	**51**

Table 38. Predicted Crash Frequencies and Rates by Ramp Terminal (RampTerminal NB)

Segment Number/Intersection Name/Cross Road	Location (Sta. ft)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Travel Crash Rate (crashes/million veh)
RampTerminal NB (v1)	572+50.000	3.400	3.4000	1.6747	1.7254	0.70

Table 39. Predicted Crash Frequencies by Year (RampTerminal NB)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2042	3.40	1.68	49.254	1.73	50.746
Total	3.40	1.68	49.254	1.73	50.746
Average	3.40	1.68	49.254	1.73	50.746

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 40. Predicted Crash Severity by Ramp Terminal (RampTerminal NB)

Seg. No.	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)
1	0.0198	0.1040	0.3440	1.2068	1.7254

Table 41. Predicted Ramp Terminal Crash Type Distribution (RampTerminal NB)

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Ramp Terminal	Collision with Animal	0.00	0.0	0.00	0.0	0.00	0.0
Ramp Terminal	Collision with Fixed Object	0.13	3.8	0.27	8.0	0.40	11.9
Ramp Terminal	Collision with Other Object	0.00	0.0	0.01	0.3	0.01	0.3
Ramp Terminal	Other Single-vehicle Collision	0.11	3.2	0.04	1.3	0.15	4.5
Ramp Terminal	Collision with Parked Vehicle	0.01	0.3	0.03	0.8	0.04	1.1
Ramp Terminal	Total Single Vehicle Crashes	0.25	7.4	0.35	10.4	0.60	17.7
Ramp Terminal	Right-Angle Collision	0.87	25.7	0.64	18.9	1.52	44.6
Ramp Terminal	Head-on Collision	0.03	1.0	0.03	0.8	0.06	1.7
Ramp Terminal	Other Multi-vehicle Collision	0.02	0.6	0.04	1.3	0.07	2.0
Ramp Terminal	Rear-end Collision	0.46	13.5	0.48	14.0	0.94	27.6
Ramp Terminal	Sideswipe, Same Direction Collision	0.03	1.0	0.18	5.4	0.22	6.4
Ramp Terminal	Total Multiple Vehicle Crashes	1.42	41.9	1.37	40.4	2.80	82.3
Ramp Terminal	Total Ramp Terminal Crashes	1.68	49.3	1.73	50.7	3.40	100.0
	Total Crashes	1.68	49.3	1.73	50.7	3.40	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Interactive Highway Safety Design Model

Crash Prediction Evaluation Report

Highway 160

No-build 2022

December 11, 2020

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Report Overview

Report Generated: Dec 11, 2020 5:14 PM
Report Template: System: Multi-Page [System] (mlcpm2, Nov 27, 2020 3:23 PM)

Evaluation Date: Thu Dec 10 19:28:22 CST 2020
IHSDM Version: v16.0.0 (Sep 30, 2020)
Crash Prediction Module: v11.0.0 (Sep 30, 2020)

User Name: mhuebbe
Organization Name: EFK Moen, LLC
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Project Title: Project 67
Project Comment: Created Wed Dec 09 16:11:58 CST 2020
Project Unit System: U.S. Customary

Highway Title: Highway 160
Highway Comment: Created Wed Dec 09 22:20:13 CST 2020
Highway Version: 1

Evaluation Title: Evaluation 160 No Build 2022
Evaluation Comment: Created Thu Dec 10 19:27:43 CST 2020

Minimum Location: 534+24.000
Maximum Location: 596+34.000
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: HSM Configuration
Crash Distribution: HSM Configuration
Model/CMF: HSM Configuration
First Year of Analysis: 2022
Last Year of Analysis: 2022
Empirical-Bayes Analysis: None
First Year of Observed Crashes:
Last Year of Observed Crashes:

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Section Types

Section 1 Evaluation

Section: Section 1
Evaluation Start Location: 534+24.000
Evaluation End Location: 596+34.000
Area Type: Rural
Functional Class: Multiple
Type of Alignment: Undivided, Two Lane
Model Category: Rural, Two Lane
Calibration Factor: 2U=1.0; 4ST=1.0; RT_ST_FI=1.0; RT_ST_PDO=1.0;

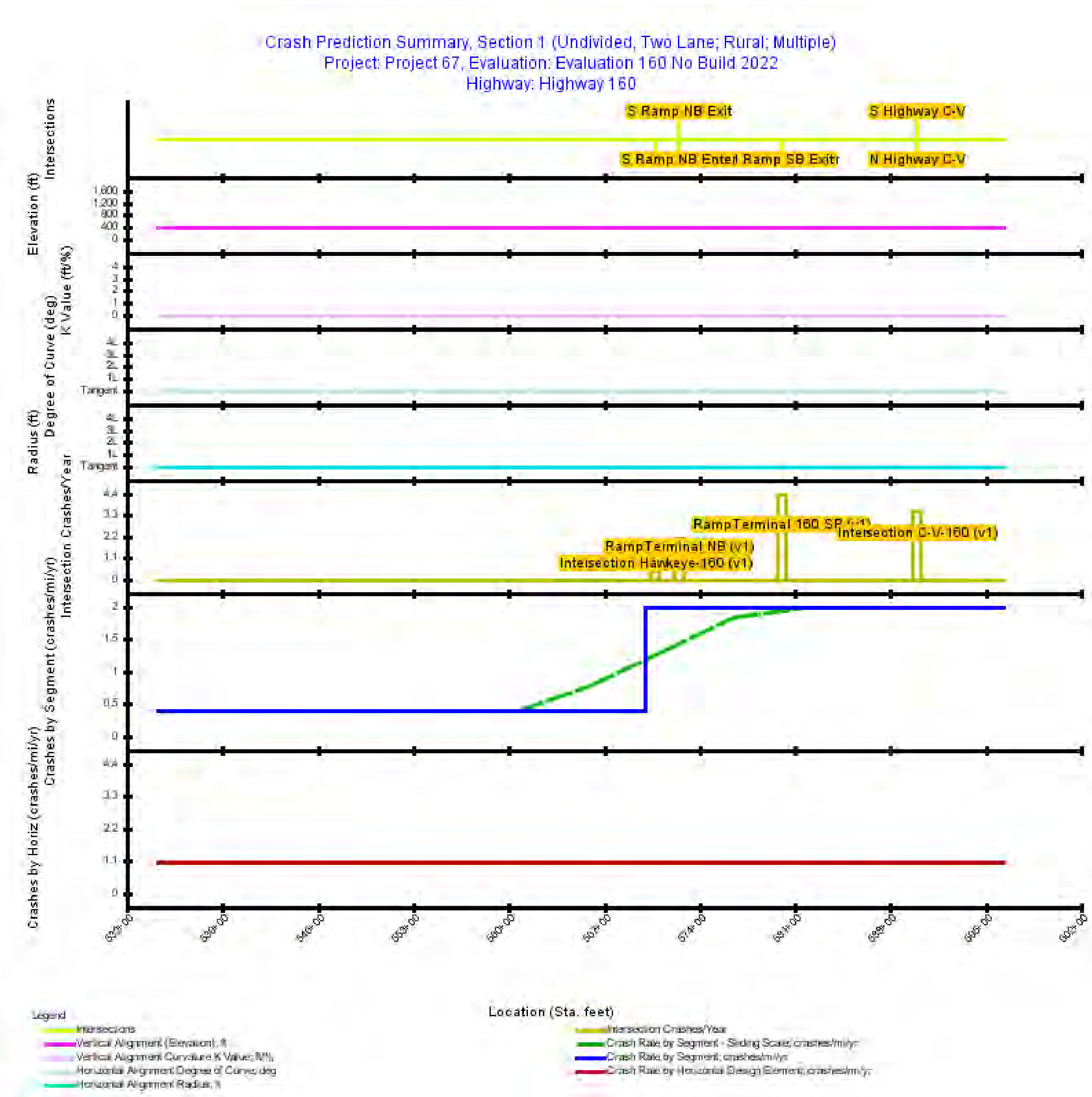

Figure 1. Crash Prediction Summary (Section 1)

Table 1. Evaluation Highway - Homogeneous Segments (Section 1)

Seg. No.	Type	Start Location (Sta. ft)	End Location (Sta. ft)	Length (ft)	Length (mi)	AADT	Left Lane Width (ft)	Right Lane Width (ft)	Left Shoulder Width (ft)	Right Shoulder Width (ft)	Grade (%)	Driveway Density (driveways/mi)	Hazard Rating	Centerline Rumble Strip	Passing Lanes	TWLT Lane	Lighting	Automated Speed Enforcement
1	Rural Two-Lane Segment Two-lane Undivided	534+24.000	570+00.000	3,576.00	0.6773	2022: 986	12.00	12.00	4.00	4.00	0.00	13.0	4	false	0	false	false	false
2	Rural Two-Lane Segment Two-lane Undivided	570+00.000	596+34.000	2,634.00	0.4989	2022: 7,100	12.00	12.00	6.00	6.00	0.00	8.0	3	false	0	false	false	false

Table 2. Evaluation Intersection - Section 1

Inter. No.	Title	Type	Location (Sta. ft)	Major AADT	Minor AADT	Legs	Traffic Control	Major road approaches w/Left Turn Lanes	Major road approaches w/Right Turn Lanes	Skew1	Skew2	Lighted at Night
1	Intersection Hawkeye-160 (v1)	Rural Two-Lane Intersection Four-Legged w/STOP control	570+75.000	2022: 7,100	2022: 55	4	Stop-Controlled	0	0	0.00	0.00	false

Table 3. Evaluation Intersection - Section 1

Inter. No.	Title	Type	Location (Sta. ft)	Major AADT	Minor AADT	Legs	Traffic Control	Major road approaches w/Left Turn Lanes	Major road approaches w/Right Turn Lanes	Skew1	Skew2	Lighted at Night
4	Intersection C-V-160 (v1)	Rural Two-Lane Intersection Four-Legged w/STOP control	589+95.000	2022: 7,100	2022: 1,600	4	Stop-Controlled	0	0	0.63	0.63	false

Table 4. Evaluation Ramp Terminal - Site (Section 1)

Inter. No.	Title	Type	Area Type	Legs	Location (Sta. ft)	Traffic Control	AADT
2	RampTerminal NB (v1)	Freeway Ramp Terminal A2 - Three-Leg at Two-Quadrant Parclo A	Rural	4	572+50.000	Stop-Controlled	Inside: 2022: 7,100; Outside: 2022: 7,100 :: Entrance: 2022: 2,600; Exit: 2022: 4,100
3	RampTerminal 160 SB (v1)	Freeway Ramp Terminal A2 - Three-Leg at Two-Quadrant Parclo A	Rural	4	580+00.000	Stop-Controlled	Inside: 2022: 7,100; Outside: 2022: 7,100 :: Entrance: 2022: 2,900; Exit: 2022: 5,900

Table 5. Predicted Highway Crash Rates and Frequencies Summary (Section 1)

First Year of Analysis	**2022**
Last Year of Analysis	**2022**
Evaluated Length (mi)	**1.1761**
Average Future Road AADT (vpd)	**3,579**
Predicted Crashes	
Total Crashes	**11.72**
Fatal and Injury Crashes	**6.00**
Property-Damage-Only Crashes	**5.71**
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	**51**
Percent Property-Damage-Only Crashes (%)	**49**
Predicted Crash Rate	
Crash Rate (crashes/mi/yr)	**9.9638**
FI Crash Rate (crashes/mi/yr)	**5.1059**
PDO Crash Rate (crashes/mi/yr)	**4.8579**
Predicted Travel Crash Rate	
Total Travel (million veh-mi)	**1.54**
Travel Crash Rate (crashes/million veh-mi)	**7.63**
Travel FI Crash Rate (crashes/million veh-mi)	**3.91**
Travel PDO Crash Rate (crashes/million veh-mi)	**3.72**

Table 6. Predicted Crash Frequencies and Rates by Highway Segment/Intersection (Section 1)

Segment Number/Intersection Name/Cross Road	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)	Predicted Intersection Travel Crash Rate (crashes/million veh)
1	534+24.000	570+00.000	0.6773	0.267	0.2674	0.0858	0.1816	0.3948	1.10	
2	570+00.000	596+34.000	0.4989	0.992	0.9922	0.3185	0.6737	1.9889	0.77	
Intersection Hawkeye-160 (v1)	570+75.000			0.452	0.4517	0.1947	0.2570			0.17
RampTerminal NB (v1)	572+50.000			2.069	2.0691	0.9301	1.1391			0.54
RampTerminal 160 SB (v1)	580+00.000			4.397	4.3969	2.9497	1.4471			1.05
Intersection C-V-160 (v1)	589+95.000			3.542	3.5415	1.5264	2.0151			1.13
All Segments			1.1761	1.260	1.2596	0.4043	0.8553	1.0710	0.82	
All Intersections				10.459	10.4592	5.6009	4.8583			0.76
Total			1.1761	11.719	11.7187	6.0052	5.7136	9.9638		

Table 7. Predicted Crash Frequencies and Rates by Horizontal Design Element (Section 1)

Title	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
Tangent	534+24.000	596+34.000	1.1761	1.260	1.2596	0.4043	0.8553	1.0710	0.96

Table 8. Predicted Crash Frequencies by Year (Section 1)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2022	11.72	6.00	51.244	5.71	48.756
Total	11.72	6.00	51.244	5.71	48.756
Average	11.72	6.00	51.244	5.71	48.756

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 9. Predicted Crash Severity by Ramp Terminal or Roundabout (Section 1)

Seg. No.	Type	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)
2	FRERampTerminal	0.0110	0.0578	0.1911	0.6702	1.1391
3	FRERampTerminal	0.0349	0.1832	0.6060	2.1257	1.4471

Table 10. Predicted Crash Type Distribution (Section 1)

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Highway Segment	Collision with Animal	0.01	0.1	0.16	1.3	0.15	1.3
Highway Segment	Collision with Bicycle	0.00	0.0	0.00	0.0	0.00	0.0
Highway Segment	Other Single-vehicle Collision	0.00	0.0	0.03	0.2	0.03	0.2
Highway Segment	Overturned	0.01	0.1	0.01	0.1	0.03	0.3
Highway Segment	Collision with Pedestrian	0.00	0.0	0.00	0.0	0.00	0.0
Highway Segment	Run Off Road	0.22	1.9	0.43	3.7	0.66	5.6
Highway Segment	Total Single Vehicle Crashes	0.26	2.2	0.63	5.4	0.87	7.4
Highway Segment	Angle Collision	0.04	0.3	0.06	0.5	0.11	0.9
Highway Segment	Head-on Collision	0.01	0.1	0.00	0.0	0.02	0.2
Highway Segment	Other Multiple-vehicle Collision	0.01	0.1	0.03	0.2	0.03	0.3
Highway Segment	Rear-end Collision	0.07	0.6	0.10	0.9	0.18	1.5
Highway Segment	Sideswipe	0.01	0.1	0.03	0.3	0.05	0.4
Highway Segment	Total Multiple Vehicle Crashes	0.15	1.3	0.23	1.9	0.39	3.3
Highway Segment	Total Highway Segment Crashes	0.41	3.5	0.85	7.3	1.26	10.7
Intersection	Collision with Animal	0.01	0.1	0.03	0.3	0.04	0.3
Intersection	Collision with Bicycle	0.00	0.0	0.00	0.0	0.00	0.0
Intersection	Other Single-vehicle Collision	0.01	0.1	0.02	0.2	0.03	0.3
Intersection	Overturned	0.01	0.1	0.01	0.1	0.02	0.2
Intersection	Collision with Pedestrian	0.00	0.0	0.00	0.0	0.00	0.0
Intersection	Run Off Road	0.16	1.4	0.33	2.8	0.49	4.2
Intersection	Total Single Vehicle Crashes	0.19	1.6	0.40	3.4	0.59	5.0
Intersection	Angle Collision	0.92	7.8	0.80	6.9	1.72	14.7
Intersection	Head-on Collision	0.10	0.9	0.06	0.5	0.16	1.4
Intersection	Other Multiple-vehicle Collision	0.07	0.6	0.08	0.7	0.16	1.3
Intersection	Rear-end Collision	0.36	3.1	0.60	5.2	0.97	8.2
Intersection	Sideswipe	0.08	0.6	0.33	2.8	0.40	3.4
Intersection	Total Multiple Vehicle Crashes	1.53	13.0	1.88	16.0	3.41	29.1
Intersection	Total Intersection Crashes	1.72	14.7	2.27	19.4	3.99	34.1
Ramp Terminal	Collision with Animal	0.00	0.0	0.00	0.0	0.00	0.0
Ramp Terminal	Collision with Fixed Object	0.30	2.6	0.41	3.5	0.71	6.1
Ramp Terminal	Collision with Other Object	0.00	0.0	0.01	0.1	0.01	0.1
Ramp Terminal	Other Single-vehicle Collision	0.25	2.2	0.07	0.6	0.32	2.7
Ramp Terminal	Collision with Parked Vehicle	0.03	0.2	0.04	0.3	0.07	0.6
Ramp Terminal	Total Single Vehicle Crashes	0.58	5.0	0.53	4.5	1.11	9.5
Ramp Terminal	Angle Collision	2.02	17.3	0.96	8.2	2.99	25.5
Ramp Terminal	Head-on Collision	0.08	0.7	0.04	0.3	0.12	1.0
Ramp Terminal	Other Multiple-vehicle Collision	0.05	0.4	0.07	0.6	0.12	1.0
Ramp Terminal	Rear-end Collision	1.07	9.1	0.71	6.1	1.78	15.2
Ramp Terminal	Sideswipe, Same Direction Collision	0.08	0.7	0.28	2.4	0.35	3.0
Ramp Terminal	Total Multiple Vehicle Crashes	3.30	28.1	2.06	17.6	5.36	45.7
Ramp Terminal	Total Ramp Terminal Crashes	3.88	33.1	2.59	22.1	6.47	55.2
	Total Crashes	6.01	51.3	5.71	48.8	11.72	100.0

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Interactive Highway Safety Design Model

Crash Prediction Evaluation Report

Highway 160

No-build 2042

December 11, 2020

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Report Overview

Report Generated: Dec 11, 2020 5:15 PM
Report Template: System: Multi-Page [System] (mlcpm2, Nov 27, 2020 3:23 PM)

Evaluation Date: Thu Dec 10 19:39:29 CST 2020
IHSDM Version: v16.0.0 (Sep 30, 2020)
Crash Prediction Module: v11.0.0 (Sep 30, 2020)

User Name: mhuebbe
Organization Name: EFK Moen, LLC
Phone: 314-394-3133
E-Mail: mhuebbe@efkmoen.com

Project Title: Project 67
Project Comment: Created Wed Dec 09 16:11:58 CST 2020
Project Unit System: U.S. Customary

Highway Title: Highway 160
Highway Comment: Created Wed Dec 09 22:20:13 CST 2020
Highway Version: 1

Evaluation Title: Evaluation 160 No Build 2042
Evaluation Comment: Created Thu Dec 10 19:39:05 CST 2020

Minimum Location: 534+24.000
Maximum Location: 596+34.000
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: HSM Configuration
Crash Distribution: HSM Configuration
Model/CMF: HSM Configuration
First Year of Analysis: 2042
Last Year of Analysis: 2042
Empirical-Bayes Analysis: None
First Year of Observed Crashes:
Last Year of Observed Crashes:

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The models produced for NCHRP Project 17-70 have independent value in terms of informing the design of a roundabout and assessing the effects of different design characteristics on the expected safety performance of a roundabout.

The HSM-1 interim method previously included in IHSDM for evaluating roundabouts on urban/suburban arterials (i.e., evaluating an existing intersection and then applying a Crash Modification Factor for replacing the existing intersection with a roundabout) has been deactivated in IHSDM, to minimize any confusion with the new roundabout methodology.

Section Types

Section 1 Evaluation

Section: Section 1
Evaluation Start Location: 534+24.000
Evaluation End Location: 596+34.000
Area Type: Rural
Functional Class: Multiple
Type of Alignment: Undivided, Two Lane
Model Category: Rural, Two Lane
Calibration Factor: 2U=1.0; 4ST=1.0; RT_ST_FI=1.0; RT_ST_PDO=1.0;

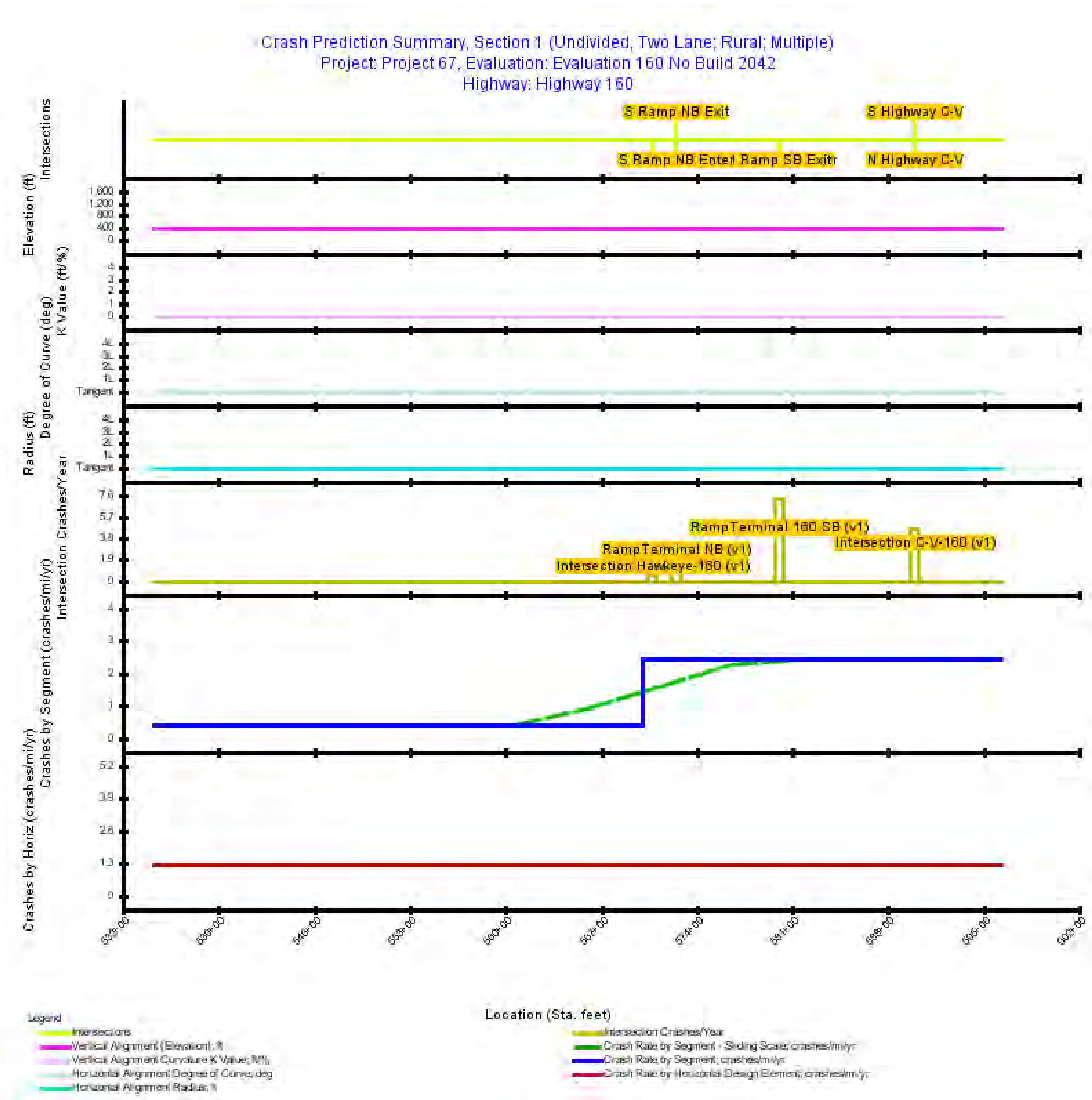

Figure 1. Crash Prediction Summary (Section 1)

Table 1. Evaluation Highway - Homogeneous Segments (Section 1)

Seg. No.	Type	Start Location (Sta. ft)	End Location (Sta. ft)	Length (ft)	Length (mi)	AADT	Left Lane Width (ft)	Right Lane Width (ft)	Left Shoulder Width (ft)	Right Shoulder Width (ft)	Grade (%)	Driveway Density (driveways/mi)	Hazard Rating	Centerline Rumble Strip	Passing Lanes	TWLT Lane	Lighting	Automated Speed Enforcement
1	Rural Two-Lane Segment Two-lane Undivided	534+24.000	570+00.000	3,576.00	0.6773	2042: 1,000	12.00	12.00	4.00	4.00	0.00	13.0	4	false	0	false	false	false
2	Rural Two-Lane Segment Two-lane Undivided	570+00.000	596+34.000	2,634.00	0.4989	2042: 8,800	12.00	12.00	6.00	6.00	0.00	8.0	3	false	0	false	false	false

Table 2. Evaluation Intersection - Section 1

Inter. No.	Title	Type	Location (Sta. ft)	Major AADT	Minor AADT	Legs	Traffic Control	Major road approaches w/Left Turn Lanes	Major road approaches w/Right Turn Lanes	Skew1	Skew2	Lighted at Night
1	Intersection Hawkeye-160 (v1)	Rural Two-Lane Intersection Four-Legged w/STOP control	570+75.000	2042: 8,800	2042: 60	4	Stop-Controlled	0	0	0.00	0.00	false

Table 3. Evaluation Intersection - Section 1

Inter. No.	Title	Type	Location (Sta. ft)	Major AADT	Minor AADT	Legs	Traffic Control	Major road approaches w/Left Turn Lanes	Major road approaches w/Right Turn Lanes	Skew1	Skew2	Lighted at Night
4	Intersection C-V-160 (v1)	Rural Two-Lane Intersection Four-Legged w/STOP control	589+95.000	2042: 8,800	2042: 2,000	4	Stop-Controlled	0	0	0.63	0.63	false

Table 4. Evaluation Ramp Terminal - Site (Section 1)

Inter. No.	Title	Type	Area Type	Legs	Location (Sta. ft)	Traffic Control	AADT
2	RampTerminal NB (v1)	Freeway Ramp Terminal A2 - Three-Leg at Two-Quadrant Parclo A	Rural	4	572+50.000	Stop-Controlled	Inside: 2042: 8,800; Outside: 2042: 8,800 :: Entrance: 2042: 3,500; Exit: 2042: 5,400
3	RampTerminal 160 SB (v1)	Freeway Ramp Terminal A2 - Three-Leg at Two-Quadrant Parclo A	Rural	4	580+00.000	Stop-Controlled	Inside: 2042: 8,800; Outside: 2042: 8,800 :: Entrance: 2042: 3,600; Exit: 2042: 7,200

Table 5. Predicted Highway Crash Rates and Frequencies Summary (Section 1)

First Year of Analysis	**2042**
Last Year of Analysis	**2042**
Evaluated Length (mi)	**1.1761**
Average Future Road AADT (vpd)	**4,308**
Predicted Crashes	
Total Crashes	**17.38**
Fatal and Injury Crashes	**9.66**
Property-Damage-Only Crashes	**7.72**
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	**56**
Percent Property-Damage-Only Crashes (%)	**44**
Predicted Crash Rate	
Crash Rate (crashes/mi/yr)	**14.7773**
FI Crash Rate (crashes/mi/yr)	**8.2160**
PDO Crash Rate (crashes/mi/yr)	**6.5614**
Predicted Travel Crash Rate	
Total Travel (million veh-mi)	**1.85**
Travel Crash Rate (crashes/million veh-mi)	**9.40**
Travel FI Crash Rate (crashes/million veh-mi)	**5.22**
Travel PDO Crash Rate (crashes/million veh-mi)	**4.17**

Table 6. Predicted Crash Frequencies and Rates by Highway Segment/Intersection (Section 1)

Segment Number/Intersection Name/Cross Road	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)	Predicted Intersection Travel Crash Rate (crashes/million veh)
1	534+24.000	570+00.000	0.6773	0.271	0.2711	0.0870	0.1841	0.4003	1.10	
2	570+00.000	596+34.000	0.4989	1.220	1.2197	0.3915	0.8282	2.4449	0.76	
Intersection Hawkeye-160 (v1)	570+75.000			0.542	0.5418	0.2335	0.3083			0.17
RampTerminal NB (v1)	572+50.000			3.400	3.4000	1.6747	1.7254			0.70
RampTerminal 160 SB (v1)	580+00.000			7.332	7.3319	5.2870	2.0449			1.41
Intersection C-V-160 (v1)	589+95.000			4.616	4.6157	1.9894	2.6263			1.19
All Segments			1.1761	1.491	1.4908	0.4786	1.0123	1.2676	0.81	
All Intersections				15.889	15.8893	9.1845	6.7048			0.93
Total			1.1761	17.380	17.3802	9.6631	7.7171	14.7773		

Table 7. Predicted Crash Frequencies and Rates by Horizontal Design Element (Section 1)

Title	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
Tangent	534+24.000	596+34.000	1.1761	1.491	1.4908	0.4786	1.0123	1.2676	0.95

Table 8. Predicted Crash Frequencies by Year (Section 1)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2042	17.38	9.66	55.598	7.72	44.402
Total	17.38	9.66	55.598	7.72	44.402
Average	17.38	9.66	55.598	7.72	44.402

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 9. Predicted Crash Severity by Ramp Terminal or Roundabout (Section 1)

Seg. No.	Type	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)
2	FRERampTerminal	0.0198	0.1040	0.3440	1.2068	1.7254
3	FRERampTerminal	0.0625	0.3283	1.0861	3.8100	2.0449

Table 10. Predicted Crash Type Distribution (Section 1)

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Highway Segment	Collision with Animal	0.02	0.1	0.19	1.1	0.18	1.0
Highway Segment	Collision with Bicycle	0.00	0.0	0.00	0.0	0.00	0.0
Highway Segment	Other Single-vehicle Collision	0.00	0.0	0.03	0.2	0.03	0.2
Highway Segment	Overturned	0.02	0.1	0.01	0.1	0.04	0.2
Highway Segment	Collision with Pedestrian	0.00	0.0	0.00	0.0	0.00	0.0
Highway Segment	Run Off Road	0.26	1.5	0.51	2.9	0.78	4.5
Highway Segment	Total Single Vehicle Crashes	0.30	1.8	0.74	4.3	1.03	5.9
Highway Segment	Angle Collision	0.05	0.3	0.07	0.4	0.13	0.7
Highway Segment	Head-on Collision	0.02	0.1	0.00	0.0	0.02	0.1
Highway Segment	Other Multiple-vehicle Collision	0.01	0.1	0.03	0.2	0.04	0.2
Highway Segment	Rear-end Collision	0.08	0.5	0.12	0.7	0.21	1.2
Highway Segment	Sideswipe	0.02	0.1	0.04	0.2	0.06	0.3
Highway Segment	Total Multiple Vehicle Crashes	0.17	1.0	0.27	1.5	0.46	2.6
Highway Segment	Total Highway Segment Crashes	0.48	2.8	1.01	5.8	1.49	8.6
Intersection	Collision with Animal	0.01	0.1	0.04	0.2	0.05	0.3
Intersection	Collision with Bicycle	0.00	0.0	0.00	0.0	0.01	0.0
Intersection	Other Single-vehicle Collision	0.01	0.1	0.03	0.2	0.04	0.2
Intersection	Overturned	0.01	0.1	0.01	0.1	0.03	0.1
Intersection	Collision with Pedestrian	0.00	0.0	0.00	0.0	0.01	0.0
Intersection	Run Off Road	0.21	1.2	0.42	2.4	0.63	3.6
Intersection	Total Single Vehicle Crashes	0.25	1.4	0.51	2.9	0.76	4.4
Intersection	Angle Collision	1.18	6.8	1.04	6.0	2.22	12.8
Intersection	Head-on Collision	0.13	0.8	0.07	0.4	0.21	1.2
Intersection	Other Multiple-vehicle Collision	0.09	0.5	0.11	0.6	0.20	1.2
Intersection	Rear-end Collision	0.47	2.7	0.78	4.5	1.25	7.2
Intersection	Sideswipe	0.10	0.6	0.42	2.4	0.52	3.0
Intersection	Total Multiple Vehicle Crashes	1.97	11.4	2.42	13.9	4.40	25.3
Intersection	Total Intersection Crashes	2.22	12.8	2.94	16.9	5.16	29.7
Ramp Terminal	Collision with Animal	0.00	0.0	0.00	0.0	0.00	0.0
Ramp Terminal	Collision with Fixed Object	0.54	3.1	0.60	3.4	1.14	6.6
Ramp Terminal	Collision with Other Object	0.00	0.0	0.02	0.1	0.02	0.1
Ramp Terminal	Other Single-vehicle Collision	0.45	2.6	0.10	0.6	0.55	3.2
Ramp Terminal	Collision with Parked Vehicle	0.05	0.3	0.06	0.3	0.10	0.6
Ramp Terminal	Total Single Vehicle Crashes	1.04	6.0	0.77	4.4	1.81	10.4
Ramp Terminal	Angle Collision	3.63	20.9	1.40	8.1	5.04	29.0
Ramp Terminal	Head-on Collision	0.14	0.8	0.06	0.3	0.20	1.1
Ramp Terminal	Other Multiple-vehicle Collision	0.09	0.5	0.10	0.6	0.19	1.1
Ramp Terminal	Rear-end Collision	1.91	11.0	1.04	6.0	2.96	17.0
Ramp Terminal	Sideswipe, Same Direction Collision	0.14	0.8	0.40	2.3	0.54	3.1
Ramp Terminal	Total Multiple Vehicle Crashes	5.92	34.0	3.00	17.3	8.92	51.3
Ramp Terminal	Total Ramp Terminal Crashes	6.96	40.1	3.77	21.7	10.73	61.7
	Total Crashes	9.66	55.6	7.72	44.4	17.38	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Appendix D

D-3

Alternative 1

2022 - 2042

Interactive Highway Safety Design Model

Crash Prediction Evaluation Report

Highway 67

Alternative 1

December 11, 2020

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Report Overview

Report Generated: Dec 11, 2020 1:33 PM
Report Template: System: Multi-Page [System] (mlcpm2, Nov 27, 2020 3:23 PM)

Evaluation Date: Fri Dec 11 13:18:02 CST 2020
IHSDM Version: v16.0.0 (Sep 30, 2020)
Crash Prediction Module: v11.0.0 (Sep 30, 2020)

User Name: mhuebbe
Organization Name: EFK Moen, LLC
Phone: 314-394-3133
E-Mail: mhuebbe@efkmoen.com

Project Title: Project 67-Alt1 Dia
Project Comment: Created Wed Dec 09 16:11:58 CST 2020
Project Unit System: U.S. Customary

Highway Title: Highway 67
Highway Comment: Created Fri Dec 11 11:13:00 CST 2020
Highway Version: 1

Evaluation Title: Evaluation Build 2022-2042
Evaluation Comment: Created Fri Dec 11 13:15:49 CST 2020

Minimum Location: 405+00.000
Maximum Location: 665+43.000
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: HSM Configuration
Crash Distribution: HSM Configuration
Model/CMF: HSM Configuration
First Year of Analysis: 2022
Last Year of Analysis: 2042
Empirical-Bayes Analysis: None
First Year of Observed Crashes:
Last Year of Observed Crashes:

Disclaimer Regarding Crash Prediction Method

IMPORTANT NOTICE ABOUT COMPARING RESULTS FROM HIGHWAY SAFETY MANUAL FIRST EDITION (2010) MODELS TO RESULTS FROM NEW MODELS DEVELOPED UNDER NCHRP PROJECTS 17-70 AND 17-58

Since the publication of the Highway Safety Manual - First Edition (HSM-1), in 2010 by the American Association of State Highway and Transportation Officials (AASHTO), multiple research efforts have been undertaken through the National Cooperative Highway Research Program (NCHRP) to develop safety performance models for road segment and intersection facility types that were not initially reflected in the HSM-1, in order to expand the breadth and depth of the HSM in the future.

The IHSDM Crash Prediction Module (CPM) is intended as a faithful implementation of HSM Part C predictive methods. As NCHRP projects to develop new predictive methods for the HSM are completed, FHWA works to incorporate the new methods into IHSDM, sometimes in advance of publication in the HSM. The following new crash predictive methods have been accepted by NCHRP project panels and incorporated into IHSDM, while pending AASHTO's approval for incorporation into a future edition of the HSM:

- Roundabouts: completed in 2018 under NCHRP Project 17-70, the new methods will provide improved outcomes for the safety analysis of roundabouts.
- 6+ lane and one-way urban/suburban arterials (including models for segments and intersections): completed under NCHRP Project 17-58.

However, in the absence of local calibration factors (see HSM-1 Part C, Appendix A for guidance on calibration of the predictive models), it is neither appropriate nor advisable to directly compare the results from new models (from NCHRP Projects 17-58 and 17-70) to results from HSM-1 models, as the models were not calibrated to the same base state data sets, and consequently can produce unexpected results. If local calibration factors are available and applied to both new models and HSM-1 models, then it may be appropriate to directly compare the results.*[Note: Work being performed under NCHRP Project 17-72 (Update of Crash Modification Factors for the Highway Safety Manual) is expected to re-calibrate many of the old (HSM-1) and new (e.g., NCHRP 17-70) models to data from a single (or small number of) states, that would allow results from all models to be directly compared.]*

The models produced for NCHRP Project 17-70 have independent value in terms of informing the design of a roundabout and assessing the effects of different design characteristics on the expected safety performance of a roundabout.

The HSM-1 interim method previously included in IHSDM for evaluating roundabouts on urban/suburban arterials (i.e., evaluating an existing intersection and then applying a Crash Modification Factor for replacing the existing intersection with a roundabout) has been deactivated in IHSDM, to minimize any confusion with the new roundabout methodology.

Section Types

Section 1 Evaluation

Section: Section 1
Evaluation Start Location: 405+00.000
Evaluation End Location: 425+00.000
Area Type: Rural
Functional Class: Arterial
Type of Alignment: Divided, Multilane
Model Category: Rural, Multilane
Calibration Factor: 4D=1.0; 4ST=1.0;

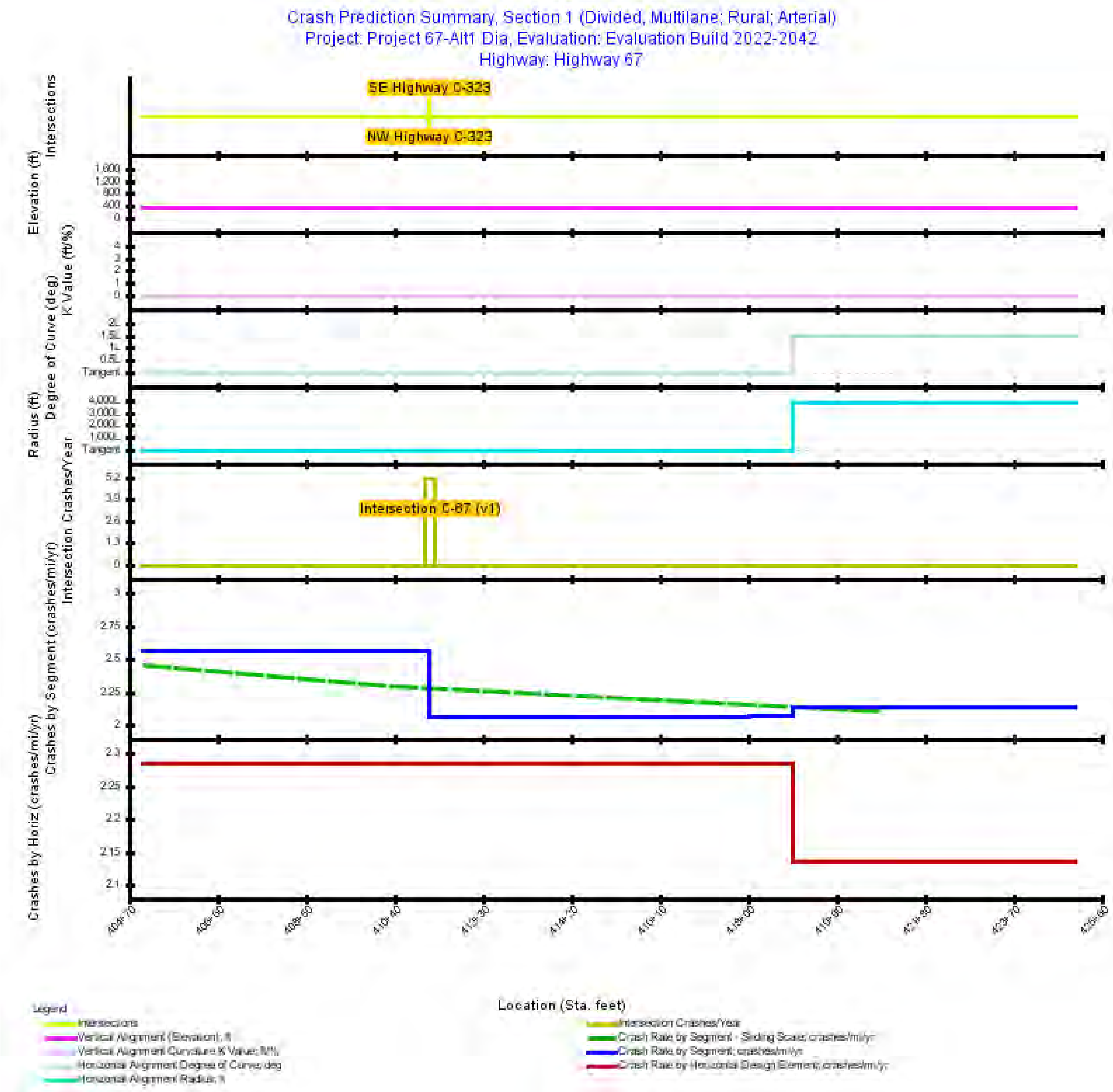

Figure 1. Crash Prediction Summary (Section 1)

Table 1. Evaluation Highway - Homogeneous Segments (Section 1)

Seg. No.	Type	Start Location (Sta. ft)	End Location (Sta. ft)	Length (ft)	Length (mi)	AADT	Left Lane Width (ft)	Right Lane Width (ft)	Left Shoulder Width (ft)	Right Shoulder Width (ft)	Median Width (ft)	Median Type	Effective Median Width (ft)	Lighting	Automated Speed Enforcement	Left Side Slope	Right Side Slope
1	Rural Multi-Lane Segment Four-lane Divided	405+00.000	411+15.000	615.00	0.1165	2022: 12,300; 2023: 12,460; 2024: 12,620; 2025: 12,780; 2026: 12,940; 2027: 13,100; 2028: 13,260; 2029: 13,420; 2030: 13,580; 2031: 13,740; 2032: 13,900; 2033: 14,060; 2034: 14,220; 2035: 14,380; 2036: 14,540; 2037: 14,700; 2038: 14,860; 2039: 15,020; 2040: 15,180; 2041: 15,340; 2042: 15,500	12.00	12.00	8.00	8.00	52.00	Traversable Median	60.00	false	false		
2	Rural Multi-Lane Segment Four-lane Divided	411+15.000	418+00.000	685.00	0.1297	2022: 10,000; 2023: 10,130; 2024: 10,260; 2025: 10,390; 2026: 10,520; 2027: 10,650; 2028: 10,780; 2029: 10,910; 2030: 11,040; 2031: 11,170; 2032: 11,300; 2033: 11,430; 2034: 11,560; 2035: 11,690; 2036: 11,820; 2037: 11,950; 2038: 12,080; 2039: 12,210; 2040: 12,340; 2041: 12,470; 2042: 12,600	12.00	12.00	8.00	8.00	52.00	Traversable Median	60.00	false	false		
3	Rural Multi-Lane Segment Four-lane Divided	418+00.000	418+95.990	95.99	0.0182	2022: 10,000; 2023: 10,130; 2024: 10,260; 2025: 10,390; 2026: 10,520; 2027: 10,650; 2028: 10,780; 2029: 10,910; 2030: 11,040; 2031: 11,170; 2032: 11,300; 2033: 11,430; 2034: 11,560; 2035: 11,690; 2036: 11,820; 2037: 11,950; 2038: 12,080; 2039: 12,210; 2040: 12,340; 2041: 12,470; 2042: 12,600	12.00	12.00	8.00	8.00	49.15	Traversable Median	57.15	false	false		
4	Rural Multi-Lane Segment Four-lane Divided	418+95.990	425+00.000	604.01	0.1144	2022: 10,000; 2023: 10,130; 2024: 10,260; 2025: 10,390; 2026: 10,520; 2027: 10,650; 2028: 10,780; 2029: 10,910; 2030: 11,040; 2031: 11,170; 2032: 11,300; 2033: 11,430; 2034: 11,560; 2035: 11,690; 2036: 11,820; 2037: 11,950; 2038: 12,080; 2039: 12,210; 2040: 12,340; 2041: 12,470; 2042: 12,600	12.00	12.00	8.00	8.00	28.40	Traversable Median	36.40	false	false		

Table 2. Evaluation Intersection (Section 1)

Inter. No.	Title	Type	Location (Sta. ft)	Major AADT	Minor AADT	Legs	Traffic Control	Major road approaches w/Left Turn Lanes	Major road approaches w/Right Turn Lanes	Skew1	Skew2	Lighted at Night
1	Intersection C-67 (v1)	Rural Multi-Lane Intersection Four-Legged w/STOP control	411+14.900	2022: 12,300; 2023: 12,460; 2024: 12,620; 2025: 12,780; 2026: 12,940; 2027: 13,100; 2028: 13,260; 2029: 13,420; 2030: 13,580; 2031: 13,740; 2032: 13,900; 2033: 14,060; 2034: 14,220; 2035: 14,380; 2036: 14,540; 2037: 14,700; 2038: 14,860; 2039: 15,020; 2040: 15,180; 2041: 15,340; 2042: 15,500	2022: 1,600; 2023: 1,620; 2024: 1,640; 2025: 1,660; 2026: 1,680; 2027: 1,700; 2028: 1,720; 2029: 1,740; 2030: 1,760; 2031: 1,780; 2032: 1,800; 2033: 1,820; 2034: 1,840; 2035: 1,860; 2036: 1,880; 2037: 1,900; 2038: 1,920; 2039: 1,940; 2040: 1,960; 2041: 1,980; 2042: 2,000	4	Stop-Controlled	0	0	20.00	0.01	false

Table 3. Predicted Highway Crash Rates and Frequencies Summary (Section 1)

First Year of Analysis	2022
Last Year of Analysis	2042
Evaluated Length (mi)	0.3788
Average Future Road AADT (vpd)	12,099
Predicted Crashes	
Total Crashes	125.38
Fatal and Injury Crashes	72.56
Fatal and Serious Injury Crashes	40.58
Property-Damage-Only Crashes	52.83
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	58
Percent Fatal and Serious Injury Crashes (%)	32
Percent Property-Damage-Only Crashes (%)	42
Predicted Crash Rate	
Crash Rate (crashes/mi/yr)	15.7626
FI Crash Rate (crashes/mi/yr)	9.1212
FI no/C Crash Rate (crashes/mi/yr)	5.1016
PDO Crash Rate (crashes/mi/yr)	6.6414
Predicted Travel Crash Rate	
Total Travel (million veh-mi)	35.13
Travel Crash Rate (crashes/million veh-mi)	3.57
Travel FI Crash Rate (crashes/million veh-mi)	2.06
Travel FI no/C Crash Rate (crashes/million veh-mi)	1.16
Travel PDO Crash Rate (crashes/million veh-mi)	1.50

Table 4. Predicted Crash Frequencies and Rates by Highway Segment/Intersection (Section 1)

Segment Number/Intersection Name/Cross Road	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted FI no/C Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)	Predicted Intersection Travel Crash Rate (crashes/million veh)
1	405+00.000	411+15.000	0.1165	6.271	0.2986	0.1512	0.0946	0.1474	2.5635	0.51	
Intersection C-67 (v1)	411+14.900			107.574	5.1226	3.0202	1.6574	2.1024			0.97
2	411+15.000	418+00.000	0.1297	5.620	0.2676	0.1381	0.0879	0.1295	2.0630	0.50	
3	418+00.000	418+95.990	0.0182	0.790	0.0376	0.0194	0.0124	0.0182	2.0691	0.50	
4	418+95.990	425+00.000	0.1144	5.129	0.2443	0.1261	0.0802	0.1182	2.1352	0.52	
All Segments			0.3788	17.810	0.8481	0.4348	0.2750	0.4133	2.2390	0.51	
All Intersections				107.574	5.1226	3.0202	1.6574	2.1024			0.97
Total			0.3788	125.384	5.9707	3.4550	1.9324	2.5157	15.7626		

Table 5. Predicted Crash Frequencies and Rates by Horizontal Design Element (Section 1)

Title	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted FI no/C Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
Tangent	405+00.000	418+95.990	0.2644	12.681	0.6039	0.3088	0.1948	0.2951	2.2839	0.50
Simple Curve 1	418+95.990	425+00.000	0.1144	5.129	0.2443	0.1261	0.0802	0.1182	2.1352	0.52

Table 6. Predicted Crash Frequencies by Year (Section 1)

Year	Total Crashes	FI Crashes	Percent FI (%)	FI/no C Crashes	Percent FI/no C (%)	PDO Crashes	Percent PDO (%)
2022	5.12	2.93	57.202	1.67	32.661	2.19	42.798
2023	5.21	2.98	57.269	1.70	32.630	2.22	42.731
2024	5.29	3.03	57.335	1.72	32.600	2.26	42.665
2025	5.37	3.08	57.400	1.75	32.570	2.29	42.600
2026	5.46	3.14	57.465	1.78	32.541	2.32	42.535
2027	5.54	3.19	57.529	1.80	32.512	2.35	42.471
2028	5.62	3.24	57.593	1.83	32.483	2.39	42.407
2029	5.71	3.29	57.657	1.85	32.455	2.42	42.343
2030	5.79	3.35	57.719	1.88	32.427	2.45	42.281
2031	5.88	3.40	57.781	1.91	32.400	2.48	42.219
2032	5.97	3.45	57.843	1.93	32.373	2.52	42.157
2033	6.05	3.50	57.904	1.96	32.346	2.55	42.096
2034	6.14	3.56	57.965	1.98	32.320	2.58	42.035
2035	6.22	3.61	58.025	2.01	32.294	2.61	41.975
2036	6.31	3.67	58.085	2.04	32.269	2.65	41.915
2037	6.40	3.72	58.144	2.06	32.243	2.68	41.856
2038	6.49	3.77	58.203	2.09	32.218	2.71	41.797
2039	6.57	3.83	58.261	2.12	32.194	2.74	41.739
2040	6.66	3.88	58.319	2.14	32.169	2.78	41.681
2041	6.75	3.94	58.376	2.17	32.145	2.81	41.624
2042	6.83	3.99	58.433	2.20	32.122	2.84	41.567
Total	125.38	72.56	57.866	40.58	32.365	52.83	42.134
Average	5.97	3.46	57.866	1.93	32.365	2.52	42.134

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 7. Predicted Crash Type Distribution (Section 1)

Element Type	Crash Type	Fatal and Injury		Fatal and Serious Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Highway Segment	Single	6.64	5.3	4.49	3.6	6.87	5.5	13.68	10.9
Highway Segment	Total Single Vehicle Crashes	6.64	5.3	4.49	3.6	6.87	5.5	13.68	10.9
Highway Segment	Angle Collision	0.44	0.3	0.26	0.2	0.36	0.3	0.77	0.6
Highway Segment	Head-on Collision	0.12	0.1	0.10	0.1	0.02	0.0	0.11	0.1
Highway Segment	Rear-end Collision	1.49	1.2	0.66	0.5	0.76	0.6	2.07	1.6
Highway Segment	Sideswipe	0.25	0.2	0.13	0.1	0.46	0.4	0.77	0.6
Highway Segment	Total Multiple Vehicle Crashes	2.29	1.8	1.15	0.9	1.60	1.3	3.71	3.0
Highway Segment	Total Highway Segment Crashes	9.13	7.3	5.78	4.6	8.68	6.9	17.81	14.2
Highway Segment	Other Collision	0.20	0.2	0.13	0.1	0.21	0.2	0.43	0.3
Intersection	Single	9.39	7.5	6.93	5.5	10.73	8.6	21.73	17.3
Intersection	Total Single Vehicle Crashes	9.39	7.5	6.93	5.5	10.73	8.6	21.73	17.3
Intersection	Angle Collision	33.87	27.0	19.87	15.9	12.89	10.3	42.49	33.9
Intersection	Head-on Collision	1.14	0.9	0.80	0.6	0.66	0.5	1.72	1.4
Intersection	Rear-end Collision	13.51	10.8	3.76	3.0	10.60	8.5	24.53	19.6
Intersection	Sideswipe	2.66	2.1	1.39	1.1	6.89	5.5	11.51	9.2
Intersection	Total Multiple Vehicle Crashes	51.18	40.9	25.83	20.6	31.04	24.8	80.25	64.1
Intersection	Total Intersection Crashes	63.49	50.7	34.81	27.8	44.19	35.3	107.47	85.8
Intersection	Other Collision	2.92	2.3	2.05	1.6	2.43	1.9	5.49	4.4
	Total Crashes	72.62	58.0	40.58	32.4	52.87	42.2	125.28	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Section 2 Evaluation

Section: Section 2
Evaluation Start Location: 425+00.000
Evaluation End Location: 665+43.000
Functional Class: Freeway
Type of Alignment: Divided, Multilane
Model Category: Freeway Segment
Calibration Factor: FI_MV=1.0; FI_SV=1.0; PDO_MV=1.0; PDO_SV=1.0;

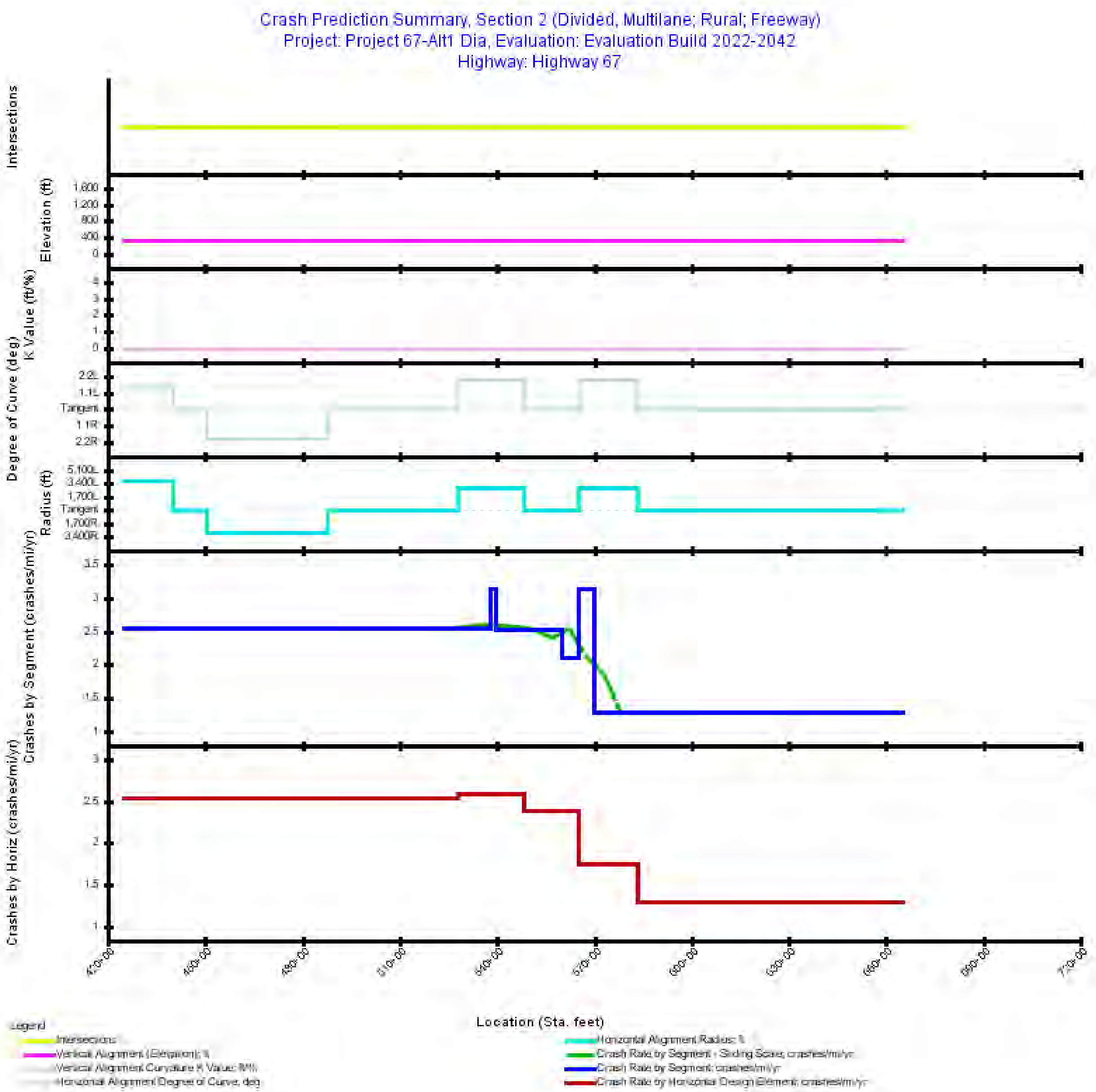

Figure 2. Crash Prediction Summary (Section 2)

Table 8. Evaluation Freeway - Homogeneous Segments (Section 2)

Seg. No.	Type	Area Type	Start Location (Sta. ft)	End Location (Sta. ft)	Length (ft)	Length (mi)	AADT	Median Width (ft)	Type	Effective Median Width (ft)
5	Four-lane Freeway	Rural	425+00.000	537+84.000	11,284.00	2.1371	2022: 10,000; 2023: 10,130; 2024: 10,260; 2025: 10,390; 2026: 10,520; 2027: 10,650; 2028: 10,780; 2029: 10,910; 2030: 11,040; 2031: 11,170; 2032: 11,300; 2033: 11,430; 2034: 11,560; 2035: 11,690; 2036: 11,820; 2037: 11,950; 2038: 12,080; 2039: 12,210; 2040: 12,340; 2041: 12,470; 2042: 12,600	10.50	Traversable Median	18.50
6	Four-lane Freeway	Rural	537+84.000	539+57.580	173.58	0.0329	2022: 10,000; 2023: 10,130; 2024: 10,260; 2025: 10,390; 2026: 10,520; 2027: 10,650; 2028: 10,780; 2029: 10,910; 2030: 11,040; 2031: 11,170; 2032: 11,300; 2033: 11,430; 2034: 11,560; 2035: 11,690; 2036: 11,820; 2037: 11,950; 2038: 12,080; 2039: 12,210; 2040: 12,340; 2041: 12,470; 2042: 12,600	10.50	Traversable Median	18.50
7	Four-lane Freeway	Rural	539+57.580	559+88.750	2,031.17	0.3847	2022: 10,000; 2023: 10,130; 2024: 10,260; 2025: 10,390; 2026: 10,520; 2027: 10,650; 2028: 10,780; 2029: 10,910; 2030: 11,040; 2031: 11,170; 2032: 11,300; 2033: 11,430; 2034: 11,560; 2035: 11,690; 2036: 11,820; 2037: 11,950; 2038: 12,080; 2039: 12,210; 2040: 12,340; 2041: 12,470; 2042: 12,600	10.50	Traversable Median	18.50
8	Four-lane Freeway	Rural	559+88.750	565+40.830	552.08	0.1046	2022: 10,000; 2023: 10,130; 2024: 10,260; 2025: 10,390; 2026: 10,520; 2027: 10,650; 2028: 10,780; 2029: 10,910; 2030: 11,040; 2031: 11,170; 2032: 11,300; 2033: 11,430; 2034: 11,560; 2035: 11,690; 2036: 11,820; 2037: 11,950; 2038: 12,080; 2039: 12,210; 2040: 12,340; 2041: 12,470; 2042: 12,600	10.50	Traversable Median	18.50
9	Four-lane Freeway	Rural	565+40.830	570+00.000	459.17	0.0870	2022: 10,000; 2023: 10,130; 2024: 10,260; 2025: 10,390; 2026: 10,520; 2027: 10,650; 2028: 10,780; 2029: 10,910; 2030: 11,040; 2031: 11,170; 2032: 11,300; 2033: 11,430; 2034: 11,560; 2035: 11,690; 2036: 11,820; 2037: 11,950; 2038: 12,080; 2039: 12,210; 2040: 12,340; 2041: 12,470; 2042: 12,600	10.50	Traversable Median	18.50
10	Four-lane Freeway	Rural	570+00.000	665+43.000	9,543.00	1.8074	2022: 5,500; 2023: 5,575; 2024: 5,650; 2025: 5,725; 2026: 5,800; 2027: 5,875; 2028: 5,950; 2029: 6,025; 2030: 6,100; 2031: 6,175; 2032: 6,250; 2033: 6,325; 2034: 6,400; 2035: 6,475; 2036: 6,550; 2037: 6,625; 2038: 6,700; 2039: 6,775; 2040: 6,850; 2041: 6,925; 2042: 7,000	10.50	Traversable Median	18.50

Table 9. Predicted Freeway Crash Rates and Frequencies Summary (Section 2)

First Year of Analysis	**2022**
Last Year of Analysis	**2042**
Effective Length (mi)	**4.5536**
Average Future Road AADT (vpd)	**9,296**
Predicted Crashes	
Total Crashes	**195.88**
Fatal and Injury Crashes	**69.59**
Property-Damage-Only Crashes	**126.29**
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	**36**
Percent Property-Damage-Only Crashes (%)	**64**
Predicted Crash Rate	
Crash Rate (crashes/mi/yr)	**2.0484**
FI Crash Rate (crashes/mi/yr)	**0.7277**
PDO Crash Rate (crashes/mi/yr)	**1.3206**
Predicted Travel Crash Rate	
Total Travel (million veh-mi)	**324.45**
Travel Crash Rate (crashes/million veh-mi)	**0.60**
Travel FI Crash Rate (crashes/million veh-mi)	**0.21**
Travel PDO Crash Rate (crashes/million veh-mi)	**0.39**

Note: *Effective Length* is the *segment length* minus the length of the *speed change lanes* if present.
Note: *Total Travel and Crash Rates/Million Vehicle Miles* for *Speed Change Lanes* reflect AADTs that are **half of the Freeway Segment AADTs** based on the assumption of 50/50 directional distribution.

Table 10. Predicted Crash Frequencies and Rates by Freeway Segment/Intersection (Section 2)

Segment Number/Intersection Name/Cross Road	Start Location (Sta. ft)	End Location (Sta. ft)	Effective Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
5	425+00.000	537+84.000	2.1371	114.196	5.4379	1.9033	3.5346	2.5445	0.62
6	537+84.000	539+57.580	0.0329	2.158	0.1028	0.0370	0.0657	3.1258	0.76
7	539+57.580	559+88.750	0.3847	20.338	0.9685	0.3398	0.6286	2.5175	0.61
8	559+88.750	565+40.830	0.1046	4.632	0.2206	0.0757	0.1449	2.1095	0.51
9	565+40.830	570+00.000	0.0870	5.715	0.2721	0.0981	0.1740	3.1291	0.76
10	570+00.000	665+43.000	1.8074	48.840	2.3257	0.8599	1.4658	1.2868	0.56
Total			4.5536	195.877	9.3275	3.3139	6.0136	2.0484	0.60

Note: *Effective Length* is the *segment length* minus the length of the *speed change lanes* if present. This may create Freeway segments with zero effective length and zero crashes.

Table 11. Predicted Crash Frequencies and Rates by Horizontal Design Element (Section 2)

Title	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
Simple Curve 1	425+00.000	440+15.580	0.2870	15.338	0.7304	0.2556	0.4747	2.5445	0.62
Tangent	440+15.580	450+69.500	0.1996	10.666	0.5079	0.1778	0.3301	2.5445	0.62
Simple Curve 2	450+69.500	487+95.230	0.7056	37.705	1.7955	0.6284	1.1670	2.5445	0.62
Tangent	487+95.230	528+21.950	0.7626	40.751	1.9405	0.6792	1.2613	2.5445	0.62
Simple Curve 3	528+21.950	548+47.520	0.3836	20.805	0.9907	0.3482	0.6425	2.5824	0.63
Tangent	548+47.520	565+40.830	0.3207	16.059	0.7647	0.2666	0.4981	2.3845	0.58
Simple Curve 4	565+40.830	583+43.830	0.3415	12.592	0.5996	0.2192	0.3804	1.7560	0.61
Tangent	583+43.830	665+43.000	1.5529	41.962	1.9982	0.7388	1.2594	1.2868	0.56

Table 12. Predicted Crash Frequencies by Year (Section 2)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2022	8.35	3.02	36.128	5.34	63.872
2023	8.45	3.05	36.066	5.40	63.934
2024	8.55	3.08	36.004	5.47	63.996
2025	8.65	3.11	35.943	5.54	64.057
2026	8.74	3.14	35.883	5.61	64.117
2027	8.84	3.17	35.823	5.67	64.177
2028	8.94	3.20	35.765	5.74	64.235
2029	9.04	3.23	35.707	5.81	64.293
2030	9.13	3.26	35.649	5.88	64.351
2031	9.23	3.29	35.593	5.95	64.407
2032	9.33	3.31	35.537	6.01	64.463
2033	9.43	3.34	35.482	6.08	64.518
2034	9.52	3.37	35.427	6.15	64.573
2035	9.62	3.40	35.373	6.22	64.627
2036	9.72	3.43	35.320	6.29	64.680
2037	9.81	3.46	35.267	6.35	64.733
2038	9.91	3.49	35.215	6.42	64.785
2039	10.01	3.52	35.164	6.49	64.836
2040	10.11	3.55	35.113	6.56	64.887
2041	10.20	3.58	35.062	6.63	64.938
2042	10.30	3.61	35.013	6.69	64.987
Total	195.88	69.59	35.528	126.29	64.472
Average	9.33	3.31	35.528	6.01	64.472

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 13. Predicted Crash Severity by Freeway Segment (Section 2)

Seg. No.	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)
5	1.5511	3.8256	15.6276	18.9655	74.2258
6	0.0319	0.0799	0.3105	0.3552	1.3804
7	0.2655	0.6570	2.7408	3.4728	13.2016
8	0.0575	0.1391	0.6042	0.7880	3.0432
9	0.0846	0.2119	0.8229	0.9415	3.6537
10	0.6653	1.6176	6.9178	8.8573	30.7815
Total	2.6559	6.5311	27.0238	33.3804	126.2863

Table 14. Predicted Freeway Crash Type Distribution (Section 2)

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Highway Segment	Collision with Animal	0.60	0.3	7.46	3.8	8.06	4.1
Highway Segment	Collision with Fixed Object	33.95	17.3	71.72	36.6	105.67	53.9
Highway Segment	Collision with Other Object	1.86	0.9	14.34	7.3	16.20	8.3
Highway Segment	Other Single-vehicle Collision	22.04	11.2	18.59	9.5	40.62	20.7
Highway Segment	Collision with Parked Vehicle	1.44	0.7	2.64	1.3	4.08	2.1
Highway Segment	Total Single Vehicle Crashes	59.88	30.6	114.74	58.6	174.62	89.2
Highway Segment	Right-Angle Collision	0.54	0.3	0.35	0.2	0.89	0.5
Highway Segment	Head-on Collision	0.17	0.1	0.05	0.0	0.22	0.1
Highway Segment	Other Multi-vehicle Collision	0.57	0.3	0.90	0.5	1.47	0.8
Highway Segment	Rear-end Collision	6.12	3.1	5.86	3.0	11.98	6.1
Highway Segment	Sideswipe, Same Direction Collision	2.30	1.2	4.39	2.2	6.69	3.4
Highway Segment	Total Multiple Vehicle Crashes	9.71	5.0	11.54	5.9	21.25	10.8
Highway Segment	Total Highway Segment Crashes	69.59	35.5	126.29	64.5	195.88	100.0
	Total Crashes	69.59	35.5	126.29	64.5	195.88	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Interactive Highway Safety Design Model

Crash Prediction Evaluation Report

67-160 Interchange

Alternative 1

December 11, 2020

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Combined Report

Combined Report Overview

Report Generated: Dec 11, 2020 1:32 PM
Report Template: System: Multi-Page [System] (mlcpm2, Nov 27, 2020 3:23 PM)

Evaluation Title: Evaluation Interchange 2022-2042
Evaluation Comment: Created Fri Dec 11 13:27:03 CST 2020
Evaluation Date: Fri Dec 11 13:29:59 CST 2020

User Name: mhuebbe
Organization Name: EFK Moen, LLC
Phone: 314-394-3133
E-Mail: mhuebbe@efkmoen.com

Project Title: Project 67-Alt1 Dia
Project Comment: Created Wed Dec 09 16:11:58 CST 2020
Project Unit System: U.S. Customary

Interchange Title: Interchange 160-67
Interchange Comment: Created Thu Dec 10 08:43:05 CST 2020

Report Overview

Disclaimer Regarding Crash Prediction Method

IMPORTANT NOTICE ABOUT COMPARING RESULTS FROM HIGHWAY SAFETY MANUAL FIRST EDITION (2010) MODELS TO RESULTS FROM NEW MODELS DEVELOPED UNDER NCHRP PROJECTS 17-70 AND 17-58

Since the publication of the Highway Safety Manual - First Edition (HSM-1), in 2010 by the American Association of State Highway and Transportation Officials (AASHTO), multiple research efforts have been undertaken through the National Cooperative Highway Research Program (NCHRP) to develop safety performance models for road segment and intersection facility types that were not initially reflected in the HSM-1, in order to expand the breadth and depth of the HSM in the future.

The IHSDM Crash Prediction Module (CPM) is intended as a faithful implementation of HSM Part C predictive methods. As NCHRP projects to develop new predictive methods for the HSM are completed, FHWA works to incorporate the new methods into IHSDM, sometimes in advance of publication in the HSM. The following new crash predictive methods have been accepted by NCHRP project panels and incorporated into IHSDM, while pending AASHTO's approval for incorporation into a future edition of the HSM:

- Roundabouts: completed in 2018 under NCHRP Project 17-70, the new methods will provide improved outcomes for the safety analysis of roundabouts.
- 6+ lane and one-way urban/suburban arterials (including models for segments and intersections): completed under NCHRP Project 17-58.

However, in the absence of local calibration factors (see HSM-1 Part C, Appendix A for guidance on calibration of the predictive models), it is neither appropriate nor advisable to directly compare the results from new models (from NCHRP Projects 17-58 and 17-70) to results from HSM-1 models, as the models were not calibrated to the same base state data sets, and consequently can produce unexpected results. If local calibration factors are available and applied to both new models and HSM-1 models, then it may be appropriate to directly compare the results.*[Note: Work being performed under NCHRP Project 17-72 (Update of Crash Modification Factors for the Highway Safety Manual) is expected to re-calibrate many of the old (HSM-1) and new (e.g., NCHRP 17-70) models to data from a single (or small number of) states, that would allow results from all models to be directly compared.]*

The models produced for NCHRP Project 17-70 have independent value in terms of informing the design of a roundabout and assessing the effects of different design characteristics on the expected safety performance of a roundabout.

The HSM-1 interim method previously included in IHSDM for evaluating roundabouts on urban/suburban arterials (i.e., evaluating an existing intersection and then applying a Crash Modification Factor for replacing the existing intersection with a roundabout) has been deactivated in IHSDM, to minimize any confusion with the new roundabout methodology.

Section Types

Interchange 160-67 : Evaluation Interchange 2022-2042 : Ramp SB Enter Evaluation

Report Overview

Report Generated: Dec 11, 2020 1:32 PM
Report Template: System: Multi-Page [System] (mlcpm2, Nov 27, 2020 3:23 PM)

Evaluation Date: Fri Dec 11 13:27:48 CST 2020
IHSDM Version: v16.0.0 (Sep 30, 2020)
Crash Prediction Module: v11.0.0 (Sep 30, 2020)

User Name: mhuebbe
Organization Name: EFK Moen, LLC
Phone: 314-394-3133
E-Mail: mhuebbe@efkmoen.com

Project Title: Interchange 160-67
Project Comment: Created Thu Dec 10 08:43:05 CST 2020
Project Unit System: U.S. Customary

Highway Title: Ramp SB Enter
Highway Comment: Created Thu Dec 10 11:12:22 CST 2020
Highway Version: 1

Evaluation Title: Interchange 160-67 : Evaluation Interchange 2022-2042 : Ramp SB Enter
Evaluation Comment: Created Fri Dec 11 13:27:34 CST 2020

Minimum Location: 0.000
Maximum Location: 7+18.230
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: HSM Configuration
Crash Distribution: HSM Configuration
Model/CMF: HSM Configuration
First Year of Analysis: 2022
Last Year of Analysis: 2042
Empirical-Bayes Analysis: None
First Year of Observed Crashes:
Last Year of Observed Crashes:

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Since the publication of the Highway Safety Manual - First Edition (HSM-1), in 2010 by the American Association of State Highway and Transportation Officials (AASHTO), multiple research efforts have been undertaken through the National Cooperative Highway Research Program (NCHRP) to develop safety performance models for road segment and intersection facility types that were not initially reflected in the HSM-1, in order to expand the breadth and depth of the HSM in the future.

The IHSDM Crash Prediction Module (CPM) is intended as a faithful implementation of HSM Part C predictive methods. As NCHRP projects to develop new predictive methods for the HSM are completed, FHWA works to incorporate the new methods into IHSDM, sometimes in advance of publication in the HSM. The following new crash predictive methods have been accepted by NCHRP project panels and incorporated into IHSDM, while pending AASHTO's approval for incorporation into a future edition of the HSM:

- Roundabouts: completed in 2018 under NCHRP Project 17-70, the new methods will provide improved outcomes for the safety analysis of roundabouts.
- 6+ lane and one-way urban/suburban arterials (including models for segments and intersections): completed under NCHRP Project 17-58.

However, in the absence of local calibration factors (see HSM-1 Part C, Appendix A for guidance on calibration of the predictive models), it is neither appropriate nor advisable to directly compare the results from new models (from NCHRP Projects 17-58 and 17-70) to results from HSM-1 models, as the models were not calibrated to the same base state data sets, and consequently can produce unexpected results. If local calibration factors are available and applied to both new models and HSM-1 models, then it may be appropriate to directly compare the results.*[Note: Work being performed under NCHRP Project 17-72 (Update of Crash Modification Factors for the Highway Safety Manual) is expected to re-calibrate many of the old (HSM-1) and new (e.g., NCHRP 17-70) models to data from a single (or small number of) states, that would allow results from all models to be directly compared.]*

The models produced for NCHRP Project 17-70 have independent value in terms of informing the design of a roundabout and assessing the effects of different design characteristics on the expected safety performance of a roundabout.

The HSM-1 interim method previously included in IHSDM for evaluating roundabouts on urban/suburban arterials (i.e., evaluating an existing intersection and then applying a Crash Modification Factor for replacing the existing intersection with a roundabout) has been deactivated in IHSDM, to minimize any confusion with the new roundabout methodology.

Freeway Ramp Evaluation

Section: Section 1
Evaluation Start Location: 0.000
Evaluation End Location: 7+18.230
Functional Class: Freeway Service Ramp
Type of Alignment: One Direction
Model Category: Freeway Service Ramp

Calibration Factor: ENT_RAMP_MV_FI=1.0; ENT_RAMP_MV_PDO=1.0; ENT_RAMP_SV_FI=1.0; ENT_RAMP_SV_PDO=1.0;

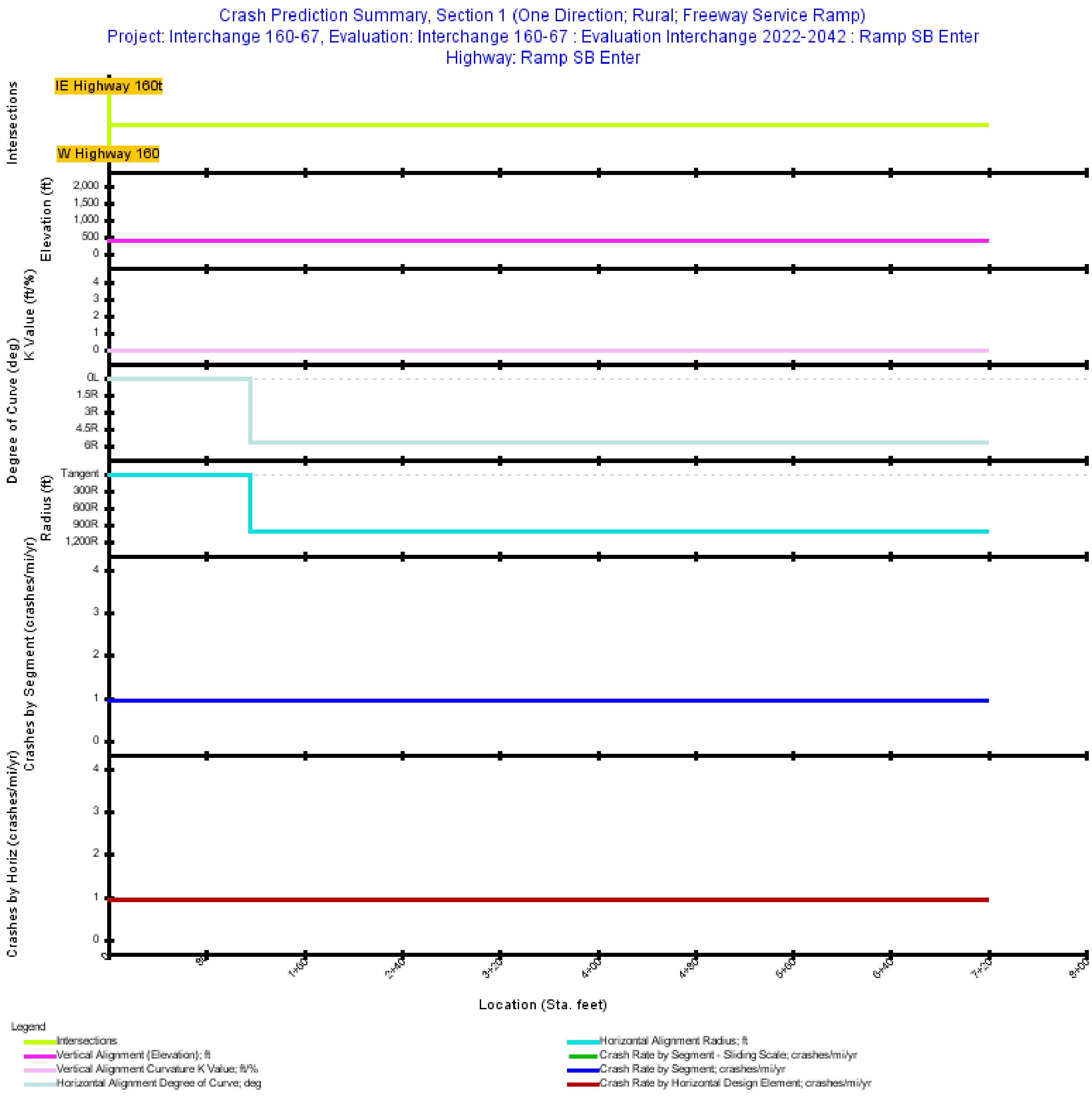

Figure 1. Crash Prediction Summary (Freeway Ramp Sections)

Table 1. Evaluation Freeway - Homogeneous Segments (Freeway Ramp Sections)

Seg. No.	Type	Area Type	Start Location (Sta. ft)	End Location (Sta. ft)	Length (ft)	Length (mi)	AADT
1	Freeway Ramp and C-D Road One-lane Ramp Entrance	Rural	0.000	7+18.230	718.23	0.1360	2022: 2,900; 2023: 2,935; 2024: 2,970; 2025: 3,005; 2026: 3,040; 2027: 3,075; 2028: 3,110; 2029: 3,145; 2030: 3,180; 2031: 3,215; 2032: 3,250; 2033: 3,285; 2034: 3,320; 2035: 3,355; 2036: 3,390; 2037: 3,425; 2038: 3,460; 2039: 3,495; 2040: 3,530; 2041: 3,565; 2042: 3,600

Table 2. Predicted Ramp Crash Rates and Frequencies Summary (Freeway Ramp Sections)

First Year of Analysis	**2022**
Last Year of Analysis	**2042**
Evaluated Length (mi)	**0.1360**
Average Future Road AADT (vpd)	**3,250**
Predicted Crashes	
Total Crashes	**2.73**
Fatal and Injury Crashes	**1.11**
Property-Damage-Only Crashes	**1.62**
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	**41**
Percent Property-Damage-Only Crashes (%)	**59**
Predicted Crash Rate	
Crash Rate (crashes/mi/yr)	**0.9546**
FI Crash Rate (crashes/mi/yr)	**0.3878**
PDO Crash Rate (crashes/mi/yr)	**0.5668**
Predicted Travel Crash Rate	
Total Travel (million veh-mi)	**3.39**
Travel Crash Rate (crashes/million veh-mi)	**0.81**
Travel FI Crash Rate (crashes/million veh-mi)	**0.33**
Travel PDO Crash Rate (crashes/million veh-mi)	**0.48**

Table 3. Predicted Crash Frequencies and Rates by Ramp Segment/Intersection (Freeway Ramp Sections)

Segment Number/Intersection Name/Cross Road	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
1	0.000	7+18.230	0.1360	2.727	0.1299	0.0528	0.0771	0.9546	0.81
Total			0.1360	2.727	0.1299	0.0528	0.0771	0.9546	

Table 4. Predicted Crash Frequencies and Rates by Horizontal Design Element (Freeway Ramp Sections)

Title	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
Tangent	0.000	1+15.840	0.0219	0.440	0.0209	0.0085	0.0124	0.9546	0.81
Simple Curve 1	1+15.840	7+18.230	0.1141	2.287	0.1089	0.0442	0.0647	0.9546	0.81

Table 5. Predicted Crash Frequencies by Year (Freeway Ramp Sections)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2022	0.12	0.05	40.824	0.07	59.176
2023	0.12	0.05	40.804	0.07	59.196
2024	0.12	0.05	40.784	0.07	59.216
2025	0.12	0.05	40.764	0.07	59.236
2026	0.12	0.05	40.744	0.07	59.256
2027	0.12	0.05	40.725	0.07	59.275
2028	0.13	0.05	40.705	0.07	59.295
2029	0.13	0.05	40.686	0.07	59.314
2030	0.13	0.05	40.666	0.08	59.334
2031	0.13	0.05	40.647	0.08	59.353
2032	0.13	0.05	40.628	0.08	59.372
2033	0.13	0.05	40.609	0.08	59.391
2034	0.13	0.05	40.590	0.08	59.410
2035	0.13	0.05	40.571	0.08	59.429
2036	0.13	0.05	40.552	0.08	59.448
2037	0.14	0.06	40.533	0.08	59.467
2038	0.14	0.06	40.515	0.08	59.485
2039	0.14	0.06	40.496	0.08	59.504
2040	0.14	0.06	40.478	0.08	59.522
2041	0.14	0.06	40.459	0.08	59.541
2042	0.14	0.06	40.441	0.08	59.559
Total	2.73	1.11	40.624	1.62	59.376
Average	0.13	0.05	40.624	0.08	59.376

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 6. Predicted Crash Severity by Ramp Segment (Freeway Ramp Sections)

Seg. No.	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)
1	0.0308	0.0934	0.6115	0.3720	1.6191

Table 7. Predicted Freeway Ramp Crash Type Distribution (Freeway Ramp Sections)

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Highway Segment	Collision with Animal	0.01	0.4	0.09	3.2	0.10	3.5
Highway Segment	Collision with Fixed Object	0.61	22.2	0.83	30.3	1.43	52.5
Highway Segment	Collision with Other Object	0.03	1.2	0.17	6.1	0.20	7.3
Highway Segment	Other Single-vehicle Collision	0.39	14.4	0.21	7.9	0.61	22.3
Highway Segment	Collision with Parked Vehicle	0.03	0.9	0.03	1.1	0.06	2.1
Highway Segment	Total Single Vehicle Crashes	1.07	39.2	1.32	48.5	2.39	87.7
Highway Segment	Right-Angle Collision	0.00	0.1	0.01	0.3	0.01	0.4
Highway Segment	Head-on Collision	0.00	0.0	0.00	0.0	0.00	0.1
Highway Segment	Other Multi-vehicle Collision	0.00	0.1	0.02	0.8	0.03	0.9
Highway Segment	Rear-end Collision	0.03	0.9	0.15	5.5	0.18	6.4
Highway Segment	Sideswipe, Same Direction Collision	0.01	0.3	0.11	4.1	0.12	4.5
Highway Segment	Total Multiple Vehicle Crashes	0.04	1.5	0.30	10.9	0.34	12.3
Highway Segment	Total Highway Segment Crashes	1.11	40.6	1.62	59.4	2.73	100.0
	Total Crashes	1.11	40.6	1.62	59.4	2.73	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Interchange 160-67 : Evaluation Interchange 2022-2042 : Ramp SB Exit Evaluation

Report Overview

Report Generated: Dec 11, 2020 1:32 PM

Report Template: System: Multi-Page [System] (mlcpm2, Nov 27, 2020 3:23 PM)

Evaluation Date: Fri Dec 11 13:28:12 CST 2020
IHSDM Version: v16.0.0 (Sep 30, 2020)
Crash Prediction Module: v11.0.0 (Sep 30, 2020)

User Name: mhuebbe
Organization Name: EFK Moen, LLC
Phone: 314-394-3133
E-Mail: mhuebbe@efkmoen.com

Project Title: Interchange 160-67
Project Comment: Created Thu Dec 10 08:43:05 CST 2020
Project Unit System: U.S. Customary

Highway Title: Ramp SB Exit
Highway Comment: Created Thu Dec 10 11:42:40 CST 2020
Highway Version: 1

Evaluation Title: Interchange 160-67 : Evaluation Interchange 2022-2042 : Ramp SB Exit
Evaluation Comment: Created Fri Dec 11 13:27:58 CST 2020

Minimum Location: 0.000
Maximum Location: 17+62.820
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: HSM Configuration
Crash Distribution: HSM Configuration
Model/CMF: HSM Configuration
First Year of Analysis: 2022
Last Year of Analysis: 2042
Empirical-Bayes Analysis: None
First Year of Observed Crashes:
Last Year of Observed Crashes:

Disclaimer Regarding Crash Prediction Method

IMPORTANT NOTICE ABOUT COMPARING RESULTS FROM HIGHWAY SAFETY MANUAL FIRST EDITION (2010) MODELS TO RESULTS FROM NEW MODELS DEVELOPED UNDER NCHRP PROJECTS 17-70 AND 17-58

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- Roundabouts: completed in 2018 under NCHRP Project 17-70, the new methods will provide improved outcomes for the safety analysis of roundabouts.
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Freeway Ramp Evaluation

Section: Section 1
Evaluation Start Location: 0.000
Evaluation End Location: 17+62.820
Functional Class: Freeway Service Ramp
Type of Alignment: One Direction
Model Category: Freeway Service Ramp
Calibration Factor: EX_RAMP_MV_FI=1.0; EX_RAMP_MV_PDO=1.0; EX_RAMP_SV_FI=1.0; EX_RAMP_SV_PDO=1.0;

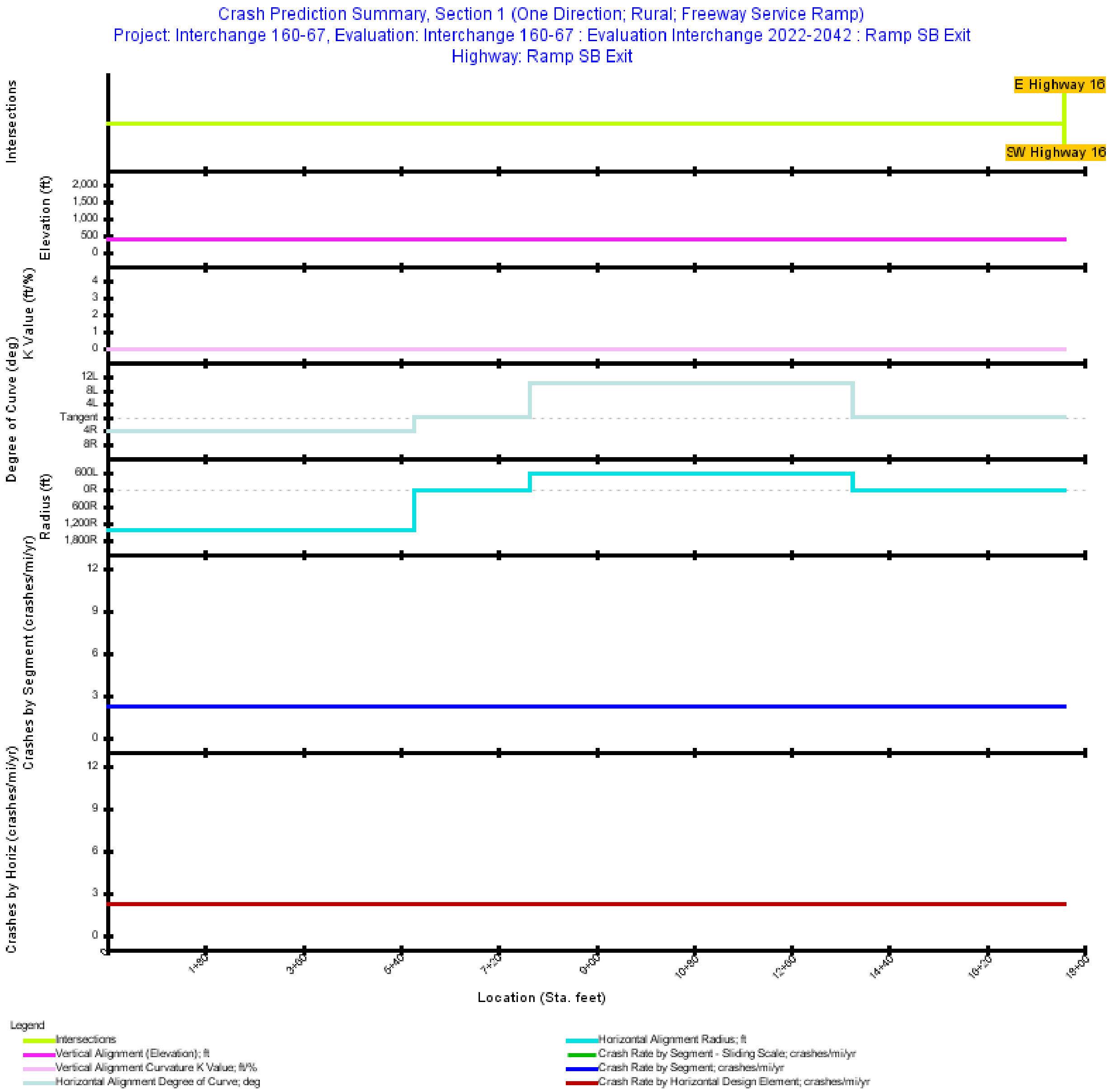

Figure 2. Crash Prediction Summary (Freeway Ramp Sections)

Table 8. Evaluation Freeway - Homogeneous Segments (Freeway Ramp Sections)

Seg. No.	Type	Area Type	Start Location (Sta. ft)	End Location (Sta. ft)	Length (ft)	Length (mi)	AADT
1	Freeway Ramp and C-D Road One-lane Ramp Exit	Rural	0.000	17+62.820	1,762.82	0.3339	2022: 5,900; 2023: 5,965; 2024: 6,030; 2025: 6,095; 2026: 6,160; 2027: 6,225; 2028: 6,290; 2029: 6,355; 2030: 6,420; 2031: 6,485; 2032: 6,550; 2033: 6,615; 2034: 6,680; 2035: 6,745; 2036: 6,810; 2037: 6,875; 2038: 6,940; 2039: 7,005; 2040: 7,070; 2041: 7,135; 2042: 7,200

Table 9. Predicted Ramp Crash Rates and Frequencies Summary (Freeway Ramp Sections)

First Year of Analysis	**2022**
Last Year of Analysis	**2042**
Evaluated Length (mi)	**0.3339**
Average Future Road AADT (vpd)	**6,550**
Predicted Crashes	
Total Crashes	**15.57**
Fatal and Injury Crashes	**7.17**
Property-Damage-Only Crashes	**8.39**
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	**46**
Percent Property-Damage-Only Crashes (%)	**54**
Predicted Crash Rate	
Crash Rate (crashes/mi/yr)	**2.2202**
FI Crash Rate (crashes/mi/yr)	**1.0231**
PDO Crash Rate (crashes/mi/yr)	**1.1971**
Predicted Travel Crash Rate	
Total Travel (million veh-mi)	**16.76**
Travel Crash Rate (crashes/million veh-mi)	**0.93**
Travel FI Crash Rate (crashes/million veh-mi)	**0.43**
Travel PDO Crash Rate (crashes/million veh-mi)	**0.50**

Table 10. Predicted Crash Frequencies and Rates by Ramp Segment/Intersection (Freeway Ramp Sections)

Segment Number/Intersection Name/Cross Road	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
1	0.000	17+62.820	0.3339	15.566	0.7413	0.3416	0.3997	2.2202	0.93
Total			0.3339	15.566	0.7413	0.3416	0.3997	2.2202	

Table 11. Predicted Crash Frequencies and Rates by Horizontal Design Element (Freeway Ramp Sections)

Title	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi /yr)	Predicted Travel Crash Rate (crashes/mi llion veh-mi)
Simple Curve 1	0.000	5+64.230	0.1069	4.982	0.2373	0.1093	0.1279	2.2202	0.93
Tangent	5+64.230	7+78.690	0.0406	1.894	0.0902	0.0416	0.0486	2.2202	0.93
Simple Curve 2	7+78.690	13+71.820	0.1123	5.238	0.2494	0.1149	0.1345	2.2202	0.93
Tangent	13+71.820	17+62.820	0.0741	3.453	0.1644	0.0758	0.0887	2.2202	0.93

Table 12. Predicted Crash Frequencies by Year (Freeway Ramp Sections)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2022	0.69	0.32	46.125	0.37	53.875
2023	0.69	0.32	46.121	0.37	53.879
2024	0.70	0.32	46.117	0.38	53.883
2025	0.70	0.32	46.112	0.38	53.888
2026	0.71	0.33	46.108	0.38	53.892
2027	0.71	0.33	46.104	0.39	53.896
2028	0.72	0.33	46.100	0.39	53.900
2029	0.72	0.33	46.095	0.39	53.905
2030	0.73	0.34	46.091	0.39	53.909
2031	0.74	0.34	46.087	0.40	53.913
2032	0.74	0.34	46.082	0.40	53.918
2033	0.75	0.34	46.078	0.40	53.922
2034	0.75	0.35	46.073	0.41	53.927
2035	0.76	0.35	46.069	0.41	53.931
2036	0.76	0.35	46.065	0.41	53.935
2037	0.77	0.35	46.060	0.41	53.940
2038	0.77	0.36	46.056	0.42	53.944
2039	0.78	0.36	46.051	0.42	53.949
2040	0.78	0.36	46.047	0.42	53.953
2041	0.79	0.36	46.042	0.43	53.958
2042	0.80	0.37	46.038	0.43	53.962
Total	15.57	7.17	46.081	8.39	53.919
Average	0.74	0.34	46.081	0.40	53.919

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 13. Predicted Crash Severity by Ramp Segment (Freeway Ramp Sections)

Seg. No.	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)
1	0.2761	0.8373	3.6223	2.4375	8.3933

Table 14. Predicted Freeway Ramp Crash Type Distribution (Freeway Ramp Sections)

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Highway Segment	Collision with Animal	0.07	0.5	0.50	3.2	0.57	3.7
Highway Segment	Collision with Fixed Object	4.04	26.0	4.80	30.8	8.84	56.8
Highway Segment	Collision with Other Object	0.22	1.4	0.96	6.2	1.18	7.6
Highway Segment	Other Single-vehicle Collision	2.62	16.8	1.24	8.0	3.87	24.8
Highway Segment	Collision with Parked Vehicle	0.17	1.1	0.18	1.1	0.35	2.2
Highway Segment	Total Single Vehicle Crashes	7.12	45.8	7.67	49.3	14.80	95.1
Highway Segment	Right-Angle Collision	0.00	0.0	0.02	0.1	0.02	0.2
Highway Segment	Head-on Collision	0.00	0.0	0.00	0.0	0.00	0.0
Highway Segment	Other Multi-vehicle Collision	0.00	0.0	0.06	0.4	0.06	0.4
Highway Segment	Rear-end Collision	0.03	0.2	0.36	2.3	0.40	2.5
Highway Segment	Sideswipe, Same Direction Collision	0.01	0.1	0.27	1.8	0.28	1.8
Highway Segment	Total Multiple Vehicle Crashes	0.05	0.3	0.72	4.6	0.77	4.9
Highway Segment	Total Highway Segment Crashes	7.17	46.1	8.39	53.9	15.57	100.0
	Total Crashes	7.17	46.1	8.39	53.9	15.57	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 15. Evaluation Message

Start Location (Sta. ft)	End Location (Sta. ft)	Message
0.000	17+62.820	for segment #1 (0.000 to 17+62.820), traffic volume (7,005 vpd) for 2039 is not within the model limit (7,000 vpd) for reliable results for segment type 1EX
0.000	17+62.820	for segment #1 (0.000 to 17+62.820), traffic volume (7,070 vpd) for 2040 is not within the model limit (7,000 vpd) for reliable results for segment type 1EX
0.000	17+62.820	for segment #1 (0.000 to 17+62.820), traffic volume (7,135 vpd) for 2041 is not within the model limit (7,000 vpd) for reliable results for segment type 1EX
0.000	17+62.820	for segment #1 (0.000 to 17+62.820), traffic volume (7,200 vpd) for 2042 is not within the model limit (7,000 vpd) for reliable results for segment type 1EX

Interchange 160-67 : Evaluation Interchange 2022-2042 : RampTerminal 160 SB Evaluation

Report Overview

Report Generated: Dec 11, 2020 1:32 PM
Report Template: System: Multi-Page [System] (mlcpm2, Nov 27, 2020 3:23 PM)

Evaluation Date: Fri Dec 11 13:28:44 CST 2020
IHSDM Version: v16.0.0 (Sep 30, 2020)
Crash Prediction Module: v11.0.0 (Sep 30, 2020)

User Name: mhuebbe
Organization Name: EFK Moen, LLC
Phone: 314-394-3133
E-Mail: mhuebbe@efkmoen.com

Project Title: Interchange 160-67
Project Comment: Created Thu Dec 10 08:43:05 CST 2020
Project Unit System: U.S. Customary

Intersection Title: RampTerminal 160 SB
Intersection Comment: Created Thu Dec 10 12:35:13 CST 2020
Intersection Version: v1

Evaluation Title: Interchange 160-67 : Evaluation Interchange 2022-2042 : RampTerminal 160 SB
Evaluation Comment: Created Fri Dec 11 13:28:38 CST 2020

Minimum Location: 534+24.000
Maximum Location: 596+34.000
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: HSM Configuration
Crash Distribution: HSM Configuration
Model/CMF: HSM Configuration
First Year of Analysis: 2022
Last Year of Analysis: 2042
Empirical-Bayes Analysis: None
First Year of Observed Crashes:
Last Year of Observed Crashes:

Disclaimer Regarding Crash Prediction Method

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- Roundabouts: completed in 2018 under NCHRP Project 17-70, the new methods will provide improved outcomes for the safety analysis of roundabouts.
- 6+ lane and one-way urban/suburban arterials (including models for segments and intersections): completed under NCHRP Project 17-58.

However, in the absence of local calibration factors (see HSM-1 Part C, Appendix A for guidance on calibration of the predictive models), it is neither appropriate nor advisable to directly compare the results from new models (from NCHRP Projects 17-58 and 17-70) to results from HSM-1 models, as the models were not calibrated to the same base state data sets, and consequently can produce unexpected results. If local calibration factors are available and applied to both new models and HSM-1 models, then it may be appropriate to directly compare the results.*[Note: Work being performed under NCHRP Project 17-72 (Update of Crash Modification Factors for the Highway Safety Manual) is expected to re-calibrate many of the old (HSM-1) and new (e.g., NCHRP 17-70) models to data from a single (or small number of) states, that would allow results from all models to be directly compared.]*

The models produced for NCHRP Project 17-70 have independent value in terms of informing the design of a roundabout and assessing the effects of different design characteristics on the expected safety performance of a roundabout.

The HSM-1 interim method previously included in IHSDM for evaluating roundabouts on urban/suburban arterials (i.e., evaluating an existing intersection and then applying a Crash Modification Factor for replacing the existing intersection with a roundabout) has been deactivated in IHSDM, to minimize any confusion with the new roundabout methodology.

RampTerminal 160 SB Evaluation

Intersection: RampTerminal 160 SB
Evaluation Start Location: 534+24.000
Evaluation End Location: 596+34.000
Calibration Factor: RT_ST_FI=1.0; RT_ST_PDO=1.0;

Table 16. Evaluation Ramp Terminal - Site (RampTerminal 160 SB)

Inter. No.	Title	Type	Area Type	Legs	Location (Sta. ft)	Traffic Control	AADT
1	RampTerminal 160 SB (v1)	Freeway Ramp Terminal D4 - Four-Leg with Diagonal Ramps	Rural	4	580+00.000	Stop-Controlled	Inside: 2022: 7,100; 2023: 7,185; 2024: 7,270; 2025: 7,355; 2026: 7,440; 2027: 7,525; 2028: 7,610; 2029: 7,695; 2030: 7,780; 2031: 7,865; 2032: 7,950; 2033: 8,035; 2034: 8,120; 2035: 8,205; 2036: 8,290; 2037: 8,375; 2038: 8,460; 2039: 8,545; 2040: 8,630; 2041: 8,715; 2042: 8,800; Outside: 2022: 7,100; 2023: 7,185; 2024: 7,270; 2025: 7,355; 2026: 7,440; 2027: 7,525; 2028: 7,610; 2029: 7,695; 2030: 7,780; 2031: 7,865; 2032: 7,950; 2033: 8,035; 2034: 8,120; 2035: 8,205; 2036: 8,290; 2037: 8,375; 2038: 8,460; 2039: 8,545; 2040: 8,630; 2041: 8,715; 2042: 8,800 :: Entrance: 2022: 2,900; 2023: 2,935; 2024: 2,970; 2025: 3,005; 2026: 3,040; 2027: 3,075; 2028: 3,110; 2029: 3,145; 2030: 3,180; 2031: 3,215; 2032: 3,250; 2033: 3,285; 2034: 3,320; 2035: 3,355; 2036: 3,390; 2037: 3,425; 2038: 3,460; 2039: 3,495; 2040: 3,530; 2041: 3,565; 2042: 3,600; Exit: 2022: 5,900; 2023: 5,965; 2024: 6,030; 2025: 6,095; 2026: 6,160; 2027: 6,225; 2028: 6,290; 2029: 6,355; 2030: 6,420; 2031: 6,485; 2032: 6,550; 2033: 6,615; 2034: 6,680; 2035: 6,745; 2036: 6,810; 2037: 6,875; 2038: 6,940; 2039: 7,005; 2040: 7,070; 2041: 7,135; 2042: 7,200

Table 17. Predicted Ramp Terminal Crash Rates and Frequencies Summary (RampTerminal 160 SB)

First Year of Analysis	**2022**
Last Year of Analysis	**2042**
Predicted Crashes	
Total Crashes	**78.59**
Fatal and Injury Crashes	**47.04**
Property-Damage-Only Crashes	**31.55**
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	**60**
Percent Property-Damage-Only Crashes (%)	**40**

Table 18. Predicted Crash Frequencies and Rates by Ramp Terminal (RampTerminal 160 SB)

Segment Number/Intersection Name/Cross Road	Location (Sta. ft)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Travel Crash Rate (crashes/million veh)
RampTerminal 160 SB (v1)	580+00.000	78.592	3.7425	2.2400	1.5025	0.80

Table 19. Predicted Crash Frequencies by Year (RampTerminal 160 SB)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2022	2.94	1.64	55.894	1.30	44.106
2023	3.01	1.69	56.247	1.32	43.753
2024	3.08	1.74	56.602	1.34	43.398
2025	3.15	1.80	56.960	1.36	43.040
2026	3.23	1.85	57.319	1.38	42.681
2027	3.30	1.91	57.681	1.40	42.319
2028	3.38	1.96	58.044	1.42	41.956
2029	3.46	2.02	58.410	1.44	41.590
2030	3.54	2.08	58.776	1.46	41.224
2031	3.62	2.14	59.145	1.48	40.855
2032	3.71	2.21	59.515	1.50	40.485
2033	3.79	2.27	59.886	1.52	40.114
2034	3.88	2.34	60.260	1.54	39.740
2035	3.97	2.41	60.634	1.56	39.366
2036	4.07	2.48	61.009	1.58	38.991
2037	4.16	2.55	61.386	1.61	38.614
2038	4.26	2.63	61.764	1.63	38.236
2039	4.36	2.71	62.142	1.65	37.858
2040	4.46	2.79	62.522	1.67	37.478
2041	4.56	2.87	62.902	1.69	37.098
2042	4.67	2.95	63.283	1.71	36.717
Total	78.59	47.04	59.854	31.55	40.146
Average	3.74	2.24	59.854	1.50	40.146

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the

distribution of these three crashes had been derived independently.

Table 20. Predicted Crash Severity by Ramp Terminal (RampTerminal 160 SB)

Seg. No.	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)
1	0.5564	2.9213	9.6638	33.8991	31.5516

Table 21. Predicted Ramp Terminal Crash Type Distribution (RampTerminal 160 SB)

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Ramp Terminal	Collision with Animal	0.00	0.0	0.00	0.0	0.00	0.0
Ramp Terminal	Collision with Fixed Object	3.67	4.7	4.99	6.3	8.65	11.0
Ramp Terminal	Collision with Other Object	0.00	0.0	0.16	0.2	0.16	0.2
Ramp Terminal	Other Single-vehicle Collision	3.06	3.9	0.82	1.0	3.88	4.9
Ramp Terminal	Collision with Parked Vehicle	0.33	0.4	0.47	0.6	0.80	1.0
Ramp Terminal	Total Single Vehicle Crashes	7.06	9.0	6.44	8.2	13.49	17.2
Ramp Terminal	Right-Angle Collision	24.55	31.2	11.74	14.9	36.29	46.2
Ramp Terminal	Head-on Collision	0.94	1.2	0.47	0.6	1.41	1.8
Ramp Terminal	Other Multi-vehicle Collision	0.61	0.8	0.82	1.0	1.43	1.8
Ramp Terminal	Rear-end Collision	12.94	16.5	8.71	11.1	21.64	27.5
Ramp Terminal	Sideswipe, Same Direction Collision	0.94	1.2	3.38	4.3	4.32	5.5
Ramp Terminal	Total Multiple Vehicle Crashes	39.98	50.9	25.11	32.0	65.10	82.8
Ramp Terminal	Total Ramp Terminal Crashes	47.04	59.9	31.55	40.1	78.59	100.0
	Total Crashes	47.04	59.9	31.55	40.1	78.59	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Interchange 160-67 : Evaluation Interchange 2022-2042 : Ramp NB Enter Evaluation

Report Overview

Report Generated: Dec 11, 2020 1:32 PM
Report Template: System: Multi-Page [System] (mlcpm2, Nov 27, 2020 3:23 PM)

Evaluation Date: Fri Dec 11 13:29:02 CST 2020
IHSDM Version: v16.0.0 (Sep 30, 2020)
Crash Prediction Module: v11.0.0 (Sep 30, 2020)

User Name: mhuebbe
Organization Name: EFK Moen, LLC
Phone: 314-394-3133
E-Mail: mhuebbe@efkmoen.com

Project Title: Interchange 160-67
Project Comment: Created Thu Dec 10 08:43:05 CST 2020
Project Unit System: U.S. Customary

Highway Title: Ramp NB Enter
Highway Comment: Created Thu Dec 10 12:44:09 CST 2020
Highway Version: 1

Evaluation Title: Interchange 160-67 : Evaluation Interchange 2022-2042 : Ramp NB Enter
Evaluation Comment: Created Fri Dec 11 13:28:50 CST 2020

Minimum Location: 0.000
Maximum Location: 9+57.000
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: HSM Configuration
Crash Distribution: HSM Configuration
Model/CMF: HSM Configuration
First Year of Analysis: 2022
Last Year of Analysis: 2042
Empirical-Bayes Analysis: None
First Year of Observed Crashes:
Last Year of Observed Crashes:

Disclaimer Regarding Crash Prediction Method

IMPORTANT NOTICE ABOUT COMPARING RESULTS FROM HIGHWAY SAFETY MANUAL FIRST EDITION (2010) MODELS TO RESULTS FROM NEW MODELS DEVELOPED UNDER NCHRP PROJECTS 17-70 AND 17-58

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Freeway Ramp Evaluation

Section: Section 1
Evaluation Start Location: 0.000
Evaluation End Location: 9+57.000
Functional Class: Freeway Service Ramp
Type of Alignment: One Direction
Model Category: Freeway Service Ramp

Calibration Factor: ENT_RAMP_MV_FI=1.0; ENT_RAMP_MV_PDO=1.0; ENT_RAMP_SV_FI=1.0; ENT_RAMP_SV_PDO=1.0;

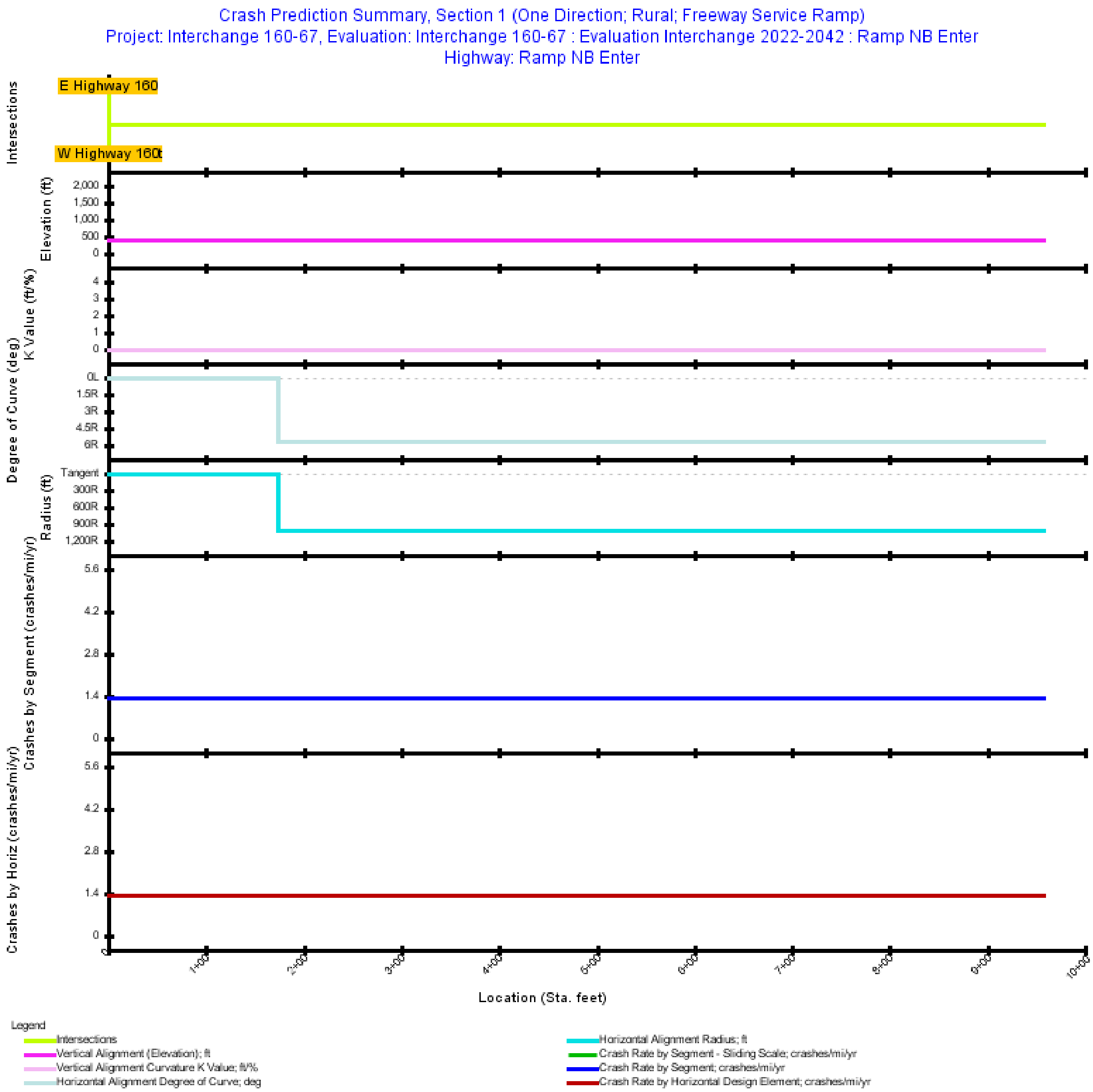

Figure 3. Crash Prediction Summary (Freeway Ramp Sections)

Table 22. Evaluation Freeway - Homogeneous Segments (Freeway Ramp Sections)

Seg. No.	Type	Area Type	Start Location (Sta. ft)	End Location (Sta. ft)	Length (ft)	Length (mi)	AADT
1	Freeway Ramp and C-D Road One-lane Ramp Entrance	Rural	0.000	9+57.000	957.00	0.1812	2022: 4,100; 2023: 4,165; 2024: 4,230; 2025: 4,295; 2026: 4,360; 2027: 4,425; 2028: 4,490; 2029: 4,555; 2030: 4,620; 2031: 4,685; 2032: 4,750; 2033: 4,815; 2034: 4,880; 2035: 4,945; 2036: 5,010; 2037: 5,075; 2038: 5,140; 2039: 5,205; 2040: 5,270; 2041: 5,335; 2042: 5,400

Table 23. Predicted Ramp Crash Rates and Frequencies Summary (Freeway Ramp Sections)

First Year of Analysis	**2022**
Last Year of Analysis	**2042**
Evaluated Length (mi)	**0.1812**
Average Future Road AADT (vpd)	**4,750**
Predicted Crashes	
Total Crashes	**5.05**
Fatal and Injury Crashes	**2.01**
Property-Damage-Only Crashes	**3.04**
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	**40**
Percent Property-Damage-Only Crashes (%)	**60**
Predicted Crash Rate	
Crash Rate (crashes/mi/yr)	**1.3257**
FI Crash Rate (crashes/mi/yr)	**0.5283**
PDO Crash Rate (crashes/mi/yr)	**0.7974**
Predicted Travel Crash Rate	
Total Travel (million veh-mi)	**6.60**
Travel Crash Rate (crashes/million veh-mi)	**0.77**
Travel FI Crash Rate (crashes/million veh-mi)	**0.30**
Travel PDO Crash Rate (crashes/million veh-mi)	**0.46**

Table 24. Predicted Crash Frequencies and Rates by Ramp Segment/Intersection (Freeway Ramp Sections)

Segment Number/Intersection Name/Cross Road	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
1	0.000	9+57.000	0.1812	5.046	0.2403	0.0958	0.1445	1.3257	0.77
Total			0.1812	5.046	0.2403	0.0958	0.1445	1.3257	

Table 25. Predicted Crash Frequencies and Rates by Horizontal Design Element (Freeway Ramp Sections)

Title	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
Tangent	0.000	1+74.000	0.0330	0.917	0.0437	0.0174	0.0263	1.3257	0.77
Simple Curve 1	1+74.000	9+57.000	0.1483	4.128	0.1966	0.0783	0.1183	1.3257	0.77

Table 26. Predicted Crash Frequencies by Year (Freeway Ramp Sections)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2022	0.21	0.09	40.152	0.13	59.848
2023	0.22	0.09	40.121	0.13	59.879
2024	0.22	0.09	40.091	0.13	59.909
2025	0.22	0.09	40.061	0.13	59.939
2026	0.23	0.09	40.032	0.14	59.968
2027	0.23	0.09	40.002	0.14	59.998
2028	0.23	0.09	39.973	0.14	60.027
2029	0.23	0.09	39.944	0.14	60.056
2030	0.23	0.09	39.915	0.14	60.085
2031	0.24	0.10	39.887	0.14	60.113
2032	0.24	0.10	39.858	0.14	60.142
2033	0.24	0.10	39.830	0.15	60.170
2034	0.24	0.10	39.802	0.15	60.198
2035	0.25	0.10	39.774	0.15	60.226
2036	0.25	0.10	39.747	0.15	60.253
2037	0.25	0.10	39.719	0.15	60.281
2038	0.26	0.10	39.692	0.15	60.308
2039	0.26	0.10	39.665	0.16	60.335
2040	0.26	0.10	39.639	0.16	60.361
2041	0.26	0.10	39.612	0.16	60.388
2042	0.27	0.10	39.586	0.16	60.414
Total	5.05	2.01	39.851	3.04	60.149
Average	0.24	0.10	39.851	0.14	60.149

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 27. Predicted Crash Severity by Ramp Segment (Freeway Ramp Sections)

Seg. No.	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)
1	0.0559	0.1696	1.1101	0.6753	3.0351

Table 28. Predicted Freeway Ramp Crash Type Distribution (Freeway Ramp Sections)

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Highway Segment	Collision with Animal	0.02	0.4	0.15	3.1	0.17	3.5
Highway Segment	Collision with Fixed Object	1.10	21.8	1.49	29.6	2.59	51.4
Highway Segment	Collision with Other Object	0.06	1.2	0.30	5.9	0.36	7.1
Highway Segment	Other Single-vehicle Collision	0.71	14.1	0.39	7.7	1.10	21.8
Highway Segment	Collision with Parked Vehicle	0.05	0.9	0.06	1.1	0.10	2.0
Highway Segment	Total Single Vehicle Crashes	1.94	38.4	2.39	47.4	4.33	85.8
Highway Segment	Right-Angle Collision	0.00	0.1	0.02	0.4	0.02	0.5
Highway Segment	Head-on Collision	0.00	0.0	0.00	0.1	0.00	0.1
Highway Segment	Other Multi-vehicle Collision	0.00	0.1	0.05	1.0	0.06	1.1
Highway Segment	Rear-end Collision	0.05	0.9	0.33	6.5	0.37	7.4
Highway Segment	Sideswipe, Same Direction Collision	0.02	0.3	0.24	4.8	0.26	5.2
Highway Segment	Total Multiple Vehicle Crashes	0.07	1.4	0.64	12.8	0.72	14.2
Highway Segment	Total Highway Segment Crashes	2.01	39.9	3.04	60.1	5.05	100.0
	Total Crashes	2.01	39.9	3.04	60.1	5.05	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Interchange 160-67 : Evaluation Interchange 2022-2042 : Ramp NB Exit Evaluation

Report Overview

Report Generated: Dec 11, 2020 1:32 PM

Report Template: System: Multi-Page [System] (mlcpm2, Nov 27, 2020 3:23 PM)

Evaluation Date: Fri Dec 11 13:29:22 CST 2020
IHSDM Version: v16.0.0 (Sep 30, 2020)
Crash Prediction Module: v11.0.0 (Sep 30, 2020)

User Name: mhuebbe
Organization Name: EFK Moen, LLC
Phone: 314-394-3133
E-Mail: mhuebbe@efkmoen.com

Project Title: Interchange 160-67
Project Comment: Created Thu Dec 10 08:43:05 CST 2020
Project Unit System: U.S. Customary

Highway Title: Ramp NB Exit
Highway Comment: Created Thu Dec 10 13:04:40 CST 2020
Highway Version: 1

Evaluation Title: Interchange 160-67 : Evaluation Interchange 2022-2042 : Ramp NB Exit
Evaluation Comment: Created Fri Dec 11 13:29:09 CST 2020

Minimum Location: 0.000
Maximum Location: 17+63.150
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: HSM Configuration
Crash Distribution: HSM Configuration
Model/CMF: HSM Configuration
First Year of Analysis: 2022
Last Year of Analysis: 2042
Empirical-Bayes Analysis: None
First Year of Observed Crashes:
Last Year of Observed Crashes:

Disclaimer Regarding Crash Prediction Method

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Freeway Ramp Evaluation

Section: Section 1
Evaluation Start Location: 0.000
Evaluation End Location: 17+63.150
Functional Class: Freeway Service Ramp
Type of Alignment: One Direction
Model Category: Freeway Service Ramp
Calibration Factor: EX_RAMP_MV_FI=1.0; EX_RAMP_MV_PDO=1.0; EX_RAMP_SV_FI=1.0; EX_RAMP_SV_PDO=1.0;

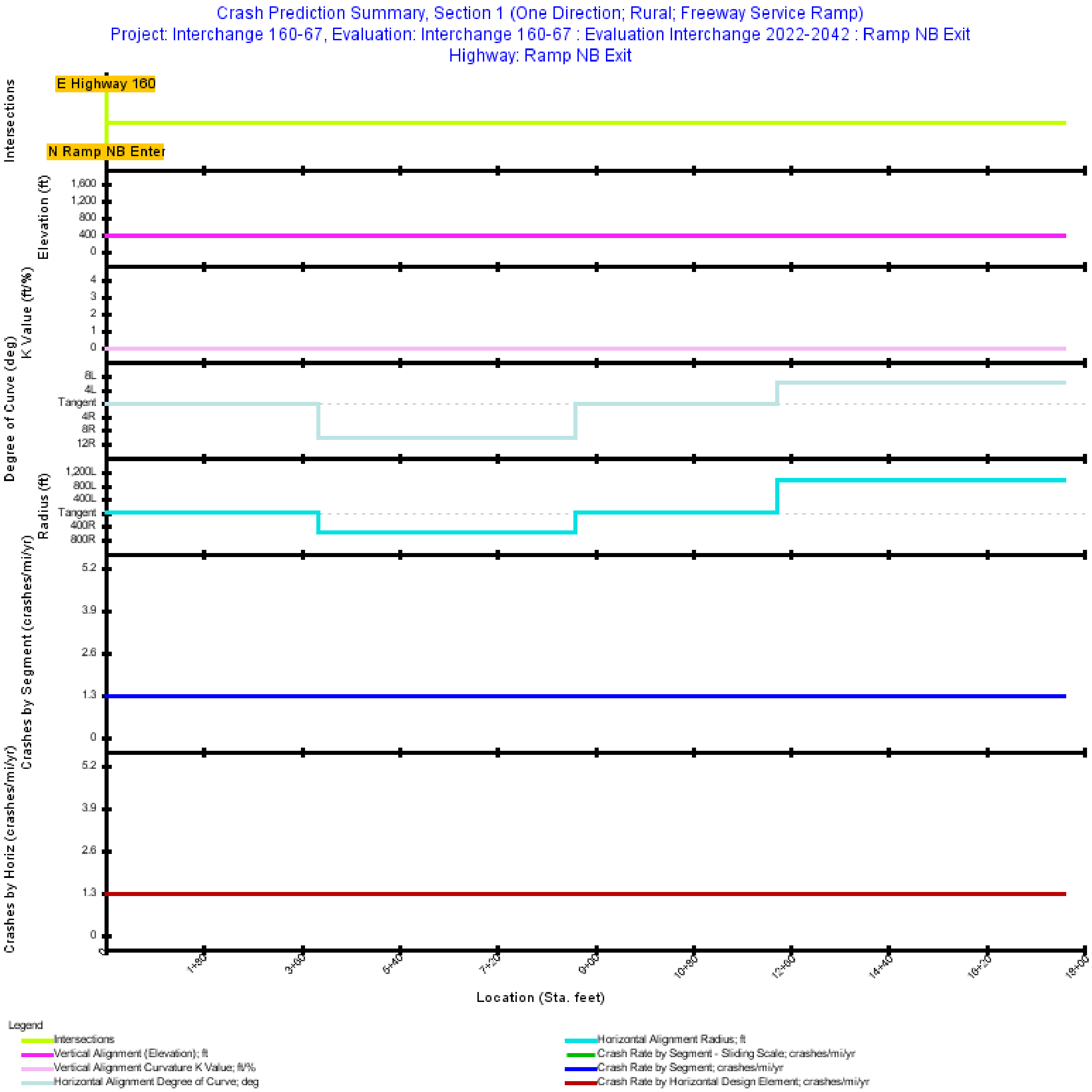

Figure 4. Crash Prediction Summary (Freeway Ramp Sections)

Table 29. Evaluation Freeway - Homogeneous Segments (Freeway Ramp Sections)

Seg. No.	Type	Area Type	Start Location (Sta. ft)	End Location (Sta. ft)	Length (ft)	Length (mi)	AADT
1	Freeway Ramp and C-D Road One-lane Ramp Exit	Rural	0.000	17+63.150	1,763.15	0.3339	2022: 2,600; 2023: 2,645; 2024: 2,690; 2025: 2,735; 2026: 2,780; 2027: 2,825; 2028: 2,870; 2029: 2,915; 2030: 2,960; 2031: 3,005; 2032: 3,050; 2033: 3,095; 2034: 3,140; 2035: 3,185; 2036: 3,230; 2037: 3,275; 2038: 3,320; 2039: 3,365; 2040: 3,410; 2041: 3,455; 2042: 3,500

Table 30. Predicted Ramp Crash Rates and Frequencies Summary (Freeway Ramp Sections)

First Year of Analysis	**2022**
Last Year of Analysis	**2042**
Evaluated Length (mi)	**0.3339**
Average Future Road AADT (vpd)	**3,050**
Predicted Crashes	
Total Crashes	**8.98**
Fatal and Injury Crashes	**4.16**
Property-Damage-Only Crashes	**4.82**
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	**46**
Percent Property-Damage-Only Crashes (%)	**54**
Predicted Crash Rate	
Crash Rate (crashes/mi/yr)	**1.2800**
FI Crash Rate (crashes/mi/yr)	**0.5931**
PDO Crash Rate (crashes/mi/yr)	**0.6869**
Predicted Travel Crash Rate	
Total Travel (million veh-mi)	**7.81**
Travel Crash Rate (crashes/million veh-mi)	**1.15**
Travel FI Crash Rate (crashes/million veh-mi)	**0.53**
Travel PDO Crash Rate (crashes/million veh-mi)	**0.62**

Table 31. Predicted Crash Frequencies and Rates by Ramp Segment/Intersection (Freeway Ramp Sections)

Segment Number/Intersection Name/Cross Road	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
1	0.000	17+63.150	0.3339	8.976	0.4274	0.1981	0.2294	1.2800	1.15
Total			0.3339	8.976	0.4274	0.1981	0.2294	1.2800	

Table 32. Predicted Crash Frequencies and Rates by Horizontal Design Element (Freeway Ramp Sections)

Title	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi /yr)	Predicted Travel Crash Rate (crashes/mi llion veh-mi)
Tangent	0.000	3+91.000	0.0741	1.991	0.0948	0.0439	0.0509	1.2800	1.15
Simple Curve 1	3+91.000	8+62.620	0.0893	2.401	0.1143	0.0530	0.0614	1.2800	1.15
Tangent	8+62.620	12+34.880	0.0705	1.895	0.0902	0.0418	0.0484	1.2800	1.15
Simple Curve 2	12+34.880	17+63.150	0.1001	2.689	0.1281	0.0593	0.0687	1.2800	1.15

Table 33. Predicted Crash Frequencies by Year (Freeway Ramp Sections)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2022	0.38	0.18	46.346	0.20	53.654
2023	0.39	0.18	46.345	0.21	53.655
2024	0.39	0.18	46.344	0.21	53.656
2025	0.40	0.18	46.344	0.21	53.656
2026	0.40	0.18	46.343	0.21	53.657
2027	0.41	0.19	46.342	0.22	53.658
2028	0.41	0.19	46.341	0.22	53.659
2029	0.41	0.19	46.340	0.22	53.660
2030	0.42	0.19	46.339	0.23	53.661
2031	0.42	0.20	46.338	0.23	53.662
2032	0.43	0.20	46.336	0.23	53.664
2033	0.43	0.20	46.335	0.23	53.665
2034	0.44	0.20	46.334	0.23	53.666
2035	0.44	0.20	46.332	0.24	53.668
2036	0.45	0.21	46.331	0.24	53.669
2037	0.45	0.21	46.329	0.24	53.671
2038	0.46	0.21	46.327	0.24	53.673
2039	0.46	0.21	46.326	0.25	53.674
2040	0.46	0.21	46.324	0.25	53.676
2041	0.47	0.22	46.322	0.25	53.678
2042	0.47	0.22	46.320	0.25	53.680
Total	8.98	4.16	46.334	4.82	53.666
Average	0.43	0.20	46.334	0.23	53.666

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 34. Predicted Crash Severity by Ramp Segment (Freeway Ramp Sections)

Seg. No.	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)
1	0.1594	0.4833	2.0932	1.4233	4.8172

Table 35. Predicted Freeway Ramp Crash Type Distribution (Freeway Ramp Sections)

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Highway Segment	Collision with Animal	0.04	0.5	0.29	3.3	0.34	3.7
Highway Segment	Collision with Fixed Object	2.34	26.1	2.84	31.6	5.18	57.7
Highway Segment	Collision with Other Object	0.13	1.4	0.57	6.3	0.70	7.7
Highway Segment	Other Single-vehicle Collision	1.52	16.9	0.73	8.2	2.26	25.1
Highway Segment	Collision with Parked Vehicle	0.10	1.1	0.10	1.2	0.20	2.3
Highway Segment	Total Single Vehicle Crashes	4.13	46.1	4.54	50.6	8.67	96.6
Highway Segment	Right-Angle Collision	0.00	0.0	0.01	0.1	0.01	0.1
Highway Segment	Head-on Collision	0.00	0.0	0.00	0.0	0.00	0.0
Highway Segment	Other Multi-vehicle Collision	0.00	0.0	0.02	0.2	0.02	0.3
Highway Segment	Rear-end Collision	0.02	0.2	0.14	1.6	0.16	1.8
Highway Segment	Sideswipe, Same Direction Collision	0.01	0.1	0.11	1.2	0.11	1.2
Highway Segment	Total Multiple Vehicle Crashes	0.03	0.3	0.28	3.1	0.30	3.4
Highway Segment	Total Highway Segment Crashes	4.16	46.3	4.82	53.7	8.98	100.0
	Total Crashes	4.16	46.3	4.82	53.7	8.98	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Interchange 160-67 : Evaluation Interchange 2022-2042 : RampTerminal 160 NB Evaluation

Report Overview

Report Generated: Dec 11, 2020 1:32 PM

Report Template: System: Multi-Page [System] (mlcpm2, Nov 27, 2020 3:23 PM)

Evaluation Date: Fri Dec 11 13:29:50 CST 2020
IHSDM Version: v16.0.0 (Sep 30, 2020)
Crash Prediction Module: v11.0.0 (Sep 30, 2020)

User Name: mhuebbe
Organization Name: EFK Moen, LLC
Phone: 314-394-3133
E-Mail: mhuebbe@efkmoen.com

Project Title: Interchange 160-67
Project Comment: Created Thu Dec 10 08:43:05 CST 2020
Project Unit System: U.S. Customary

Intersection Title: RampTerminal 160 NB
Intersection Comment: Created Fri Dec 11 12:18:12 CST 2020
Intersection Version: v1

Evaluation Title: Interchange 160-67 : Evaluation Interchange 2022-2042 : RampTerminal 160 NB
Evaluation Comment: Created Fri Dec 11 13:29:45 CST 2020

Minimum Location: 534+24.000
Maximum Location: 596+34.000
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: HSM Configuration
Crash Distribution: HSM Configuration
Model/CMF: HSM Configuration
First Year of Analysis: 2022
Last Year of Analysis: 2042
Empirical-Bayes Analysis: None
First Year of Observed Crashes:
Last Year of Observed Crashes:

Disclaimer Regarding Crash Prediction Method

IMPORTANT NOTICE ABOUT COMPARING RESULTS FROM HIGHWAY SAFETY MANUAL FIRST EDITION (2010) MODELS TO RESULTS FROM NEW MODELS DEVELOPED UNDER NCHRP PROJECTS 17-70 AND 17-58

Since the publication of the Highway Safety Manual - First Edition (HSM-1), in 2010 by the American Association of State Highway and Transportation Officials (AASHTO), multiple research efforts have been undertaken through the National Cooperative Highway Research Program (NCHRP) to develop safety performance models for road segment and intersection facility types that were not initially reflected in the HSM-1, in order to expand the breadth and depth of the HSM in the future.

The IHSDM Crash Prediction Module (CPM) is intended as a faithful implementation of HSM Part C predictive methods. As NCHRP projects to develop new predictive methods for the HSM are completed, FHWA works to incorporate the new methods into IHSDM, sometimes in advance of publication in the HSM. The following new crash predictive methods have been accepted by NCHRP project panels and incorporated into IHSDM, while pending AASHTO's approval for incorporation into a future edition of the HSM:

- Roundabouts: completed in 2018 under NCHRP Project 17-70, the new methods will provide improved outcomes for the safety analysis of roundabouts.
- 6+ lane and one-way urban/suburban arterials (including models for segments and intersections): completed under NCHRP Project 17-58.

However, in the absence of local calibration factors (see HSM-1 Part C, Appendix A for guidance on calibration of the predictive models), it is neither appropriate nor advisable to directly compare the results from new models (from NCHRP Projects 17-58 and 17-70) to results from HSM-1 models, as the models were not calibrated to the same base state data sets, and consequently can produce unexpected results. If local calibration factors are available and applied to both new models and HSM-1 models, then it may be appropriate to directly compare the results.*[Note: Work being performed under NCHRP Project 17-72 (Update of Crash Modification Factors for the Highway Safety Manual) is expected to re-calibrate many of the old (HSM-1) and new (e.g., NCHRP 17-70) models to data from a single (or small number of) states, that would allow results from all models to be directly compared.]*

The models produced for NCHRP Project 17-70 have independent value in terms of informing the design of a roundabout and assessing the effects of different design characteristics on the expected safety performance of a roundabout.

The HSM-1 interim method previously included in IHSDM for evaluating roundabouts on urban/suburban arterials (i.e., evaluating an existing intersection and then applying a Crash Modification Factor for replacing the existing intersection with a roundabout) has been deactivated in IHSDM, to minimize any confusion with the new roundabout methodology.

RampTerminal 160 NB Evaluation

Intersection: RampTerminal 160 NB
Evaluation Start Location: 534+24.000
Evaluation End Location: 596+34.000
Calibration Factor: RT_ST_FI=1.0; RT_ST_PDO=1.0;

Table 36. Evaluation Ramp Terminal - Site (RampTerminal 160 NB)

Inter. No.	Title	Type	Area Type	Legs	Location (Sta. ft)	Traffic Control	AADT
1	RampTerminal 160 NB (v1)	Freeway Ramp Terminal D4 - Four-Leg with Diagonal Ramps	Rural	4	572+50.000	Stop-Controlled	Inside: 2022: 7,100; 2023: 7,185; 2024: 7,270; 2025: 7,355; 2026: 7,440; 2027: 7,525; 2028: 7,610; 2029: 7,695; 2030: 7,780; 2031: 7,865; 2032: 7,950; 2033: 8,035; 2034: 8,120; 2035: 8,205; 2036: 8,290; 2037: 8,375; 2038: 8,460; 2039: 8,545; 2040: 8,630; 2041: 8,715; 2042: 8,800; Outside: 2022: 7,100; 2023: 7,185; 2024: 7,270; 2025: 7,355; 2026: 7,440; 2027: 7,525; 2028: 7,610; 2029: 7,695; 2030: 7,780; 2031: 7,865; 2032: 7,950; 2033: 8,035; 2034: 8,120; 2035: 8,205; 2036: 8,290; 2037: 8,375; 2038: 8,460; 2039: 8,545; 2040: 8,630; 2041: 8,715; 2042: 8,800 :: Entrance: 2022: 4,100; 2023: 4,165; 2024: 4,230; 2025: 4,295; 2026: 4,360; 2027: 4,425; 2028: 4,490; 2029: 4,555; 2030: 4,620; 2031: 4,685; 2032: 4,750; 2033: 4,815; 2034: 4,880; 2035: 4,945; 2036: 5,010; 2037: 5,075; 2038: 5,140; 2039: 5,205; 2040: 5,270; 2041: 5,335; 2042: 5,400

Table 37. Predicted Ramp Terminal Crash Rates and Frequencies Summary (RampTerminal 160 NB)

First Year of Analysis	**2022**
Last Year of Analysis	**2042**
Predicted Crashes	
Total Crashes	**30.95**
Fatal and Injury Crashes	**8.59**
Property-Damage-Only Crashes	**22.36**
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	**28**
Percent Property-Damage-Only Crashes (%)	**72**

Table 38. Predicted Crash Frequencies and Rates by Ramp Terminal (RampTerminal 160 NB)

Segment Number/Intersection Name/Cross Road	Location (Sta. ft)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Travel Crash Rate (crashes/million veh)
RampTerminal 160 NB (v1)	572+50.000	30.945	1.4736	0.4090	1.0645	0.39

Table 39. Predicted Crash Frequencies by Year (RampTerminal 160 NB)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2022	1.26	0.35	28.285	0.90	71.715
2023	1.28	0.36	28.229	0.92	71.771
2024	1.30	0.37	28.174	0.93	71.826
2025	1.32	0.37	28.120	0.95	71.880
2026	1.34	0.38	28.067	0.96	71.933
2027	1.36	0.38	28.015	0.98	71.985
2028	1.39	0.39	27.964	1.00	72.036
2029	1.41	0.39	27.914	1.01	72.086
2030	1.43	0.40	27.865	1.03	72.135
2031	1.45	0.40	27.817	1.05	72.183
2032	1.47	0.41	27.769	1.06	72.231
2033	1.49	0.41	27.722	1.08	72.278
2034	1.52	0.42	27.676	1.10	72.324
2035	1.54	0.42	27.631	1.11	72.369
2036	1.56	0.43	27.587	1.13	72.413
2037	1.58	0.44	27.543	1.15	72.457
2038	1.60	0.44	27.500	1.16	72.500
2039	1.63	0.45	27.458	1.18	72.542
2040	1.65	0.45	27.416	1.20	72.584
2041	1.67	0.46	27.375	1.22	72.625
2042	1.70	0.46	27.334	1.23	72.666
Total	30.95	8.59	27.758	22.36	72.242
Average	1.47	0.41	27.758	1.06	72.242

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the

distribution of these three crashes had been derived independently.

Table 40. Predicted Crash Severity by Ramp Terminal (RampTerminal 160 NB)

Seg. No.	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)
1	0.1016	0.5334	1.7646	6.1900	22.3551

Table 41. Predicted Ramp Terminal Crash Type Distribution (RampTerminal 160 NB)

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Ramp Terminal	Collision with Animal	0.00	0.0	0.00	0.0	0.00	0.0
Ramp Terminal	Collision with Fixed Object	0.67	2.2	3.53	11.4	4.20	13.6
Ramp Terminal	Collision with Other Object	0.00	0.0	0.11	0.4	0.11	0.4
Ramp Terminal	Other Single-vehicle Collision	0.56	1.8	0.58	1.9	1.14	3.7
Ramp Terminal	Collision with Parked Vehicle	0.06	0.2	0.34	1.1	0.40	1.3
Ramp Terminal	Total Single Vehicle Crashes	1.29	4.2	4.56	14.7	5.85	18.9
Ramp Terminal	Right-Angle Collision	4.48	14.5	8.32	26.9	12.80	41.4
Ramp Terminal	Head-on Collision	0.17	0.6	0.34	1.1	0.51	1.6
Ramp Terminal	Other Multi-vehicle Collision	0.11	0.4	0.58	1.9	0.69	2.2
Ramp Terminal	Rear-end Collision	2.36	7.6	6.17	19.9	8.53	27.6
Ramp Terminal	Sideswipe, Same Direction Collision	0.17	0.6	2.39	7.7	2.56	8.3
Ramp Terminal	Total Multiple Vehicle Crashes	7.30	23.6	17.80	57.5	25.10	81.1
Ramp Terminal	Total Ramp Terminal Crashes	8.59	27.8	22.36	72.2	30.95	100.0
	Total Crashes	8.59	27.8	22.36	72.2	30.95	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Interactive Highway Safety Design Model

Crash Prediction Evaluation Report

Highway 160

Alternative 1

December 11, 2020

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Report Overview

Report Generated: Dec 11, 2020 1:33 PM
Report Template: System: Multi-Page [System] (mlcpm2, Nov 27, 2020 3:23 PM)

Evaluation Date: Fri Dec 11 13:31:08 CST 2020
IHSDM Version: v16.0.0 (Sep 30, 2020)
Crash Prediction Module: v11.0.0 (Sep 30, 2020)

User Name: mhuebbe
Organization Name: EFK Moen, LLC
Phone: 314-394-3133
E-Mail: mhuebbe@efkmoen.com

Project Title: Project 67-Alt1 Dia
Project Comment: Created Wed Dec 09 16:11:58 CST 2020
Project Unit System: U.S. Customary

Highway Title: Highway 160
Highway Comment: Created Wed Dec 09 22:20:13 CST 2020
Highway Version: 1

Evaluation Title: Evaluation 160 Build 2022-2042
Evaluation Comment: Created Fri Dec 11 13:30:33 CST 2020

Minimum Location: 534+24.000
Maximum Location: 596+34.000
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: HSM Configuration
Crash Distribution: HSM Configuration
Model/CMF: HSM Configuration
First Year of Analysis: 2022
Last Year of Analysis: 2042
Empirical-Bayes Analysis: None
First Year of Observed Crashes:
Last Year of Observed Crashes:

Disclaimer Regarding Crash Prediction Method

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The IHSDM Crash Prediction Module (CPM) is intended as a faithful implementation of HSM Part C predictive methods. As NCHRP projects to develop new predictive methods for the HSM are completed, FHWA works to incorporate the new methods into IHSDM, sometimes in advance of publication in the HSM. The following new crash predictive methods have been accepted by NCHRP project panels and incorporated into IHSDM, while pending AASHTO's approval for incorporation into a future edition of the HSM:

- Roundabouts: completed in 2018 under NCHRP Project 17-70, the new methods will provide improved outcomes for the safety analysis of roundabouts.
- 6+ lane and one-way urban/suburban arterials (including models for segments and intersections): completed under NCHRP Project 17-58.

However, in the absence of local calibration factors (see HSM-1 Part C, Appendix A for guidance on calibration of the predictive models), it is neither appropriate nor advisable to directly compare the results from new models (from NCHRP Projects 17-58 and 17-70) to results from HSM-1 models, as the models were not calibrated to the same base state data sets, and consequently can produce unexpected results. If local calibration factors are available and applied to both new models and HSM-1 models, then it may be appropriate to directly compare the results.*[Note: Work being performed under NCHRP Project 17-72 (Update of Crash Modification Factors for the Highway Safety Manual) is expected to re-calibrate many of the old (HSM-1) and new (e.g., NCHRP 17-70) models to data from a single (or small number of) states, that would allow results from all models to be directly compared.]*

The models produced for NCHRP Project 17-70 have independent value in terms of informing the design of a roundabout and assessing the effects of different design characteristics on the expected safety performance of a roundabout.

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Section Types

Section 1 Evaluation

Section: Section 1
Evaluation Start Location: 534+24.000
Evaluation End Location: 596+34.000
Area Type: Rural
Functional Class: Multiple
Type of Alignment: Undivided, Two Lane
Model Category: Rural, Two Lane
Calibration Factor: 2U=1.0; 4ST=1.0; RT_ST_FI=1.0; RT_ST_PDO=1.0;

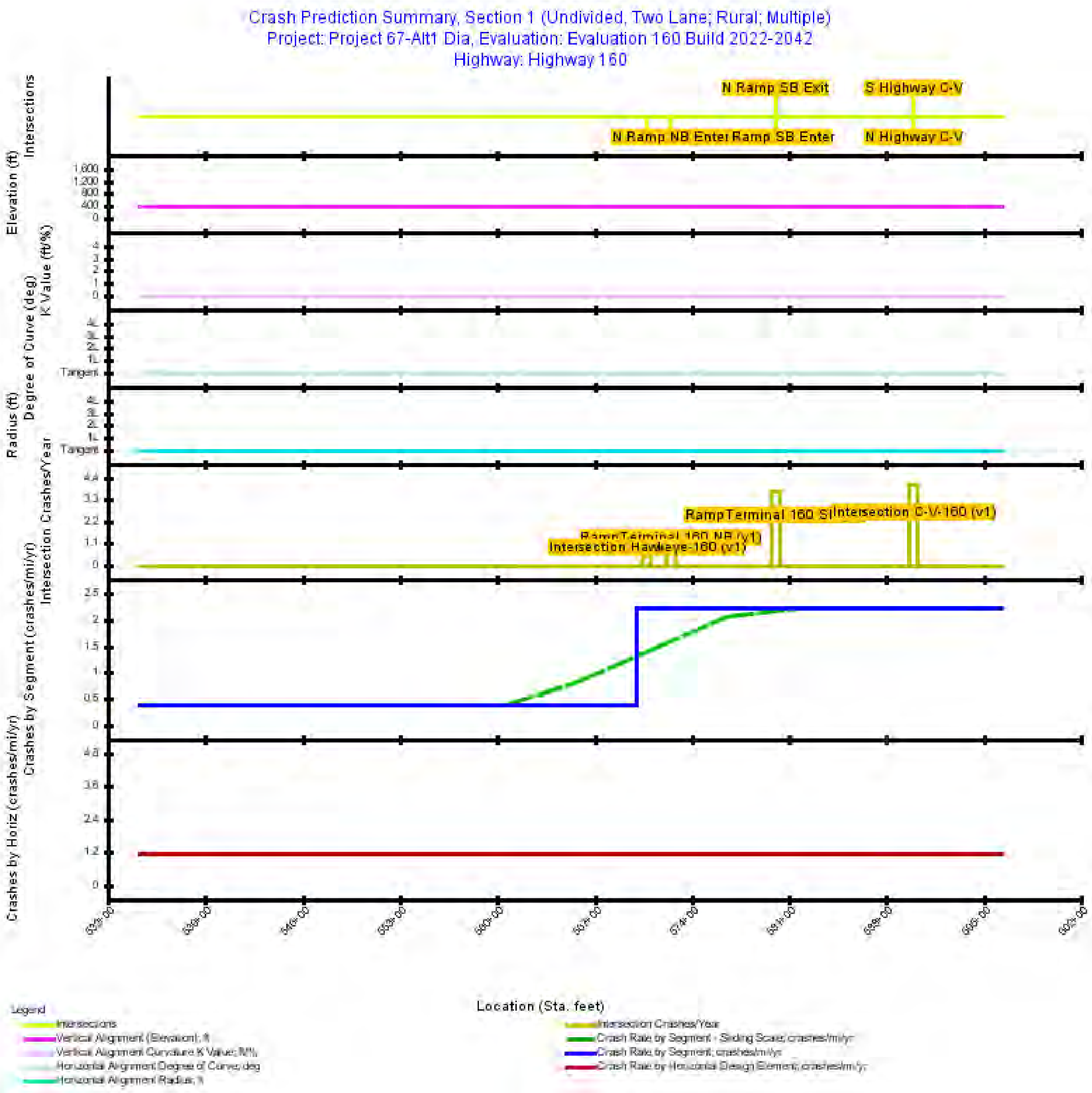

Figure 1. Crash Prediction Summary (Section 1)

Table 1. Evaluation Highway - Homogeneous Segments (Section 1)

Seg. No.	Type	Start Location (Sta. ft)	End Location (Sta. ft)	Length (ft)	Length (mi)	AADT	Left Lane Width (ft)	Right Lane Width (ft)	Left Shoulder Width (ft)	Right Shoulder Width (ft)	Grade (%)	Driveway Density (driveways/ mi)	Hazard Rating	Centerline Rumble Strip	Passing Lanes	TWLT Lane	Lighting	Automated Speed Enforcement
1	Rural Two-Lane Segment Two-lane Undivided	534+24.000	570+00.000	3,576.00	0.6773	2022: 986; 2023: 987; 2024-2025: 988; 2026: 989; 2027-2028: 990; 2029: 991; 2030-2031: 992; 2032: 993; 2033-2034: 994; 2035: 995; 2036-2037: 996; 2038: 997; 2039-2040: 998; 2041: 999; 2042: 1,000	12.00	12.00	4.00	4.00	0.00	13.0	4	false	0	false	false	false
2	Rural Two-Lane Segment Two-lane Undivided	570+00.000	596+34.000	2,634.00	0.4989	2022: 7,100; 2023: 7,185; 2024: 7,270; 2025: 7,355; 2026: 7,440; 2027: 7,525; 2028: 7,610; 2029: 7,695; 2030: 7,780; 2031: 7,865; 2032: 7,950; 2033: 8,035; 2034: 8,120; 2035: 8,205; 2036: 8,290; 2037: 8,375; 2038: 8,460; 2039: 8,545; 2040: 8,630; 2041: 8,715; 2042: 8,800	12.00	12.00	6.00	6.00	0.00	8.0	3	false	0	false	false	false

Table 2. Evaluation Intersection - Section 1

Inter. No.	Title	Type	Location (Sta. ft)	Major AADT	Minor AADT	Legs	Traffic Control	Major road approaches w/Left Turn Lanes	Major road approaches w/Right Turn Lanes	Skew1	Skew2	Lighted at Night
3	Intersection Hawkeye-160 (v1)	Rural Two-Lane Intersection Four-Legged w/STOP control	570+75.000	2022: 7,100; 2023: 7,185; 2024: 7,270; 2025: 7,355; 2026: 7,440; 2027: 7,525; 2028: 7,610; 2029: 7,695; 2030: 7,780; 2031: 7,865; 2032: 7,950; 2033: 8,035; 2034: 8,120; 2035: 8,205; 2036: 8,290; 2037: 8,375; 2038: 8,460; 2039: 8,545; 2040: 8,630; 2041: 8,715; 2042: 8,800	2022-2025: 55; 2026-2029: 56; 2030-2033: 57; 2034-2037: 58; 2038-2041: 59; 2042: 60	4	Stop-Controlled	0	0	0.00	0.00	false
4	Intersection C-V-160 (v1)	Rural Two-Lane Intersection Four-Legged w/STOP control	589+95.000	2022: 7,100; 2023: 7,185; 2024: 7,270; 2025: 7,355; 2026: 7,440; 2027: 7,525; 2028: 7,610; 2029: 7,695; 2030: 7,780; 2031: 7,865; 2032: 7,950; 2033: 8,035; 2034: 8,120; 2035: 8,205; 2036: 8,290; 2037: 8,375; 2038: 8,460; 2039: 8,545; 2040: 8,630; 2041: 8,715; 2042: 8,800	2022: 1,600; 2023: 1,620; 2024: 1,640; 2025: 1,660; 2026: 1,680; 2027: 1,700; 2028: 1,720; 2029: 1,740; 2030: 1,760; 2031: 1,780; 2032: 1,800; 2033: 1,820; 2034: 1,840; 2035: 1,860; 2036: 1,880; 2037: 1,900; 2038: 1,920; 2039: 1,940; 2040: 1,960; 2041: 1,980; 2042: 2,000	4	Stop-Controlled	0	0	0.63	0.63	false

Table 3. Evaluation Ramp Terminal - Site (Section 1)

Inter. No.	Title	Type	Area Type	Legs	Location (Sta. ft)	Traffic Control	AADT
1	RampTerminal 160 SB (v1)	Freeway Ramp Terminal D4 - Four-Leg with Diagonal Ramps	Rural	4	580+00.000	Stop-Controlled	Inside: 2022: 7,100; 2023: 7,185; 2024: 7,270; 2025: 7,355; 2026: 7,440; 2027: 7,525; 2028: 7,610; 2029: 7,695; 2030: 7,780; 2031: 7,865; 2032: 7,950; 2033: 8,035; 2034: 8,120; 2035: 8,205; 2036: 8,290; 2037: 8,375; 2038: 8,460; 2039: 8,545; 2040: 8,630; 2041: 8,715; 2042: 8,800; Outside: 2022: 7,100; 2023: 7,185; 2024: 7,270; 2025: 7,355; 2026: 7,440; 2027: 7,525; 2028: 7,610; 2029: 7,695; 2030: 7,780; 2031: 7,865; 2032: 7,950; 2033: 8,035; 2034: 8,120; 2035: 8,205; 2036: 8,290; 2037: 8,375; 2038: 8,460; 2039: 8,545; 2040: 8,630; 2041: 8,715; 2042: 8,800 :: Entrance: 2022: 2,900; 2023: 2,935; 2024: 2,970; 2025: 3,005; 2026: 3,040; 2027: 3,075; 2028: 3,110; 2029: 3,145; 2030: 3,180; 2031: 3,215; 2032: 3,250; 2033: 3,285; 2034: 3,320; 2035: 3,355; 2036: 3,390; 2037: 3,425; 2038: 3,460; 2039: 3,495; 2040: 3,530; 2041: 3,565; 2042: 3,600; Exit: 2022: 5,900; 2023: 5,965; 2024: 6,030; 2025: 6,095; 2026: 6,160; 2027: 6,225; 2028: 6,290; 2029: 6,355; 2030: 6,420; 2031: 6,485; 2032: 6,550; 2033: 6,615; 2034: 6,680; 2035: 6,745; 2036: 6,810; 2037: 6,875; 2038: 6,940; 2039: 7,005; 2040: 7,070; 2041: 7,135; 2042: 7,200
2	RampTerminal 160 NB (v1)	Freeway Ramp Terminal D4 - Four-Leg with Diagonal Ramps	Rural	4	572+50.000	Stop-Controlled	Inside: 2022: 7,100; 2023: 7,185; 2024: 7,270; 2025: 7,355; 2026: 7,440; 2027: 7,525; 2028: 7,610; 2029: 7,695; 2030: 7,780; 2031: 7,865; 2032: 7,950; 2033: 8,035; 2034: 8,120; 2035: 8,205; 2036: 8,290; 2037: 8,375; 2038: 8,460; 2039: 8,545; 2040: 8,630; 2041: 8,715; 2042: 8,800; Outside: 2022: 7,100; 2023: 7,185; 2024: 7,270; 2025: 7,355; 2026: 7,440; 2027: 7,525; 2028: 7,610; 2029: 7,695; 2030: 7,780; 2031: 7,865; 2032: 7,950; 2033: 8,035; 2034: 8,120; 2035: 8,205; 2036: 8,290; 2037: 8,375; 2038: 8,460; 2039: 8,545; 2040: 8,630; 2041: 8,715; 2042: 8,800 :: Entrance: 2022: 4,100; 2023: 4,165; 2024: 4,230; 2025: 4,295; 2026: 4,360; 2027: 4,425; 2028: 4,490; 2029: 4,555; 2030: 4,620; 2031: 4,685; 2032: 4,750; 2033: 4,815; 2034: 4,880; 2035: 4,945; 2036: 5,010; 2037: 5,075; 2038: 5,140; 2039: 5,205; 2040: 5,270; 2041: 5,335; 2042: 5,400

Table 4. Predicted Highway Crash Rates and Frequencies Summary (Section 1)

First Year of Analysis	**2022**
Last Year of Analysis	**2042**
Evaluated Length (mi)	**1.1761**
Average Future Road AADT (vpd)	**3,944**
Predicted Crashes	
Total Crashes	**234.38**
Fatal and Injury Crashes	**106.26**
Property-Damage-Only Crashes	**128.12**
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	**45**
Percent Property-Damage-Only Crashes (%)	**55**
Predicted Crash Rate	
Crash Rate (crashes/mi/yr)	**9.4895**
FI Crash Rate (crashes/mi/yr)	**4.3022**
PDO Crash Rate (crashes/mi/yr)	**5.1872**
Predicted Travel Crash Rate	
Total Travel (million veh-mi)	**35.55**
Travel Crash Rate (crashes/million veh-mi)	**6.59**
Travel FI Crash Rate (crashes/million veh-mi)	**2.99**
Travel PDO Crash Rate (crashes/million veh-mi)	**3.60**

Table 5. Predicted Crash Frequencies and Rates by Highway Segment/Intersection (Section 1)

Segment Number/Intersection Name/Cross Road	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)	Predicted Intersection Travel Crash Rate (crashes/million veh)
1	534+24.000	570+00.000	0.6773	5.655	0.2693	0.0864	0.1828	0.3976	1.10	
2	570+00.000	596+34.000	0.4989	23.228	1.1061	0.3551	0.7510	2.2173	0.76	
Intersection Hawkeye-160 (v1)	570+75.000			10.391	0.4948	0.2133	0.2815			0.17
RampTerminal 160 NB (v1)	572+50.000			30.945	1.4736	0.4090	1.0645			0.39
RampTerminal 160 SB (v1)	580+00.000			78.592	3.7425	2.2400	1.5025			0.80
Intersection C-V-160 (v1)	589+95.000			85.568	4.0747	1.7562	2.3185			1.16
All Segments			1.1761	28.883	1.3754	0.4415	0.9339	1.1694	0.81	
All Intersections				205.496	9.7855	4.6185	5.1670			0.66
Total			1.1761	234.379	11.1609	5.0600	6.1009	9.4895		

Table 6. Predicted Crash Frequencies and Rates by Horizontal Design Element (Section 1)

Title	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
Tangent	534+24.000	596+34.000	1.1761	28.883	1.3754	0.4415	0.9339	1.1694	0.96

Table 7. Predicted Crash Frequencies by Year (Section 1)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2022	9.45	4.12	43.643	5.33	56.357
2023	9.61	4.21	43.784	5.40	56.216
2024	9.77	4.29	43.928	5.48	56.072
2025	9.93	4.38	44.075	5.55	55.925
2026	10.10	4.46	44.224	5.63	55.776
2027	10.26	4.55	44.376	5.71	55.624
2028	10.43	4.64	44.532	5.79	55.468
2029	10.60	4.74	44.690	5.86	55.310
2030	10.78	4.83	44.851	5.94	55.149
2031	10.95	4.93	45.015	6.02	54.985
2032	11.12	5.03	45.183	6.10	54.817
2033	11.30	5.12	45.353	6.17	54.647
2034	11.48	5.23	45.526	6.25	54.474
2035	11.66	5.33	45.702	6.33	54.298
2036	11.85	5.44	45.882	6.41	54.118
2037	12.03	5.54	46.065	6.49	53.935
2038	12.23	5.66	46.250	6.57	53.750
2039	12.42	5.77	46.439	6.65	53.561
2040	12.61	5.88	46.631	6.73	53.369
2041	12.81	6.00	46.827	6.81	53.173
2042	13.01	6.12	47.024	6.89	52.976
Total	234.38	106.26	45.337	128.12	54.663
Average	11.16	5.06	45.337	6.10	54.663

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 8. Predicted Crash Severity by Ramp Terminal or Roundabout (Section 1)

Seg. No.	Type	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)
2	FRERampTerminal	0.1016	0.5334	1.7646	6.1900	22.3551
1	FRERampTerminal	0.5564	2.9213	9.6638	33.8991	31.5516

Table 9. Predicted Crash Type Distribution (Section 1)

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Highway Segment	Collision with Animal	0.35	0.1	3.61	1.5	3.50	1.5
Highway Segment	Collision with Bicycle	0.04	0.0	0.02	0.0	0.06	0.0
Highway Segment	Other Single-vehicle Collision	0.07	0.0	0.57	0.2	0.61	0.3
Highway Segment	Overturned	0.34	0.1	0.29	0.1	0.72	0.3
Highway Segment	Collision with Pedestrian	0.07	0.0	0.02	0.0	0.09	0.0
Highway Segment	Run Off Road	5.05	2.2	9.90	4.2	15.05	6.4
Highway Segment	Total Single Vehicle Crashes	5.92	2.5	14.41	6.2	20.02	8.5
Highway Segment	Angle Collision	0.94	0.4	1.41	0.6	2.46	1.0
Highway Segment	Head-on Collision	0.32	0.1	0.06	0.0	0.46	0.2
Highway Segment	Other Multiple-vehicle Collision	0.24	0.1	0.59	0.3	0.78	0.3
Highway Segment	Rear-end Collision	1.53	0.7	2.39	1.0	4.10	1.8
Highway Segment	Sideswipe	0.35	0.1	0.74	0.3	1.07	0.5
Highway Segment	Total Multiple Vehicle Crashes	3.38	1.4	5.20	2.2	8.87	3.8
Highway Segment	Total Highway Segment Crashes	9.29	4.0	19.61	8.4	28.88	12.3
Intersection	Collision with Animal	0.25	0.1	0.76	0.3	0.96	0.4
Intersection	Collision with Bicycle	0.04	0.0	0.06	0.0	0.10	0.0
Intersection	Other Single-vehicle Collision	0.17	0.1	0.55	0.2	0.77	0.3
Intersection	Overturned	0.25	0.1	0.22	0.1	0.48	0.2
Intersection	Collision with Pedestrian	0.04	0.0	0.06	0.0	0.10	0.0
Intersection	Run Off Road	3.89	1.7	7.86	3.4	11.71	5.0
Intersection	Total Single Vehicle Crashes	4.63	2.0	9.50	4.1	14.11	6.0
Intersection	Angle Collision	22.00	9.4	19.33	8.2	41.36	17.6
Intersection	Head-on Collision	2.48	1.1	1.36	0.6	3.84	1.6
Intersection	Other Multiple-vehicle Collision	1.74	0.7	2.02	0.9	3.74	1.6
Intersection	Rear-end Collision	8.69	3.7	14.52	6.2	23.22	9.9
Intersection	Sideswipe	1.82	0.8	7.86	3.4	9.69	4.1
Intersection	Total Multiple Vehicle Crashes	36.73	15.7	45.10	19.2	81.85	34.9
Intersection	Total Intersection Crashes	41.36	17.6	54.60	23.3	95.96	40.9
Ramp Terminal	Collision with Animal	0.00	0.0	0.00	0.0	0.00	0.0
Ramp Terminal	Collision with Fixed Object	4.34	1.9	8.52	3.6	12.86	5.5
Ramp Terminal	Collision with Other Object	0.00	0.0	0.27	0.1	0.27	0.1
Ramp Terminal	Other Single-vehicle Collision	3.62	1.5	1.40	0.6	5.02	2.1
Ramp Terminal	Collision with Parked Vehicle	0.39	0.2	0.81	0.3	1.20	0.5
Ramp Terminal	Total Single Vehicle Crashes	8.35	3.6	11.00	4.7	19.34	8.3
Ramp Terminal	Angle Collision	29.04	12.4	20.05	8.6	49.09	20.9
Ramp Terminal	Head-on Collision	1.11	0.5	0.81	0.3	1.92	0.8
Ramp Terminal	Other Multiple-vehicle Collision	0.72	0.3	1.40	0.6	2.12	0.9
Ramp Terminal	Rear-end Collision	15.30	6.5	14.88	6.3	30.18	12.9
Ramp Terminal	Sideswipe, Same Direction Collision	1.11	0.5	5.77	2.5	6.88	2.9
Ramp Terminal	Total Multiple Vehicle Crashes	47.29	20.2	42.91	18.3	90.20	38.5
Ramp Terminal	Total Ramp Terminal Crashes	55.63	23.7	53.91	23.0	109.54	46.7
	Total Crashes	106.28	45.3	128.12	54.7	234.38	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Appendix D

D-4

Alternative 2

2022 – 2042

Interactive Highway Safety Design Model

Crash Prediction Evaluation Report

Highway 67

Alternative 2

December 11, 2020

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Report Overview

Report Generated: Dec 11, 2020 3:42 PM
Report Template: System: Multi-Page [System] (mlcpm2, Nov 27, 2020 3:23 PM)

Evaluation Date: Fri Dec 11 15:31:01 CST 2020
IHSDM Version: v16.0.0 (Sep 30, 2020)
Crash Prediction Module: v11.0.0 (Sep 30, 2020)

User Name: mhuebbe
Organization Name: EFK Moen, LLC
Phone: 314-394-3133
E-Mail: mhuebbe@efkmoen.com

Project Title: Project 67-Alt2
Project Comment: Created Wed Dec 09 16:11:58 CST 2020
Project Unit System: U.S. Customary

Highway Title: Highway 67
Highway Comment: Created Fri Dec 11 11:13:00 CST 2020
Highway Version: 1

Evaluation Title: Evaluation 67 Alt2 2022-2042
Evaluation Comment: Created Fri Dec 11 15:30:29 CST 2020

Minimum Location: 405+00.000
Maximum Location: 665+43.000
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: HSM Configuration
Crash Distribution: HSM Configuration
Model/CMF: HSM Configuration
First Year of Analysis: 2022
Last Year of Analysis: 2042
Empirical-Bayes Analysis: None
First Year of Observed Crashes:
Last Year of Observed Crashes:

Disclaimer Regarding Crash Prediction Method

IMPORTANT NOTICE ABOUT COMPARING RESULTS FROM HIGHWAY SAFETY MANUAL FIRST EDITION (2010) MODELS TO RESULTS FROM NEW MODELS DEVELOPED UNDER NCHRP PROJECTS 17-70 AND 17-58

Since the publication of the Highway Safety Manual - First Edition (HSM-1), in 2010 by the American Association of State Highway and Transportation Officials (AASHTO), multiple research efforts have been undertaken through the National Cooperative Highway Research Program (NCHRP) to develop safety performance models for road segment and intersection facility types that were not initially reflected in the HSM-1, in order to expand the breadth and depth of the HSM in the future.

The IHSDM Crash Prediction Module (CPM) is intended as a faithful implementation of HSM Part C predictive methods. As NCHRP projects to develop new predictive methods for the HSM are completed, FHWA works to incorporate the new methods into IHSDM, sometimes in advance of publication in the HSM. The following new crash predictive methods have been accepted by NCHRP project panels and incorporated into IHSDM, while pending AASHTO's approval for incorporation into a future edition of the HSM:

- Roundabouts: completed in 2018 under NCHRP Project 17-70, the new methods will provide improved outcomes for the safety analysis of roundabouts.
- 6+ lane and one-way urban/suburban arterials (including models for segments and intersections): completed under NCHRP Project 17-58.

However, in the absence of local calibration factors (see HSM-1 Part C, Appendix A for guidance on calibration of the predictive models), it is neither appropriate nor advisable to directly compare the results from new models (from NCHRP Projects 17-58 and 17-70) to results from HSM-1 models, as the models were not calibrated to the same base state data sets, and consequently can produce unexpected results. If local calibration factors are available and applied to both new models and HSM-1 models, then it may be appropriate to directly compare the results.*[Note: Work being performed under NCHRP Project 17-72 (Update of Crash Modification Factors for the Highway Safety Manual) is expected to re-calibrate many of the old (HSM-1) and new (e.g., NCHRP 17-70) models to data from a single (or small number of) states, that would allow results from all models to be directly compared.]*

The models produced for NCHRP Project 17-70 have independent value in terms of informing the design of a roundabout and assessing the effects of different design characteristics on the expected safety performance of a roundabout.

The HSM-1 interim method previously included in IHSDM for evaluating roundabouts on urban/suburban arterials (i.e., evaluating an existing intersection and then applying a Crash Modification Factor for replacing the existing intersection with a roundabout) has been deactivated in IHSDM, to minimize any confusion with the new roundabout methodology.

Section Types

Section 1 Evaluation

Section: Section 1
Evaluation Start Location: 405+00.000
Evaluation End Location: 425+00.000
Area Type: Rural
Functional Class: Arterial
Type of Alignment: Divided, Multilane
Model Category: Rural, Multilane
Calibration Factor: 4D=1.0; 4ST=1.0;

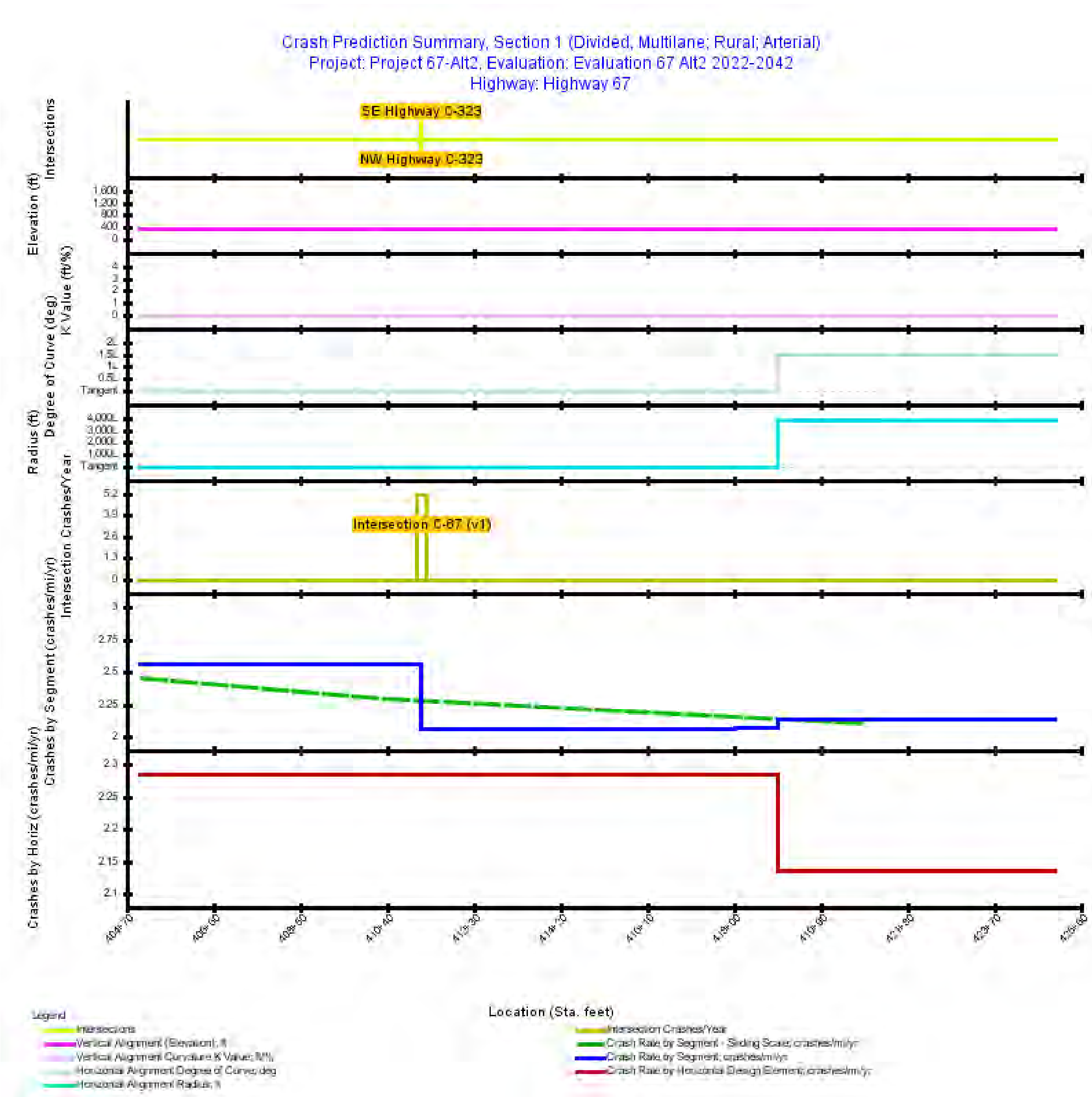

Figure 1. Crash Prediction Summary (Section 1)

Table 1. Evaluation Highway - Homogeneous Segments (Section 1)

Seg. No.	Type	Start Location (Sta. ft)	End Location (Sta. ft)	Length (ft)	Length (mi)	AADT	Left Lane Width (ft)	Right Lane Width (ft)	Left Shoulder Width (ft)	Right Shoulder Width (ft)	Median Width (ft)	Median Type	Effective Median Width (ft)	Lighting	Automated Speed Enforcement	Left Side Slope	Right Side Slope
1	Rural Multi-Lane Segment Four-lane Divided	405+00.000	411+15.000	615.00	0.1165	2022: 12,300; 2023: 12,460; 2024: 12,620; 2025: 12,780; 2026: 12,940; 2027: 13,100; 2028: 13,260; 2029: 13,420; 2030: 13,580; 2031: 13,740; 2032: 13,900; 2033: 14,060; 2034: 14,220; 2035: 14,380; 2036: 14,540; 2037: 14,700; 2038: 14,860; 2039: 15,020; 2040: 15,180; 2041: 15,340; 2042: 15,500	12.00	12.00	8.00	8.00	52.00	Traversable Median	60.00	false	false		
2	Rural Multi-Lane Segment Four-lane Divided	411+15.000	418+00.000	685.00	0.1297	2022: 10,000; 2023: 10,130; 2024: 10,260; 2025: 10,390; 2026: 10,520; 2027: 10,650; 2028: 10,780; 2029: 10,910; 2030: 11,040; 2031: 11,170; 2032: 11,300; 2033: 11,430; 2034: 11,560; 2035: 11,690; 2036: 11,820; 2037: 11,950; 2038: 12,080; 2039: 12,210; 2040: 12,340; 2041: 12,470; 2042: 12,600	12.00	12.00	8.00	8.00	52.00	Traversable Median	60.00	false	false		
3	Rural Multi-Lane Segment Four-lane Divided	418+00.000	418+95.990	95.99	0.0182	2022: 10,000; 2023: 10,130; 2024: 10,260; 2025: 10,390; 2026: 10,520; 2027: 10,650; 2028: 10,780; 2029: 10,910; 2030: 11,040; 2031: 11,170; 2032: 11,300; 2033: 11,430; 2034: 11,560; 2035: 11,690; 2036: 11,820; 2037: 11,950; 2038: 12,080; 2039: 12,210; 2040: 12,340; 2041: 12,470; 2042: 12,600	12.00	12.00	8.00	8.00	49.15	Traversable Median	57.15	false	false		
4	Rural Multi-Lane Segment Four-lane Divided	418+95.990	425+00.000	604.01	0.1144	2022: 10,000; 2023: 10,130; 2024: 10,260; 2025: 10,390; 2026: 10,520; 2027: 10,650; 2028: 10,780; 2029: 10,910; 2030: 11,040; 2031: 11,170; 2032: 11,300; 2033: 11,430; 2034: 11,560; 2035: 11,690; 2036: 11,820; 2037: 11,950; 2038: 12,080; 2039: 12,210; 2040: 12,340; 2041: 12,470; 2042: 12,600	12.00	12.00	8.00	8.00	28.40	Traversable Median	36.40	false	false		

Table 2. Evaluation Intersection (Section 1)

Inter. No.	Title	Type	Location (Sta. ft)	Major AADT	Minor AADT	Legs	Traffic Control	Major road approaches w/Left Turn Lanes	Major road approaches w/Right Turn Lanes	Skew1	Skew2	Lighted at Night
1	Intersection C-67 (v1)	Rural Multi-Lane Intersection Four-Legged w/STOP control	411+14.900	2022: 12,300; 2023: 12,460; 2024: 12,620; 2025: 12,780; 2026: 12,940; 2027: 13,100; 2028: 13,260; 2029: 13,420; 2030: 13,580; 2031: 13,740; 2032: 13,900; 2033: 14,060; 2034: 14,220; 2035: 14,380; 2036: 14,540; 2037: 14,700; 2038: 14,860; 2039: 15,020; 2040: 15,180; 2041: 15,340; 2042: 15,500	2022: 1,600; 2023: 1,620; 2024: 1,640; 2025: 1,660; 2026: 1,680; 2027: 1,700; 2028: 1,720; 2029: 1,740; 2030: 1,760; 2031: 1,780; 2032: 1,800; 2033: 1,820; 2034: 1,840; 2035: 1,860; 2036: 1,880; 2037: 1,900; 2038: 1,920; 2039: 1,940; 2040: 1,960; 2041: 1,980; 2042: 2,000	4	Stop-Controlled	0	0	20.00	0.01	false

Table 3. Predicted Highway Crash Rates and Frequencies Summary (Section 1)

First Year of Analysis	2022
Last Year of Analysis	2042
Evaluated Length (mi)	0.3788
Average Future Road AADT (vpd)	12,099
Predicted Crashes	
Total Crashes	125.38
Fatal and Injury Crashes	72.56
Fatal and Serious Injury Crashes	40.58
Property-Damage-Only Crashes	52.83
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	58
Percent Fatal and Serious Injury Crashes (%)	32
Percent Property-Damage-Only Crashes (%)	42
Predicted Crash Rate	
Crash Rate (crashes/mi/yr)	15.7626
FI Crash Rate (crashes/mi/yr)	9.1212
FI no/C Crash Rate (crashes/mi/yr)	5.1016
PDO Crash Rate (crashes/mi/yr)	6.6414
Predicted Travel Crash Rate	
Total Travel (million veh-mi)	35.13
Travel Crash Rate (crashes/million veh-mi)	3.57
Travel FI Crash Rate (crashes/million veh-mi)	2.06
Travel FI no/C Crash Rate (crashes/million veh-mi)	1.16
Travel PDO Crash Rate (crashes/million veh-mi)	1.50

Table 4. Predicted Crash Frequencies and Rates by Highway Segment/Intersection (Section 1)

Segment Number/Intersection Name/Cross Road	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted FI no/C Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)	Predicted Intersection Travel Crash Rate (crashes/million veh)
1	405+00.000	411+15.000	0.1165	6.271	0.2986	0.1512	0.0946	0.1474	2.5635	0.51	
Intersection C-67 (v1)	411+14.900			107.574	5.1226	3.0202	1.6574	2.1024			0.97
2	411+15.000	418+00.000	0.1297	5.620	0.2676	0.1381	0.0879	0.1295	2.0630	0.50	
3	418+00.000	418+95.990	0.0182	0.790	0.0376	0.0194	0.0124	0.0182	2.0691	0.50	
4	418+95.990	425+00.000	0.1144	5.129	0.2443	0.1261	0.0802	0.1182	2.1352	0.52	
All Segments			0.3788	17.810	0.8481	0.4348	0.2750	0.4133	2.2390	0.51	
All Intersections				107.574	5.1226	3.0202	1.6574	2.1024			0.97
Total			0.3788	125.384	5.9707	3.4550	1.9324	2.5157	15.7626		

Table 5. Predicted Crash Frequencies and Rates by Horizontal Design Element (Section 1)

Title	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted FI no/C Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
Tangent	405+00.000	418+95.990	0.2644	12.681	0.6039	0.3088	0.1948	0.2951	2.2839	0.50
Simple Curve 1	418+95.990	425+00.000	0.1144	5.129	0.2443	0.1261	0.0802	0.1182	2.1352	0.52

Table 6. Predicted Crash Frequencies by Year (Section 1)

Year	Total Crashes	FI Crashes	Percent FI (%)	FI/no C Crashes	Percent FI/no C (%)	PDO Crashes	Percent PDO (%)
2022	5.12	2.93	57.202	1.67	32.661	2.19	42.798
2023	5.21	2.98	57.269	1.70	32.630	2.22	42.731
2024	5.29	3.03	57.335	1.72	32.600	2.26	42.665
2025	5.37	3.08	57.400	1.75	32.570	2.29	42.600
2026	5.46	3.14	57.465	1.78	32.541	2.32	42.535
2027	5.54	3.19	57.529	1.80	32.512	2.35	42.471
2028	5.62	3.24	57.593	1.83	32.483	2.39	42.407
2029	5.71	3.29	57.657	1.85	32.455	2.42	42.343
2030	5.79	3.35	57.719	1.88	32.427	2.45	42.281
2031	5.88	3.40	57.781	1.91	32.400	2.48	42.219
2032	5.97	3.45	57.843	1.93	32.373	2.52	42.157
2033	6.05	3.50	57.904	1.96	32.346	2.55	42.096
2034	6.14	3.56	57.965	1.98	32.320	2.58	42.035
2035	6.22	3.61	58.025	2.01	32.294	2.61	41.975
2036	6.31	3.67	58.085	2.04	32.269	2.65	41.915
2037	6.40	3.72	58.144	2.06	32.243	2.68	41.856
2038	6.49	3.77	58.203	2.09	32.218	2.71	41.797
2039	6.57	3.83	58.261	2.12	32.194	2.74	41.739
2040	6.66	3.88	58.319	2.14	32.169	2.78	41.681
2041	6.75	3.94	58.376	2.17	32.145	2.81	41.624
2042	6.83	3.99	58.433	2.20	32.122	2.84	41.567
Total	125.38	72.56	57.866	40.58	32.365	52.83	42.134
Average	5.97	3.46	57.866	1.93	32.365	2.52	42.134

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 7. Predicted Crash Type Distribution (Section 1)

Element Type	Crash Type	Fatal and Injury		Fatal and Serious Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Highway Segment	Single	6.64	5.3	4.49	3.6	6.87	5.5	13.68	10.9
Highway Segment	Total Single Vehicle Crashes	6.64	5.3	4.49	3.6	6.87	5.5	13.68	10.9
Highway Segment	Angle Collision	0.44	0.3	0.26	0.2	0.36	0.3	0.77	0.6
Highway Segment	Head-on Collision	0.12	0.1	0.10	0.1	0.02	0.0	0.11	0.1
Highway Segment	Rear-end Collision	1.49	1.2	0.66	0.5	0.76	0.6	2.07	1.6
Highway Segment	Sideswipe	0.25	0.2	0.13	0.1	0.46	0.4	0.77	0.6
Highway Segment	Total Multiple Vehicle Crashes	2.29	1.8	1.15	0.9	1.60	1.3	3.71	3.0
Highway Segment	Total Highway Segment Crashes	9.13	7.3	5.78	4.6	8.68	6.9	17.81	14.2
Highway Segment	Other Collision	0.20	0.2	0.13	0.1	0.21	0.2	0.43	0.3
Intersection	Single	9.39	7.5	6.93	5.5	10.73	8.6	21.73	17.3
Intersection	Total Single Vehicle Crashes	9.39	7.5	6.93	5.5	10.73	8.6	21.73	17.3
Intersection	Angle Collision	33.87	27.0	19.87	15.9	12.89	10.3	42.49	33.9
Intersection	Head-on Collision	1.14	0.9	0.80	0.6	0.66	0.5	1.72	1.4
Intersection	Rear-end Collision	13.51	10.8	3.76	3.0	10.60	8.5	24.53	19.6
Intersection	Sideswipe	2.66	2.1	1.39	1.1	6.89	5.5	11.51	9.2
Intersection	Total Multiple Vehicle Crashes	51.18	40.9	25.83	20.6	31.04	24.8	80.25	64.1
Intersection	Total Intersection Crashes	63.49	50.7	34.81	27.8	44.19	35.3	107.47	85.8
Intersection	Other Collision	2.92	2.3	2.05	1.6	2.43	1.9	5.49	4.4
	Total Crashes	72.62	58.0	40.58	32.4	52.87	42.2	125.28	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Section 2 Evaluation

Section: Section 2
Evaluation Start Location: 425+00.000
Evaluation End Location: 665+43.000
Functional Class: Freeway
Type of Alignment: Divided, Multilane
Model Category: Freeway Segment
Calibration Factor: FI_MV=1.0; FI_SV=1.0; PDO_MV=1.0; PDO_SV=1.0;

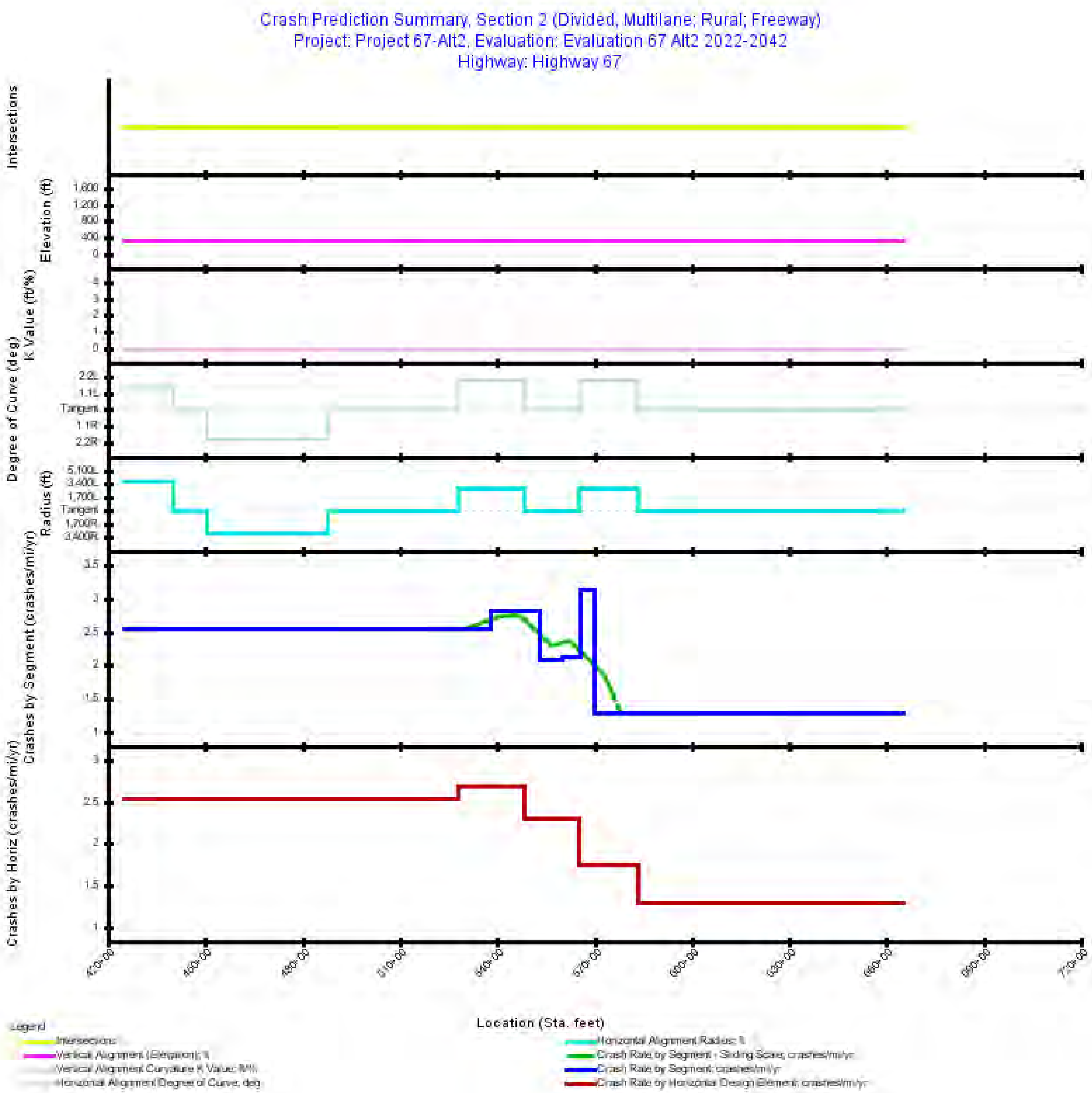

Figure 2. Crash Prediction Summary (Section 2)

Table 8. Evaluation Freeway - Homogeneous Segments (Section 2)

Seg. No.	Type	Area Type	Start Location (Sta. ft)	End Location (Sta. ft)	Length (ft)	Length (mi)	AADT	Median Width (ft)	Type	Effective Median Width (ft)
5	Four-lane Freeway	Rural	425+00.000	537+84.000	11,284.00	2.1371	2022: 10,000; 2023: 10,130; 2024: 10,260; 2025: 10,390; 2026: 10,520; 2027: 10,650; 2028: 10,780; 2029: 10,910; 2030: 11,040; 2031: 11,170; 2032: 11,300; 2033: 11,430; 2034: 11,560; 2035: 11,690; 2036: 11,820; 2037: 11,950; 2038: 12,080; 2039: 12,210; 2040: 12,340; 2041: 12,470; 2042: 12,600	10.50	Traversable Median	18.50
6	Four-lane Freeway	Rural	537+84.000	553+17.000	1,533.00	0.2903	2022: 10,000; 2023: 10,130; 2024: 10,260; 2025: 10,390; 2026: 10,520; 2027: 10,650; 2028: 10,780; 2029: 10,910; 2030: 11,040; 2031: 11,170; 2032: 11,300; 2033: 11,430; 2034: 11,560; 2035: 11,690; 2036: 11,820; 2037: 11,950; 2038: 12,080; 2039: 12,210; 2040: 12,340; 2041: 12,470; 2042: 12,600	10.50	Traversable Median	18.50
7	Four-lane Freeway	Rural	553+17.000	559+88.750	671.75	0.1272	2022: 10,000; 2023: 10,130; 2024: 10,260; 2025: 10,390; 2026: 10,520; 2027: 10,650; 2028: 10,780; 2029: 10,910; 2030: 11,040; 2031: 11,170; 2032: 11,300; 2033: 11,430; 2034: 11,560; 2035: 11,690; 2036: 11,820; 2037: 11,950; 2038: 12,080; 2039: 12,210; 2040: 12,340; 2041: 12,470; 2042: 12,600	10.50	Traversable Median	18.50
8	Four-lane Freeway	Rural	559+88.750	565+51.000	562.25	0.1065	2022: 10,000; 2023: 10,130; 2024: 10,260; 2025: 10,390; 2026: 10,520; 2027: 10,650; 2028: 10,780; 2029: 10,910; 2030: 11,040; 2031: 11,170; 2032: 11,300; 2033: 11,430; 2034: 11,560; 2035: 11,690; 2036: 11,820; 2037: 11,950; 2038: 12,080; 2039: 12,210; 2040: 12,340; 2041: 12,470; 2042: 12,600	10.50	Traversable Median	18.50
9	Four-lane Freeway	Rural	565+51.000	570+00.000	449.00	0.0850	2022: 10,000; 2023: 10,130; 2024: 10,260; 2025: 10,390; 2026: 10,520; 2027: 10,650; 2028: 10,780; 2029: 10,910; 2030: 11,040; 2031: 11,170; 2032: 11,300; 2033: 11,430; 2034: 11,560; 2035: 11,690; 2036: 11,820; 2037: 11,950; 2038: 12,080; 2039: 12,210; 2040: 12,340; 2041: 12,470; 2042: 12,600	10.50	Traversable Median	18.50
10	Four-lane Freeway	Rural	570+00.000	665+43.000	9,543.00	1.8074	2022: 5,500; 2023: 5,575; 2024: 5,650; 2025: 5,725; 2026: 5,800; 2027: 5,875; 2028: 5,950; 2029: 6,025; 2030: 6,100; 2031: 6,175; 2032: 6,250; 2033: 6,325; 2034: 6,400; 2035: 6,475; 2036: 6,550; 2037: 6,625; 2038: 6,700; 2039: 6,775; 2040: 6,850; 2041: 6,925; 2042: 7,000	10.50	Traversable Median	18.50

Table 9. Predicted Freeway Crash Rates and Frequencies Summary (Section 2)

First Year of Analysis	**2022**
Last Year of Analysis	**2042**
Effective Length (mi)	**4.5536**
Average Future Road AADT (vpd)	**9,296**
Predicted Crashes	
Total Crashes	**195.98**
Fatal and Injury Crashes	**69.64**
Property-Damage-Only Crashes	**126.33**
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	**36**
Percent Property-Damage-Only Crashes (%)	**64**
Predicted Crash Rate	
Crash Rate (crashes/mi/yr)	**2.0494**
FI Crash Rate (crashes/mi/yr)	**0.7283**
PDO Crash Rate (crashes/mi/yr)	**1.3211**
Predicted Travel Crash Rate	
Total Travel (million veh-mi)	**324.45**
Travel Crash Rate (crashes/million veh-mi)	**0.60**
Travel FI Crash Rate (crashes/million veh-mi)	**0.21**
Travel PDO Crash Rate (crashes/million veh-mi)	**0.39**

Note: *Effective Length* is the *segment length* minus the length of the *speed change lanes* if present.
Note: *Total Travel and Crash Rates/Million Vehicle Miles* for *Speed Change Lanes* reflect AADTs that are **half of the Freeway Segment AADTs** based on the assumption of 50/50 directional distribution.

Table 10. Predicted Crash Frequencies and Rates by Freeway Segment/Intersection (Section 2)

Segment Number/Intersection Name/Cross Road	Start Location (Sta. ft)	End Location (Sta. ft)	Effective Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
5	425+00.000	537+84.000	2.1371	114.100	5.4333	1.9012	3.5322	2.5424	0.62
6	537+84.000	553+17.000	0.2903	17.132	0.8158	0.2911	0.5247	2.8098	0.68
7	553+17.000	559+88.750	0.1272	5.563	0.2649	0.0905	0.1745	2.0823	0.51
8	559+88.750	565+51.000	0.1065	4.752	0.2263	0.0777	0.1486	2.1250	0.52
9	565+51.000	570+00.000	0.0850	5.589	0.2661	0.0960	0.1702	3.1295	0.76
10	570+00.000	665+43.000	1.8074	48.840	2.3257	0.8599	1.4658	1.2868	0.56
Total			4.5536	195.976	9.3322	3.3163	6.0159	2.0494	0.60

Note: *Effective Length* is the *segment length* minus the length of the *speed change lanes* if present. This may create Freeway segments with zero effective length and zero crashes.

Table 11. Predicted Crash Frequencies and Rates by Horizontal Design Element (Section 2)

Title	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
Simple Curve 1	425+00.000	440+15.580	0.2870	15.325	0.7298	0.2554	0.4744	2.5424	0.62
Tangent	440+15.580	450+69.500	0.1996	10.657	0.5075	0.1776	0.3299	2.5424	0.62
Simple Curve 2	450+69.500	487+95.230	0.7056	37.673	1.7940	0.6277	1.1662	2.5424	0.62
Tangent	487+95.230	528+21.950	0.7626	40.717	1.9389	0.6784	1.2605	2.5424	0.62
Simple Curve 3	528+21.950	548+47.520	0.3836	21.613	1.0292	0.3640	0.6652	2.6828	0.65
Tangent	548+47.520	565+40.830	0.3207	15.476	0.7369	0.2559	0.4811	2.2979	0.56
Simple Curve 4	565+40.830	583+43.830	0.3415	12.552	0.5977	0.2185	0.3793	1.7504	0.61
Tangent	583+43.830	665+43.000	1.5529	41.962	1.9982	0.7388	1.2594	1.2868	0.56

Table 12. Predicted Crash Frequencies by Year (Section 2)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2022	8.36	3.02	36.137	5.34	63.863
2023	8.46	3.05	36.074	5.41	63.926
2024	8.55	3.08	36.012	5.47	63.988
2025	8.65	3.11	35.951	5.54	64.049
2026	8.75	3.14	35.891	5.61	64.109
2027	8.85	3.17	35.831	5.68	64.168
2028	8.94	3.20	35.773	5.74	64.227
2029	9.04	3.23	35.715	5.81	64.285
2030	9.14	3.26	35.658	5.88	64.342
2031	9.23	3.29	35.601	5.95	64.399
2032	9.33	3.32	35.545	6.01	64.455
2033	9.43	3.35	35.490	6.08	64.510
2034	9.53	3.38	35.435	6.15	64.565
2035	9.62	3.40	35.382	6.22	64.618
2036	9.72	3.43	35.328	6.29	64.672
2037	9.82	3.46	35.276	6.36	64.725
2038	9.92	3.49	35.223	6.42	64.777
2039	10.01	3.52	35.172	6.49	64.828
2040	10.11	3.55	35.121	6.56	64.879
2041	10.21	3.58	35.070	6.63	64.930
2042	10.31	3.61	35.020	6.70	64.980
Total	195.98	69.64	35.536	126.33	64.464
Average	9.33	3.32	35.536	6.02	64.464

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 13. Predicted Crash Severity by Freeway Segment (Section 2)

Seg. No.	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)
5	1.5494	3.8213	15.6101	18.9442	74.1752
6	0.2345	0.5857	2.3758	2.9164	11.0193
7	0.0676	0.1642	0.7169	0.9511	3.6635
8	0.0592	0.1432	0.6209	0.8079	3.1208
9	0.0827	0.2072	0.8048	0.9208	3.5733
10	0.6653	1.6177	6.9179	8.8575	30.7817
Total	2.6586	6.5393	27.0464	33.3979	126.3338

Table 14. Predicted Freeway Crash Type Distribution (Section 2)

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Highway Segment	Collision with Animal	0.60	0.3	7.46	3.8	8.06	4.1
Highway Segment	Collision with Fixed Object	33.98	17.3	71.75	36.6	105.73	53.9
Highway Segment	Collision with Other Object	1.86	0.9	14.35	7.3	16.21	8.3
Highway Segment	Other Single-vehicle Collision	22.05	11.3	18.60	9.5	40.65	20.7
Highway Segment	Collision with Parked Vehicle	1.44	0.7	2.64	1.3	4.08	2.1
Highway Segment	Total Single Vehicle Crashes	59.93	30.6	114.79	58.6	174.72	89.2
Highway Segment	Right-Angle Collision	0.54	0.3	0.35	0.2	0.89	0.5
Highway Segment	Head-on Collision	0.17	0.1	0.05	0.0	0.22	0.1
Highway Segment	Other Multi-vehicle Collision	0.57	0.3	0.90	0.5	1.47	0.8
Highway Segment	Rear-end Collision	6.12	3.1	5.86	3.0	11.98	6.1
Highway Segment	Sideswipe, Same Direction Collision	2.30	1.2	4.39	2.2	6.69	3.4
Highway Segment	Total Multiple Vehicle Crashes	9.71	5.0	11.54	5.9	21.25	10.8
Highway Segment	Total Highway Segment Crashes	69.64	35.5	126.33	64.5	195.98	100.0
	Total Crashes	69.64	35.5	126.33	64.5	195.98	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Interactive Highway Safety Design Model

Crash Prediction Evaluation Report

67-160 Interchange

Alternative 2

December 11, 2020

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Combined Report

Combined Report Overview

Report Generated: Dec 11, 2020 3:42 PM
Report Template: System: Multi-Page [System] (mlcpm2, Nov 27, 2020 3:23 PM)

Evaluation Title: Evaluation Interchange 2022-2042
Evaluation Comment: Created Fri Dec 11 15:25:32 CST 2020
Evaluation Date: Fri Dec 11 15:28:57 CST 2020

User Name: mhuebbe
Organization Name: EFK Moen, LLC
Phone: 314-394-3133
E-Mail: mhuebbe@efkmoen.com

Project Title: Project 67-Alt2
Project Comment: Created Wed Dec 09 16:11:58 CST 2020
Project Unit System: U.S. Customary

Interchange Title: Interchange 160-67
Interchange Comment: Created Thu Dec 10 08:43:05 CST 2020

Report Overview

Disclaimer Regarding Crash Prediction Method

IMPORTANT NOTICE ABOUT COMPARING RESULTS FROM HIGHWAY SAFETY MANUAL FIRST EDITION (2010) MODELS TO RESULTS FROM NEW MODELS DEVELOPED UNDER NCHRP PROJECTS 17-70 AND 17-58

Since the publication of the Highway Safety Manual - First Edition (HSM-1), in 2010 by the American Association of State Highway and Transportation Officials (AASHTO), multiple research efforts have been undertaken through the National Cooperative Highway Research Program (NCHRP) to develop safety performance models for road segment and intersection facility types that were not initially reflected in the HSM-1, in order to expand the breadth and depth of the HSM in the future.

The IHSDM Crash Prediction Module (CPM) is intended as a faithful implementation of HSM Part C predictive methods. As NCHRP projects to develop new predictive methods for the HSM are completed, FHWA works to incorporate the new methods into IHSDM, sometimes in advance of publication in the HSM. The following new crash predictive methods have been accepted by NCHRP project panels and incorporated into IHSDM, while pending AASHTO's approval for incorporation into a future edition of the HSM:

- Roundabouts: completed in 2018 under NCHRP Project 17-70, the new methods will provide improved outcomes for the safety analysis of roundabouts.
- 6+ lane and one-way urban/suburban arterials (including models for segments and intersections): completed under NCHRP Project 17-58.

However, in the absence of local calibration factors (see HSM-1 Part C, Appendix A for guidance on calibration of the predictive models), it is neither appropriate nor advisable to directly compare the results from new models (from NCHRP Projects 17-58 and 17-70) to results from HSM-1 models, as the models were not calibrated to the same base state data sets, and consequently can produce unexpected results. If local calibration factors are available and applied to both new models and HSM-1 models, then it may be appropriate to directly compare the results.*[Note: Work being performed under NCHRP Project 17-72 (Update of Crash Modification Factors for the Highway Safety Manual) is expected to re-calibrate many of the old (HSM-1) and new (e.g., NCHRP 17-70) models to data from a single (or small number of) states, that would allow results from all models to be directly compared.]*

The models produced for NCHRP Project 17-70 have independent value in terms of informing the design of a roundabout and assessing the effects of different design characteristics on the expected safety performance of a roundabout.

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Section Types

Interchange 160-67 : Evaluation Interchange 2022-2042 : Ramp SB Enter Evaluation

Report Overview

Report Generated: Dec 11, 2020 3:42 PM
Report Template: System: Multi-Page [System] (mlcpm2, Nov 27, 2020 3:23 PM)

Evaluation Date: Fri Dec 11 15:27:29 CST 2020
IHSDM Version: v16.0.0 (Sep 30, 2020)
Crash Prediction Module: v11.0.0 (Sep 30, 2020)

User Name: mhuebbe
Organization Name: EFK Moen, LLC
Phone: 314-394-3133
E-Mail: mhuebbe@efkmoen.com

Project Title: Interchange 160-67
Project Comment: Created Thu Dec 10 08:43:05 CST 2020
Project Unit System: U.S. Customary

Highway Title: Ramp SB Enter
Highway Comment: Created Thu Dec 10 11:12:22 CST 2020
Highway Version: 1

Evaluation Title: Interchange 160-67 : Evaluation Interchange 2022-2042 : Ramp SB Enter
Evaluation Comment: Created Fri Dec 11 15:27:12 CST 2020

Minimum Location: 0.000
Maximum Location: 7+18.230
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: HSM Configuration
Crash Distribution: HSM Configuration
Model/CMF: HSM Configuration
First Year of Analysis: 2022
Last Year of Analysis: 2042
Empirical-Bayes Analysis: None
First Year of Observed Crashes:
Last Year of Observed Crashes:

Disclaimer Regarding Crash Prediction Method

IMPORTANT NOTICE ABOUT COMPARING RESULTS FROM HIGHWAY SAFETY MANUAL FIRST EDITION (2010) MODELS TO RESULTS FROM NEW MODELS DEVELOPED UNDER NCHRP PROJECTS 17-70 AND 17-58

Since the publication of the Highway Safety Manual - First Edition (HSM-1), in 2010 by the American Association of State Highway and Transportation Officials (AASHTO), multiple research efforts have been undertaken through the National Cooperative Highway Research Program (NCHRP) to develop safety performance models for road segment and intersection facility types that were not initially reflected in the HSM-1, in order to expand the breadth and depth of the HSM in the future.

The IHSDM Crash Prediction Module (CPM) is intended as a faithful implementation of HSM Part C predictive methods. As NCHRP projects to develop new predictive methods for the HSM are completed, FHWA works to incorporate the new methods into IHSDM, sometimes in advance of publication in the HSM. The following new crash predictive methods have been accepted by NCHRP project panels and incorporated into IHSDM, while pending AASHTO's approval for incorporation into a future edition of the HSM:

- Roundabouts: completed in 2018 under NCHRP Project 17-70, the new methods will provide improved outcomes for the safety analysis of roundabouts.
- 6+ lane and one-way urban/suburban arterials (including models for segments and intersections): completed under NCHRP Project 17-58.

However, in the absence of local calibration factors (see HSM-1 Part C, Appendix A for guidance on calibration of the predictive models), it is neither appropriate nor advisable to directly compare the results from new models (from NCHRP Projects 17-58 and 17-70) to results from HSM-1 models, as the models were not calibrated to the same base state data sets, and consequently can produce unexpected results. If local calibration factors are available and applied to both new models and HSM-1 models, then it may be appropriate to directly compare the results.*[Note: Work being performed under NCHRP Project 17-72 (Update of Crash Modification Factors for the Highway Safety Manual) is expected to re-calibrate many of the old (HSM-1) and new (e.g., NCHRP 17-70) models to data from a single (or small number of) states, that would allow results from all models to be directly compared.]*

The models produced for NCHRP Project 17-70 have independent value in terms of informing the design of a roundabout and assessing the effects of different design characteristics on the expected safety performance of a roundabout.

The HSM-1 interim method previously included in IHSDM for evaluating roundabouts on urban/suburban arterials (i.e., evaluating an existing intersection and then applying a Crash Modification Factor for replacing the existing intersection with a roundabout) has been deactivated in IHSDM, to minimize any confusion with the new roundabout methodology.

Freeway Ramp Evaluation

Section: Section 1
Evaluation Start Location: 0.000
Evaluation End Location: 7+18.230
Functional Class: Freeway Service Ramp
Type of Alignment: One Direction
Model Category: Freeway Service Ramp

Calibration Factor: ENT_RAMP_MV_FI=1.0; ENT_RAMP_MV_PDO=1.0; ENT_RAMP_SV_FI=1.0; ENT_RAMP_SV_PDO=1.0;

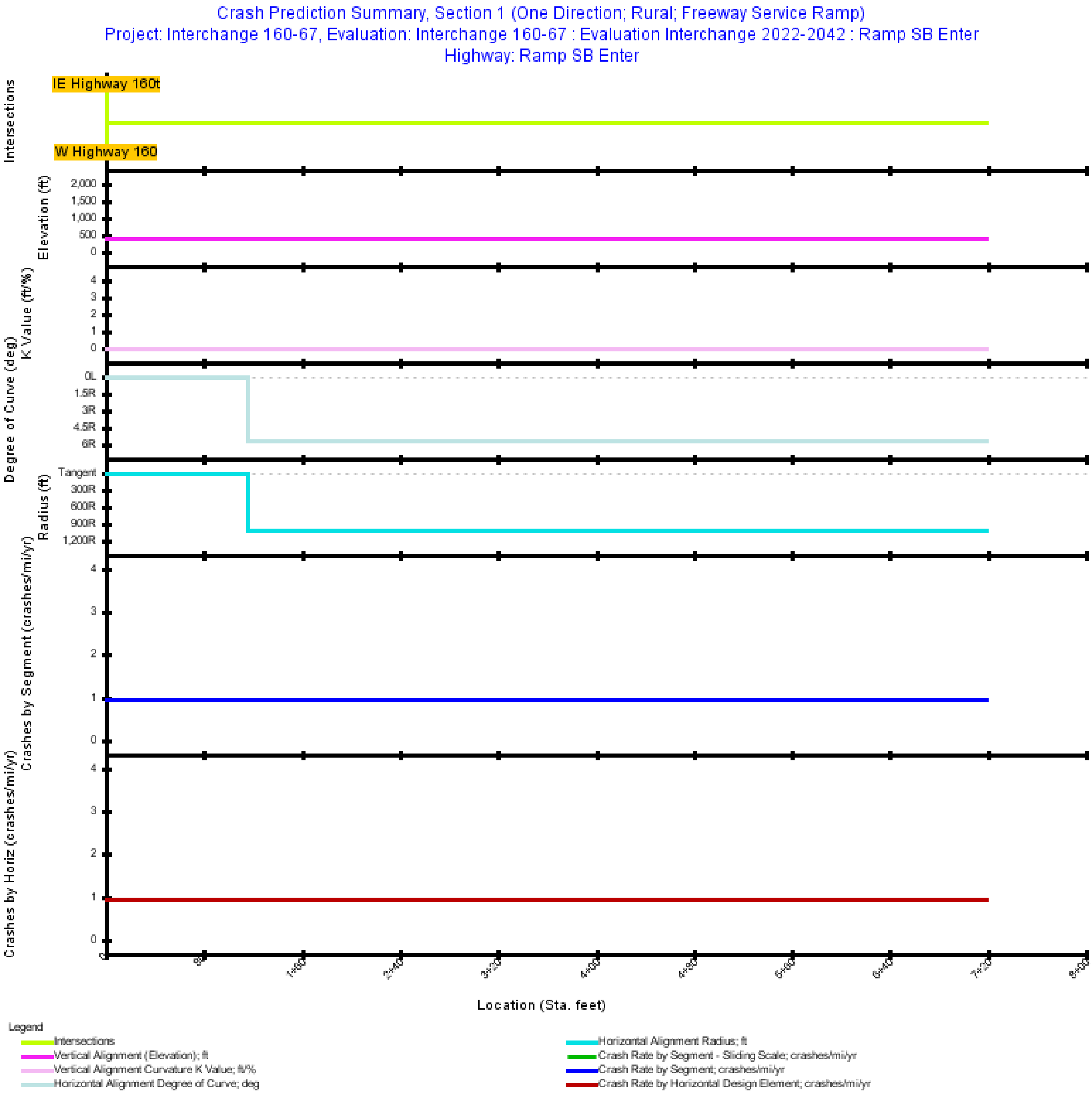

Figure 1. Crash Prediction Summary (Freeway Ramp Sections)

Table 1. Evaluation Freeway - Homogeneous Segments (Freeway Ramp Sections)

Seg. No.	Type	Area Type	Start Location (Sta. ft)	End Location (Sta. ft)	Length (ft)	Length (mi)	AADT
1	Freeway Ramp and C-D Road One-lane Ramp Entrance	Rural	0.000	7+18.230	718.23	0.1360	2022: 2,900; 2023: 2,935; 2024: 2,970; 2025: 3,005; 2026: 3,040; 2027: 3,075; 2028: 3,110; 2029: 3,145; 2030: 3,180; 2031: 3,215; 2032: 3,250; 2033: 3,285; 2034: 3,320; 2035: 3,355; 2036: 3,390; 2037: 3,425; 2038: 3,460; 2039: 3,495; 2040: 3,530; 2041: 3,565; 2042: 3,600

Table 2. Predicted Ramp Crash Rates and Frequencies Summary (Freeway Ramp Sections)

First Year of Analysis	2022
Last Year of Analysis	2042
Evaluated Length (mi)	0.1360
Average Future Road AADT (vpd)	3,250
Predicted Crashes	
Total Crashes	2.73
Fatal and Injury Crashes	1.11
Property-Damage-Only Crashes	1.62
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	41
Percent Property-Damage-Only Crashes (%)	59
Predicted Crash Rate	
Crash Rate (crashes/mi/yr)	0.9546
FI Crash Rate (crashes/mi/yr)	0.3878
PDO Crash Rate (crashes/mi/yr)	0.5668
Predicted Travel Crash Rate	
Total Travel (million veh-mi)	3.39
Travel Crash Rate (crashes/million veh-mi)	0.81
Travel FI Crash Rate (crashes/million veh-mi)	0.33
Travel PDO Crash Rate (crashes/million veh-mi)	0.48

Table 3. Predicted Crash Frequencies and Rates by Ramp Segment/Intersection (Freeway Ramp Sections)

Segment Number/Intersection Name/Cross Road	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
1	0.000	7+18.230	0.1360	2.727	0.1299	0.0528	0.0771	0.9546	0.81
Total			0.1360	2.727	0.1299	0.0528	0.0771	0.9546	

Table 4. Predicted Crash Frequencies and Rates by Horizontal Design Element (Freeway Ramp Sections)

Title	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
Tangent	0.000	1+15.840	0.0219	0.440	0.0209	0.0085	0.0124	0.9546	0.81
Simple Curve 1	1+15.840	7+18.230	0.1141	2.287	0.1089	0.0442	0.0647	0.9546	0.81

Table 5. Predicted Crash Frequencies by Year (Freeway Ramp Sections)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2022	0.12	0.05	40.824	0.07	59.176
2023	0.12	0.05	40.804	0.07	59.196
2024	0.12	0.05	40.784	0.07	59.216
2025	0.12	0.05	40.764	0.07	59.236
2026	0.12	0.05	40.744	0.07	59.256
2027	0.12	0.05	40.725	0.07	59.275
2028	0.13	0.05	40.705	0.07	59.295
2029	0.13	0.05	40.686	0.07	59.314
2030	0.13	0.05	40.666	0.08	59.334
2031	0.13	0.05	40.647	0.08	59.353
2032	0.13	0.05	40.628	0.08	59.372
2033	0.13	0.05	40.609	0.08	59.391
2034	0.13	0.05	40.590	0.08	59.410
2035	0.13	0.05	40.571	0.08	59.429
2036	0.13	0.05	40.552	0.08	59.448
2037	0.14	0.06	40.533	0.08	59.467
2038	0.14	0.06	40.515	0.08	59.485
2039	0.14	0.06	40.496	0.08	59.504
2040	0.14	0.06	40.478	0.08	59.522
2041	0.14	0.06	40.459	0.08	59.541
2042	0.14	0.06	40.441	0.08	59.559
Total	2.73	1.11	40.624	1.62	59.376
Average	0.13	0.05	40.624	0.08	59.376

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 6. Predicted Crash Severity by Ramp Segment (Freeway Ramp Sections)

Seg. No.	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)
1	0.0308	0.0934	0.6115	0.3720	1.6191

Table 7. Predicted Freeway Ramp Crash Type Distribution (Freeway Ramp Sections)

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Highway Segment	Collision with Animal	0.01	0.4	0.09	3.2	0.10	3.5
Highway Segment	Collision with Fixed Object	0.61	22.2	0.83	30.3	1.43	52.5
Highway Segment	Collision with Other Object	0.03	1.2	0.17	6.1	0.20	7.3
Highway Segment	Other Single-vehicle Collision	0.39	14.4	0.21	7.9	0.61	22.3
Highway Segment	Collision with Parked Vehicle	0.03	0.9	0.03	1.1	0.06	2.1
Highway Segment	Total Single Vehicle Crashes	1.07	39.2	1.32	48.5	2.39	87.7
Highway Segment	Right-Angle Collision	0.00	0.1	0.01	0.3	0.01	0.4
Highway Segment	Head-on Collision	0.00	0.0	0.00	0.0	0.00	0.1
Highway Segment	Other Multi-vehicle Collision	0.00	0.1	0.02	0.8	0.03	0.9
Highway Segment	Rear-end Collision	0.03	0.9	0.15	5.5	0.18	6.4
Highway Segment	Sideswipe, Same Direction Collision	0.01	0.3	0.11	4.1	0.12	4.5
Highway Segment	Total Multiple Vehicle Crashes	0.04	1.5	0.30	10.9	0.34	12.3
Highway Segment	Total Highway Segment Crashes	1.11	40.6	1.62	59.4	2.73	100.0
	Total Crashes	1.11	40.6	1.62	59.4	2.73	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Interchange 160-67 : Evaluation Interchange 2022-2042 : Ramp SB Exit Evaluation

Report Overview

Report Generated: Dec 11, 2020 3:42 PM

Report Template: System: Multi-Page [System] (mlcpm2, Nov 27, 2020 3:23 PM)

Evaluation Date: Fri Dec 11 15:27:43 CST 2020
IHSDM Version: v16.0.0 (Sep 30, 2020)
Crash Prediction Module: v11.0.0 (Sep 30, 2020)

User Name: mhuebbe
Organization Name: EFK Moen, LLC
Phone: 314-394-3133
E-Mail: mhuebbe@efkmoen.com

Project Title: Interchange 160-67
Project Comment: Created Thu Dec 10 08:43:05 CST 2020
Project Unit System: U.S. Customary

Highway Title: Ramp SB Exit
Highway Comment: Created Thu Dec 10 11:42:40 CST 2020
Highway Version: 1

Evaluation Title: Interchange 160-67 : Evaluation Interchange 2022-2042 : Ramp SB Exit
Evaluation Comment: Created Fri Dec 11 15:27:35 CST 2020

Minimum Location: 0.000
Maximum Location: 17+62.820
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: HSM Configuration
Crash Distribution: HSM Configuration
Model/CMF: HSM Configuration
First Year of Analysis: 2022
Last Year of Analysis: 2042
Empirical-Bayes Analysis: None
First Year of Observed Crashes:
Last Year of Observed Crashes:

Disclaimer Regarding Crash Prediction Method

IMPORTANT NOTICE ABOUT COMPARING RESULTS FROM HIGHWAY SAFETY MANUAL FIRST EDITION (2010) MODELS TO RESULTS FROM NEW MODELS DEVELOPED UNDER NCHRP PROJECTS 17-70 AND 17-58

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However, in the absence of local calibration factors (see HSM-1 Part C, Appendix A for guidance on calibration of the predictive models), it is neither appropriate nor advisable to directly compare the results from new models (from NCHRP Projects 17-58 and 17-70) to results from HSM-1 models, as the models were not calibrated to the same base state data sets, and consequently can produce unexpected results. If local calibration factors are available and applied to both new models and HSM-1 models, then it may be appropriate to directly compare the results.*[Note: Work being performed under NCHRP Project 17-72 (Update of Crash Modification Factors for the Highway Safety Manual) is expected to re-calibrate many of the old (HSM-1) and new (e.g., NCHRP 17-70) models to data from a single (or small number of) states, that would allow results from all models to be directly compared.]*

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Freeway Ramp Evaluation

Section: Section 1
Evaluation Start Location: 0.000
Evaluation End Location: 17+62.820
Functional Class: Freeway Service Ramp
Type of Alignment: One Direction
Model Category: Freeway Service Ramp
Calibration Factor: EX_RAMP_MV_FI=1.0; EX_RAMP_MV_PDO=1.0; EX_RAMP_SV_FI=1.0; EX_RAMP_SV_PDO=1.0;

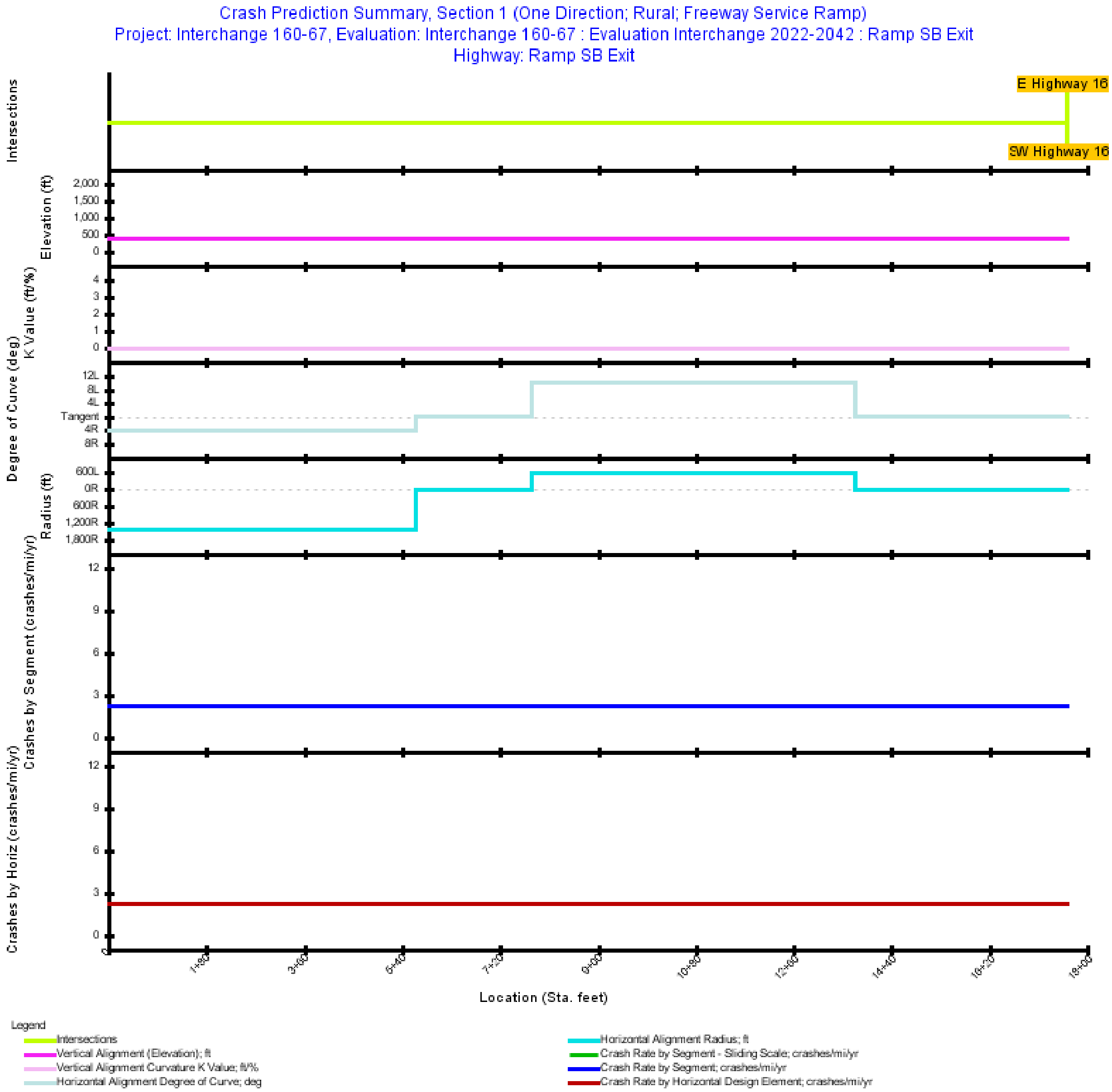

Figure 2. Crash Prediction Summary (Freeway Ramp Sections)

Table 8. Evaluation Freeway - Homogeneous Segments (Freeway Ramp Sections)

Seg. No.	Type	Area Type	Start Location (Sta. ft)	End Location (Sta. ft)	Length (ft)	Length (mi)	AADT
1	Freeway Ramp and C-D Road One-lane Ramp Exit	Rural	0.000	17+62.820	1,762.82	0.3339	2022: 5,900; 2023: 5,965; 2024: 6,030; 2025: 6,095; 2026: 6,160; 2027: 6,225; 2028: 6,290; 2029: 6,355; 2030: 6,420; 2031: 6,485; 2032: 6,550; 2033: 6,615; 2034: 6,680; 2035: 6,745; 2036: 6,810; 2037: 6,875; 2038: 6,940; 2039: 7,005; 2040: 7,070; 2041: 7,135; 2042: 7,200

Table 9. Predicted Ramp Crash Rates and Frequencies Summary (Freeway Ramp Sections)

First Year of Analysis	**2022**
Last Year of Analysis	**2042**
Evaluated Length (mi)	**0.3339**
Average Future Road AADT (vpd)	**6,550**
Predicted Crashes	
Total Crashes	**15.57**
Fatal and Injury Crashes	**7.17**
Property-Damage-Only Crashes	**8.39**
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	**46**
Percent Property-Damage-Only Crashes (%)	**54**
Predicted Crash Rate	
Crash Rate (crashes/mi/yr)	**2.2202**
FI Crash Rate (crashes/mi/yr)	**1.0231**
PDO Crash Rate (crashes/mi/yr)	**1.1971**
Predicted Travel Crash Rate	
Total Travel (million veh-mi)	**16.76**
Travel Crash Rate (crashes/million veh-mi)	**0.93**
Travel FI Crash Rate (crashes/million veh-mi)	**0.43**
Travel PDO Crash Rate (crashes/million veh-mi)	**0.50**

Table 10. Predicted Crash Frequencies and Rates by Ramp Segment/Intersection (Freeway Ramp Sections)

Segment Number/Intersection Name/Cross Road	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
1	0.000	17+62.820	0.3339	15.566	0.7413	0.3416	0.3997	2.2202	0.93
Total			0.3339	15.566	0.7413	0.3416	0.3997	2.2202	

Table 11. Predicted Crash Frequencies and Rates by Horizontal Design Element (Freeway Ramp Sections)

Title	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi /yr)	Predicted Travel Crash Rate (crashes/mi llion veh-mi)
Simple Curve 1	0.000	5+64.230	0.1069	4.982	0.2373	0.1093	0.1279	2.2202	0.93
Tangent	5+64.230	7+78.690	0.0406	1.894	0.0902	0.0416	0.0486	2.2202	0.93
Simple Curve 2	7+78.690	13+71.820	0.1123	5.238	0.2494	0.1149	0.1345	2.2202	0.93
Tangent	13+71.820	17+62.820	0.0741	3.453	0.1644	0.0758	0.0887	2.2202	0.93

Table 12. Predicted Crash Frequencies by Year (Freeway Ramp Sections)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2022	0.69	0.32	46.125	0.37	53.875
2023	0.69	0.32	46.121	0.37	53.879
2024	0.70	0.32	46.117	0.38	53.883
2025	0.70	0.32	46.112	0.38	53.888
2026	0.71	0.33	46.108	0.38	53.892
2027	0.71	0.33	46.104	0.39	53.896
2028	0.72	0.33	46.100	0.39	53.900
2029	0.72	0.33	46.095	0.39	53.905
2030	0.73	0.34	46.091	0.39	53.909
2031	0.74	0.34	46.087	0.40	53.913
2032	0.74	0.34	46.082	0.40	53.918
2033	0.75	0.34	46.078	0.40	53.922
2034	0.75	0.35	46.073	0.41	53.927
2035	0.76	0.35	46.069	0.41	53.931
2036	0.76	0.35	46.065	0.41	53.935
2037	0.77	0.35	46.060	0.41	53.940
2038	0.77	0.36	46.056	0.42	53.944
2039	0.78	0.36	46.051	0.42	53.949
2040	0.78	0.36	46.047	0.42	53.953
2041	0.79	0.36	46.042	0.43	53.958
2042	0.80	0.37	46.038	0.43	53.962
Total	15.57	7.17	46.081	8.39	53.919
Average	0.74	0.34	46.081	0.40	53.919

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 13. Predicted Crash Severity by Ramp Segment (Freeway Ramp Sections)

Seg. No.	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)
1	0.2761	0.8373	3.6223	2.4375	8.3933

Table 14. Predicted Freeway Ramp Crash Type Distribution (Freeway Ramp Sections)

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Highway Segment	Collision with Animal	0.07	0.5	0.50	3.2	0.57	3.7
Highway Segment	Collision with Fixed Object	4.04	26.0	4.80	30.8	8.84	56.8
Highway Segment	Collision with Other Object	0.22	1.4	0.96	6.2	1.18	7.6
Highway Segment	Other Single-vehicle Collision	2.62	16.8	1.24	8.0	3.87	24.8
Highway Segment	Collision with Parked Vehicle	0.17	1.1	0.18	1.1	0.35	2.2
Highway Segment	Total Single Vehicle Crashes	7.12	45.8	7.67	49.3	14.80	95.1
Highway Segment	Right-Angle Collision	0.00	0.0	0.02	0.1	0.02	0.2
Highway Segment	Head-on Collision	0.00	0.0	0.00	0.0	0.00	0.0
Highway Segment	Other Multi-vehicle Collision	0.00	0.0	0.06	0.4	0.06	0.4
Highway Segment	Rear-end Collision	0.03	0.2	0.36	2.3	0.40	2.5
Highway Segment	Sideswipe, Same Direction Collision	0.01	0.1	0.27	1.8	0.28	1.8
Highway Segment	Total Multiple Vehicle Crashes	0.05	0.3	0.72	4.6	0.77	4.9
Highway Segment	Total Highway Segment Crashes	7.17	46.1	8.39	53.9	15.57	100.0
	Total Crashes	7.17	46.1	8.39	53.9	15.57	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 15. Evaluation Message

Start Location (Sta. ft)	End Location (Sta. ft)	Message
0.000	17+62.820	for segment #1 (0.000 to 17+62.820), traffic volume (7,005 vpd) for 2039 is not within the model limit (7,000 vpd) for reliable results for segment type 1EX
0.000	17+62.820	for segment #1 (0.000 to 17+62.820), traffic volume (7,070 vpd) for 2040 is not within the model limit (7,000 vpd) for reliable results for segment type 1EX
0.000	17+62.820	for segment #1 (0.000 to 17+62.820), traffic volume (7,135 vpd) for 2041 is not within the model limit (7,000 vpd) for reliable results for segment type 1EX
0.000	17+62.820	for segment #1 (0.000 to 17+62.820), traffic volume (7,200 vpd) for 2042 is not within the model limit (7,000 vpd) for reliable results for segment type 1EX

Interchange 160-67 : Evaluation Interchange 2022-2042 : RampTerminal 160 SB Evaluation

Report Overview

Report Generated: Dec 11, 2020 3:42 PM
Report Template: System: Multi-Page [System] (mlcpm2, Nov 27, 2020 3:23 PM)

Evaluation Date: Fri Dec 11 15:28:14 CST 2020
IHSDM Version: v16.0.0 (Sep 30, 2020)
Crash Prediction Module: v11.0.0 (Sep 30, 2020)

User Name: mhuebbe
Organization Name: EFK Moen, LLC
Phone: 314-394-3133
E-Mail: mhuebbe@efkmoen.com

Project Title: Interchange 160-67
Project Comment: Created Thu Dec 10 08:43:05 CST 2020
Project Unit System: U.S. Customary

Intersection Title: RampTerminal 160 SB
Intersection Comment: Created Thu Dec 10 12:35:13 CST 2020
Intersection Version: v1

Evaluation Title: Interchange 160-67 : Evaluation Interchange 2022-2042 : RampTerminal 160 SB
Evaluation Comment: Created Fri Dec 11 15:28:07 CST 2020

Minimum Location: 534+24.000
Maximum Location: 596+34.000
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: HSM Configuration
Crash Distribution: HSM Configuration
Model/CMF: HSM Configuration
First Year of Analysis: 2022
Last Year of Analysis: 2042
Empirical-Bayes Analysis: None
First Year of Observed Crashes:
Last Year of Observed Crashes:

Disclaimer Regarding Crash Prediction Method

IMPORTANT NOTICE ABOUT COMPARING RESULTS FROM HIGHWAY SAFETY MANUAL FIRST EDITION (2010) MODELS TO RESULTS FROM NEW MODELS DEVELOPED UNDER NCHRP PROJECTS 17-70 AND 17-58

Since the publication of the Highway Safety Manual - First Edition (HSM-1), in 2010 by the American Association of State Highway and Transportation Officials (AASHTO), multiple research efforts have been undertaken through the National Cooperative Highway Research Program (NCHRP) to develop safety performance models for road segment and intersection facility types that were not initially reflected in the HSM-1, in order to expand the breadth and depth of the HSM in the future.

The IHSDM Crash Prediction Module (CPM) is intended as a faithful implementation of HSM Part C predictive methods. As NCHRP projects to develop new predictive methods for the HSM are completed, FHWA works to incorporate the new methods into IHSDM, sometimes in advance of publication in the HSM. The following new crash predictive methods have been accepted by NCHRP project panels and incorporated into IHSDM, while pending AASHTO's approval for incorporation into a future edition of the HSM:

- Roundabouts: completed in 2018 under NCHRP Project 17-70, the new methods will provide improved outcomes for the safety analysis of roundabouts.
- 6+ lane and one-way urban/suburban arterials (including models for segments and intersections): completed under NCHRP Project 17-58.

However, in the absence of local calibration factors (see HSM-1 Part C, Appendix A for guidance on calibration of the predictive models), it is neither appropriate nor advisable to directly compare the results from new models (from NCHRP Projects 17-58 and 17-70) to results from HSM-1 models, as the models were not calibrated to the same base state data sets, and consequently can produce unexpected results. If local calibration factors are available and applied to both new models and HSM-1 models, then it may be appropriate to directly compare the results.*[Note: Work being performed under NCHRP Project 17-72 (Update of Crash Modification Factors for the Highway Safety Manual) is expected to re-calibrate many of the old (HSM-1) and new (e.g., NCHRP 17-70) models to data from a single (or small number of) states, that would allow results from all models to be directly compared.]*

The models produced for NCHRP Project 17-70 have independent value in terms of informing the design of a roundabout and assessing the effects of different design characteristics on the expected safety performance of a roundabout.

The HSM-1 interim method previously included in IHSDM for evaluating roundabouts on urban/suburban arterials (i.e., evaluating an existing intersection and then applying a Crash Modification Factor for replacing the existing intersection with a roundabout) has been deactivated in IHSDM, to minimize any confusion with the new roundabout methodology.

RampTerminal 160 SB Evaluation

Intersection: RampTerminal 160 SB
Evaluation Start Location: 534+24.000
Evaluation End Location: 596+34.000
Calibration Factor: RT_ST_FI=1.0; RT_ST_PDO=1.0;

Table 16. Evaluation Ramp Terminal - Site (RampTerminal 160 SB)

Inter. No.	Title	Type	Area Type	Legs	Location (Sta. ft)	Traffic Control	AADT
1	RampTerminal 160 SB (v1)	Freeway Ramp Terminal D4 - Four-Leg with Diagonal Ramps	Rural	4	580+00.000	Stop-Controlled	Inside: 2022: 7,100; 2023: 7,185; 2024: 7,270; 2025: 7,355; 2026: 7,440; 2027: 7,525; 2028: 7,610; 2029: 7,695; 2030: 7,780; 2031: 7,865; 2032: 7,950; 2033: 8,035; 2034: 8,120; 2035: 8,205; 2036: 8,290; 2037: 8,375; 2038: 8,460; 2039: 8,545; 2040: 8,630; 2041: 8,715; 2042: 8,800; Outside: 2022: 7,100; 2023: 7,185; 2024: 7,270; 2025: 7,355; 2026: 7,440; 2027: 7,525; 2028: 7,610; 2029: 7,695; 2030: 7,780; 2031: 7,865; 2032: 7,950; 2033: 8,035; 2034: 8,120; 2035: 8,205; 2036: 8,290; 2037: 8,375; 2038: 8,460; 2039: 8,545; 2040: 8,630; 2041: 8,715; 2042: 8,800 :: Entrance: 2022: 2,900; 2023: 2,935; 2024: 2,970; 2025: 3,005; 2026: 3,040; 2027: 3,075; 2028: 3,110; 2029: 3,145; 2030: 3,180; 2031: 3,215; 2032: 3,250; 2033: 3,285; 2034: 3,320; 2035: 3,355; 2036: 3,390; 2037: 3,425; 2038: 3,460; 2039: 3,495; 2040: 3,530; 2041: 3,565; 2042: 3,600; Exit: 2022: 5,900; 2023: 5,965; 2024: 6,030; 2025: 6,095; 2026: 6,160; 2027: 6,225; 2028: 6,290; 2029: 6,355; 2030: 6,420; 2031: 6,485; 2032: 6,550; 2033: 6,615; 2034: 6,680; 2035: 6,745; 2036: 6,810; 2037: 6,875; 2038: 6,940; 2039: 7,005; 2040: 7,070; 2041: 7,135; 2042: 7,200

Table 17. Predicted Ramp Terminal Crash Rates and Frequencies Summary (RampTerminal 160 SB)

First Year of Analysis	**2022**
Last Year of Analysis	**2042**
Predicted Crashes	
Total Crashes	**79.31**
Fatal and Injury Crashes	**47.76**
Property-Damage-Only Crashes	**31.55**
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	**60**
Percent Property-Damage-Only Crashes (%)	**40**

Table 18. Predicted Crash Frequencies and Rates by Ramp Terminal (RampTerminal 160 SB)

Segment Number/Intersection Name/Cross Road	Location (Sta. ft)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Travel Crash Rate (crashes/million veh)
RampTerminal 160 SB (v1)	580+00.000	79.310	3.7767	2.2742	1.5025	0.81

Table 19. Predicted Crash Frequencies by Year (RampTerminal 160 SB)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2022	2.96	1.67	56.267	1.30	43.733
2023	3.04	1.72	56.619	1.32	43.381
2024	3.11	1.77	56.974	1.34	43.026
2025	3.18	1.82	57.331	1.36	42.669
2026	3.25	1.88	57.690	1.38	42.310
2027	3.33	1.93	58.050	1.40	41.950
2028	3.41	1.99	58.413	1.42	41.587
2029	3.49	2.05	58.777	1.44	41.223
2030	3.57	2.11	59.143	1.46	40.857
2031	3.66	2.18	59.510	1.48	40.490
2032	3.74	2.24	59.879	1.50	40.121
2033	3.83	2.31	60.250	1.52	39.750
2034	3.92	2.38	60.621	1.54	39.379
2035	4.01	2.45	60.995	1.56	39.005
2036	4.10	2.52	61.369	1.58	38.631
2037	4.20	2.59	61.744	1.61	38.256
2038	4.30	2.67	62.121	1.63	37.879
2039	4.40	2.75	62.498	1.65	37.502
2040	4.50	2.83	62.876	1.67	37.124
2041	4.60	2.91	63.255	1.69	36.745
2042	4.71	3.00	63.634	1.71	36.366
Total	79.31	47.76	60.217	31.55	39.783
Average	3.78	2.27	60.217	1.50	39.783

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the

distribution of these three crashes had been derived independently.

Table 20. Predicted Crash Severity by Ramp Terminal (RampTerminal 160 SB)

Seg. No.	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)
1	0.5649	2.9659	9.8113	34.4163	31.5516

Table 21. Predicted Ramp Terminal Crash Type Distribution (RampTerminal 160 SB)

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Ramp Terminal	Collision with Animal	0.00	0.0	0.00	0.0	0.00	0.0
Ramp Terminal	Collision with Fixed Object	3.73	4.7	4.99	6.3	8.71	11.0
Ramp Terminal	Collision with Other Object	0.00	0.0	0.16	0.2	0.16	0.2
Ramp Terminal	Other Single-vehicle Collision	3.10	3.9	0.82	1.0	3.92	4.9
Ramp Terminal	Collision with Parked Vehicle	0.33	0.4	0.47	0.6	0.81	1.0
Ramp Terminal	Total Single Vehicle Crashes	7.16	9.0	6.44	8.1	13.60	17.1
Ramp Terminal	Right-Angle Collision	24.93	31.4	11.74	14.8	36.67	46.2
Ramp Terminal	Head-on Collision	0.95	1.2	0.47	0.6	1.43	1.8
Ramp Terminal	Other Multi-vehicle Collision	0.62	0.8	0.82	1.0	1.44	1.8
Ramp Terminal	Rear-end Collision	13.13	16.6	8.71	11.0	21.84	27.5
Ramp Terminal	Sideswipe, Same Direction Collision	0.95	1.2	3.38	4.3	4.33	5.5
Ramp Terminal	Total Multiple Vehicle Crashes	40.59	51.2	25.11	31.7	65.71	82.9
Ramp Terminal	Total Ramp Terminal Crashes	47.76	60.2	31.55	39.8	79.31	100.0
	Total Crashes	47.76	60.2	31.55	39.8	79.31	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Interchange 160-67 : Evaluation Interchange 2022-2042 : Ramp NB Exit Evaluation

Report Overview

Report Generated: Dec 11, 2020 3:42 PM
Report Template: System: Multi-Page [System] (mlcpm2, Nov 27, 2020 3:23 PM)

Evaluation Date: Fri Dec 11 15:28:25 CST 2020
IHSDM Version: v16.0.0 (Sep 30, 2020)
Crash Prediction Module: v11.0.0 (Sep 30, 2020)

User Name: mhuebbe
Organization Name: EFK Moen, LLC
Phone: 314-394-3133
E-Mail: mhuebbe@efkmoen.com

Project Title: Interchange 160-67
Project Comment: Created Thu Dec 10 08:43:05 CST 2020
Project Unit System: U.S. Customary

Highway Title: Ramp NB Exit
Highway Comment: Created Fri Dec 11 14:49:44 CST 2020
Highway Version: 1

Evaluation Title: Interchange 160-67 : Evaluation Interchange 2022-2042 : Ramp NB Exit
Evaluation Comment: Created Fri Dec 11 15:28:17 CST 2020

Minimum Location: 0.000
Maximum Location: 20+34.680
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: HSM Configuration
Crash Distribution: HSM Configuration
Model/CMF: HSM Configuration
First Year of Analysis: 2022
Last Year of Analysis: 2042
Empirical-Bayes Analysis: None
First Year of Observed Crashes:
Last Year of Observed Crashes:

Disclaimer Regarding Crash Prediction Method

IMPORTANT NOTICE ABOUT COMPARING RESULTS FROM HIGHWAY SAFETY MANUAL FIRST EDITION (2010) MODELS TO RESULTS FROM NEW MODELS DEVELOPED UNDER NCHRP PROJECTS 17-70 AND 17-58

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The IHSDM Crash Prediction Module (CPM) is intended as a faithful implementation of HSM Part C predictive methods. As NCHRP projects to develop new predictive methods for the HSM are completed, FHWA works to incorporate the new methods into IHSDM, sometimes in advance of publication in the HSM. The following new crash predictive methods have been accepted by NCHRP project panels and incorporated into IHSDM, while pending AASHTO's approval for incorporation into a future edition of the HSM:

- Roundabouts: completed in 2018 under NCHRP Project 17-70, the new methods will provide improved outcomes for the safety analysis of roundabouts.
- 6+ lane and one-way urban/suburban arterials (including models for segments and intersections): completed under NCHRP Project 17-58.

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The models produced for NCHRP Project 17-70 have independent value in terms of informing the design of a roundabout and assessing the effects of different design characteristics on the expected safety performance of a roundabout.

The HSM-1 interim method previously included in IHSDM for evaluating roundabouts on urban/suburban arterials (i.e., evaluating an existing intersection and then applying a Crash Modification Factor for replacing the existing intersection with a roundabout) has been deactivated in IHSDM, to minimize any confusion with the new roundabout methodology.

Freeway Ramp Evaluation

Section: Section 1
Evaluation Start Location: 0.000
Evaluation End Location: 20+34.680
Functional Class: Freeway Service Ramp
Type of Alignment: One Direction
Model Category: Freeway Service Ramp

Calibration Factor: EX_RAMP_MV_FI=1.0; EX_RAMP_MV_PDO=1.0; EX_RAMP_SV_FI=1.0; EX_RAMP_SV_PDO=1.0;

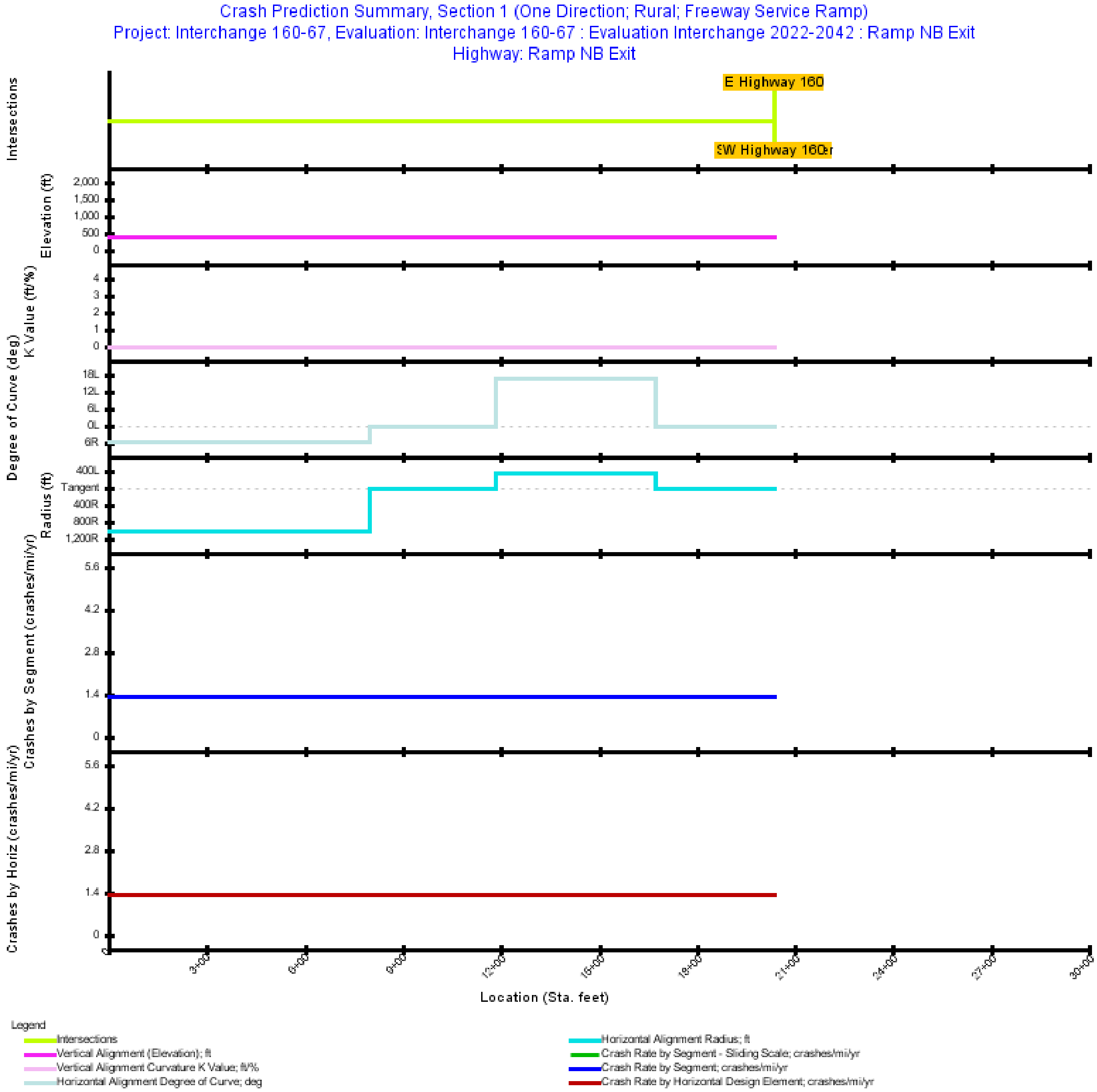

Figure 3. Crash Prediction Summary (Freeway Ramp Sections)

Table 22. Evaluation Freeway - Homogeneous Segments (Freeway Ramp Sections)

Seg. No.	Type	Area Type	Start Location (Sta. ft)	End Location (Sta. ft)	Length (ft)	Length (mi)	AADT
1	Freeway Ramp and C-D Road One-lane Ramp Exit	Rural	0.000	20+34.680	2,034.68	0.3854	2022: 2,600; 2023: 2,645; 2024: 2,690; 2025: 2,735; 2026: 2,780; 2027: 2,825; 2028: 2,870; 2029: 2,915; 2030: 2,960; 2031: 3,005; 2032: 3,050; 2033: 3,095; 2034: 3,140; 2035: 3,185; 2036: 3,230; 2037: 3,275; 2038: 3,320; 2039: 3,365; 2040: 3,410; 2041: 3,455; 2042: 3,500

Table 23. Predicted Ramp Crash Rates and Frequencies Summary (Freeway Ramp Sections)

First Year of Analysis	**2022**
Last Year of Analysis	**2042**
Evaluated Length (mi)	**0.3854**
Average Future Road AADT (vpd)	**3,050**
Predicted Crashes	
Total Crashes	**10.75**
Fatal and Injury Crashes	**4.92**
Property-Damage-Only Crashes	**5.83**
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	**46**
Percent Property-Damage-Only Crashes (%)	**54**
Predicted Crash Rate	
Crash Rate (crashes/mi/yr)	**1.3281**
FI Crash Rate (crashes/mi/yr)	**0.6078**
PDO Crash Rate (crashes/mi/yr)	**0.7203**
Predicted Travel Crash Rate	
Total Travel (million veh-mi)	**9.01**
Travel Crash Rate (crashes/million veh-mi)	**1.19**
Travel FI Crash Rate (crashes/million veh-mi)	**0.55**
Travel PDO Crash Rate (crashes/million veh-mi)	**0.65**

Table 24. Predicted Crash Frequencies and Rates by Ramp Segment/Intersection (Freeway Ramp Sections)

Segment Number/Intersection Name/Cross Road	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
1	0.000	20+34.680	0.3854	10.747	0.5118	0.2342	0.2776	1.3281	1.19
Total			0.3854	10.747	0.5118	0.2342	0.2776	1.3281	

Table 25. Predicted Crash Frequencies and Rates by Horizontal Design Element (Freeway Ramp Sections)

Title	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi /yr)	Predicted Travel Crash Rate (crashes/mi llion veh-mi)
Simple Curve 1	0.000	8+00.810	0.1517	4.230	0.2014	0.0922	0.1092	1.3281	1.19
Tangent	8+00.810	11+85.860	0.0729	2.034	0.0969	0.0443	0.0525	1.3281	1.19
Simple Curve 2	11+85.860	16+72.010	0.0921	2.568	0.1223	0.0560	0.0663	1.3281	1.19
Tangent	16+72.010	20+34.680	0.0687	1.916	0.0912	0.0417	0.0495	1.3281	1.19

Table 26. Predicted Crash Frequencies by Year (Freeway Ramp Sections)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2022	0.46	0.21	45.762	0.25	54.238
2023	0.46	0.21	45.763	0.25	54.237
2024	0.47	0.21	45.764	0.25	54.236
2025	0.47	0.22	45.764	0.26	54.236
2026	0.48	0.22	45.764	0.26	54.236
2027	0.48	0.22	45.764	0.26	54.236
2028	0.49	0.22	45.765	0.27	54.235
2029	0.50	0.23	45.765	0.27	54.235
2030	0.50	0.23	45.764	0.27	54.236
2031	0.51	0.23	45.764	0.28	54.236
2032	0.51	0.23	45.764	0.28	54.236
2033	0.52	0.24	45.764	0.28	54.236
2034	0.52	0.24	45.764	0.28	54.236
2035	0.53	0.24	45.763	0.29	54.237
2036	0.53	0.24	45.763	0.29	54.237
2037	0.54	0.25	45.762	0.29	54.238
2038	0.54	0.25	45.761	0.29	54.239
2039	0.55	0.25	45.761	0.30	54.239
2040	0.56	0.25	45.760	0.30	54.240
2041	0.56	0.26	45.759	0.30	54.241
2042	0.56	0.26	45.758	0.31	54.242
Total	10.75	4.92	45.763	5.83	54.237
Average	0.51	0.23	45.763	0.28	54.237

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 27. Predicted Crash Severity by Ramp Segment (Freeway Ramp Sections)

Seg. No.	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)
1	0.1905	0.5777	2.4952	1.6548	5.8290

Table 28. Predicted Freeway Ramp Crash Type Distribution (Freeway Ramp Sections)

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Highway Segment	Collision with Animal	0.05	0.5	0.36	3.3	0.41	3.8
Highway Segment	Collision with Fixed Object	2.77	25.8	3.45	32.1	6.22	57.9
Highway Segment	Collision with Other Object	0.15	1.4	0.69	6.4	0.84	7.8
Highway Segment	Other Single-vehicle Collision	1.80	16.7	0.90	8.3	2.69	25.1
Highway Segment	Collision with Parked Vehicle	0.12	1.1	0.13	1.2	0.24	2.3
Highway Segment	Total Single Vehicle Crashes	4.89	45.5	5.52	51.4	10.41	96.9
Highway Segment	Right-Angle Collision	0.00	0.0	0.01	0.1	0.01	0.1
Highway Segment	Head-on Collision	0.00	0.0	0.00	0.0	0.00	0.0
Highway Segment	Other Multi-vehicle Collision	0.00	0.0	0.02	0.2	0.03	0.2
Highway Segment	Rear-end Collision	0.02	0.2	0.16	1.5	0.17	1.6
Highway Segment	Sideswipe, Same Direction Collision	0.01	0.1	0.12	1.1	0.12	1.1
Highway Segment	Total Multiple Vehicle Crashes	0.03	0.3	0.31	2.9	0.34	3.1
Highway Segment	Total Highway Segment Crashes	4.92	45.8	5.83	54.2	10.75	100.0
	Total Crashes	4.92	45.8	5.83	54.2	10.75	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Interchange 160-67 : Evaluation Interchange 2022-2042 : Ramp NB Enter Evaluation

Report Overview

Report Generated: Dec 11, 2020 3:42 PM
Report Template: System: Multi-Page [System] (mlcpm2, Nov 27, 2020 3:23 PM)

Evaluation Date: Fri Dec 11 15:28:38 CST 2020
IHSDM Version: v16.0.0 (Sep 30, 2020)
Crash Prediction Module: v11.0.0 (Sep 30, 2020)

User Name: mhuebbe
Organization Name: EFK Moen, LLC
Phone: 314-394-3133
E-Mail: mhuebbe@efkmoen.com

Project Title: Interchange 160-67
Project Comment: Created Thu Dec 10 08:43:05 CST 2020
Project Unit System: U.S. Customary

Highway Title: Ramp NB Enter
Highway Comment: Created Fri Dec 11 14:58:52 CST 2020
Highway Version: 1

Evaluation Title: Interchange 160-67 : Evaluation Interchange 2022-2042 : Ramp NB Enter
Evaluation Comment: Created Fri Dec 11 15:28:31 CST 2020

Minimum Location: 0.000
Maximum Location: 15+51.630
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: HSM Configuration
Crash Distribution: HSM Configuration
Model/CMF: HSM Configuration
First Year of Analysis: 2022
Last Year of Analysis: 2042
Empirical-Bayes Analysis: None
First Year of Observed Crashes:
Last Year of Observed Crashes:

Disclaimer Regarding Crash Prediction Method

IMPORTANT NOTICE ABOUT COMPARING RESULTS FROM HIGHWAY SAFETY MANUAL FIRST EDITION (2010) MODELS TO RESULTS FROM NEW MODELS DEVELOPED UNDER NCHRP PROJECTS 17-70 AND 17-58

Since the publication of the Highway Safety Manual - First Edition (HSM-1), in 2010 by the American Association of State Highway and Transportation Officials (AASHTO), multiple research efforts have been undertaken through the National Cooperative Highway Research Program (NCHRP) to develop safety performance models for road segment and intersection facility types that were not initially reflected in the HSM-1, in order to expand the breadth and depth of the HSM in the future.

The IHSDM Crash Prediction Module (CPM) is intended as a faithful implementation of HSM Part C predictive methods. As NCHRP projects to develop new predictive methods for the HSM are completed, FHWA works to incorporate the new methods into IHSDM, sometimes in advance of publication in the HSM. The following new crash predictive methods have been accepted by NCHRP project panels and incorporated into IHSDM, while pending AASHTO's approval for incorporation into a future edition of the HSM:

- Roundabouts: completed in 2018 under NCHRP Project 17-70, the new methods will provide improved outcomes for the safety analysis of roundabouts.
- 6+ lane and one-way urban/suburban arterials (including models for segments and intersections): completed under NCHRP Project 17-58.

However, in the absence of local calibration factors (see HSM-1 Part C, Appendix A for guidance on calibration of the predictive models), it is neither appropriate nor advisable to directly compare the results from new models (from NCHRP Projects 17-58 and 17-70) to results from HSM-1 models, as the models were not calibrated to the same base state data sets, and consequently can produce unexpected results. If local calibration factors are available and applied to both new models and HSM-1 models, then it may be appropriate to directly compare the results.*[Note: Work being performed under NCHRP Project 17-72 (Update of Crash Modification Factors for the Highway Safety Manual) is expected to re-calibrate many of the old (HSM-1) and new (e.g., NCHRP 17-70) models to data from a single (or small number of) states, that would allow results from all models to be directly compared.]*

The models produced for NCHRP Project 17-70 have independent value in terms of informing the design of a roundabout and assessing the effects of different design characteristics on the expected safety performance of a roundabout.

The HSM-1 interim method previously included in IHSDM for evaluating roundabouts on urban/suburban arterials (i.e., evaluating an existing intersection and then applying a Crash Modification Factor for replacing the existing intersection with a roundabout) has been deactivated in IHSDM, to minimize any confusion with the new roundabout methodology.

Freeway Ramp Evaluation

Section: Section 1
Evaluation Start Location: 0.000
Evaluation End Location: 15+51.630
Functional Class: Freeway Service Ramp
Type of Alignment: One Direction
Model Category: Freeway Service Ramp
Calibration Factor: ENT_RAMP_MV_FI=1.0; ENT_RAMP_MV_PDO=1.0; ENT_RAMP_SV_FI=1.0; ENT_RAMP_SV_PDO=1.0;

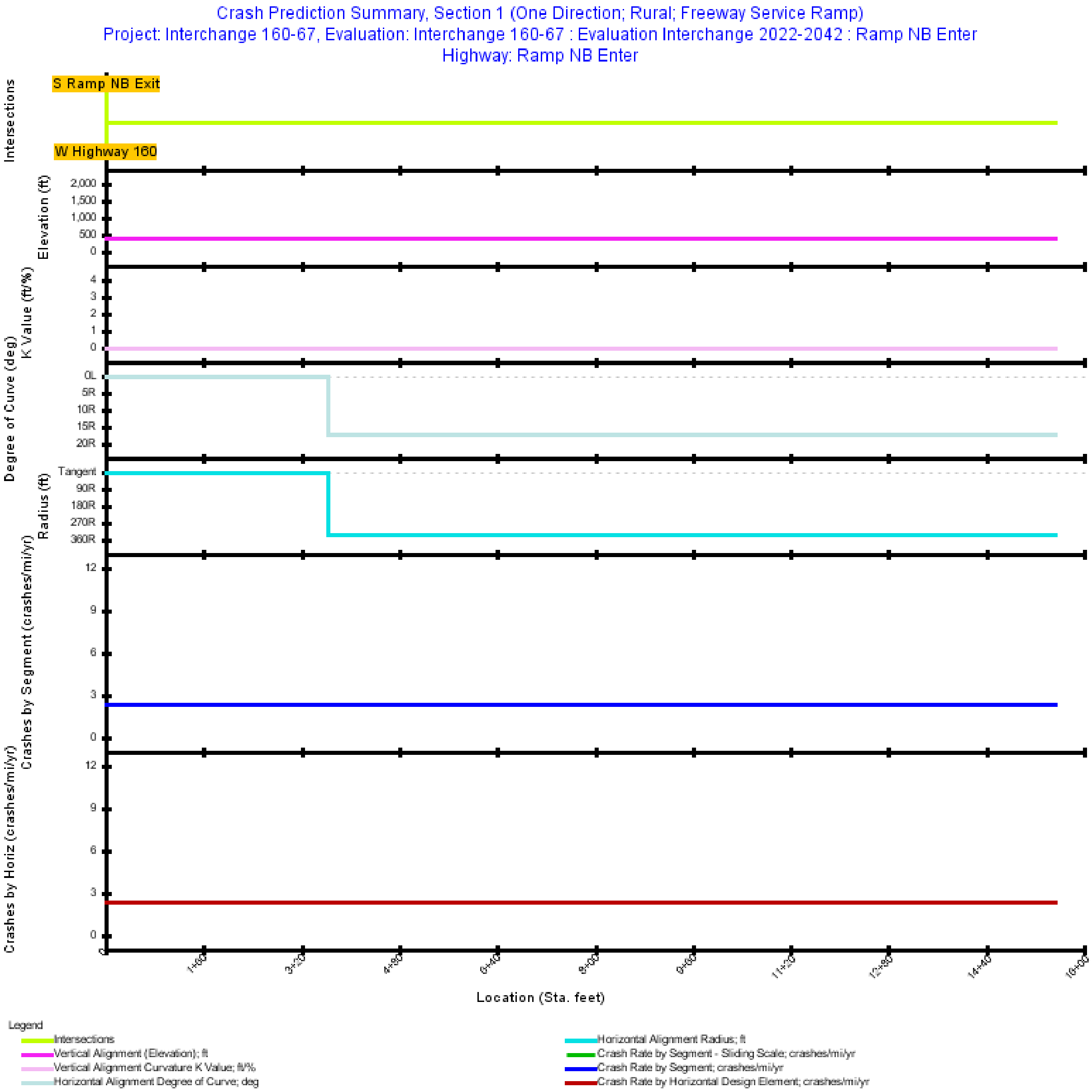

Figure 4. Crash Prediction Summary (Freeway Ramp Sections)

Table 29. Evaluation Freeway - Homogeneous Segments (Freeway Ramp Sections)

Seg. No.	Type	Area Type	Start Location (Sta. ft)	End Location (Sta. ft)	Length (ft)	Length (mi)	AADT
1	Freeway Ramp and C-D Road One-lane Ramp Entrance	Rural	0.000	15+51.630	1,551.63	0.2939	2022: 4,100; 2023: 4,165; 2024: 4,230; 2025: 4,295; 2026: 4,360; 2027: 4,425; 2028: 4,490; 2029: 4,555; 2030: 4,620; 2031: 4,685; 2032: 4,750; 2033: 4,815; 2034: 4,880; 2035: 4,945; 2036: 5,010; 2037: 5,075; 2038: 5,140; 2039: 5,205; 2040: 5,270; 2041: 5,335; 2042: 5,400

Table 30. Predicted Ramp Crash Rates and Frequencies Summary (Freeway Ramp Sections)

First Year of Analysis	**2022**
Last Year of Analysis	**2042**
Evaluated Length (mi)	**0.2939**
Average Future Road AADT (vpd)	**4,750**
Predicted Crashes	
Total Crashes	**14.65**
Fatal and Injury Crashes	**5.81**
Property-Damage-Only Crashes	**8.84**
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	**40**
Percent Property-Damage-Only Crashes (%)	**60**
Predicted Crash Rate	
Crash Rate (crashes/mi/yr)	**2.3736**
FI Crash Rate (crashes/mi/yr)	**0.9416**
PDO Crash Rate (crashes/mi/yr)	**1.4320**
Predicted Travel Crash Rate	
Total Travel (million veh-mi)	**10.70**
Travel Crash Rate (crashes/million veh-mi)	**1.37**
Travel FI Crash Rate (crashes/million veh-mi)	**0.54**
Travel PDO Crash Rate (crashes/million veh-mi)	**0.83**

Table 31. Predicted Crash Frequencies and Rates by Ramp Segment/Intersection (Freeway Ramp Sections)

Segment Number/Intersection Name/Cross Road	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
1	0.000	15+51.630	0.2939	14.648	0.6975	0.2767	0.4208	2.3736	1.37
Total			0.2939	14.648	0.6975	0.2767	0.4208	2.3736	

Table 32. Predicted Crash Frequencies and Rates by Horizontal Design Element (Freeway Ramp Sections)

Title	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi /yr)	Predicted Travel Crash Rate (crashes/mi llion veh-mi)
Tangent	0.000	3+62.670	0.0687	3.424	0.1630	0.0647	0.0984	2.3736	1.37
Simple Curve 1	3+62.670	15+51.630	0.2252	11.225	0.5345	0.2120	0.3225	2.3736	1.37

Table 33. Predicted Crash Frequencies by Year (Freeway Ramp Sections)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2022	0.62	0.25	39.848	0.38	60.152
2023	0.63	0.25	39.830	0.38	60.170
2024	0.64	0.26	39.812	0.39	60.188
2025	0.65	0.26	39.794	0.39	60.206
2026	0.65	0.26	39.777	0.39	60.223
2027	0.66	0.26	39.759	0.40	60.241
2028	0.67	0.27	39.742	0.40	60.258
2029	0.68	0.27	39.725	0.41	60.275
2030	0.68	0.27	39.708	0.41	60.292
2031	0.69	0.27	39.690	0.42	60.310
2032	0.70	0.28	39.673	0.42	60.327
2033	0.70	0.28	39.656	0.42	60.344
2034	0.71	0.28	39.640	0.43	60.360
2035	0.72	0.28	39.623	0.43	60.377
2036	0.73	0.29	39.606	0.44	60.394
2037	0.73	0.29	39.590	0.44	60.410
2038	0.74	0.29	39.573	0.45	60.427
2039	0.75	0.30	39.557	0.45	60.443
2040	0.76	0.30	39.541	0.46	60.459
2041	0.76	0.30	39.524	0.46	60.476
2042	0.77	0.30	39.508	0.47	60.492
Total	14.65	5.81	39.669	8.84	60.331
Average	0.70	0.28	39.669	0.42	60.331

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 34. Predicted Crash Severity by Ramp Segment (Freeway Ramp Sections)

Seg. No.	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)
1	0.1568	0.4756	3.1378	2.0405	8.8375

Table 35. Predicted Freeway Ramp Crash Type Distribution (Freeway Ramp Sections)

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Highway Segment	Collision with Animal	0.06	0.4	0.49	3.3	0.55	3.7
Highway Segment	Collision with Fixed Object	3.20	21.9	4.70	32.1	7.90	53.9
Highway Segment	Collision with Other Object	0.17	1.2	0.94	6.4	1.11	7.6
Highway Segment	Other Single-vehicle Collision	2.08	14.2	1.22	8.3	3.30	22.5
Highway Segment	Collision with Parked Vehicle	0.14	0.9	0.17	1.2	0.31	2.1
Highway Segment	Total Single Vehicle Crashes	5.65	38.6	7.52	51.3	13.17	89.9
Highway Segment	Right-Angle Collision	0.01	0.1	0.04	0.3	0.05	0.3
Highway Segment	Head-on Collision	0.00	0.0	0.01	0.0	0.01	0.1
Highway Segment	Other Multi-vehicle Collision	0.01	0.1	0.10	0.7	0.11	0.8
Highway Segment	Rear-end Collision	0.10	0.7	0.67	4.6	0.77	5.3
Highway Segment	Sideswipe, Same Direction Collision	0.04	0.3	0.50	3.4	0.54	3.7
Highway Segment	Total Multiple Vehicle Crashes	0.16	1.1	1.32	9.0	1.48	10.1
Highway Segment	Total Highway Segment Crashes	5.81	39.7	8.84	60.3	14.65	100.0
	Total Crashes	5.81	39.7	8.84	60.3	14.65	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Interchange 160-67 : Evaluation Interchange 2022-2042 : RampTerminal 160 NB Evaluation

Report Overview

Report Generated: Dec 11, 2020 3:42 PM

Report Template: System: Multi-Page [System] (mlcpm2, Nov 27, 2020 3:23 PM)

Evaluation Date: Fri Dec 11 15:28:50 CST 2020
IHSDM Version: v16.0.0 (Sep 30, 2020)
Crash Prediction Module: v11.0.0 (Sep 30, 2020)

User Name: mhuebbe
Organization Name: EFK Moen, LLC
Phone: 314-394-3133
E-Mail: mhuebbe@efkmoen.com

Project Title: Interchange 160-67
Project Comment: Created Thu Dec 10 08:43:05 CST 2020
Project Unit System: U.S. Customary

Intersection Title: RampTerminal 160 NB
Intersection Comment: Created Fri Dec 11 15:13:50 CST 2020
Intersection Version: v1

Evaluation Title: Interchange 160-67 : Evaluation Interchange 2022-2042 : RampTerminal 160 NB
Evaluation Comment: Created Fri Dec 11 15:28:44 CST 2020

Minimum Location: 534+24.000
Maximum Location: 596+34.000
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: HSM Configuration
Crash Distribution: HSM Configuration
Model/CMF: HSM Configuration
First Year of Analysis: 2022
Last Year of Analysis: 2042
Empirical-Bayes Analysis: None
First Year of Observed Crashes:
Last Year of Observed Crashes:

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RampTerminal 160 NB Evaluation

Intersection: RampTerminal 160 NB
Evaluation Start Location: 534+24.000
Evaluation End Location: 596+34.000
Calibration Factor: RT_ST_FI=1.0; RT_ST_PDO=1.0;

Table 36. Evaluation Ramp Terminal - Site (RampTerminal 160 NB)

Inter. No.	Title	Type	Area Type	Legs	Location (Sta. ft)	Traffic Control	AADT
1	RampTerminal 160 NB (v1)	Freeway Ramp Terminal A2 - Three-Leg at Two-Quadrant Parclo A	Rural	4	571+15.000	Stop-Controlled	Inside: 2022: 7,100; 2023: 7,185; 2024: 7,270; 2025: 7,355; 2026: 7,440; 2027: 7,525; 2028: 7,610; 2029: 7,695; 2030: 7,780; 2031: 7,865; 2032: 7,950; 2033: 8,035; 2034: 8,120; 2035: 8,205; 2036: 8,290; 2037: 8,375; 2038: 8,460; 2039: 8,545; 2040: 8,630; 2041: 8,715; 2042: 8,800; Outside: 2022: 7,100; 2023: 7,185; 2024: 7,270; 2025: 7,355; 2026: 7,440; 2027: 7,525; 2028: 7,610; 2029: 7,695; 2030: 7,780; 2031: 7,865; 2032: 7,950; 2033: 8,035; 2034: 8,120; 2035: 8,205; 2036: 8,290; 2037: 8,375; 2038: 8,460; 2039: 8,545; 2040: 8,630; 2041: 8,715; 2042: 8,800 :: Entrance: 2022: 4,100; 2023: 4,165; 2024: 4,230; 2025: 4,295; 2026: 4,360; 2027: 4,425; 2028: 4,490; 2029: 4,555; 2030: 4,620; 2031: 4,685; 2032: 4,750; 2033: 4,815; 2034: 4,880; 2035: 4,945; 2036: 5,010; 2037: 5,075; 2038: 5,140; 2039: 5,205; 2040: 5,270; 2041: 5,335; 2042: 5,400; Exit: 2022: 2,600; 2023: 2,645; 2024: 2,690; 2025: 2,735; 2026: 2,780; 2027: 2,825; 2028: 2,870; 2029: 2,915; 2030: 2,960; 2031: 3,005; 2032: 3,050; 2033: 3,095; 2034: 3,140; 2035: 3,185; 2036: 3,230; 2037: 3,275; 2038: 3,320; 2039: 3,365; 2040: 3,410; 2041: 3,455; 2042: 3,500

Table 37. Predicted Ramp Terminal Crash Rates and Frequencies Summary (RampTerminal 160 NB)

First Year of Analysis	**2022**
Last Year of Analysis	**2042**
Predicted Crashes	
Total Crashes	**44.45**
Fatal and Injury Crashes	**14.52**
Property-Damage-Only Crashes	**29.92**
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	**33**
Percent Property-Damage-Only Crashes (%)	**67**

Table 38. Predicted Crash Frequencies and Rates by Ramp Terminal (RampTerminal 160 NB)

Segment Number/Intersection Name/Cross Road	Location (Sta. ft)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Travel Crash Rate (crashes/million veh)
RampTerminal 160 NB (v1)	571+15.000	44.445	2.1164	0.6916	1.4249	0.49

Table 39. Predicted Crash Frequencies by Year (RampTerminal 160 NB)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2022	1.70	0.56	32.813	1.14	67.187
2023	1.74	0.57	32.787	1.17	67.213
2024	1.77	0.58	32.763	1.19	67.237
2025	1.81	0.59	32.742	1.22	67.258
2026	1.86	0.61	32.722	1.25	67.278
2027	1.90	0.62	32.704	1.28	67.296
2028	1.94	0.63	32.688	1.30	67.311
2029	1.98	0.65	32.675	1.33	67.325
2030	2.02	0.66	32.663	1.36	67.337
2031	2.07	0.68	32.654	1.39	67.346
2032	2.11	0.69	32.646	1.42	67.354
2033	2.15	0.70	32.640	1.45	67.360
2034	2.20	0.72	32.636	1.48	67.364
2035	2.24	0.73	32.634	1.51	67.366
2036	2.29	0.75	32.634	1.54	67.366
2037	2.33	0.76	32.636	1.57	67.364
2038	2.38	0.78	32.640	1.60	67.360
2039	2.42	0.79	32.645	1.63	67.355
2040	2.47	0.81	32.653	1.66	67.347
2041	2.52	0.82	32.662	1.69	67.338
2042	2.56	0.84	32.673	1.73	67.327
Total	44.45	14.52	32.676	29.92	67.324
Average	2.12	0.69	32.676	1.43	67.324

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the

distribution of these three crashes had been derived independently.

Table 40. Predicted Crash Severity by Ramp Terminal (RampTerminal 160 NB)

Seg. No.	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)
1	0.1718	0.9019	2.9836	10.4658	29.9220

Table 41. Predicted Ramp Terminal Crash Type Distribution (RampTerminal 160 NB)

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Ramp Terminal	Collision with Animal	0.00	0.0	0.00	0.0	0.00	0.0
Ramp Terminal	Collision with Fixed Object	1.13	2.5	4.73	10.6	5.86	13.2
Ramp Terminal	Collision with Other Object	0.00	0.0	0.15	0.3	0.15	0.3
Ramp Terminal	Other Single-vehicle Collision	0.94	2.1	0.78	1.8	1.72	3.9
Ramp Terminal	Collision with Parked Vehicle	0.10	0.2	0.45	1.0	0.55	1.2
Ramp Terminal	Total Single Vehicle Crashes	2.18	4.9	6.10	13.7	8.28	18.6
Ramp Terminal	Right-Angle Collision	7.58	17.1	11.13	25.0	18.71	42.1
Ramp Terminal	Head-on Collision	0.29	0.7	0.45	1.0	0.74	1.7
Ramp Terminal	Other Multi-vehicle Collision	0.19	0.4	0.78	1.8	0.97	2.2
Ramp Terminal	Rear-end Collision	3.99	9.0	8.26	18.6	12.25	27.6
Ramp Terminal	Sideswipe, Same Direction Collision	0.29	0.7	3.20	7.2	3.49	7.9
Ramp Terminal	Total Multiple Vehicle Crashes	12.35	27.8	23.82	53.6	36.16	81.4
Ramp Terminal	Total Ramp Terminal Crashes	14.52	32.7	29.92	67.3	44.45	100.0
	Total Crashes	14.52	32.7	29.92	67.3	44.45	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Interactive Highway Safety Design Model

Crash Prediction Evaluation Report

Highway 160

Alternative 2

December 11, 2020

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Report Overview

Report Generated: Dec 11, 2020 3:41 PM
Report Template: System: Multi-Page [System] (mlcpm2, Nov 27, 2020 3:23 PM)

Evaluation Date: Fri Dec 11 15:30:13 CST 2020
IHSDM Version: v16.0.0 (Sep 30, 2020)
Crash Prediction Module: v11.0.0 (Sep 30, 2020)

User Name: mhuebbe
Organization Name: EFK Moen, LLC
Phone: 314-394-3133
E-Mail: mhuebbe@efkmoen.com

Project Title: Project 67-Alt2
Project Comment: Created Wed Dec 09 16:11:58 CST 2020
Project Unit System: U.S. Customary

Highway Title: Highway 160
Highway Comment: Created Wed Dec 09 22:20:13 CST 2020
Highway Version: 1

Evaluation Title: Evaluation 160 Alt2 2022-2042
Evaluation Comment: Created Fri Dec 11 15:29:11 CST 2020

Minimum Location: 534+24.000
Maximum Location: 596+34.000
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: HSM Configuration
Crash Distribution: HSM Configuration
Model/CMF: HSM Configuration
First Year of Analysis: 2022
Last Year of Analysis: 2042
Empirical-Bayes Analysis: None
First Year of Observed Crashes:
Last Year of Observed Crashes:

Disclaimer Regarding Crash Prediction Method

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Section Types

Section 1 Evaluation

Section: Section 1
Evaluation Start Location: 534+24.000
Evaluation End Location: 596+34.000
Area Type: Rural
Functional Class: Multiple
Type of Alignment: Undivided, Two Lane
Model Category: Rural, Two Lane
Calibration Factor: 2U=1.0; 4ST=1.0; RT_ST_FI=1.0; RT_ST_PDO=1.0;

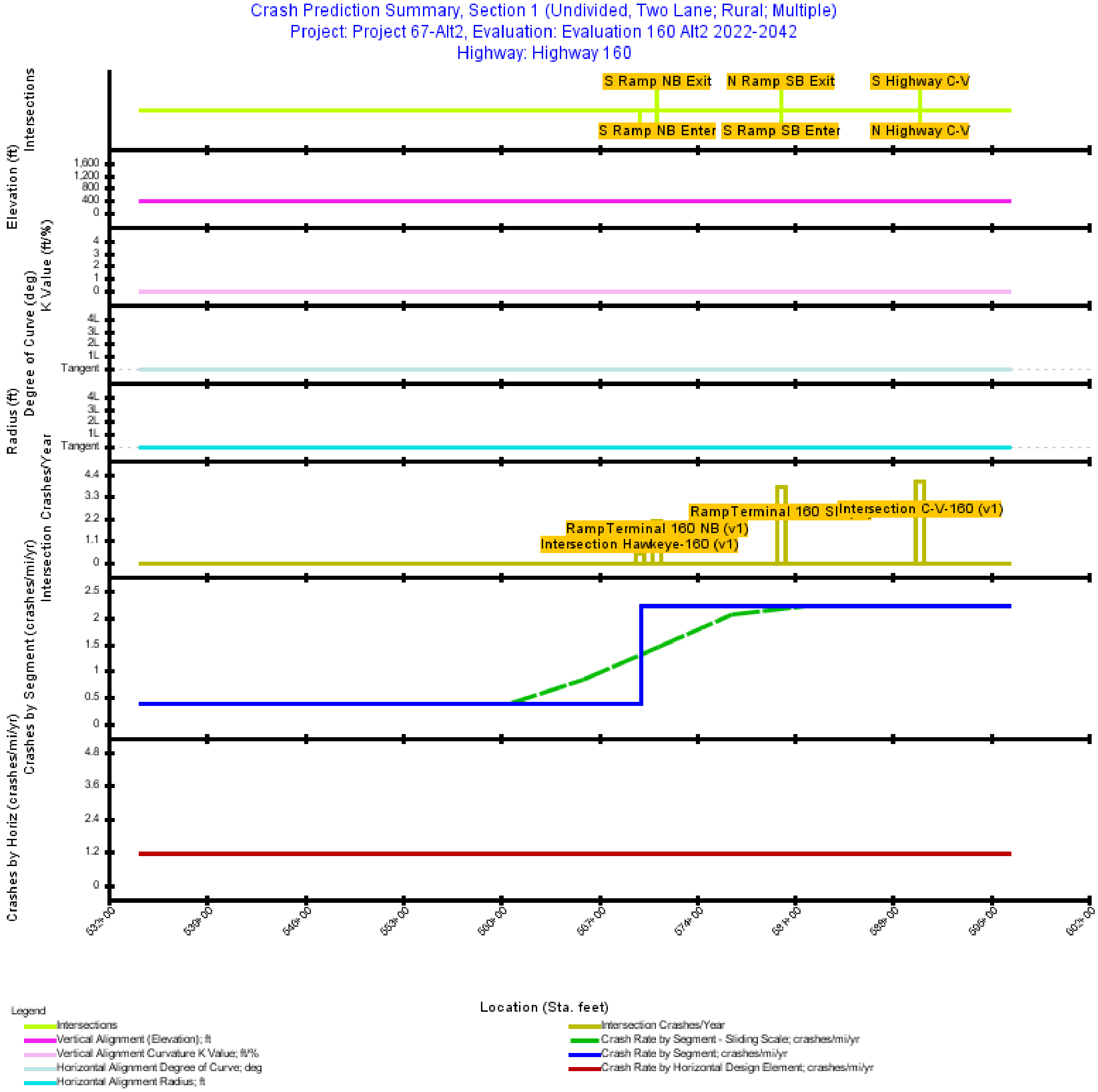

Figure 1. Crash Prediction Summary (Section 1)

Table 1. Evaluation Highway - Homogeneous Segments (Section 1)

Seg. No.	Type	Start Location (Sta. ft)	End Location (Sta. ft)	Length (ft)	Length (mi)	AADT	Left Lane Width (ft)	Right Lane Width (ft)	Left Shoulder Width (ft)	Right Shoulder Width (ft)	Grade (%)	Driveway Density (driveways/mi)	Hazard Rating	Centerline Rumble Strip	Passing Lanes	TWLT Lane	Lighting	Automated Speed Enforcement
1	Rural Two-Lane Segment Two-lane Undivided	534+24.000	570+00.000	3,576.00	0.6773	2022: 986; 2023: 987; 2024-2025: 988; 2026: 989; 2027-2028: 990; 2029: 991; 2030-2031: 992; 2032: 993; 2033-2034: 994; 2035: 995; 2036-2037: 996; 2038: 997; 2039-2040: 998; 2041: 999; 2042: 1,000	12.00	12.00	4.00	4.00	0.00	13.0	4	false	0	false	false	false
2	Rural Two-Lane Segment Two-lane Undivided	570+00.000	596+34.000	2,634.00	0.4989	2022: 7,100; 2023: 7,185; 2024: 7,270; 2025: 7,355; 2026: 7,440; 2027: 7,525; 2028: 7,610; 2029: 7,695; 2030: 7,780; 2031: 7,865; 2032: 7,950; 2033: 8,035; 2034: 8,120; 2035: 8,205; 2036: 8,290; 2037: 8,375; 2038: 8,460; 2039: 8,545; 2040: 8,630; 2041: 8,715; 2042: 8,800	12.00	12.00	6.00	6.00	0.00	8.0	3	false	0	false	false	false

Table 2. Evaluation Intersection - Section 1

Inter. No.	Title	Type	Location (Sta. ft)	Major AADT	Minor AADT	Legs	Traffic Control	Major road approaches w/Left Turn Lanes	Major road approaches w/Right Turn Lanes	Skew1	Skew2	Lighted at Night
3	Intersection Hawkeye-160 (v1)	Rural Two-Lane Intersection Four-Legged w/STOP control	569+90.000	2022: 7,100; 2023: 7,185; 2024: 7,270; 2025: 7,355; 2026: 7,440; 2027: 7,525; 2028: 7,610; 2029: 7,695; 2030: 7,780; 2031: 7,865; 2032: 7,950; 2033: 8,035; 2034: 8,120; 2035: 8,205; 2036: 8,290; 2037: 8,375; 2038: 8,460; 2039: 8,545; 2040: 8,630; 2041: 8,715; 2042: 8,800	2022-2025: 55; 2026-2029: 56; 2030-2033: 57; 2034-2037: 58; 2038-2041: 59; 2042: 60	4	Stop-Controlled	0	0	0.00	0.00	false
4	Intersection C-V-160 (v1)	Rural Two-Lane Intersection Four-Legged w/STOP control	589+95.000	2022: 7,100; 2023: 7,185; 2024: 7,270; 2025: 7,355; 2026: 7,440; 2027: 7,525; 2028: 7,610; 2029: 7,695; 2030: 7,780; 2031: 7,865; 2032: 7,950; 2033: 8,035; 2034: 8,120; 2035: 8,205; 2036: 8,290; 2037: 8,375; 2038: 8,460; 2039: 8,545; 2040: 8,630; 2041: 8,715; 2042: 8,800	2022: 1,600; 2023: 1,620; 2024: 1,640; 2025: 1,660; 2026: 1,680; 2027: 1,700; 2028: 1,720; 2029: 1,740; 2030: 1,760; 2031: 1,780; 2032: 1,800; 2033: 1,820; 2034: 1,840; 2035: 1,860; 2036: 1,880; 2037: 1,900; 2038: 1,920; 2039: 1,940; 2040: 1,960; 2041: 1,980; 2042: 2,000	4	Stop-Controlled	0	0	0.63	0.63	false

Table 3. Evaluation Ramp Terminal - Site (Section 1)

Inter. No.	Title	Type	Area Type	Legs	Location (Sta. ft)	Traffic Control	AADT
1	RampTerminal 160 SB (v1)	Freeway Ramp Terminal D4 - Four-Leg with Diagonal Ramps	Rural	4	580+00.000	Stop-Controlled	Inside: 2022: 7,100; 2023: 7,185; 2024: 7,270; 2025: 7,355; 2026: 7,440; 2027: 7,525; 2028: 7,610; 2029: 7,695; 2030: 7,780; 2031: 7,865; 2032: 7,950; 2033: 8,035; 2034: 8,120; 2035: 8,205; 2036: 8,290; 2037: 8,375; 2038: 8,460; 2039: 8,545; 2040: 8,630; 2041: 8,715; 2042: 8,800; Outside: 2022: 7,100; 2023: 7,185; 2024: 7,270; 2025: 7,355; 2026: 7,440; 2027: 7,525; 2028: 7,610; 2029: 7,695; 2030: 7,780; 2031: 7,865; 2032: 7,950; 2033: 8,035; 2034: 8,120; 2035: 8,205; 2036: 8,290; 2037: 8,375; 2038: 8,460; 2039: 8,545; 2040: 8,630; 2041: 8,715; 2042: 8,800 :: Entrance: 2022: 2,900; 2023: 2,935; 2024: 2,970; 2025: 3,005; 2026: 3,040; 2027: 3,075; 2028: 3,110; 2029: 3,145; 2030: 3,180; 2031: 3,215; 2032: 3,250; 2033: 3,285; 2034: 3,320; 2035: 3,355; 2036: 3,390; 2037: 3,425; 2038: 3,460; 2039: 3,495; 2040: 3,530; 2041: 3,565; 2042: 3,600; Exit: 2022: 5,900; 2023: 5,965; 2024: 6,030; 2025: 6,095; 2026: 6,160; 2027: 6,225; 2028: 6,290; 2029: 6,355; 2030: 6,420; 2031: 6,485; 2032: 6,550; 2033: 6,615; 2034: 6,680; 2035: 6,745; 2036: 6,810; 2037: 6,875; 2038: 6,940; 2039: 7,005; 2040: 7,070; 2041: 7,135; 2042: 7,200
2	RampTerminal 160 NB (v1)	Freeway Ramp Terminal A2 - Three-Leg at Two-Quadrant Parclo A	Rural	4	571+15.000	Stop-Controlled	Inside: 2022: 7,100; 2023: 7,185; 2024: 7,270; 2025: 7,355; 2026: 7,440; 2027: 7,525; 2028: 7,610; 2029: 7,695; 2030: 7,780; 2031: 7,865; 2032: 7,950; 2033: 8,035; 2034: 8,120; 2035: 8,205; 2036: 8,290; 2037: 8,375; 2038: 8,460; 2039: 8,545; 2040: 8,630; 2041: 8,715; 2042: 8,800; Outside: 2022: 7,100; 2023: 7,185; 2024: 7,270; 2025: 7,355; 2026: 7,440; 2027: 7,525; 2028: 7,610; 2029: 7,695; 2030: 7,780; 2031: 7,865; 2032: 7,950; 2033: 8,035; 2034: 8,120; 2035: 8,205; 2036: 8,290; 2037: 8,375; 2038: 8,460; 2039: 8,545; 2040: 8,630; 2041: 8,715; 2042: 8,800 :: Entrance: 2022: 4,100; 2023: 4,165; 2024: 4,230; 2025: 4,295; 2026: 4,360; 2027: 4,425; 2028: 4,490; 2029: 4,555; 2030: 4,620; 2031: 4,685; 2032: 4,750; 2033: 4,815; 2034: 4,880; 2035: 4,945; 2036: 5,010; 2037: 5,075; 2038: 5,140; 2039: 5,205; 2040: 5,270; 2041: 5,335; 2042: 5,400; Exit: 2022: 2,600; 2023: 2,645; 2024: 2,690; 2025: 2,735; 2026: 2,780; 2027: 2,825; 2028: 2,870; 2029: 2,915; 2030: 2,960; 2031: 3,005; 2032: 3,050; 2033: 3,095; 2034: 3,140; 2035: 3,185; 2036: 3,230; 2037: 3,275; 2038: 3,320; 2039: 3,365; 2040: 3,410; 2041: 3,455; 2042: 3,500

Table 4. Predicted Highway Crash Rates and Frequencies Summary (Section 1)

First Year of Analysis	2022
Last Year of Analysis	2042
Evaluated Length (mi)	1.1761
Average Future Road AADT (vpd)	3,944
Predicted Crashes	
Total Crashes	248.60
Fatal and Injury Crashes	112.91
Property-Damage-Only Crashes	135.69
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	45
Percent Property-Damage-Only Crashes (%)	55
Predicted Crash Rate	
Crash Rate (crashes/mi/yr)	10.0651
FI Crash Rate (crashes/mi/yr)	4.5715
PDO Crash Rate (crashes/mi/yr)	5.4936
Predicted Travel Crash Rate	
Total Travel (million veh-mi)	35.55
Travel Crash Rate (crashes/million veh-mi)	6.99
Travel FI Crash Rate (crashes/million veh-mi)	3.18
Travel PDO Crash Rate (crashes/million veh-mi)	3.82

Table 5. Predicted Crash Frequencies and Rates by Highway Segment/Intersection (Section 1)

Segment Number/Intersection Name/Cross Road	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)	Predicted Intersection Travel Crash Rate (crashes/million veh)
1	534+24.000	570+00.000	0.6773	5.655	0.2693	0.0864	0.1828	0.3976	1.10	
Intersection Hawkeye-160 (v1)	569+90.000			10.391	0.4948	0.2133	0.2815			0.30
2	570+00.000	596+34.000	0.4989	23.228	1.1061	0.3551	0.7510	2.2173	0.76	
RampTerminal 160 NB (v1)	571+15.000			44.445	2.1164	0.6916	1.4249			0.49
RampTerminal 160 SB (v1)	580+00.000			79.310	3.7767	2.2742	1.5025			0.81
Intersection C-V-160 (v1)	589+95.000			85.568	4.0747	1.7562	2.3185			1.16
All Segments			1.1761	28.883	1.3754	0.4415	0.9339	1.1694	0.81	
All Intersections				219.714	10.4626	4.9352	5.5274			0.74
Total			1.1761	248.597	11.8380	5.3767	6.4612	10.0651		

Table 6. Predicted Crash Frequencies and Rates by Horizontal Design Element (Section 1)

Title	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
Tangent	534+24.000	596+34.000	1.1761	28.883	1.3754	0.4415	0.9339	1.1694	0.96

Table 7. Predicted Crash Frequencies by Year (Section 1)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2022	9.91	4.35	43.880	5.56	56.120
2023	10.09	4.44	44.007	5.65	55.993
2024	10.27	4.53	44.136	5.74	55.864
2025	10.45	4.63	44.269	5.82	55.731
2026	10.64	4.72	44.403	5.92	55.597
2027	10.82	4.82	44.541	6.00	55.459
2028	11.01	4.92	44.681	6.09	55.319
2029	11.20	5.02	44.825	6.18	55.175
2030	11.40	5.13	44.970	6.27	55.030
2031	11.60	5.23	45.119	6.36	54.881
2032	11.79	5.34	45.271	6.45	54.729
2033	11.99	5.45	45.426	6.54	54.574
2034	12.20	5.56	45.583	6.64	54.417
2035	12.40	5.67	45.743	6.73	54.257
2036	12.61	5.79	45.907	6.82	54.093
2037	12.82	5.91	46.074	6.91	53.926
2038	13.04	6.03	46.243	7.01	53.757
2039	13.25	6.15	46.416	7.10	53.584
2040	13.47	6.28	46.592	7.20	53.408
2041	13.69	6.40	46.771	7.29	53.229
2042	13.92	6.54	46.951	7.38	53.049
Total	248.60	112.91	45.419	135.69	54.581
Average	11.84	5.38	45.419	6.46	54.581

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 8. Predicted Crash Severity by Ramp Terminal or Roundabout (Section 1)

Seg. No.	Type	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)
2	FRERampTerminal	0.1718	0.9019	2.9836	10.4658	29.9220
1	FRERampTerminal	0.5649	2.9659	9.8113	34.4163	31.5516

Table 9. Predicted Crash Type Distribution (Section 1)

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Highway Segment	Collision with Animal	0.35	0.1	3.61	1.5	3.50	1.4
Highway Segment	Collision with Bicycle	0.04	0.0	0.02	0.0	0.06	0.0
Highway Segment	Other Single-vehicle Collision	0.07	0.0	0.57	0.2	0.61	0.2
Highway Segment	Overturned	0.34	0.1	0.29	0.1	0.72	0.3
Highway Segment	Collision with Pedestrian	0.07	0.0	0.02	0.0	0.09	0.0
Highway Segment	Run Off Road	5.05	2.0	9.90	4.0	15.05	6.1
Highway Segment	Total Single Vehicle Crashes	5.92	2.4	14.41	5.8	20.02	8.1
Highway Segment	Angle Collision	0.94	0.4	1.41	0.6	2.46	1.0
Highway Segment	Head-on Collision	0.32	0.1	0.06	0.0	0.46	0.2
Highway Segment	Other Multiple-vehicle Collision	0.24	0.1	0.59	0.2	0.78	0.3
Highway Segment	Rear-end Collision	1.53	0.6	2.39	1.0	4.10	1.6
Highway Segment	Sideswipe	0.35	0.1	0.74	0.3	1.07	0.4
Highway Segment	Total Multiple Vehicle Crashes	3.38	1.4	5.20	2.1	8.87	3.6
Highway Segment	Total Highway Segment Crashes	9.29	3.7	19.61	7.9	28.88	11.6
Intersection	Collision with Animal	0.25	0.1	0.76	0.3	0.96	0.4
Intersection	Collision with Bicycle	0.04	0.0	0.06	0.0	0.10	0.0
Intersection	Other Single-vehicle Collision	0.17	0.1	0.55	0.2	0.77	0.3
Intersection	Overturned	0.25	0.1	0.22	0.1	0.48	0.2
Intersection	Collision with Pedestrian	0.04	0.0	0.06	0.0	0.10	0.0
Intersection	Run Off Road	3.89	1.6	7.86	3.2	11.71	4.7
Intersection	Total Single Vehicle Crashes	4.63	1.9	9.50	3.8	14.11	5.7
Intersection	Angle Collision	22.00	8.9	19.33	7.8	41.36	16.6
Intersection	Head-on Collision	2.48	1.0	1.36	0.5	3.84	1.5
Intersection	Other Multiple-vehicle Collision	1.74	0.7	2.02	0.8	3.74	1.5
Intersection	Rear-end Collision	8.69	3.5	14.52	5.8	23.22	9.3
Intersection	Sideswipe	1.82	0.7	7.86	3.2	9.69	3.9
Intersection	Total Multiple Vehicle Crashes	36.73	14.8	45.10	18.1	81.85	32.9
Intersection	Total Intersection Crashes	41.36	16.6	54.60	22.0	95.96	38.6
Ramp Terminal	Collision with Animal	0.00	0.0	0.00	0.0	0.00	0.0
Ramp Terminal	Collision with Fixed Object	4.86	2.0	9.71	3.9	14.57	5.9
Ramp Terminal	Collision with Other Object	0.00	0.0	0.31	0.1	0.31	0.1
Ramp Terminal	Other Single-vehicle Collision	4.05	1.6	1.60	0.6	5.65	2.3
Ramp Terminal	Collision with Parked Vehicle	0.44	0.2	0.92	0.4	1.36	0.5
Ramp Terminal	Total Single Vehicle Crashes	9.34	3.8	12.54	5.0	21.88	8.8
Ramp Terminal	Angle Collision	32.51	13.1	22.87	9.2	55.38	22.3
Ramp Terminal	Head-on Collision	1.25	0.5	0.92	0.4	2.17	0.9
Ramp Terminal	Other Multiple-vehicle Collision	0.81	0.3	1.60	0.6	2.41	1.0
Ramp Terminal	Rear-end Collision	17.13	6.9	16.97	6.8	34.09	13.7
Ramp Terminal	Sideswipe, Same Direction Collision	1.25	0.5	6.58	2.6	7.82	3.1
Ramp Terminal	Total Multiple Vehicle Crashes	52.94	21.3	48.93	19.7	101.87	41.0
Ramp Terminal	Total Ramp Terminal Crashes	62.28	25.1	61.47	24.7	123.75	49.8
	Total Crashes	112.93	45.4	135.69	54.6	248.60	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Appendix D

D-5

Alternative 3

2022 – 2042

Interactive Highway Safety Design Model

Crash Prediction Evaluation Report

Highway 67

Alternative 3

December 11, 2020

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Report Overview

Report Generated: Dec 11, 2020 4:51 PM
Report Template: System: Multi-Page [System] (mlcpm2, Nov 27, 2020 3:23 PM)

Evaluation Date: Fri Dec 11 16:51:44 CST 2020
IHSDM Version: v16.0.0 (Sep 30, 2020)
Crash Prediction Module: v11.0.0 (Sep 30, 2020)

User Name: mhuebbe
Organization Name: EFK Moen, LLC
Phone: 314-394-3133
E-Mail: mhuebbe@efkmoen.com

Project Title: Project 67-Alt3 Roundabout
Project Comment: Created Wed Dec 09 16:11:58 CST 2020
Project Unit System: U.S. Customary

Highway Title: Highway 67
Highway Comment: Created Fri Dec 11 11:13:00 CST 2020
Highway Version: 1

Evaluation Title: Evaluation 67 Alt 3 2022-2042
Evaluation Comment: Created Fri Dec 11 16:50:22 CST 2020

Minimum Location: 405+00.000
Maximum Location: 665+43.000
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: HSM Configuration
Crash Distribution: HSM Configuration
Model/CMF: HSM Configuration
First Year of Analysis: 2022
Last Year of Analysis: 2042
Empirical-Bayes Analysis: None
First Year of Observed Crashes:
Last Year of Observed Crashes:

Disclaimer Regarding Crash Prediction Method

IMPORTANT NOTICE ABOUT COMPARING RESULTS FROM HIGHWAY SAFETY MANUAL FIRST EDITION (2010) MODELS TO RESULTS FROM NEW MODELS DEVELOPED UNDER NCHRP PROJECTS 17-70 AND 17-58

Since the publication of the Highway Safety Manual - First Edition (HSM-1), in 2010 by the American Association of State Highway and Transportation Officials (AASHTO), multiple research efforts have been undertaken through the National Cooperative Highway Research Program (NCHRP) to develop safety performance models for road segment and intersection facility types that were not initially reflected in the HSM-1, in order to expand the breadth and depth of the HSM in the future.

The IHSDM Crash Prediction Module (CPM) is intended as a faithful implementation of HSM Part C predictive methods. As NCHRP projects to develop new predictive methods for the HSM are completed, FHWA works to incorporate the new methods into IHSDM, sometimes in advance of publication in the HSM. The following new crash predictive methods have been accepted by NCHRP project panels and incorporated into IHSDM, while pending AASHTO's approval for incorporation into a future edition of the HSM:

- Roundabouts: completed in 2018 under NCHRP Project 17-70, the new methods will provide improved outcomes for the safety analysis of roundabouts.
- 6+ lane and one-way urban/suburban arterials (including models for segments and intersections): completed under NCHRP Project 17-58.

However, in the absence of local calibration factors (see HSM-1 Part C, Appendix A for guidance on calibration of the predictive models), it is neither appropriate nor advisable to directly compare the results from new models (from NCHRP Projects 17-58 and 17-70) to results from HSM-1 models, as the models were not calibrated to the same base state data sets, and consequently can produce unexpected results. If local calibration factors are available and applied to both new models and HSM-1 models, then it may be appropriate to directly compare the results.*[Note: Work being performed under NCHRP Project 17-72 (Update of Crash Modification Factors for the Highway Safety Manual) is expected to re-calibrate many of the old (HSM-1) and new (e.g., NCHRP 17-70) models to data from a single (or small number of) states, that would allow results from all models to be directly compared.]*

The models produced for NCHRP Project 17-70 have independent value in terms of informing the design of a roundabout and assessing the effects of different design characteristics on the expected safety performance of a roundabout.

The HSM-1 interim method previously included in IHSDM for evaluating roundabouts on urban/suburban arterials (i.e., evaluating an existing intersection and then applying a Crash Modification Factor for replacing the existing intersection with a roundabout) has been deactivated in IHSDM, to minimize any confusion with the new roundabout methodology.

Section Types

Section 1 Evaluation

Section: Section 1
Evaluation Start Location: 405+00.000
Evaluation End Location: 425+00.000
Area Type: Rural
Functional Class: Arterial
Type of Alignment: Divided, Multilane
Model Category: Rural, Multilane
Calibration Factor: 4D=1.0; 4ST=1.0;

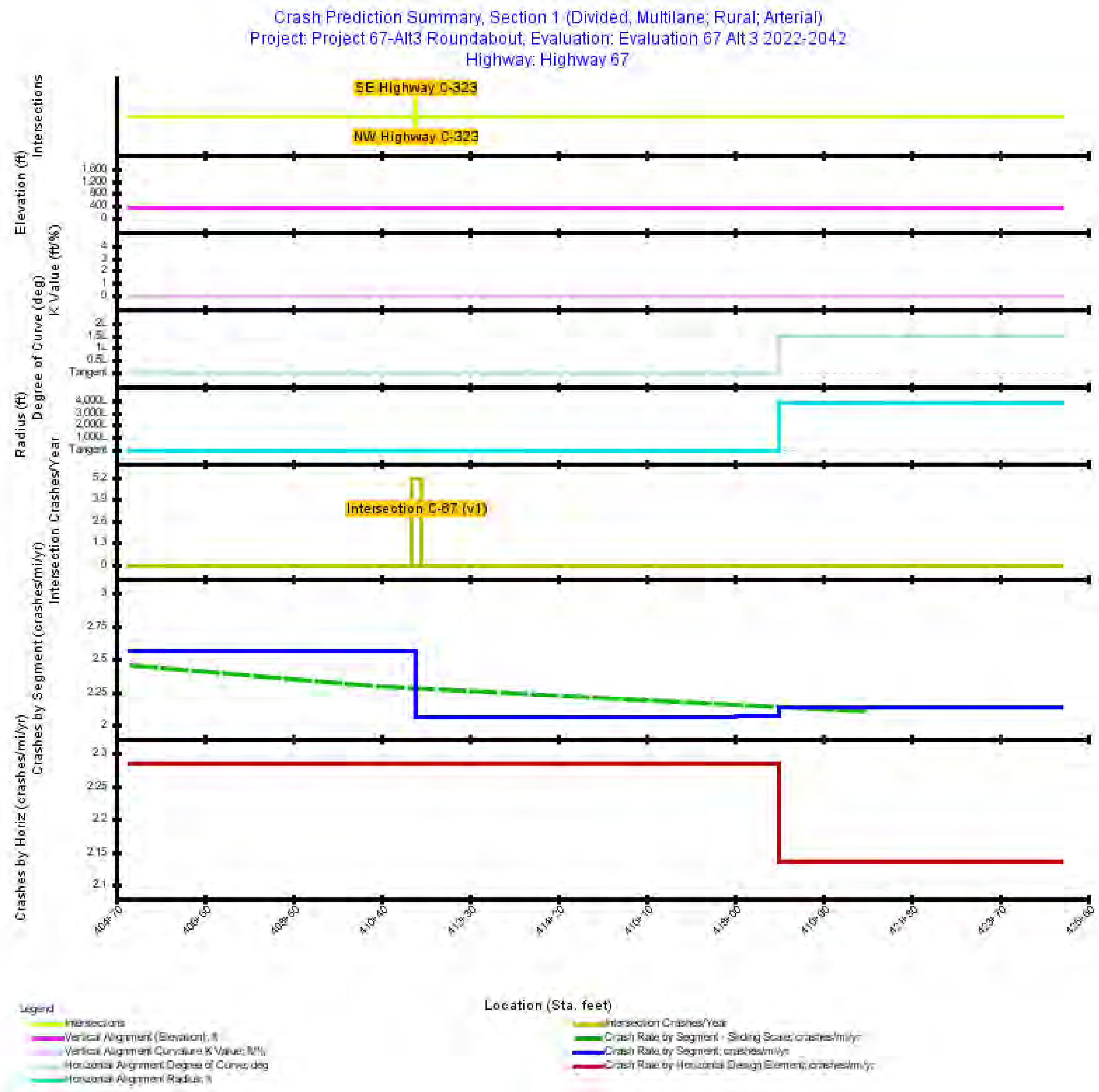

Figure 1. Crash Prediction Summary (Section 1)

Table 1. Evaluation Highway - Homogeneous Segments (Section 1)

Seg. No.	Type	Start Location (Sta. ft)	End Location (Sta. ft)	Length (ft)	Length (mi)	AADT	Left Lane Width (ft)	Right Lane Width (ft)	Left Shoulder Width (ft)	Right Shoulder Width (ft)	Median Width (ft)	Median Type	Effective Median Width (ft)	Lighting	Automated Speed Enforcement	Left Side Slope	Right Side Slope
1	Rural Multi-Lane Segment Four-lane Divided	405+00.000	411+15.000	615.00	0.1165	2022: 12,300; 2023: 12,460; 2024: 12,620; 2025: 12,780; 2026: 12,940; 2027: 13,100; 2028: 13,260; 2029: 13,420; 2030: 13,580; 2031: 13,740; 2032: 13,900; 2033: 14,060; 2034: 14,220; 2035: 14,380; 2036: 14,540; 2037: 14,700; 2038: 14,860; 2039: 15,020; 2040: 15,180; 2041: 15,340; 2042: 15,500	12.00	12.00	8.00	8.00	52.00	Traversable Median	60.00	false	false		
2	Rural Multi-Lane Segment Four-lane Divided	411+15.000	418+00.000	685.00	0.1297	2022: 10,000; 2023: 10,130; 2024: 10,260; 2025: 10,390; 2026: 10,520; 2027: 10,650; 2028: 10,780; 2029: 10,910; 2030: 11,040; 2031: 11,170; 2032: 11,300; 2033: 11,430; 2034: 11,560; 2035: 11,690; 2036: 11,820; 2037: 11,950; 2038: 12,080; 2039: 12,210; 2040: 12,340; 2041: 12,470; 2042: 12,600	12.00	12.00	8.00	8.00	52.00	Traversable Median	60.00	false	false		
3	Rural Multi-Lane Segment Four-lane Divided	418+00.000	418+95.990	95.99	0.0182	2022: 10,000; 2023: 10,130; 2024: 10,260; 2025: 10,390; 2026: 10,520; 2027: 10,650; 2028: 10,780; 2029: 10,910; 2030: 11,040; 2031: 11,170; 2032: 11,300; 2033: 11,430; 2034: 11,560; 2035: 11,690; 2036: 11,820; 2037: 11,950; 2038: 12,080; 2039: 12,210; 2040: 12,340; 2041: 12,470; 2042: 12,600	12.00	12.00	8.00	8.00	49.15	Traversable Median	57.15	false	false		
4	Rural Multi-Lane Segment Four-lane Divided	418+95.990	425+00.000	604.01	0.1144	2022: 10,000; 2023: 10,130; 2024: 10,260; 2025: 10,390; 2026: 10,520; 2027: 10,650; 2028: 10,780; 2029: 10,910; 2030: 11,040; 2031: 11,170; 2032: 11,300; 2033: 11,430; 2034: 11,560; 2035: 11,690; 2036: 11,820; 2037: 11,950; 2038: 12,080; 2039: 12,210; 2040: 12,340; 2041: 12,470; 2042: 12,600	12.00	12.00	8.00	8.00	28.40	Traversable Median	36.40	false	false		

Table 2. Evaluation Intersection (Section 1)

Inter. No.	Title	Type	Location (Sta. ft)	Major AADT	Minor AADT	Legs	Traffic Control	Major road approaches w/Left Turn Lanes	Major road approaches w/Right Turn Lanes	Skew1	Skew2	Lighted at Night
1	Intersection C-67 (v1)	Rural Multi-Lane Intersection Four-Legged w/STOP control	411+14.900	2022: 12,300; 2023: 12,460; 2024: 12,620; 2025: 12,780; 2026: 12,940; 2027: 13,100; 2028: 13,260; 2029: 13,420; 2030: 13,580; 2031: 13,740; 2032: 13,900; 2033: 14,060; 2034: 14,220; 2035: 14,380; 2036: 14,540; 2037: 14,700; 2038: 14,860; 2039: 15,020; 2040: 15,180; 2041: 15,340; 2042: 15,500	2022: 1,600; 2023: 1,620; 2024: 1,640; 2025: 1,660; 2026: 1,680; 2027: 1,700; 2028: 1,720; 2029: 1,740; 2030: 1,760; 2031: 1,780; 2032: 1,800; 2033: 1,820; 2034: 1,840; 2035: 1,860; 2036: 1,880; 2037: 1,900; 2038: 1,920; 2039: 1,940; 2040: 1,960; 2041: 1,980; 2042: 2,000	4	Stop-Controlled	0	0	20.00	0.01	false

Table 3. Predicted Highway Crash Rates and Frequencies Summary (Section 1)

First Year of Analysis	**2022**
Last Year of Analysis	**2042**
Evaluated Length (mi)	**0.3788**
Average Future Road AADT (vpd)	**12,099**
Predicted Crashes	
Total Crashes	**125.38**
Fatal and Injury Crashes	**72.56**
Fatal and Serious Injury Crashes	**40.58**
Property-Damage-Only Crashes	**52.83**
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	**58**
Percent Fatal and Serious Injury Crashes (%)	**32**
Percent Property-Damage-Only Crashes (%)	**42**
Predicted Crash Rate	
Crash Rate (crashes/mi/yr)	**15.7626**
FI Crash Rate (crashes/mi/yr)	**9.1212**
FI no/C Crash Rate (crashes/mi/yr)	**5.1016**
PDO Crash Rate (crashes/mi/yr)	**6.6414**
Predicted Travel Crash Rate	
Total Travel (million veh-mi)	**35.13**
Travel Crash Rate (crashes/million veh-mi)	**3.57**
Travel FI Crash Rate (crashes/million veh-mi)	**2.06**
Travel FI no/C Crash Rate (crashes/million veh-mi)	**1.16**
Travel PDO Crash Rate (crashes/million veh-mi)	**1.50**

Table 4. Predicted Crash Frequencies and Rates by Highway Segment/Intersection (Section 1)

Segment Number/Intersection Name/Cross Road	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted FI no/C Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)	Predicted Intersection Travel Crash Rate (crashes/million veh)
1	405+00.000	411+15.000	0.1165	6.271	0.2986	0.1512	0.0946	0.1474	2.5635	0.51	
Intersection C-67 (v1)	411+14.900			107.574	5.1226	3.0202	1.6574	2.1024			0.97
2	411+15.000	418+00.000	0.1297	5.620	0.2676	0.1381	0.0879	0.1295	2.0630	0.50	
3	418+00.000	418+95.990	0.0182	0.790	0.0376	0.0194	0.0124	0.0182	2.0691	0.50	
4	418+95.990	425+00.000	0.1144	5.129	0.2443	0.1261	0.0802	0.1182	2.1352	0.52	
All Segments			0.3788	17.810	0.8481	0.4348	0.2750	0.4133	2.2390	0.51	
All Intersections				107.574	5.1226	3.0202	1.6574	2.1024			0.97
Total			0.3788	125.384	5.9707	3.4550	1.9324	2.5157	15.7626		

Table 5. Predicted Crash Frequencies and Rates by Horizontal Design Element (Section 1)

Title	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted FI no/C Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
Tangent	405+00.000	418+95.990	0.2644	12.681	0.6039	0.3088	0.1948	0.2951	2.2839	0.50
Simple Curve 1	418+95.990	425+00.000	0.1144	5.129	0.2443	0.1261	0.0802	0.1182	2.1352	0.52

Table 6. Predicted Crash Frequencies by Year (Section 1)

Year	Total Crashes	FI Crashes	Percent FI (%)	FI/no C Crashes	Percent FI/no C (%)	PDO Crashes	Percent PDO (%)
2022	5.12	2.93	57.202	1.67	32.661	2.19	42.798
2023	5.21	2.98	57.269	1.70	32.630	2.22	42.731
2024	5.29	3.03	57.335	1.72	32.600	2.26	42.665
2025	5.37	3.08	57.400	1.75	32.570	2.29	42.600
2026	5.46	3.14	57.465	1.78	32.541	2.32	42.535
2027	5.54	3.19	57.529	1.80	32.512	2.35	42.471
2028	5.62	3.24	57.593	1.83	32.483	2.39	42.407
2029	5.71	3.29	57.657	1.85	32.455	2.42	42.343
2030	5.79	3.35	57.719	1.88	32.427	2.45	42.281
2031	5.88	3.40	57.781	1.91	32.400	2.48	42.219
2032	5.97	3.45	57.843	1.93	32.373	2.52	42.157
2033	6.05	3.50	57.904	1.96	32.346	2.55	42.096
2034	6.14	3.56	57.965	1.98	32.320	2.58	42.035
2035	6.22	3.61	58.025	2.01	32.294	2.61	41.975
2036	6.31	3.67	58.085	2.04	32.269	2.65	41.915
2037	6.40	3.72	58.144	2.06	32.243	2.68	41.856
2038	6.49	3.77	58.203	2.09	32.218	2.71	41.797
2039	6.57	3.83	58.261	2.12	32.194	2.74	41.739
2040	6.66	3.88	58.319	2.14	32.169	2.78	41.681
2041	6.75	3.94	58.376	2.17	32.145	2.81	41.624
2042	6.83	3.99	58.433	2.20	32.122	2.84	41.567
Total	125.38	72.56	57.866	40.58	32.365	52.83	42.134
Average	5.97	3.46	57.866	1.93	32.365	2.52	42.134

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 7. Predicted Crash Type Distribution (Section 1)

Element Type	Crash Type	Fatal and Injury		Fatal and Serious Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Highway Segment	Single	6.64	5.3	4.49	3.6	6.87	5.5	13.68	10.9
Highway Segment	Total Single Vehicle Crashes	6.64	5.3	4.49	3.6	6.87	5.5	13.68	10.9
Highway Segment	Angle Collision	0.44	0.3	0.26	0.2	0.36	0.3	0.77	0.6
Highway Segment	Head-on Collision	0.12	0.1	0.10	0.1	0.02	0.0	0.11	0.1
Highway Segment	Rear-end Collision	1.49	1.2	0.66	0.5	0.76	0.6	2.07	1.6
Highway Segment	Sideswipe	0.25	0.2	0.13	0.1	0.46	0.4	0.77	0.6
Highway Segment	Total Multiple Vehicle Crashes	2.29	1.8	1.15	0.9	1.60	1.3	3.71	3.0
Highway Segment	Total Highway Segment Crashes	9.13	7.3	5.78	4.6	8.68	6.9	17.81	14.2
Highway Segment	Other Collision	0.20	0.2	0.13	0.1	0.21	0.2	0.43	0.3
Intersection	Single	9.39	7.5	6.93	5.5	10.73	8.6	21.73	17.3
Intersection	Total Single Vehicle Crashes	9.39	7.5	6.93	5.5	10.73	8.6	21.73	17.3
Intersection	Angle Collision	33.87	27.0	19.87	15.9	12.89	10.3	42.49	33.9
Intersection	Head-on Collision	1.14	0.9	0.80	0.6	0.66	0.5	1.72	1.4
Intersection	Rear-end Collision	13.51	10.8	3.76	3.0	10.60	8.5	24.53	19.6
Intersection	Sideswipe	2.66	2.1	1.39	1.1	6.89	5.5	11.51	9.2
Intersection	Total Multiple Vehicle Crashes	51.18	40.9	25.83	20.6	31.04	24.8	80.25	64.1
Intersection	Total Intersection Crashes	63.49	50.7	34.81	27.8	44.19	35.3	107.47	85.8
Intersection	Other Collision	2.92	2.3	2.05	1.6	2.43	1.9	5.49	4.4
	Total Crashes	72.62	58.0	40.58	32.4	52.87	42.2	125.28	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Section 2 Evaluation

Section: Section 2
Evaluation Start Location: 425+00.000
Evaluation End Location: 665+43.000
Functional Class: Freeway
Type of Alignment: Divided, Multilane
Model Category: Freeway Segment
Calibration Factor: FI_MV=1.0; FI_SV=1.0; PDO_MV=1.0; PDO_SV=1.0;

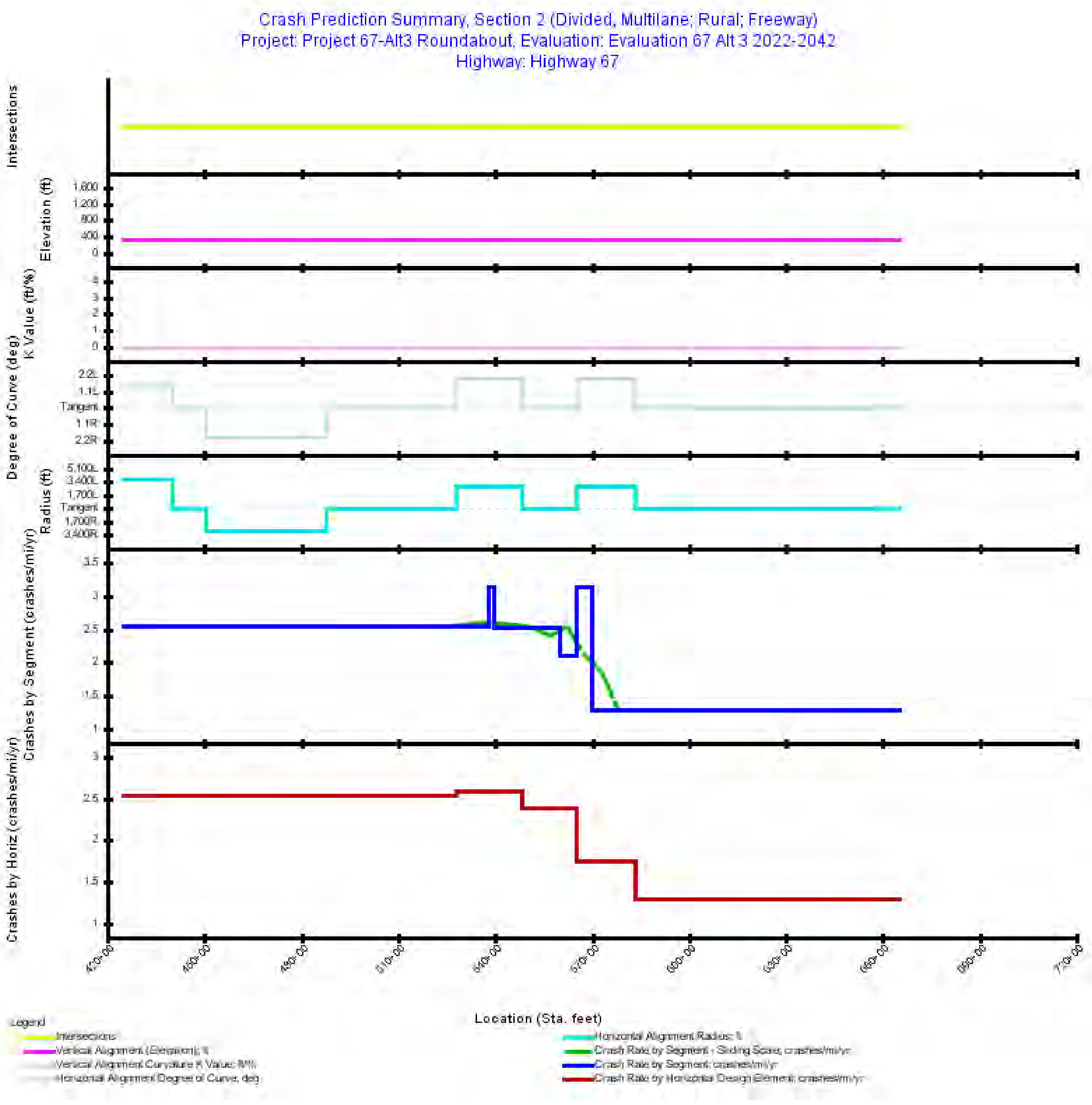

Figure 2. Crash Prediction Summary (Section 2)

Table 8. Evaluation Freeway - Homogeneous Segments (Section 2)

Seg. No.	Type	Area Type	Start Location (Sta. ft)	End Location (Sta. ft)	Length (ft)	Length (mi)	AADT	Median Width (ft)	Type	Effective Median Width (ft)
5	Four-lane Freeway	Rural	425+00.000	537+84.000	11,284.00	2.1371	2022: 10,000; 2023: 10,130; 2024: 10,260; 2025: 10,390; 2026: 10,520; 2027: 10,650; 2028: 10,780; 2029: 10,910; 2030: 11,040; 2031: 11,170; 2032: 11,300; 2033: 11,430; 2034: 11,560; 2035: 11,690; 2036: 11,820; 2037: 11,950; 2038: 12,080; 2039: 12,210; 2040: 12,340; 2041: 12,470; 2042: 12,600	10.50	Traversable Median	18.50
6	Four-lane Freeway	Rural	537+84.000	539+57.580	173.58	0.0329	2022: 10,000; 2023: 10,130; 2024: 10,260; 2025: 10,390; 2026: 10,520; 2027: 10,650; 2028: 10,780; 2029: 10,910; 2030: 11,040; 2031: 11,170; 2032: 11,300; 2033: 11,430; 2034: 11,560; 2035: 11,690; 2036: 11,820; 2037: 11,950; 2038: 12,080; 2039: 12,210; 2040: 12,340; 2041: 12,470; 2042: 12,600	10.50	Traversable Median	18.50
7	Four-lane Freeway	Rural	539+57.580	559+88.750	2,031.17	0.3847	2022: 10,000; 2023: 10,130; 2024: 10,260; 2025: 10,390; 2026: 10,520; 2027: 10,650; 2028: 10,780; 2029: 10,910; 2030: 11,040; 2031: 11,170; 2032: 11,300; 2033: 11,430; 2034: 11,560; 2035: 11,690; 2036: 11,820; 2037: 11,950; 2038: 12,080; 2039: 12,210; 2040: 12,340; 2041: 12,470; 2042: 12,600	10.50	Traversable Median	18.50
8	Four-lane Freeway	Rural	559+88.750	565+40.830	552.08	0.1046	2022: 10,000; 2023: 10,130; 2024: 10,260; 2025: 10,390; 2026: 10,520; 2027: 10,650; 2028: 10,780; 2029: 10,910; 2030: 11,040; 2031: 11,170; 2032: 11,300; 2033: 11,430; 2034: 11,560; 2035: 11,690; 2036: 11,820; 2037: 11,950; 2038: 12,080; 2039: 12,210; 2040: 12,340; 2041: 12,470; 2042: 12,600	10.50	Traversable Median	18.50
9	Four-lane Freeway	Rural	565+40.830	570+00.000	459.17	0.0870	2022: 10,000; 2023: 10,130; 2024: 10,260; 2025: 10,390; 2026: 10,520; 2027: 10,650; 2028: 10,780; 2029: 10,910; 2030: 11,040; 2031: 11,170; 2032: 11,300; 2033: 11,430; 2034: 11,560; 2035: 11,690; 2036: 11,820; 2037: 11,950; 2038: 12,080; 2039: 12,210; 2040: 12,340; 2041: 12,470; 2042: 12,600	10.50	Traversable Median	18.50
10	Four-lane Freeway	Rural	570+00.000	665+43.000	9,543.00	1.8074	2022: 5,500; 2023: 5,575; 2024: 5,650; 2025: 5,725; 2026: 5,800; 2027: 5,875; 2028: 5,950; 2029: 6,025; 2030: 6,100; 2031: 6,175; 2032: 6,250; 2033: 6,325; 2034: 6,400; 2035: 6,475; 2036: 6,550; 2037: 6,625; 2038: 6,700; 2039: 6,775; 2040: 6,850; 2041: 6,925; 2042: 7,000	10.50	Traversable Median	18.50

Table 9. Predicted Freeway Crash Rates and Frequencies Summary (Section 2)

First Year of Analysis	**2022**
Last Year of Analysis	**2042**
Effective Length (mi)	**4.5536**
Average Future Road AADT (vpd)	**9,296**
Predicted Crashes	
Total Crashes	**195.88**
Fatal and Injury Crashes	**69.59**
Property-Damage-Only Crashes	**126.29**
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	**36**
Percent Property-Damage-Only Crashes (%)	**64**
Predicted Crash Rate	
Crash Rate (crashes/mi/yr)	**2.0484**
FI Crash Rate (crashes/mi/yr)	**0.7277**
PDO Crash Rate (crashes/mi/yr)	**1.3206**
Predicted Travel Crash Rate	
Total Travel (million veh-mi)	**324.45**
Travel Crash Rate (crashes/million veh-mi)	**0.60**
Travel FI Crash Rate (crashes/million veh-mi)	**0.21**
Travel PDO Crash Rate (crashes/million veh-mi)	**0.39**

Note: *Effective Length* is the *segment length* minus the length of the *speed change lanes* if present.
Note: *Total Travel and Crash Rates/Million Vehicle Miles* for *Speed Change Lanes* reflect AADTs that are **half of the Freeway Segment AADTs** based on the assumption of 50/50 directional distribution.

Table 10. Predicted Crash Frequencies and Rates by Freeway Segment/Intersection (Section 2)

Segment Number/Intersection Name/Cross Road	Start Location (Sta. ft)	End Location (Sta. ft)	Effective Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
5	425+00.000	537+84.000	2.1371	114.196	5.4379	1.9033	3.5346	2.5445	0.62
6	537+84.000	539+57.580	0.0329	2.158	0.1028	0.0370	0.0657	3.1258	0.76
7	539+57.580	559+88.750	0.3847	20.338	0.9685	0.3398	0.6286	2.5175	0.61
8	559+88.750	565+40.830	0.1046	4.632	0.2206	0.0757	0.1449	2.1095	0.51
9	565+40.830	570+00.000	0.0870	5.715	0.2721	0.0981	0.1740	3.1291	0.76
10	570+00.000	665+43.000	1.8074	48.840	2.3257	0.8599	1.4658	1.2868	0.56
Total			4.5536	195.877	9.3275	3.3139	6.0136	2.0484	0.60

Note: *Effective Length* is the *segment length* minus the length of the *speed change lanes* if present. This may create Freeway segments with zero effective length and zero crashes.

Table 11. Predicted Crash Frequencies and Rates by Horizontal Design Element (Section 2)

Title	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
Simple Curve 1	425+00.000	440+15.580	0.2870	15.338	0.7304	0.2556	0.4747	2.5445	0.62
Tangent	440+15.580	450+69.500	0.1996	10.666	0.5079	0.1778	0.3301	2.5445	0.62
Simple Curve 2	450+69.500	487+95.230	0.7056	37.705	1.7955	0.6284	1.1670	2.5445	0.62
Tangent	487+95.230	528+21.950	0.7626	40.751	1.9405	0.6792	1.2613	2.5445	0.62
Simple Curve 3	528+21.950	548+47.520	0.3836	20.805	0.9907	0.3482	0.6425	2.5824	0.63
Tangent	548+47.520	565+40.830	0.3207	16.059	0.7647	0.2666	0.4981	2.3845	0.58
Simple Curve 4	565+40.830	583+43.830	0.3415	12.592	0.5996	0.2192	0.3804	1.7560	0.61
Tangent	583+43.830	665+43.000	1.5529	41.962	1.9982	0.7388	1.2594	1.2868	0.56

Table 12. Predicted Crash Frequencies by Year (Section 2)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2022	8.35	3.02	36.128	5.34	63.872
2023	8.45	3.05	36.066	5.40	63.934
2024	8.55	3.08	36.004	5.47	63.996
2025	8.65	3.11	35.943	5.54	64.057
2026	8.74	3.14	35.883	5.61	64.117
2027	8.84	3.17	35.823	5.67	64.177
2028	8.94	3.20	35.765	5.74	64.235
2029	9.04	3.23	35.707	5.81	64.293
2030	9.13	3.26	35.649	5.88	64.351
2031	9.23	3.29	35.593	5.95	64.407
2032	9.33	3.31	35.537	6.01	64.463
2033	9.43	3.34	35.482	6.08	64.518
2034	9.52	3.37	35.427	6.15	64.573
2035	9.62	3.40	35.373	6.22	64.627
2036	9.72	3.43	35.320	6.29	64.680
2037	9.81	3.46	35.267	6.35	64.733
2038	9.91	3.49	35.215	6.42	64.785
2039	10.01	3.52	35.164	6.49	64.836
2040	10.11	3.55	35.113	6.56	64.887
2041	10.20	3.58	35.062	6.63	64.938
2042	10.30	3.61	35.013	6.69	64.987
Total	195.88	69.59	35.528	126.29	64.472
Average	9.33	3.31	35.528	6.01	64.472

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 13. Predicted Crash Severity by Freeway Segment (Section 2)

Seg. No.	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)
5	1.5511	3.8256	15.6276	18.9655	74.2258
6	0.0319	0.0799	0.3105	0.3552	1.3804
7	0.2655	0.6570	2.7408	3.4728	13.2016
8	0.0575	0.1391	0.6042	0.7880	3.0432
9	0.0846	0.2119	0.8229	0.9415	3.6537
10	0.6653	1.6176	6.9178	8.8573	30.7815
Total	2.6559	6.5311	27.0238	33.3804	126.2863

Table 14. Predicted Freeway Crash Type Distribution (Section 2)

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Highway Segment	Collision with Animal	0.60	0.3	7.46	3.8	8.06	4.1
Highway Segment	Collision with Fixed Object	33.95	17.3	71.72	36.6	105.67	53.9
Highway Segment	Collision with Other Object	1.86	0.9	14.34	7.3	16.20	8.3
Highway Segment	Other Single-vehicle Collision	22.04	11.2	18.59	9.5	40.62	20.7
Highway Segment	Collision with Parked Vehicle	1.44	0.7	2.64	1.3	4.08	2.1
Highway Segment	Total Single Vehicle Crashes	59.88	30.6	114.74	58.6	174.62	89.2
Highway Segment	Right-Angle Collision	0.54	0.3	0.35	0.2	0.89	0.5
Highway Segment	Head-on Collision	0.17	0.1	0.05	0.0	0.22	0.1
Highway Segment	Other Multi-vehicle Collision	0.57	0.3	0.90	0.5	1.47	0.8
Highway Segment	Rear-end Collision	6.12	3.1	5.86	3.0	11.98	6.1
Highway Segment	Sideswipe, Same Direction Collision	2.30	1.2	4.39	2.2	6.69	3.4
Highway Segment	Total Multiple Vehicle Crashes	9.71	5.0	11.54	5.9	21.25	10.8
Highway Segment	Total Highway Segment Crashes	69.59	35.5	126.29	64.5	195.88	100.0
	Total Crashes	69.59	35.5	126.29	64.5	195.88	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Interactive Highway Safety Design Model

Crash Prediction Evaluation Report

67-160 Interchange Ramps

Alternative 3

December 11, 2020

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Combined Report

Combined Report Overview

Report Generated: Dec 11, 2020 4:42 PM
Report Template: System: Multi-Page [System] (mlcpm2, Nov 27, 2020 3:23 PM)

Evaluation Title: Evaluation Interchange Roundabout 2022-2042
Evaluation Comment: Created Fri Dec 11 14:02:10 CST 2020
Evaluation Date: Fri Dec 11 14:04:15 CST 2020

User Name: mhuebbe
Organization Name: EFK Moen, LLC
Phone: 314-394-3133
E-Mail: mhuebbe@efkmoen.com

Project Title: Project 67-Alt3 Roundabout
Project Comment: Created Wed Dec 09 16:11:58 CST 2020
Project Unit System: U.S. Customary

Interchange Title: Interchange 160-67
Interchange Comment: Created Thu Dec 10 08:43:05 CST 2020

Report Overview

Disclaimer Regarding Crash Prediction Method

IMPORTANT NOTICE ABOUT COMPARING RESULTS FROM HIGHWAY SAFETY MANUAL FIRST EDITION (2010) MODELS TO RESULTS FROM NEW MODELS DEVELOPED UNDER NCHRP PROJECTS 17-70 AND 17-58

Since the publication of the Highway Safety Manual - First Edition (HSM-1), in 2010 by the American Association of State Highway and Transportation Officials (AASHTO), multiple research efforts have been undertaken through the National Cooperative Highway Research Program (NCHRP) to develop safety performance models for road segment and intersection facility types that were not initially reflected in the HSM-1, in order to expand the breadth and depth of the HSM in the future.

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- Roundabouts: completed in 2018 under NCHRP Project 17-70, the new methods will provide improved outcomes for the safety analysis of roundabouts.
- 6+ lane and one-way urban/suburban arterials (including models for segments and intersections): completed under NCHRP Project 17-58.

However, in the absence of local calibration factors (see HSM-1 Part C, Appendix A for guidance on calibration of the predictive models), it is neither appropriate nor advisable to directly compare the results from new models (from NCHRP Projects 17-58 and 17-70) to results from HSM-1 models, as the models were not calibrated to the same base state data sets, and consequently can produce unexpected results. If local calibration factors are available and applied to both new models and HSM-1 models, then it may be appropriate to directly compare the results.*[Note: Work being performed under NCHRP Project 17-72 (Update of Crash Modification Factors for the Highway Safety Manual) is expected to re-calibrate many of the old (HSM-1) and new (e.g., NCHRP 17-70) models to data from a single (or small number of) states, that would allow results from all models to be directly compared.]*

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Section Types

Interchange 160-67 : Evaluation Interchange Roundabout 2022-2042 : Ramp SB Enter Evaluation

Report Overview

Report Generated: Dec 11, 2020 4:42 PM
Report Template: System: Multi-Page [System] (mlcpm2, Nov 27, 2020 3:23 PM)

Evaluation Date: Fri Dec 11 14:03:20 CST 2020
IHSDM Version: v16.0.0 (Sep 30, 2020)
Crash Prediction Module: v11.0.0 (Sep 30, 2020)

User Name: mhuebbe
Organization Name: EFK Moen, LLC
Phone: 314-394-3133
E-Mail: mhuebbe@efkmoen.com

Project Title: Interchange 160-67
Project Comment: Created Thu Dec 10 08:43:05 CST 2020
Project Unit System: U.S. Customary

Highway Title: Ramp SB Enter
Highway Comment: Created Thu Dec 10 11:12:22 CST 2020
Highway Version: 1

Evaluation Title: Interchange 160-67 : Evaluation Interchange Roundabout 2022-2042 : Ramp SB Enter
Evaluation Comment: Created Fri Dec 11 14:03:06 CST 2020

Minimum Location: 0.000
Maximum Location: 7+18.230
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: HSM Configuration
Crash Distribution: HSM Configuration
Model/CMF: HSM Configuration
First Year of Analysis: 2022
Last Year of Analysis: 2042
Empirical-Bayes Analysis: None
First Year of Observed Crashes:
Last Year of Observed Crashes:

Disclaimer Regarding Crash Prediction Method

IMPORTANT NOTICE ABOUT COMPARING RESULTS FROM HIGHWAY SAFETY MANUAL FIRST EDITION (2010) MODELS TO RESULTS FROM NEW MODELS DEVELOPED UNDER NCHRP PROJECTS 17-70 AND 17-58

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Freeway Ramp Evaluation

Section: Section 1
Evaluation Start Location: 0.000
Evaluation End Location: 7+18.230
Functional Class: Freeway Service Ramp
Type of Alignment: One Direction
Model Category: Freeway Service Ramp

Calibration Factor: ENT_RAMP_MV_FI=1.0; ENT_RAMP_MV_PDO=1.0; ENT_RAMP_SV_FI=1.0; ENT_RAMP_SV_PDO=1.0;

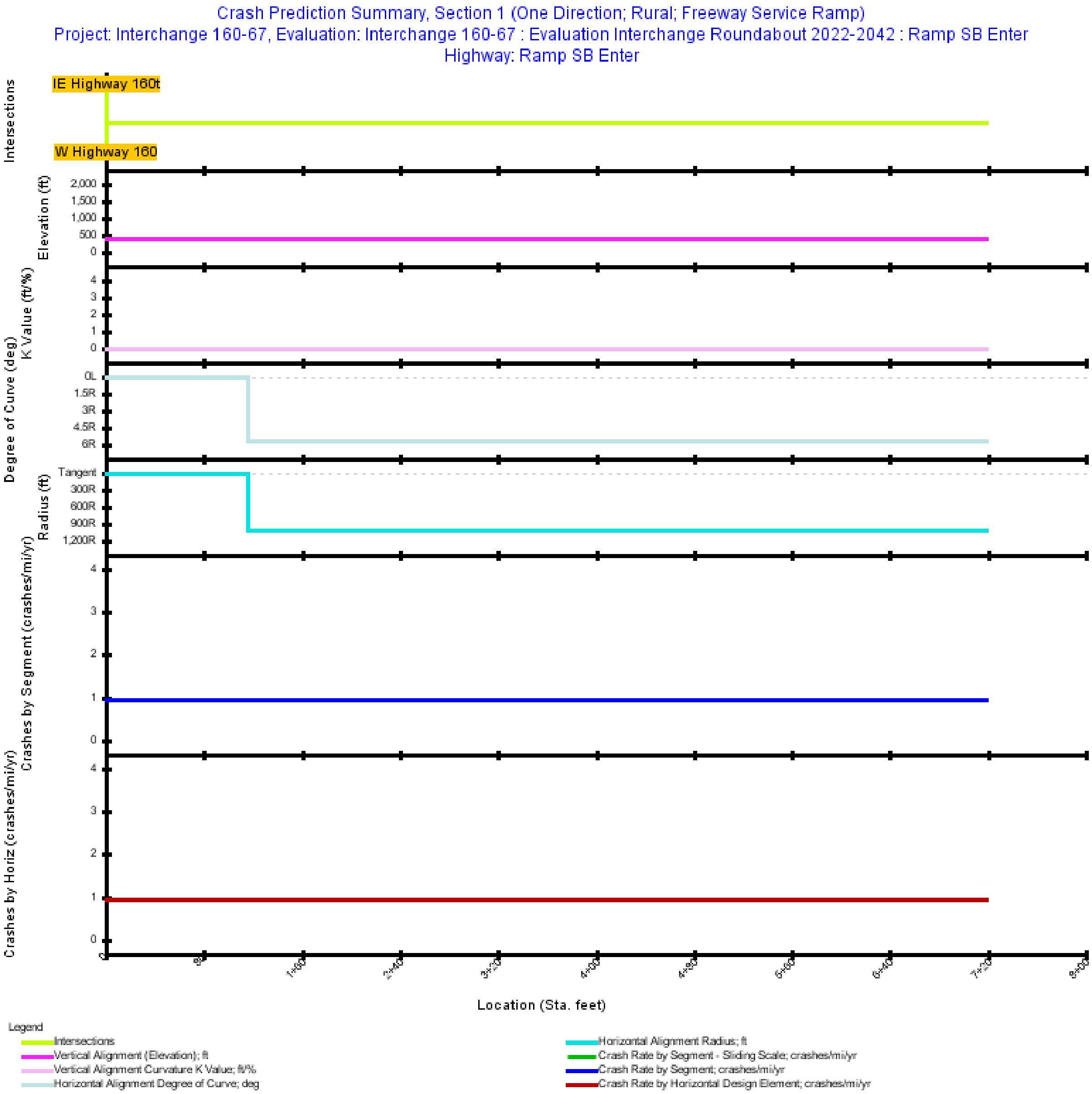

Figure 1. Crash Prediction Summary (Freeway Ramp Sections)

Table 1. Evaluation Freeway - Homogeneous Segments (Freeway Ramp Sections)

Seg. No.	Type	Area Type	Start Location (Sta. ft)	End Location (Sta. ft)	Length (ft)	Length (mi)	AADT
1	Freeway Ramp and C-D Road One-lane Ramp Entrance	Rural	0.000	7+18.230	718.23	0.1360	2022: 2,900; 2023: 2,935; 2024: 2,970; 2025: 3,005; 2026: 3,040; 2027: 3,075; 2028: 3,110; 2029: 3,145; 2030: 3,180; 2031: 3,215; 2032: 3,250; 2033: 3,285; 2034: 3,320; 2035: 3,355; 2036: 3,390; 2037: 3,425; 2038: 3,460; 2039: 3,495; 2040: 3,530; 2041: 3,565; 2042: 3,600

Table 2. Predicted Ramp Crash Rates and Frequencies Summary (Freeway Ramp Sections)

First Year of Analysis	**2022**
Last Year of Analysis	**2042**
Evaluated Length (mi)	**0.1360**
Average Future Road AADT (vpd)	**3,250**
Predicted Crashes	
Total Crashes	**2.73**
Fatal and Injury Crashes	**1.11**
Property-Damage-Only Crashes	**1.62**
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	**41**
Percent Property-Damage-Only Crashes (%)	**59**
Predicted Crash Rate	
Crash Rate (crashes/mi/yr)	**0.9546**
FI Crash Rate (crashes/mi/yr)	**0.3878**
PDO Crash Rate (crashes/mi/yr)	**0.5668**
Predicted Travel Crash Rate	
Total Travel (million veh-mi)	**3.39**
Travel Crash Rate (crashes/million veh-mi)	**0.81**
Travel FI Crash Rate (crashes/million veh-mi)	**0.33**
Travel PDO Crash Rate (crashes/million veh-mi)	**0.48**

Table 3. Predicted Crash Frequencies and Rates by Ramp Segment/Intersection (Freeway Ramp Sections)

Segment Number/Intersection Name/Cross Road	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
1	0.000	7+18.230	0.1360	2.727	0.1299	0.0528	0.0771	0.9546	0.81
Total			0.1360	2.727	0.1299	0.0528	0.0771	0.9546	

Table 4. Predicted Crash Frequencies and Rates by Horizontal Design Element (Freeway Ramp Sections)

Title	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
Tangent	0.000	1+15.840	0.0219	0.440	0.0209	0.0085	0.0124	0.9546	0.81
Simple Curve 1	1+15.840	7+18.230	0.1141	2.287	0.1089	0.0442	0.0647	0.9546	0.81

Table 5. Predicted Crash Frequencies by Year (Freeway Ramp Sections)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2022	0.12	0.05	40.824	0.07	59.176
2023	0.12	0.05	40.804	0.07	59.196
2024	0.12	0.05	40.784	0.07	59.216
2025	0.12	0.05	40.764	0.07	59.236
2026	0.12	0.05	40.744	0.07	59.256
2027	0.12	0.05	40.725	0.07	59.275
2028	0.13	0.05	40.705	0.07	59.295
2029	0.13	0.05	40.686	0.07	59.314
2030	0.13	0.05	40.666	0.08	59.334
2031	0.13	0.05	40.647	0.08	59.353
2032	0.13	0.05	40.628	0.08	59.372
2033	0.13	0.05	40.609	0.08	59.391
2034	0.13	0.05	40.590	0.08	59.410
2035	0.13	0.05	40.571	0.08	59.429
2036	0.13	0.05	40.552	0.08	59.448
2037	0.14	0.06	40.533	0.08	59.467
2038	0.14	0.06	40.515	0.08	59.485
2039	0.14	0.06	40.496	0.08	59.504
2040	0.14	0.06	40.478	0.08	59.522
2041	0.14	0.06	40.459	0.08	59.541
2042	0.14	0.06	40.441	0.08	59.559
Total	2.73	1.11	40.624	1.62	59.376
Average	0.13	0.05	40.624	0.08	59.376

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 6. Predicted Crash Severity by Ramp Segment (Freeway Ramp Sections)

Seg. No.	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)
1	0.0308	0.0934	0.6115	0.3720	1.6191

Table 7. Predicted Freeway Ramp Crash Type Distribution (Freeway Ramp Sections)

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Highway Segment	Collision with Animal	0.01	0.4	0.09	3.2	0.10	3.5
Highway Segment	Collision with Fixed Object	0.61	22.2	0.83	30.3	1.43	52.5
Highway Segment	Collision with Other Object	0.03	1.2	0.17	6.1	0.20	7.3
Highway Segment	Other Single-vehicle Collision	0.39	14.4	0.21	7.9	0.61	22.3
Highway Segment	Collision with Parked Vehicle	0.03	0.9	0.03	1.1	0.06	2.1
Highway Segment	Total Single Vehicle Crashes	1.07	39.2	1.32	48.5	2.39	87.7
Highway Segment	Right-Angle Collision	0.00	0.1	0.01	0.3	0.01	0.4
Highway Segment	Head-on Collision	0.00	0.0	0.00	0.0	0.00	0.1
Highway Segment	Other Multi-vehicle Collision	0.00	0.1	0.02	0.8	0.03	0.9
Highway Segment	Rear-end Collision	0.03	0.9	0.15	5.5	0.18	6.4
Highway Segment	Sideswipe, Same Direction Collision	0.01	0.3	0.11	4.1	0.12	4.5
Highway Segment	Total Multiple Vehicle Crashes	0.04	1.5	0.30	10.9	0.34	12.3
Highway Segment	Total Highway Segment Crashes	1.11	40.6	1.62	59.4	2.73	100.0
	Total Crashes	1.11	40.6	1.62	59.4	2.73	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Interchange 160-67 : Evaluation Interchange Roundabout 2022-2042 : Ramp SB Exit Evaluation

Report Overview

Report Generated: Dec 11, 2020 4:42 PM

Report Template: System: Multi-Page [System] (mlcpm2, Nov 27, 2020 3:23 PM)

Evaluation Date: Fri Dec 11 14:03:36 CST 2020
IHSDM Version: v16.0.0 (Sep 30, 2020)
Crash Prediction Module: v11.0.0 (Sep 30, 2020)

User Name: mhuebbe
Organization Name: EFK Moen, LLC
Phone: 314-394-3133
E-Mail: mhuebbe@efkmoen.com

Project Title: Interchange 160-67
Project Comment: Created Thu Dec 10 08:43:05 CST 2020
Project Unit System: U.S. Customary

Highway Title: Ramp SB Exit
Highway Comment: Created Thu Dec 10 11:42:40 CST 2020
Highway Version: 1

Evaluation Title: Interchange 160-67 : Evaluation Interchange Roundabout 2022-2042 : Ramp SB Exit
Evaluation Comment: Created Fri Dec 11 14:03:27 CST 2020

Minimum Location: 0.000
Maximum Location: 17+62.820
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: HSM Configuration
Crash Distribution: HSM Configuration
Model/CMF: HSM Configuration
First Year of Analysis: 2022
Last Year of Analysis: 2042
Empirical-Bayes Analysis: None
First Year of Observed Crashes:
Last Year of Observed Crashes:

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Freeway Ramp Evaluation

Section: Section 1
Evaluation Start Location: 0.000
Evaluation End Location: 17+62.820
Functional Class: Freeway Service Ramp
Type of Alignment: One Direction
Model Category: Freeway Service Ramp
Calibration Factor: EX_RAMP_MV_FI=1.0; EX_RAMP_MV_PDO=1.0; EX_RAMP_SV_FI=1.0; EX_RAMP_SV_PDO=1.0;

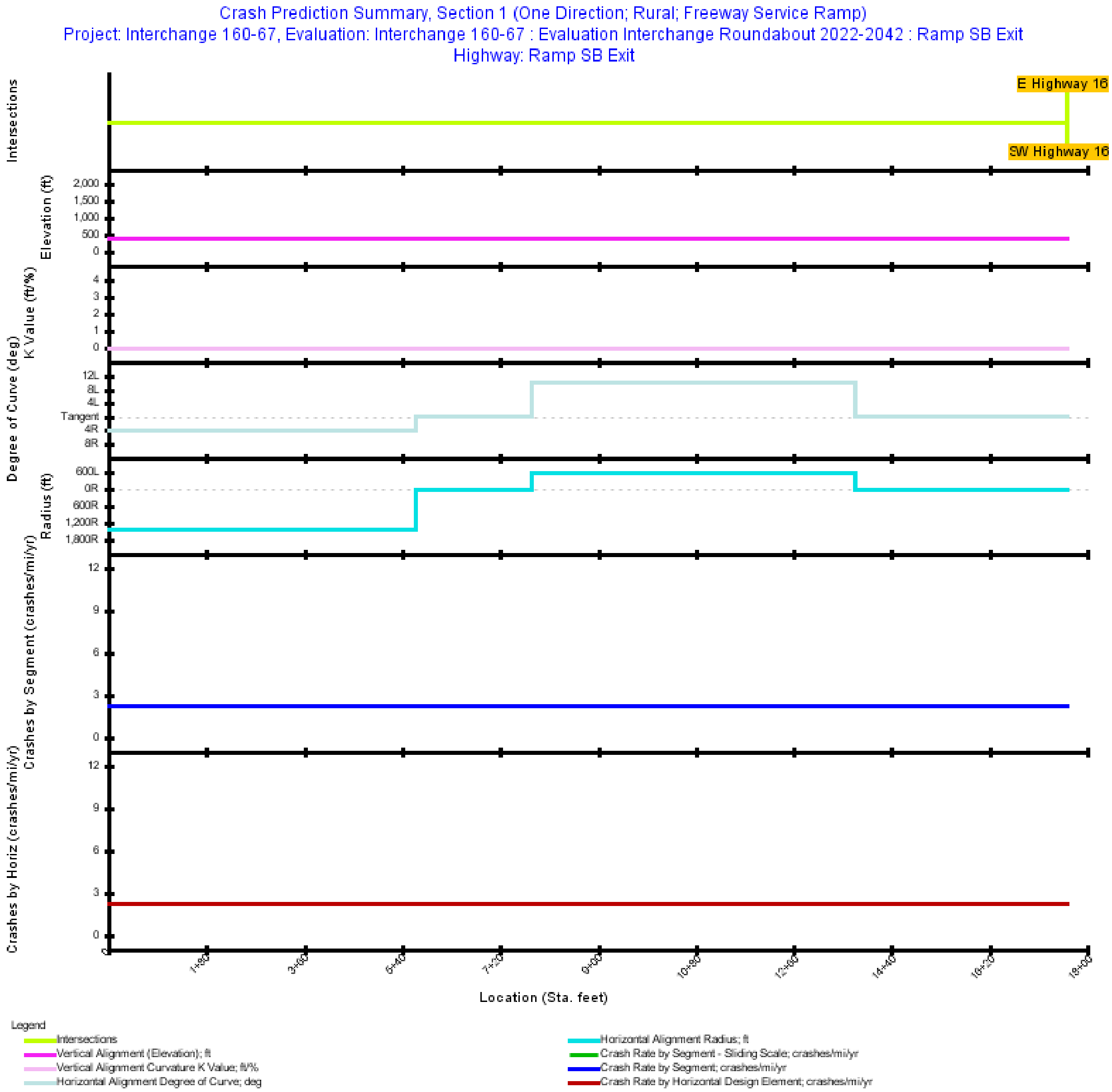

Figure 2. Crash Prediction Summary (Freeway Ramp Sections)

Table 8. Evaluation Freeway - Homogeneous Segments (Freeway Ramp Sections)

Seg. No.	Type	Area Type	Start Location (Sta. ft)	End Location (Sta. ft)	Length (ft)	Length (mi)	AADT
1	Freeway Ramp and C-D Road One-lane Ramp Exit	Rural	0.000	17+62.820	1,762.82	0.3339	2022: 5,900; 2023: 5,965; 2024: 6,030; 2025: 6,095; 2026: 6,160; 2027: 6,225; 2028: 6,290; 2029: 6,355; 2030: 6,420; 2031: 6,485; 2032: 6,550; 2033: 6,615; 2034: 6,680; 2035: 6,745; 2036: 6,810; 2037: 6,875; 2038: 6,940; 2039: 7,005; 2040: 7,070; 2041: 7,135; 2042: 7,200

Table 9. Predicted Ramp Crash Rates and Frequencies Summary (Freeway Ramp Sections)

First Year of Analysis	**2022**
Last Year of Analysis	**2042**
Evaluated Length (mi)	**0.3339**
Average Future Road AADT (vpd)	**6,550**
Predicted Crashes	
Total Crashes	**15.57**
Fatal and Injury Crashes	**7.17**
Property-Damage-Only Crashes	**8.39**
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	**46**
Percent Property-Damage-Only Crashes (%)	**54**
Predicted Crash Rate	
Crash Rate (crashes/mi/yr)	**2.2202**
FI Crash Rate (crashes/mi/yr)	**1.0231**
PDO Crash Rate (crashes/mi/yr)	**1.1971**
Predicted Travel Crash Rate	
Total Travel (million veh-mi)	**16.76**
Travel Crash Rate (crashes/million veh-mi)	**0.93**
Travel FI Crash Rate (crashes/million veh-mi)	**0.43**
Travel PDO Crash Rate (crashes/million veh-mi)	**0.50**

Table 10. Predicted Crash Frequencies and Rates by Ramp Segment/Intersection (Freeway Ramp Sections)

Segment Number/Intersection Name/Cross Road	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
1	0.000	17+62.820	0.3339	15.566	0.7413	0.3416	0.3997	2.2202	0.93
Total			0.3339	15.566	0.7413	0.3416	0.3997	2.2202	

Table 11. Predicted Crash Frequencies and Rates by Horizontal Design Element (Freeway Ramp Sections)

Title	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi /yr)	Predicted Travel Crash Rate (crashes/mi llion veh-mi)
Simple Curve 1	0.000	5+64.230	0.1069	4.982	0.2373	0.1093	0.1279	2.2202	0.93
Tangent	5+64.230	7+78.690	0.0406	1.894	0.0902	0.0416	0.0486	2.2202	0.93
Simple Curve 2	7+78.690	13+71.820	0.1123	5.238	0.2494	0.1149	0.1345	2.2202	0.93
Tangent	13+71.820	17+62.820	0.0741	3.453	0.1644	0.0758	0.0887	2.2202	0.93

Table 12. Predicted Crash Frequencies by Year (Freeway Ramp Sections)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2022	0.69	0.32	46.125	0.37	53.875
2023	0.69	0.32	46.121	0.37	53.879
2024	0.70	0.32	46.117	0.38	53.883
2025	0.70	0.32	46.112	0.38	53.888
2026	0.71	0.33	46.108	0.38	53.892
2027	0.71	0.33	46.104	0.39	53.896
2028	0.72	0.33	46.100	0.39	53.900
2029	0.72	0.33	46.095	0.39	53.905
2030	0.73	0.34	46.091	0.39	53.909
2031	0.74	0.34	46.087	0.40	53.913
2032	0.74	0.34	46.082	0.40	53.918
2033	0.75	0.34	46.078	0.40	53.922
2034	0.75	0.35	46.073	0.41	53.927
2035	0.76	0.35	46.069	0.41	53.931
2036	0.76	0.35	46.065	0.41	53.935
2037	0.77	0.35	46.060	0.41	53.940
2038	0.77	0.36	46.056	0.42	53.944
2039	0.78	0.36	46.051	0.42	53.949
2040	0.78	0.36	46.047	0.42	53.953
2041	0.79	0.36	46.042	0.43	53.958
2042	0.80	0.37	46.038	0.43	53.962
Total	15.57	7.17	46.081	8.39	53.919
Average	0.74	0.34	46.081	0.40	53.919

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 13. Predicted Crash Severity by Ramp Segment (Freeway Ramp Sections)

Seg. No.	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)
1	0.2761	0.8373	3.6223	2.4375	8.3933

Table 14. Predicted Freeway Ramp Crash Type Distribution (Freeway Ramp Sections)

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Highway Segment	Collision with Animal	0.07	0.5	0.50	3.2	0.57	3.7
Highway Segment	Collision with Fixed Object	4.04	26.0	4.80	30.8	8.84	56.8
Highway Segment	Collision with Other Object	0.22	1.4	0.96	6.2	1.18	7.6
Highway Segment	Other Single-vehicle Collision	2.62	16.8	1.24	8.0	3.87	24.8
Highway Segment	Collision with Parked Vehicle	0.17	1.1	0.18	1.1	0.35	2.2
Highway Segment	Total Single Vehicle Crashes	7.12	45.8	7.67	49.3	14.80	95.1
Highway Segment	Right-Angle Collision	0.00	0.0	0.02	0.1	0.02	0.2
Highway Segment	Head-on Collision	0.00	0.0	0.00	0.0	0.00	0.0
Highway Segment	Other Multi-vehicle Collision	0.00	0.0	0.06	0.4	0.06	0.4
Highway Segment	Rear-end Collision	0.03	0.2	0.36	2.3	0.40	2.5
Highway Segment	Sideswipe, Same Direction Collision	0.01	0.1	0.27	1.8	0.28	1.8
Highway Segment	Total Multiple Vehicle Crashes	0.05	0.3	0.72	4.6	0.77	4.9
Highway Segment	Total Highway Segment Crashes	7.17	46.1	8.39	53.9	15.57	100.0
	Total Crashes	7.17	46.1	8.39	53.9	15.57	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 15. Evaluation Message

Start Location (Sta. ft)	End Location (Sta. ft)	Message
0.000	17+62.820	for segment #1 (0.000 to 17+62.820), traffic volume (7,005 vpd) for 2039 is not within the model limit (7,000 vpd) for reliable results for segment type 1EX
0.000	17+62.820	for segment #1 (0.000 to 17+62.820), traffic volume (7,070 vpd) for 2040 is not within the model limit (7,000 vpd) for reliable results for segment type 1EX
0.000	17+62.820	for segment #1 (0.000 to 17+62.820), traffic volume (7,135 vpd) for 2041 is not within the model limit (7,000 vpd) for reliable results for segment type 1EX
0.000	17+62.820	for segment #1 (0.000 to 17+62.820), traffic volume (7,200 vpd) for 2042 is not within the model limit (7,000 vpd) for reliable results for segment type 1EX

Interchange 160-67 : Evaluation Interchange Roundabout 2022-2042 : Ramp NB Enter Evaluation

Report Overview

Report Generated: Dec 11, 2020 4:42 PM
Report Template: System: Multi-Page [System] (mlcpm2, Nov 27, 2020 3:23 PM)

Evaluation Date: Fri Dec 11 14:03:51 CST 2020
IHSDM Version: v16.0.0 (Sep 30, 2020)
Crash Prediction Module: v11.0.0 (Sep 30, 2020)

User Name: mhuebbe
Organization Name: EFK Moen, LLC
Phone: 314-394-3133
E-Mail: mhuebbe@efkmoen.com

Project Title: Interchange 160-67
Project Comment: Created Thu Dec 10 08:43:05 CST 2020
Project Unit System: U.S. Customary

Highway Title: Ramp NB Enter
Highway Comment: Created Thu Dec 10 12:44:09 CST 2020
Highway Version: 1

Evaluation Title: Interchange 160-67 : Evaluation Interchange Roundabout 2022-2042 : Ramp NB Enter
Evaluation Comment: Created Fri Dec 11 14:03:41 CST 2020

Minimum Location: 0.000
Maximum Location: 9+57.000
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: HSM Configuration
Crash Distribution: HSM Configuration
Model/CMF: HSM Configuration
First Year of Analysis: 2022
Last Year of Analysis: 2042
Empirical-Bayes Analysis: None
First Year of Observed Crashes:
Last Year of Observed Crashes:

Disclaimer Regarding Crash Prediction Method

IMPORTANT NOTICE ABOUT COMPARING RESULTS FROM HIGHWAY SAFETY MANUAL FIRST EDITION (2010) MODELS TO RESULTS FROM NEW MODELS DEVELOPED UNDER NCHRP PROJECTS 17-70 AND 17-58

Since the publication of the Highway Safety Manual - First Edition (HSM-1), in 2010 by the American Association of State Highway and Transportation Officials (AASHTO), multiple research efforts have been undertaken through the National Cooperative Highway Research Program (NCHRP) to develop safety performance models for road segment and intersection facility types that were not initially reflected in the HSM-1, in order to expand the breadth and depth of the HSM in the future.

The IHSDM Crash Prediction Module (CPM) is intended as a faithful implementation of HSM Part C predictive methods. As NCHRP projects to develop new predictive methods for the HSM are completed, FHWA works to incorporate the new methods into IHSDM, sometimes in advance of publication in the HSM. The following new crash predictive methods have been accepted by NCHRP project panels and incorporated into IHSDM, while pending AASHTO's approval for incorporation into a future edition of the HSM:

- Roundabouts: completed in 2018 under NCHRP Project 17-70, the new methods will provide improved outcomes for the safety analysis of roundabouts.
- 6+ lane and one-way urban/suburban arterials (including models for segments and intersections): completed under NCHRP Project 17-58.

However, in the absence of local calibration factors (see HSM-1 Part C, Appendix A for guidance on calibration of the predictive models), it is neither appropriate nor advisable to directly compare the results from new models (from NCHRP Projects 17-58 and 17-70) to results from HSM-1 models, as the models were not calibrated to the same base state data sets, and consequently can produce unexpected results. If local calibration factors are available and applied to both new models and HSM-1 models, then it may be appropriate to directly compare the results.*[Note: Work being performed under NCHRP Project 17-72 (Update of Crash Modification Factors for the Highway Safety Manual) is expected to re-calibrate many of the old (HSM-1) and new (e.g., NCHRP 17-70) models to data from a single (or small number of) states, that would allow results from all models to be directly compared.]*

The models produced for NCHRP Project 17-70 have independent value in terms of informing the design of a roundabout and assessing the effects of different design characteristics on the expected safety performance of a roundabout.

The HSM-1 interim method previously included in IHSDM for evaluating roundabouts on urban/suburban arterials (i.e., evaluating an existing intersection and then applying a Crash Modification Factor for replacing the existing intersection with a roundabout) has been deactivated in IHSDM, to minimize any confusion with the new roundabout methodology.

Freeway Ramp Evaluation

Section: Section 1
Evaluation Start Location: 0.000
Evaluation End Location: 9+57.000
Functional Class: Freeway Service Ramp
Type of Alignment: One Direction
Model Category: Freeway Service Ramp
Calibration Factor: ENT_RAMP_MV_FI=1.0; ENT_RAMP_MV_PDO=1.0; ENT_RAMP_SV_FI=1.0; ENT_RAMP_SV_PDO=1.0;

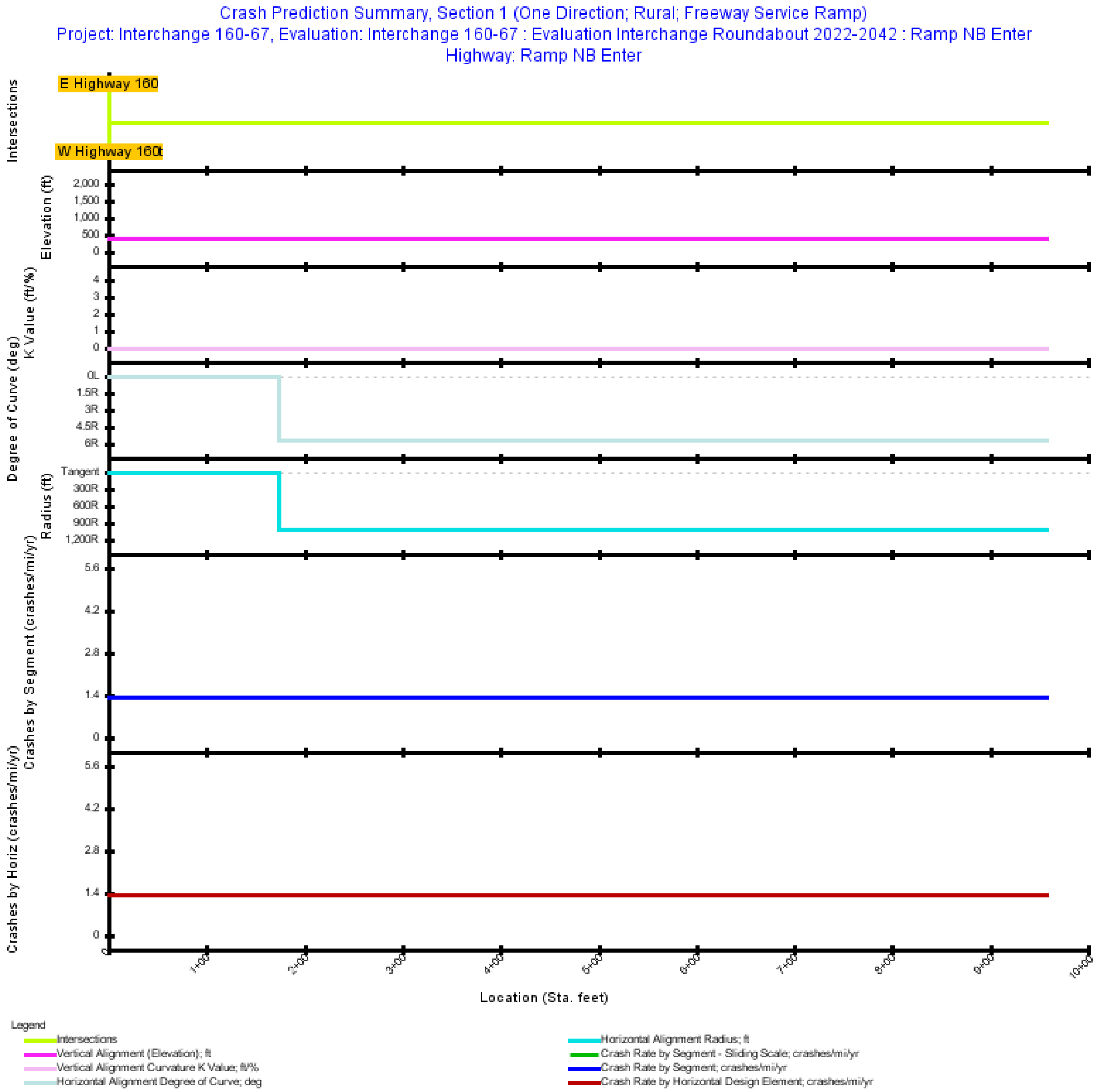

Figure 3. Crash Prediction Summary (Freeway Ramp Sections)

Table 16. Evaluation Freeway - Homogeneous Segments (Freeway Ramp Sections)

Seg. No.	Type	Area Type	Start Location (Sta. ft)	End Location (Sta. ft)	Length (ft)	Length (mi)	AADT
1	Freeway Ramp and C-D Road One-lane Ramp Entrance	Rural	0.000	9+57.000	957.00	0.1812	2022: 4,100; 2023: 4,165; 2024: 4,230; 2025: 4,295; 2026: 4,360; 2027: 4,425; 2028: 4,490; 2029: 4,555; 2030: 4,620; 2031: 4,685; 2032: 4,750; 2033: 4,815; 2034: 4,880; 2035: 4,945; 2036: 5,010; 2037: 5,075; 2038: 5,140; 2039: 5,205; 2040: 5,270; 2041: 5,335; 2042: 5,400

Table 17. Predicted Ramp Crash Rates and Frequencies Summary (Freeway Ramp Sections)

First Year of Analysis	**2022**
Last Year of Analysis	**2042**
Evaluated Length (mi)	**0.1812**
Average Future Road AADT (vpd)	**4,750**
Predicted Crashes	
Total Crashes	**5.05**
Fatal and Injury Crashes	**2.01**
Property-Damage-Only Crashes	**3.04**
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	**40**
Percent Property-Damage-Only Crashes (%)	**60**
Predicted Crash Rate	
Crash Rate (crashes/mi/yr)	**1.3257**
FI Crash Rate (crashes/mi/yr)	**0.5283**
PDO Crash Rate (crashes/mi/yr)	**0.7974**
Predicted Travel Crash Rate	
Total Travel (million veh-mi)	**6.60**
Travel Crash Rate (crashes/million veh-mi)	**0.77**
Travel FI Crash Rate (crashes/million veh-mi)	**0.30**
Travel PDO Crash Rate (crashes/million veh-mi)	**0.46**

Table 18. Predicted Crash Frequencies and Rates by Ramp Segment/Intersection (Freeway Ramp Sections)

Segment Number/Intersection Name/Cross Road	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
1	0.000	9+57.000	0.1812	5.046	0.2403	0.0958	0.1445	1.3257	0.77
Total			0.1812	5.046	0.2403	0.0958	0.1445	1.3257	

Table 19. Predicted Crash Frequencies and Rates by Horizontal Design Element (Freeway Ramp Sections)

Title	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
Tangent	0.000	1+74.000	0.0330	0.917	0.0437	0.0174	0.0263	1.3257	0.77
Simple Curve 1	1+74.000	9+57.000	0.1483	4.128	0.1966	0.0783	0.1183	1.3257	0.77

Table 20. Predicted Crash Frequencies by Year (Freeway Ramp Sections)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2022	0.21	0.09	40.152	0.13	59.848
2023	0.22	0.09	40.121	0.13	59.879
2024	0.22	0.09	40.091	0.13	59.909
2025	0.22	0.09	40.061	0.13	59.939
2026	0.23	0.09	40.032	0.14	59.968
2027	0.23	0.09	40.002	0.14	59.998
2028	0.23	0.09	39.973	0.14	60.027
2029	0.23	0.09	39.944	0.14	60.056
2030	0.23	0.09	39.915	0.14	60.085
2031	0.24	0.10	39.887	0.14	60.113
2032	0.24	0.10	39.858	0.14	60.142
2033	0.24	0.10	39.830	0.15	60.170
2034	0.24	0.10	39.802	0.15	60.198
2035	0.25	0.10	39.774	0.15	60.226
2036	0.25	0.10	39.747	0.15	60.253
2037	0.25	0.10	39.719	0.15	60.281
2038	0.26	0.10	39.692	0.15	60.308
2039	0.26	0.10	39.665	0.16	60.335
2040	0.26	0.10	39.639	0.16	60.361
2041	0.26	0.10	39.612	0.16	60.388
2042	0.27	0.10	39.586	0.16	60.414
Total	5.05	2.01	39.851	3.04	60.149
Average	0.24	0.10	39.851	0.14	60.149

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 21. Predicted Crash Severity by Ramp Segment (Freeway Ramp Sections)

Seg. No.	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)
1	0.0559	0.1696	1.1101	0.6753	3.0351

Table 22. Predicted Freeway Ramp Crash Type Distribution (Freeway Ramp Sections)

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Highway Segment	Collision with Animal	0.02	0.4	0.15	3.1	0.17	3.5
Highway Segment	Collision with Fixed Object	1.10	21.8	1.49	29.6	2.59	51.4
Highway Segment	Collision with Other Object	0.06	1.2	0.30	5.9	0.36	7.1
Highway Segment	Other Single-vehicle Collision	0.71	14.1	0.39	7.7	1.10	21.8
Highway Segment	Collision with Parked Vehicle	0.05	0.9	0.06	1.1	0.10	2.0
Highway Segment	Total Single Vehicle Crashes	1.94	38.4	2.39	47.4	4.33	85.8
Highway Segment	Right-Angle Collision	0.00	0.1	0.02	0.4	0.02	0.5
Highway Segment	Head-on Collision	0.00	0.0	0.00	0.1	0.00	0.1
Highway Segment	Other Multi-vehicle Collision	0.00	0.1	0.05	1.0	0.06	1.1
Highway Segment	Rear-end Collision	0.05	0.9	0.33	6.5	0.37	7.4
Highway Segment	Sideswipe, Same Direction Collision	0.02	0.3	0.24	4.8	0.26	5.2
Highway Segment	Total Multiple Vehicle Crashes	0.07	1.4	0.64	12.8	0.72	14.2
Highway Segment	Total Highway Segment Crashes	2.01	39.9	3.04	60.1	5.05	100.0
	Total Crashes	2.01	39.9	3.04	60.1	5.05	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Interchange 160-67 : Evaluation Interchange Roundabout 2022-2042 : Ramp NB Exit Evaluation

Report Overview

Report Generated: Dec 11, 2020 4:42 PM

Report Template: System: Multi-Page [System] (mlcpm2, Nov 27, 2020 3:23 PM)

Evaluation Date: Fri Dec 11 14:04:05 CST 2020
IHSDM Version: v16.0.0 (Sep 30, 2020)
Crash Prediction Module: v11.0.0 (Sep 30, 2020)

User Name: mhuebbe
Organization Name: EFK Moen, LLC
Phone: 314-394-3133
E-Mail: mhuebbe@efkmoen.com

Project Title: Interchange 160-67
Project Comment: Created Thu Dec 10 08:43:05 CST 2020
Project Unit System: U.S. Customary

Highway Title: Ramp NB Exit
Highway Comment: Created Thu Dec 10 13:04:40 CST 2020
Highway Version: 1

Evaluation Title: Interchange 160-67 : Evaluation Interchange Roundabout 2022-2042 : Ramp NB Exit
Evaluation Comment: Created Fri Dec 11 14:03:56 CST 2020

Minimum Location: 0.000
Maximum Location: 17+63.150
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: HSM Configuration
Crash Distribution: HSM Configuration
Model/CMF: HSM Configuration
First Year of Analysis: 2022
Last Year of Analysis: 2042
Empirical-Bayes Analysis: None
First Year of Observed Crashes:
Last Year of Observed Crashes:

Disclaimer Regarding Crash Prediction Method

IMPORTANT NOTICE ABOUT COMPARING RESULTS FROM HIGHWAY SAFETY MANUAL FIRST EDITION (2010) MODELS TO RESULTS FROM NEW MODELS DEVELOPED UNDER NCHRP PROJECTS 17-70 AND 17-58

Since the publication of the Highway Safety Manual - First Edition (HSM-1), in 2010 by the American Association of State Highway and Transportation Officials (AASHTO), multiple research efforts have been undertaken through the National Cooperative Highway Research Program (NCHRP) to develop safety performance models for road segment and intersection facility types that were not initially reflected in the HSM-1, in order to expand the breadth and depth of the HSM in the future.

The IHSDM Crash Prediction Module (CPM) is intended as a faithful implementation of HSM Part C predictive methods. As NCHRP projects to develop new predictive methods for the HSM are completed, FHWA works to incorporate the new methods into IHSDM, sometimes in advance of publication in the HSM. The following new crash predictive methods have been accepted by NCHRP project panels and incorporated into IHSDM, while pending AASHTO's approval for incorporation into a future edition of the HSM:

- Roundabouts: completed in 2018 under NCHRP Project 17-70, the new methods will provide improved outcomes for the safety analysis of roundabouts.
- 6+ lane and one-way urban/suburban arterials (including models for segments and intersections): completed under NCHRP Project 17-58.

However, in the absence of local calibration factors (see HSM-1 Part C, Appendix A for guidance on calibration of the predictive models), it is neither appropriate nor advisable to directly compare the results from new models (from NCHRP Projects 17-58 and 17-70) to results from HSM-1 models, as the models were not calibrated to the same base state data sets, and consequently can produce unexpected results. If local calibration factors are available and applied to both new models and HSM-1 models, then it may be appropriate to directly compare the results.*[Note: Work being performed under NCHRP Project 17-72 (Update of Crash Modification Factors for the Highway Safety Manual) is expected to re-calibrate many of the old (HSM-1) and new (e.g., NCHRP 17-70) models to data from a single (or small number of) states, that would allow results from all models to be directly compared.]*

The models produced for NCHRP Project 17-70 have independent value in terms of informing the design of a roundabout and assessing the effects of different design characteristics on the expected safety performance of a roundabout.

The HSM-1 interim method previously included in IHSDM for evaluating roundabouts on urban/suburban arterials (i.e., evaluating an existing intersection and then applying a Crash Modification Factor for replacing the existing intersection with a roundabout) has been deactivated in IHSDM, to minimize any confusion with the new roundabout methodology.

Freeway Ramp Evaluation

Section: Section 1
Evaluation Start Location: 0.000
Evaluation End Location: 17+63.150
Functional Class: Freeway Service Ramp
Type of Alignment: One Direction
Model Category: Freeway Service Ramp
Calibration Factor: EX_RAMP_MV_FI=1.0; EX_RAMP_MV_PDO=1.0; EX_RAMP_SV_FI=1.0; EX_RAMP_SV_PDO=1.0;

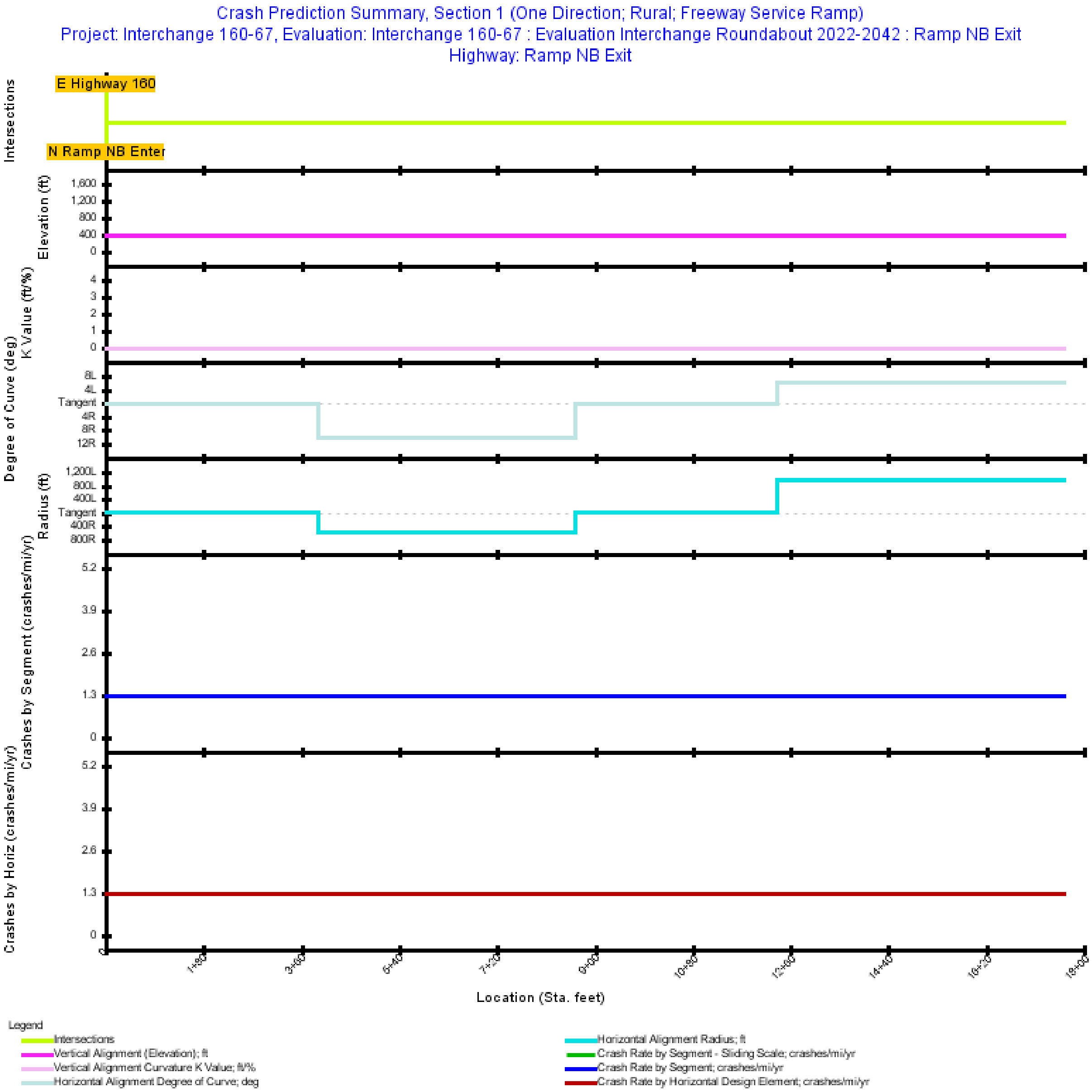

Figure 4. Crash Prediction Summary (Freeway Ramp Sections)

Table 23. Evaluation Freeway - Homogeneous Segments (Freeway Ramp Sections)

Seg. No.	Type	Area Type	Start Location (Sta. ft)	End Location (Sta. ft)	Length (ft)	Length (mi)	AADT
1	Freeway Ramp and C-D Road One-lane Ramp Exit	Rural	0.000	17+63.150	1,763.15	0.3339	2022: 2,600; 2023: 2,645; 2024: 2,690; 2025: 2,735; 2026: 2,780; 2027: 2,825; 2028: 2,870; 2029: 2,915; 2030: 2,960; 2031: 3,005; 2032: 3,050; 2033: 3,095; 2034: 3,140; 2035: 3,185; 2036: 3,230; 2037: 3,275; 2038: 3,320; 2039: 3,365; 2040: 3,410; 2041: 3,455; 2042: 3,500

Table 24. Predicted Ramp Crash Rates and Frequencies Summary (Freeway Ramp Sections)

First Year of Analysis	2022
Last Year of Analysis	2042
Evaluated Length (mi)	0.3339
Average Future Road AADT (vpd)	3,050
Predicted Crashes	
Total Crashes	8.98
Fatal and Injury Crashes	4.16
Property-Damage-Only Crashes	4.82
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	46
Percent Property-Damage-Only Crashes (%)	54
Predicted Crash Rate	
Crash Rate (crashes/mi/yr)	1.2800
FI Crash Rate (crashes/mi/yr)	0.5931
PDO Crash Rate (crashes/mi/yr)	0.6869
Predicted Travel Crash Rate	
Total Travel (million veh-mi)	7.81
Travel Crash Rate (crashes/million veh-mi)	1.15
Travel FI Crash Rate (crashes/million veh-mi)	0.53
Travel PDO Crash Rate (crashes/million veh-mi)	0.62

Table 25. Predicted Crash Frequencies and Rates by Ramp Segment/Intersection (Freeway Ramp Sections)

Segment Number/Intersection Name/Cross Road	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
1	0.000	17+63.150	0.3339	8.976	0.4274	0.1981	0.2294	1.2800	1.15
Total			0.3339	8.976	0.4274	0.1981	0.2294	1.2800	

Table 26. Predicted Crash Frequencies and Rates by Horizontal Design Element (Freeway Ramp Sections)

Title	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi /yr)	Predicted Travel Crash Rate (crashes/mi llion veh-mi)
Tangent	0.000	3+91.000	0.0741	1.991	0.0948	0.0439	0.0509	1.2800	1.15
Simple Curve 1	3+91.000	8+62.620	0.0893	2.401	0.1143	0.0530	0.0614	1.2800	1.15
Tangent	8+62.620	12+34.880	0.0705	1.895	0.0902	0.0418	0.0484	1.2800	1.15
Simple Curve 2	12+34.880	17+63.150	0.1001	2.689	0.1281	0.0593	0.0687	1.2800	1.15

Table 27. Predicted Crash Frequencies by Year (Freeway Ramp Sections)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2022	0.38	0.18	46.346	0.20	53.654
2023	0.39	0.18	46.345	0.21	53.655
2024	0.39	0.18	46.344	0.21	53.656
2025	0.40	0.18	46.344	0.21	53.656
2026	0.40	0.18	46.343	0.21	53.657
2027	0.41	0.19	46.342	0.22	53.658
2028	0.41	0.19	46.341	0.22	53.659
2029	0.41	0.19	46.340	0.22	53.660
2030	0.42	0.19	46.339	0.23	53.661
2031	0.42	0.20	46.338	0.23	53.662
2032	0.43	0.20	46.336	0.23	53.664
2033	0.43	0.20	46.335	0.23	53.665
2034	0.44	0.20	46.334	0.23	53.666
2035	0.44	0.20	46.332	0.24	53.668
2036	0.45	0.21	46.331	0.24	53.669
2037	0.45	0.21	46.329	0.24	53.671
2038	0.46	0.21	46.327	0.24	53.673
2039	0.46	0.21	46.326	0.25	53.674
2040	0.46	0.21	46.324	0.25	53.676
2041	0.47	0.22	46.322	0.25	53.678
2042	0.47	0.22	46.320	0.25	53.680
Total	8.98	4.16	46.334	4.82	53.666
Average	0.43	0.20	46.334	0.23	53.666

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 28. Predicted Crash Severity by Ramp Segment (Freeway Ramp Sections)

Seg. No.	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)
1	0.1594	0.4833	2.0932	1.4233	4.8172

Table 29. Predicted Freeway Ramp Crash Type Distribution (Freeway Ramp Sections)

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Highway Segment	Collision with Animal	0.04	0.5	0.29	3.3	0.34	3.7
Highway Segment	Collision with Fixed Object	2.34	26.1	2.84	31.6	5.18	57.7
Highway Segment	Collision with Other Object	0.13	1.4	0.57	6.3	0.70	7.7
Highway Segment	Other Single-vehicle Collision	1.52	16.9	0.73	8.2	2.26	25.1
Highway Segment	Collision with Parked Vehicle	0.10	1.1	0.10	1.2	0.20	2.3
Highway Segment	Total Single Vehicle Crashes	4.13	46.1	4.54	50.6	8.67	96.6
Highway Segment	Right-Angle Collision	0.00	0.0	0.01	0.1	0.01	0.1
Highway Segment	Head-on Collision	0.00	0.0	0.00	0.0	0.00	0.0
Highway Segment	Other Multi-vehicle Collision	0.00	0.0	0.02	0.2	0.02	0.3
Highway Segment	Rear-end Collision	0.02	0.2	0.14	1.6	0.16	1.8
Highway Segment	Sideswipe, Same Direction Collision	0.01	0.1	0.11	1.2	0.11	1.2
Highway Segment	Total Multiple Vehicle Crashes	0.03	0.3	0.28	3.1	0.30	3.4
Highway Segment	Total Highway Segment Crashes	4.16	46.3	4.82	53.7	8.98	100.0
	Total Crashes	4.16	46.3	4.82	53.7	8.98	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Interactive Highway Safety Design Model

Crash Prediction Evaluation Report

Highway 160

Alternative 3

December 11, 2020

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Report Overview

Report Generated: Dec 11, 2020 4:39 PM
Report Template: System: Multi-Page [System] (mlcpm2, Nov 27, 2020 3:23 PM)

Evaluation Date: Fri Dec 11 14:19:57 CST 2020
IHSDM Version: v16.0.0 (Sep 30, 2020)
Crash Prediction Module: v11.0.0 (Sep 30, 2020)

User Name: mhuebbe
Organization Name: EFK Moen, LLC
Phone: 314-394-3133
E-Mail: mhuebbe@efkmoen.com

Project Title: Project 67-Alt3 Roundabout
Project Comment: Created Wed Dec 09 16:11:58 CST 2020
Project Unit System: U.S. Customary

Highway Title: Highway 160
Highway Comment: Created Wed Dec 09 22:20:13 CST 2020
Highway Version: 1

Evaluation Title: Evaluation 160 Alt3 2022-2042
Evaluation Comment: Created Fri Dec 11 14:18:54 CST 2020

Minimum Location: 534+24.000
Maximum Location: 596+34.000
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: HSM Configuration
Crash Distribution: HSM Configuration
Model/CMF: HSM Configuration
First Year of Analysis: 2022
Last Year of Analysis: 2042
Empirical-Bayes Analysis: None
First Year of Observed Crashes:
Last Year of Observed Crashes:

Disclaimer Regarding Crash Prediction Method

IMPORTANT NOTICE ABOUT COMPARING RESULTS FROM HIGHWAY SAFETY MANUAL FIRST EDITION (2010) MODELS TO RESULTS FROM NEW MODELS DEVELOPED UNDER NCHRP PROJECTS 17-70 AND 17-58

Since the publication of the Highway Safety Manual - First Edition (HSM-1), in 2010 by the American Association of State Highway and Transportation Officials (AASHTO), multiple research efforts have been undertaken through the National Cooperative Highway Research Program (NCHRP) to develop safety performance models for road segment and intersection facility types that were not initially reflected in the HSM-1, in order to expand the breadth and depth of the HSM in the future.

The IHSDM Crash Prediction Module (CPM) is intended as a faithful implementation of HSM Part C predictive methods. As NCHRP projects to develop new predictive methods for the HSM are completed, FHWA works to incorporate the new methods into IHSDM, sometimes in advance of publication in the HSM. The following new crash predictive methods have been accepted by NCHRP project panels and incorporated into IHSDM, while pending AASHTO's approval for incorporation into a future edition of the HSM:

- Roundabouts: completed in 2018 under NCHRP Project 17-70, the new methods will provide improved outcomes for the safety analysis of roundabouts.
- 6+ lane and one-way urban/suburban arterials (including models for segments and intersections): completed under NCHRP Project 17-58.

However, in the absence of local calibration factors (see HSM-1 Part C, Appendix A for guidance on calibration of the predictive models), it is neither appropriate nor advisable to directly compare the results from new models (from NCHRP Projects 17-58 and 17-70) to results from HSM-1 models, as the models were not calibrated to the same base state data sets, and consequently can produce unexpected results. If local calibration factors are available and applied to both new models and HSM-1 models, then it may be appropriate to directly compare the results.*[Note: Work being performed under NCHRP Project 17-72 (Update of Crash Modification Factors for the Highway Safety Manual) is expected to re-calibrate many of the old (HSM-1) and new (e.g., NCHRP 17-70) models to data from a single (or small number of) states, that would allow results from all models to be directly compared.]*

The models produced for NCHRP Project 17-70 have independent value in terms of informing the design of a roundabout and assessing the effects of different design characteristics on the expected safety performance of a roundabout.

The HSM-1 interim method previously included in IHSDM for evaluating roundabouts on urban/suburban arterials (i.e., evaluating an existing intersection and then applying a Crash Modification Factor for replacing the existing intersection with a roundabout) has been deactivated in IHSDM, to minimize any confusion with the new roundabout methodology.

Section Types

Section 1 Evaluation

Section: Section 1
Evaluation Start Location: 534+24.000
Evaluation End Location: 596+34.000
Area Type: Rural
Functional Class: Multiple
Type of Alignment: Undivided, Two Lane
Model Category: Rural, Two Lane
Calibration Factor: 2U=1.0; 4ST=1.0; RTL 41R=1.0;

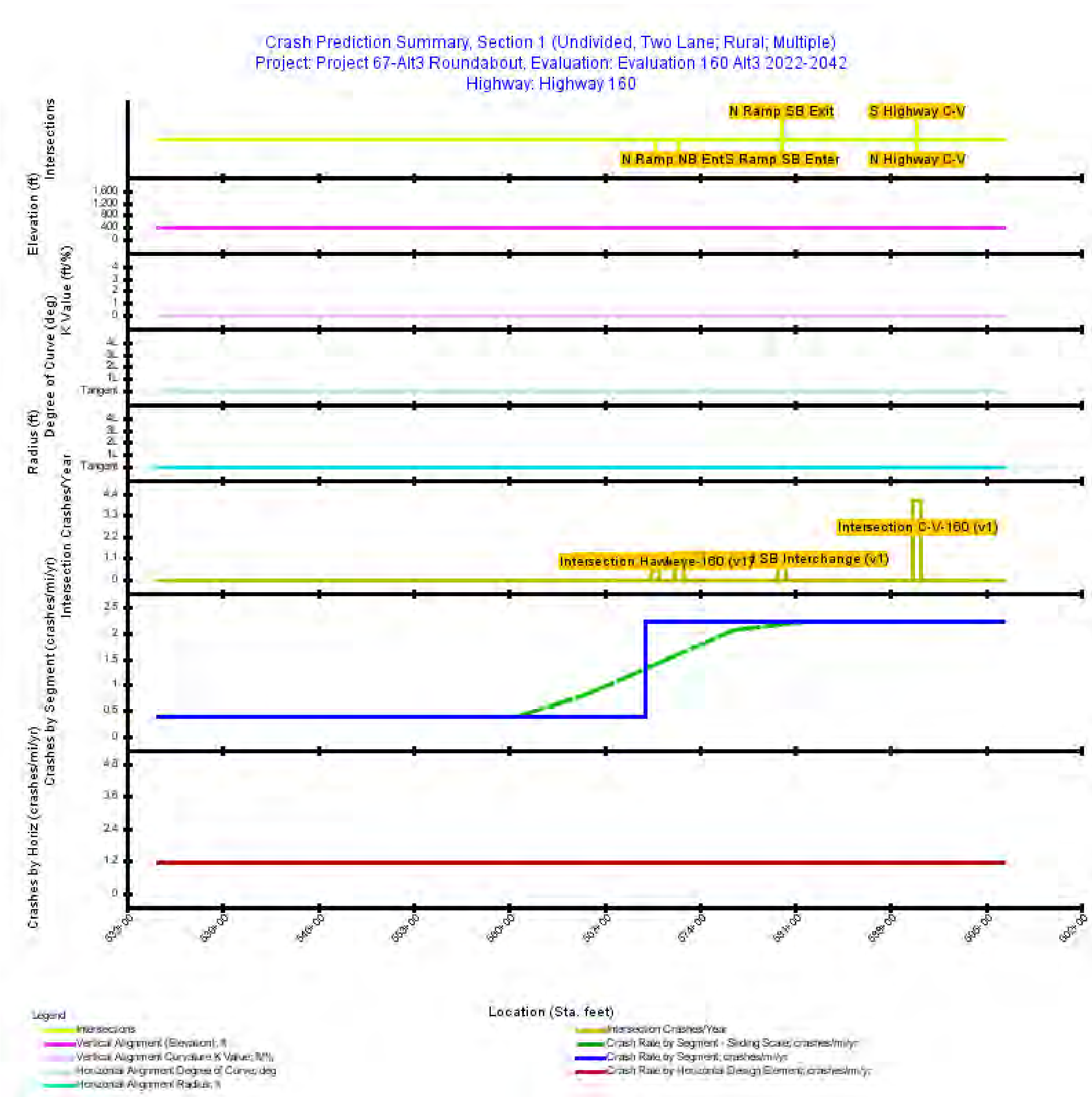


Figure 1. Crash Prediction Summary (Section 1)

Table 1. Evaluation Highway - Homogeneous Segments (Section 1)

Seg. No.	Type	Start Location (Sta. ft)	End Location (Sta. ft)	Length (ft)	Length (mi)	AADT	Left Lane Width (ft)	Right Lane Width (ft)	Left Shoulder Width (ft)	Right Shoulder Width (ft)	Grade (%)	Driveway Density (driveways/mi)	Hazard Rating	Centerline Rumble Strip	Passing Lanes	TWLT Lane	Lighting	Automated Speed Enforcement
1	Rural Two-Lane Segment Two-lane Undivided	534+24.000	570+00.000	3,576.00	0.6773	2022: 986; 2023: 987; 2024-2025: 988; 2026: 989; 2027-2028: 990; 2029: 991; 2030-2031: 992; 2032: 993; 2033-2034: 994; 2035: 995; 2036-2037: 996; 2038: 997; 2039-2040: 998; 2041: 999; 2042: 1,000	12.00	12.00	4.00	4.00	0.00	13.0	4	false	0	false	false	false
2	Rural Two-Lane Segment Two-lane Undivided	570+00.000	596+34.000	2,634.00	0.4989	2022: 7,100; 2023: 7,185; 2024: 7,270; 2025: 7,355; 2026: 7,440; 2027: 7,525; 2028: 7,610; 2029: 7,695; 2030: 7,780; 2031: 7,865; 2032: 7,950; 2033: 8,035; 2034: 8,120; 2035: 8,205; 2036: 8,290; 2037: 8,375; 2038: 8,460; 2039: 8,545; 2040: 8,630; 2041: 8,715; 2042: 8,800	12.00	12.00	6.00	6.00	0.00	8.0	3	false	0	false	false	false

Table 2. Evaluation Intersection - Section 1

Inter. No.	Title	Type	Location (Sta. ft)	Major AADT	Minor AADT	Legs	Traffic Control	Major road approaches w/Left Turn Lanes	Major road approaches w/Right Turn Lanes	Skew1	Skew2	Lighted at Night
3	Intersection Hawkeye-160 (v1)	Rural Two-Lane Intersection Four-Legged w/STOP control	570+75.000	2022: 7,100; 2023: 7,185; 2024: 7,270; 2025: 7,355; 2026: 7,440; 2027: 7,525; 2028: 7,610; 2029: 7,695; 2030: 7,780; 2031: 7,865; 2032: 7,950; 2033: 8,035; 2034: 8,120; 2035: 8,205; 2036: 8,290; 2037: 8,375; 2038: 8,460; 2039: 8,545; 2040: 8,630; 2041: 8,715; 2042: 8,800	2022-2025: 55; 2026-2029: 56; 2030-2033: 57; 2034-2037: 58; 2038-2041: 59; 2042: 60	4	Stop-Controlled	0	0	0.00	0.00	false
4	Intersection C-V-160 (v1)	Rural Two-Lane Intersection Four-Legged w/STOP control	589+95.000	2022: 7,100; 2023: 7,185; 2024: 7,270; 2025: 7,355; 2026: 7,440; 2027: 7,525; 2028: 7,610; 2029: 7,695; 2030: 7,780; 2031: 7,865; 2032: 7,950; 2033: 8,035; 2034: 8,120; 2035: 8,205; 2036: 8,290; 2037: 8,375; 2038: 8,460; 2039: 8,545; 2040: 8,630; 2041: 8,715; 2042: 8,800	2022: 1,600; 2023: 1,620; 2024: 1,640; 2025: 1,660; 2026: 1,680; 2027: 1,700; 2028: 1,720; 2029: 1,740; 2030: 1,760; 2031: 1,780; 2032: 1,800; 2033: 1,820; 2034: 1,840; 2035: 1,860; 2036: 1,880; 2037: 1,900; 2038: 1,920; 2039: 1,940; 2040: 1,960; 2041: 1,980; 2042: 2,000	4	Stop-Controlled	0	0	0.63	0.63	false

Table 3. Evaluation Roundabout - Site (Section 1)

Inter. No.	Title	Type	Area Type	Legs	Location (Sta. ft)	Entering AADT
1	Roundabout NB Interchange (v1)	Roundabout 41R - Roundabout with 4 legs and a single circulating lane	Rural	4	572+50.000	Leg 1: 2022: 3,550; 2023: 3,592; 2024: 3,635; 2025: 3,677; 2026: 3,720; 2027: 3,762; 2028: 3,805; 2029: 3,847; 2030: 3,890; 2031: 3,932; 2032: 3,975; 2033: 4,017; 2034: 4,060; 2035: 4,102; 2036: 4,145; 2037: 4,187; 2038: 4,230; 2039: 4,272; 2040: 4,315; 2041: 4,357; 2042: 4,400; Leg 2: 2022: 2,600; 2023: 2,645; 2024: 2,690; 2025: 2,735; 2026: 2,780; 2027: 2,825; 2028: 2,870; 2029: 2,915; 2030: 2,960; 2031: 3,005; 2032: 3,050; 2033: 3,095; 2034: 3,140; 2035: 3,185; 2036: 3,230; 2037: 3,275; 2038: 3,320; 2039: 3,365; 2040: 3,410; 2041: 3,455; 2042: 3,500; Leg 3: 2022: 3,550; 2023: 3,592; 2024: 3,635; 2025: 3,677; 2026: 3,720; 2027: 3,762; 2028: 3,805; 2029: 3,847; 2030: 3,890; 2031: 3,932; 2032: 3,975; 2033: 4,017; 2034: 4,060; 2035: 4,102; 2036: 4,145; 2037: 4,187; 2038: 4,230; 2039: 4,272; 2040: 4,315; 2041: 4,357; 2042: 4,400; Leg 4: 2022-2042: 0
2	Roundabout SB Interchange (v1)	Roundabout 41R - Roundabout with 4 legs and a single circulating lane	Rural	4	580+00.000	Leg 1: 2022: 5,900; 2023: 5,965; 2024: 6,030; 2025: 6,095; 2026: 6,160; 2027: 6,225; 2028: 6,290; 2029: 6,355; 2030: 6,420; 2031: 6,485; 2032: 6,550; 2033: 6,615; 2034: 6,680; 2035: 6,745; 2036: 6,810; 2037: 6,875; 2038: 6,940; 2039: 7,005; 2040: 7,070; 2041: 7,135; 2042: 7,200; Leg 2: 2022: 3,550; 2023: 3,592; 2024: 3,635; 2025: 3,677; 2026: 3,720; 2027: 3,762; 2028: 3,805; 2029: 3,847; 2030: 3,890; 2031: 3,932; 2032: 3,975; 2033: 4,017; 2034: 4,060; 2035: 4,102; 2036: 4,145; 2037: 4,187; 2038: 4,230; 2039: 4,272; 2040: 4,315; 2041: 4,357; 2042: 4,400; Leg 3: 2022-2042: 0; Leg 4: 2022: 3,550; 2023: 3,592; 2024: 3,635; 2025: 3,677; 2026: 3,720; 2027: 3,762; 2028: 3,805; 2029: 3,847; 2030: 3,890; 2031: 3,932; 2032: 3,975; 2033: 4,017; 2034: 4,060; 2035: 4,102; 2036: 4,145; 2037: 4,187; 2038: 4,230; 2039: 4,272; 2040: 4,315; 2041: 4,357; 2042: 4,400

Table 4. User Defined CMF Used in the Eval Intersection CPM Evaluation (Section 1)

Site No.	Name	Start CMF Year	End CMF Year	Severity	CMF Value
1	Roundabout	2020	2042		
2	Roundabout				

Table 5. Predicted Highway Crash Rates and Frequencies Summary (Section 1)

First Year of Analysis	**2022**
Last Year of Analysis	**2042**
Evaluated Length (mi)	**1.1761**
Average Future Road AADT (vpd)	**3,944**
Predicted Crashes	
Total Crashes	**157.19**
Fatal and Injury Crashes	**53.58**
Property-Damage-Only Crashes	**103.61**
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	**34**
Percent Property-Damage-Only Crashes (%)	**66**
Predicted Crash Rate	
Crash Rate (crashes/mi/yr)	**6.3644**
FI Crash Rate (crashes/mi/yr)	**2.1693**
PDO Crash Rate (crashes/mi/yr)	**4.1951**
Predicted Travel Crash Rate	
Total Travel (million veh-mi)	**35.55**
Travel Crash Rate (crashes/million veh-mi)	**4.42**
Travel FI Crash Rate (crashes/million veh-mi)	**1.51**
Travel PDO Crash Rate (crashes/million veh-mi)	**2.91**

Table 6. Predicted Crash Frequencies and Rates by Highway Segment/Intersection (Section 1)

Segment Number/Intersection Name/Cross Road	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)	Predicted Intersection Travel Crash Rate (crashes/million veh)
1	534+24.000	570+00.000	0.6773	5.655	0.2693	0.0864	0.1828	0.3976	1.10	
2	570+00.000	596+34.000	0.4989	23.228	1.1061	0.3551	0.7510	2.2173	0.76	
Intersection Hawkeye-160 (v1)	570+75.000			10.391	0.4948	0.2133	0.2815			0.17
Roundabout NB Interchange (v1)	572+50.000			14.569	0.6937	0.0614	0.6324			0.16
Roundabout SB Interchange (v1)	580+00.000			17.784	0.8468	0.0790	0.7678			0.18
Intersection C-V-160 (v1)	589+95.000			85.568	4.0747	1.7562	2.3185			1.16
All Segments			1.1761	28.883	1.3754	0.4415	0.9339	1.1694	0.81	
All Intersections				128.311	6.1101	2.1099	4.0002			0.40
Total			1.1761	157.194	7.4854	2.5514	4.9341	6.3644		

Table 7. Predicted Crash Frequencies and Rates by Horizontal Design Element (Section 1)

Title	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
Tangent	534+24.000	596+34.000	1.1761	28.883	1.3754	0.4415	0.9339	1.1694	0.96

Table 8. Predicted Crash Frequencies by Year (Section 1)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2022	6.67	2.25	33.759	4.42	66.241
2023	6.75	2.28	33.792	4.47	66.208
2024	6.83	2.31	33.824	4.52	66.176
2025	6.91	2.34	33.855	4.57	66.145
2026	7.00	2.37	33.893	4.62	66.107
2027	7.08	2.40	33.924	4.67	66.076
2028	7.16	2.43	33.954	4.73	66.046
2029	7.24	2.46	33.984	4.78	66.016
2030	7.32	2.49	34.020	4.83	65.980
2031	7.40	2.52	34.049	4.88	65.951
2032	7.48	2.55	34.078	4.93	65.922
2033	7.56	2.58	34.107	4.98	65.893
2034	7.65	2.61	34.141	5.04	65.859
2035	7.73	2.64	34.169	5.09	65.831
2036	7.81	2.67	34.196	5.14	65.804
2037	7.89	2.70	34.224	5.19	65.776
2038	7.98	2.73	34.256	5.25	65.744
2039	8.06	2.76	34.283	5.30	65.717
2040	8.14	2.79	34.309	5.35	65.691
2041	8.22	2.82	34.335	5.40	65.665
2042	8.31	2.86	34.367	5.45	65.633
Total	157.19	53.58	34.085	103.61	65.915
Average	7.49	2.55	34.085	4.93	65.915

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 9. Predicted Crash Severity by Ramp Terminal or Roundabout (Section 1)

Seg. No.	Type	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)
1	Roundabout	0.0094	0.0931	0.5991	0.5876	13.2794
2	Roundabout	0.0118	0.1172	0.7541	0.7769	16.1235

Table 10. Predicted Crash Type Distribution (Section 1)

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Highway Segment	Collision with Animal	0.35	0.2	3.61	2.3	3.50	2.2
Highway Segment	Collision with Bicycle	0.04	0.0	0.02	0.0	0.06	0.0
Highway Segment	Other Single-vehicle Collision	0.07	0.0	0.57	0.4	0.61	0.4
Highway Segment	Overturned	0.34	0.2	0.29	0.2	0.72	0.5
Highway Segment	Collision with Pedestrian	0.07	0.0	0.02	0.0	0.09	0.1
Highway Segment	Run Off Road	5.05	3.2	9.90	6.3	15.05	9.6
Highway Segment	Total Single Vehicle Crashes	5.92	3.8	14.41	9.2	20.02	12.7
Highway Segment	Angle Collision	0.94	0.6	1.41	0.9	2.46	1.6
Highway Segment	Head-on Collision	0.32	0.2	0.06	0.0	0.46	0.3
Highway Segment	Other Multiple-vehicle Collision	0.24	0.2	0.59	0.4	0.78	0.5
Highway Segment	Rear-end Collision	1.53	1.0	2.39	1.5	4.10	2.6
Highway Segment	Sideswipe	0.35	0.2	0.74	0.5	1.07	0.7
Highway Segment	Total Multiple Vehicle Crashes	3.38	2.1	5.20	3.3	8.87	5.6
Highway Segment	Total Highway Segment Crashes	9.29	5.9	19.61	12.5	28.88	18.4
Intersection	Collision with Animal	0.25	0.2	1.18	0.7	1.37	0.9
Intersection	Collision with Bicycle	0.04	0.0	0.06	0.0	0.10	0.1
Intersection	Collision with Fixed Object	0.64	0.4	7.67	4.9	8.31	5.3
Intersection	Collision with Other Object	0.00	0.0	0.00	0.0	0.00	0.0
Intersection	Other Single-vehicle Collision	0.78	0.5	3.96	2.5	4.79	3.0
Intersection	Overturned	0.25	0.2	0.22	0.1	0.48	0.3
Intersection	Collision with Parked Vehicle	0.01	0.0	0.09	0.1	0.09	0.1
Intersection	Collision with Pedestrian	0.04	0.0	0.06	0.0	0.10	0.1
Intersection	Run Off Road	3.89	2.5	7.86	5.0	11.71	7.4
Intersection	Total Single Vehicle Crashes	5.89	3.7	21.09	13.4	26.95	17.1
Intersection	Angle Collision	22.34	14.2	23.71	15.1	46.08	29.3
Intersection	Head-on Collision	2.51	1.6	1.48	0.9	3.99	2.5
Intersection	Other Multiple-vehicle Collision	1.95	1.2	4.08	2.6	6.01	3.8
Intersection	Rear-end Collision	9.56	6.1	21.82	13.9	31.39	20.0
Intersection	Sideswipe	2.05	1.3	11.86	7.5	13.92	8.9
Intersection	Total Multiple Vehicle Crashes	38.42	24.4	62.95	40.0	101.39	64.5
Intersection	Total Intersection Crashes	44.31	28.2	84.03	53.4	128.34	81.6
	Total Crashes	53.60	34.1	103.64	65.9	157.22	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Appendix E

- Detected Operational Analysis

HCS7 Freeway Facilities Report

Project Information

Analyst	BSE	Date	11/23/2020
Agency	MoDOT	Analysis Year	2022
Jurisdiction	Poplar Bluff, MO	Time Period Analyzed	2022 AM Peak
Project Description	NB Route 67 - 2022 AM - ALT 1 & 3	Unit	United States Customary

Facility Global Input

Jam Density, pc/mi/ln	190.0	Density at Capacity, pc/mi/ln	45.0
Queue Discharge Capacity Drop, %	7	Total Segments	5
Total Time Periods	1	Time Period Duration, min	15
Facility Length, mi	4.09		

Facility Segment Data

No.	Coded	Analyzed	Name	Length, ft	Lanes
1	Basic	Basic		7950	2
2	Diverge	Diverge	Route 160 Off-Ramp_	1500	2
3	Basic	Basic		2420	2
4	Merge	Merge	Route 160 On-Ramp_	1500	2
5	Basic	Basic		8200	2

Facility Segment Data

Segment 1: Basic

Time Period	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.86	0.870	333	4700	0.07	65.0	2.6	A

Segment 2: Diverge

Time Period	PHF		fHV		Flow Rate (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R	Freeway	Ramp	
1	0.86	0.86	0.870	0.952	333	39	4700	2100	0.07	0.02	59.5	59.5	2.8	1.3	A

Segment 3: Basic

Time Period	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.86	0.870	290	4700	0.06	64.8	2.2	A

Segment 4: Merge

Time Period	PHF		fHV		Flow Rate (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R	Freeway	Ramp	
1	0.86	0.86	0.870	0.909	868	578	4700	2100	0.18	0.28	59.6	59.6	7.3	6.0	A

Segment 5: Basic

Time Period	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS

1	0.86	0.870	894	4700	0.19	65.0	6.9	A

Facility Time Period Results

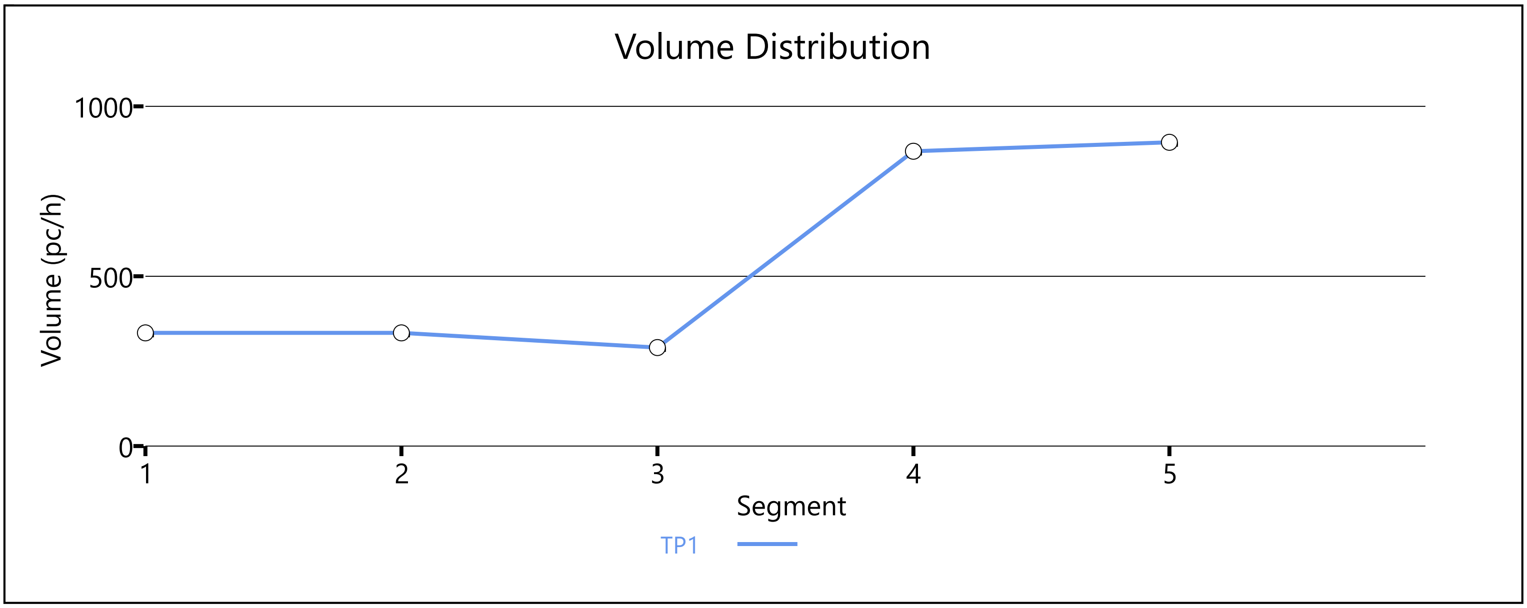
T	Speed, mi/h	Density, pc/mi/ln	Density, veh/mi/ln	Travel Time, min	LOS
1	64.1	4.5	4.0	3.80	A

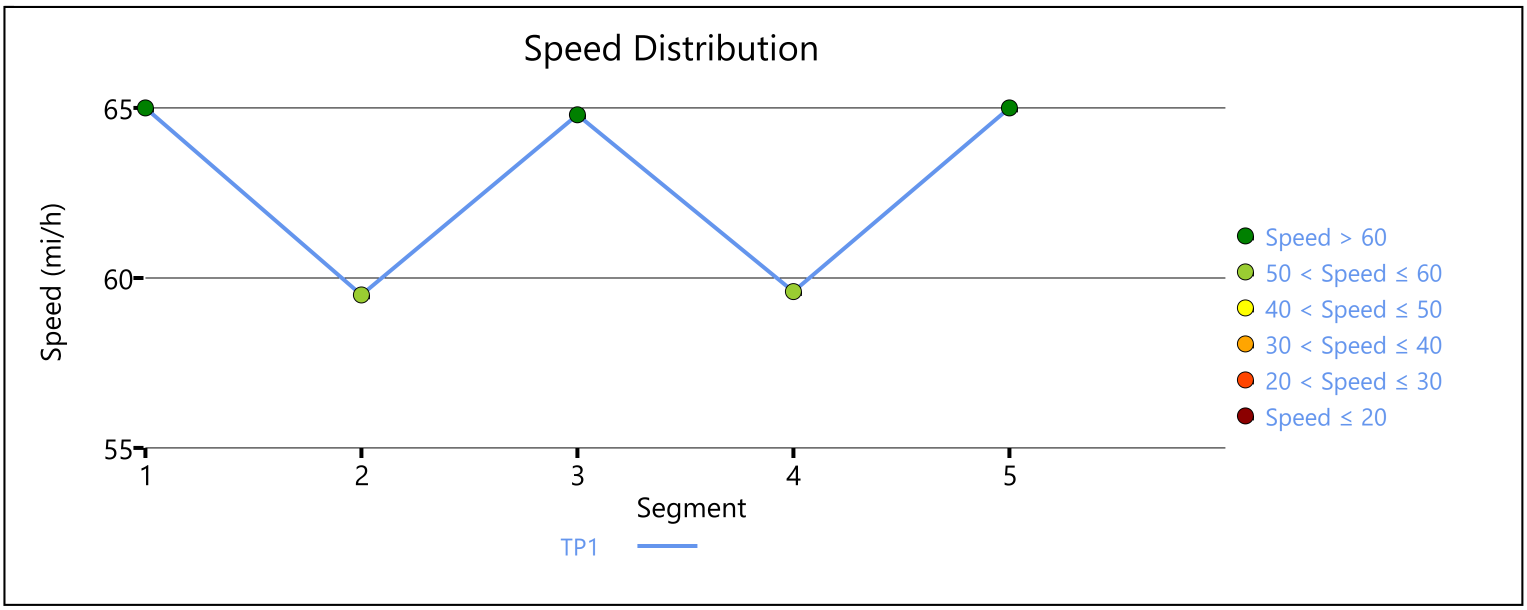
Facility Overall Results

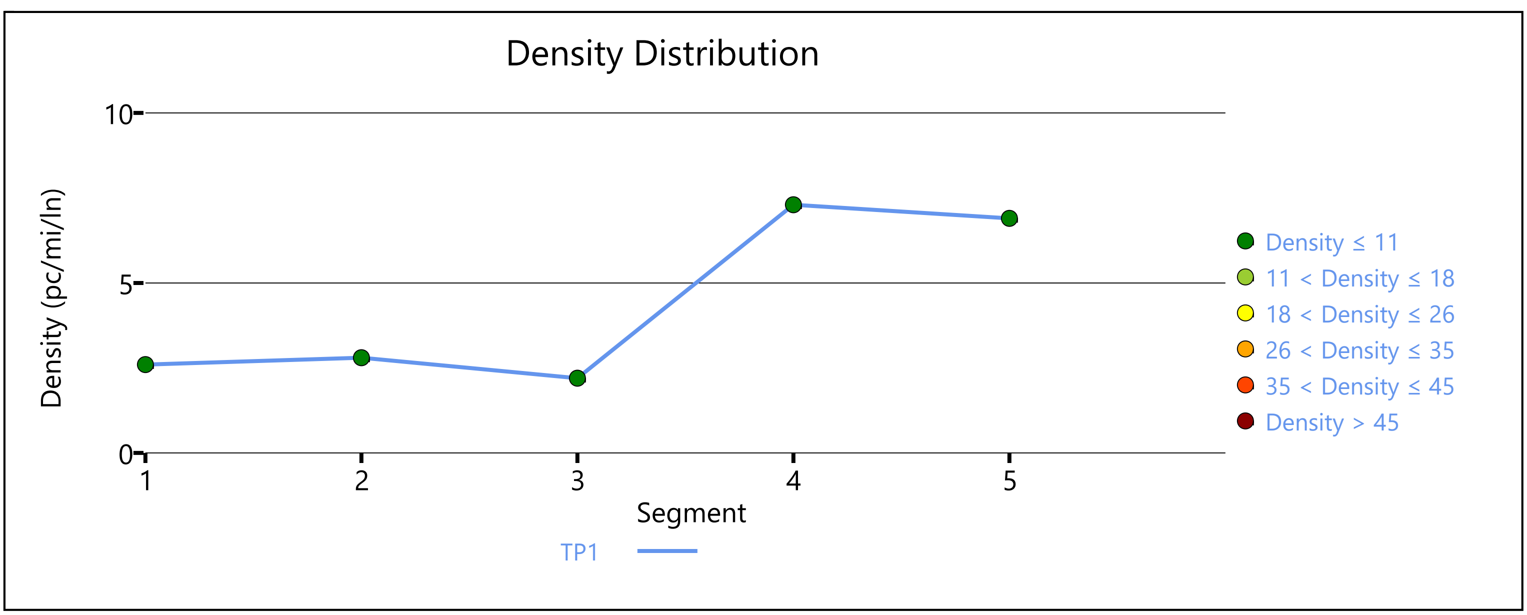
Space Mean Speed, mi/h	64.1	Density, veh/mi/ln	4.0
Average Travel Time, min	3.80	Density, pc/mi/ln	4.5

Messages

Comments


Volume Distribution
1000
500
0
Volume (pc/h)
1
2
3
4
5
Segment
TP1


Speed Distribution
65
60
55
Speed (mi/h)
1
2
3
4
5
Segment
TP1
Speed > 60
50 < Speed ≤ 60
40 < Speed ≤ 50
30 < Speed ≤ 40
20 < Speed ≤ 30
Speed ≤ 20


Density Distribution
10
5
0
Density (pc/mi/ln)
1
2
3
4
5
Segment
TP1
Density ≤ 11
11 < Density ≤ 18
18 < Density ≤ 26
26 < Density ≤ 35
35 < Density ≤ 45
Density > 45

HCS7 Freeway Facilities Report

Project Information

Analyst	BSE	Date	11/23/2020
Agency	MoDOT	Analysis Year	2022
Jurisdiction	Poplar Bluff, MO	Time Period Analyzed	2022 AM Peak
Project Description	NB Route 67 - 2022 AM - ALT 2	Unit	United States Customary

Facility Global Input

Jam Density, pc/mi/ln	190.0	Density at Capacity, pc/mi/ln	45.0
Queue Discharge Capacity Drop, %	7	Total Segments	5
Total Time Periods	1	Time Period Duration, min	15
Facility Length, mi	4.09		

Facility Segment Data

No.	Coded	Analyzed	Name	Length, ft	Lanes
1	Basic	Basic		7950	2
2	Diverge	Diverge	Route 160 Off-Ramp_	1500	2
3	Basic	Basic		1080	2
4	Merge	Merge	Route 160 On-Ramp_	1500	2
5	Basic	Basic		9540	2

Facility Segment Data

Segment 1: Basic

Time Period	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.86	0.870	333	4700	0.07	65.0	2.6	A

Segment 2: Diverge

Time Period	PHF		fHV		Flow Rate (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R	Freeway	Ramp	
1	0.86	0.86	0.870	0.952	333	39	4700	2100	0.07	0.02	59.5	59.5	2.8	1.3	A

Segment 3: Basic

Time Period	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.86	0.870	290	4700	0.06	64.3	2.2	A

Segment 4: Merge

Time Period	PHF		fHV		Flow Rate (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R	Freeway	Ramp	
1	0.86	0.86	0.870	0.909	868	578	4700	2000	0.18	0.29	59.7	59.7	7.3	3.1	A

Segment 5: Basic

Time Period	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS

1	0.86	0.870	894	4700	0.19	65.0	6.9	A

Facility Time Period Results

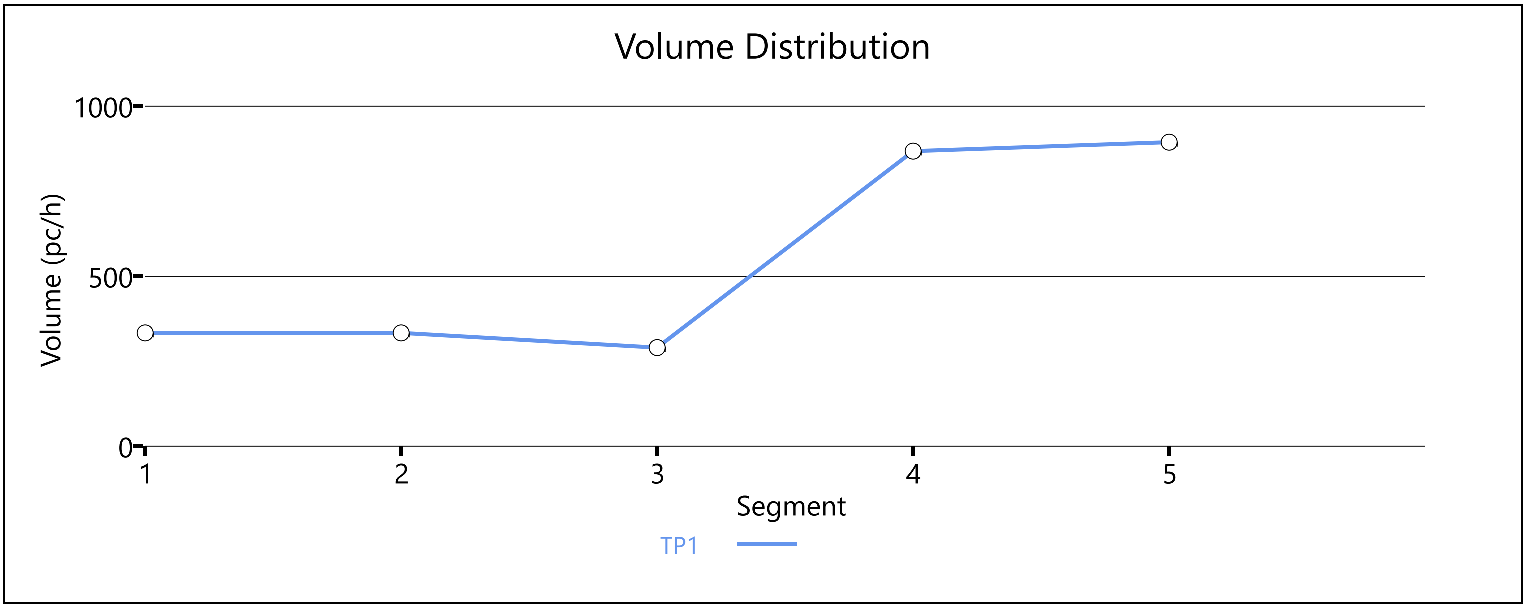
T	Speed, mi/h	Density, pc/mi/ln	Density, veh/mi/ln	Travel Time, min	LOS
1	64.2	4.8	4.2	3.80	A

Facility Overall Results

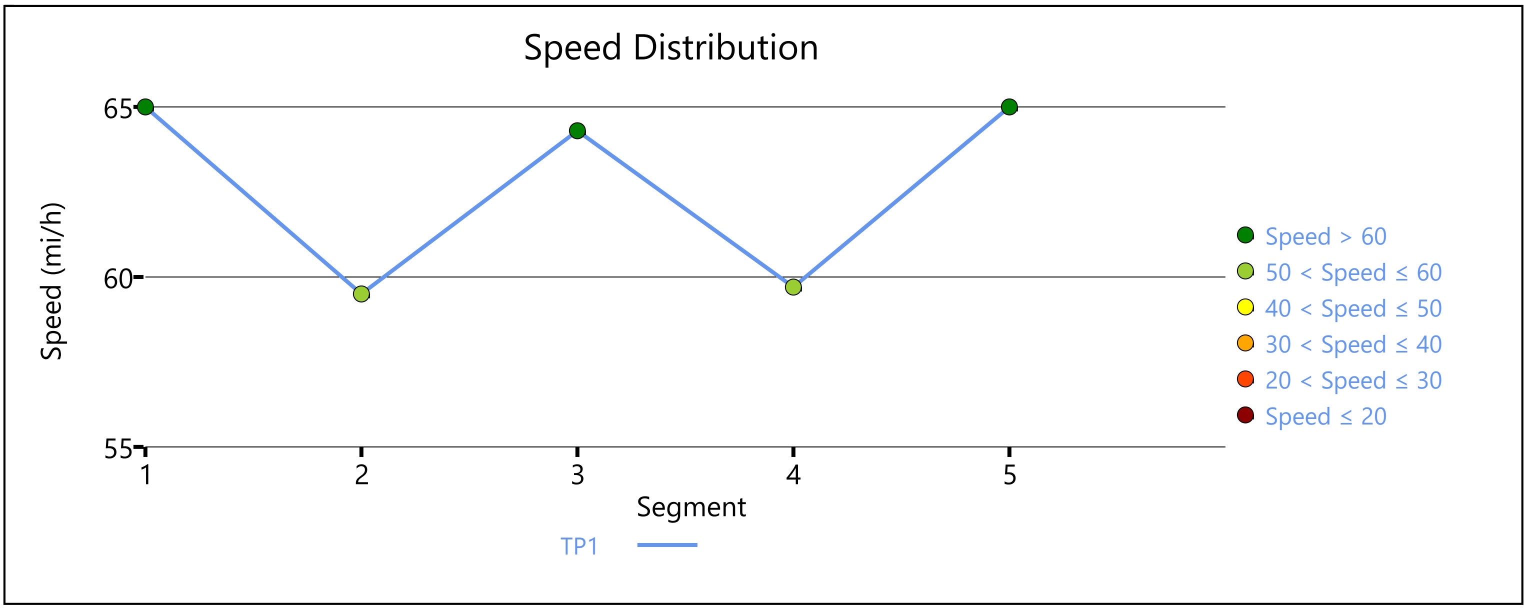
Space Mean Speed, mi/h	64.2	Density, veh/mi/ln	4.2
Average Travel Time, min	3.80	Density, pc/mi/ln	4.8

Messages

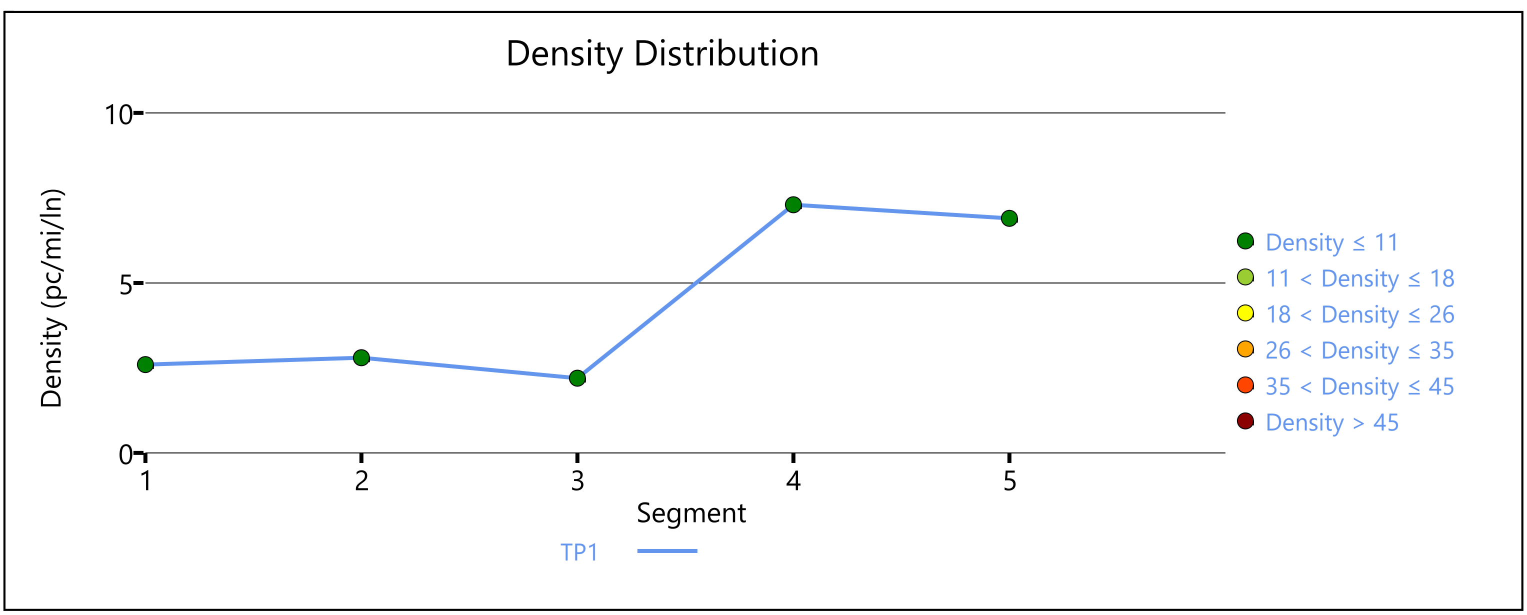
Comments



Volume Distribution
1000
500
0
Volume (pc/h)
1
2
3
4
5
Segment
TP1



Speed Distribution
65
60
55
Speed (mi/h)
1
2
3
4
5
Segment
TP1
Speed > 60
50 < Speed ≤ 60
40 < Speed ≤ 50
30 < Speed ≤ 40
20 < Speed ≤ 30
Speed ≤ 20



Density Distribution
10
5
0
Density (pc/mi/ln)
1
2
3
4
5
Segment
TP1
Density ≤ 11
11 < Density ≤ 18
18 < Density ≤ 26
26 < Density ≤ 35
35 < Density ≤ 45
Density > 45

HCS7 Freeway Facilities Report

Project Information

Analyst	BSE	Date	11/23/2020
Agency	MoDOT	Analysis Year	2022
Jurisdiction	Poplar Bluff, MO	Time Period Analyzed	2022 AM Peak
Project Description	SB Route 67 - 2022 AM - ALT 1, 2 & 3	Unit	United States Customary

Facility Global Input

Jam Density, pc/mi/ln	190.0	Density at Capacity, pc/mi/ln	45.0
Queue Discharge Capacity Drop, %	7	Total Segments	5
Total Time Periods	1	Time Period Duration, min	15
Facility Length, mi	4.09		

Facility Segment Data

No.	Coded	Analyzed	Name	Length, ft	Lanes
1	Basic	Basic		8500	2
2	Diverge	Diverge	Route 160 Off-Ramp_	1500	2
3	Basic	Basic		2070	2
4	Merge	Merge	Route 160 On-Ramp_	1500	2
5	Basic	Basic		8000	2

Facility Segment Data

Segment 1: Basic

Time Period	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.86	0.870	394	4700	0.08	65.0	3.0	A

Segment 2: Diverge

Time Period	PHF		fHV		Flow Rate (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R	Freeway	Ramp	
1	0.86	0.86	0.870	0.909	394	162	4700	2000	0.08	0.08	56.3	56.3	3.5	1.7	A

Segment 3: Basic

Time Period	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.86	0.870	225	4700	0.05	64.5	1.7	A

Segment 4: Merge

Time Period	PHF		fHV		Flow Rate (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R	Freeway	Ramp	
1	0.86	0.86	0.870	0.952	306	81	4700	2100	0.07	0.04	59.3	59.3	2.6	3.1	A

Segment 5: Basic

Time Period	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS

1	0.86	0.870	313	4700	0.07	65.0	2.4	A

Facility Time Period Results

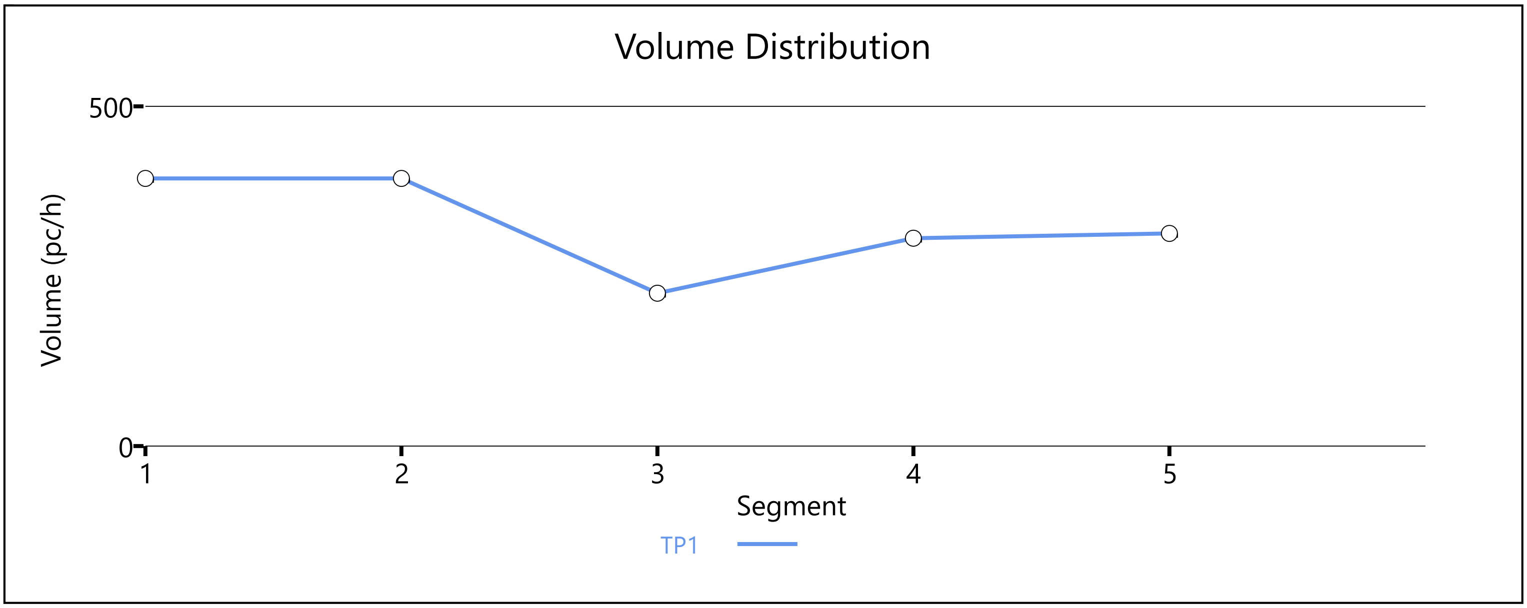
T	Speed, mi/h	Density, pc/mi/ln	Density, veh/mi/ln	Travel Time, min	LOS
1	63.8	2.7	2.3	3.80	A

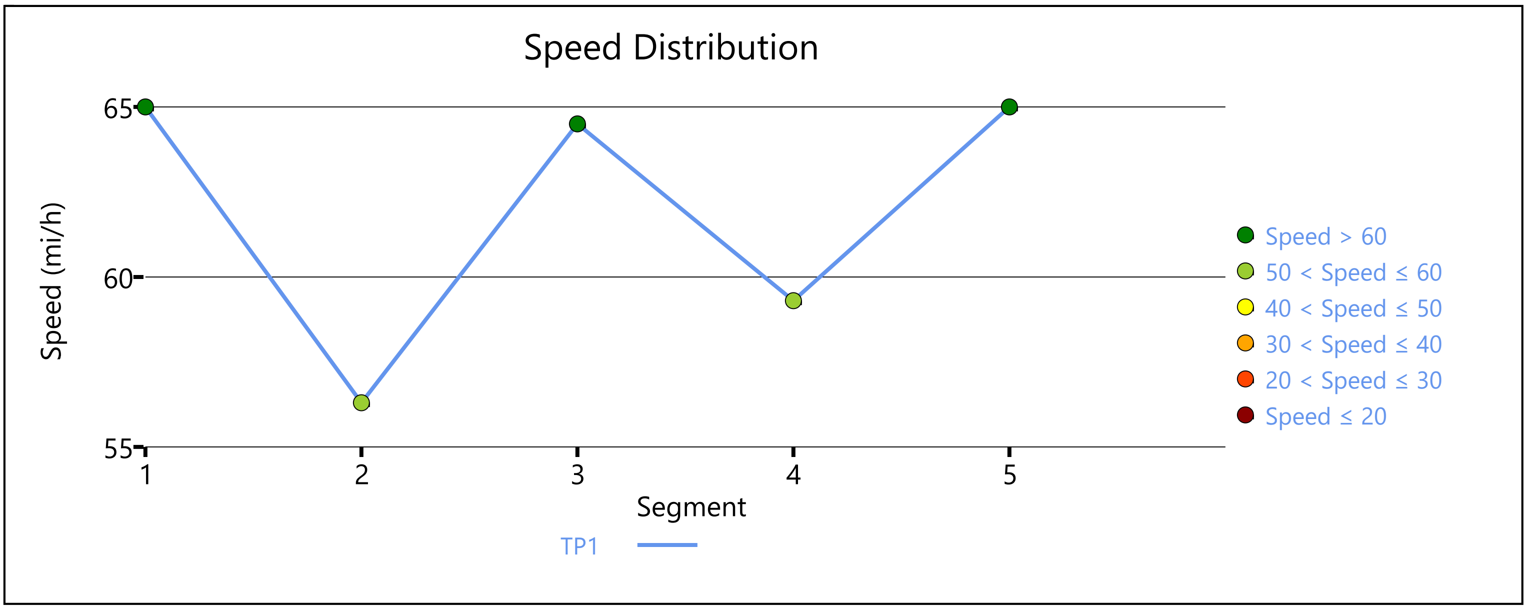
Facility Overall Results

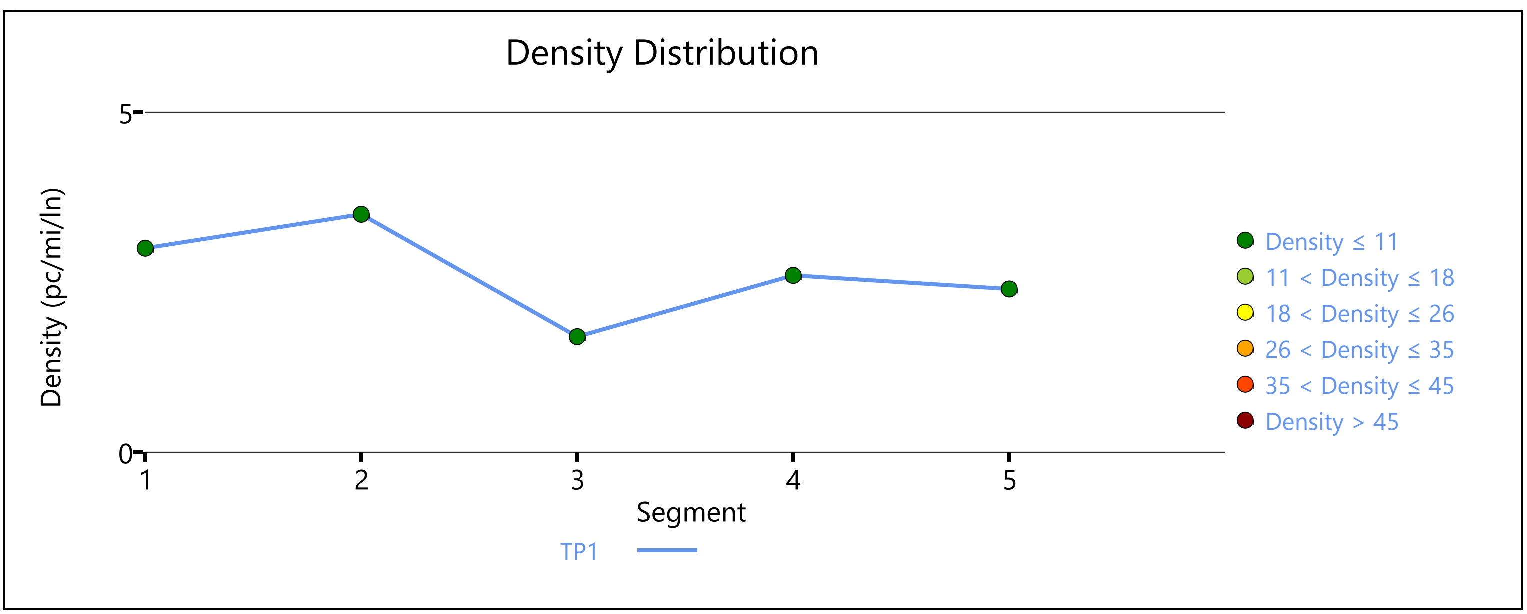
Space Mean Speed, mi/h	63.8	Density, veh/mi/ln	2.3
Average Travel Time, min	3.80	Density, pc/mi/ln	2.7

Messages

Comments


Volume Distribution
500
0
Volume (pc/h)
1
2
3
4
5
Segment
TP1


Speed Distribution
65
60
55
Speed (mi/h)
1
2
3
4
5
Segment
TP1
Speed > 60
50 < Speed ≤ 60
40 < Speed ≤ 50
30 < Speed ≤ 40
20 < Speed ≤ 30
Speed ≤ 20


Density Distribution
5
0
Density (pc/mi/ln)
1
2
3
4
5
Segment
TP1
Density ≤ 11
11 < Density ≤ 18
18 < Density ≤ 26
26 < Density ≤ 35
35 < Density ≤ 45
Density > 45

HCS7 Freeway Facilities Report

Project Information

Analyst	BSE	Date	11/23/2020
Agency	MoDOT	Analysis Year	2022
Jurisdiction	Poplar Bluff, MO	Time Period Analyzed	2022 PM Peak
Project Description	NB Route 67 - 2022 PM - ALT 1 & 3	Unit	United States Customary

Facility Global Input

Jam Density, pc/mi/ln	190.0	Density at Capacity, pc/mi/ln	45.0
Queue Discharge Capacity Drop, %	7	Total Segments	5
Total Time Periods	1	Time Period Duration, min	15
Facility Length, mi	4.09		

Facility Segment Data

No.	Coded	Analyzed	Name	Length, ft	Lanes
1	Basic	Basic		7950	2
2	Diverge	Diverge	Route 160 Off-Ramp_	1500	2
3	Basic	Basic		2420	2
4	Merge	Merge	Route 160 On-Ramp_	1500	2
5	Basic	Basic		8200	2

Facility Segment Data

Segment 1: Basic

Time Period	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.90	0.870	330	4700	0.07	65.0	2.5	A

Segment 2: Diverge

Time Period	PHF		fHV		Flow Rate (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R	Freeway	Ramp	
1	0.90	0.90	0.870	0.952	330	69	4700	2100	0.07	0.03	59.5	59.5	2.8	1.2	A

Segment 3: Basic

Time Period	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.90	0.870	254	4700	0.05	64.8	2.0	A

Segment 4: Merge

Time Period	PHF		fHV		Flow Rate (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R	Freeway	Ramp	
1	0.90	0.90	0.870	0.909	507	253	4700	2100	0.11	0.12	59.7	59.7	4.2	3.4	A

Segment 5: Basic

Time Period	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS

1	0.90	0.870	519	4700	0.11	65.0	4.0	A

Facility Time Period Results

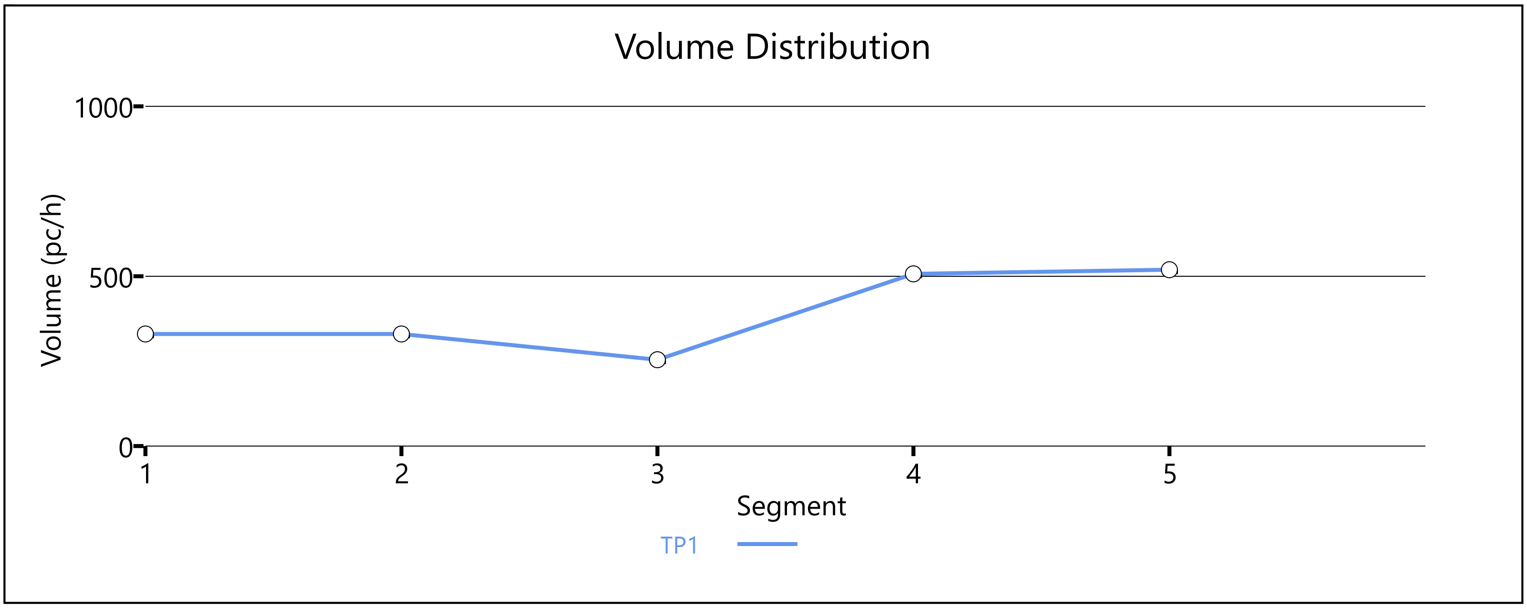
T	Speed, mi/h	Density, pc/mi/ln	Density, veh/mi/ln	Travel Time, min	LOS
1	64.2	3.2	2.8	3.80	A

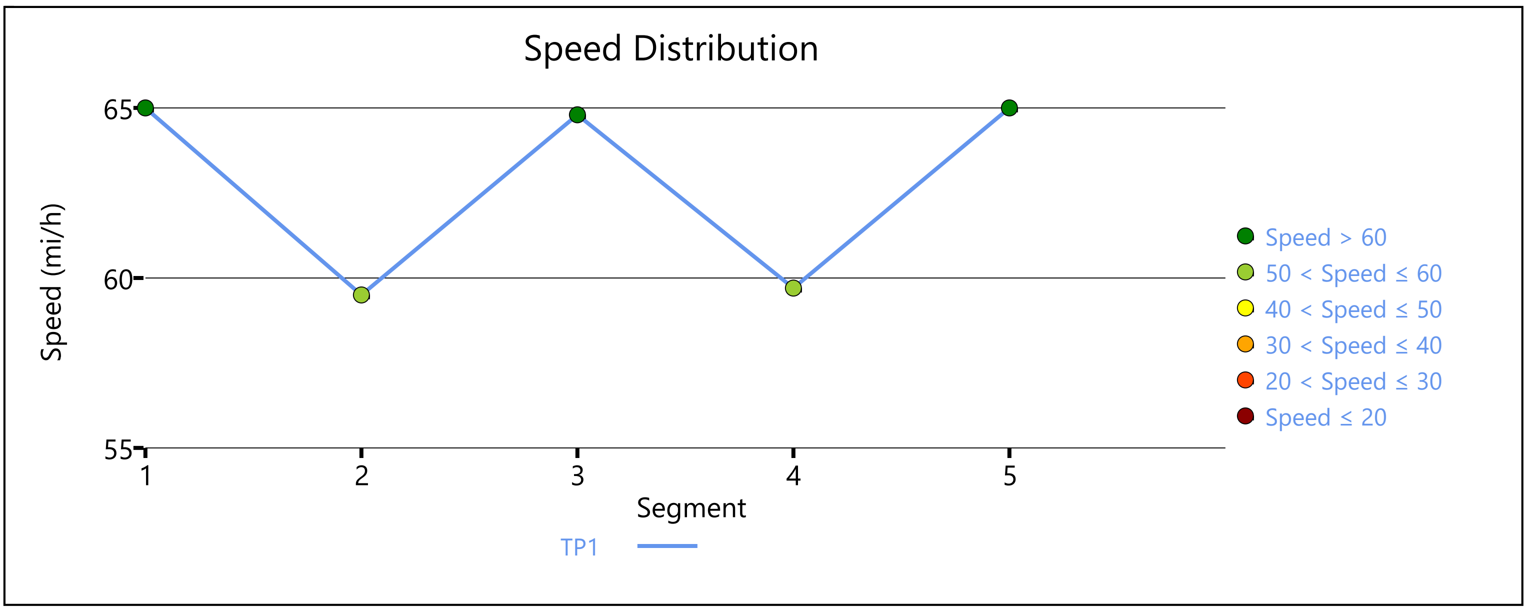
Facility Overall Results

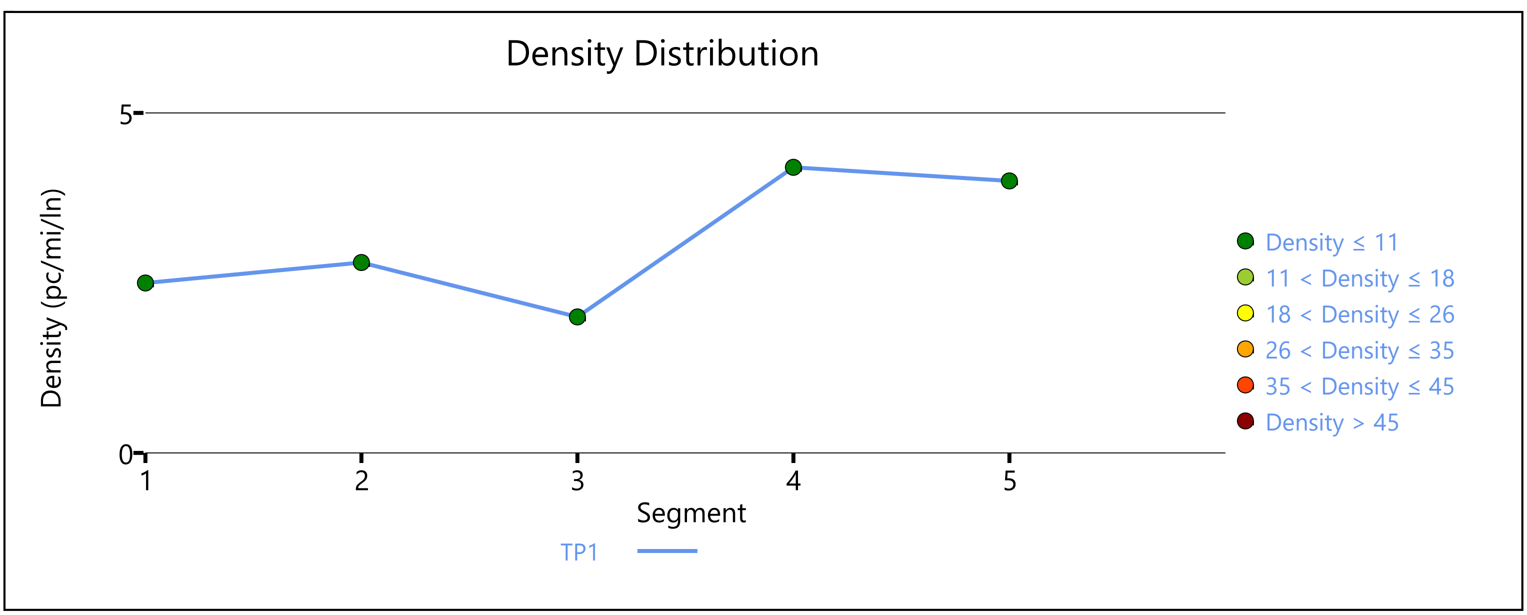
Space Mean Speed, mi/h	64.2	Density, veh/mi/ln	2.8
Average Travel Time, min	3.80	Density, pc/mi/ln	3.2

Messages

Comments


Volume Distribution
1000
500
0
Volume (pc/h)
1
2
3
4
5
Segment
TP1


Speed Distribution
65
60
55
Speed (mi/h)
1
2
3
4
5
Segment
TP1
Speed > 60
50 < Speed ≤ 60
40 < Speed ≤ 50
30 < Speed ≤ 40
20 < Speed ≤ 30
Speed ≤ 20


Density Distribution
5
0
Density (pc/mi/ln)
1
2
3
4
5
Segment
TP1
Density ≤ 11
11 < Density ≤ 18
18 < Density ≤ 26
26 < Density ≤ 35
35 < Density ≤ 45
Density > 45

HCS7 Freeway Facilities Report

Project Information

Analyst	BSE	Date	11/23/2020
Agency	MoDOT	Analysis Year	2022
Jurisdiction	Poplar Bluff, MO	Time Period Analyzed	2022 PM Peak
Project Description	NB Route 67 - 2022 PM - ALT 2	Unit	United States Customary

Facility Global Input

Jam Density, pc/mi/ln	190.0	Density at Capacity, pc/mi/ln	45.0
Queue Discharge Capacity Drop, %	7	Total Segments	5
Total Time Periods	1	Time Period Duration, min	15
Facility Length, mi	4.09		

Facility Segment Data

No.	Coded	Analyzed	Name	Length, ft	Lanes
1	Basic	Basic		7950	2
2	Diverge	Diverge	Route 160 Off-Ramp_	1500	2
3	Basic	Basic		1080	2
4	Merge	Merge	Route 160 On-Ramp_	1500	2
5	Basic	Basic		9540	2

Facility Segment Data

Segment 1: Basic

Time Period	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.90	0.870	330	4700	0.07	65.0	2.5	A

Segment 2: Diverge

Time Period	PHF		fHV		Flow Rate (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R	Freeway	Ramp	
1	0.90	0.90	0.870	0.952	330	69	4700	2100	0.07	0.03	59.5	59.5	2.8	1.2	A

Segment 3: Basic

Time Period	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.90	0.870	254	4700	0.05	64.3	2.0	A

Segment 4: Merge

Time Period	PHF		fHV		Flow Rate (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R	Freeway	Ramp	
1	0.90	0.90	0.870	0.909	507	253	4700	2000	0.11	0.13	59.8	59.8	4.2	0.4	A

Segment 5: Basic

Time Period	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS

1	0.90	0.870	519	4700	0.11	65.0	4.0	A

Facility Time Period Results

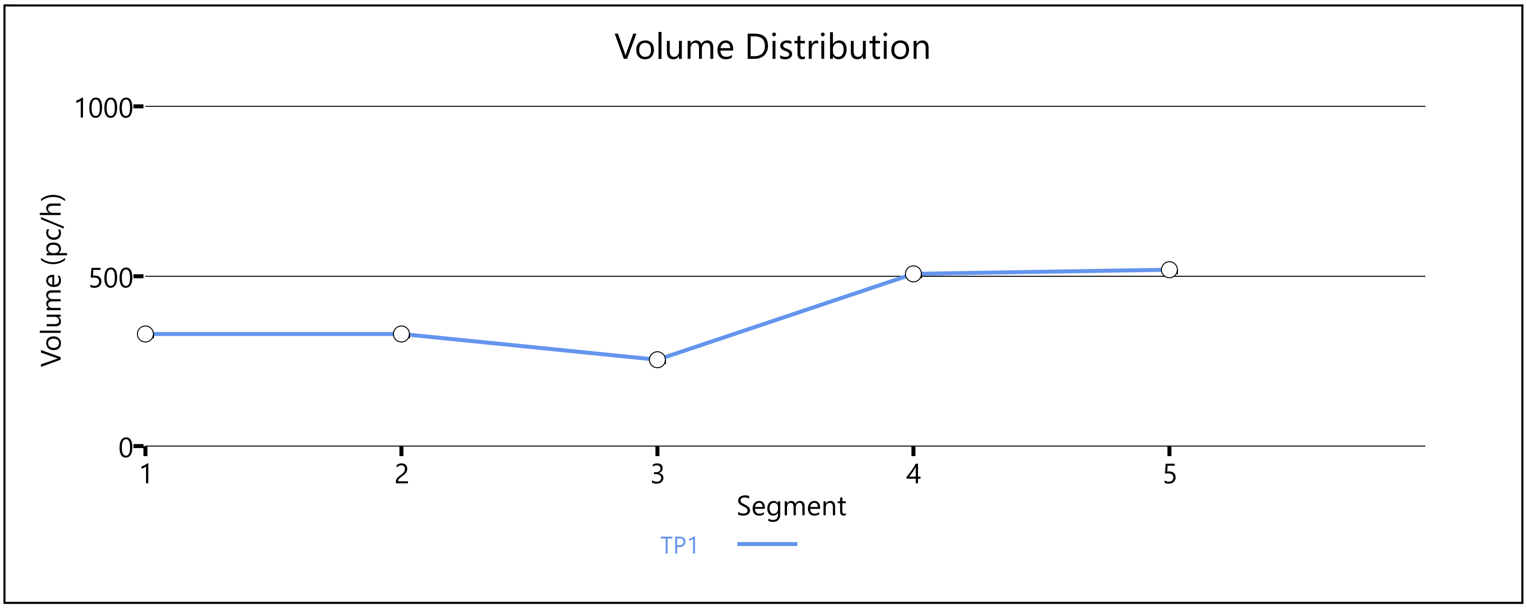
T	Speed, mi/h	Density, pc/mi/ln	Density, veh/mi/ln	Travel Time, min	LOS
1	64.2	3.3	2.9	3.80	A

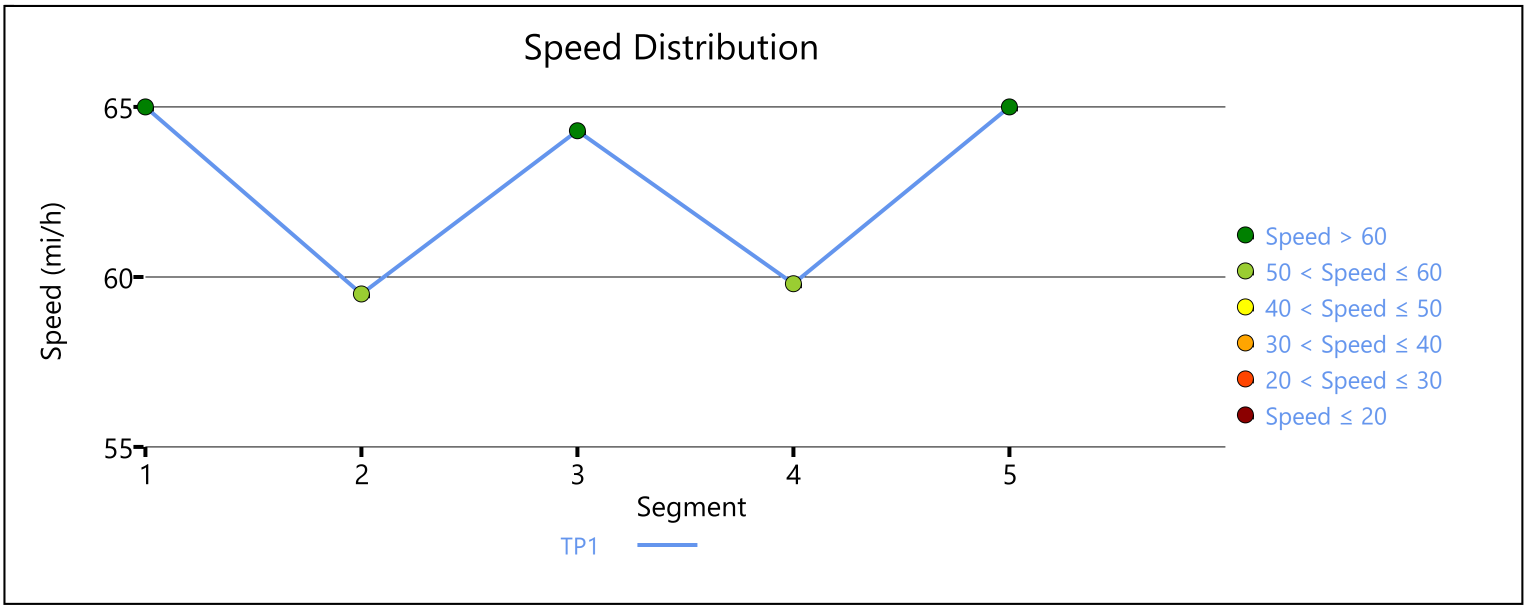
Facility Overall Results

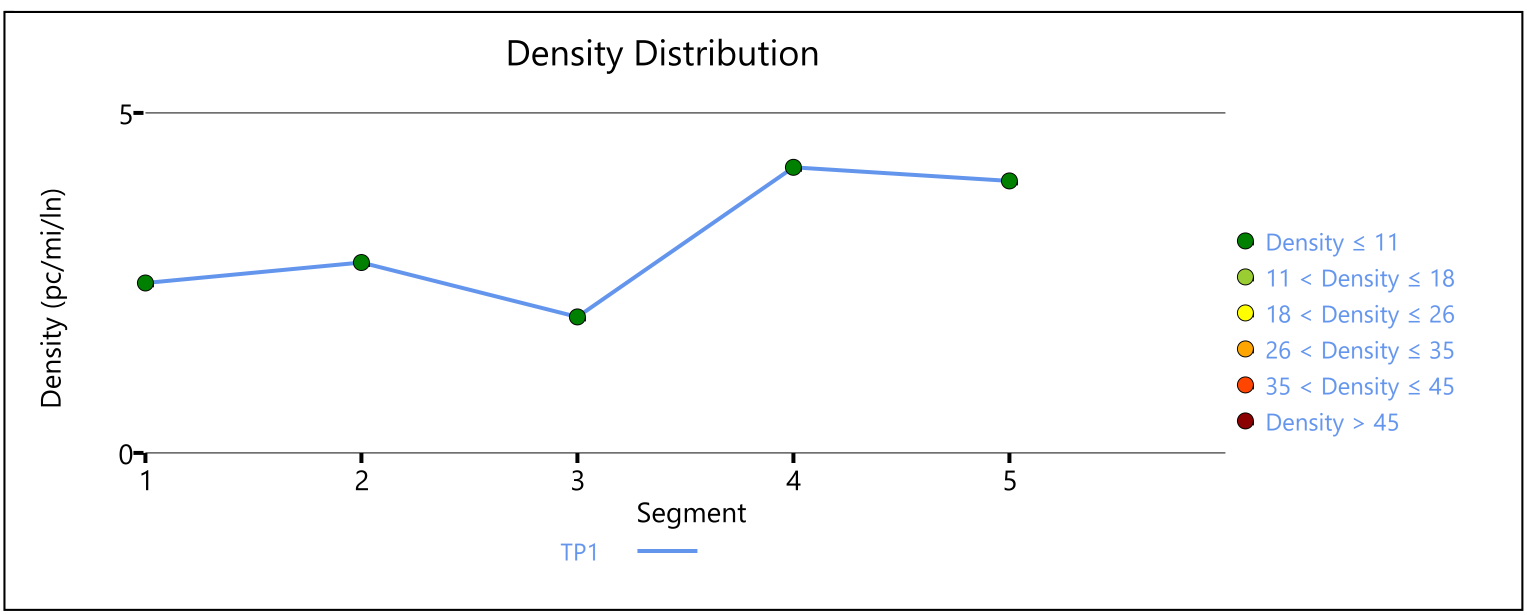
Space Mean Speed, mi/h	64.2	Density, veh/mi/ln	2.9
Average Travel Time, min	3.80	Density, pc/mi/ln	3.3

Messages

Comments







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HCS7 Freeway Facilities Report

Project Information

Analyst	BSE	Date	11/23/2020
Agency	MoDOT	Analysis Year	2022
Jurisdiction	Poplar Bluff, MO	Time Period Analyzed	2022 PM Peak
Project Description	SB Route 67 - 2022 PM - ALT 1, 2 & 3	Unit	United States Customary

Facility Global Input

Jam Density, pc/mi/ln	190.0	Density at Capacity, pc/mi/ln	45.0
Queue Discharge Capacity Drop, %	7	Total Segments	5
Total Time Periods	1	Time Period Duration, min	15
Facility Length, mi	4.09		

Facility Segment Data

No.	Coded	Analyzed	Name	Length, ft	Lanes
1	Basic	Basic		8500	2
2	Diverge	Diverge	Route 160 Off-Ramp_	1500	2
3	Basic	Basic		2070	2
4	Merge	Merge	Route 160 On-Ramp_	1500	2
5	Basic	Basic		8000	2

Facility Segment Data

Segment 1: Basic

Time Period	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.90	0.870	756	4700	0.16	65.0	5.8	A

Segment 2: Diverge

Time Period	PHF		fHV		Flow Rate (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R	Freeway	Ramp	
1	0.90	0.90	0.870	0.909	756	400	4700	2000	0.16	0.20	55.8	55.8	6.8	4.8	A

Segment 3: Basic

Time Period	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.90	0.870	338	4700	0.07	64.5	2.6	A

Segment 4: Merge

Time Period	PHF		fHV		Flow Rate (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R	Freeway	Ramp	
1	0.90	0.90	0.870	0.952	372	34	4700	2100	0.08	0.02	59.2	59.2	3.1	3.6	A

Segment 5: Basic

Time Period	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS

1	0.90	0.870	375	4700	0.08	65.0	2.9	A

Facility Time Period Results

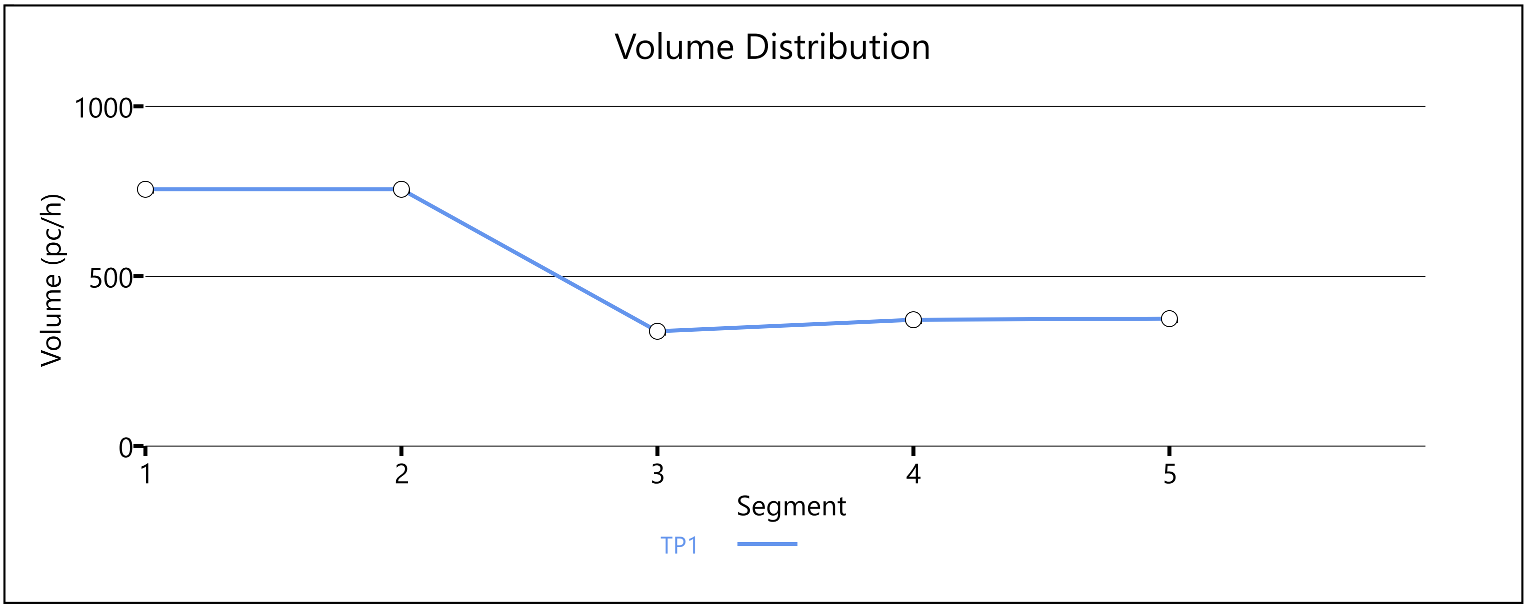
T	Speed, mi/h	Density, pc/mi/ln	Density, veh/mi/ln	Travel Time, min	LOS
1	63.7	4.3	3.7	3.80	A

Facility Overall Results

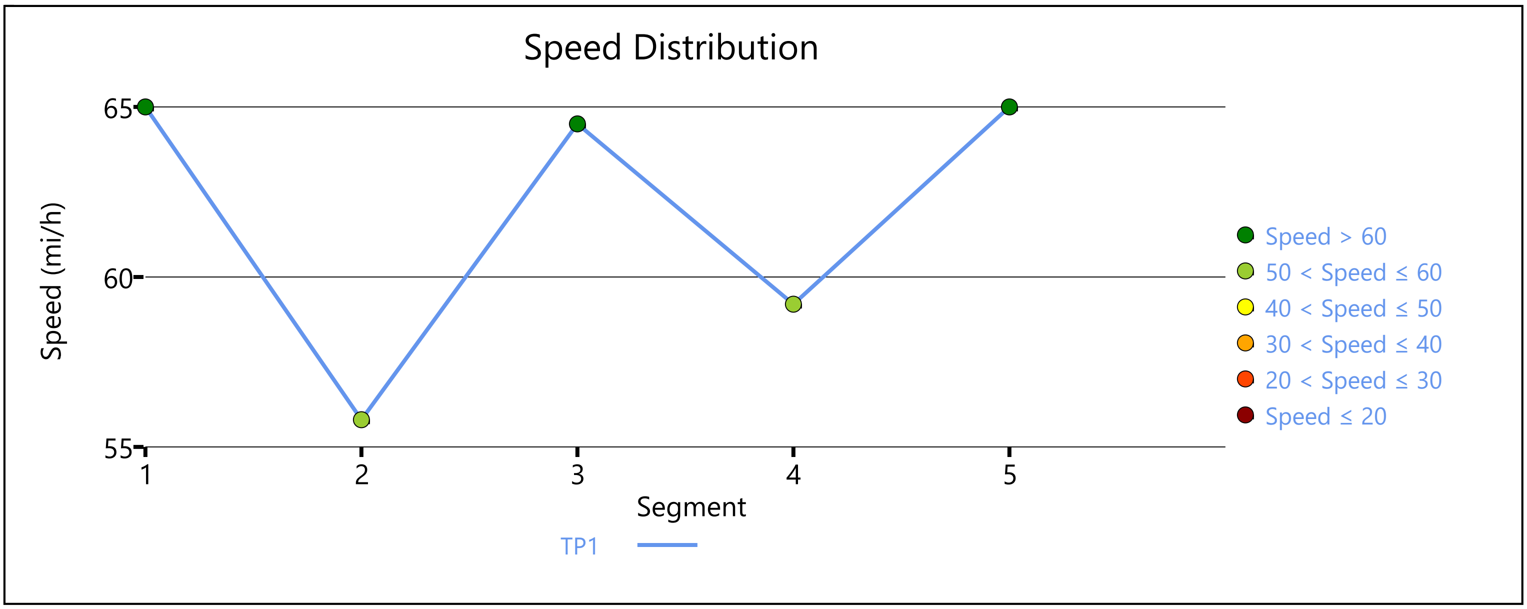
Space Mean Speed, mi/h	63.7	Density, veh/mi/ln	3.7
Average Travel Time, min	3.80	Density, pc/mi/ln	4.3

Messages

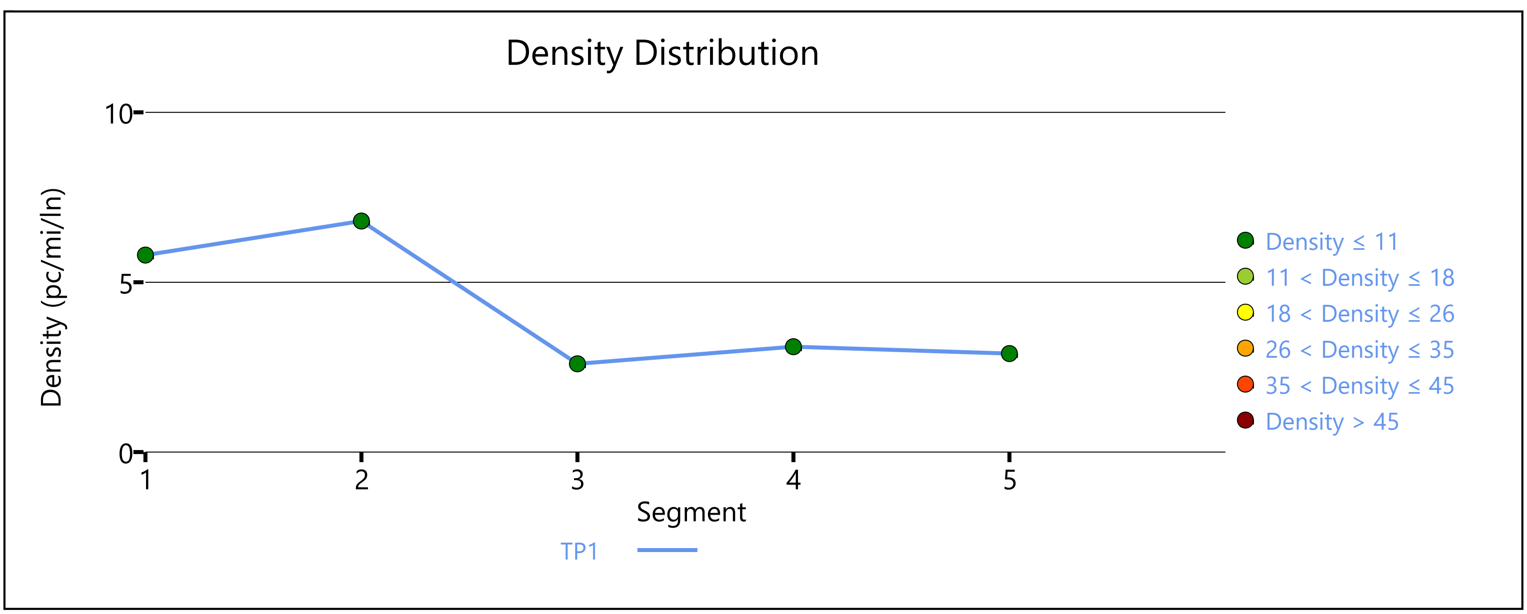
Comments



Volume Distribution
1000
500
0
Volume (pc/h)
1
2
3
4
5
Segment
TP1



Speed Distribution
65
60
55
Speed (mi/h)
1
2
3
4
5
Segment
TP1
Speed > 60
50 < Speed ≤ 60
40 < Speed ≤ 50
30 < Speed ≤ 40
20 < Speed ≤ 30
Speed ≤ 20



Density Distribution
10
5
0
Density (pc/mi/ln)
1
2
3
4
5
Segment
TP1
Density ≤ 11
11 < Density ≤ 18
18 < Density ≤ 26
26 < Density ≤ 35
35 < Density ≤ 45
Density > 45

HCS7 Freeway Facilities Report

Project Information

Analyst	BSE	Date	11/23/2020
Agency	MoDOT	Analysis Year	2042
Jurisdiction	Poplar Bluff, MO	Time Period Analyzed	2042 AM Peak
Project Description	NB Route 67 - 2042 AM - ALT 1 & 3	Unit	United States Customary

Facility Global Input

Jam Density, pc/mi/ln	190.0	Density at Capacity, pc/mi/ln	45.0
Queue Discharge Capacity Drop, %	7	Total Segments	5
Total Time Periods	1	Time Period Duration, min	15
Facility Length, mi	4.09		

Facility Segment Data

No.	Coded	Analyzed	Name	Length, ft	Lanes
1	Basic	Basic		7950	2
2	Diverge	Diverge	Route 160 Off-Ramp_	1500	2
3	Basic	Basic		2420	2
4	Merge	Merge	Route 160 On-Ramp_	1500	2
5	Basic	Basic		8200	2

Facility Segment Data

Segment 1: Basic

Time Period	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.86	0.870	446	4700	0.09	65.0	3.4	A

Segment 2: Diverge

Time Period	PHF		fHV		Flow Rate (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R	Freeway	Ramp	
1	0.86	0.86	0.870	0.952	446	53	4700	2100	0.09	0.03	59.5	59.5	3.7	2.2	A

Segment 3: Basic

Time Period	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.86	0.870	389	4700	0.08	64.8	3.0	A

Segment 4: Merge

Time Period	PHF		fHV		Flow Rate (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R	Freeway	Ramp	
1	0.86	0.86	0.870	0.909	1163	774	4700	2100	0.25	0.37	59.5	59.5	9.8	8.2	A

Segment 5: Basic

Time Period	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS

1	0.86	0.870	1198	4700	0.25	65.0	9.2	A

Facility Time Period Results

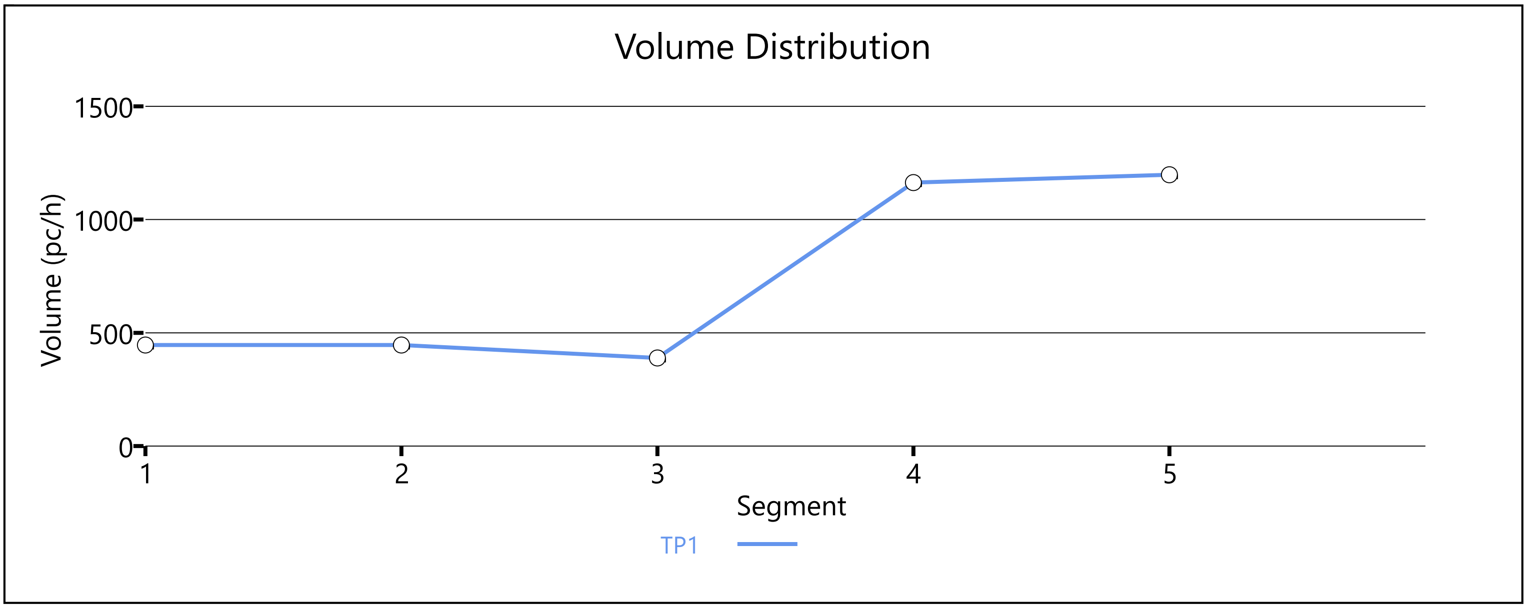
T	Speed, mi/h	Density, pc/mi/ln	Density, veh/mi/ln	Travel Time, min	LOS
1	64.1	6.0	5.3	3.80	A

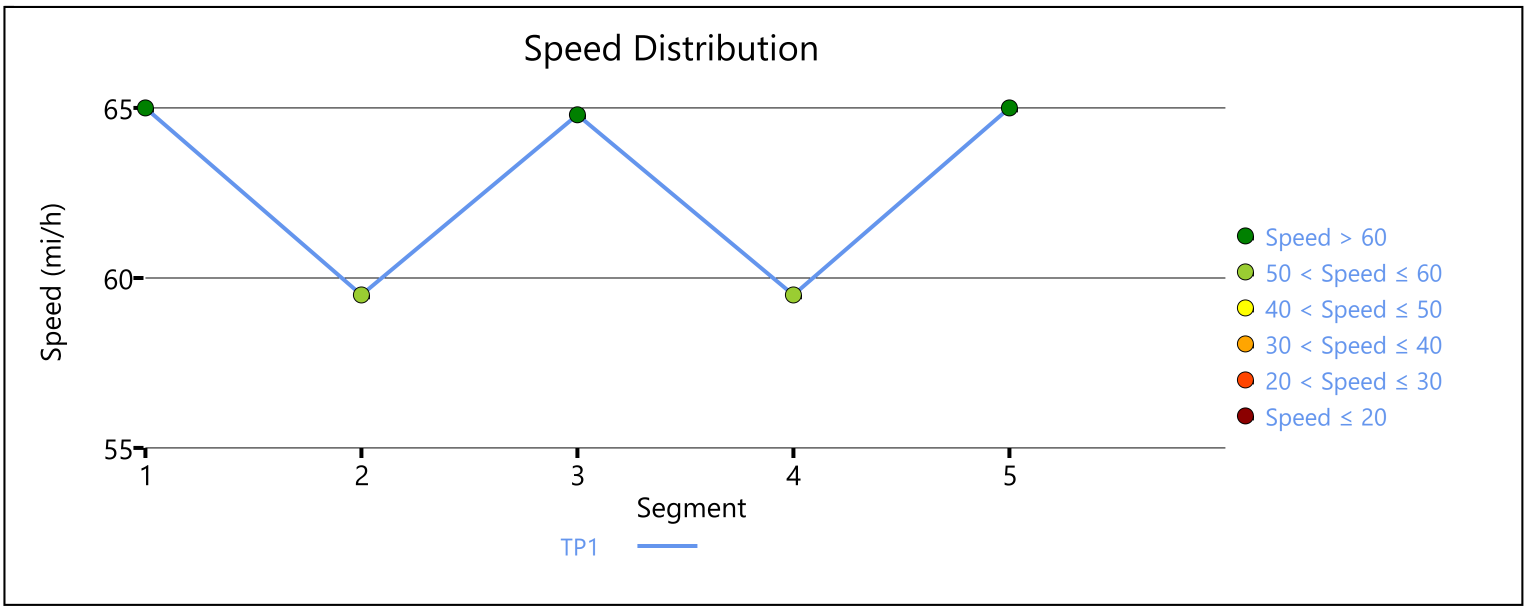
Facility Overall Results

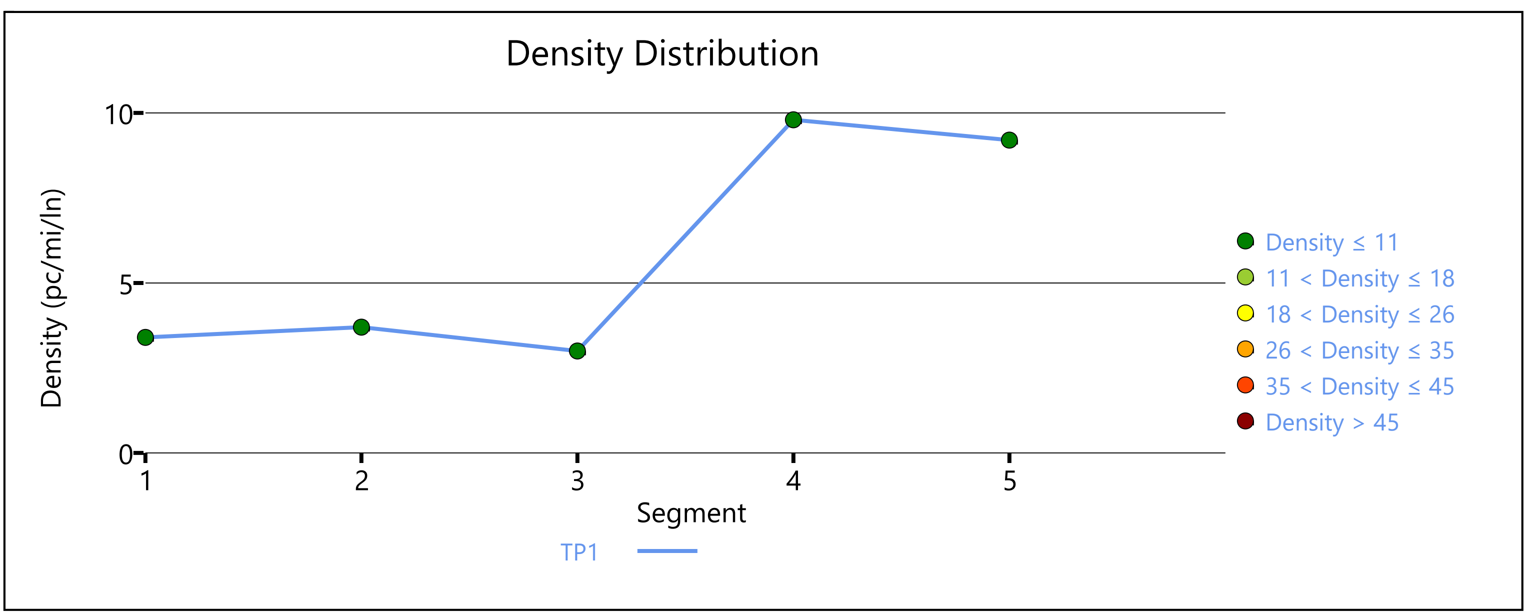
Space Mean Speed, mi/h	64.1	Density, veh/mi/ln	5.3
Average Travel Time, min	3.80	Density, pc/mi/ln	6.0

Messages

Comments


Volume Distribution
1500
1000
500
0
Volume (pc/h)
1
2
3
4
5
Segment
TP1


Speed Distribution
65
60
55
Speed (mi/h)
1
2
3
4
5
Segment
TP1
Speed > 60
50 < Speed ≤ 60
40 < Speed ≤ 50
30 < Speed ≤ 40
20 < Speed ≤ 30
Speed ≤ 20


Density Distribution
10
5
0
Density (pc/mi/ln)
1
2
3
4
5
Segment
TP1
Density ≤ 11
11 < Density ≤ 18
18 < Density ≤ 26
26 < Density ≤ 35
35 < Density ≤ 45
Density > 45

HCS7 Freeway Facilities Report

Project Information

Analyst	BSE	Date	11/23/2020
Agency	MoDOT	Analysis Year	2042
Jurisdiction	Poplar Bluff, MO	Time Period Analyzed	2042 AM Peak
Project Description	NB Route 67 - 2042 AM - ALT 2	Unit	United States Customary

Facility Global Input

Jam Density, pc/mi/ln	190.0	Density at Capacity, pc/mi/ln	45.0
Queue Discharge Capacity Drop, %	7	Total Segments	5
Total Time Periods	1	Time Period Duration, min	15
Facility Length, mi	4.09		

Facility Segment Data

No.	Coded	Analyzed	Name	Length, ft	Lanes
1	Basic	Basic		7950	2
2	Diverge	Diverge	Route 160 Off-Ramp_	1500	2
3	Basic	Basic		1080	2
4	Merge	Merge	Route 160 On-Ramp_	1500	2
5	Basic	Basic		9540	2

Facility Segment Data

Segment 1: Basic

Time Period	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.86	0.870	446	4700	0.09	65.0	3.4	A

Segment 2: Diverge

Time Period	PHF		fHV		Flow Rate (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R	Freeway	Ramp	
1	0.86	0.86	0.870	0.952	446	53	4700	2100	0.09	0.03	59.5	59.5	3.7	2.2	A

Segment 3: Basic

Time Period	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.86	0.870	389	4700	0.08	64.3	3.0	A

Segment 4: Merge

Time Period	PHF		fHV		Flow Rate (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R	Freeway	Ramp	
1	0.86	0.86	0.870	0.909	1163	774	4700	2000	0.25	0.39	59.6	59.6	9.8	5.3	A

Segment 5: Basic

Time Period	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS

1	0.86	0.870	1198	4700	0.25	65.0	9.2	A

Facility Time Period Results

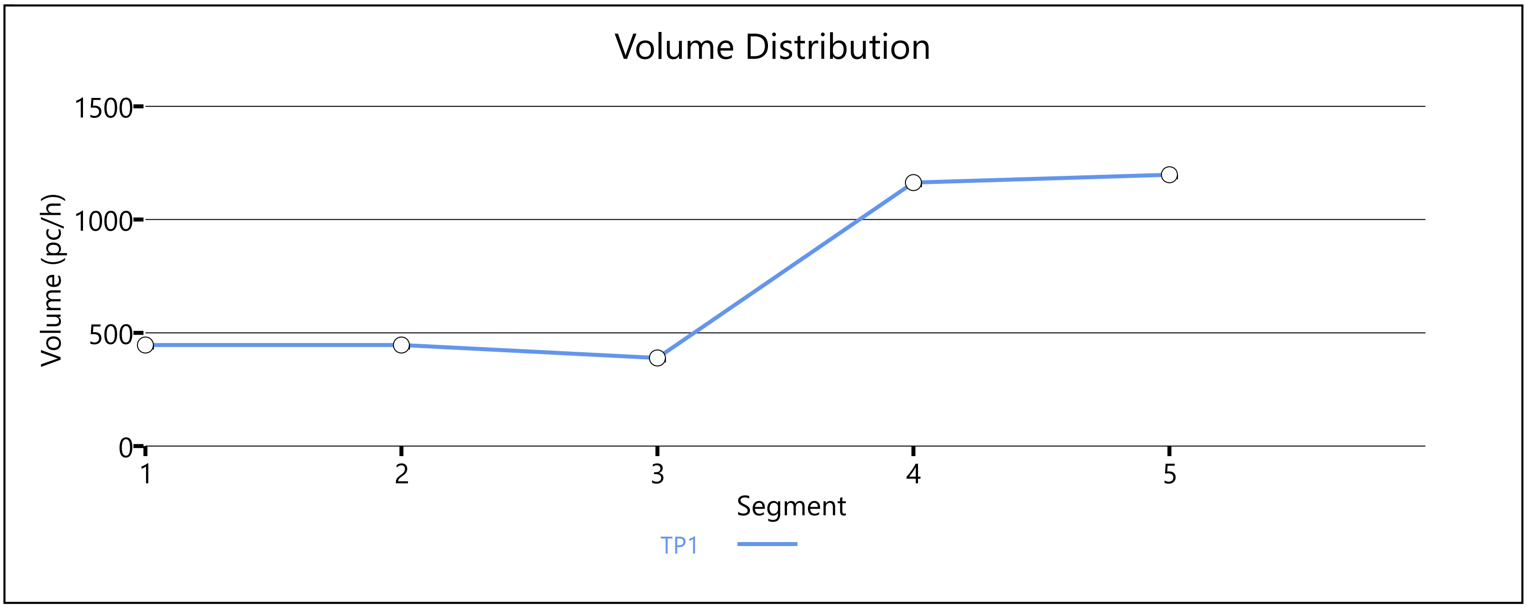
T	Speed, mi/h	Density, pc/mi/ln	Density, veh/mi/ln	Travel Time, min	LOS
1	64.2	6.4	5.6	3.80	A

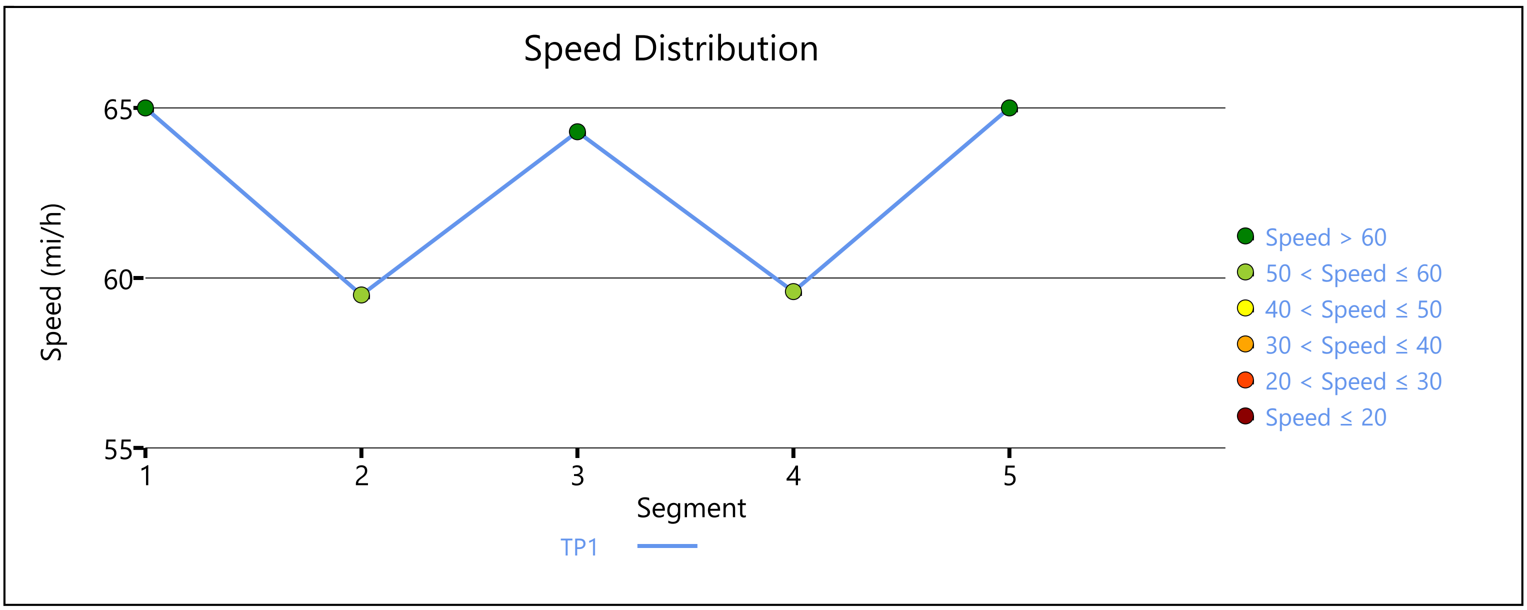
Facility Overall Results

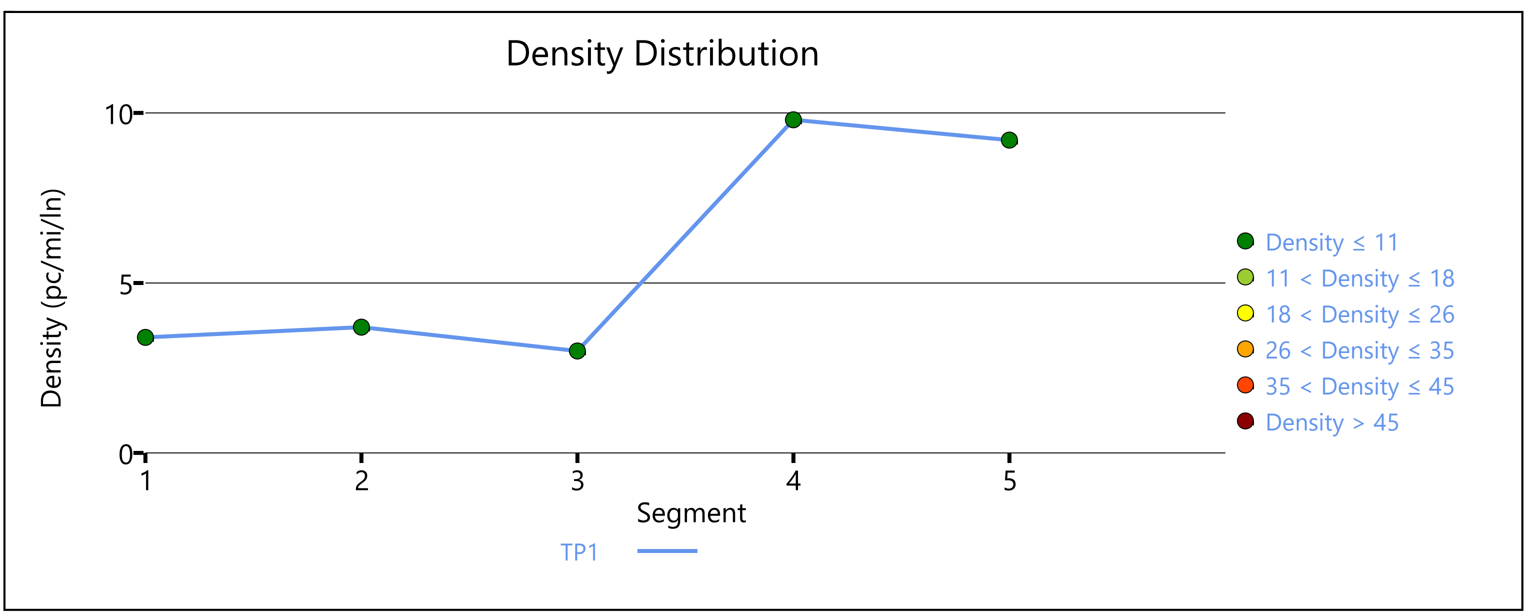
Space Mean Speed, mi/h	64.2	Density, veh/mi/ln	5.6
Average Travel Time, min	3.80	Density, pc/mi/ln	6.4

Messages

Comments


Volume Distribution
1500
1000
500
0
Volume (pc/h)
1
2
3
4
5
Segment
TP1


Speed Distribution
65
60
55
Speed (mi/h)
1
2
3
4
5
Segment
TP1
Speed > 60
50 < Speed ≤ 60
40 < Speed ≤ 50
30 < Speed ≤ 40
20 < Speed ≤ 30
Speed ≤ 20


Density Distribution
10
5
0
Density (pc/mi/ln)
1
2
3
4
5
Segment
TP1
Density ≤ 11
11 < Density ≤ 18
18 < Density ≤ 26
26 < Density ≤ 35
35 < Density ≤ 45
Density > 45

HCS7 Freeway Facilities Report

Project Information

Analyst	BSE	Date	11/23/2020
Agency	MoDOT	Analysis Year	2042
Jurisdiction	Poplar Bluff, MO	Time Period Analyzed	2042 AM Peak
Project Description	SB Route 67 - 2042 AM - ALT 1, 2 & 3	Unit	United States Customary

Facility Global Input

Jam Density, pc/mi/ln	190.0	Density at Capacity, pc/mi/ln	45.0
Queue Discharge Capacity Drop, %	7	Total Segments	5
Total Time Periods	1	Time Period Duration, min	15
Facility Length, mi	3.89		

Facility Segment Data

No.	Coded	Analyzed	Name	Length, ft	Lanes
1	Basic	Basic		8500	2
2	Diverge	Diverge	Route 160 Off-Ramp_	1500	2
3	Basic	Basic		1055	2
4	Merge	Merge	Route 160 On-Ramp_	1500	2
5	Basic	Basic		8000	2

Facility Segment Data

Segment 1: Basic

Time Period	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.86	0.870	478	4700	0.10	65.0	3.7	A

Segment 2: Diverge

Time Period	PHF		fHV		Flow Rate (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R	Freeway	Ramp	
1	0.86	0.90	0.870	0.909	478	188	4700	2000	0.10	0.09	56.3	56.3	4.2	2.4	A

Segment 3: Basic

Time Period	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.86	0.870	273	4700	0.06	63.9	2.1	A

Segment 4: Merge

Time Period	PHF		fHV		Flow Rate (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R	Freeway	Ramp	
1	0.86	0.90	0.870	0.952	368	95	4700	2100	0.08	0.05	59.2	59.2	3.1	3.5	A

Segment 5: Basic

Time Period	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS

1	0.86	0.870	381	4700	0.08	65.0	2.9	A

Facility Time Period Results

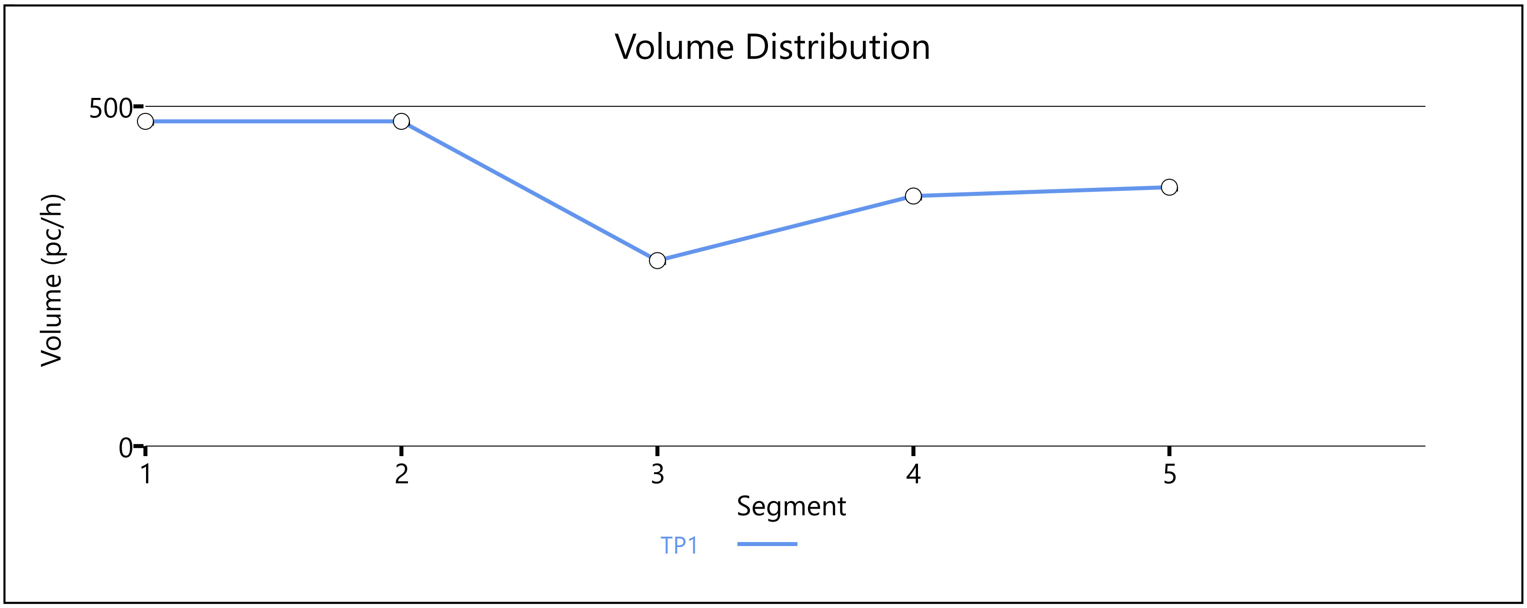
T	Speed, mi/h	Density, pc/mi/ln	Density, veh/mi/ln	Travel Time, min	LOS
1	63.8	3.3	2.9	3.70	A

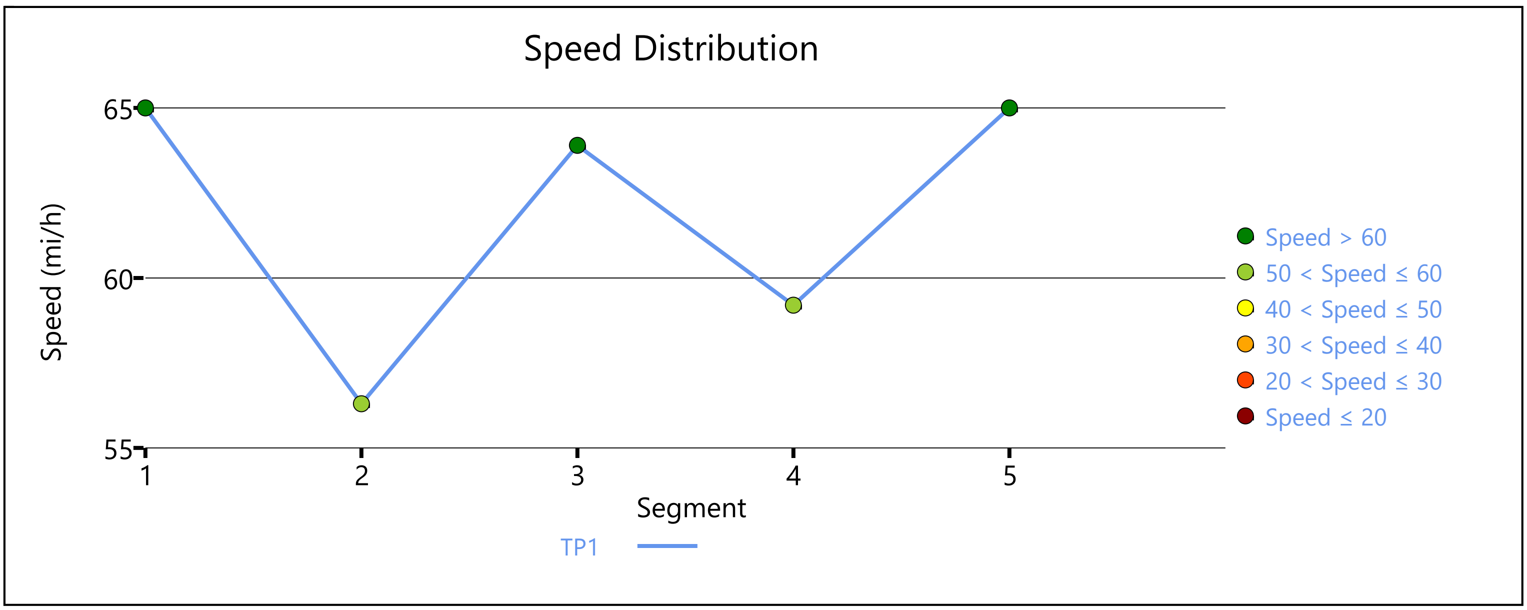
Facility Overall Results

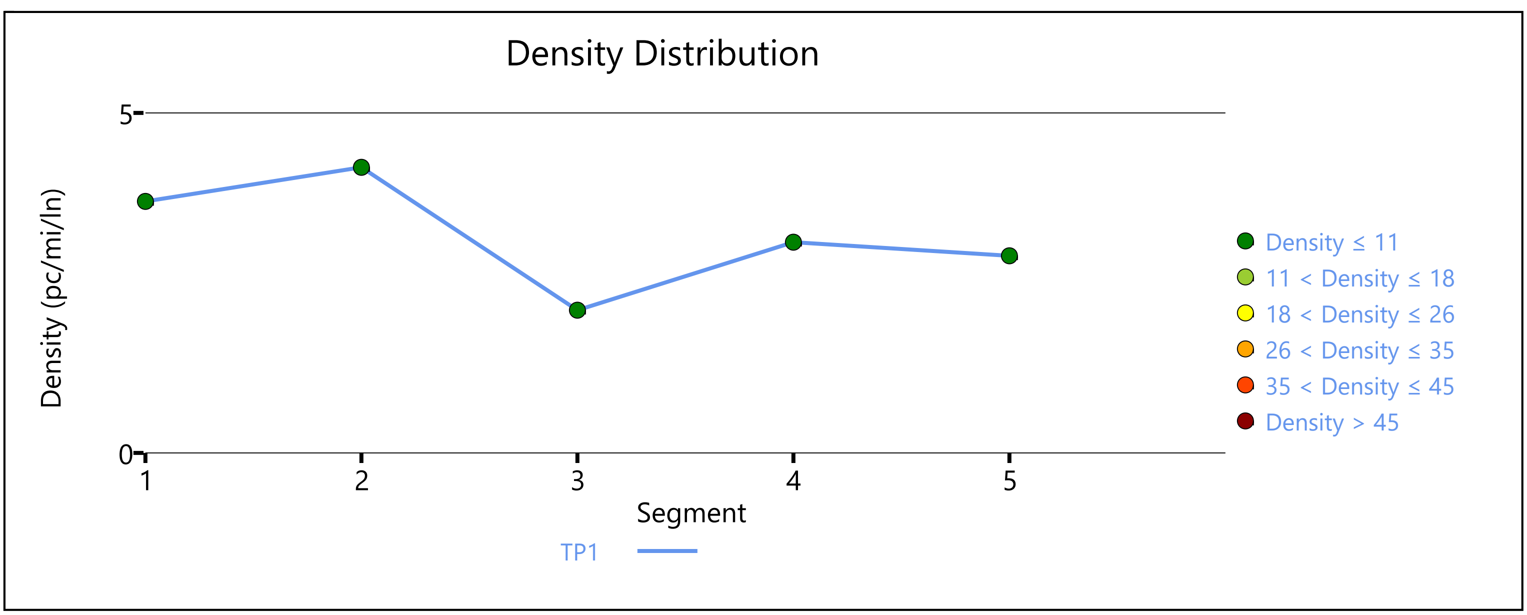
Space Mean Speed, mi/h	63.8	Density, veh/mi/ln	2.9
Average Travel Time, min	3.70	Density, pc/mi/ln	3.3

Messages

Comments


Volume Distribution
500
0
1
2
3
4
5
Volume (pc/h)
Segment
TP1


Speed Distribution
65
60
55
1
2
3
4
5
Speed (mi/h)
Segment
TP1
Speed > 60
50 < Speed ≤ 60
40 < Speed ≤ 50
30 < Speed ≤ 40
20 < Speed ≤ 30
Speed ≤ 20


Density Distribution
5
0
1
2
3
4
5
Density (pc/mi/ln)
Segment
TP1
Density ≤ 11
11 < Density ≤ 18
18 < Density ≤ 26
26 < Density ≤ 35
35 < Density ≤ 45
Density > 45

HCS7 Freeway Facilities Report

Project Information

Analyst	BSE	Date	11/23/2020
Agency	MoDOT	Analysis Year	2042
Jurisdiction	Poplar Bluff, MO	Time Period Analyzed	2042 PM Peak
Project Description	NB Route 67 - 2042 PM - ALT 1 & 3	Unit	United States Customary

Facility Global Input

Jam Density, pc/mi/ln	190.0	Density at Capacity, pc/mi/ln	45.0
Queue Discharge Capacity Drop, %	7	Total Segments	5
Total Time Periods	1	Time Period Duration, min	15
Facility Length, mi	4.09		

Facility Segment Data

No.	Coded	Analyzed	Name	Length, ft	Lanes
1	Basic	Basic		7950	2
2	Diverge	Diverge	Route 160 Off-Ramp_	1500	2
3	Basic	Basic		2420	2
4	Merge	Merge	Route 160 On-Ramp_	1500	2
5	Basic	Basic		8200	2

Facility Segment Data

Segment 1: Basic

Time Period	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.90	0.870	442	4700	0.09	65.0	3.4	A

Segment 2: Diverge

Time Period	PHF		fHV		Flow Rate (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R	Freeway	Ramp	
1	0.90	0.90	0.870	0.952	442	93	4700	2100	0.09	0.04	59.5	59.5	3.7	2.2	A

Segment 3: Basic

Time Period	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.90	0.870	340	4700	0.07	64.8	2.6	A

Segment 4: Merge

Time Period	PHF		fHV		Flow Rate (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R	Freeway	Ramp	
1	0.90	0.90	0.870	0.909	677	337	4700	2100	0.14	0.16	59.6	59.6	5.7	4.7	A

Segment 5: Basic

Time Period	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS

1	0.90	0.870	692	4700	0.15	65.0	5.3	A

Facility Time Period Results

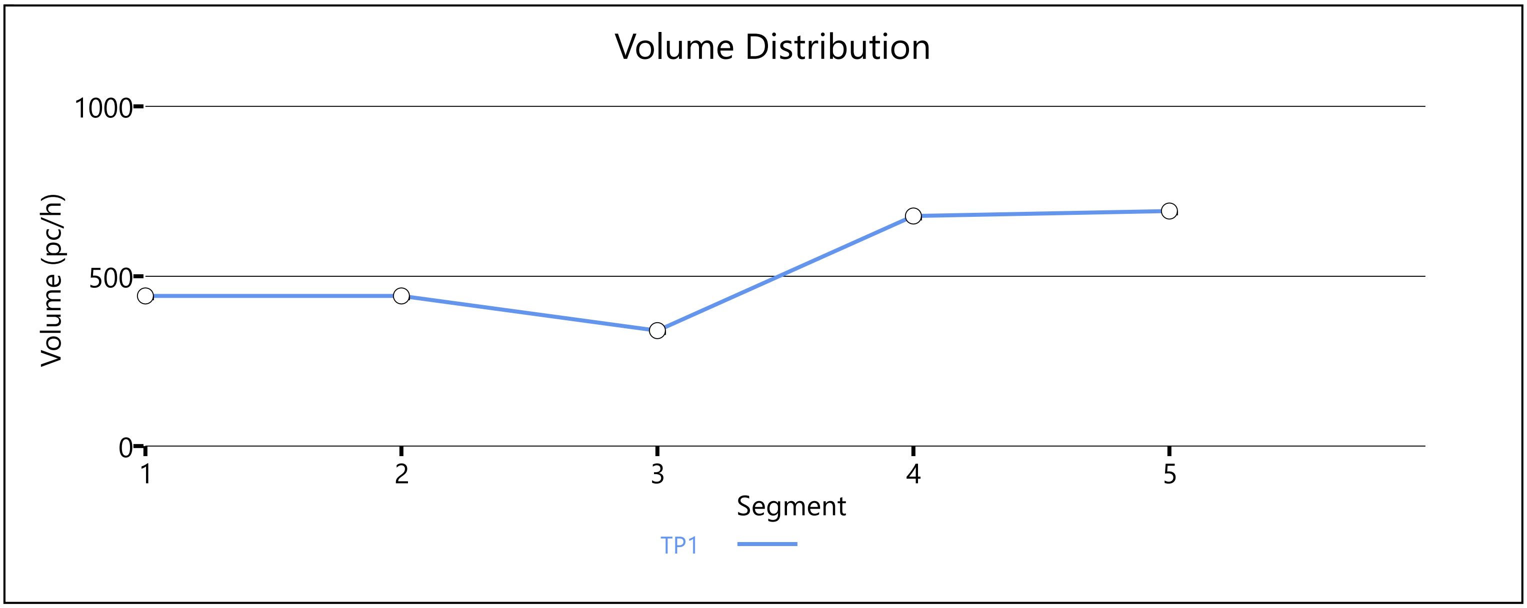
T	Speed, mi/h	Density, pc/mi/ln	Density, veh/mi/ln	Travel Time, min	LOS
1	64.1	4.2	3.7	3.80	A

Facility Overall Results

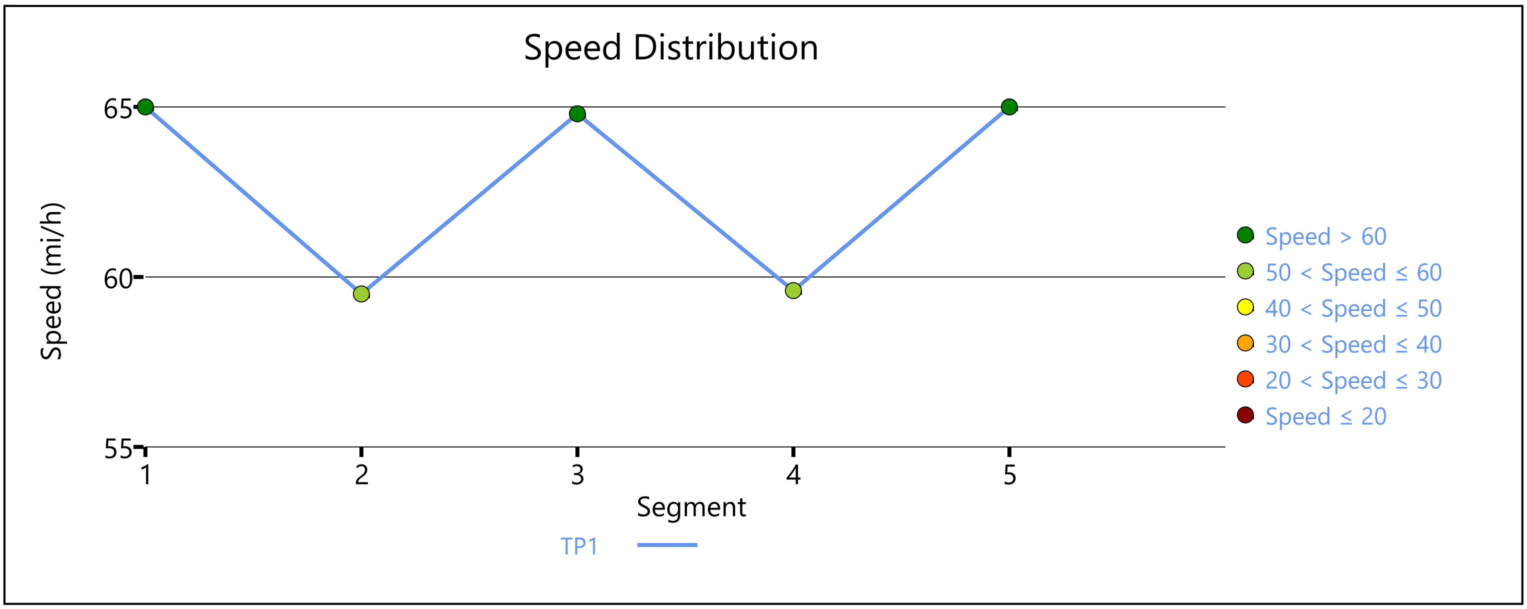
Space Mean Speed, mi/h	64.1	Density, veh/mi/ln	3.7
Average Travel Time, min	3.80	Density, pc/mi/ln	4.2

Messages

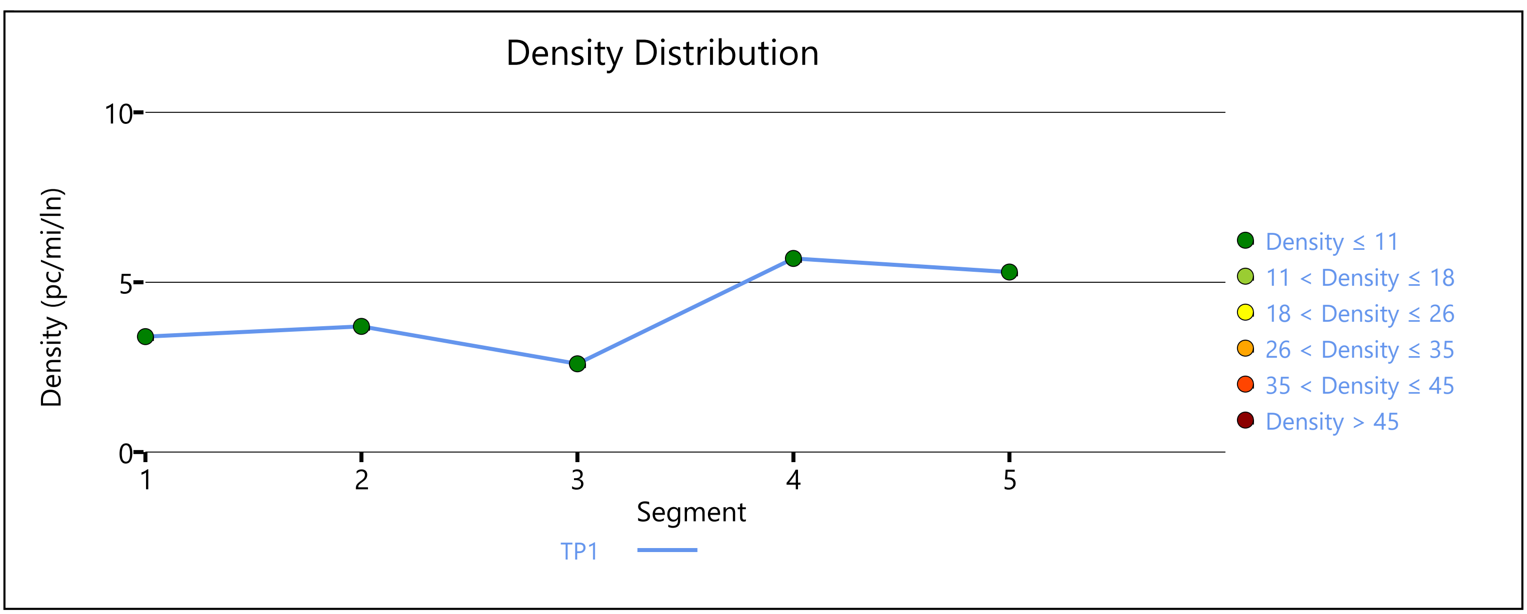
Comments



Volume Distribution
Volume (pc/h)
1000
500
0
1
2
3
4
5
Segment
TP1



Speed Distribution
Speed (mi/h)
65
60
55
1
2
3
4
5
Segment
TP1
Speed > 60
50 < Speed ≤ 60
40 < Speed ≤ 50
30 < Speed ≤ 40
20 < Speed ≤ 30
Speed ≤ 20



Density Distribution
Density (pc/mi/ln)
10
5
0
1
2
3
4
5
Segment
TP1
Density ≤ 11
11 < Density ≤ 18
18 < Density ≤ 26
26 < Density ≤ 35
35 < Density ≤ 45
Density > 45

HCS7 Freeway Facilities Report

Project Information

Analyst	BSE	Date	11/23/2020
Agency	MoDOT	Analysis Year	2042
Jurisdiction	Poplar Bluff, MO	Time Period Analyzed	2042 PM Peak
Project Description	NB Route 67 - 2042 PM - ALT 2	Unit	United States Customary

Facility Global Input

Jam Density, pc/mi/ln	190.0	Density at Capacity, pc/mi/ln	45.0
Queue Discharge Capacity Drop, %	7	Total Segments	5
Total Time Periods	1	Time Period Duration, min	15
Facility Length, mi	4.09		

Facility Segment Data

No.	Coded	Analyzed	Name	Length, ft	Lanes
1	Basic	Basic		7950	2
2	Diverge	Diverge	Route 160 Off-Ramp_	1500	2
3	Basic	Basic		1080	2
4	Merge	Merge	Route 160 On-Ramp_	1500	2
5	Basic	Basic		9540	2

Facility Segment Data

Segment 1: Basic

Time Period	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.90	0.870	442	4700	0.09	65.0	3.4	A

Segment 2: Diverge

Time Period	PHF		fHV		Flow Rate (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R	Freeway	Ramp	
1	0.90	0.90	0.870	0.952	442	93	4700	2100	0.09	0.04	59.5	59.5	3.7	2.2	A

Segment 3: Basic

Time Period	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.90	0.870	340	4700	0.07	64.3	2.6	A

Segment 4: Merge

Time Period	PHF		fHV		Flow Rate (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R	Freeway	Ramp	
1	0.90	0.90	0.870	0.909	677	337	4700	2000	0.14	0.17	59.7	59.7	5.7	1.7	A

Segment 5: Basic

Time Period	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS

1	0.90	0.870	692	4700	0.15	65.0	5.3	A

Facility Time Period Results

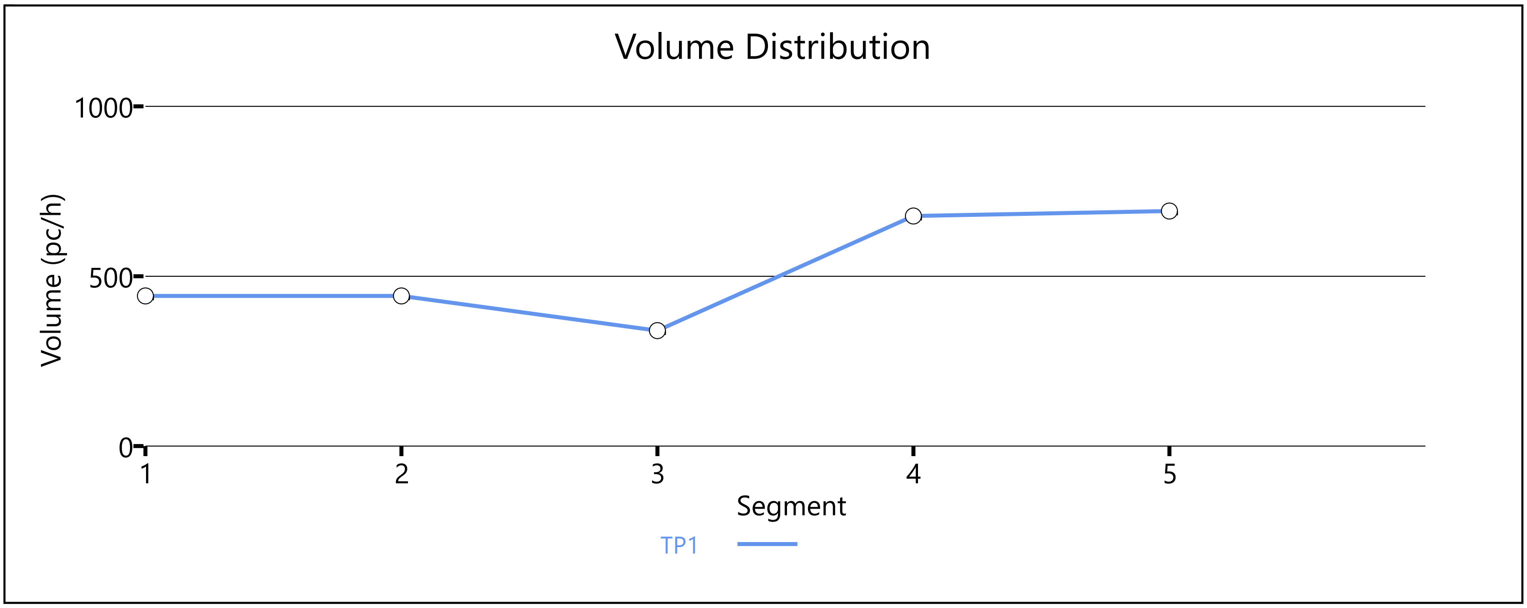
T	Speed, mi/h	Density, pc/mi/ln	Density, veh/mi/ln	Travel Time, min	LOS
1	64.2	4.4	3.8	3.80	A

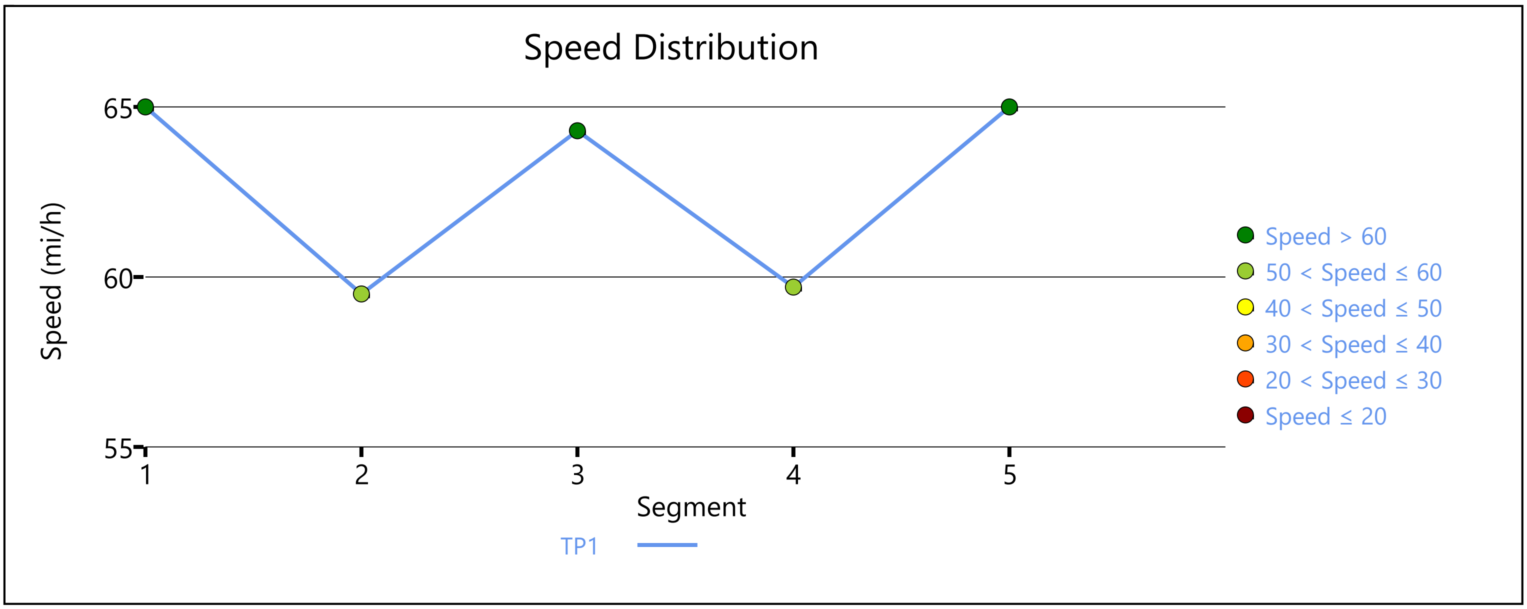
Facility Overall Results

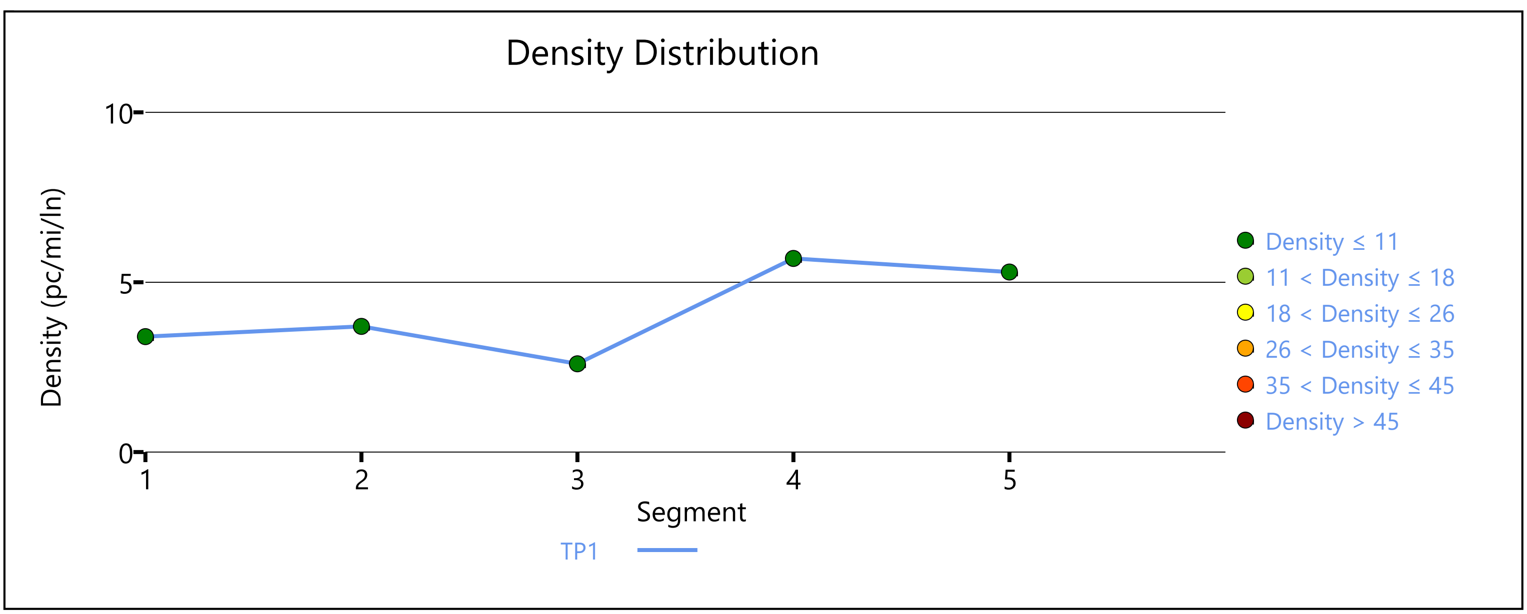
Space Mean Speed, mi/h	64.2	Density, veh/mi/ln	3.8
Average Travel Time, min	3.80	Density, pc/mi/ln	4.4

Messages

Comments


Volume Distribution
1000
500
0
Volume (pc/h)
1
2
3
4
5
Segment
TP1


Speed Distribution
65
60
55
Speed (mi/h)
1
2
3
4
5
Segment
TP1
Speed > 60
50 < Speed ≤ 60
40 < Speed ≤ 50
30 < Speed ≤ 40
20 < Speed ≤ 30
Speed ≤ 20


Density Distribution
10
5
0
Density (pc/mi/ln)
1
2
3
4
5
Segment
TP1
Density ≤ 11
11 < Density ≤ 18
18 < Density ≤ 26
26 < Density ≤ 35
35 < Density ≤ 45
Density > 45

HCS7 Freeway Facilities Report

Project Information

Analyst	BSE	Date	11/23/2020
Agency	MoDOT	Analysis Year	2022
Jurisdiction	Poplar Bluff, MO	Time Period Analyzed	2042 PM Peak
Project Description	SB Route 67 - 2042 PM - ALT 1, 2 & 3	Unit	United States Customary

Facility Global Input

Jam Density, pc/mi/ln	190.0	Density at Capacity, pc/mi/ln	45.0
Queue Discharge Capacity Drop, %	7	Total Segments	5
Total Time Periods	1	Time Period Duration, min	15
Facility Length, mi	4.09		

Facility Segment Data

No.	Coded	Analyzed	Name	Length, ft	Lanes
1	Basic	Basic		8500	2
2	Diverge	Diverge	Route 160 Off-Ramp_	1500	2
3	Basic	Basic		2070	2
4	Merge	Merge	Route 160 On-Ramp_	1500	2
5	Basic	Basic		8000	2

Facility Segment Data

Segment 1: Basic

Time Period	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.90	0.870	914	4700	0.19	65.0	7.0	A

Segment 2: Diverge

Time Period	PHF		fHV		Flow Rate (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R	Freeway	Ramp	
1	0.90	0.90	0.870	0.909	914	483	4700	2000	0.19	0.24	55.7	55.7	8.2	6.2	A

Segment 3: Basic

Time Period	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.90	0.870	410	4700	0.09	64.5	3.2	A

Segment 4: Merge

Time Period	PHF		fHV		Flow Rate (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R	Freeway	Ramp	
1	0.90	0.90	0.870	0.952	452	42	4700	2100	0.10	0.02	59.2	59.2	3.8	4.2	A

Segment 5: Basic

Time Period	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS

1	0.90	0.870	456	4700	0.10	65.0	3.5	A

Facility Time Period Results

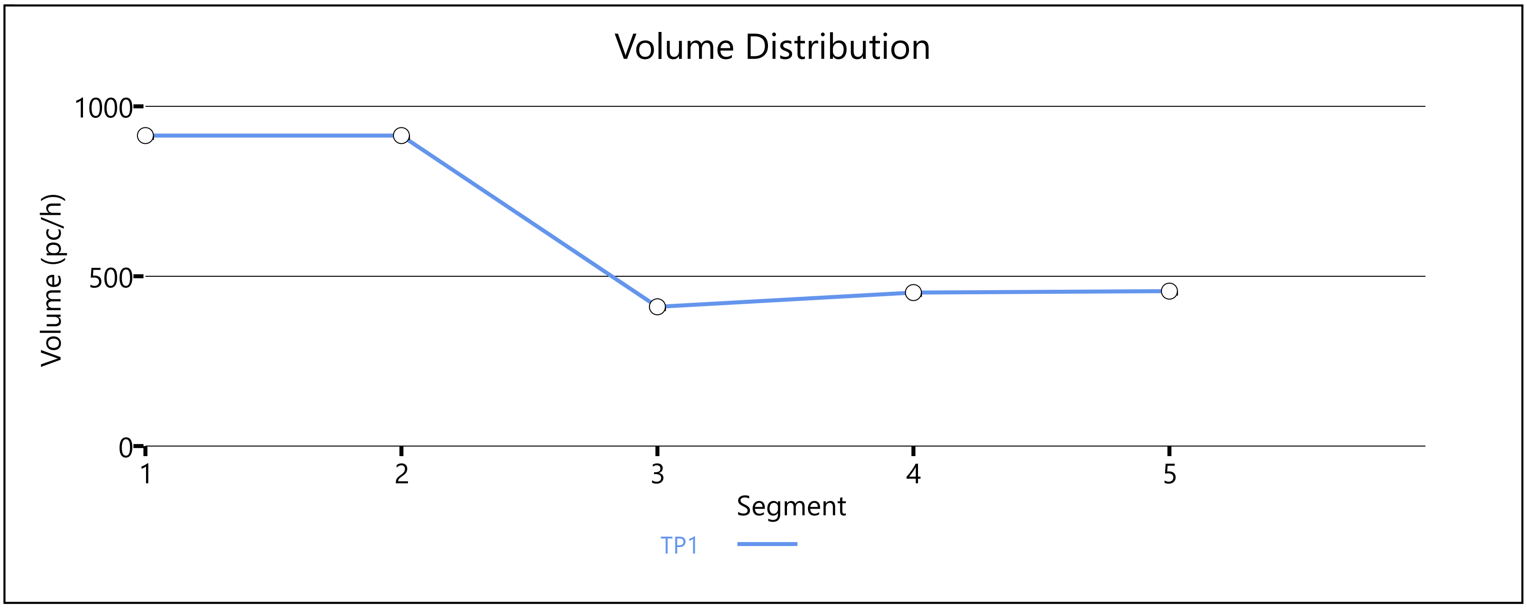
T	Speed, mi/h	Density, pc/mi/ln	Density, veh/mi/ln	Travel Time, min	LOS
1	63.7	5.2	4.5	3.90	A

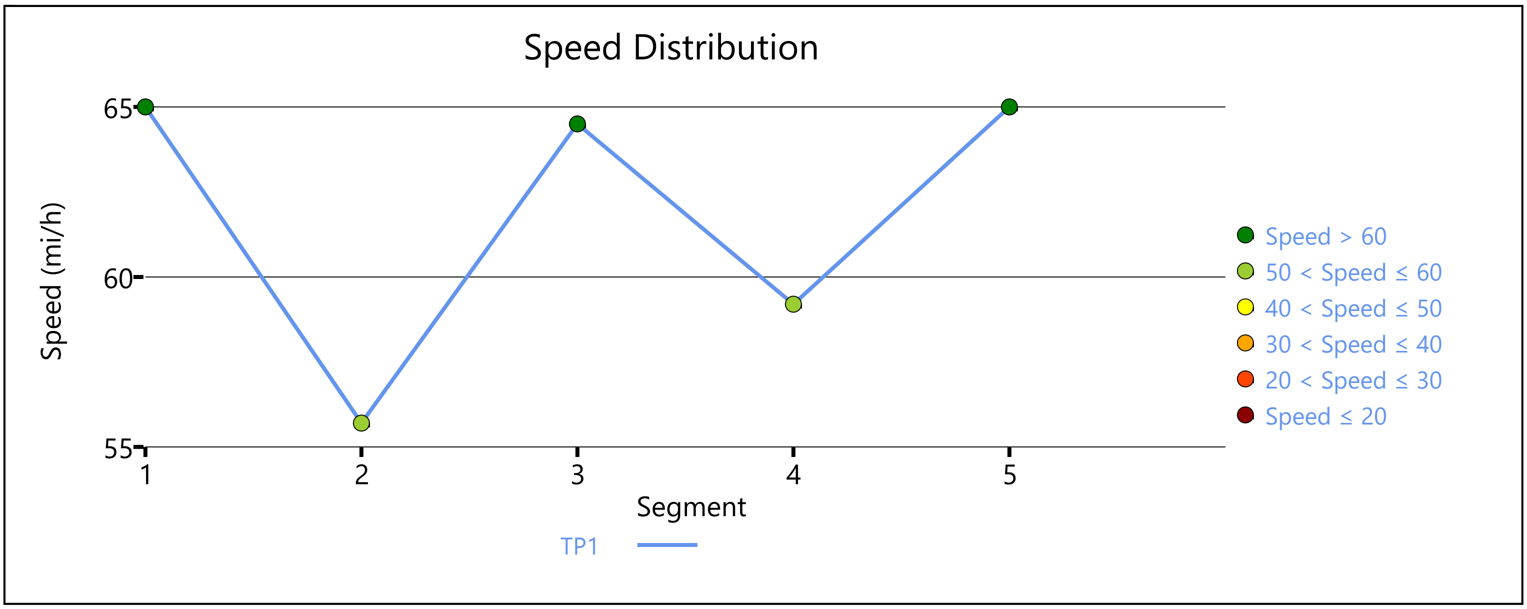
Facility Overall Results

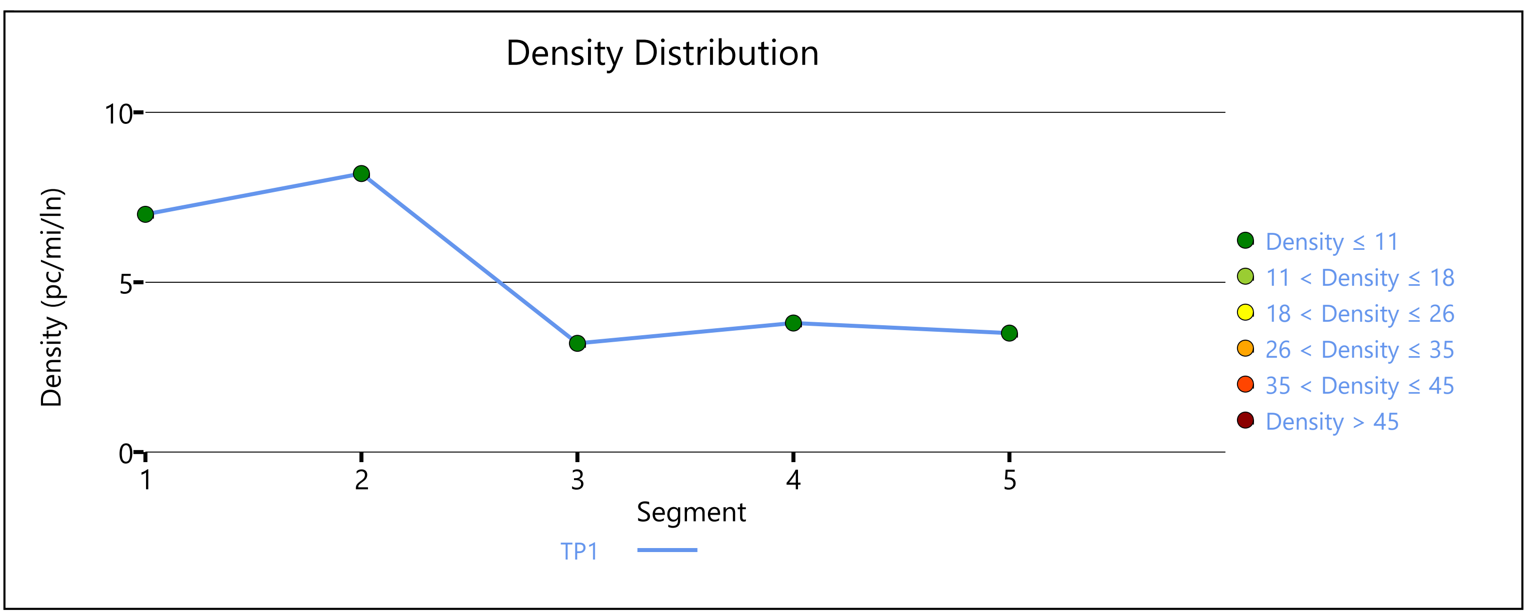
Space Mean Speed, mi/h	63.7	Density, veh/mi/ln	4.5
Average Travel Time, min	3.90	Density, pc/mi/ln	5.2

Messages

Comments


Volume Distribution
1000
500
0
Volume (pc/h)
1
2
3
4
5
Segment
TP1


Speed Distribution
65
60
55
Speed (mi/h)
1
2
3
4
5
Segment
TP1
Speed > 60
50 < Speed ≤ 60
40 < Speed ≤ 50
30 < Speed ≤ 40
20 < Speed ≤ 30
Speed ≤ 20


Density Distribution
10
5
0
Density (pc/mi/ln)
1
2
3
4
5
Segment
TP1
Density ≤ 11
11 < Density ≤ 18
18 < Density ≤ 26
26 < Density ≤ 35
35 < Density ≤ 45
Density > 45

HCS7 Freeway Facilities Report

Project Information

Analyst	BSE	Date	11/23/2020
Agency	MoDOT	Analysis Year	2042
Jurisdiction	Poplar Bluff, MO	Time Period Analyzed	2042 AM Peak
Project Description	NB Route 67 - 2042 AM - ALT 1 & 3 - with Freeway Conversion	Unit	United States Customary

Facility Global Input

Jam Density, pc/mi/ln	190.0	Density at Capacity, pc/mi/ln	45.0
Queue Discharge Capacity Drop, %	7	Total Segments	5
Total Time Periods	1	Time Period Duration, min	15
Facility Length, mi	4.09		

Facility Segment Data

No.	Coded	Analyzed	Name	Length, ft	Lanes
1	Basic	Basic		7950	2
2	Diverge	Diverge	Route 160 Off-Ramp_	1500	2
3	Basic	Basic		2420	2
4	Merge	Merge	Route 160 On-Ramp_	1500	2
5	Basic	Basic		8200	2

Facility Segment Data

Segment 1: Basic

Time Period	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.86	0.870	446	4700	0.09	65.0	3.4	A

Segment 2: Diverge

Time Period	PHF		fHV		Flow Rate (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R	Freeway	Ramp	
1	0.86	0.86	0.870	0.952	446	82	4700	2100	0.09	0.04	59.5	59.5	3.7	2.2	A

Segment 3: Basic

Time Period	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.86	0.870	357	4700	0.08	64.8	2.7	A

Segment 4: Merge

Time Period	PHF		fHV		Flow Rate (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R	Freeway	Ramp	
1	0.86	0.86	0.870	0.909	1374	1017	4700	2100	0.29	0.48	59.5	59.5	11.5	9.8	A

Segment 5: Basic

Time	PHF	fHV	Flow Rate	Capacity	d/c	Speed	Density	LOS

Period			(pc/h)	(pc/h)	Ratio	(mi/h)	(pc/mi/ln)	
1	0.86	0.870	1419	4700	0.30	65.0	10.9	A

Facility Time Period Results

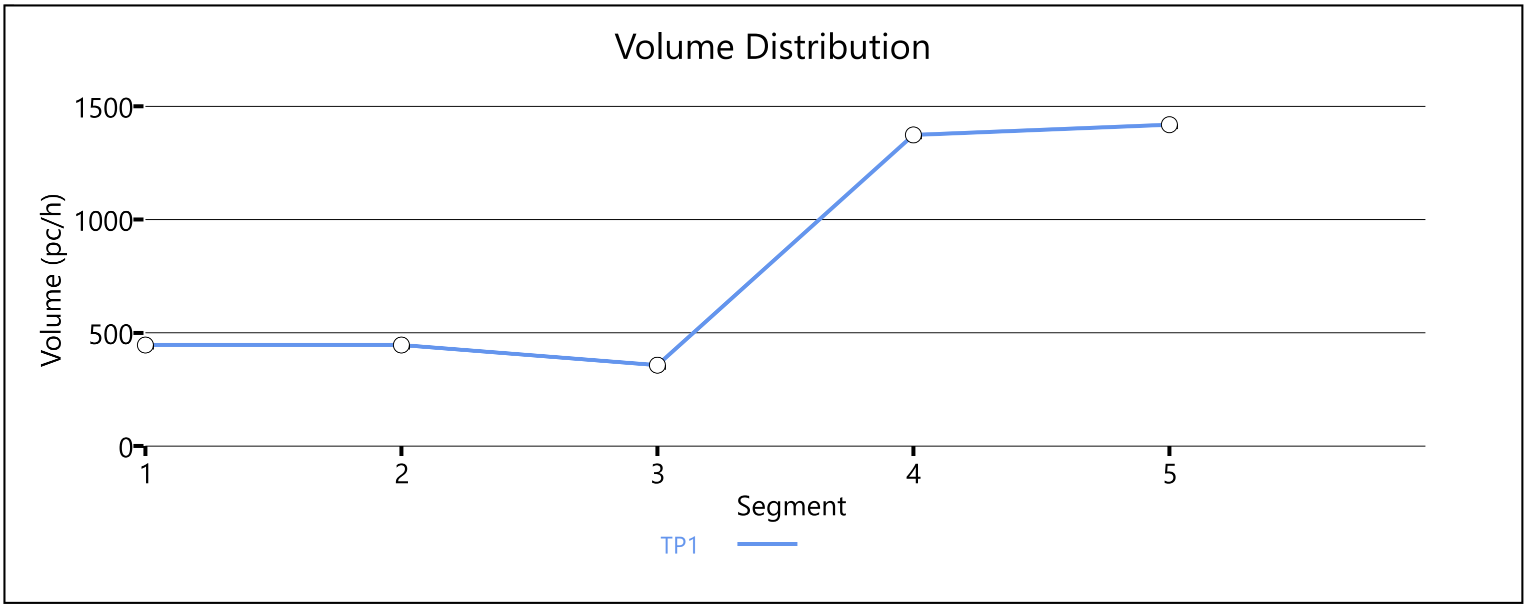
T	Speed, mi/h	Density, pc/mi/ln	Density, veh/mi/ln	Travel Time, min	LOS
1	64.1	6.8	5.9	3.80	A

Facility Overall Results

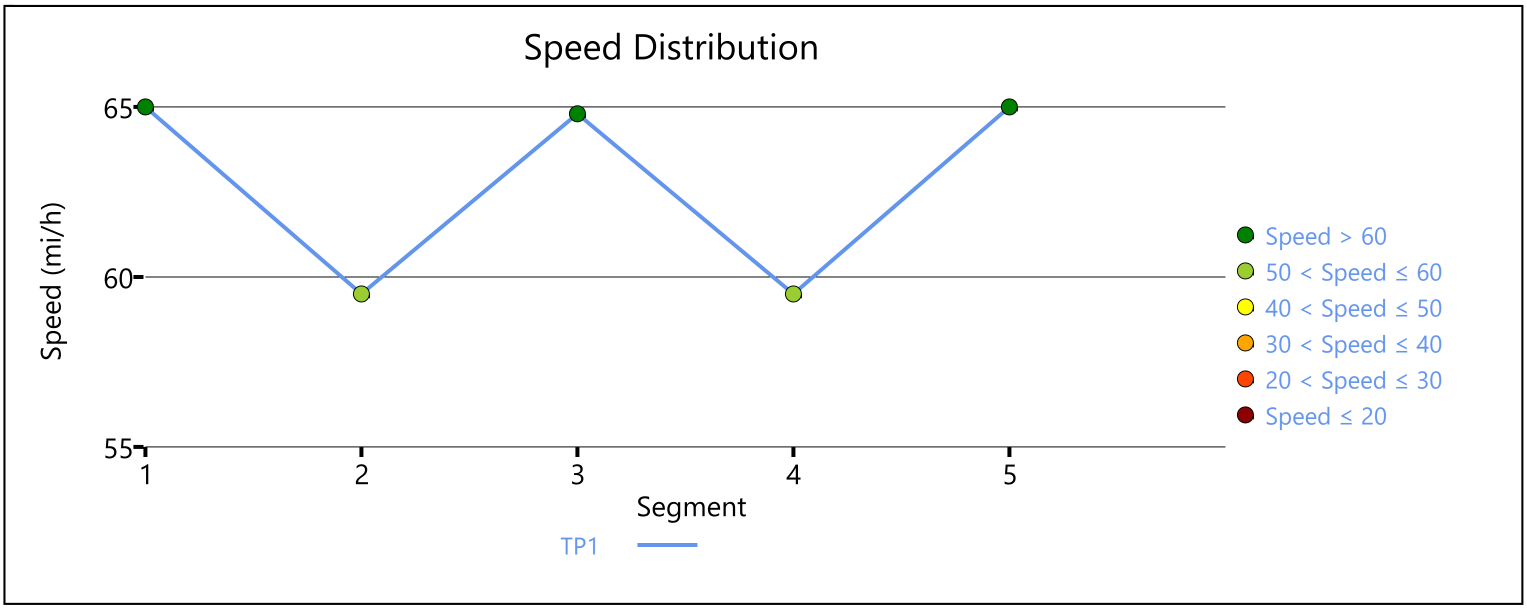
Space Mean Speed, mi/h	64.1	Density, veh/mi/ln	5.9
Average Travel Time, min	3.80	Density, pc/mi/ln	6.8

Messages

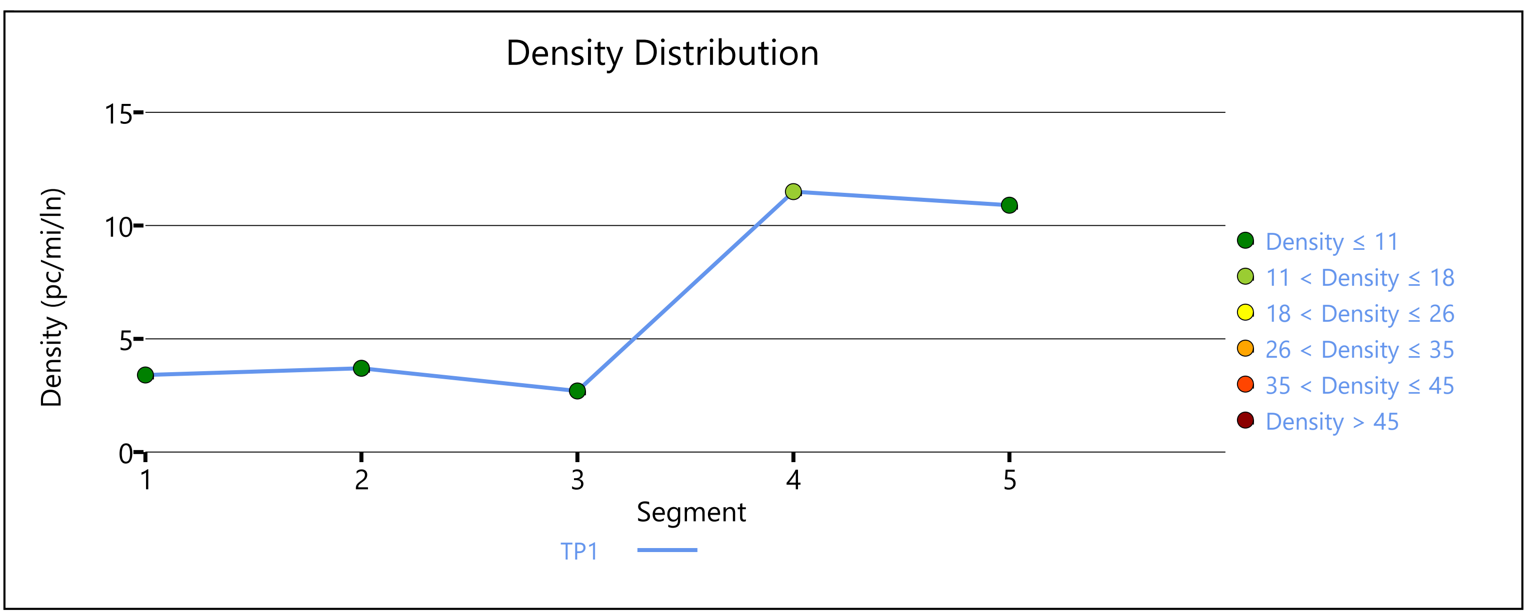
Comments



Volume Distribution
1500
1000
500
0
Volume (pc/h)
1
2
3
4
5
Segment
TP1



Speed Distribution
65
60
55
Speed (mi/h)
1
2
3
4
5
Segment
TP1
Speed > 60
50 < Speed ≤ 60
40 < Speed ≤ 50
30 < Speed ≤ 40
20 < Speed ≤ 30
Speed ≤ 20



Density Distribution
15
10
5
0
Density (pc/mi/ln)
1
2
3
4
5
Segment
TP1
Density ≤ 11
11 < Density ≤ 18
18 < Density ≤ 26
26 < Density ≤ 35
35 < Density ≤ 45
Density > 45

HCS7 Freeway Facilities Report

Project Information

Analyst	BSE	Date	11/23/2020
Agency	MoDOT	Analysis Year	2042
Jurisdiction	Poplar Bluff, MO	Time Period Analyzed	2042 AM Peak
Project Description	NB Route 67 - 2042 AM - ALT 2 - with Freeway Conversion	Unit	United States Customary

Facility Global Input

Jam Density, pc/mi/ln	190.0	Density at Capacity, pc/mi/ln	45.0
Queue Discharge Capacity Drop, %	7	Total Segments	5
Total Time Periods	1	Time Period Duration, min	15
Facility Length, mi	4.09		

Facility Segment Data

No.	Coded	Analyzed	Name	Length, ft	Lanes
1	Basic	Basic		7950	2
2	Diverge	Diverge	Route 160 Off-Ramp_	1500	2
3	Basic	Basic		1080	2
4	Merge	Merge	Route 160 On-Ramp_	1500	2
5	Basic	Basic		9540	2

Facility Segment Data

Segment 1: Basic

Time Period	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.86	0.870	446	4700	0.09	65.0	3.4	A

Segment 2: Diverge

Time Period	PHF		fHV		Flow Rate (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R	Freeway	Ramp	
1	0.86	0.86	0.870	0.952	446	82	4700	2100	0.09	0.04	59.5	59.5	3.7	2.2	A

Segment 3: Basic

Time Period	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.86	0.870	357	4700	0.08	64.3	2.7	A

Segment 4: Merge

Time Period	PHF		fHV		Flow Rate (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R	Freeway	Ramp	
1	0.86	0.86	0.870	0.909	1374	1017	4700	2000	0.29	0.51	59.6	59.6	11.5	6.8	A

Segment 5: Basic

Time Period	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS

1	0.86	0.870	1419	4700	0.30	65.0	10.9	A

Facility Time Period Results

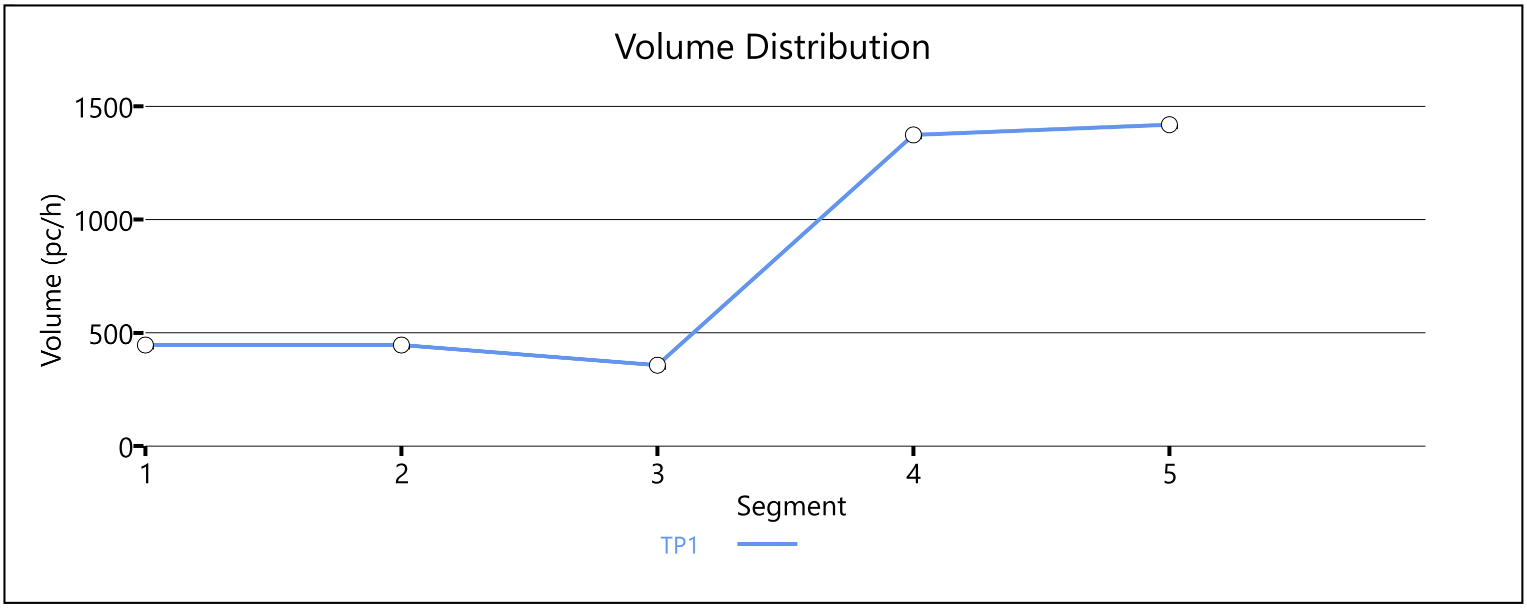
T	Speed, mi/h	Density, pc/mi/ln	Density, veh/mi/ln	Travel Time, min	LOS
1	64.2	7.3	6.3	3.80	A

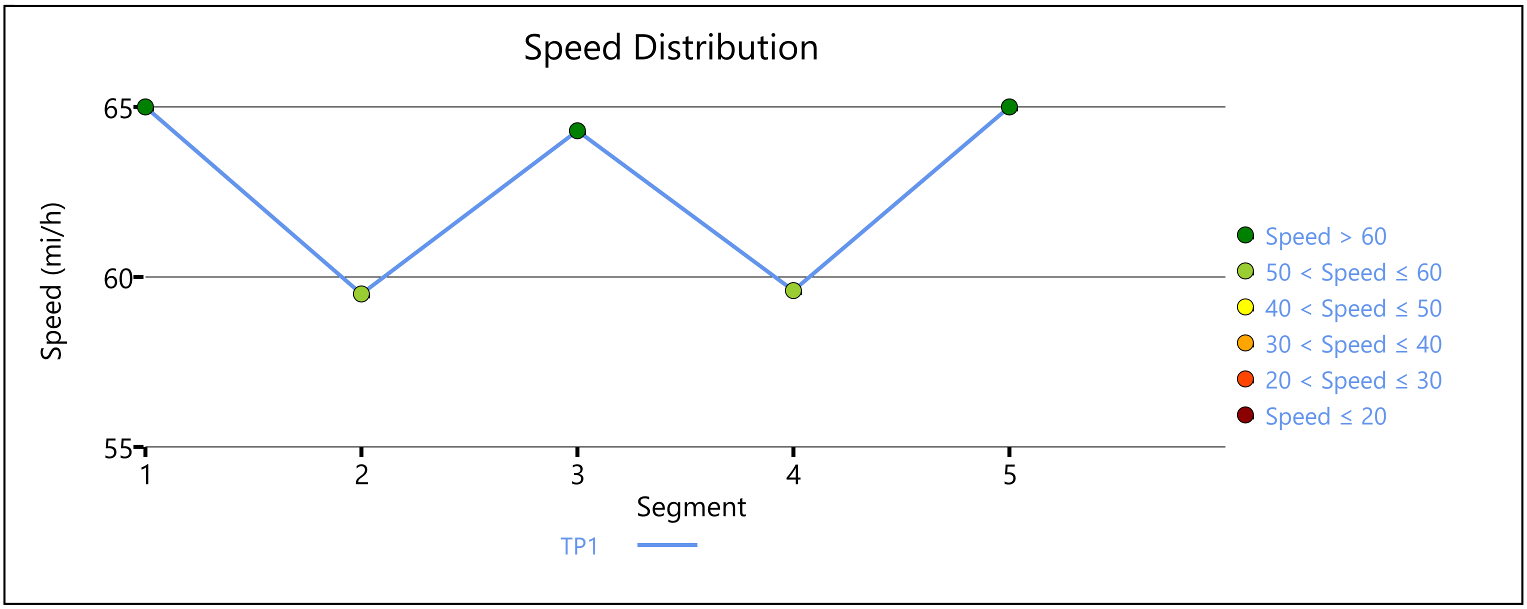
Facility Overall Results

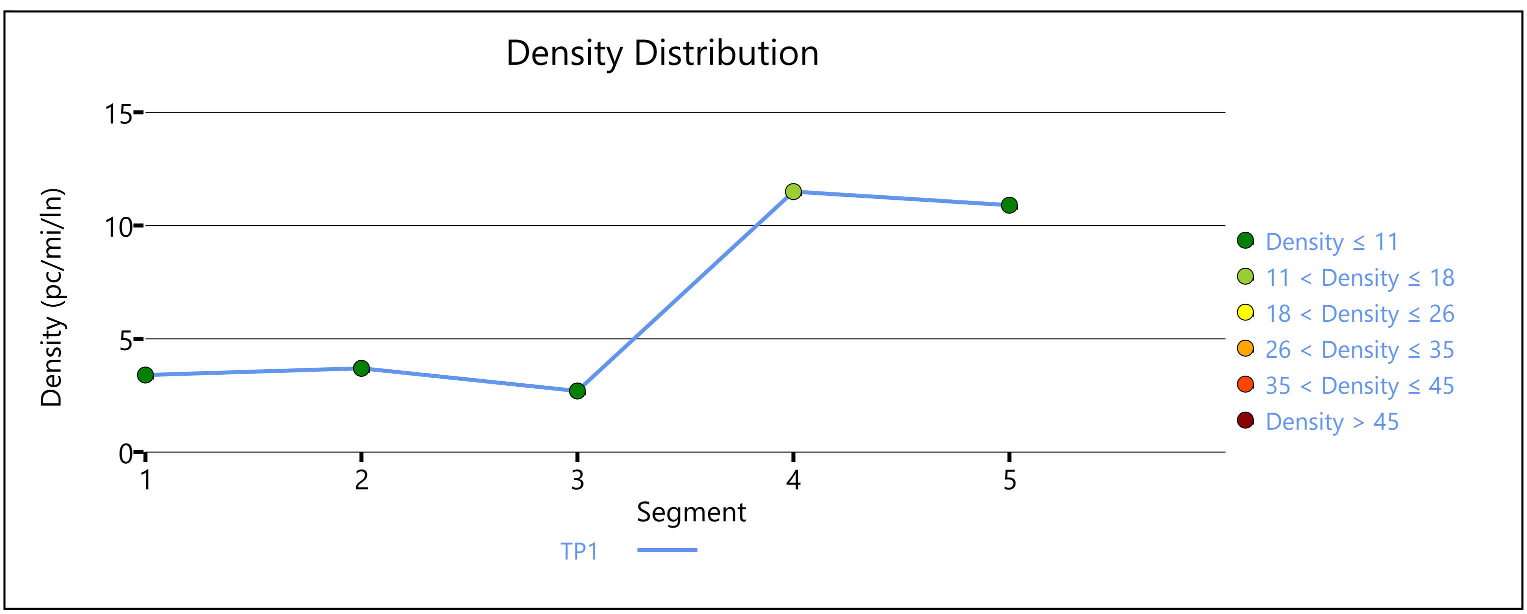
Space Mean Speed, mi/h	64.2	Density, veh/mi/ln	6.3
Average Travel Time, min	3.80	Density, pc/mi/ln	7.3

Messages

Comments


Volume Distribution
1500
1000
500
0
Volume (pc/h)
1
2
3
4
5
Segment
TP1


Speed Distribution
65
60
55
Speed (mi/h)
1
2
3
4
5
Segment
TP1
Speed > 60
50 < Speed ≤ 60
40 < Speed ≤ 50
30 < Speed ≤ 40
20 < Speed ≤ 30
Speed ≤ 20


Density Distribution
15
10
5
0
Density (pc/mi/ln)
1
2
3
4
5
Segment
TP1
Density ≤ 11
11 < Density ≤ 18
18 < Density ≤ 26
26 < Density ≤ 35
35 < Density ≤ 45
Density > 45

HCS7 Freeway Facilities Report

Project Information

Analyst	BSE	Date	11/23/2020
Agency	MoDOT	Analysis Year	2042
Jurisdiction	Poplar Bluff, MO	Time Period Analyzed	2042 AM Peak
Project Description	SB Route 67 - 2042 AM - ALT 1, 2 & 3 - with Freeway Conversion	Unit	United States Customary

Facility Global Input

Jam Density, pc/mi/ln	190.0	Density at Capacity, pc/mi/ln	45.0
Queue Discharge Capacity Drop, %	7	Total Segments	5
Total Time Periods	1	Time Period Duration, min	15
Facility Length, mi	4.09		

Facility Segment Data

No.	Coded	Analyzed	Name	Length, ft	Lanes
1	Basic	Basic		8500	2
2	Diverge	Diverge	Route 160 Off-Ramp_	1500	2
3	Basic	Basic		2070	2
4	Merge	Merge	Route 160 On-Ramp_	1500	2
5	Basic	Basic		8000	2

Facility Segment Data

Segment 1: Basic

Time Period	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.86	0.870	568	4700	0.12	65.0	4.4	A

Segment 2: Diverge

Time Period	PHF		fHV		Flow Rate (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R	Freeway	Ramp	
1	0.86	0.90	0.870	0.909	568	274	4700	2000	0.12	0.14	56.1	56.1	5.1	3.2	A

Segment 3: Basic

Time Period	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.86	0.870	269	4700	0.06	64.5	2.1	A

Segment 4: Merge

Time Period	PHF		fHV		Flow Rate (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R	Freeway	Ramp	
1	0.86	0.90	0.870	0.952	367	98	4700	2100	0.08	0.05	59.2	59.2	3.1	3.5	A

Segment 5: Basic

Time	PHF	fHV	Flow Rate	Capacity	d/c	Speed	Density	LOS

Period			(pc/h)	(pc/h)	Ratio	(mi/h)	(pc/mi/ln)	
1	0.86	0.870	381	4700	0.08	65.0	2.9	A

Facility Time Period Results

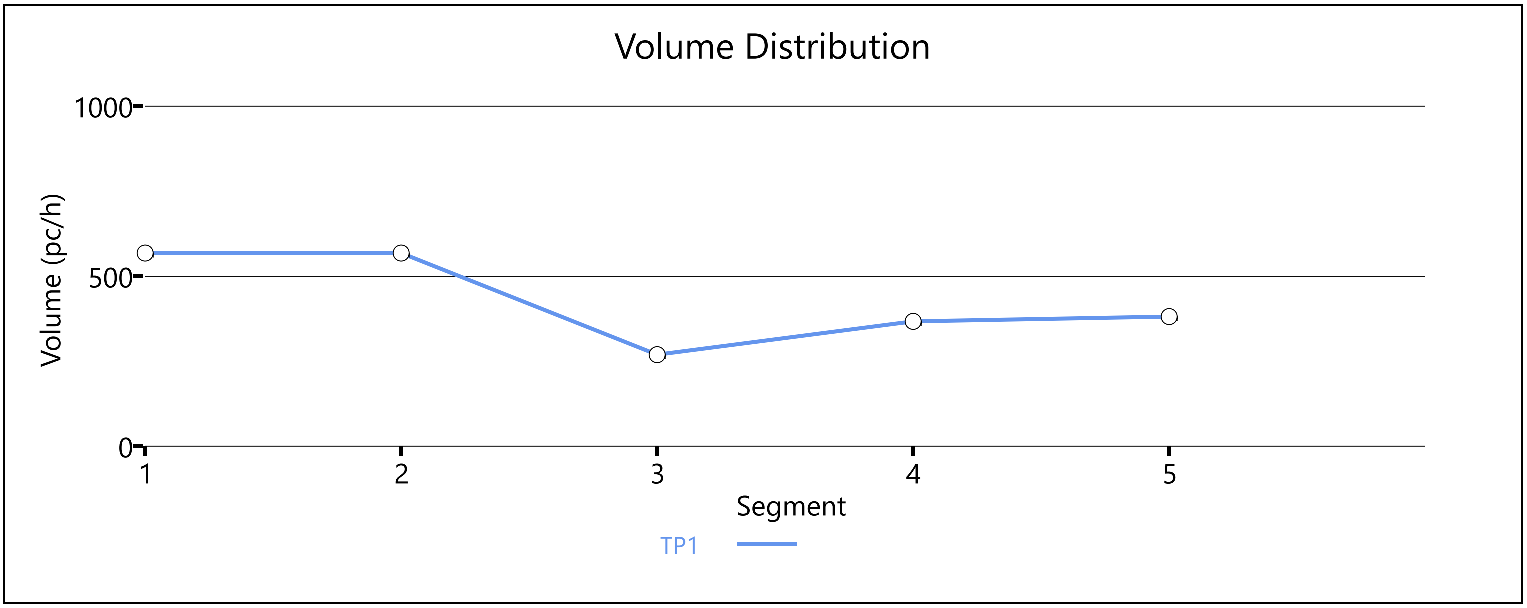
T	Speed, mi/h	Density, pc/mi/ln	Density, veh/mi/ln	Travel Time, min	LOS
1	63.8	3.6	3.1	3.80	A

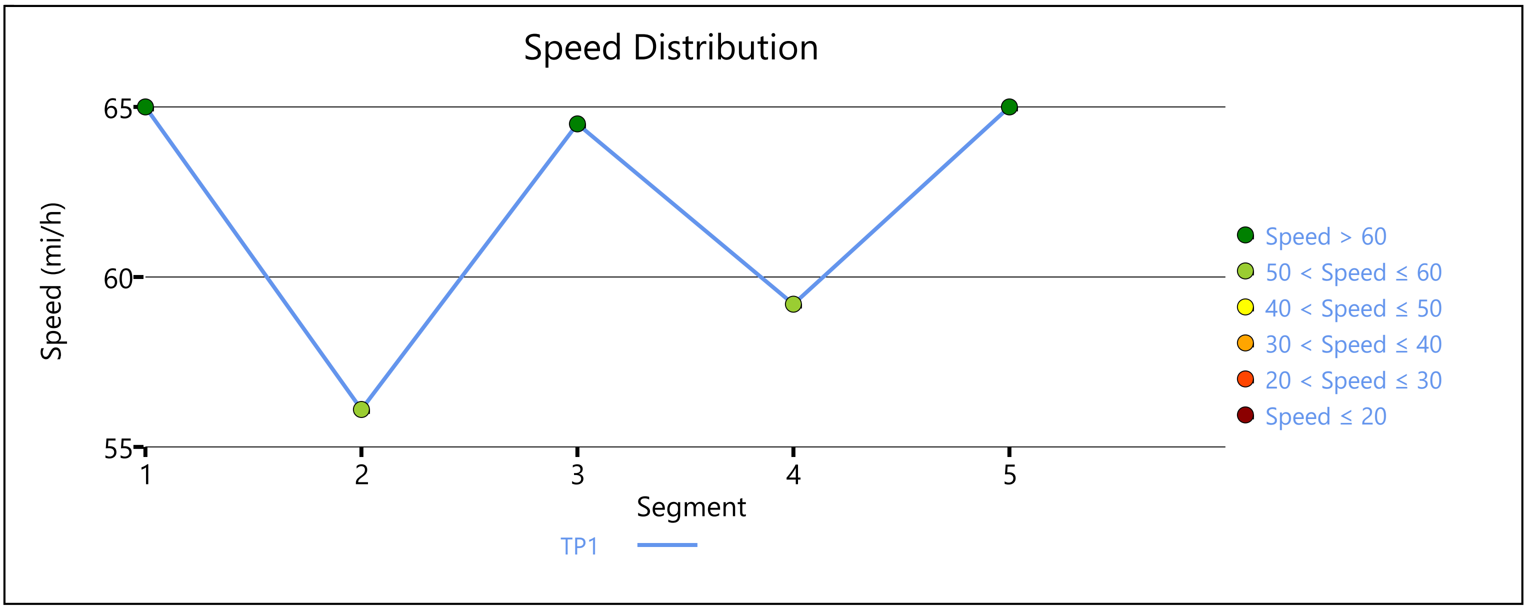
Facility Overall Results

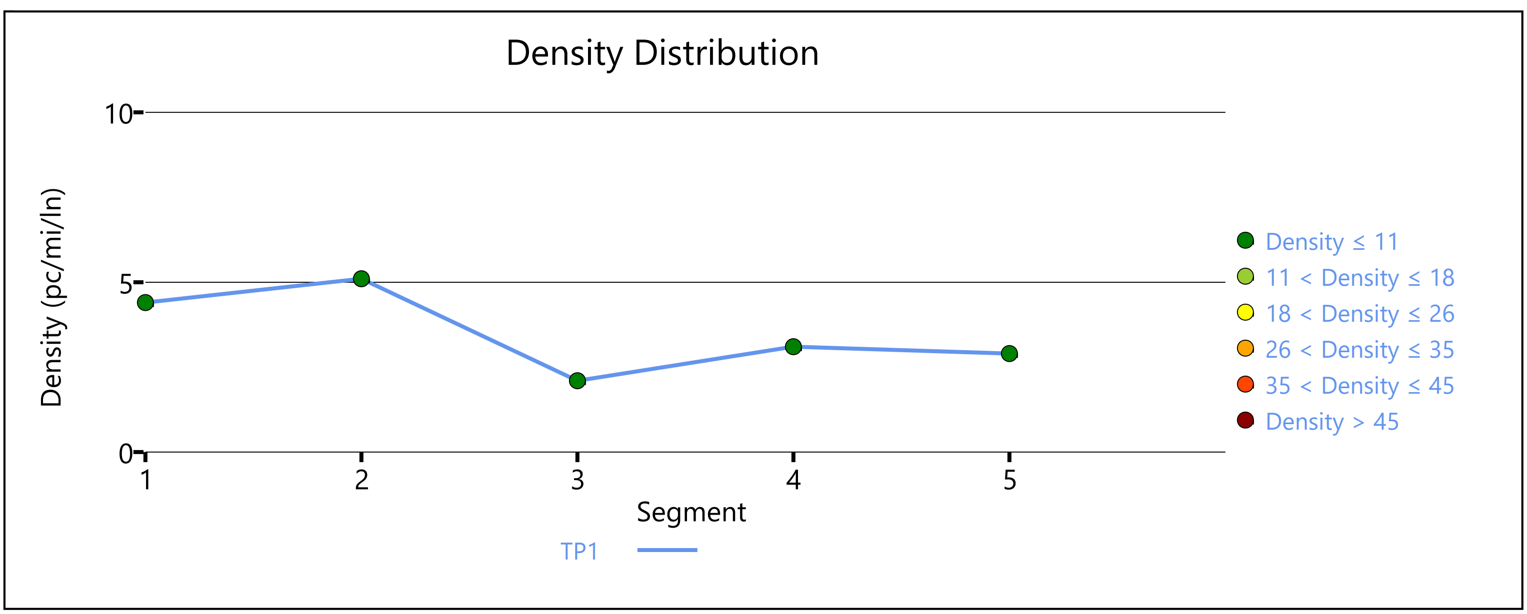
Space Mean Speed, mi/h	63.8	Density, veh/mi/ln	3.1
Average Travel Time, min	3.80	Density, pc/mi/ln	3.6

Messages

Comments


Volume Distribution
1000
500
0
Volume (pc/h)
1
2
3
4
5
Segment
TP1


Speed Distribution
65
60
55
Speed (mi/h)
1
2
3
4
5
Segment
TP1
Speed > 60
50 < Speed ≤ 60
40 < Speed ≤ 50
30 < Speed ≤ 40
20 < Speed ≤ 30
Speed ≤ 20


Density Distribution
10
5
0
Density (pc/mi/ln)
1
2
3
4
5
Segment
TP1
Density ≤ 11
11 < Density ≤ 18
18 < Density ≤ 26
26 < Density ≤ 35
35 < Density ≤ 45
Density > 45

HCS7 Freeway Facilities Report

Project Information

Analyst	BSE	Date	11/23/2020
Agency	MoDOT	Analysis Year	2042
Jurisdiction	Poplar Bluff, MO	Time Period Analyzed	2042 PM Peak
Project Description	NB Route 67 - 2042 PM - ALT 1 & 3 - with Freeway Conversion	Unit	United States Customary

Facility Global Input

Jam Density, pc/mi/ln	190.0	Density at Capacity, pc/mi/ln	45.0
Queue Discharge Capacity Drop, %	7	Total Segments	5
Total Time Periods	1	Time Period Duration, min	15
Facility Length, mi	4.09		

Facility Segment Data

No.	Coded	Analyzed	Name	Length, ft	Lanes
1	Basic	Basic		7950	2
2	Diverge	Diverge	Route 160 Off-Ramp_	1500	2
3	Basic	Basic		2420	2
4	Merge	Merge	Route 160 On-Ramp_	1500	2
5	Basic	Basic		8200	2

Facility Segment Data

Segment 1: Basic

Time Period	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.90	0.870	442	4700	0.09	65.0	3.4	A

Segment 2: Diverge

Time Period	PHF		fHV		Flow Rate (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R	Freeway	Ramp	
1	0.90	0.90	0.870	0.952	442	104	4700	2100	0.09	0.05	59.4	59.4	3.7	2.2	A

Segment 3: Basic

Time Period	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.90	0.870	328	4700	0.07	64.8	2.5	A

Segment 4: Merge

Time Period	PHF		fHV		Flow Rate (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R	Freeway	Ramp	
1	0.90	0.90	0.870	0.909	807	479	4700	2100	0.17	0.23	59.6	59.6	6.8	5.6	A

Segment 5: Basic

Time	PHF	fHV	Flow Rate	Capacity	d/c	Speed	Density	LOS

Period			(pc/h)	(pc/h)	Ratio	(mi/h)	(pc/mi/ln)	
1	0.90	0.870	829	4700	0.18	65.0	6.4	A

Facility Time Period Results

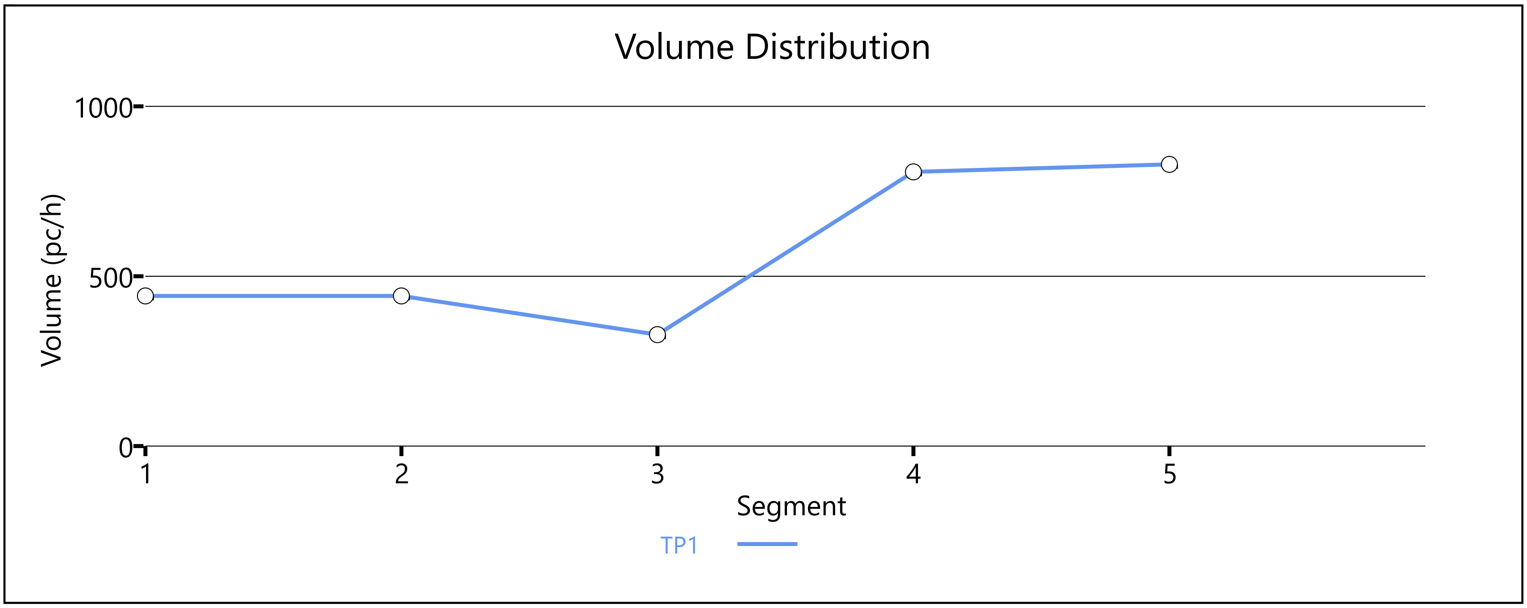
T	Speed, mi/h	Density, pc/mi/ln	Density, veh/mi/ln	Travel Time, min	LOS
1	64.1	4.7	4.1	3.80	A

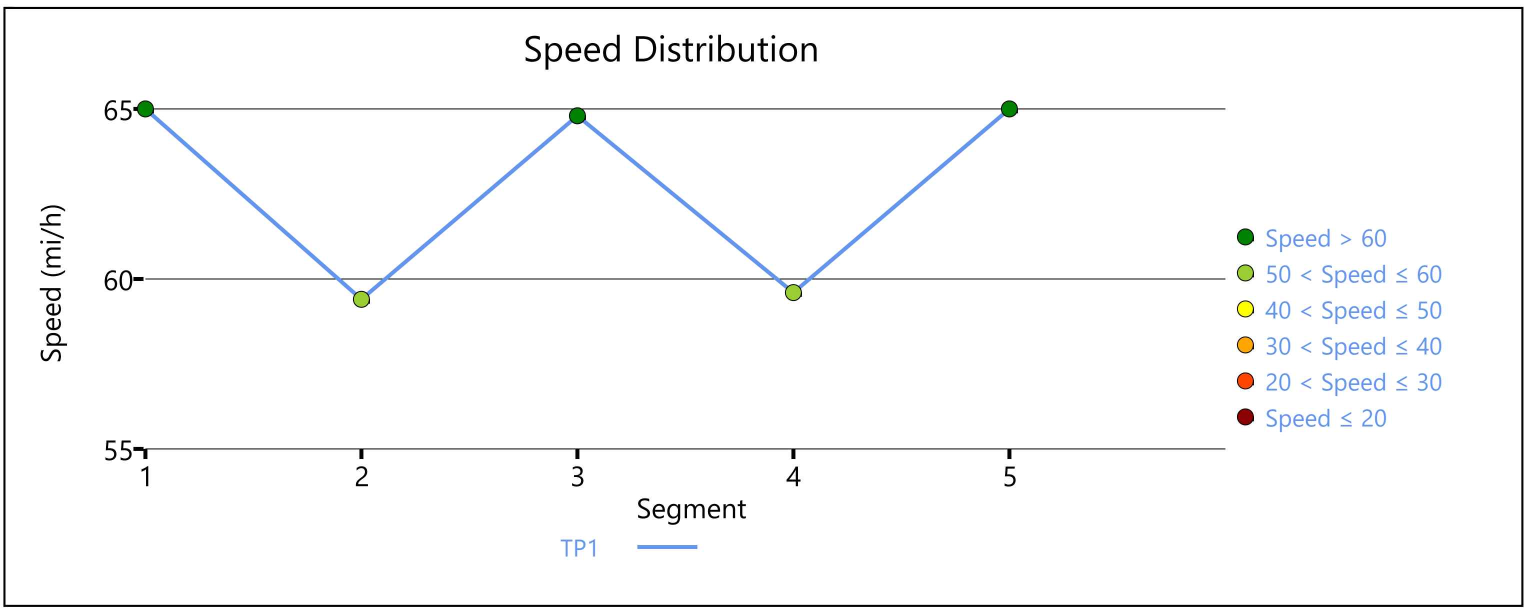
Facility Overall Results

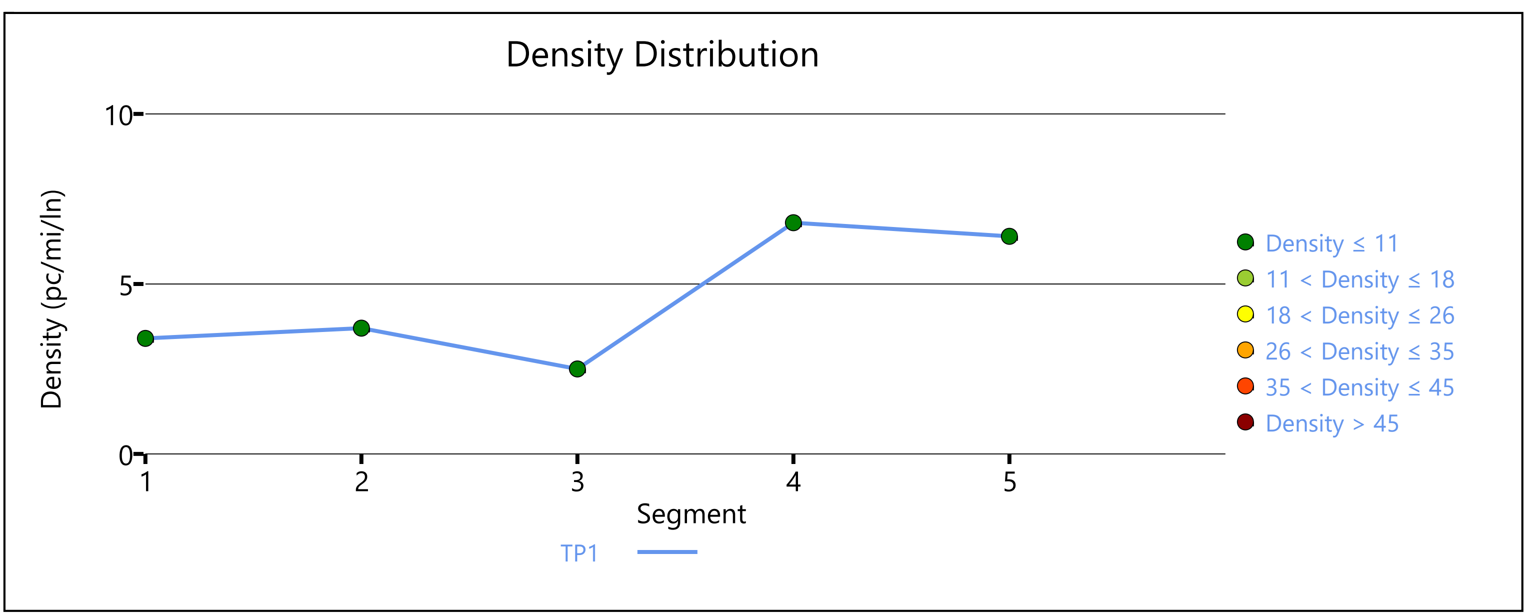
Space Mean Speed, mi/h	64.1	Density, veh/mi/ln	4.1
Average Travel Time, min	3.80	Density, pc/mi/ln	4.7

Messages

Comments


Volume Distribution
1000
500
0
Volume (pc/h)
1
2
3
4
5
Segment
TP1


Speed Distribution
65
60
55
Speed (mi/h)
1
2
3
4
5
Segment
TP1
Speed > 60
50 < Speed ≤ 60
40 < Speed ≤ 50
30 < Speed ≤ 40
20 < Speed ≤ 30
Speed ≤ 20


Density Distribution
10
5
0
Density (pc/mi/ln)
1
2
3
4
5
Segment
TP1
Density ≤ 11
11 < Density ≤ 18
18 < Density ≤ 26
26 < Density ≤ 35
35 < Density ≤ 45
Density > 45

HCS7 Freeway Facilities Report

Project Information

Analyst	BSE	Date	11/23/2020
Agency	MoDOT	Analysis Year	2042
Jurisdiction	Poplar Bluff, MO	Time Period Analyzed	2042 PM Peak
Project Description	NB Route 67 - 2042 PM - ALT 2 - with Freeway Conversion	Unit	United States Customary

Facility Global Input

Jam Density, pc/mi/ln	190.0	Density at Capacity, pc/mi/ln	45.0
Queue Discharge Capacity Drop, %	7	Total Segments	5
Total Time Periods	1	Time Period Duration, min	15
Facility Length, mi	4.09		

Facility Segment Data

No.	Coded	Analyzed	Name	Length, ft	Lanes
1	Basic	Basic		7950	2
2	Diverge	Diverge	Route 160 Off-Ramp_	1500	2
3	Basic	Basic		1080	2
4	Merge	Merge	Route 160 On-Ramp_	1500	2
5	Basic	Basic		9540	2

Facility Segment Data

Segment 1: Basic

Time Period	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.90	0.870	442	4700	0.09	65.0	3.4	A

Segment 2: Diverge

Time Period	PHF		fHV		Flow Rate (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R	Freeway	Ramp	
1	0.90	0.90	0.870	0.952	442	104	4700	2100	0.09	0.05	59.4	59.4	3.7	2.2	A

Segment 3: Basic

Time Period	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.90	0.870	328	4700	0.07	64.3	2.5	A

Segment 4: Merge

Time Period	PHF		fHV		Flow Rate (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R	Freeway	Ramp	
1	0.90	0.90	0.870	0.909	807	479	4700	2000	0.17	0.24	59.7	59.7	6.8	2.7	A

Segment 5: Basic

Time Period	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS

1	0.90	0.870	829	4700	0.18	65.0	6.4	A

Facility Time Period Results

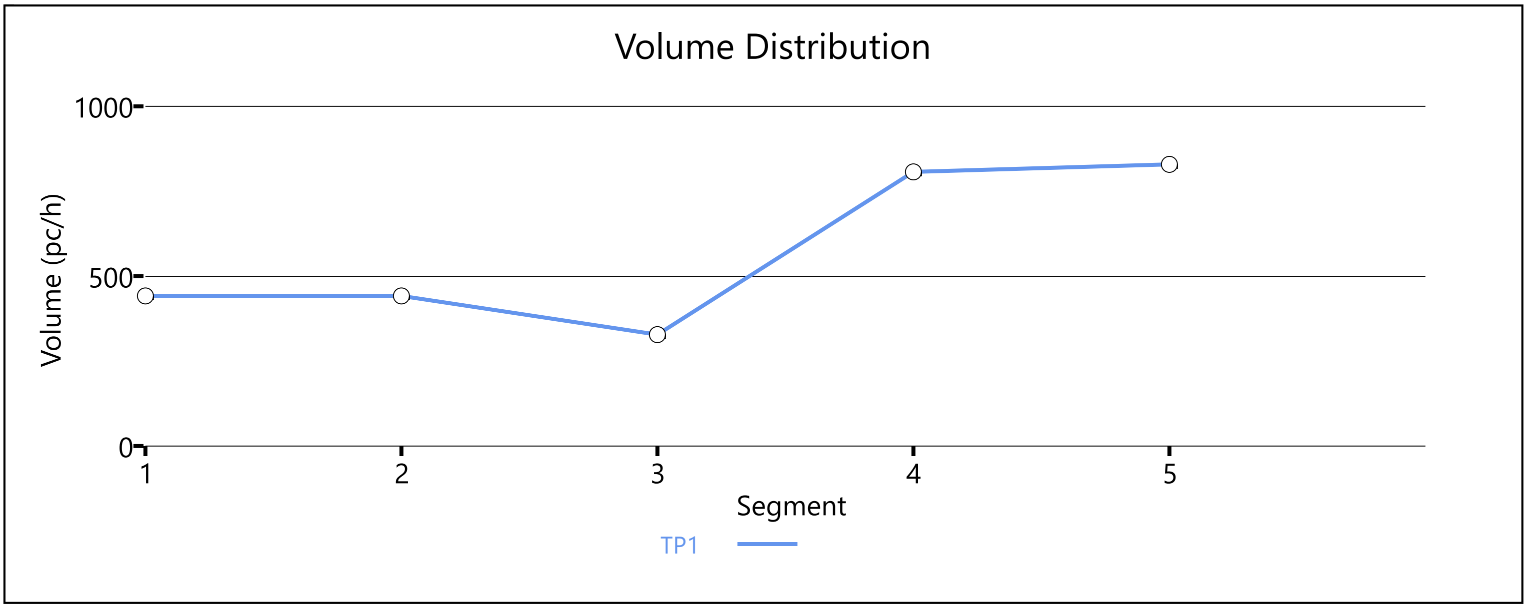
T	Speed, mi/h	Density, pc/mi/ln	Density, veh/mi/ln	Travel Time, min	LOS
1	64.2	4.9	4.3	3.80	A

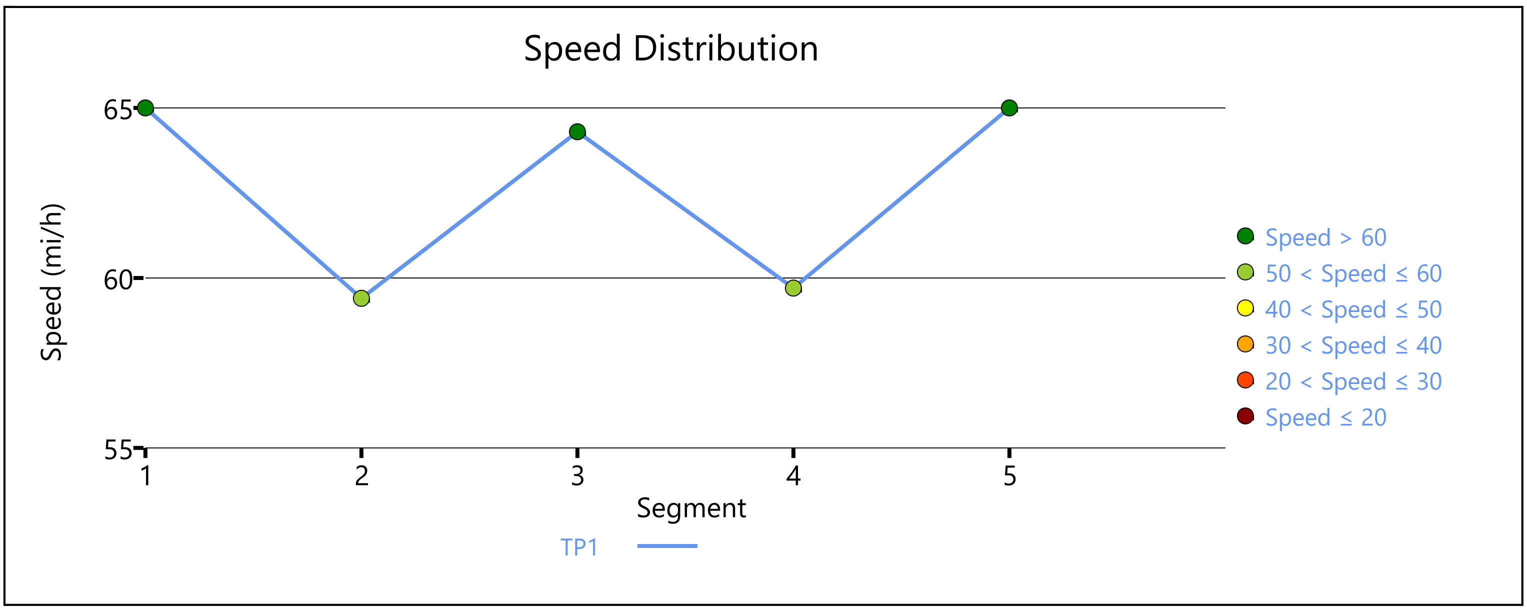
Facility Overall Results

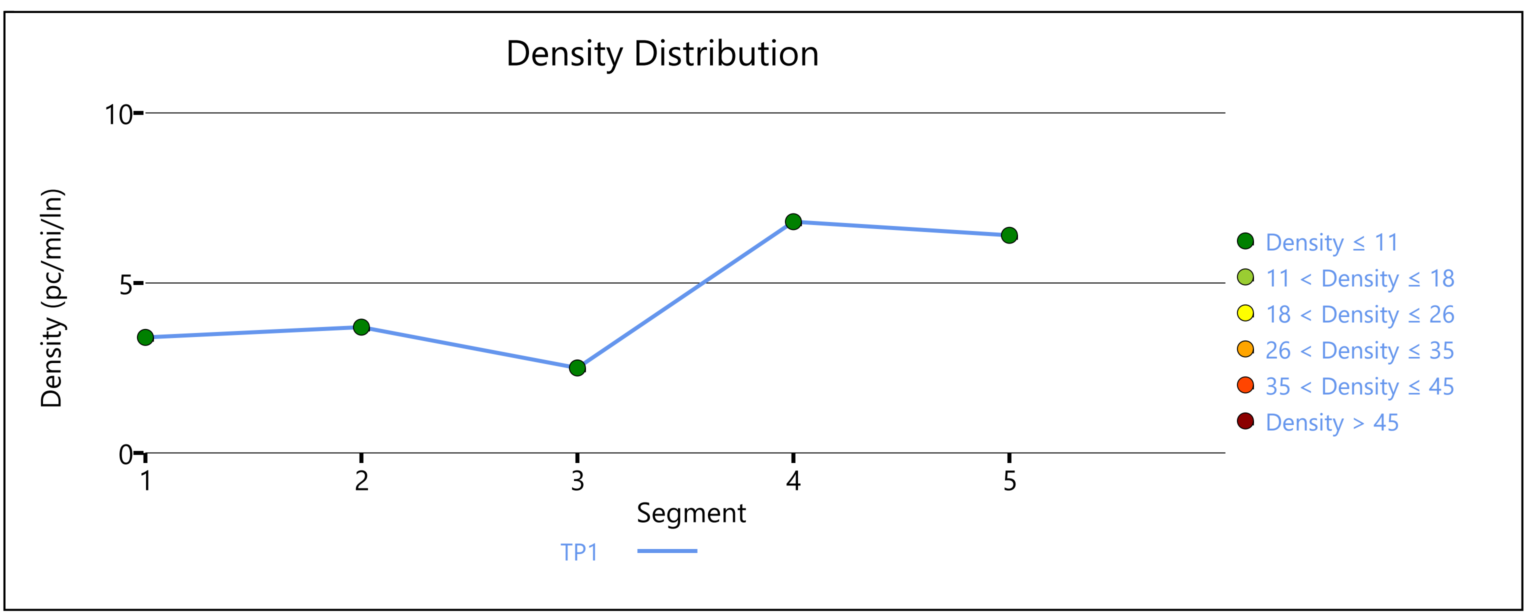
Space Mean Speed, mi/h	64.2	Density, veh/mi/ln	4.3
Average Travel Time, min	3.80	Density, pc/mi/ln	4.9

Messages

Comments


Volume Distribution
1000
500
0
Volume (pc/h)
1
2
3
4
5
Segment
TP1


Speed Distribution
65
60
55
Speed (mi/h)
1
2
3
4
5
Segment
TP1
Speed > 60
50 < Speed ≤ 60
40 < Speed ≤ 50
30 < Speed ≤ 40
20 < Speed ≤ 30
Speed ≤ 20


Density Distribution
10
5
0
Density (pc/mi/ln)
1
2
3
4
5
Segment
TP1
Density ≤ 11
11 < Density ≤ 18
18 < Density ≤ 26
26 < Density ≤ 35
35 < Density ≤ 45
Density > 45

HCS7 Freeway Facilities Report

Project Information

Analyst	BSE	Date	11/23/2020
Agency	MoDOT	Analysis Year	2042
Jurisdiction	Poplar Bluff, MO	Time Period Analyzed	2042 PM Peak
Project Description	SB Route 67 - 2042 PM - ALT 1, 2 & 3 - With Freeway Conversion	Unit	United States Customary

Facility Global Input

Jam Density, pc/mi/ln	190.0	Density at Capacity, pc/mi/ln	45.0
Queue Discharge Capacity Drop, %	7	Total Segments	5
Total Time Periods	1	Time Period Duration, min	15
Facility Length, mi	4.09		

Facility Segment Data

No.	Coded	Analyzed	Name	Length, ft	Lanes
1	Basic	Basic		8500	2
2	Diverge	Diverge	Route 160 Off-Ramp_	1500	2
3	Basic	Basic		2070	2
4	Merge	Merge	Route 160 On-Ramp_	1500	2
5	Basic	Basic		8000	2

Facility Segment Data

Segment 1: Basic

Time Period	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.90	0.870	1152	4700	0.25	65.0	8.9	A

Segment 2: Diverge

Time Period	PHF		fHV		Flow Rate (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R	Freeway	Ramp	
1	0.90	0.90	0.870	0.909	1152	721	4700	2000	0.25	0.36	55.2	55.2	10.4	8.2	A

Segment 3: Basic

Time Period	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.90	0.870	398	4700	0.08	64.5	3.1	A

Segment 4: Merge

Time Period	PHF		fHV		Flow Rate (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R	Freeway	Ramp	
1	0.90	0.90	0.870	0.952	451	53	4700	2100	0.10	0.03	59.2	59.2	3.8	4.2	A

Segment 5: Basic

Time	PHF	fHV	Flow Rate	Capacity	d/c	Speed	Density	LOS

Period			(pc/h)	(pc/h)	Ratio	(mi/h)	(pc/mi/ln)	
1	0.90	0.870	456	4700	0.10	65.0	3.5	A

Facility Time Period Results

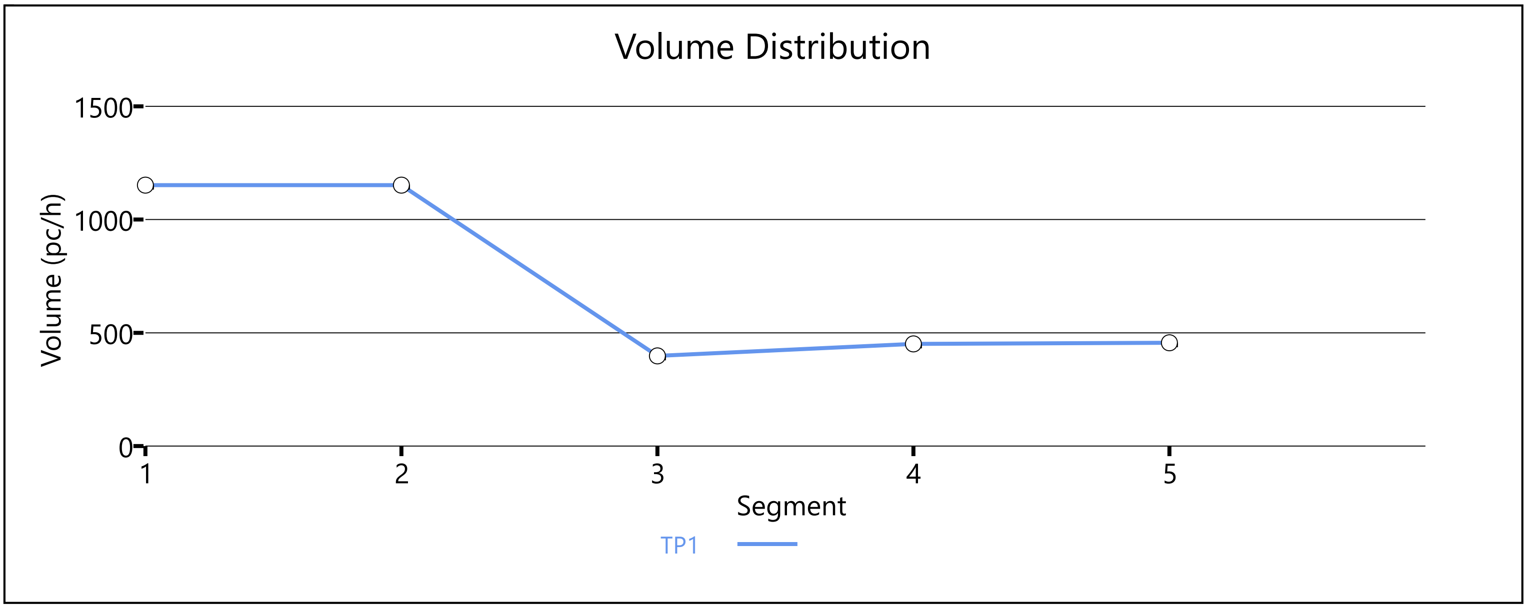
T	Speed, mi/h	Density, pc/mi/ln	Density, veh/mi/ln	Travel Time, min	LOS
1	63.6	6.1	5.3	3.90	A

Facility Overall Results

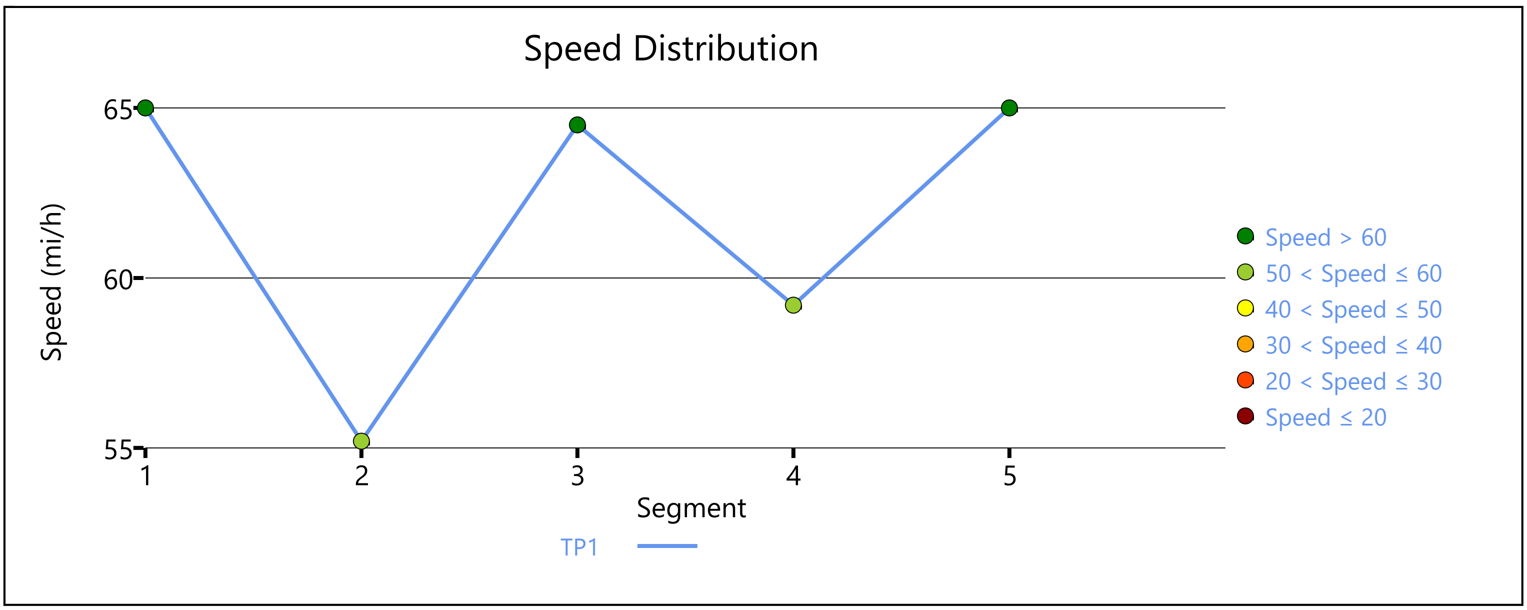
Space Mean Speed, mi/h	63.6	Density, veh/mi/ln	5.3
Average Travel Time, min	3.90	Density, pc/mi/ln	6.1

Messages

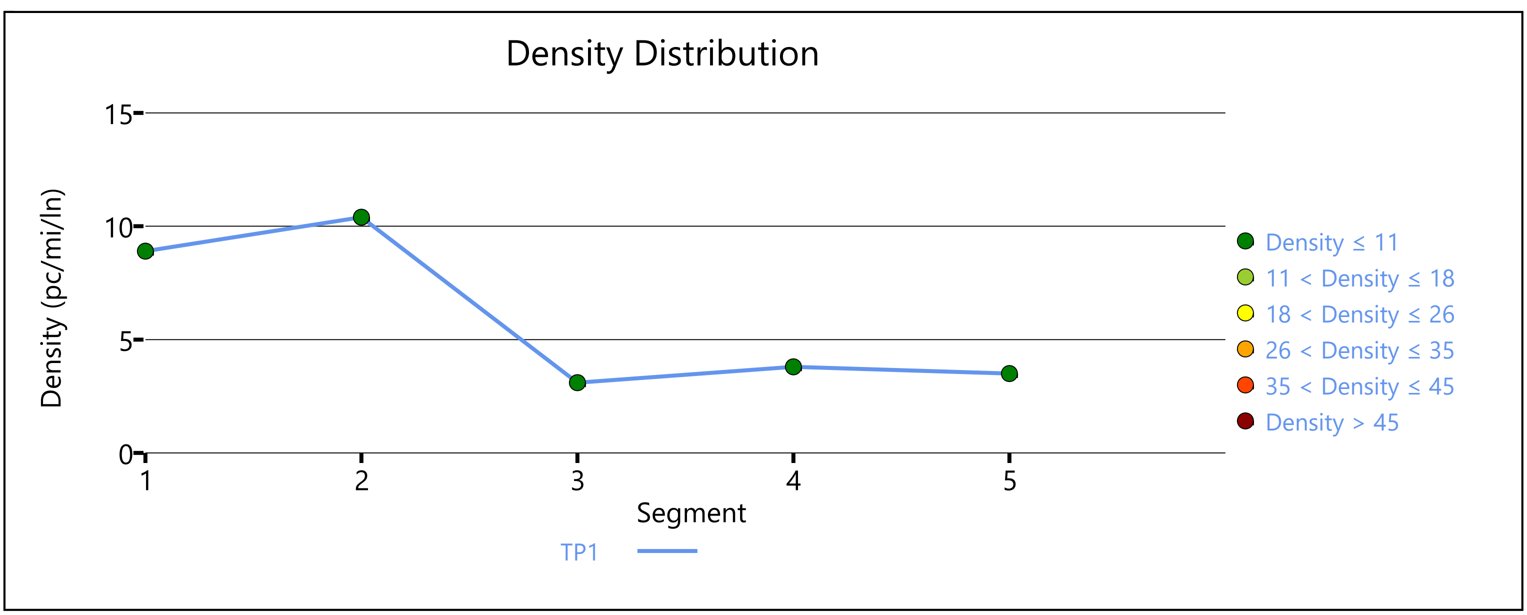
Comments



Volume Distribution
1500
1000
500
0
Volume (pc/h)
1
2
3
4
5
Segment
TP1



Speed Distribution
65
60
55
Speed (mi/h)
1
2
3
4
5
Segment
TP1
Speed > 60
50 < Speed ≤ 60
40 < Speed ≤ 50
30 < Speed ≤ 40
20 < Speed ≤ 30
Speed ≤ 20



Density Distribution
15
10
5
0
Density (pc/mi/ln)
1
2
3
4
5
Segment
TP1
Density ≤ 11
11 < Density ≤ 18
18 < Density ≤ 26
26 < Density ≤ 35
35 < Density ≤ 45
Density > 45

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	95	15	2	1	14	43	1	629	17	25	285	32
Future Volume (vph)	95	15	2	1	14	43	1	629	17	25	285	32
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		0	220		150	180		0
Storage Lanes	0		0	0		0	1		1	1		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	0.95
Frt		0.997			0.900				0.850		0.985	
Flt Protected		0.960			0.999		0.950			0.950		
Satd. Flow (prot)	0	1783	0	0	1675	0	1770	3139	1583	1770	3128	0
Flt Permitted		0.960			0.999		0.950			0.950		
Satd. Flow (perm)	0	1783	0	0	1675	0	1770	3139	1583	1770	3128	0
Link Speed (mph)		30			30			65			65	
Link Distance (ft)		384			236			1273			351	
Travel Time (s)		8.7			5.4			13.4			3.7	
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80	0.86	0.86	0.86	0.86	0.86	0.86
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	15%	2%	2%	15%	2%
Adj. Flow (vph)	119	19	3	1	18	54	1	731	20	29	331	37
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	141	0	0	73	0	1	731	20	29	368	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			60			60	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Stop			Stop			Free			Free	

Intersection Summary

Area Type: Other

Control Type: Unsignalized

Intersection Capacity Utilization 40.3% ICU Level of Service A

Analysis Period (min) 15

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	1	0	0	0	0	1	0	240	0	0	229	1
Future Volume (vph)	1	0	0	0	0	1	0	240	0	0	229	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt					0.865						0.999	
Flt Protected		0.950										
Satd. Flow (prot)	0	1770	0	0	1611	0	0	1652	0	0	1651	0
Flt Permitted		0.950										
Satd. Flow (perm)	0	1770	0	0	1611	0	0	1652	0	0	1651	0
Link Speed (mph)		30			30			60			60	
Link Distance (ft)		751			536			1843			682	
Travel Time (s)		17.1			12.2			20.9			7.8	
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80	0.86	0.86	0.86	0.86	0.86	0.86
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	15%	2%	2%	15%	2%
Adj. Flow (vph)	1	0	0	0	0	1	0	279	0	0	266	1
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	1	0	0	1	0	0	279	0	0	267	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Stop			Stop			Free			Free	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	
Intersection Capacity Utilization 22.6%	ICU Level of Service A
Analysis Period (min) 15	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	1	0	0	0	0	1	0	238	0	0	228	1
Future Volume (vph)	1	0	0	0	0	1	0	238	0	0	228	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt					0.865						0.999	
Flt Protected		0.950										
Satd. Flow (prot)	0	1770	0	0	1611	0	0	1652	0	0	1651	0
Flt Permitted		0.950										
Satd. Flow (perm)	0	1770	0	0	1611	0	0	1652	0	0	1651	0
Link Speed (mph)		30			30			60			60	
Link Distance (ft)		485			406			490			1843	
Travel Time (s)		11.0			9.2			5.6			20.9	
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80	0.86	0.86	0.86	0.86	0.86	0.86
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	15%	2%	2%	15%	2%
Adj. Flow (vph)	1	0	0	0	0	1	0	277	0	0	265	1
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	1	0	0	1	0	0	277	0	0	266	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Stop			Stop			Free			Free	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	
Intersection Capacity Utilization 22.5%	ICU Level of Service A
Analysis Period (min) 15	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	24	464	9	15	150	11	7	7	41	16	1	33
Future Volume (vph)	24	464	9	15	150	11	7	7	41	16	1	33
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.998			0.991			0.900			0.911	
Flt Protected		0.998			0.996			0.994			0.984	
Satd. Flow (prot)	0	1802	0	0	1786	0	0	1666	0	0	1670	0
Flt Permitted		0.998			0.996			0.994			0.984	
Satd. Flow (perm)	0	1802	0	0	1786	0	0	1666	0	0	1670	0
Link Speed (mph)		45			45			30			45	
Link Distance (ft)		1590			1013			619			557	
Travel Time (s)		24.1			15.3			14.1			8.4	
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	2%	2%	2%	2%	2%	2%
Adj. Flow (vph)	30	580	11	19	188	14	9	9	51	20	1	41
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	621	0	0	221	0	0	69	0	0	62	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Free			Free			Stop			Stop	

Intersection Summary		
Area Type:	Other	
Control Type: Unsignalized		
Intersection Capacity Utilization 43.4%		ICU Level of Service A
Analysis Period (min) 15		

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	58	465	55	7	5	118
Future Volume (vph)	58	465	55	7	5	118
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.984		0.870	
Flt Protected		0.994			0.998	
Satd. Flow (prot)	0	1789	1771	0	1571	0
Flt Permitted		0.994			0.998	
Satd. Flow (perm)	0	1789	1771	0	1571	0
Link Speed (mph)		45	45		30	
Link Distance (ft)		1013	730		536	
Travel Time (s)		15.3	11.1		12.2	
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80
Heavy Vehicles (%)	10%	5%	5%	10%	5%	5%
Adj. Flow (vph)	73	581	69	9	6	148
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	654	78	0	154	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(ft)		0	0		12	
Link Offset(ft)		0	0		0	
Crosswalk Width(ft)		16	16		16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15			9	15	9
Sign Control		Free	Free		Stop	

Intersection Summary	
Area Type: Other	
Control Type: Unsignalized	
Intersection Capacity Utilization 48.6%	ICU Level of Service A
Analysis Period (min) 15	

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	50	420	16	35	27	4
Future Volume (vph)	50	420	16	35	27	4
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)		325	0		0	0
Storage Lanes		1	0		1	0
Taper Length (ft)			25		25	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.850			0.983	
Flt Protected				0.985	0.958	
Satd. Flow (prot)	1810	1538	0	1782	1627	0
Flt Permitted				0.985	0.958	
Satd. Flow (perm)	1810	1538	0	1782	1627	0
Link Speed (mph)	45			55	30	
Link Distance (ft)	730			270	420	
Travel Time (s)	11.1			3.3	9.5	
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80
Heavy Vehicles (%)	5%	5%	5%	5%	10%	10%
Adj. Flow (vph)	63	525	20	44	34	5
Shared Lane Traffic (%)						
Lane Group Flow (vph)	63	525	0	64	39	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	0			0	12	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)		9	15		15	9
Sign Control	Free			Free	Stop	

Intersection Summary	
Area Type: Other	
Control Type: Unsignalized	
Intersection Capacity Utilization 36.0%	ICU Level of Service A
Analysis Period (min) 15	

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	53	1	0	49	2	0
Future Volume (vph)	53	1	0	49	2	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.998					
Flt Protected					0.950	
Satd. Flow (prot)	1806	0	0	1810	1770	0
Flt Permitted					0.950	
Satd. Flow (perm)	1806	0	0	1810	1770	0
Link Speed (mph)	55			55	30	
Link Distance (ft)	270			3236	478	
Travel Time (s)	3.3			40.1	10.9	
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80
Heavy Vehicles (%)	5%	5%	5%	5%	2%	2%
Adj. Flow (vph)	66	1	0	61	3	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	67	0	0	61	3	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	0			0	12	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)		9	15		15	9
Sign Control	Free			Free	Stop	

Intersection Summary	
Area Type: Other	
Control Type: Unsignalized	
Intersection Capacity Utilization 13.3%	ICU Level of Service A
Analysis Period (min) 15	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	1	45	5	2	40	2	6	0	1	0	0	3
Future Volume (vph)	1	45	5	2	40	2	6	0	1	0	0	3
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.987			0.993			0.985			0.865	
Flt Protected		0.999			0.997			0.957				
Satd. Flow (prot)	0	1784	0	0	1791	0	0	1756	0	0	1611	0
Flt Permitted		0.999			0.997			0.957				
Satd. Flow (perm)	0	1784	0	0	1791	0	0	1756	0	0	1611	0
Link Speed (mph)		55			55			30			30	
Link Distance (ft)		3236			2284			2605			1665	
Travel Time (s)		40.1			28.3			59.2			37.8	
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	2%	2%	2%	2%	2%	2%
Adj. Flow (vph)	1	56	6	3	50	3	8	0	1	0	0	4
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	63	0	0	56	0	0	9	0	0	4	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Free			Free			Stop			Stop	

Intersection Summary		
Area Type:	Other	
Control Type: Unsignalized		
Intersection Capacity Utilization 15.3%		ICU Level of Service A
Analysis Period (min) 15		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	66	8	0	7	14	18	1	385	6	24	570	134
Future Volume (vph)	66	8	0	7	14	18	1	385	6	24	570	134
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		0	220		150	180		0
Storage Lanes	0		0	0		0	1		1	1		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	0.95
Frt					0.937				0.850		0.971	
Flt Protected		0.957			0.991		0.950			0.950		
Satd. Flow (prot)	0	1783	0	0	1730	0	1770	3139	1583	1770	3115	0
Flt Permitted		0.957			0.991		0.950			0.950		
Satd. Flow (perm)	0	1783	0	0	1730	0	1770	3139	1583	1770	3115	0
Link Speed (mph)		30			30			65			65	
Link Distance (ft)		384			236			1273			351	
Travel Time (s)		8.7			5.4			13.4			3.7	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	15%	2%	2%	15%	2%
Adj. Flow (vph)	78	9	0	8	16	21	1	428	7	27	633	149
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	87	0	0	45	0	1	428	7	27	782	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			60			60	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Stop			Stop			Free			Free	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	
Intersection Capacity Utilization 37.4%	ICU Level of Service A
Analysis Period (min) 15	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	1	0	0	0	0	0	0	250	0	1	285	1
Future Volume (vph)	1	0	0	0	0	0	0	250	0	1	285	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt												
Flt Protected		0.950										
Satd. Flow (prot)	0	1770	0	0	1863	0	0	1652	0	0	1653	0
Flt Permitted		0.950										
Satd. Flow (perm)	0	1770	0	0	1863	0	0	1652	0	0	1653	0
Link Speed (mph)		30			30			60			60	
Link Distance (ft)		751			536			1843			682	
Travel Time (s)		17.1			12.2			20.9			7.8	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	15%	2%	2%	15%	2%
Adj. Flow (vph)	1	0	0	0	0	0	0	278	0	1	317	1
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	1	0	0	0	0	0	278	0	0	319	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Stop			Stop			Free			Free	

Intersection Summary		
Area Type:	Other	
Control Type: Unsignalized		
Intersection Capacity Utilization 25.9%		ICU Level of Service A
Analysis Period (min) 15		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	1	0	0	0	0	0	0	249	0	1	285	1
Future Volume (vph)	1	0	0	0	0	0	0	249	0	1	285	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt												
Flt Protected		0.950										
Satd. Flow (prot)	0	1770	0	0	1863	0	0	1652	0	0	1653	0
Flt Permitted		0.950										
Satd. Flow (perm)	0	1770	0	0	1863	0	0	1652	0	0	1653	0
Link Speed (mph)		30			30			60			60	
Link Distance (ft)		485			406			490			1843	
Travel Time (s)		11.0			9.2			5.6			20.9	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	15%	2%	2%	15%	2%
Adj. Flow (vph)	1	0	0	0	0	0	0	277	0	1	317	1
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	1	0	0	0	0	0	277	0	0	319	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Stop			Stop			Free			Free	

Intersection Summary	
Area Type: Other	
Control Type: Unsignalized	
Intersection Capacity Utilization 25.9%	ICU Level of Service A
Analysis Period (min) 15	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	33	210	8	40	356	25	21	11	35	24	12	49
Future Volume (vph)	33	210	8	40	356	25	21	11	35	24	12	49
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.996			0.992			0.930			0.922	
Flt Protected		0.993			0.995			0.984			0.986	
Satd. Flow (prot)	0	1790	0	0	1786	0	0	1705	0	0	1693	0
Flt Permitted		0.993			0.995			0.984			0.986	
Satd. Flow (perm)	0	1790	0	0	1786	0	0	1705	0	0	1693	0
Link Speed (mph)		45			45			30			45	
Link Distance (ft)		1590			1013			619			557	
Travel Time (s)		24.1			15.3			14.1			8.4	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	2%	2%	2%	2%	2%	2%
Adj. Flow (vph)	39	247	9	47	419	29	25	13	41	28	14	58
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	295	0	0	495	0	0	79	0	0	100	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Free			Free			Stop			Stop	

Intersection Summary		
Area Type:	Other	
Control Type: Unsignalized		
Intersection Capacity Utilization 40.6%		ICU Level of Service A
Analysis Period (min) 15		

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	21	242	106	8	9	308
Future Volume (vph)	21	242	106	8	9	308
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.991		0.869	
Flt Protected		0.996			0.999	
Satd. Flow (prot)	0	1795	1788	0	1571	0
Flt Permitted		0.996			0.999	
Satd. Flow (perm)	0	1795	1788	0	1571	0
Link Speed (mph)		45	45		30	
Link Distance (ft)		1013	730		536	
Travel Time (s)		15.3	11.1		12.2	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Heavy Vehicles (%)	10%	5%	5%	10%	5%	5%
Adj. Flow (vph)	25	285	125	9	11	362
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	310	134	0	373	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(ft)		0	0		12	
Link Offset(ft)		0	0		0	
Crosswalk Width(ft)		16	16		16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15			9	15	9
Sign Control		Free	Free		Stop	

Intersection Summary	
Area Type: Other	
Control Type: Unsignalized	
Intersection Capacity Utilization 46.8%	ICU Level of Service A
Analysis Period (min) 15	

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	58	193	6	69	45	13
Future Volume (vph)	58	193	6	69	45	13
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)		325	0		0	0
Storage Lanes		1	0		1	0
Taper Length (ft)			25		25	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.850			0.970	
Flt Protected				0.996	0.962	
Satd. Flow (prot)	1810	1538	0	1802	1612	0
Flt Permitted				0.996	0.962	
Satd. Flow (perm)	1810	1538	0	1802	1612	0
Link Speed (mph)	45			55	30	
Link Distance (ft)	730			270	420	
Travel Time (s)	11.1			3.3	9.5	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Heavy Vehicles (%)	5%	5%	5%	5%	10%	10%
Adj. Flow (vph)	68	227	7	81	53	15
Shared Lane Traffic (%)						
Lane Group Flow (vph)	68	227	0	88	68	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	0			0	12	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)		9	15		15	9
Sign Control	Free			Free	Stop	

Intersection Summary	
Area Type: Other	
Control Type: Unsignalized	
Intersection Capacity Utilization 22.6%	ICU Level of Service A
Analysis Period (min) 15	

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	69	2	0	74	1	0
Future Volume (vph)	69	2	0	74	1	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.997					
Flt Protected					0.950	
Satd. Flow (prot)	1804	0	0	1810	1770	0
Flt Permitted					0.950	
Satd. Flow (perm)	1804	0	0	1810	1770	0
Link Speed (mph)	55			55	30	
Link Distance (ft)	270			3236	478	
Travel Time (s)	3.3			40.1	10.9	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Heavy Vehicles (%)	5%	5%	5%	5%	2%	2%
Adj. Flow (vph)	81	2	0	87	1	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	83	0	0	87	1	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	0			0	12	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)		9	15		15	9
Sign Control	Free			Free	Stop	

Intersection Summary	
Area Type: Other	
Control Type: Unsignalized	
Intersection Capacity Utilization 13.9%	ICU Level of Service A
Analysis Period (min) 15	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✣			✣			✣			✣	
Traffic Volume (vph)	1	62	4	2	68	0	0	0	1	0	0	1
Future Volume (vph)	1	62	4	2	68	0	0	0	1	0	0	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.991						0.865			0.865	
Flt Protected		0.999			0.999							
Satd. Flow (prot)	0	1791	0	0	1808	0	0	1611	0	0	1611	0
Flt Permitted		0.999			0.999							
Satd. Flow (perm)	0	1791	0	0	1808	0	0	1611	0	0	1611	0
Link Speed (mph)		55			55			30			30	
Link Distance (ft)		3236			2284			2605			1665	
Travel Time (s)		40.1			28.3			59.2			37.8	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	2%	2%	2%	2%	2%	2%
Adj. Flow (vph)	1	73	5	2	80	0	0	0	1	0	0	1
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	79	0	0	82	0	0	1	0	0	1	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Free			Free			Stop			Stop	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	
Intersection Capacity Utilization 14.7%	ICU Level of Service A
Analysis Period (min) 15	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	98	15	2	1	14	44	1	648	18	25	290	33
Future Volume (vph)	98	15	2	1	14	44	1	648	18	25	290	33
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		0	220		150	180		0
Storage Lanes	0		0	0		0	1		1	1		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	0.95
Frt		0.997			0.900				0.850		0.985	
Flt Protected		0.959			0.999		0.950			0.950		
Satd. Flow (prot)	0	1781	0	0	1675	0	1770	3139	1583	1770	3128	0
Flt Permitted		0.959			0.999		0.950			0.950		
Satd. Flow (perm)	0	1781	0	0	1675	0	1770	3139	1583	1770	3128	0
Link Speed (mph)		30			30			65			65	
Link Distance (ft)		384			236			1273			351	
Travel Time (s)		8.7			5.4			13.4			3.7	
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80	0.86	0.86	0.86	0.86	0.86	0.86
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	15%	2%	2%	15%	2%
Adj. Flow (vph)	123	19	3	1	18	55	1	753	21	29	337	38
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	145	0	0	74	0	1	753	21	29	375	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			60			60	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Stop			Stop			Free			Free	

Intersection Summary

Area Type: Other

Control Type: Unsignalized

Intersection Capacity Utilization 40.4% ICU Level of Service A

Analysis Period (min) 15

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	1	0	0	0	0	1	0	247	0	0	233	1
Future Volume (vph)	1	0	0	0	0	1	0	247	0	0	233	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt					0.865							
Flt Protected		0.950										
Satd. Flow (prot)	0	1770	0	0	1611	0	0	1652	0	0	1653	0
Flt Permitted		0.950										
Satd. Flow (perm)	0	1770	0	0	1611	0	0	1652	0	0	1653	0
Link Speed (mph)		30			30			60			60	
Link Distance (ft)		751			536			1843			682	
Travel Time (s)		17.1			12.2			20.9			7.8	
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80	0.86	0.86	0.86	0.86	0.86	0.86
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	15%	2%	2%	15%	2%
Adj. Flow (vph)	1	0	0	0	0	1	0	287	0	0	271	1
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	1	0	0	1	0	0	287	0	0	272	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Stop			Stop			Free			Free	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	
Intersection Capacity Utilization 23.0%	ICU Level of Service A
Analysis Period (min) 15	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	1	0	0	0	0	1	0	245	0	0	232	1
Future Volume (vph)	1	0	0	0	0	1	0	245	0	0	232	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt					0.865							
Flt Protected		0.950										
Satd. Flow (prot)	0	1770	0	0	1611	0	0	1652	0	0	1653	0
Flt Permitted		0.950										
Satd. Flow (perm)	0	1770	0	0	1611	0	0	1652	0	0	1653	0
Link Speed (mph)		30			30			60			60	
Link Distance (ft)		485			406			490			1843	
Travel Time (s)		11.0			9.2			5.6			20.9	
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80	0.86	0.86	0.86	0.86	0.86	0.86
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	15%	2%	2%	15%	2%
Adj. Flow (vph)	1	0	0	0	0	1	0	285	0	0	270	1
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	1	0	0	1	0	0	285	0	0	271	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Stop			Stop			Free			Free	

Intersection Summary

Area Type: Other

Control Type: Unsignalized

Intersection Capacity Utilization 22.9% ICU Level of Service A

Analysis Period (min) 15

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	25	478	9	15	153	11	7	7	42	16	1	34
Future Volume (vph)	25	478	9	15	153	11	7	7	42	16	1	34
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.998			0.992			0.899			0.909	
Flt Protected		0.998			0.996			0.994			0.985	
Satd. Flow (prot)	0	1802	0	0	1788	0	0	1665	0	0	1668	0
Flt Permitted		0.998			0.996			0.994			0.985	
Satd. Flow (perm)	0	1802	0	0	1788	0	0	1665	0	0	1668	0
Link Speed (mph)		45			45			30			45	
Link Distance (ft)		1590			1013			619			557	
Travel Time (s)		24.1			15.3			14.1			8.4	
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	2%	2%	2%	2%	2%	2%
Adj. Flow (vph)	31	598	11	19	191	14	9	9	53	20	1	43
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	640	0	0	224	0	0	71	0	0	64	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Free			Free			Stop			Stop	

Intersection Summary		
Area Type:	Other	
Control Type: Unsignalized		
Intersection Capacity Utilization 44.6%		ICU Level of Service A
Analysis Period (min) 15		

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	59	478	57	7	5	120
Future Volume (vph)	59	478	57	7	5	120
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.985		0.870	
Flt Protected		0.995			0.998	
Satd. Flow (prot)	0	1791	1773	0	1571	0
Flt Permitted		0.995			0.998	
Satd. Flow (perm)	0	1791	1773	0	1571	0
Link Speed (mph)		45	45		30	
Link Distance (ft)		1013	730		536	
Travel Time (s)		15.3	11.1		12.2	
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80
Heavy Vehicles (%)	10%	5%	5%	10%	5%	5%
Adj. Flow (vph)	74	598	71	9	6	150
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	672	80	0	156	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(ft)		0	0		12	
Link Offset(ft)		0	0		0	
Crosswalk Width(ft)		16	16		16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15			9	15	9
Sign Control		Free	Free		Stop	

Intersection Summary

Area Type: Other

Control Type: Unsignalized

Intersection Capacity Utilization 49.5% ICU Level of Service A

Analysis Period (min) 15

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	51	432	16	36	28	4
Future Volume (vph)	51	432	16	36	28	4
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)		325	0		0	0
Storage Lanes		1	0		1	0
Taper Length (ft)			25		25	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.850			0.983	
Flt Protected				0.985	0.958	
Satd. Flow (prot)	1810	1538	0	1782	1627	0
Flt Permitted				0.985	0.958	
Satd. Flow (perm)	1810	1538	0	1782	1627	0
Link Speed (mph)	45			55	30	
Link Distance (ft)	730			270	420	
Travel Time (s)	11.1			3.3	9.5	
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80
Heavy Vehicles (%)	5%	5%	5%	5%	10%	10%
Adj. Flow (vph)	64	540	20	45	35	5
Shared Lane Traffic (%)						
Lane Group Flow (vph)	64	540	0	65	40	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	0			0	12	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)		9	15		15	9
Sign Control	Free			Free	Stop	

Intersection Summary	
Area Type: Other	
Control Type: Unsignalized	
Intersection Capacity Utilization 36.7%	ICU Level of Service A
Analysis Period (min) 15	

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	54	1	0	50	2	0
Future Volume (vph)	54	1	0	50	2	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.998					
Flt Protected					0.950	
Satd. Flow (prot)	1806	0	0	1810	1770	0
Flt Permitted					0.950	
Satd. Flow (perm)	1806	0	0	1810	1770	0
Link Speed (mph)	55			55	30	
Link Distance (ft)	270			3236	478	
Travel Time (s)	3.3			40.1	10.9	
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80
Heavy Vehicles (%)	5%	5%	5%	5%	2%	2%
Adj. Flow (vph)	68	1	0	63	3	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	69	0	0	63	3	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	0			0	12	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)		9	15		15	9
Sign Control	Free			Free	Stop	

Intersection Summary		
Area Type:	Other	
Control Type: Unsignalized		
Intersection Capacity Utilization 13.3%		ICU Level of Service A
Analysis Period (min) 15		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	1	46	5	2	41	0	6	0	1	0	0	3
Future Volume (vph)	1	46	5	2	41	0	6	0	1	0	0	3
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.988						0.985			0.865	
Flt Protected		0.999			0.997			0.957				
Satd. Flow (prot)	0	1786	0	0	1804	0	0	1756	0	0	1611	0
Flt Permitted		0.999			0.997			0.957				
Satd. Flow (perm)	0	1786	0	0	1804	0	0	1756	0	0	1611	0
Link Speed (mph)		55			55			30			30	
Link Distance (ft)		3236			2284			2605			1665	
Travel Time (s)		40.1			28.3			59.2			37.8	
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	2%	2%	2%	2%	2%	2%
Adj. Flow (vph)	1	58	6	3	51	0	8	0	1	0	0	4
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	65	0	0	54	0	0	9	0	0	4	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Free			Free			Stop			Stop	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	
Intersection Capacity Utilization 15.3%	ICU Level of Service A
Analysis Period (min) 15	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	66	8	0	7	14	19	1	396	6	24	581	137
Future Volume (vph)	66	8	0	7	14	19	1	396	6	24	581	137
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		0	220		150	180		0
Storage Lanes	0		0	0		0	1		1	1		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	0.95
Frt					0.935				0.850		0.971	
Flt Protected		0.957			0.991		0.950			0.950		
Satd. Flow (prot)	0	1783	0	0	1726	0	1770	3139	1583	1770	3115	0
Flt Permitted		0.957			0.991		0.950			0.950		
Satd. Flow (perm)	0	1783	0	0	1726	0	1770	3139	1583	1770	3115	0
Link Speed (mph)		30			30			65			65	
Link Distance (ft)		384			236			1273			351	
Travel Time (s)		8.7			5.4			13.4			3.7	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	15%	2%	2%	15%	2%
Adj. Flow (vph)	78	9	0	8	16	22	1	440	7	27	646	152
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	87	0	0	46	0	1	440	7	27	798	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			60			60	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Stop			Stop			Free			Free	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	
Intersection Capacity Utilization 37.8%	ICU Level of Service A
Analysis Period (min) 15	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	1	0	0	0	0	0	0	257	0	1	293	1
Future Volume (vph)	1	0	0	0	0	0	0	257	0	1	293	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt												
Flt Protected		0.950										
Satd. Flow (prot)	0	1770	0	0	1863	0	0	1652	0	0	1653	0
Flt Permitted		0.950										
Satd. Flow (perm)	0	1770	0	0	1863	0	0	1652	0	0	1653	0
Link Speed (mph)		30			30			60			60	
Link Distance (ft)		751			536			1843			682	
Travel Time (s)		17.1			12.2			20.9			7.8	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	15%	2%	2%	15%	2%
Adj. Flow (vph)	1	0	0	0	0	0	0	286	0	1	326	1
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	1	0	0	0	0	0	286	0	0	328	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Stop			Stop			Free			Free	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	
Intersection Capacity Utilization 26.3%	ICU Level of Service A
Analysis Period (min) 15	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	1	0	0	0	0	0	0	256	0	1	290	1
Future Volume (vph)	1	0	0	0	0	0	0	256	0	1	290	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt												
Flt Protected		0.950										
Satd. Flow (prot)	0	1770	0	0	1863	0	0	1652	0	0	1653	0
Flt Permitted		0.950										
Satd. Flow (perm)	0	1770	0	0	1863	0	0	1652	0	0	1653	0
Link Speed (mph)		30			30			60			60	
Link Distance (ft)		485			406			490			1843	
Travel Time (s)		11.0			9.2			5.6			20.9	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	15%	2%	2%	15%	2%
Adj. Flow (vph)	1	0	0	0	0	0	0	284	0	1	322	1
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	1	0	0	0	0	0	284	0	0	324	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Stop			Stop			Free			Free	

Intersection Summary		
Area Type:	Other	
Control Type: Unsignalized		
Intersection Capacity Utilization 26.1%		ICU Level of Service A
Analysis Period (min) 15		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✣			✣			✣			✣	
Traffic Volume (vph)	34	216	8	41	363	26	22	11	36	25	12	50
Future Volume (vph)	34	216	8	41	363	26	22	11	36	25	12	50
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.996			0.992			0.930			0.922	
Flt Protected		0.993			0.995			0.984			0.986	
Satd. Flow (prot)	0	1790	0	0	1786	0	0	1705	0	0	1693	0
Flt Permitted		0.993			0.995			0.984			0.986	
Satd. Flow (perm)	0	1790	0	0	1786	0	0	1705	0	0	1693	0
Link Speed (mph)		45			45			30			45	
Link Distance (ft)		1590			1013			619			557	
Travel Time (s)		24.1			15.3			14.1			8.4	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	2%	2%	2%	2%	2%	2%
Adj. Flow (vph)	40	254	9	48	427	31	26	13	42	29	14	59
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	303	0	0	506	0	0	81	0	0	102	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Free			Free			Stop			Stop	

Intersection Summary	
Area Type: Other	
Control Type: Unsignalized	
Intersection Capacity Utilization 41.4%	ICU Level of Service A
Analysis Period (min) 15	

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	21	249	108	8	9	314
Future Volume (vph)	21	249	108	8	9	314
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.991		0.869	
Flt Protected		0.996			0.999	
Satd. Flow (prot)	0	1796	1788	0	1571	0
Flt Permitted		0.996			0.999	
Satd. Flow (perm)	0	1796	1788	0	1571	0
Link Speed (mph)		45	45		30	
Link Distance (ft)		1013	730		536	
Travel Time (s)		15.3	11.1		12.2	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Heavy Vehicles (%)	10%	5%	5%	10%	5%	5%
Adj. Flow (vph)	25	293	127	9	11	369
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	318	136	0	380	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(ft)		0	0		12	
Link Offset(ft)		0	0		0	
Crosswalk Width(ft)		16	16		16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15			9	15	9
Sign Control		Free	Free		Stop	

Intersection Summary	
Area Type: Other	
Control Type: Unsignalized	
Intersection Capacity Utilization 47.5%	ICU Level of Service A
Analysis Period (min) 15	

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	59	199	6	70	46	13
Future Volume (vph)	59	199	6	70	46	13
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)		325	0		0	0
Storage Lanes		1	0		1	0
Taper Length (ft)			25		25	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.850			0.971	
Flt Protected				0.996	0.962	
Satd. Flow (prot)	1810	1538	0	1802	1613	0
Flt Permitted				0.996	0.962	
Satd. Flow (perm)	1810	1538	0	1802	1613	0
Link Speed (mph)	45			55	30	
Link Distance (ft)	730			270	420	
Travel Time (s)	11.1			3.3	9.5	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Heavy Vehicles (%)	5%	5%	5%	5%	10%	10%
Adj. Flow (vph)	69	234	7	82	54	15
Shared Lane Traffic (%)						
Lane Group Flow (vph)	69	234	0	89	69	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	0			0	12	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)		9	15		15	9
Sign Control	Free			Free	Stop	

Intersection Summary	
Area Type: Other	
Control Type: Unsignalized	
Intersection Capacity Utilization 23.0%	ICU Level of Service A
Analysis Period (min) 15	

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	71	2	0	76	1	0
Future Volume (vph)	71	2	0	76	1	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.997					
Flt Protected					0.950	
Satd. Flow (prot)	1804	0	0	1810	1770	0
Flt Permitted					0.950	
Satd. Flow (perm)	1804	0	0	1810	1770	0
Link Speed (mph)	55			55	30	
Link Distance (ft)	270			3236	478	
Travel Time (s)	3.3			40.1	10.9	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Heavy Vehicles (%)	5%	5%	5%	5%	2%	2%
Adj. Flow (vph)	84	2	0	89	1	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	86	0	0	89	1	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	0			0	12	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)		9	15		15	9
Sign Control	Free			Free	Stop	

Intersection Summary	
Area Type: Other	
Control Type: Unsignalized	
Intersection Capacity Utilization 14.0%	ICU Level of Service A
Analysis Period (min) 15	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	1	64	4	2	70	0	0	0	1	0	0	1
Future Volume (vph)	1	64	4	2	70	0	0	0	1	0	0	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.992						0.865			0.865	
Flt Protected		0.999			0.999							
Satd. Flow (prot)	0	1793	0	0	1808	0	0	1611	0	0	1611	0
Flt Permitted		0.999			0.999							
Satd. Flow (perm)	0	1793	0	0	1808	0	0	1611	0	0	1611	0
Link Speed (mph)		55			55			30			30	
Link Distance (ft)		3236			2284			2605			1665	
Travel Time (s)		40.1			28.3			59.2			37.8	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	2%	2%	2%	2%	2%	2%
Adj. Flow (vph)	1	75	5	2	82	0	0	0	1	0	0	1
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	81	0	0	84	0	0	1	0	0	1	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Free			Free			Stop			Stop	

Intersection Summary		
Area Type:	Other	
Control Type: Unsignalized		
Intersection Capacity Utilization 14.8%		ICU Level of Service A
Analysis Period (min) 15		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	131	20	2	1	18	59	1	867	23	31	352	39
Future Volume (vph)	131	20	2	1	18	59	1	867	23	31	352	39
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		0	220		150	180		0
Storage Lanes	0		0	0		0	1		1	1		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	0.95
Frt		0.998			0.898				0.850		0.985	
Flt Protected		0.959			0.999		0.950			0.950		
Satd. Flow (prot)	0	1783	0	0	1671	0	1770	3139	1583	1770	3127	0
Flt Permitted		0.959			0.999		0.950			0.950		
Satd. Flow (perm)	0	1783	0	0	1671	0	1770	3139	1583	1770	3127	0
Link Speed (mph)		30			30			65			65	
Link Distance (ft)		384			236			1273			351	
Travel Time (s)		8.7			5.4			13.4			3.7	
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80	0.86	0.86	0.86	0.86	0.86	0.86
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	15%	2%	2%	15%	2%
Adj. Flow (vph)	164	25	3	1	23	74	1	1008	27	36	409	45
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	192	0	0	98	0	1	1008	27	36	454	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			60			60	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Stop			Stop			Free			Free	

Intersection Summary	
Area Type: Other	
Control Type: Unsignalized	
Intersection Capacity Utilization 47.5%	ICU Level of Service A
Analysis Period (min) 15	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	1	0	0	0	0	1	0	331	0	0	283	1
Future Volume (vph)	1	0	0	0	0	1	0	331	0	0	283	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt					0.865							
Flt Protected		0.950										
Satd. Flow (prot)	0	1770	0	0	1611	0	0	1652	0	0	1653	0
Flt Permitted		0.950										
Satd. Flow (perm)	0	1770	0	0	1611	0	0	1652	0	0	1653	0
Link Speed (mph)		30			30			60			60	
Link Distance (ft)		751			536			1843			682	
Travel Time (s)		17.1			12.2			20.9			7.8	
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80	0.86	0.86	0.86	0.86	0.86	0.86
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	15%	2%	2%	15%	2%
Adj. Flow (vph)	1	0	0	0	0	1	0	385	0	0	329	1
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	1	0	0	1	0	0	385	0	0	330	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Stop			Stop			Free			Free	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	
Intersection Capacity Utilization 27.4%	ICU Level of Service A
Analysis Period (min) 15	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	1	0	0	0	0	1	0	328	0	0	281	1
Future Volume (vph)	1	0	0	0	0	1	0	328	0	0	281	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt					0.865							
Flt Protected		0.950										
Satd. Flow (prot)	0	1770	0	0	1611	0	0	1652	0	0	1653	0
Flt Permitted		0.950										
Satd. Flow (perm)	0	1770	0	0	1611	0	0	1652	0	0	1653	0
Link Speed (mph)		30			30			60			60	
Link Distance (ft)		485			406			490			1843	
Travel Time (s)		11.0			9.2			5.6			20.9	
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80	0.86	0.86	0.86	0.86	0.86	0.86
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	15%	2%	2%	15%	2%
Adj. Flow (vph)	1	0	0	0	0	1	0	381	0	0	327	1
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	1	0	0	1	0	0	381	0	0	328	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Stop			Stop			Free			Free	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	
Intersection Capacity Utilization 27.3%	ICU Level of Service A
Analysis Period (min) 15	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✣			✣			✣			✣	
Traffic Volume (vph)	31	640	12	20	185	14	9	9	53	21	1	43
Future Volume (vph)	31	640	12	20	185	14	9	9	53	21	1	43
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.998			0.991			0.899			0.910	
Flt Protected		0.998			0.995			0.994			0.984	
Satd. Flow (prot)	0	1802	0	0	1784	0	0	1665	0	0	1668	0
Flt Permitted		0.998			0.995			0.994			0.984	
Satd. Flow (perm)	0	1802	0	0	1784	0	0	1665	0	0	1668	0
Link Speed (mph)		45			45			30			45	
Link Distance (ft)		1590			1013			619			557	
Travel Time (s)		24.1			15.3			14.1			8.4	
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	2%	2%	2%	2%	2%	2%
Adj. Flow (vph)	39	800	15	25	231	18	11	11	66	26	1	54
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	854	0	0	274	0	0	88	0	0	81	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Free			Free			Stop			Stop	

Intersection Summary	
Area Type: Other	
Control Type: Unsignalized	
Intersection Capacity Utilization 56.0%	ICU Level of Service B
Analysis Period (min) 15	

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	72	638	74	9	6	146
Future Volume (vph)	72	638	74	9	6	146
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.986		0.871	
Flt Protected		0.995			0.998	
Satd. Flow (prot)	0	1792	1775	0	1573	0
Flt Permitted		0.995			0.998	
Satd. Flow (perm)	0	1792	1775	0	1573	0
Link Speed (mph)		45	45		30	
Link Distance (ft)		1013	730		536	
Travel Time (s)		15.3	11.1		12.2	
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80
Heavy Vehicles (%)	10%	5%	5%	10%	5%	5%
Adj. Flow (vph)	90	798	93	11	8	183
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	888	104	0	191	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(ft)		0	0		12	
Link Offset(ft)		0	0		0	
Crosswalk Width(ft)		16	16		16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15			9	15	9
Sign Control		Free	Free		Stop	

Intersection Summary

Area Type: Other

Control Type: Unsignalized

Intersection Capacity Utilization 60.3% ICU Level of Service B

Analysis Period (min) 15

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	65	579	22	46	37	6
Future Volume (vph)	65	579	22	46	37	6
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)		325	0		0	0
Storage Lanes		1	0		1	0
Taper Length (ft)			25		25	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.850			0.980	
Flt Protected				0.984	0.959	
Satd. Flow (prot)	1810	1538	0	1781	1623	0
Flt Permitted				0.984	0.959	
Satd. Flow (perm)	1810	1538	0	1781	1623	0
Link Speed (mph)	45			55	30	
Link Distance (ft)	730			270	420	
Travel Time (s)	11.1			3.3	9.5	
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80
Heavy Vehicles (%)	5%	5%	5%	5%	10%	10%
Adj. Flow (vph)	81	724	28	58	46	8
Shared Lane Traffic (%)						
Lane Group Flow (vph)	81	724	0	86	54	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	0			0	12	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)		9	15		15	9
Sign Control	Free			Free	Stop	

Intersection Summary	
Area Type: Other	
Control Type: Unsignalized	
Intersection Capacity Utilization 46.2%	ICU Level of Service A
Analysis Period (min) 15	

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	69	1	0	64	3	0
Future Volume (vph)	69	1	0	64	3	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.998					
Flt Protected					0.950	
Satd. Flow (prot)	1806	0	0	1810	1770	0
Flt Permitted					0.950	
Satd. Flow (perm)	1806	0	0	1810	1770	0
Link Speed (mph)	55			55	30	
Link Distance (ft)	270			3236	478	
Travel Time (s)	3.3			40.1	10.9	
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80
Heavy Vehicles (%)	5%	5%	5%	5%	2%	2%
Adj. Flow (vph)	86	1	0	80	4	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	87	0	0	80	4	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	0			0	12	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)		9	15		15	9
Sign Control	Free			Free	Stop	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	
Intersection Capacity Utilization 13.7%	ICU Level of Service A
Analysis Period (min) 15	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	1	59	6	2	52	0	8	0	1	0	0	4
Future Volume (vph)	1	59	6	2	52	0	8	0	1	0	0	4
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.987						0.988			0.865	
Flt Protected		0.999			0.998			0.957				
Satd. Flow (prot)	0	1784	0	0	1806	0	0	1761	0	0	1611	0
Flt Permitted		0.999			0.998			0.957				
Satd. Flow (perm)	0	1784	0	0	1806	0	0	1761	0	0	1611	0
Link Speed (mph)		55			55			30			30	
Link Distance (ft)		3236			2284			2605			1665	
Travel Time (s)		40.1			28.3			59.2			37.8	
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	2%	2%	2%	2%	2%	2%
Adj. Flow (vph)	1	74	8	3	65	0	10	0	1	0	0	5
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	83	0	0	68	0	0	11	0	0	5	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Free			Free			Stop			Stop	

Intersection Summary		
Area Type:	Other	
Control Type: Unsignalized		
Intersection Capacity Utilization 17.5%		ICU Level of Service A
Analysis Period (min) 15		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	91	10	0	9	18	25	1	531	8	30	703	165
Future Volume (vph)	91	10	0	9	18	25	1	531	8	30	703	165
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		0	220		150	180		0
Storage Lanes	0		0	0		0	1		1	1		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	0.95
Frt					0.936				0.850		0.972	
Flt Protected		0.957			0.991		0.950			0.950		
Satd. Flow (prot)	0	1783	0	0	1728	0	1770	3139	1583	1770	3118	0
Flt Permitted		0.957			0.991		0.950			0.950		
Satd. Flow (perm)	0	1783	0	0	1728	0	1770	3139	1583	1770	3118	0
Link Speed (mph)		30			30			65			65	
Link Distance (ft)		384			236			1273			351	
Travel Time (s)		8.7			5.4			13.4			3.7	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	15%	2%	2%	15%	2%
Adj. Flow (vph)	107	12	0	11	21	29	1	590	9	33	781	183
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	119	0	0	61	0	1	590	9	33	964	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			60			60	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Stop			Stop			Free			Free	

Intersection Summary

Area Type: Other

Control Type: Unsignalized

Intersection Capacity Utilization 43.8% ICU Level of Service A

Analysis Period (min) 15

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	1	0	0	0	0	0	0	345	0	1	354	1
Future Volume (vph)	1	0	0	0	0	0	0	345	0	1	354	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt												
Flt Protected		0.950										
Satd. Flow (prot)	0	1770	0	0	1863	0	0	1652	0	0	1653	0
Flt Permitted		0.950										
Satd. Flow (perm)	0	1770	0	0	1863	0	0	1652	0	0	1653	0
Link Speed (mph)		30			30			60			60	
Link Distance (ft)		751			536			1843			682	
Travel Time (s)		17.1			12.2			20.9			7.8	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	15%	2%	2%	15%	2%
Adj. Flow (vph)	1	0	0	0	0	0	0	383	0	1	393	1
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	1	0	0	0	0	0	383	0	0	395	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Stop			Stop			Free			Free	

Intersection Summary		
Area Type:	Other	
Control Type: Unsignalized		
Intersection Capacity Utilization 29.5%		ICU Level of Service A
Analysis Period (min) 15		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	1	0	0	0	0	0	0	343	0	1	352	1
Future Volume (vph)	1	0	0	0	0	0	0	343	0	1	352	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt												
Flt Protected		0.950										
Satd. Flow (prot)	0	1770	0	0	1863	0	0	1652	0	0	1653	0
Flt Permitted		0.950										
Satd. Flow (perm)	0	1770	0	0	1863	0	0	1652	0	0	1653	0
Link Speed (mph)		30			30			60			60	
Link Distance (ft)		485			406			490			1843	
Travel Time (s)		11.0			9.2			5.6			20.9	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	15%	2%	2%	15%	2%
Adj. Flow (vph)	1	0	0	0	0	0	0	381	0	1	391	1
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	1	0	0	0	0	0	381	0	0	393	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Stop			Stop			Free			Free	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	
Intersection Capacity Utilization 29.4%	ICU Level of Service A
Analysis Period (min) 15	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	43	289	10	52	439	33	27	14	46	31	16	64
Future Volume (vph)	43	289	10	52	439	33	27	14	46	31	16	64
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.996			0.991			0.929			0.922	
Flt Protected		0.994			0.995			0.985			0.986	
Satd. Flow (prot)	0	1791	0	0	1784	0	0	1705	0	0	1693	0
Flt Permitted		0.994			0.995			0.985			0.986	
Satd. Flow (perm)	0	1791	0	0	1784	0	0	1705	0	0	1693	0
Link Speed (mph)		45			45			30			45	
Link Distance (ft)		1590			1013			619			557	
Travel Time (s)		24.1			15.3			14.1			8.4	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	2%	2%	2%	2%	2%	2%
Adj. Flow (vph)	51	340	12	61	516	39	32	16	54	36	19	75
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	403	0	0	616	0	0	102	0	0	130	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Free			Free			Stop			Stop	

Intersection Summary	
Area Type: Other	
Control Type: Unsignalized	
Intersection Capacity Utilization 50.0%	ICU Level of Service A
Analysis Period (min) 15	

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	26	330	142	10	11	380
Future Volume (vph)	26	330	142	10	11	380
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.991		0.869	
Flt Protected		0.996			0.999	
Satd. Flow (prot)	0	1796	1788	0	1571	0
Flt Permitted		0.996			0.999	
Satd. Flow (perm)	0	1796	1788	0	1571	0
Link Speed (mph)		45	45		30	
Link Distance (ft)		1013	730		536	
Travel Time (s)		15.3	11.1		12.2	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Heavy Vehicles (%)	10%	5%	5%	10%	5%	5%
Adj. Flow (vph)	31	388	167	12	13	447
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	419	179	0	460	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(ft)		0	0		12	
Link Offset(ft)		0	0		0	
Crosswalk Width(ft)		16	16		16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15			9	15	9
Sign Control		Free	Free		Stop	

Intersection Summary	
Area Type: Other	
Control Type: Unsignalized	
Intersection Capacity Utilization 61.0%	ICU Level of Service B
Analysis Period (min) 15	

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	75	266	8	90	62	18
Future Volume (vph)	75	266	8	90	62	18
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)		325	0		0	0
Storage Lanes		1	0		1	0
Taper Length (ft)			25		25	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.850			0.970	
Flt Protected				0.996	0.963	
Satd. Flow (prot)	1810	1538	0	1802	1613	0
Flt Permitted				0.996	0.963	
Satd. Flow (perm)	1810	1538	0	1802	1613	0
Link Speed (mph)	45			55	30	
Link Distance (ft)	730			270	420	
Travel Time (s)	11.1			3.3	9.5	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Heavy Vehicles (%)	5%	5%	5%	5%	10%	10%
Adj. Flow (vph)	88	313	9	106	73	21
Shared Lane Traffic (%)						
Lane Group Flow (vph)	88	313	0	115	94	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	0			0	12	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)		9	15		15	9
Sign Control	Free			Free	Stop	

Intersection Summary

Area Type: Other

Control Type: Unsignalized

Intersection Capacity Utilization 28.3% ICU Level of Service A

Analysis Period (min) 15

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	90	2	0	97	1	0
Future Volume (vph)	90	2	0	97	1	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.997					
Flt Protected					0.950	
Satd. Flow (prot)	1804	0	0	1810	1770	0
Flt Permitted					0.950	
Satd. Flow (perm)	1804	0	0	1810	1770	0
Link Speed (mph)	55			55	30	
Link Distance (ft)	270			3236	478	
Travel Time (s)	3.3			40.1	10.9	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Heavy Vehicles (%)	5%	5%	5%	5%	2%	2%
Adj. Flow (vph)	106	2	0	114	1	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	108	0	0	114	1	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	0			0	12	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)		9	15		15	9
Sign Control	Free			Free	Stop	

Intersection Summary	
Area Type: Other	
Control Type: Unsignalized	
Intersection Capacity Utilization 15.1%	ICU Level of Service A
Analysis Period (min) 15	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	1	81	5	2	89	0	0	0	1	0	0	1
Future Volume (vph)	1	81	5	2	89	0	0	0	1	0	0	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.992						0.865			0.865	
Flt Protected					0.999							
Satd. Flow (prot)	0	1795	0	0	1808	0	0	1611	0	0	1611	0
Flt Permitted					0.999							
Satd. Flow (perm)	0	1795	0	0	1808	0	0	1611	0	0	1611	0
Link Speed (mph)		55			55			30			30	
Link Distance (ft)		3236			2284			2605			1665	
Travel Time (s)		40.1			28.3			59.2			37.8	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	2%	2%	2%	2%	2%	2%
Adj. Flow (vph)	1	95	6	2	105	0	0	0	1	0	0	1
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	102	0	0	107	0	0	1	0	0	1	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Free			Free			Stop			Stop	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	
Intersection Capacity Utilization 15.9%	ICU Level of Service A
Analysis Period (min) 15	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	0	0	0	0	1057	0	0	422	0
Future Volume (vph)	0	0	0	0	0	0	0	1057	0	0	422	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		0	220		150	180		0
Storage Lanes	0		0	0		0	1		1	1		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	0.95
Frt												
Flt Protected												
Satd. Flow (prot)	0	1863	0	0	1863	0	1863	3139	1863	1863	3139	0
Flt Permitted												
Satd. Flow (perm)	0	1863	0	0	1863	0	1863	3139	1863	1863	3139	0
Link Speed (mph)		30			30			65			65	
Link Distance (ft)		384			236			1273			351	
Travel Time (s)		8.7			5.4			13.4			3.7	
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80	0.86	0.86	0.86	0.86	0.86	0.86
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	15%	2%	2%	15%	2%
Adj. Flow (vph)	0	0	0	0	0	0	0	1229	0	0	491	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	0	0	0	0	0	0	1229	0	0	491	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			60			60	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Stop			Stop			Free			Free	

Intersection Summary	
Area Type: Other	
Control Type: Unsignalized	
Intersection Capacity Utilization 32.6%	ICU Level of Service A
Analysis Period (min) 15	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	1	0	0	0	0	1	0	331	0	0	283	1
Future Volume (vph)	1	0	0	0	0	1	0	331	0	0	283	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt					0.865							
Flt Protected		0.950										
Satd. Flow (prot)	0	1770	0	0	1611	0	0	1652	0	0	1653	0
Flt Permitted		0.950										
Satd. Flow (perm)	0	1770	0	0	1611	0	0	1652	0	0	1653	0
Link Speed (mph)		30			30			60			60	
Link Distance (ft)		751			536			1843			682	
Travel Time (s)		17.1			12.2			20.9			7.8	
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80	0.86	0.86	0.86	0.86	0.86	0.86
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	15%	2%	2%	15%	2%
Adj. Flow (vph)	1	0	0	0	0	1	0	385	0	0	329	1
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	1	0	0	1	0	0	385	0	0	330	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Stop			Stop			Free			Free	

Intersection Summary	
Area Type: Other	
Control Type: Unsignalized	
Intersection Capacity Utilization 27.4%	ICU Level of Service A
Analysis Period (min) 15	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	1	0	0	0	0	1	0	328	0	0	281	1
Future Volume (vph)	1	0	0	0	0	1	0	328	0	0	281	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt					0.865							
Flt Protected		0.950										
Satd. Flow (prot)	0	1770	0	0	1611	0	0	1652	0	0	1653	0
Flt Permitted		0.950										
Satd. Flow (perm)	0	1770	0	0	1611	0	0	1652	0	0	1653	0
Link Speed (mph)		30			30			60			60	
Link Distance (ft)		485			406			490			1843	
Travel Time (s)		11.0			9.2			5.6			20.9	
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80	0.86	0.86	0.86	0.86	0.86	0.86
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	15%	2%	2%	15%	2%
Adj. Flow (vph)	1	0	0	0	0	1	0	381	0	0	327	1
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	1	0	0	1	0	0	381	0	0	328	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Stop			Stop			Free			Free	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	
Intersection Capacity Utilization 27.3%	ICU Level of Service A
Analysis Period (min) 15	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	31	640	12	20	185	72	9	9	53	174	1	43
Future Volume (vph)	31	640	12	20	185	72	9	9	53	174	1	43
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.998			0.965			0.899			0.973	
Flt Protected		0.998			0.996			0.994			0.962	
Satd. Flow (prot)	0	1802	0	0	1739	0	0	1665	0	0	1744	0
Flt Permitted		0.998			0.996			0.994			0.962	
Satd. Flow (perm)	0	1802	0	0	1739	0	0	1665	0	0	1744	0
Link Speed (mph)		45			45			30			45	
Link Distance (ft)		1590			1013			619			557	
Travel Time (s)		24.1			15.3			14.1			8.4	
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	2%	2%	2%	2%	2%	2%
Adj. Flow (vph)	39	800	15	25	231	90	11	11	66	218	1	54
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	854	0	0	346	0	0	88	0	0	273	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Free			Free			Stop			Stop	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	
Intersection Capacity Utilization 68.3%	ICU Level of Service C
Analysis Period (min) 15	

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	74	789	93	10	37	185
Future Volume (vph)	74	789	93	10	37	185
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.986		0.887	
Flt Protected		0.996			0.992	
Satd. Flow (prot)	0	1795	1776	0	1592	0
Flt Permitted		0.996			0.992	
Satd. Flow (perm)	0	1795	1776	0	1592	0
Link Speed (mph)		45	45		30	
Link Distance (ft)		1013	730		536	
Travel Time (s)		15.3	11.1		12.2	
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80
Heavy Vehicles (%)	10%	5%	5%	10%	5%	5%
Adj. Flow (vph)	93	986	116	13	46	231
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	1079	129	0	277	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(ft)		0	0		12	
Link Offset(ft)		0	0		0	
Crosswalk Width(ft)		16	16		16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15			9	15	9
Sign Control		Free	Free		Stop	

Intersection Summary	
Area Type: Other	
Control Type: Unsignalized	
Intersection Capacity Utilization 72.4%	ICU Level of Service C
Analysis Period (min) 15	

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	116	710	81	65	38	29
Future Volume (vph)	116	710	81	65	38	29
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)		325	0		0	0
Storage Lanes		1	0		1	0
Taper Length (ft)			25		25	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.850			0.942	
Flt Protected				0.973	0.972	
Satd. Flow (prot)	1810	1538	0	1761	1582	0
Flt Permitted				0.973	0.972	
Satd. Flow (perm)	1810	1538	0	1761	1582	0
Link Speed (mph)	45			55	30	
Link Distance (ft)	730			270	420	
Travel Time (s)	11.1			3.3	9.5	
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80
Heavy Vehicles (%)	5%	5%	5%	5%	10%	10%
Adj. Flow (vph)	145	888	101	81	48	36
Shared Lane Traffic (%)						
Lane Group Flow (vph)	145	888	0	182	84	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	0			0	12	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)		9	15		15	9
Sign Control	Free			Free	Stop	

Intersection Summary		
Area Type:	Other	
Control Type: Unsignalized		
Intersection Capacity Utilization 58.5%		ICU Level of Service B
Analysis Period (min) 15		

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	144	1	0	143	3	0
Future Volume (vph)	144	1	0	143	3	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.999					
Flt Protected					0.950	
Satd. Flow (prot)	1808	0	0	1810	1770	0
Flt Permitted					0.950	
Satd. Flow (perm)	1808	0	0	1810	1770	0
Link Speed (mph)	55			55	30	
Link Distance (ft)	270			3236	478	
Travel Time (s)	3.3			40.1	10.9	
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80
Heavy Vehicles (%)	5%	5%	5%	5%	2%	2%
Adj. Flow (vph)	180	1	0	179	4	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	181	0	0	179	4	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	0			0	12	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)		9	15		15	9
Sign Control	Free			Free	Stop	

Intersection Summary	
Area Type: Other	
Control Type: Unsignalized	
Intersection Capacity Utilization 17.6%	ICU Level of Service A
Analysis Period (min) 15	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	143	1	0	142	0	3	0	0	0	0	0
Future Volume (vph)	0	143	1	0	142	0	3	0	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.999										
Flt Protected								0.950				
Satd. Flow (prot)	0	1808	0	0	1810	0	0	1770	0	0	1863	0
Flt Permitted								0.950				
Satd. Flow (perm)	0	1808	0	0	1810	0	0	1770	0	0	1863	0
Link Speed (mph)		55			55			30			30	
Link Distance (ft)		3236			2284			2605			1665	
Travel Time (s)		40.1			28.3			59.2			37.8	
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	2%	2%	2%	2%	2%	2%
Adj. Flow (vph)	0	179	1	0	178	0	4	0	0	0	0	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	180	0	0	178	0	0	4	0	0	0	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Free			Free			Stop			Stop	

Intersection Summary	
Area Type: Other	
Control Type: Unsignalized	
Intersection Capacity Utilization 17.6%	ICU Level of Service A
Analysis Period (min) 15	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	0	0	0	0	531	0	0	703	0
Future Volume (vph)	0	0	0	0	0	0	0	531	0	0	703	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		0	220		150	180		0
Storage Lanes	0		0	0		0	1		1	1		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	0.95
Frt												
Flt Protected												
Satd. Flow (prot)	0	1863	0	0	1863	0	1863	3139	1863	1863	3139	0
Flt Permitted												
Satd. Flow (perm)	0	1863	0	0	1863	0	1863	3139	1863	1863	3139	0
Link Speed (mph)		30			30			65			65	
Link Distance (ft)		384			236			1273			351	
Travel Time (s)		8.7			5.4			13.4			3.7	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	15%	2%	2%	15%	2%
Adj. Flow (vph)	0	0	0	0	0	0	0	590	0	0	781	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	0	0	0	0	0	0	590	0	0	781	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			60			60	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Stop			Stop			Free			Free	

Intersection Summary

Area Type: Other

Control Type: Unsignalized

Intersection Capacity Utilization 22.8% ICU Level of Service A

Analysis Period (min) 15

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	1	0	0	0	0	0	0	345	0	1	354	1
Future Volume (vph)	1	0	0	0	0	0	0	345	0	1	354	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt												
Flt Protected		0.950										
Satd. Flow (prot)	0	1770	0	0	1863	0	0	1652	0	0	1653	0
Flt Permitted		0.950										
Satd. Flow (perm)	0	1770	0	0	1863	0	0	1652	0	0	1653	0
Link Speed (mph)		30			30			60			60	
Link Distance (ft)		751			536			1843			682	
Travel Time (s)		17.1			12.2			20.9			7.8	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	15%	2%	2%	15%	2%
Adj. Flow (vph)	1	0	0	0	0	0	0	383	0	1	393	1
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	1	0	0	0	0	0	383	0	0	395	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Stop			Stop			Free			Free	

Intersection Summary

Area Type: Other
Control Type: Unsignalized
Intersection Capacity Utilization 29.5% ICU Level of Service A
Analysis Period (min) 15

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	1	0	0	0	0	0	0	343	0	1	352	1
Future Volume (vph)	1	0	0	0	0	0	0	343	0	1	352	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt												
Flt Protected		0.950										
Satd. Flow (prot)	0	1770	0	0	1863	0	0	1652	0	0	1653	0
Flt Permitted		0.950										
Satd. Flow (perm)	0	1770	0	0	1863	0	0	1652	0	0	1653	0
Link Speed (mph)		30			30			60			60	
Link Distance (ft)		485			406			490			1843	
Travel Time (s)		11.0			9.2			5.6			20.9	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	15%	2%	2%	15%	2%
Adj. Flow (vph)	1	0	0	0	0	0	0	381	0	1	391	1
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	1	0	0	0	0	0	381	0	0	393	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Stop			Stop			Free			Free	

Intersection Summary	
Area Type: Other	
Control Type: Unsignalized	
Intersection Capacity Utilization 29.4%	ICU Level of Service A
Analysis Period (min) 15	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	43	289	10	52	439	217	27	14	46	132	16	64
Future Volume (vph)	43	289	10	52	439	217	27	14	46	132	16	64
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.996			0.959			0.929			0.959	
Flt Protected		0.994			0.996			0.985			0.970	
Satd. Flow (prot)	0	1791	0	0	1728	0	0	1705	0	0	1733	0
Flt Permitted		0.994			0.996			0.985			0.970	
Satd. Flow (perm)	0	1791	0	0	1728	0	0	1705	0	0	1733	0
Link Speed (mph)		45			45			30			45	
Link Distance (ft)		1590			1013			619			557	
Travel Time (s)		24.1			15.3			14.1			8.4	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	2%	2%	2%	2%	2%	2%
Adj. Flow (vph)	51	340	12	61	516	255	32	16	54	155	19	75
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	403	0	0	832	0	0	102	0	0	249	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Free			Free			Stop			Stop	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	
Intersection Capacity Utilization 71.7%	ICU Level of Service C
Analysis Period (min) 15	

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	26	431	161	19	41	545
Future Volume (vph)	26	431	161	19	41	545
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.986		0.874	
Flt Protected		0.997			0.997	
Satd. Flow (prot)	0	1799	1775	0	1577	0
Flt Permitted		0.997			0.997	
Satd. Flow (perm)	0	1799	1775	0	1577	0
Link Speed (mph)		45	45		30	
Link Distance (ft)		1013	730		536	
Travel Time (s)		15.3	11.1		12.2	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Heavy Vehicles (%)	10%	5%	5%	10%	5%	5%
Adj. Flow (vph)	31	507	189	22	48	641
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	538	211	0	689	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(ft)		0	0		12	
Link Offset(ft)		0	0		0	
Crosswalk Width(ft)		16	16		16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15			9	15	9
Sign Control		Free	Free		Stop	

Intersection Summary

Area Type: Other

Control Type: Unsignalized

Intersection Capacity Utilization 79.7% ICU Level of Service D

Analysis Period (min) 15

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	115	357	33	117	63	26
Future Volume (vph)	115	357	33	117	63	26
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)		325	0		0	0
Storage Lanes		1	0		1	0
Taper Length (ft)			25		25	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.850			0.960	
Flt Protected				0.989	0.966	
Satd. Flow (prot)	1810	1538	0	1790	1602	0
Flt Permitted				0.989	0.966	
Satd. Flow (perm)	1810	1538	0	1790	1602	0
Link Speed (mph)	45			55	30	
Link Distance (ft)	730			270	420	
Travel Time (s)	11.1			3.3	9.5	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Heavy Vehicles (%)	5%	5%	5%	5%	10%	10%
Adj. Flow (vph)	135	420	39	138	74	31
Shared Lane Traffic (%)						
Lane Group Flow (vph)	135	420	0	177	105	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	0			0	12	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)		9	15		15	9
Sign Control	Free			Free	Stop	

Intersection Summary

Area Type: Other

Control Type: Unsignalized

Intersection Capacity Utilization 36.8% ICU Level of Service A

Analysis Period (min) 15

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	139	2	0	149	1	0
Future Volume (vph)	139	2	0	149	1	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.998					
Flt Protected					0.950	
Satd. Flow (prot)	1806	0	0	1810	1770	0
Flt Permitted					0.950	
Satd. Flow (perm)	1806	0	0	1810	1770	0
Link Speed (mph)	55			55	30	
Link Distance (ft)	270			3236	478	
Travel Time (s)	3.3			40.1	10.9	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Heavy Vehicles (%)	5%	5%	5%	5%	2%	2%
Adj. Flow (vph)	164	2	0	175	1	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	166	0	0	175	1	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	0			0	12	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)		9	15		15	9
Sign Control	Free			Free	Stop	

Intersection Summary	
Area Type: Other	
Control Type: Unsignalized	
Intersection Capacity Utilization 17.8%	ICU Level of Service A
Analysis Period (min) 15	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	138	2	0	149	0	1	0	0	0	0	0
Future Volume (vph)	0	138	2	0	149	0	1	0	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.998										
Flt Protected								0.950				
Satd. Flow (prot)	0	1806	0	0	1810	0	0	1770	0	0	1863	0
Flt Permitted								0.950				
Satd. Flow (perm)	0	1806	0	0	1810	0	0	1770	0	0	1863	0
Link Speed (mph)		55			55			30			30	
Link Distance (ft)		3236			2284			2605			1665	
Travel Time (s)		40.1			28.3			59.2			37.8	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	2%	2%	2%	2%	2%	2%
Adj. Flow (vph)	0	162	2	0	175	0	1	0	0	0	0	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	164	0	0	175	0	0	1	0	0	0	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Free			Free			Stop			Stop	

Intersection Summary	
Area Type: Other	
Control Type: Unsignalized	
Intersection Capacity Utilization 17.8%	ICU Level of Service A
Analysis Period (min) 15	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	25	478	9	17	153	11	7	7	44	16	1	34
Future Volume (vph)	25	478	9	17	153	11	7	7	44	16	1	34
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.998			0.992			0.898			0.909	
Flt Protected		0.998			0.995			0.994			0.985	
Satd. Flow (prot)	0	1802	0	0	1786	0	0	1663	0	0	1668	0
Flt Permitted		0.998			0.995			0.994			0.985	
Satd. Flow (perm)	0	1802	0	0	1786	0	0	1663	0	0	1668	0
Link Speed (mph)		45			45			30			45	
Link Distance (ft)		1590			1013			619			557	
Travel Time (s)		24.1			15.3			14.1			8.4	
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	2%	2%	2%	2%	2%	2%
Adj. Flow (vph)	31	598	11	21	191	14	9	9	55	20	1	43
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	640	0	0	226	0	0	73	0	0	64	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Free			Free			Stop			Stop	

Intersection Summary		
Area Type:	Other	
Control Type: Unsignalized		
Intersection Capacity Utilization 44.2%		ICU Level of Service A
Analysis Period (min) 15		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	480	59	7	57	0	0	0	0	5	0	122
Future Volume (vph)	0	480	59	7	57	0	0	0	0	5	0	122
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	200		0	0		0	0		0
Storage Lanes	0		0	1		0	0		0	0		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.985									0.870	
Flt Protected				0.950							0.998	
Satd. Flow (prot)	0	1773	0	1641	1810	0	0	0	0	0	1571	0
Flt Permitted				0.950							0.998	
Satd. Flow (perm)	0	1773	0	1641	1810	0	0	0	0	0	1571	0
Link Speed (mph)		45			45			30			30	
Link Distance (ft)		1013			730			515			536	
Travel Time (s)		15.3			11.1			11.7			12.2	
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Heavy Vehicles (%)	10%	5%	10%	10%	5%	10%	2%	2%	2%	5%	2%	5%
Adj. Flow (vph)	0	600	74	9	71	0	0	0	0	6	0	153
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	674	0	9	71	0	0	0	0	0	159	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Free			Free			Stop			Stop	

Intersection Summary

Area Type: Other

Control Type: Unsignalized

Intersection Capacity Utilization 50.0% ICU Level of Service A

Analysis Period (min) 15

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	434	51	0	0	36	18	28	0	4	0	0	0
Future Volume (vph)	434	51	0	0	36	18	28	0	4	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	200		0	0		0	0		0	0		0
Storage Lanes	1		0	0		0	0		0	0		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt					0.954			0.983				
Flt Protected	0.950							0.958				
Satd. Flow (prot)	1719	1810	0	0	1726	0	0	1627	0	0	0	0
Flt Permitted	0.950							0.958				
Satd. Flow (perm)	1719	1810	0	0	1726	0	0	1627	0	0	0	0
Link Speed (mph)		45			55			30			30	
Link Distance (ft)		730			200			420			390	
Travel Time (s)		11.1			2.5			9.5			8.9	
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	10%	2%	10%	2%	2%	2%
Adj. Flow (vph)	543	64	0	0	45	23	35	0	5	0	0	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	543	64	0	0	68	0	0	40	0	0	0	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Free			Free			Stop			Stop	

Intersection Summary

Area Type: Other

Control Type: Unsignalized

Intersection Capacity Utilization 50.0% ICU Level of Service A

Analysis Period (min) 15

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	1	46	5	2	41	0	6	0	1	0	0	3
Future Volume (vph)	1	46	5	2	41	0	6	0	1	0	0	3
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.988						0.985			0.865	
Flt Protected		0.999			0.997			0.957				
Satd. Flow (prot)	0	1792	0	0	1807	0	0	1756	0	0	1611	0
Flt Permitted		0.999			0.997			0.957				
Satd. Flow (perm)	0	1792	0	0	1807	0	0	1756	0	0	1611	0
Link Speed (mph)		55			55			30			30	
Link Distance (ft)		3306			2284			2605			1665	
Travel Time (s)		41.0			28.3			59.2			37.8	
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Heavy Vehicles (%)	2%	5%	2%	2%	5%	2%	2%	2%	2%	2%	2%	2%
Adj. Flow (vph)	1	58	6	3	51	0	8	0	1	0	0	4
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	65	0	0	54	0	0	9	0	0	4	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Free			Free			Stop			Stop	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	
Intersection Capacity Utilization 15.3%	ICU Level of Service A
Analysis Period (min) 15	

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	54	1	0	50	4	0
Future Volume (vph)	54	1	0	50	4	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.998					
Flt Protected					0.950	
Satd. Flow (prot)	1807	0	0	1810	1770	0
Flt Permitted					0.950	
Satd. Flow (perm)	1807	0	0	1810	1770	0
Link Speed (mph)	55			55	30	
Link Distance (ft)	200			3306	462	
Travel Time (s)	2.5			41.0	10.5	
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80
Heavy Vehicles (%)	5%	2%	2%	5%	2%	2%
Adj. Flow (vph)	68	1	0	63	5	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	69	0	0	63	5	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	0			0	12	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)		9	15		15	9
Sign Control	Free			Free	Stop	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	
Intersection Capacity Utilization 13.3%	ICU Level of Service A
Analysis Period (min) 15	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	98	15	2	1	14	44	1	648	18	25	290	33
Future Volume (vph)	98	15	2	1	14	44	1	648	18	25	290	33
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		0	220		150	180		0
Storage Lanes	0		0	0		0	1		1	1		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	0.95
Frt		0.997			0.900				0.850		0.985	
Flt Protected		0.959			0.999		0.950			0.950		
Satd. Flow (prot)	0	1781	0	0	1675	0	1770	3139	1583	1770	3128	0
Flt Permitted		0.959			0.999		0.950			0.950		
Satd. Flow (perm)	0	1781	0	0	1675	0	1770	3139	1583	1770	3128	0
Link Speed (mph)		30			30			65			65	
Link Distance (ft)		384			236			1273			351	
Travel Time (s)		8.7			5.4			13.4			3.7	
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80	0.86	0.86	0.86	0.86	0.86	0.86
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	15%	2%	2%	15%	2%
Adj. Flow (vph)	123	19	3	1	18	55	1	753	21	29	337	38
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	145	0	0	74	0	1	753	21	29	375	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			60			60	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Stop			Stop			Free			Free	

Intersection Summary	
Area Type: Other	
Control Type: Unsignalized	
Intersection Capacity Utilization 40.4%	ICU Level of Service A
Analysis Period (min) 15	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	34	216	8	43	363	26	22	11	38	25	12	50
Future Volume (vph)	34	216	8	43	363	26	22	11	38	25	12	50
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.996			0.992			0.928			0.922	
Flt Protected		0.993			0.995			0.985			0.986	
Satd. Flow (prot)	0	1790	0	0	1786	0	0	1703	0	0	1693	0
Flt Permitted		0.993			0.995			0.985			0.986	
Satd. Flow (perm)	0	1790	0	0	1786	0	0	1703	0	0	1693	0
Link Speed (mph)		45			45			30			45	
Link Distance (ft)		1590			1013			619			557	
Travel Time (s)		24.1			15.3			14.1			8.4	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	2%	2%	2%	2%	2%	2%
Adj. Flow (vph)	40	254	9	51	427	31	26	13	45	29	14	59
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	303	0	0	509	0	0	84	0	0	102	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Free			Free			Stop			Stop	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	
Intersection Capacity Utilization 41.8%	ICU Level of Service A
Analysis Period (min) 15	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	251	21	8	108	0	0	0	0	11	0	316
Future Volume (vph)	0	251	21	8	108	0	0	0	0	11	0	316
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	200		0	0		0	0		0
Storage Lanes	0		0	1		0	0		0	0		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.989									0.870	
Flt Protected				0.950							0.998	
Satd. Flow (prot)	0	1783	0	1641	1810	0	0	0	0	0	1571	0
Flt Permitted				0.950							0.998	
Satd. Flow (perm)	0	1783	0	1641	1810	0	0	0	0	0	1571	0
Link Speed (mph)		45			45			30			30	
Link Distance (ft)		1013			730			515			536	
Travel Time (s)		15.3			11.1			11.7			12.2	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Heavy Vehicles (%)	10%	5%	10%	10%	5%	10%	2%	2%	2%	5%	2%	5%
Adj. Flow (vph)	0	295	25	9	127	0	0	0	0	13	0	372
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	320	0	9	127	0	0	0	0	0	385	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Free			Free			Stop			Stop	

Intersection Summary	
Area Type: Other	
Control Type: Unsignalized	
Intersection Capacity Utilization 48.0%	ICU Level of Service A
Analysis Period (min) 15	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	201	61	0	0	70	6	46	0	13	0	0	0
Future Volume (vph)	201	61	0	0	70	6	46	0	13	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	200		0	0		0	0		0	0		0
Storage Lanes	1		0	0		0	0		0	0		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt					0.989			0.971				
Flt Protected	0.950							0.962				
Satd. Flow (prot)	1719	1810	0	0	1790	0	0	1613	0	0	0	0
Flt Permitted	0.950							0.962				
Satd. Flow (perm)	1719	1810	0	0	1790	0	0	1613	0	0	0	0
Link Speed (mph)		45			55			30			30	
Link Distance (ft)		730			170			420			390	
Travel Time (s)		11.1			2.1			9.5			8.9	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	10%	2%	10%	2%	2%	2%
Adj. Flow (vph)	236	72	0	0	82	7	54	0	15	0	0	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	236	72	0	0	89	0	0	69	0	0	0	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Free			Free			Stop			Stop	

Intersection Summary

Area Type: Other

Control Type: Unsignalized

Intersection Capacity Utilization 48.0% ICU Level of Service A

Analysis Period (min) 15

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	1	64	4	2	70	0	0	0	1	0	0	1
Future Volume (vph)	1	64	4	2	70	0	0	0	1	0	0	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.992						0.865			0.865	
Flt Protected		0.999			0.999							
Satd. Flow (prot)	0	1797	0	0	1809	0	0	1611	0	0	1611	0
Flt Permitted		0.999			0.999							
Satd. Flow (perm)	0	1797	0	0	1809	0	0	1611	0	0	1611	0
Link Speed (mph)		55			55			30			30	
Link Distance (ft)		3336			2284			2605			1665	
Travel Time (s)		41.4			28.3			59.2			37.8	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Heavy Vehicles (%)	2%	5%	2%	2%	5%	2%	2%	2%	2%	2%	2%	2%
Adj. Flow (vph)	1	75	5	2	82	0	0	0	1	0	0	1
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	81	0	0	84	0	0	1	0	0	1	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Free			Free			Stop			Stop	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	
Intersection Capacity Utilization 14.8%	ICU Level of Service A
Analysis Period (min) 15	

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	71	4	0	76	1	0
Future Volume (vph)	71	4	0	76	1	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.992					
Flt Protected					0.950	
Satd. Flow (prot)	1798	0	0	1810	1770	0
Flt Permitted					0.950	
Satd. Flow (perm)	1798	0	0	1810	1770	0
Link Speed (mph)	55			55	30	
Link Distance (ft)	170			3336	336	
Travel Time (s)	2.1			41.4	7.6	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Heavy Vehicles (%)	5%	2%	2%	5%	2%	2%
Adj. Flow (vph)	84	5	0	89	1	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	89	0	0	89	1	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	0			0	12	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)		9	15		15	9
Sign Control	Free			Free	Stop	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	
Intersection Capacity Utilization 14.0%	ICU Level of Service A
Analysis Period (min) 15	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	68	8	0	7	14	19	1	396	6	24	581	137
Future Volume (vph)	68	8	0	7	14	19	1	396	6	24	581	137
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		0	220		150	180		0
Storage Lanes	0		0	0		0	1		1	1		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	0.95
Frt					0.935				0.850		0.971	
Flt Protected		0.957			0.991		0.950			0.950		
Satd. Flow (prot)	0	1783	0	0	1726	0	1770	3139	1583	1770	3115	0
Flt Permitted		0.957			0.991		0.950			0.950		
Satd. Flow (perm)	0	1783	0	0	1726	0	1770	3139	1583	1770	3115	0
Link Speed (mph)		30			30			65			65	
Link Distance (ft)		384			236			1273			351	
Travel Time (s)		8.7			5.4			13.4			3.7	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	15%	2%	2%	15%	2%
Adj. Flow (vph)	80	9	0	8	16	22	1	440	7	27	646	152
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	89	0	0	46	0	1	440	7	27	798	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			60			60	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Stop			Stop			Free			Free	

Intersection Summary

Area Type: Other

Control Type: Unsignalized

Intersection Capacity Utilization 38.0% ICU Level of Service A

Analysis Period (min) 15

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	31	640	12	22	185	14	9	9	55	21	1	43
Future Volume (vph)	31	640	12	22	185	14	9	9	55	21	1	43
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.998			0.991			0.898			0.910	
Flt Protected		0.998			0.995			0.994			0.984	
Satd. Flow (prot)	0	1802	0	0	1784	0	0	1663	0	0	1668	0
Flt Permitted		0.998			0.995			0.994			0.984	
Satd. Flow (perm)	0	1802	0	0	1784	0	0	1663	0	0	1668	0
Link Speed (mph)		45			45			30			45	
Link Distance (ft)		1590			1013			619			557	
Travel Time (s)		24.1			15.3			14.1			8.4	
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	2%	2%	2%	2%	2%	2%
Adj. Flow (vph)	39	800	15	28	231	18	11	11	69	26	1	54
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	854	0	0	277	0	0	91	0	0	81	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Free			Free			Stop			Stop	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	
Intersection Capacity Utilization 55.7%	ICU Level of Service B
Analysis Period (min) 15	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	640	72	9	74	0	0	0	0	6	0	148
Future Volume (vph)	0	640	72	9	74	0	0	0	0	6	0	148
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	200		0	0		0	0		0
Storage Lanes	0		0	1		0	0		0	0		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.986									0.871	
Flt Protected				0.950							0.998	
Satd. Flow (prot)	0	1776	0	1641	1810	0	0	0	0	0	1573	0
Flt Permitted				0.950							0.998	
Satd. Flow (perm)	0	1776	0	1641	1810	0	0	0	0	0	1573	0
Link Speed (mph)		45			45			30			30	
Link Distance (ft)		1013			730			515			536	
Travel Time (s)		15.3			11.1			11.7			12.2	
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Heavy Vehicles (%)	10%	5%	10%	10%	5%	10%	2%	2%	2%	5%	2%	5%
Adj. Flow (vph)	0	800	90	11	93	0	0	0	0	8	0	185
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	890	0	11	93	0	0	0	0	0	193	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Free			Free			Stop			Stop	

Intersection Summary

Area Type: Other

Control Type: Unsignalized

Intersection Capacity Utilization 60.9% ICU Level of Service B

Analysis Period (min) 15

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	581	65	0	0	46	22	37	0	6	0	0	0
Future Volume (vph)	581	65	0	0	46	22	37	0	6	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	200		0	0		0	0		0	0		0
Storage Lanes	1		0	0		0	0		0	0		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt					0.956			0.980				
Flt Protected	0.950							0.959				
Satd. Flow (prot)	1719	1810	0	0	1730	0	0	1623	0	0	0	0
Flt Permitted	0.950							0.959				
Satd. Flow (perm)	1719	1810	0	0	1730	0	0	1623	0	0	0	0
Link Speed (mph)		45			55			30			30	
Link Distance (ft)		730			200			420			390	
Travel Time (s)		11.1			2.5			9.5			8.9	
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	10%	2%	10%	2%	2%	2%
Adj. Flow (vph)	726	81	0	0	58	28	46	0	8	0	0	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	726	81	0	0	86	0	0	54	0	0	0	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Free			Free			Stop			Stop	

Intersection Summary

Area Type: Other

Control Type: Unsignalized

Intersection Capacity Utilization 60.9% ICU Level of Service B

Analysis Period (min) 15

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	1	59	6	2	52	0	8	0	1	0	0	4
Future Volume (vph)	1	59	6	2	52	0	8	0	1	0	0	4
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.987						0.988			0.865	
Flt Protected		0.999			0.998			0.957				
Satd. Flow (prot)	0	1790	0	0	1808	0	0	1761	0	0	1611	0
Flt Permitted		0.999			0.998			0.957				
Satd. Flow (perm)	0	1790	0	0	1808	0	0	1761	0	0	1611	0
Link Speed (mph)		55			55			30			30	
Link Distance (ft)		3306			2284			2605			1665	
Travel Time (s)		41.0			28.3			59.2			37.8	
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Heavy Vehicles (%)	2%	5%	2%	2%	5%	2%	2%	2%	2%	2%	2%	2%
Adj. Flow (vph)	1	74	8	3	65	0	10	0	1	0	0	5
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	83	0	0	68	0	0	11	0	0	5	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Free			Free			Stop			Stop	

Intersection Summary		
Area Type:	Other	
Control Type: Unsignalized		
Intersection Capacity Utilization 17.5%		ICU Level of Service A
Analysis Period (min) 15		

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	69	1	0	64	3	0
Future Volume (vph)	69	1	0	64	3	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.998					
Flt Protected					0.950	
Satd. Flow (prot)	1806	0	0	1810	1770	0
Flt Permitted					0.950	
Satd. Flow (perm)	1806	0	0	1810	1770	0
Link Speed (mph)	55			55	30	
Link Distance (ft)	200			3306	462	
Travel Time (s)	2.5			41.0	10.5	
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80
Heavy Vehicles (%)	5%	2%	2%	5%	2%	2%
Adj. Flow (vph)	86	1	0	80	4	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	87	0	0	80	4	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	0			0	12	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)		9	15		15	9
Sign Control	Free			Free	Stop	

Intersection Summary	
Area Type: Other	
Control Type: Unsignalized	
Intersection Capacity Utilization 13.7%	ICU Level of Service A
Analysis Period (min) 15	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	131	20	2	1	18	59	1	867	23	31	352	39
Future Volume (vph)	131	20	2	1	18	59	1	867	23	31	352	39
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		0	220		150	180		0
Storage Lanes	0		0	0		0	1		1	1		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	0.95
Frt		0.998			0.898				0.850		0.985	
Flt Protected		0.959			0.999		0.950			0.950		
Satd. Flow (prot)	0	1783	0	0	1671	0	1770	3139	1583	1770	3127	0
Flt Permitted		0.959			0.999		0.950			0.950		
Satd. Flow (perm)	0	1783	0	0	1671	0	1770	3139	1583	1770	3127	0
Link Speed (mph)		30			30			65			65	
Link Distance (ft)		384			236			1273			351	
Travel Time (s)		8.7			5.4			13.4			3.7	
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80	0.86	0.86	0.86	0.86	0.86	0.86
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	15%	2%	2%	15%	2%
Adj. Flow (vph)	164	25	3	1	23	74	1	1008	27	36	409	45
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	192	0	0	98	0	1	1008	27	36	454	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			60			60	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Stop			Stop			Free			Free	

Intersection Summary

Area Type: Other

Control Type: Unsignalized

Intersection Capacity Utilization 47.5% ICU Level of Service A

Analysis Period (min) 15

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	581	65	0	0	46	24	37	0	6	0	0	0
Future Volume (vph)	581	65	0	0	46	24	37	0	6	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	200		0	0		0	0		0	0		0
Storage Lanes	1		0	0		0	0		0	0		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt					0.954			0.980				
Flt Protected	0.950							0.959				
Satd. Flow (prot)	1719	1810	0	0	1726	0	0	1623	0	0	0	0
Flt Permitted	0.555							0.959				
Satd. Flow (perm)	1004	1810	0	0	1726	0	0	1623	0	0	0	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)					30			109				
Link Speed (mph)		45			55			30			30	
Link Distance (ft)		730			217			420			390	
Travel Time (s)		11.1			2.7			9.5			8.9	
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	10%	2%	10%	2%	2%	2%
Adj. Flow (vph)	726	81	0	0	58	30	46	0	8	0	0	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	726	81	0	0	88	0	0	54	0	0	0	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2			2		1	2				
Detector Template	Left	Thru			Thru		Left	Thru				
Leading Detector (ft)	20	100			100		20	100				
Trailing Detector (ft)	0	0			0		0	0				
Detector 1 Position(ft)	0	0			0		0	0				
Detector 1 Size(ft)	20	6			6		20	6				
Detector 1 Type	Cl+Ex	Cl+Ex			Cl+Ex		Cl+Ex	Cl+Ex				
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0			0.0		0.0	0.0				
Detector 1 Queue (s)	0.0	0.0			0.0		0.0	0.0				
Detector 1 Delay (s)	0.0	0.0			0.0		0.0	0.0				
Detector 2 Position(ft)		94			94			94				
Detector 2 Size(ft)		6			6			6				
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex				
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0				
Turn Type	pm+pt	NA			NA		Split	NA				
Protected Phases	7	4			8		2	2				

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	4											
Detector Phase	7	4			8		2	2				
Switch Phase												
Minimum Initial (s)	5.0	5.0			5.0		5.0	5.0				
Minimum Split (s)	10.5	23.5			23.5		23.5	23.5				
Total Split (s)	32.0	56.5			24.5		23.5	23.5				
Total Split (%)	40.0%	70.6%			30.6%		29.4%	29.4%				
Maximum Green (s)	26.5	51.0			19.0		18.0	18.0				
Yellow Time (s)	4.0	4.0			4.0		4.0	4.0				
All-Red Time (s)	1.5	1.5			1.5		1.5	1.5				
Lost Time Adjust (s)	0.0	0.0			0.0			0.0				
Total Lost Time (s)	5.5	5.5			5.5			5.5				
Lead/Lag	Lead				Lag							
Lead-Lag Optimize?	Yes				Yes							
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0				
Recall Mode	None	C-Max			C-Max		Max	Max				
Walk Time (s)		7.0			7.0		7.0	7.0				
Flash Dont Walk (s)		11.0			11.0		11.0	11.0				
Pedestrian Calls (#/hr)		0			0		0	0				
Act Effct Green (s)	51.0	51.0			21.1			18.0				
Actuated g/C Ratio	0.64	0.64			0.26			0.22				
v/c Ratio	0.85	0.07			0.18			0.12				
Control Delay	20.7	5.7			18.3			1.2				
Queue Delay	0.0	0.0			0.0			0.0				
Total Delay	20.7	5.7			18.3			1.2				
LOS	C	A			B			A				
Approach Delay		19.2			18.3			1.2				
Approach LOS		B			B			A				
Queue Length 50th (ft)	201	14			23			0				
Queue Length 95th (ft)	250	25			51			0				
Internal Link Dist (ft)		650			137			340			310	
Turn Bay Length (ft)	200											
Base Capacity (vph)	876	1153			477			449				
Starvation Cap Reductn	0	0			0			0				
Spillback Cap Reductn	0	0			0			0				
Storage Cap Reductn	0	0			0			0				
Reduced v/c Ratio	0.83	0.07			0.18			0.12				

Intersection Summary

Area Type: Other

Cycle Length: 80

Actuated Cycle Length: 80

Offset: 0 (0%), Referenced to phase 4:EBTL and 8:WBT, Start of Green

Natural Cycle: 80

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.85

Intersection Signal Delay: 18.1 Intersection LOS: B

Intersection Capacity Utilization 60.9% ICU Level of Service B

Analysis Period (min) 15

Splits and Phases: 9: NB Route 67 Ramps & US Route 160

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	43	289	10	54	439	33	27	14	48	31	16	64
Future Volume (vph)	43	289	10	54	439	33	27	14	48	31	16	64
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.996			0.991			0.927			0.922	
Flt Protected		0.994			0.995			0.985			0.986	
Satd. Flow (prot)	0	1791	0	0	1784	0	0	1701	0	0	1693	0
Flt Permitted		0.994			0.995			0.985			0.986	
Satd. Flow (perm)	0	1791	0	0	1784	0	0	1701	0	0	1693	0
Link Speed (mph)		45			45			30			45	
Link Distance (ft)		1590			1013			619			557	
Travel Time (s)		24.1			15.3			14.1			8.4	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	2%	2%	2%	2%	2%	2%
Adj. Flow (vph)	51	340	12	64	516	39	32	16	56	36	19	75
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	403	0	0	619	0	0	104	0	0	130	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Free			Free			Stop			Stop	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	
Intersection Capacity Utilization 50.5%	ICU Level of Service A
Analysis Period (min) 15	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	332	26	10	142	0	0	0	0	13	0	382
Future Volume (vph)	0	332	26	10	142	0	0	0	0	13	0	382
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	200		0	0		0	0		0
Storage Lanes	0		0	1		0	0		0	0		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.990									0.869	
Flt Protected				0.950							0.998	
Satd. Flow (prot)	0	1785	0	1641	1810	0	0	0	0	0	1569	0
Flt Permitted				0.950							0.998	
Satd. Flow (perm)	0	1785	0	1641	1810	0	0	0	0	0	1569	0
Link Speed (mph)		45			45			30			30	
Link Distance (ft)		1013			730			515			536	
Travel Time (s)		15.3			11.1			11.7			12.2	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Heavy Vehicles (%)	10%	5%	10%	10%	5%	10%	2%	2%	2%	5%	2%	5%
Adj. Flow (vph)	0	391	31	12	167	0	0	0	0	15	0	449
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	422	0	12	167	0	0	0	0	0	464	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Free			Free			Stop			Stop	

Intersection Summary

Area Type: Other

Control Type: Unsignalized

Intersection Capacity Utilization 56.7% ICU Level of Service B

Analysis Period (min) 15

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	268	77	0	0	90	8	62	0	18	0	0	0
Future Volume (vph)	268	77	0	0	90	8	62	0	18	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	200		0	0		0	0		0	0		0
Storage Lanes	1		0	0		0	0		0	0		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt					0.989			0.970				
Flt Protected	0.950							0.963				
Satd. Flow (prot)	1719	1810	0	0	1790	0	0	1613	0	0	0	0
Flt Permitted	0.950							0.963				
Satd. Flow (perm)	1719	1810	0	0	1790	0	0	1613	0	0	0	0
Link Speed (mph)		45			55			30			30	
Link Distance (ft)		730			170			420			390	
Travel Time (s)		11.1			2.1			9.5			8.9	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	10%	2%	10%	2%	2%	2%
Adj. Flow (vph)	315	91	0	0	106	9	73	0	21	0	0	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	315	91	0	0	115	0	0	94	0	0	0	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Free			Free			Stop			Stop	

Intersection Summary

Area Type: Other

Control Type: Unsignalized

Intersection Capacity Utilization 56.7% ICU Level of Service B

Analysis Period (min) 15

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	1	81	5	2	89	0	0	0	1	0	0	1
Future Volume (vph)	1	81	5	2	89	0	0	0	1	0	0	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.992						0.865			0.865	
Flt Protected					0.999							
Satd. Flow (prot)	0	1799	0	0	1809	0	0	1611	0	0	1611	0
Flt Permitted					0.999							
Satd. Flow (perm)	0	1799	0	0	1809	0	0	1611	0	0	1611	0
Link Speed (mph)		55			55			30			30	
Link Distance (ft)		3336			2284			2605			1665	
Travel Time (s)		41.4			28.3			59.2			37.8	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Heavy Vehicles (%)	2%	5%	2%	2%	5%	2%	2%	2%	2%	2%	2%	2%
Adj. Flow (vph)	1	95	6	2	105	0	0	0	1	0	0	1
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	102	0	0	107	0	0	1	0	0	1	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Free			Free			Stop			Stop	

Intersection Summary

Area Type: Other

Control Type: Unsignalized

Intersection Capacity Utilization 15.9% ICU Level of Service A

Analysis Period (min) 15

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	90	4	0	97	1	0
Future Volume (vph)	90	4	0	97	1	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.994					
Flt Protected					0.950	
Satd. Flow (prot)	1801	0	0	1810	1770	0
Flt Permitted					0.950	
Satd. Flow (perm)	1801	0	0	1810	1770	0
Link Speed (mph)	55			55	30	
Link Distance (ft)	170			3336	336	
Travel Time (s)	2.1			41.4	7.6	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Heavy Vehicles (%)	5%	2%	2%	5%	2%	2%
Adj. Flow (vph)	106	5	0	114	1	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	111	0	0	114	1	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	0			0	12	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)		9	15		15	9
Sign Control	Free			Free	Stop	

Intersection Summary

Area Type: Other

Control Type: Unsignalized

Intersection Capacity Utilization 15.1% ICU Level of Service A

Analysis Period (min) 15

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	91	10	0	9	18	25	1	531	8	30	703	165
Future Volume (vph)	91	10	0	9	18	25	1	531	8	30	703	165
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		0	220		150	180		0
Storage Lanes	0		0	0		0	1		1	1		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	0.95
Frt					0.936				0.850		0.972	
Flt Protected		0.957			0.991		0.950			0.950		
Satd. Flow (prot)	0	1783	0	0	1728	0	1770	3139	1583	1770	3118	0
Flt Permitted		0.957			0.991		0.950			0.950		
Satd. Flow (perm)	0	1783	0	0	1728	0	1770	3139	1583	1770	3118	0
Link Speed (mph)		30			30			65			65	
Link Distance (ft)		384			236			1273			351	
Travel Time (s)		8.7			5.4			13.4			3.7	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	15%	2%	2%	15%	2%
Adj. Flow (vph)	107	12	0	11	21	29	1	590	9	33	781	183
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	119	0	0	61	0	1	590	9	33	964	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			60			60	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Stop			Stop			Free			Free	

Intersection Summary	
Area Type: Other	
Control Type: Unsignalized	
Intersection Capacity Utilization 43.8%	ICU Level of Service A
Analysis Period (min) 15	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	268	77	0	0	90	8	62	0	18	0	0	0
Future Volume (vph)	268	77	0	0	90	8	62	0	18	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	200		0	0		0	0		0	0		0
Storage Lanes	1		0	0		0	0		0	0		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt					0.989			0.970				
Flt Protected	0.950							0.963				
Satd. Flow (prot)	1719	1810	0	0	1790	0	0	1613	0	0	0	0
Flt Permitted	0.523							0.963				
Satd. Flow (perm)	946	1810	0	0	1790	0	0	1613	0	0	0	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)					7			145				
Link Speed (mph)		45			55			30			30	
Link Distance (ft)		730			240			420			390	
Travel Time (s)		11.1			3.0			9.5			8.9	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	10%	2%	10%	2%	2%	2%
Adj. Flow (vph)	315	91	0	0	106	9	73	0	21	0	0	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	315	91	0	0	115	0	0	94	0	0	0	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2			2		1	2				
Detector Template	Left	Thru			Thru		Left	Thru				
Leading Detector (ft)	20	100			100		20	100				
Trailing Detector (ft)	0	0			0		0	0				
Detector 1 Position(ft)	0	0			0		0	0				
Detector 1 Size(ft)	20	6			6		20	6				
Detector 1 Type	Cl+Ex	Cl+Ex			Cl+Ex		Cl+Ex	Cl+Ex				
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0			0.0		0.0	0.0				
Detector 1 Queue (s)	0.0	0.0			0.0		0.0	0.0				
Detector 1 Delay (s)	0.0	0.0			0.0		0.0	0.0				
Detector 2 Position(ft)		94			94			94				
Detector 2 Size(ft)		6			6			6				
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex				
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0				
Turn Type	pm+pt	NA			NA		Split	NA				
Protected Phases	7	4			8		2	2				

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	4											
Detector Phase	7	4			8		2	2				
Switch Phase												
Minimum Initial (s)	5.0	5.0			5.0		5.0	5.0				
Minimum Split (s)	10.5	23.5			23.5		23.5	23.5				
Total Split (s)	13.0	36.5			23.5		23.5	23.5				
Total Split (%)	21.7%	60.8%			39.2%		39.2%	39.2%				
Maximum Green (s)	7.5	31.0			18.0		18.0	18.0				
Yellow Time (s)	4.0	4.0			4.0		4.0	4.0				
All-Red Time (s)	1.5	1.5			1.5		1.5	1.5				
Lost Time Adjust (s)	0.0	0.0			0.0			0.0				
Total Lost Time (s)	5.5	5.5			5.5			5.5				
Lead/Lag	Lead				Lag							
Lead-Lag Optimize?	Yes				Yes							
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0				
Recall Mode	None	C-Max			C-Max		Max	Max				
Walk Time (s)		7.0			7.0		7.0	7.0				
Flash Dont Walk (s)		11.0			11.0		11.0	11.0				
Pedestrian Calls (#/hr)		0			0		0	0				
Act Effct Green (s)	31.0	31.0			18.0			18.0				
Actuated g/C Ratio	0.52	0.52			0.30			0.30				
v/c Ratio	0.54	0.10			0.21			0.16				
Control Delay	12.6	7.8			16.0			2.0				
Queue Delay	0.0	0.0			0.0			0.0				
Total Delay	12.6	7.8			16.0			2.0				
LOS	B	A			B			A				
Approach Delay		11.6			16.0			2.0				
Approach LOS		B			B			A				
Queue Length 50th (ft)	62	15			29			0				
Queue Length 95th (ft)	100	32			59			10				
Internal Link Dist (ft)		650			160			340			310	
Turn Bay Length (ft)	200											
Base Capacity (vph)	585	935			541			585				
Starvation Cap Reductn	0	0			0			0				
Spillback Cap Reductn	0	0			0			0				
Storage Cap Reductn	0	0			0			0				
Reduced v/c Ratio	0.54	0.10			0.21			0.16				

Intersection Summary

Area Type: Other

Cycle Length: 60

Actuated Cycle Length: 60

Offset: 0 (0%), Referenced to phase 4:EBTL and 8:WBT, Start of Green

Natural Cycle: 60

Control Type: Actuated-Coordinated

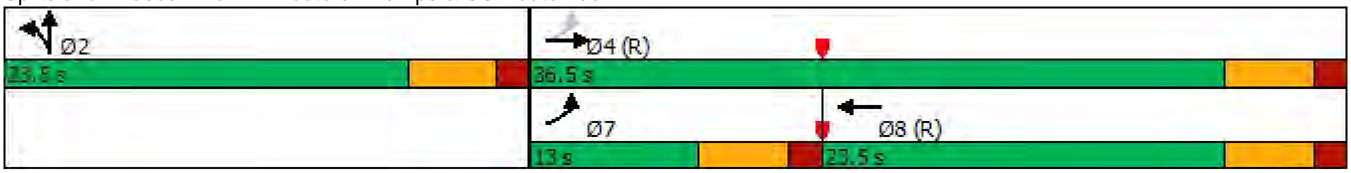
Maximum v/c Ratio: 0.54

Intersection Signal Delay: 10.9 Intersection LOS: B

Intersection Capacity Utilization 56.7% ICU Level of Service B

Analysis Period (min) 15

Splits and Phases: 9: NB Route 67 Ramps & US Route 160



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	31	640	12	22	185	72	9	9	55	174	1	43
Future Volume (vph)	31	640	12	22	185	72	9	9	55	174	1	43
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.998			0.965			0.898			0.973	
Flt Protected		0.998			0.996			0.994			0.962	
Satd. Flow (prot)	0	1802	0	0	1739	0	0	1663	0	0	1744	0
Flt Permitted		0.998			0.996			0.994			0.962	
Satd. Flow (perm)	0	1802	0	0	1739	0	0	1663	0	0	1744	0
Link Speed (mph)		45			45			30			45	
Link Distance (ft)		1590			1013			619			557	
Travel Time (s)		24.1			15.3			14.1			8.4	
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	2%	2%	2%	2%	2%	2%
Adj. Flow (vph)	39	800	15	28	231	90	11	11	69	218	1	54
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	854	0	0	349	0	0	91	0	0	273	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Free			Free			Stop			Stop	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	
Intersection Capacity Utilization 67.9%	ICU Level of Service C
Analysis Period (min) 15	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	791	74	10	93	0	0	0	0	37	0	187
Future Volume (vph)	0	791	74	10	93	0	0	0	0	37	0	187
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	200		0	0		0	0		0
Storage Lanes	0		0	1		0	0		0	0		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.988									0.887	
Flt Protected				0.950							0.992	
Satd. Flow (prot)	0	1781	0	1641	1810	0	0	0	0	0	1592	0
Flt Permitted				0.950							0.992	
Satd. Flow (perm)	0	1781	0	1641	1810	0	0	0	0	0	1592	0
Link Speed (mph)		45			45			30			30	
Link Distance (ft)		1013			730			515			536	
Travel Time (s)		15.3			11.1			11.7			12.2	
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Heavy Vehicles (%)	10%	5%	10%	10%	5%	10%	2%	2%	2%	5%	2%	5%
Adj. Flow (vph)	0	989	93	13	116	0	0	0	0	46	0	234
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	1082	0	13	116	0	0	0	0	0	280	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Free			Free			Stop			Stop	

Intersection Summary

Area Type: Other

Control Type: Unsignalized

Intersection Capacity Utilization 73.0% ICU Level of Service D

Analysis Period (min) 15

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	712	116	0	0	65	83	38	0	29	0	0	0
Future Volume (vph)	712	116	0	0	65	83	38	0	29	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	200		0	0		0	0		0	0		0
Storage Lanes	1		0	0		0	0		0	0		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt					0.924			0.942				
Flt Protected	0.950							0.972				
Satd. Flow (prot)	1719	1810	0	0	1672	0	0	1582	0	0	0	0
Flt Permitted	0.950							0.972				
Satd. Flow (perm)	1719	1810	0	0	1672	0	0	1582	0	0	0	0
Link Speed (mph)		45			55			30			30	
Link Distance (ft)		730			200			420			390	
Travel Time (s)		11.1			2.5			9.5			8.9	
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	10%	2%	10%	2%	2%	2%
Adj. Flow (vph)	890	145	0	0	81	104	48	0	36	0	0	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	890	145	0	0	185	0	0	84	0	0	0	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Free			Free			Stop			Stop	

Intersection Summary

Area Type: Other

Control Type: Unsignalized

Intersection Capacity Utilization 73.0% ICU Level of Service D

Analysis Period (min) 15

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	1	133	6	2	130	0	8	0	1	0	0	4
Future Volume (vph)	1	133	6	2	130	0	8	0	1	0	0	4
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.994						0.988			0.865	
Flt Protected					0.999			0.957				
Satd. Flow (prot)	0	1801	0	0	1809	0	0	1761	0	0	1611	0
Flt Permitted					0.999			0.957				
Satd. Flow (perm)	0	1801	0	0	1809	0	0	1761	0	0	1611	0
Link Speed (mph)		55			55			30			30	
Link Distance (ft)		3306			2284			2605			1665	
Travel Time (s)		41.0			28.3			59.2			37.8	
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Heavy Vehicles (%)	2%	5%	2%	2%	5%	2%	2%	2%	2%	2%	2%	2%
Adj. Flow (vph)	1	166	8	3	163	0	10	0	1	0	0	5
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	175	0	0	166	0	0	11	0	0	5	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Free			Free			Stop			Stop	

Intersection Summary

Area Type: Other

Control Type: Unsignalized

Intersection Capacity Utilization 21.8% ICU Level of Service A

Analysis Period (min) 15

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	144	1	0	143	5	0
Future Volume (vph)	144	1	0	143	5	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.999					
Flt Protected					0.950	
Satd. Flow (prot)	1808	0	0	1810	1770	0
Flt Permitted					0.950	
Satd. Flow (perm)	1808	0	0	1810	1770	0
Link Speed (mph)	55			55	30	
Link Distance (ft)	200			3306	439	
Travel Time (s)	2.5			41.0	10.0	
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80
Heavy Vehicles (%)	5%	2%	2%	5%	2%	2%
Adj. Flow (vph)	180	1	0	179	6	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	181	0	0	179	6	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	0			0	12	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)		9	15		15	9
Sign Control	Free			Free	Stop	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	
Intersection Capacity Utilization 17.6%	ICU Level of Service A
Analysis Period (min) 15	

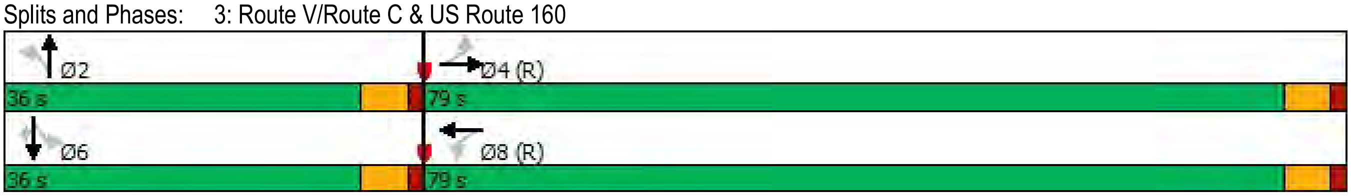
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	31	640	12	22	185	72	9	9	55	174	1	43
Future Volume (vph)	31	640	12	22	185	72	9	9	55	174	1	43
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.998			0.965			0.898				0.850
Flt Protected		0.998			0.996			0.994			0.953	
Satd. Flow (prot)	0	1802	0	0	1739	0	0	1663	0	0	1775	1583
Flt Permitted		0.971			0.906			0.958			0.647	
Satd. Flow (perm)	0	1754	0	0	1582	0	0	1602	0	0	1205	1583
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		2			31			69				54
Link Speed (mph)		45			45			30			45	
Link Distance (ft)		1590			1013			619			557	
Travel Time (s)		24.1			15.3			14.1			8.4	
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	2%	2%	2%	2%	2%	2%
Adj. Flow (vph)	39	800	15	28	231	90	11	11	69	218	1	54
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	854	0	0	349	0	0	91	0	0	219	54
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	1		1	1		1	1		1	1	1
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	Right
Leading Detector (ft)	20	100		20	100		20	100		20	100	20
Trailing Detector (ft)	0	0		0	0		0	0		0	0	0
Detector 1 Position(ft)	0	0		0	0		0	0		0	0	0
Detector 1 Size(ft)	20	100		20	100		20	100		20	100	20
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	Perm
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		6
Detector Phase	4	4		8	8		2	2		6	6	6
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	5.0
Minimum Split (s)	23.5	23.5		23.5	23.5		23.5	23.5		23.5	23.5	23.5
Total Split (s)	79.0	79.0		79.0	79.0		36.0	36.0		36.0	36.0	36.0
Total Split (%)	68.7%	68.7%		68.7%	68.7%		31.3%	31.3%		31.3%	31.3%	31.3%
Maximum Green (s)	73.5	73.5		73.5	73.5		30.5	30.5		30.5	30.5	30.5

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
All-Red Time (s)	1.5	1.5		1.5	1.5		1.5	1.5		1.5	1.5	1.5
Lost Time Adjust (s)		-1.5			-1.5			-1.5			-1.5	-1.5
Total Lost Time (s)		4.0			4.0			4.0			4.0	4.0
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Recall Mode	C-Max	C-Max		C-Max	C-Max		Max	Max		Max	Max	Max
Act Effct Green (s)		75.0			75.0			32.0			32.0	32.0
Actuated g/C Ratio		0.65			0.65			0.28			0.28	0.28
v/c Ratio		0.75			0.33			0.18			0.65	0.11
Control Delay		18.7			10.1			12.0			47.2	9.0
Queue Delay		0.1			0.0			0.0			0.0	0.0
Total Delay		18.8			10.1			12.0			47.2	9.0
LOS		B			B			B			D	A
Approach Delay		18.8			10.1			12.0			39.7	
Approach LOS		B			B			B			D	
Queue Length 50th (ft)		392			144			12			143	0
Queue Length 95th (ft)		433			158			42			199	24
Internal Link Dist (ft)		1510			933			539			477	
Turn Bay Length (ft)												
Base Capacity (vph)		1144			1042			495			335	479
Starvation Cap Reductn		0			0			0			0	0
Spillback Cap Reductn		11			0			0			0	0
Storage Cap Reductn		0			0			0			0	0
Reduced v/c Ratio		0.75			0.33			0.18			0.65	0.11

Intersection Summary

Area Type: Other
Cycle Length: 115
Actuated Cycle Length: 115
Offset: 33 (29%), Referenced to phase 4:EBTL and 8:WBTL, Start of Green
Natural Cycle: 60
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.75
Intersection Signal Delay: 20.1 Intersection LOS: C
Intersection Capacity Utilization 65.2% ICU Level of Service C
Analysis Period (min) 15

Splits and Phases: 3: Route V/Route C & US Route 160



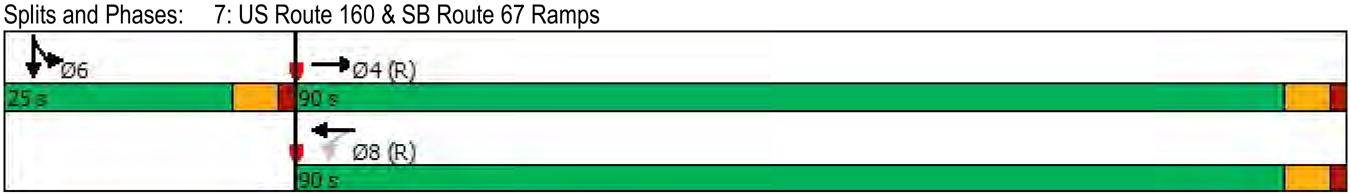
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	791	74	10	93	0	0	0	0	37	0	187
Future Volume (vph)	0	791	74	10	93	0	0	0	0	37	0	187
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	200		0	0		0	0		0
Storage Lanes	0		0	1		0	0		0	0		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.988									0.887	
Flt Protected				0.950							0.992	
Satd. Flow (prot)	0	1781	0	1641	1810	0	0	0	0	0	1592	0
Flt Permitted				0.150							0.992	
Satd. Flow (perm)	0	1781	0	259	1810	0	0	0	0	0	1592	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		12									195	
Link Speed (mph)		45			45			30			30	
Link Distance (ft)		1013			730			515			536	
Travel Time (s)		15.3			11.1			11.7			12.2	
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Heavy Vehicles (%)	10%	5%	10%	10%	5%	10%	2%	2%	2%	5%	2%	5%
Adj. Flow (vph)	0	989	93	13	116	0	0	0	0	46	0	234
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	1082	0	13	116	0	0	0	0	0	280	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors		1		1	1					1	1	
Detector Template		Thru		Left	Thru					Left	Thru	
Leading Detector (ft)		100		20	100					20	100	
Trailing Detector (ft)		0		0	0					0	0	
Detector 1 Position(ft)		0		0	0					0	0	
Detector 1 Size(ft)		100		20	100					20	100	
Detector 1 Type		Cl+Ex		Cl+Ex	Cl+Ex					Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)		0.0		0.0	0.0					0.0	0.0	
Detector 1 Queue (s)		0.0		0.0	0.0					0.0	0.0	
Detector 1 Delay (s)		0.0		0.0	0.0					0.0	0.0	
Turn Type		NA		Perm	NA					Split	NA	
Protected Phases		4			8					6	6	
Permitted Phases				8								
Detector Phase		4		8	8					6	6	
Switch Phase												
Minimum Initial (s)		5.0		5.0	5.0					5.0	5.0	
Minimum Split (s)		23.5		23.5	23.5					23.5	23.5	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Total Split (s)		90.0		90.0	90.0					25.0	25.0	
Total Split (%)		78.3%		78.3%	78.3%					21.7%	21.7%	
Maximum Green (s)		84.5		84.5	84.5					19.5	19.5	
Yellow Time (s)		4.0		4.0	4.0					4.0	4.0	
All-Red Time (s)		1.5		1.5	1.5					1.5	1.5	
Lost Time Adjust (s)		-1.5		-1.5	-1.5						-1.5	
Total Lost Time (s)		4.0		4.0	4.0						4.0	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)		3.0		3.0	3.0					3.0	3.0	
Recall Mode		C-Max		C-Max	C-Max					Max	Max	
Act Effct Green (s)		86.0		86.0	86.0						21.0	
Actuated g/C Ratio		0.75		0.75	0.75						0.18	
v/c Ratio		0.81		0.07	0.09						0.62	
Control Delay		10.5		14.0	9.8						20.5	
Queue Delay		0.1		0.0	0.0						0.0	
Total Delay		10.6		14.0	9.8						20.5	
LOS		B		B	A						C	
Approach Delay		10.6			10.3						20.5	
Approach LOS		B			B						C	
Queue Length 50th (ft)		240		2	19						55	
Queue Length 95th (ft)		258		23	89						108	
Internal Link Dist (ft)		933			650			435			456	
Turn Bay Length (ft)				200								
Base Capacity (vph)		1334		193	1353						450	
Starvation Cap Reductn		13		0	0						0	
Spillback Cap Reductn		0		0	0						0	
Storage Cap Reductn		0		0	0						0	
Reduced v/c Ratio		0.82		0.07	0.09						0.62	

Intersection Summary

Area Type: Other
Cycle Length: 115
Actuated Cycle Length: 115
Offset: 30 (26%), Referenced to phase 4:EBT and 8:WBTL, Start of Green
Natural Cycle: 80
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.81
Intersection Signal Delay: 12.4 Intersection LOS: B
Intersection Capacity Utilization 73.9% ICU Level of Service D
Analysis Period (min) 15

Splits and Phases: 7: US Route 160 & SB Route 67 Ramps



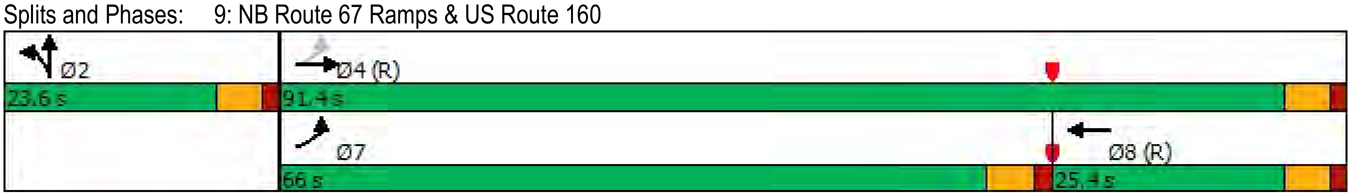
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	712	116	0	0	65	83	38	0	29	0	0	0
Future Volume (vph)	712	116	0	0	65	83	38	0	29	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	200		0	0		0	0		0	0		0
Storage Lanes	1		0	0		0	0		0	0		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt					0.924			0.942				
Flt Protected	0.950							0.972				
Satd. Flow (prot)	1719	1810	0	0	1672	0	0	1582	0	0	0	0
Flt Permitted	0.494							0.972				
Satd. Flow (perm)	894	1810	0	0	1672	0	0	1582	0	0	0	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)					49			76				
Link Speed (mph)		45			55			30			30	
Link Distance (ft)		730			200			420			390	
Travel Time (s)		11.1			2.5			9.5			8.9	
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	10%	2%	10%	2%	2%	2%
Adj. Flow (vph)	890	145	0	0	81	104	48	0	36	0	0	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	890	145	0	0	185	0	0	84	0	0	0	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	1			1		1	1				
Detector Template	Left	Thru			Thru		Left	Thru				
Leading Detector (ft)	20	100			100		20	100				
Trailing Detector (ft)	0	0			0		0	0				
Detector 1 Position(ft)	0	0			0		0	0				
Detector 1 Size(ft)	20	100			100		20	100				
Detector 1 Type	Cl+Ex	Cl+Ex			Cl+Ex		Cl+Ex	Cl+Ex				
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0			0.0		0.0	0.0				
Detector 1 Queue (s)	0.0	0.0			0.0		0.0	0.0				
Detector 1 Delay (s)	0.0	0.0			0.0		0.0	0.0				
Turn Type	pm+pt	NA			NA		Split	NA				
Protected Phases	7	4			8		2	2				
Permitted Phases	4											
Detector Phase	7	4			8		2	2				
Switch Phase												
Minimum Initial (s)	5.0	5.0			5.0		5.0	5.0				
Minimum Split (s)	10.5	23.5			23.5		23.5	23.5				

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Total Split (s)	66.0	91.4			25.4		23.6	23.6				
Total Split (%)	57.4%	79.5%			22.1%		20.5%	20.5%				
Maximum Green (s)	60.5	85.9			19.9		18.1	18.1				
Yellow Time (s)	4.0	4.0			4.0		4.0	4.0				
All-Red Time (s)	1.5	1.5			1.5		1.5	1.5				
Lost Time Adjust (s)	-1.5	-1.5			-1.5			-1.5				
Total Lost Time (s)	4.0	4.0			4.0			4.0				
Lead/Lag	Lead				Lag							
Lead-Lag Optimize?	Yes				Yes							
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0				
Recall Mode	None	C-Max			C-Max		Max	Max				
Act Effct Green (s)	87.4	87.4			35.6			19.6				
Actuated g/C Ratio	0.76	0.76			0.31			0.17				
v/c Ratio	0.87	0.11			0.34			0.25				
Control Delay	8.7	0.5			28.4			13.3				
Queue Delay	0.2	0.0			0.0			0.0				
Total Delay	8.9	0.5			28.4			13.3				
LOS	A	A			C			B				
Approach Delay		7.8			28.4			13.3				
Approach LOS		A			C			B				
Queue Length 50th (ft)	15	3			79			5				
Queue Length 95th (ft)	53	m4			140			37				
Internal Link Dist (ft)		650			120			340			310	
Turn Bay Length (ft)	200											
Base Capacity (vph)	1124	1375			551			332				
Starvation Cap Reductn	23	0			0			0				
Spillback Cap Reductn	0	0			0			0				
Storage Cap Reductn	0	0			0			0				
Reduced v/c Ratio	0.81	0.11			0.34			0.25				

Intersection Summary

Area Type: Other
Cycle Length: 115
Actuated Cycle Length: 115
Offset: 108 (94%), Referenced to phase 4:EBTL and 8:WBT, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.87
Intersection Signal Delay: 11.0 Intersection LOS: B
Intersection Capacity Utilization 73.9% ICU Level of Service D
Analysis Period (min) 15
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 9: NB Route 67 Ramps & US Route 160



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	43	289	10	54	439	217	27	14	48	132	16	64
Future Volume (vph)	43	289	10	54	439	217	27	14	48	132	16	64
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.996			0.959			0.927			0.959	
Flt Protected		0.994			0.996			0.985			0.970	
Satd. Flow (prot)	0	1791	0	0	1728	0	0	1701	0	0	1733	0
Flt Permitted		0.994			0.996			0.985			0.970	
Satd. Flow (perm)	0	1791	0	0	1728	0	0	1701	0	0	1733	0
Link Speed (mph)		45			45			30			45	
Link Distance (ft)		1590			1013			619			557	
Travel Time (s)		24.1			15.3			14.1			8.4	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	2%	2%	2%	2%	2%	2%
Adj. Flow (vph)	51	340	12	64	516	255	32	16	56	155	19	75
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	403	0	0	835	0	0	104	0	0	249	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Free			Free			Stop			Stop	

Intersection Summary		
Area Type:	Other	
Control Type: Unsignalized		
Intersection Capacity Utilization 72.1%		ICU Level of Service C
Analysis Period (min) 15		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	433	26	19	161	0	0	0	0	43	0	547
Future Volume (vph)	0	433	26	19	161	0	0	0	0	43	0	547
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	200		0	0		0	0		0
Storage Lanes	0		0	1		0	0		0	0		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.992									0.875	
Flt Protected				0.950							0.996	
Satd. Flow (prot)	0	1790	0	1641	1810	0	0	0	0	0	1577	0
Flt Permitted				0.950							0.996	
Satd. Flow (perm)	0	1790	0	1641	1810	0	0	0	0	0	1577	0
Link Speed (mph)		45			45			30			30	
Link Distance (ft)		1013			730			515			536	
Travel Time (s)		15.3			11.1			11.7			12.2	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Heavy Vehicles (%)	10%	5%	10%	10%	5%	10%	2%	2%	2%	5%	2%	5%
Adj. Flow (vph)	0	509	31	22	189	0	0	0	0	51	0	644
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	540	0	22	189	0	0	0	0	0	695	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Free			Free			Stop			Stop	

Intersection Summary	
Area Type: Other	
Control Type: Unsignalized	
Intersection Capacity Utilization 73.9%	ICU Level of Service D
Analysis Period (min) 15	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	359	117	0	0	117	33	63	0	26	0	0	0
Future Volume (vph)	359	117	0	0	117	33	63	0	26	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	200		0	0		0	0		0	0		0
Storage Lanes	1		0	0		0	0		0	0		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt					0.970			0.960				
Flt Protected	0.950							0.966				
Satd. Flow (prot)	1719	1810	0	0	1755	0	0	1602	0	0	0	0
Flt Permitted	0.950							0.966				
Satd. Flow (perm)	1719	1810	0	0	1755	0	0	1602	0	0	0	0
Link Speed (mph)		45			55			30			30	
Link Distance (ft)		730			300			420			390	
Travel Time (s)		11.1			3.7			9.5			8.9	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	10%	2%	10%	2%	2%	2%
Adj. Flow (vph)	422	138	0	0	138	39	74	0	31	0	0	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	422	138	0	0	177	0	0	105	0	0	0	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Free			Free			Stop			Stop	

Intersection Summary	
Area Type: Other	
Control Type: Unsignalized	
Intersection Capacity Utilization 73.9%	ICU Level of Service D
Analysis Period (min) 15	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	1	129	5	2	141	0	0	0	1	0	0	1
Future Volume (vph)	1	129	5	2	141	0	0	0	1	0	0	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.995						0.865			0.865	
Flt Protected					0.999							
Satd. Flow (prot)	0	1803	0	0	1808	0	0	1611	0	0	1611	0
Flt Permitted					0.999							
Satd. Flow (perm)	0	1803	0	0	1808	0	0	1611	0	0	1611	0
Link Speed (mph)		55			55			30			30	
Link Distance (ft)		3206			2284			2605			1665	
Travel Time (s)		39.7			28.3			59.2			37.8	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Heavy Vehicles (%)	2%	5%	2%	2%	5%	2%	2%	2%	2%	2%	2%	2%
Adj. Flow (vph)	1	152	6	2	166	0	0	0	1	0	0	1
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	159	0	0	168	0	0	1	0	0	1	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Free			Free			Stop			Stop	

Intersection Summary		
Area Type:	Other	
Control Type: Unsignalized		
Intersection Capacity Utilization 18.7%		ICU Level of Service A
Analysis Period (min) 15		

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	139	4	0	149	1	0
Future Volume (vph)	139	4	0	149	1	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.996					
Flt Protected					0.950	
Satd. Flow (prot)	1855	0	0	1863	1770	0
Flt Permitted					0.950	
Satd. Flow (perm)	1855	0	0	1863	1770	0
Link Speed (mph)	55			55	30	
Link Distance (ft)	300			3206	446	
Travel Time (s)	3.7			39.7	10.1	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Adj. Flow (vph)	164	5	0	175	1	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	169	0	0	175	1	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	0			0	12	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)		9	15		15	9
Sign Control	Free			Free	Stop	

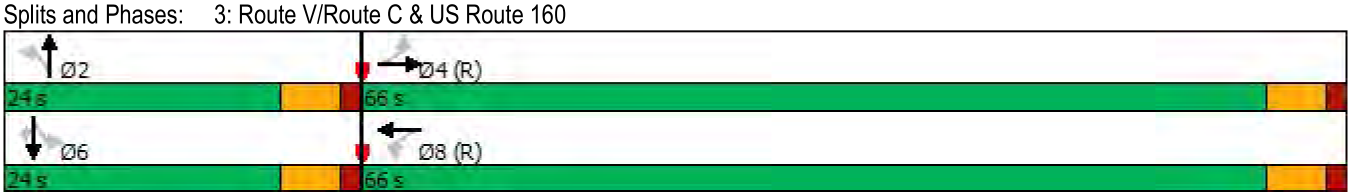
Intersection Summary	
Area Type: Other	
Control Type: Unsignalized	
Intersection Capacity Utilization 17.8%	ICU Level of Service A
Analysis Period (min) 15	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	43	289	10	54	439	217	27	14	48	132	16	64
Future Volume (vph)	43	289	10	54	439	217	27	14	48	132	16	64
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.996			0.959			0.927				0.850
Flt Protected		0.994			0.996			0.985			0.957	
Satd. Flow (prot)	0	1791	0	0	1728	0	0	1701	0	0	1783	1583
Flt Permitted		0.847			0.942			0.873			0.669	
Satd. Flow (perm)	0	1527	0	0	1635	0	0	1507	0	0	1246	1583
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		4			57			56				75
Link Speed (mph)		45			45			30			45	
Link Distance (ft)		1590			1013			619			557	
Travel Time (s)		24.1			15.3			14.1			8.4	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	2%	2%	2%	2%	2%	2%
Adj. Flow (vph)	51	340	12	64	516	255	32	16	56	155	19	75
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	403	0	0	835	0	0	104	0	0	174	75
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	1		1	1		1	1		1	1	1
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	Right
Leading Detector (ft)	20	100		20	100		20	100		20	100	20
Trailing Detector (ft)	0	0		0	0		0	0		0	0	0
Detector 1 Position(ft)	0	0		0	0		0	0		0	0	0
Detector 1 Size(ft)	20	100		20	100		20	100		20	100	20
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	Perm
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		6
Detector Phase	4	4		8	8		2	2		6	6	6
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	5.0
Minimum Split (s)	23.5	23.5		23.5	23.5		23.5	23.5		23.5	23.5	23.5
Total Split (s)	66.0	66.0		66.0	66.0		24.0	24.0		24.0	24.0	24.0
Total Split (%)	73.3%	73.3%		73.3%	73.3%		26.7%	26.7%		26.7%	26.7%	26.7%
Maximum Green (s)	60.5	60.5		60.5	60.5		18.5	18.5		18.5	18.5	18.5

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
All-Red Time (s)	1.5	1.5		1.5	1.5		1.5	1.5		1.5	1.5	1.5
Lost Time Adjust (s)		-1.5			-1.5			-1.5			-1.5	-1.5
Total Lost Time (s)		4.0			4.0			4.0			4.0	4.0
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Recall Mode	C-Max	C-Max		C-Max	C-Max		Max	Max		Max	Max	Max
Act Effct Green (s)		62.0			62.0			20.0			20.0	20.0
Actuated g/C Ratio		0.69			0.69			0.22			0.22	0.22
v/c Ratio		0.38			0.73			0.28			0.63	0.18
Control Delay		7.1			10.4			17.2			43.2	8.5
Queue Delay		0.0			0.0			0.0			0.0	0.0
Total Delay		7.1			10.4			17.2			43.2	8.5
LOS		A			B			B			D	A
Approach Delay		7.1			10.4			17.2			32.8	
Approach LOS		A			B			B			C	
Queue Length 50th (ft)		83			217			22			90	0
Queue Length 95th (ft)		119			323			60			149	30
Internal Link Dist (ft)		1510			933			539			477	
Turn Bay Length (ft)												
Base Capacity (vph)		1053			1144			378			276	410
Starvation Cap Reductn		0			0			0			0	0
Spillback Cap Reductn		0			0			0			0	0
Storage Cap Reductn		0			0			0			0	0
Reduced v/c Ratio		0.38			0.73			0.28			0.63	0.18

Intersection Summary	
Area Type: Other	
Cycle Length: 90	
Actuated Cycle Length: 90	
Offset: 71 (79%), Referenced to phase 4:EBTL and 8:WBTL, Start of Green	
Natural Cycle: 65	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.73	
Intersection Signal Delay: 13.5	Intersection LOS: B
Intersection Capacity Utilization 68.2%	ICU Level of Service C
Analysis Period (min) 15	

Splits and Phases: 3: Route V/Route C & US Route 160



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	433	26	19	161	0	0	0	0	43	0	547
Future Volume (vph)	0	433	26	19	161	0	0	0	0	43	0	547
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	200		0	0		0	0		0
Storage Lanes	0		0	1		0	0		0	0		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.992									0.875	
Flt Protected				0.950							0.996	
Satd. Flow (prot)	0	1790	0	1641	1810	0	0	0	0	0	1577	0
Flt Permitted				0.271							0.996	
Satd. Flow (perm)	0	1790	0	468	1810	0	0	0	0	0	1577	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		4									642	
Link Speed (mph)		45			45			30			30	
Link Distance (ft)		1013			730			515			536	
Travel Time (s)		15.3			11.1			11.7			12.2	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Heavy Vehicles (%)	10%	5%	10%	10%	5%	10%	2%	2%	2%	5%	2%	5%
Adj. Flow (vph)	0	509	31	22	189	0	0	0	0	51	0	644
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	540	0	22	189	0	0	0	0	0	695	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors		1		1	1					1	1	
Detector Template		Thru		Left	Thru					Left	Thru	
Leading Detector (ft)		100		20	100					20	100	
Trailing Detector (ft)		0		0	0					0	0	
Detector 1 Position(ft)		0		0	0					0	0	
Detector 1 Size(ft)		100		20	100					20	100	
Detector 1 Type		Cl+Ex		Cl+Ex	Cl+Ex					Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)		0.0		0.0	0.0					0.0	0.0	
Detector 1 Queue (s)		0.0		0.0	0.0					0.0	0.0	
Detector 1 Delay (s)		0.0		0.0	0.0					0.0	0.0	
Turn Type		NA		Perm	NA					Split	NA	
Protected Phases		4			8					6	6	
Permitted Phases				8								
Detector Phase		4		8	8					6	6	
Switch Phase												
Minimum Initial (s)		5.0		5.0	5.0					5.0	5.0	
Minimum Split (s)		23.5		23.5	23.5					23.5	23.5	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Total Split (s)		45.0		45.0	45.0					45.0	45.0	
Total Split (%)		50.0%		50.0%	50.0%					50.0%	50.0%	
Maximum Green (s)		39.5		39.5	39.5					39.5	39.5	
Yellow Time (s)		4.0		4.0	4.0					4.0	4.0	
All-Red Time (s)		1.5		1.5	1.5					1.5	1.5	
Lost Time Adjust (s)		-1.5		-1.5	-1.5						-1.5	
Total Lost Time (s)		4.0		4.0	4.0						4.0	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)		3.0		3.0	3.0					3.0	3.0	
Recall Mode		C-Max		C-Max	C-Max					Max	Max	
Act Effct Green (s)		41.0		41.0	41.0						41.0	
Actuated g/C Ratio		0.46		0.46	0.46						0.46	
v/c Ratio		0.66		0.10	0.23						0.65	
Control Delay		17.1		13.5	13.0						5.4	
Queue Delay		0.0		0.0	0.0						0.0	
Total Delay		17.1		13.5	13.0						5.4	
LOS		B		B	B						A	
Approach Delay		17.1			13.0						5.4	
Approach LOS		B			B						A	
Queue Length 50th (ft)		215		5	43						16	
Queue Length 95th (ft)		249		16	76						62	
Internal Link Dist (ft)		933			650			435			456	
Turn Bay Length (ft)				200								
Base Capacity (vph)		817		213	824						1067	
Starvation Cap Reductn		0		0	0						0	
Spillback Cap Reductn		0		0	0						0	
Storage Cap Reductn		0		0	0						0	
Reduced v/c Ratio		0.66		0.10	0.23						0.65	

Intersection Summary

Area Type: Other

Cycle Length: 90

Actuated Cycle Length: 90

Offset: 63 (70%), Referenced to phase 4:EBT and 8:WBTL, Start of Green

Natural Cycle: 50

Control Type: Actuated-Coordinated

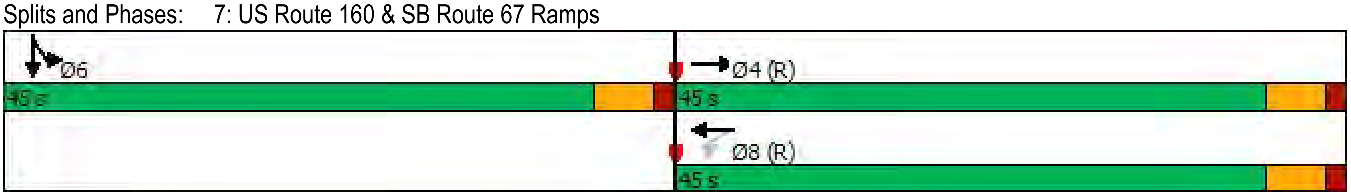
Maximum v/c Ratio: 0.66

Intersection Signal Delay: 10.9 Intersection LOS: B

Intersection Capacity Utilization 74.7% ICU Level of Service D

Analysis Period (min) 15

Splits and Phases: 7: US Route 160 & SB Route 67 Ramps



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	359	117	0	0	117	33	63	0	26	0	0	0
Future Volume (vph)	359	117	0	0	117	33	63	0	26	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	200		0	0		0	0		0	0		0
Storage Lanes	1		0	0		0	0		0	0		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt					0.970			0.960				
Flt Protected	0.950							0.966				
Satd. Flow (prot)	1719	1810	0	0	1755	0	0	1602	0	0	0	0
Flt Permitted	0.562							0.966				
Satd. Flow (perm)	1017	1810	0	0	1755	0	0	1602	0	0	0	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)					16			97				
Link Speed (mph)		45			55			30			30	
Link Distance (ft)		730			300			420			390	
Travel Time (s)		11.1			3.7			9.5			8.9	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	10%	2%	10%	2%	2%	2%
Adj. Flow (vph)	422	138	0	0	138	39	74	0	31	0	0	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	422	138	0	0	177	0	0	105	0	0	0	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	1			1		1	1				
Detector Template	Left	Thru			Thru		Left	Thru				
Leading Detector (ft)	20	100			100		20	100				
Trailing Detector (ft)	0	0			0		0	0				
Detector 1 Position(ft)	0	0			0		0	0				
Detector 1 Size(ft)	20	100			100		20	100				
Detector 1 Type	Cl+Ex	Cl+Ex			Cl+Ex		Cl+Ex	Cl+Ex				
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0			0.0		0.0	0.0				
Detector 1 Queue (s)	0.0	0.0			0.0		0.0	0.0				
Detector 1 Delay (s)	0.0	0.0			0.0		0.0	0.0				
Turn Type	pm+pt	NA			NA		Split	NA				
Protected Phases	7	4			8		2	2				
Permitted Phases	4											
Detector Phase	7	4			8		2	2				
Switch Phase												
Minimum Initial (s)	5.0	5.0			5.0		5.0	5.0				
Minimum Split (s)	10.5	23.5			23.5		23.5	23.5				

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Total Split (s)	34.0	64.0			30.0		26.0	26.0				
Total Split (%)	37.8%	71.1%			33.3%		28.9%	28.9%				
Maximum Green (s)	28.5	58.5			24.5		20.5	20.5				
Yellow Time (s)	4.0	4.0			4.0		4.0	4.0				
All-Red Time (s)	1.5	1.5			1.5		1.5	1.5				
Lost Time Adjust (s)	-1.5	-1.5			-1.5			-1.5				
Total Lost Time (s)	4.0	4.0			4.0			4.0				
Lead/Lag	Lead				Lag							
Lead-Lag Optimize?	Yes				Yes							
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0				
Recall Mode	None	C-Max			C-Max		Max	Max				
Act Effct Green (s)	60.0	60.0			39.0			22.0				
Actuated g/C Ratio	0.67	0.67			0.43			0.24				
v/c Ratio	0.52	0.11			0.23			0.23				
Control Delay	6.5	1.0			16.6			8.4				
Queue Delay	0.0	0.0			0.0			0.0				
Total Delay	6.5	1.0			16.6			8.4				
LOS	A	A			B			A				
Approach Delay		5.2			16.6			8.4				
Approach LOS		A			B			A				
Queue Length 50th (ft)	29	3			55			4				
Queue Length 95th (ft)	45	m6			104			38				
Internal Link Dist (ft)		650			220			340			310	
Turn Bay Length (ft)	200											
Base Capacity (vph)	912	1206			769			464				
Starvation Cap Reductn	0	0			0			0				
Spillback Cap Reductn	0	0			0			0				
Storage Cap Reductn	0	0			0			0				
Reduced v/c Ratio	0.46	0.11			0.23			0.23				

Intersection Summary

Area Type: Other
Cycle Length: 90
Actuated Cycle Length: 90
Offset: 88 (98%), Referenced to phase 4:EBTL and 8:WBT, Start of Green
Natural Cycle: 60
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.52
Intersection Signal Delay: 8.0 Intersection LOS: A
Intersection Capacity Utilization 74.7% ICU Level of Service D
Analysis Period (min) 15
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 9: NB Route 67 Ramps & US Route 160

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	98	15	2	1	14	44	1	648	18	25	290	33
Future Volume (vph)	98	15	2	1	14	44	1	648	18	25	290	33
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		0	220		150	180		0
Storage Lanes	0		0	0		0	1		1	1		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	0.95
Frt		0.997			0.900				0.850		0.985	
Flt Protected		0.959			0.999		0.950			0.950		
Satd. Flow (prot)	0	1781	0	0	1675	0	1770	3139	1583	1770	3128	0
Flt Permitted		0.959			0.999		0.950			0.950		
Satd. Flow (perm)	0	1781	0	0	1675	0	1770	3139	1583	1770	3128	0
Link Speed (mph)		30			30			65			65	
Link Distance (ft)		384			236			1273			351	
Travel Time (s)		8.7			5.4			13.4			3.7	
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80	0.86	0.86	0.86	0.86	0.86	0.86
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	15%	2%	2%	15%	2%
Adj. Flow (vph)	123	19	3	1	18	55	1	753	21	29	337	38
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	145	0	0	74	0	1	753	21	29	375	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			60			60	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Stop			Stop			Free			Free	

Intersection Summary

Area Type: Other

Control Type: Unsignalized

Intersection Capacity Utilization 40.4% ICU Level of Service A

Analysis Period (min) 15

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	1	0	0	0	0	1	0	247	0	0	233	1
Future Volume (vph)	1	0	0	0	0	1	0	247	0	0	233	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt					0.865							
Flt Protected		0.950										
Satd. Flow (prot)	0	1770	0	0	1611	0	0	1652	0	0	1653	0
Flt Permitted		0.950										
Satd. Flow (perm)	0	1770	0	0	1611	0	0	1652	0	0	1653	0
Link Speed (mph)		30			30			60			60	
Link Distance (ft)		751			536			1843			682	
Travel Time (s)		17.1			12.2			20.9			7.8	
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	15%	2%	2%	15%	2%
Adj. Flow (vph)	1	0	0	0	0	1	0	287	0	0	271	1
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	1	0	0	1	0	0	287	0	0	272	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Stop			Stop			Free			Free	

Intersection Summary		
Area Type:	Other	
Control Type: Unsignalized		
Intersection Capacity Utilization 23.0%		ICU Level of Service A
Analysis Period (min) 15		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	1	0	0	0	0	1	0	245	0	0	232	1
Future Volume (vph)	1	0	0	0	0	1	0	245	0	0	232	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt					0.865							
Flt Protected		0.950										
Satd. Flow (prot)	0	1770	0	0	1611	0	0	1652	0	0	1653	0
Flt Permitted		0.950										
Satd. Flow (perm)	0	1770	0	0	1611	0	0	1652	0	0	1653	0
Link Speed (mph)		30			30			60			60	
Link Distance (ft)		485			406			490			1843	
Travel Time (s)		11.0			9.2			5.6			20.9	
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80	0.86	0.86	0.86	0.86	0.86	0.86
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	15%	2%	2%	15%	2%
Adj. Flow (vph)	1	0	0	0	0	1	0	285	0	0	270	1
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	1	0	0	1	0	0	285	0	0	271	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Stop			Stop			Free			Free	

Intersection Summary		
Area Type:	Other	
Control Type: Unsignalized		
Intersection Capacity Utilization 22.9%		ICU Level of Service A
Analysis Period (min) 15		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	25	478	9	17	153	11	7	7	42	16	1	34
Future Volume (vph)	25	478	9	17	153	11	7	7	42	16	1	34
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.998			0.992			0.899			0.909	
Flt Protected		0.998			0.995			0.994			0.985	
Satd. Flow (prot)	0	1802	0	0	1786	0	0	1665	0	0	1668	0
Flt Permitted		0.998			0.995			0.994			0.985	
Satd. Flow (perm)	0	1802	0	0	1786	0	0	1665	0	0	1668	0
Link Speed (mph)		45			45			30			45	
Link Distance (ft)		1590			1013			619			557	
Travel Time (s)		24.1			15.3			14.1			8.4	
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	2%	2%	2%	2%	2%	2%
Adj. Flow (vph)	31	598	11	21	191	14	9	9	53	20	1	43
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	640	0	0	226	0	0	71	0	0	64	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Free			Free			Stop			Stop	

Intersection Summary

Area Type: Other

Control Type: Unsignalized

Intersection Capacity Utilization 44.1% ICU Level of Service A

Analysis Period (min) 15

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	480	59	7	57	0	0	0	0	5	0	122
Future Volume (vph)	0	480	59	7	57	0	0	0	0	5	0	122
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.985									0.865	
Flt Protected					0.994					0.950		
Satd. Flow (prot)	0	1773	0	0	1789	0	0	0	0	1719	0	0
Flt Permitted					0.994					0.950		
Satd. Flow (perm)	0	1773	0	0	1789	0	0	0	0	1719	0	0
Link Speed (mph)		45			45			30			30	
Link Distance (ft)		1013			871			492			536	
Travel Time (s)		15.3			13.2			11.2			12.2	
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Heavy Vehicles (%)	2%	5%	10%	10%	5%	2%	2%	2%	2%	5%	2%	5%
Adj. Flow (vph)	0	600	74	9	71	0	0	0	0	6	0	153
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	674	0	0	80	0	0	0	0	6	153	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Free			Free			Stop			Stop	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	
Intersection Capacity Utilization Err%	ICU Level of Service H
Analysis Period (min) 15	

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	51	434	18	36	28	4
Future Volume (vph)	51	434	18	36	28	4
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)		325	0		0	0
Storage Lanes		1	0		1	0
Taper Length (ft)			25		25	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.850			0.983	
Flt Protected				0.983	0.958	
Satd. Flow (prot)	1810	1538	0	1779	1627	0
Flt Permitted				0.983	0.958	
Satd. Flow (perm)	1810	1538	0	1779	1627	0
Link Speed (mph)	45			55	30	
Link Distance (ft)	871			123	420	
Travel Time (s)	13.2			1.5	9.5	
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80
Heavy Vehicles (%)	5%	5%	5%	5%	10%	10%
Adj. Flow (vph)	64	543	23	45	35	5
Shared Lane Traffic (%)						
Lane Group Flow (vph)	64	543	0	68	40	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	0			0	12	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)		9	15		15	9
Sign Control	Free			Free	Stop	

Intersection Summary

Area Type: Other

Control Type: Unsignalized

Intersection Capacity Utilization 36.9% ICU Level of Service A

Analysis Period (min) 15

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	54	1	0	50	4	0
Future Volume (vph)	54	1	0	50	4	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.998					
Flt Protected					0.950	
Satd. Flow (prot)	1806	0	0	1810	1770	0
Flt Permitted					0.950	
Satd. Flow (perm)	1806	0	0	1810	1770	0
Link Speed (mph)	55			55	30	
Link Distance (ft)	123			3242	478	
Travel Time (s)	1.5			40.2	10.9	
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80
Heavy Vehicles (%)	5%	5%	5%	5%	2%	2%
Adj. Flow (vph)	68	1	0	63	5	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	69	0	0	63	5	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	0			0	12	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)		9	15		15	9
Sign Control	Free			Free	Stop	

Intersection Summary	
Area Type: Other	
Control Type: Unsignalized	
Intersection Capacity Utilization 13.3%	ICU Level of Service A
Analysis Period (min) 15	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	1	46	5	2	41	0	6	0	1	0	0	3
Future Volume (vph)	1	46	5	2	41	0	6	0	1	0	0	3
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.988						0.985			0.865	
Flt Protected		0.999			0.997			0.957				
Satd. Flow (prot)	0	1786	0	0	1804	0	0	1756	0	0	1611	0
Flt Permitted		0.999			0.997			0.957				
Satd. Flow (perm)	0	1786	0	0	1804	0	0	1756	0	0	1611	0
Link Speed (mph)		55			55			30			30	
Link Distance (ft)		3242			2284			2605			1665	
Travel Time (s)		40.2			28.3			59.2			37.8	
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	2%	2%	2%	2%	2%	2%
Adj. Flow (vph)	1	58	6	3	51	0	8	0	1	0	0	4
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	65	0	0	54	0	0	9	0	0	4	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Free			Free			Stop			Stop	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	
Intersection Capacity Utilization 15.3%	ICU Level of Service A
Analysis Period (min) 15	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	66	8	0	7	14	19	1	396	6	24	581	137
Future Volume (vph)	66	8	0	7	14	19	1	396	6	24	581	137
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		0	220		150	180		0
Storage Lanes	0		0	0		0	1		1	1		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	0.95
Frt					0.935				0.850		0.971	
Flt Protected		0.957			0.991		0.950			0.950		
Satd. Flow (prot)	0	1783	0	0	1726	0	1770	3139	1583	1770	3115	0
Flt Permitted		0.957			0.991		0.950			0.950		
Satd. Flow (perm)	0	1783	0	0	1726	0	1770	3139	1583	1770	3115	0
Link Speed (mph)		30			30			65			65	
Link Distance (ft)		384			236			1273			351	
Travel Time (s)		8.7			5.4			13.4			3.7	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	15%	2%	2%	15%	2%
Adj. Flow (vph)	78	9	0	8	16	22	1	440	7	27	646	152
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	87	0	0	46	0	1	440	7	27	798	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			60			60	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Stop			Stop			Free			Free	

Intersection Summary

Area Type: Other

Control Type: Unsignalized

Intersection Capacity Utilization 37.8% ICU Level of Service A

Analysis Period (min) 15

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	1	0	0	0	0	0	0	257	0	1	293	1
Future Volume (vph)	1	0	0	0	0	0	0	257	0	1	293	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt												
Flt Protected		0.950										
Satd. Flow (prot)	0	1770	0	0	1863	0	0	1652	0	0	1653	0
Flt Permitted		0.950										
Satd. Flow (perm)	0	1770	0	0	1863	0	0	1652	0	0	1653	0
Link Speed (mph)		30			30			60			60	
Link Distance (ft)		751			536			1843			682	
Travel Time (s)		17.1			12.2			20.9			7.8	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	15%	2%	2%	15%	2%
Adj. Flow (vph)	1	0	0	0	0	0	0	286	0	1	326	1
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	1	0	0	0	0	0	286	0	0	328	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Stop			Stop			Free			Free	

Intersection Summary		
Area Type:	Other	
Control Type: Unsignalized		
Intersection Capacity Utilization 26.3%		ICU Level of Service A
Analysis Period (min) 15		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	1	0	0	0	0	0	0	256	0	1	290	1
Future Volume (vph)	1	0	0	0	0	0	0	256	0	1	290	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt												
Flt Protected		0.950										
Satd. Flow (prot)	0	1770	0	0	1863	0	0	1652	0	0	1653	0
Flt Permitted		0.950										
Satd. Flow (perm)	0	1770	0	0	1863	0	0	1652	0	0	1653	0
Link Speed (mph)		30			30			60			60	
Link Distance (ft)		485			406			490			1843	
Travel Time (s)		11.0			9.2			5.6			20.9	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	15%	2%	2%	15%	2%
Adj. Flow (vph)	1	0	0	0	0	0	0	284	0	1	322	1
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	1	0	0	0	0	0	284	0	0	324	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Stop			Stop			Free			Free	

Intersection Summary		
Area Type:	Other	
Control Type: Unsignalized		
Intersection Capacity Utilization 26.1%		ICU Level of Service A
Analysis Period (min) 15		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	34	216	8	43	363	26	22	11	38	25	12	50
Future Volume (vph)	34	216	8	43	363	26	22	11	38	25	12	50
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.996			0.992			0.928			0.922	
Flt Protected		0.993			0.995			0.985			0.986	
Satd. Flow (prot)	0	1790	0	0	1786	0	0	1703	0	0	1693	0
Flt Permitted		0.993			0.995			0.985			0.986	
Satd. Flow (perm)	0	1790	0	0	1786	0	0	1703	0	0	1693	0
Link Speed (mph)		45			45			30			45	
Link Distance (ft)		1590			1013			619			557	
Travel Time (s)		24.1			15.3			14.1			8.4	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	2%	2%	2%	2%	2%	2%
Adj. Flow (vph)	40	254	9	51	427	31	26	13	45	29	14	59
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	303	0	0	509	0	0	84	0	0	102	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Free			Free			Stop			Stop	

Intersection Summary		
Area Type:	Other	
Control Type: Unsignalized		
Intersection Capacity Utilization 41.8%		ICU Level of Service A
Analysis Period (min) 15		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	251	21	8	108	0	0	0	0	11	0	316
Future Volume (vph)	0	251	21	8	108	0	0	0	0	11	0	316
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.989									0.865	
Flt Protected					0.997					0.950		
Satd. Flow (prot)	0	1783	0	0	1798	0	0	0	0	1719	0	0
Flt Permitted					0.997					0.950		
Satd. Flow (perm)	0	1783	0	0	1798	0	0	0	0	1719	0	0
Link Speed (mph)		45			45			30			30	
Link Distance (ft)		1013			870			530			536	
Travel Time (s)		15.3			13.2			12.0			12.2	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Heavy Vehicles (%)	2%	5%	10%	10%	5%	2%	2%	2%	2%	5%	2%	5%
Adj. Flow (vph)	0	295	25	9	127	0	0	0	0	13	0	372
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	320	0	0	136	0	0	0	0	13	372	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Free			Free			Stop			Stop	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	
Intersection Capacity Utilization Err%	ICU Level of Service H
Analysis Period (min) 15	

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	61	201	6	70	46	13
Future Volume (vph)	61	201	6	70	46	13
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)		325	0		0	0
Storage Lanes		1	0		1	0
Taper Length (ft)			25		25	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.850			0.971	
Flt Protected				0.996	0.962	
Satd. Flow (prot)	1810	1538	0	1802	1613	0
Flt Permitted				0.996	0.962	
Satd. Flow (perm)	1810	1538	0	1802	1613	0
Link Speed (mph)	45			55	30	
Link Distance (ft)	870			123	420	
Travel Time (s)	13.2			1.5	9.5	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Heavy Vehicles (%)	5%	5%	5%	5%	10%	10%
Adj. Flow (vph)	72	236	7	82	54	15
Shared Lane Traffic (%)						
Lane Group Flow (vph)	72	236	0	89	69	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	0			0	12	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)		9	15		15	9
Sign Control	Free			Free	Stop	

Intersection Summary

Area Type: Other

Control Type: Unsignalized

Intersection Capacity Utilization 23.1% ICU Level of Service A

Analysis Period (min) 15

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	71	2	0	76	1	0
Future Volume (vph)	71	2	0	76	1	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.997					
Flt Protected					0.950	
Satd. Flow (prot)	1804	0	0	1810	1770	0
Flt Permitted					0.950	
Satd. Flow (perm)	1804	0	0	1810	1770	0
Link Speed (mph)	55			55	30	
Link Distance (ft)	123			3243	478	
Travel Time (s)	1.5			40.2	10.9	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Heavy Vehicles (%)	5%	5%	5%	5%	2%	2%
Adj. Flow (vph)	84	2	0	89	1	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	86	0	0	89	1	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	0			0	12	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)		9	15		15	9
Sign Control	Free			Free	Stop	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	
Intersection Capacity Utilization 14.0%	ICU Level of Service A
Analysis Period (min) 15	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	1	64	4	2	70	0	0	0	1	0	0	1
Future Volume (vph)	1	64	4	2	70	0	0	0	1	0	0	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.992						0.865			0.865	
Flt Protected		0.999			0.999							
Satd. Flow (prot)	0	1793	0	0	1808	0	0	1611	0	0	1611	0
Flt Permitted		0.999			0.999							
Satd. Flow (perm)	0	1793	0	0	1808	0	0	1611	0	0	1611	0
Link Speed (mph)		55			55			30			30	
Link Distance (ft)		3243			2284			2605			1665	
Travel Time (s)		40.2			28.3			59.2			37.8	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	2%	2%	2%	2%	2%	2%
Adj. Flow (vph)	1	75	5	2	82	0	0	0	1	0	0	1
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	81	0	0	84	0	0	1	0	0	1	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Free			Free			Stop			Stop	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	
Intersection Capacity Utilization 14.8%	ICU Level of Service A
Analysis Period (min) 15	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	131	20	2	1	18	59	1	867	23	31	352	39
Future Volume (vph)	131	20	2	1	18	59	1	867	23	31	352	39
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		0	220		150	180		0
Storage Lanes	0		0	0		0	1		1	1		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	0.95
Frt		0.998			0.898				0.850		0.985	
Flt Protected		0.959			0.999		0.950			0.950		
Satd. Flow (prot)	0	1783	0	0	1671	0	1770	3139	1583	1770	3127	0
Flt Permitted		0.959			0.999		0.950			0.950		
Satd. Flow (perm)	0	1783	0	0	1671	0	1770	3139	1583	1770	3127	0
Link Speed (mph)		30			30			65			65	
Link Distance (ft)		384			236			1273			351	
Travel Time (s)		8.7			5.4			13.4			3.7	
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80	0.86	0.86	0.86	0.86	0.86	0.86
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	15%	2%	2%	15%	2%
Adj. Flow (vph)	164	25	3	1	23	74	1	1008	27	36	409	45
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	192	0	0	98	0	1	1008	27	36	454	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			60			60	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Stop			Stop			Free			Free	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	
Intersection Capacity Utilization 47.5%	ICU Level of Service A
Analysis Period (min) 15	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	1	0	0	0	0	1	0	331	0	0	283	1
Future Volume (vph)	1	0	0	0	0	1	0	331	0	0	283	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt					0.865							
Flt Protected		0.950										
Satd. Flow (prot)	0	1770	0	0	1611	0	0	1652	0	0	1653	0
Flt Permitted		0.950										
Satd. Flow (perm)	0	1770	0	0	1611	0	0	1652	0	0	1653	0
Link Speed (mph)		30			30			60			60	
Link Distance (ft)		751			536			1843			682	
Travel Time (s)		17.1			12.2			20.9			7.8	
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80	0.86	0.86	0.86	0.86	0.86	0.86
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	15%	2%	2%	15%	2%
Adj. Flow (vph)	1	0	0	0	0	1	0	385	0	0	329	1
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	1	0	0	1	0	0	385	0	0	330	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Stop			Stop			Free			Free	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	
Intersection Capacity Utilization 27.4%	ICU Level of Service A
Analysis Period (min) 15	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	1	0	0	0	0	1	0	328	0	0	281	1
Future Volume (vph)	1	0	0	0	0	1	0	328	0	0	281	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt					0.865							
Flt Protected		0.950										
Satd. Flow (prot)	0	1770	0	0	1611	0	0	1652	0	0	1653	0
Flt Permitted		0.950										
Satd. Flow (perm)	0	1770	0	0	1611	0	0	1652	0	0	1653	0
Link Speed (mph)		30			30			60			60	
Link Distance (ft)		485			406			490			1843	
Travel Time (s)		11.0			9.2			5.6			20.9	
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80	0.86	0.86	0.86	0.86	0.86	0.86
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	15%	2%	2%	15%	2%
Adj. Flow (vph)	1	0	0	0	0	1	0	381	0	0	327	1
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	1	0	0	1	0	0	381	0	0	328	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Stop			Stop			Free			Free	

Intersection Summary		
Area Type: Other		
Control Type: Unsignalized		
Intersection Capacity Utilization 27.3%		ICU Level of Service A
Analysis Period (min) 15		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	31	640	12	22	185	14	9	9	55	21	1	43
Future Volume (vph)	31	640	12	22	185	14	9	9	55	21	1	43
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.998			0.991			0.898			0.910	
Flt Protected		0.998			0.995			0.994			0.984	
Satd. Flow (prot)	0	1802	0	0	1784	0	0	1663	0	0	1668	0
Flt Permitted		0.998			0.995			0.994			0.984	
Satd. Flow (perm)	0	1802	0	0	1784	0	0	1663	0	0	1668	0
Link Speed (mph)		45			45			30			45	
Link Distance (ft)		1590			1013			619			557	
Travel Time (s)		24.1			15.3			14.1			8.4	
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	2%	2%	2%	2%	2%	2%
Adj. Flow (vph)	39	800	15	28	231	18	11	11	69	26	1	54
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	854	0	0	277	0	0	91	0	0	81	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Free			Free			Stop			Stop	

Intersection Summary		
Area Type:	Other	
Control Type: Unsignalized		
Intersection Capacity Utilization 55.7%		ICU Level of Service B
Analysis Period (min) 15		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	640	72	9	74	0	0	0	0	6	0	148
Future Volume (vph)	0	640	72	9	74	0	0	0	0	6	0	148
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.986									0.865	
Flt Protected					0.995					0.950		
Satd. Flow (prot)	0	1776	0	0	1791	0	0	0	0	1719	0	0
Flt Permitted					0.995					0.950		
Satd. Flow (perm)	0	1776	0	0	1791	0	0	0	0	1719	0	0
Link Speed (mph)		45			45			30			30	
Link Distance (ft)		1013			871			492			536	
Travel Time (s)		15.3			13.2			11.2			12.2	
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Heavy Vehicles (%)	2%	5%	10%	10%	5%	2%	2%	2%	2%	5%	2%	5%
Adj. Flow (vph)	0	800	90	11	93	0	0	0	0	8	0	185
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	890	0	0	104	0	0	0	0	8	185	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Free			Free			Stop			Stop	

Intersection Summary

Area Type: Other

Control Type: Unsignalized

Intersection Capacity Utilization Err% ICU Level of Service H

Analysis Period (min) 15

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	65	581	24	46	37	6
Future Volume (vph)	65	581	24	46	37	6
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)		325	0		0	0
Storage Lanes		1	0		1	0
Taper Length (ft)			25		25	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.850			0.980	
Flt Protected				0.983	0.959	
Satd. Flow (prot)	1810	1538	0	1779	1623	0
Flt Permitted				0.983	0.959	
Satd. Flow (perm)	1810	1538	0	1779	1623	0
Link Speed (mph)	45			55	30	
Link Distance (ft)	871			123	420	
Travel Time (s)	13.2			1.5	9.5	
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80
Heavy Vehicles (%)	5%	5%	5%	5%	10%	10%
Adj. Flow (vph)	81	726	30	58	46	8
Shared Lane Traffic (%)						
Lane Group Flow (vph)	81	726	0	88	54	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	0			0	12	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)		9	15		15	9
Sign Control	Free			Free	Stop	

Intersection Summary

Area Type: Other

Control Type: Unsignalized

Intersection Capacity Utilization 46.4% ICU Level of Service A

Analysis Period (min) 15

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	69	1	0	64	5	0
Future Volume (vph)	69	1	0	64	5	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.998					
Flt Protected					0.950	
Satd. Flow (prot)	1806	0	0	1810	1770	0
Flt Permitted					0.950	
Satd. Flow (perm)	1806	0	0	1810	1770	0
Link Speed (mph)	55			55	30	
Link Distance (ft)	123			3242	478	
Travel Time (s)	1.5			40.2	10.9	
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80
Heavy Vehicles (%)	5%	5%	5%	5%	2%	2%
Adj. Flow (vph)	86	1	0	80	6	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	87	0	0	80	6	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	0			0	12	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)		9	15		15	9
Sign Control	Free			Free	Stop	

Intersection Summary	
Area Type: Other	
Control Type: Unsignalized	
Intersection Capacity Utilization 13.7%	ICU Level of Service A
Analysis Period (min) 15	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	1	59	6	2	52	0	8	0	1	0	0	4
Future Volume (vph)	1	59	6	2	52	0	8	0	1	0	0	4
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.987						0.988			0.865	
Flt Protected		0.999			0.998			0.957				
Satd. Flow (prot)	0	1784	0	0	1806	0	0	1761	0	0	1611	0
Flt Permitted		0.999			0.998			0.957				
Satd. Flow (perm)	0	1784	0	0	1806	0	0	1761	0	0	1611	0
Link Speed (mph)		55			55			30			30	
Link Distance (ft)		3242			2284			2605			1665	
Travel Time (s)		40.2			28.3			59.2			37.8	
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	2%	2%	2%	2%	2%	2%
Adj. Flow (vph)	1	74	8	3	65	0	10	0	1	0	0	5
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	83	0	0	68	0	0	11	0	0	5	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Free			Free			Stop			Stop	

Intersection Summary		
Area Type:	Other	
Control Type: Unsignalized		
Intersection Capacity Utilization 17.5%		ICU Level of Service A
Analysis Period (min) 15		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	91	10	0	9	18	25	1	531	8	30	703	165
Future Volume (vph)	91	10	0	9	18	25	1	531	8	30	703	165
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		0	220		150	180		0
Storage Lanes	0		0	0		0	1		1	1		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	0.95
Frt					0.936				0.850		0.972	
Flt Protected		0.957			0.991		0.950			0.950		
Satd. Flow (prot)	0	1783	0	0	1728	0	1770	3139	1583	1770	3118	0
Flt Permitted		0.957			0.991		0.950			0.950		
Satd. Flow (perm)	0	1783	0	0	1728	0	1770	3139	1583	1770	3118	0
Link Speed (mph)		30			30			65			65	
Link Distance (ft)		384			236			1273			351	
Travel Time (s)		8.7			5.4			13.4			3.7	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	15%	2%	2%	15%	2%
Adj. Flow (vph)	107	12	0	11	21	29	1	590	9	33	781	183
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	119	0	0	61	0	1	590	9	33	964	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			60			60	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Stop			Stop			Free			Free	

Intersection Summary	
Area Type: Other	
Control Type: Unsignalized	
Intersection Capacity Utilization 43.8%	ICU Level of Service A
Analysis Period (min) 15	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	1	0	0	0	0	0	0	345	0	1	354	1
Future Volume (vph)	1	0	0	0	0	0	0	345	0	1	354	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt												
Flt Protected		0.950										
Satd. Flow (prot)	0	1770	0	0	1863	0	0	1652	0	0	1653	0
Flt Permitted		0.950										
Satd. Flow (perm)	0	1770	0	0	1863	0	0	1652	0	0	1653	0
Link Speed (mph)		30			30			60			60	
Link Distance (ft)		751			536			1843			682	
Travel Time (s)		17.1			12.2			20.9			7.8	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	15%	2%	2%	15%	2%
Adj. Flow (vph)	1	0	0	0	0	0	0	383	0	1	393	1
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	1	0	0	0	0	0	383	0	0	395	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Stop			Stop			Free			Free	

Intersection Summary		
Area Type:	Other	
Control Type: Unsignalized		
Intersection Capacity Utilization 29.5%		ICU Level of Service A
Analysis Period (min) 15		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	1	0	0	0	0	0	0	343	0	1	352	1
Future Volume (vph)	1	0	0	0	0	0	0	343	0	1	352	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt												
Flt Protected		0.950										
Satd. Flow (prot)	0	1770	0	0	1863	0	0	1652	0	0	1653	0
Flt Permitted		0.950										
Satd. Flow (perm)	0	1770	0	0	1863	0	0	1652	0	0	1653	0
Link Speed (mph)		30			30			60			60	
Link Distance (ft)		485			406			490			1843	
Travel Time (s)		11.0			9.2			5.6			20.9	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	15%	2%	2%	15%	2%
Adj. Flow (vph)	1	0	0	0	0	0	0	381	0	1	391	1
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	1	0	0	0	0	0	381	0	0	393	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Stop			Stop			Free			Free	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	
Intersection Capacity Utilization 29.4%	ICU Level of Service A
Analysis Period (min) 15	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	43	289	10	54	439	33	27	14	48	31	16	64
Future Volume (vph)	43	289	10	54	439	33	27	14	48	31	16	64
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.996			0.991			0.927			0.922	
Flt Protected		0.994			0.995			0.985			0.986	
Satd. Flow (prot)	0	1791	0	0	1784	0	0	1701	0	0	1693	0
Flt Permitted		0.994			0.995			0.985			0.986	
Satd. Flow (perm)	0	1791	0	0	1784	0	0	1701	0	0	1693	0
Link Speed (mph)		45			45			30			45	
Link Distance (ft)		1590			1013			619			557	
Travel Time (s)		24.1			15.3			14.1			8.4	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	2%	2%	2%	2%	2%	2%
Adj. Flow (vph)	51	340	12	64	516	39	32	16	56	36	19	75
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	403	0	0	619	0	0	104	0	0	130	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Free			Free			Stop			Stop	

Intersection Summary		
Area Type:	Other	
Control Type: Unsignalized		
Intersection Capacity Utilization 50.5%		ICU Level of Service A
Analysis Period (min) 15		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	332	26	10	142	0	0	0	0	13	0	382
Future Volume (vph)	0	332	26	10	142	0	0	0	0	13	0	382
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.990									0.865	
Flt Protected					0.997					0.950		
Satd. Flow (prot)	0	1785	0	0	1798	0	0	0	0	1719	0	0
Flt Permitted					0.997					0.950		
Satd. Flow (perm)	0	1785	0	0	1798	0	0	0	0	1719	0	0
Link Speed (mph)		45			45			30			30	
Link Distance (ft)		1013			881			530			536	
Travel Time (s)		15.3			13.3			12.0			12.2	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Heavy Vehicles (%)	2%	5%	10%	10%	5%	2%	2%	2%	2%	5%	2%	5%
Adj. Flow (vph)	0	391	31	12	167	0	0	0	0	15	0	449
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	422	0	0	179	0	0	0	0	15	449	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Free			Free			Stop			Stop	

Intersection Summary

Area Type: Other

Control Type: Unsignalized

Intersection Capacity Utilization Err% ICU Level of Service H

Analysis Period (min) 15

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	77	268	8	90	62	18
Future Volume (vph)	77	268	8	90	62	18
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)		325	0		0	0
Storage Lanes		1	0		1	0
Taper Length (ft)			25		25	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.850			0.970	
Flt Protected				0.996	0.963	
Satd. Flow (prot)	1810	1538	0	1802	1613	0
Flt Permitted				0.996	0.963	
Satd. Flow (perm)	1810	1538	0	1802	1613	0
Link Speed (mph)	45			55	30	
Link Distance (ft)	881			135	420	
Travel Time (s)	13.3			1.7	9.5	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Heavy Vehicles (%)	5%	5%	5%	5%	10%	10%
Adj. Flow (vph)	91	315	9	106	73	21
Shared Lane Traffic (%)						
Lane Group Flow (vph)	91	315	0	115	94	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	0			0	12	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)		9	15		15	9
Sign Control	Free			Free	Stop	

Intersection Summary	
Area Type: Other	
Control Type: Unsignalized	
Intersection Capacity Utilization 28.4%	ICU Level of Service A
Analysis Period (min) 15	

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	90	4	0	97	1	0
Future Volume (vph)	90	4	0	97	1	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.994					
Flt Protected					0.950	
Satd. Flow (prot)	1799	0	0	1810	1770	0
Flt Permitted					0.950	
Satd. Flow (perm)	1799	0	0	1810	1770	0
Link Speed (mph)	55			55	30	
Link Distance (ft)	135			3220	478	
Travel Time (s)	1.7			39.9	10.9	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Heavy Vehicles (%)	5%	5%	5%	5%	2%	2%
Adj. Flow (vph)	106	5	0	114	1	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	111	0	0	114	1	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	0			0	12	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)		9	15		15	9
Sign Control	Free			Free	Stop	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	
Intersection Capacity Utilization 15.1%	ICU Level of Service A
Analysis Period (min) 15	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	1	81	5	2	89	0	0	0	1	0	0	1
Future Volume (vph)	1	81	5	2	89	0	0	0	1	0	0	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.992						0.865			0.865	
Flt Protected					0.999							
Satd. Flow (prot)	0	1795	0	0	1808	0	0	1611	0	0	1611	0
Flt Permitted					0.999							
Satd. Flow (perm)	0	1795	0	0	1808	0	0	1611	0	0	1611	0
Link Speed (mph)		55			55			30			30	
Link Distance (ft)		3220			2284			2605			1665	
Travel Time (s)		39.9			28.3			59.2			37.8	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	2%	2%	2%	2%	2%	2%
Adj. Flow (vph)	1	95	6	2	105	0	0	0	1	0	0	1
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	102	0	0	107	0	0	1	0	0	1	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Free			Free			Stop			Stop	

Intersection Summary

Area Type: Other

Control Type: Unsignalized

Intersection Capacity Utilization 15.9% ICU Level of Service A

Analysis Period (min) 15

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	0	0	0	0	1057	0	0	422	0
Future Volume (vph)	0	0	0	0	0	0	0	1057	0	0	422	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		0	220		150	180		0
Storage Lanes	0		0	0		0	1		1	1		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	0.95
Frt												
Flt Protected												
Satd. Flow (prot)	0	1863	0	0	1863	0	1863	3139	1863	1863	3139	0
Flt Permitted												
Satd. Flow (perm)	0	1863	0	0	1863	0	1863	3139	1863	1863	3139	0
Link Speed (mph)		30			30			65			65	
Link Distance (ft)		384			236			1273			351	
Travel Time (s)		8.7			5.4			13.4			3.7	
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80	0.86	0.86	0.86	0.86	0.86	0.86
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	15%	2%	2%	15%	2%
Adj. Flow (vph)	0	0	0	0	0	0	0	1229	0	0	491	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	0	0	0	0	0	0	1229	0	0	491	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			60			60	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Stop			Stop			Free			Free	

Intersection Summary	
Area Type: Other	
Control Type: Unsignalized	
Intersection Capacity Utilization 32.6%	ICU Level of Service A
Analysis Period (min) 15	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	1	0	0	0	0	1	0	331	0	0	283	1
Future Volume (vph)	1	0	0	0	0	1	0	331	0	0	283	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt					0.865							
Flt Protected		0.950										
Satd. Flow (prot)	0	1770	0	0	1611	0	0	1652	0	0	1653	0
Flt Permitted		0.950										
Satd. Flow (perm)	0	1770	0	0	1611	0	0	1652	0	0	1653	0
Link Speed (mph)		30			30			60			60	
Link Distance (ft)		751			536			1843			682	
Travel Time (s)		17.1			12.2			20.9			7.8	
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80	0.86	0.86	0.86	0.86	0.86	0.86
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	15%	2%	2%	15%	2%
Adj. Flow (vph)	1	0	0	0	0	1	0	385	0	0	329	1
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	1	0	0	1	0	0	385	0	0	330	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Stop			Stop			Free			Free	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	
Intersection Capacity Utilization 27.4%	ICU Level of Service A
Analysis Period (min) 15	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	1	0	0	0	0	1	0	328	0	0	281	1
Future Volume (vph)	1	0	0	0	0	1	0	328	0	0	281	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt					0.865							
Flt Protected		0.950										
Satd. Flow (prot)	0	1770	0	0	1611	0	0	1652	0	0	1653	0
Flt Permitted		0.950										
Satd. Flow (perm)	0	1770	0	0	1611	0	0	1652	0	0	1653	0
Link Speed (mph)		30			30			60			60	
Link Distance (ft)		485			406			490			1843	
Travel Time (s)		11.0			9.2			5.6			20.9	
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80	0.86	0.86	0.86	0.86	0.86	0.86
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	15%	2%	2%	15%	2%
Adj. Flow (vph)	1	0	0	0	0	1	0	381	0	0	327	1
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	1	0	0	1	0	0	381	0	0	328	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Stop			Stop			Free			Free	

Intersection Summary		
Area Type:	Other	
Control Type: Unsignalized		
Intersection Capacity Utilization 27.3%		ICU Level of Service A
Analysis Period (min) 15		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	31	640	12	22	185	72	9	9	55	174	1	43
Future Volume (vph)	31	640	12	22	185	72	9	9	55	174	1	43
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.998			0.965			0.898			0.973	
Flt Protected		0.998			0.996			0.994			0.962	
Satd. Flow (prot)	0	1802	0	0	1739	0	0	1663	0	0	1744	0
Flt Permitted		0.998			0.996			0.994			0.962	
Satd. Flow (perm)	0	1802	0	0	1739	0	0	1663	0	0	1744	0
Link Speed (mph)		45			45			30			45	
Link Distance (ft)		1590			1013			619			557	
Travel Time (s)		24.1			15.3			14.1			8.4	
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	2%	2%	2%	2%	2%	2%
Adj. Flow (vph)	39	800	15	28	231	90	11	11	69	218	1	54
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	854	0	0	349	0	0	91	0	0	273	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Free			Free			Stop			Stop	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	
Intersection Capacity Utilization 67.9%	ICU Level of Service C
Analysis Period (min) 15	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	791	74	10	93	0	0	0	0	37	0	187
Future Volume (vph)	0	791	74	10	93	0	0	0	0	37	0	187
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.988									0.865	
Flt Protected					0.995					0.950		
Satd. Flow (prot)	0	1781	0	0	1792	0	0	0	0	1719	0	0
Flt Permitted					0.995					0.950		
Satd. Flow (perm)	0	1781	0	0	1792	0	0	0	0	1719	0	0
Link Speed (mph)		45			45			30			30	
Link Distance (ft)		1013			871			492			536	
Travel Time (s)		15.3			13.2			11.2			12.2	
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Heavy Vehicles (%)	2%	5%	10%	10%	5%	2%	2%	2%	2%	5%	2%	5%
Adj. Flow (vph)	0	989	93	13	116	0	0	0	0	46	0	234
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	1082	0	0	129	0	0	0	0	46	234	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Free			Free			Stop			Stop	

Intersection Summary

Area Type: Other

Control Type: Unsignalized

Intersection Capacity Utilization Err% ICU Level of Service H

Analysis Period (min) 15

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	116	712	83	65	38	29
Future Volume (vph)	116	712	83	65	38	29
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)		325	0		0	0
Storage Lanes		1	0		1	0
Taper Length (ft)			25		25	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.850			0.942	
Flt Protected				0.973	0.972	
Satd. Flow (prot)	1810	1538	0	1761	1582	0
Flt Permitted				0.973	0.972	
Satd. Flow (perm)	1810	1538	0	1761	1582	0
Link Speed (mph)	45			55	30	
Link Distance (ft)	871			123	420	
Travel Time (s)	13.2			1.5	9.5	
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80
Heavy Vehicles (%)	5%	5%	5%	5%	10%	10%
Adj. Flow (vph)	145	890	104	81	48	36
Shared Lane Traffic (%)						
Lane Group Flow (vph)	145	890	0	185	84	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	0			0	12	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)		9	15		15	9
Sign Control	Free			Free	Stop	

Intersection Summary	
Area Type: Other	
Control Type: Unsignalized	
Intersection Capacity Utilization 58.8%	ICU Level of Service B
Analysis Period (min) 15	

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	144	1	0	143	5	0
Future Volume (vph)	144	1	0	143	5	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.999					
Flt Protected					0.950	
Satd. Flow (prot)	1808	0	0	1810	1770	0
Flt Permitted					0.950	
Satd. Flow (perm)	1808	0	0	1810	1770	0
Link Speed (mph)	55			55	30	
Link Distance (ft)	123			3242	478	
Travel Time (s)	1.5			40.2	10.9	
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80
Heavy Vehicles (%)	5%	5%	5%	5%	2%	2%
Adj. Flow (vph)	180	1	0	179	6	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	181	0	0	179	6	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	0			0	12	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)		9	15		15	9
Sign Control	Free			Free	Stop	

Intersection Summary		
Area Type:	Other	
Control Type: Unsignalized		
Intersection Capacity Utilization 17.6%		ICU Level of Service A
Analysis Period (min) 15		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	1	143	6	2	142	0	8	0	0	0	0	4
Future Volume (vph)	1	143	6	2	142	0	8	0	0	0	0	4
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.994									0.865	
Flt Protected					0.999			0.950				
Satd. Flow (prot)	0	1799	0	0	1808	0	0	1770	0	0	1611	0
Flt Permitted					0.999			0.950				
Satd. Flow (perm)	0	1799	0	0	1808	0	0	1770	0	0	1611	0
Link Speed (mph)		55			55			30			30	
Link Distance (ft)		3242			2284			2605			1665	
Travel Time (s)		40.2			28.3			59.2			37.8	
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	2%	2%	2%	2%	2%	2%
Adj. Flow (vph)	1	179	8	3	178	0	10	0	0	0	0	5
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	188	0	0	181	0	0	10	0	0	5	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Free			Free			Stop			Stop	

Intersection Summary	
Area Type: Other	
Control Type: Unsignalized	
Intersection Capacity Utilization 22.1%	ICU Level of Service A
Analysis Period (min) 15	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	31	640	12	22	185	72	9	9	55	174	1	43
Future Volume (vph)	31	640	12	22	185	72	9	9	55	174	1	43
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.998			0.965			0.898			0.973	
Flt Protected		0.998			0.996			0.994			0.962	
Satd. Flow (prot)	0	1802	0	0	1739	0	0	1663	0	0	1744	0
Flt Permitted		0.972			0.912			0.946			0.708	
Satd. Flow (perm)	0	1755	0	0	1593	0	0	1582	0	0	1283	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		2			41			69			18	
Link Speed (mph)		45			45			30			45	
Link Distance (ft)		1590			1013			619			557	
Travel Time (s)		24.1			15.3			14.1			8.4	
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	2%	2%	2%	2%	2%	2%
Adj. Flow (vph)	39	800	15	28	231	90	11	11	69	218	1	54
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	854	0	0	349	0	0	91	0	0	273	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (ft)	20	100		20	100		20	100		20	100	
Trailing Detector (ft)	0	0		0	0		0	0		0	0	
Detector 1 Position(ft)	0	0		0	0		0	0		0	0	
Detector 1 Size(ft)	20	6		20	6		20	6		20	6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Detector Phase	4	4		8	8		2	2		6	6	
Switch Phase												

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Minimum Initial (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Minimum Split (s)	23.5	23.5		23.5	23.5		23.5	23.5		23.5	23.5	
Total Split (s)	45.0	45.0		45.0	45.0		25.0	25.0		25.0	25.0	
Total Split (%)	64.3%	64.3%		64.3%	64.3%		35.7%	35.7%		35.7%	35.7%	
Maximum Green (s)	39.5	39.5		39.5	39.5		19.5	19.5		19.5	19.5	
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
All-Red Time (s)	1.5	1.5		1.5	1.5		1.5	1.5		1.5	1.5	
Lost Time Adjust (s)		0.0			0.0			0.0			0.0	
Total Lost Time (s)		5.5			5.5			5.5			5.5	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	None		None	None		Min	Min		Min	Min	
Walk Time (s)	7.0	7.0		7.0	7.0		7.0	7.0		7.0	7.0	
Flash Dont Walk (s)	11.0	11.0		11.0	11.0		11.0	11.0		11.0	11.0	
Pedestrian Calls (#/hr)	0	0		0	0		0	0		0	0	
Act Effct Green (s)		33.7			33.7			16.4			16.4	
Actuated g/C Ratio		0.55			0.55			0.27			0.27	
v/c Ratio		0.89			0.39			0.19			0.77	
Control Delay		26.2			8.7			9.1			37.6	
Queue Delay		0.0			0.0			0.0			0.0	
Total Delay		26.2			8.7			9.1			37.6	
LOS		C			A			A			D	
Approach Delay		26.2			8.7			9.1			37.6	
Approach LOS		C			A			A			D	
Queue Length 50th (ft)		283			65			7			99	
Queue Length 95th (ft)		359			96			31			#157	
Internal Link Dist (ft)		1510			933			539			477	
Turn Bay Length (ft)												
Base Capacity (vph)		1175			1079			568			436	
Starvation Cap Reductn		0			0			0			0	
Spillback Cap Reductn		0			0			0			0	
Storage Cap Reductn		0			0			0			0	
Reduced v/c Ratio		0.73			0.32			0.16			0.63	

Intersection Summary

Area Type: Other

Cycle Length: 70

Actuated Cycle Length: 61.5

Natural Cycle: 70

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 0.89

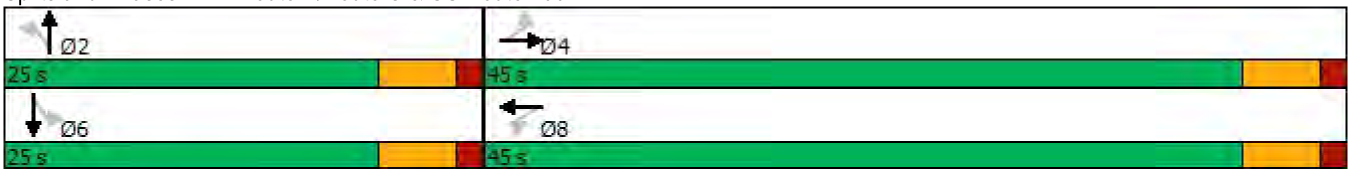
Intersection Signal Delay: 23.3 Intersection LOS: C

Intersection Capacity Utilization 70.4% ICU Level of Service C

Analysis Period (min) 15

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 4: Route V/Route C & US Route 160



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	0	0	0	0	647	0	0	898	0
Future Volume (vph)	0	0	0	0	0	0	0	647	0	0	898	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		0	220		150	180		0
Storage Lanes	0		0	0		0	1		1	1		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	0.95
Frt												
Flt Protected												
Satd. Flow (prot)	0	1863	0	0	1863	0	1863	3139	1863	1863	3139	0
Flt Permitted												
Satd. Flow (perm)	0	1863	0	0	1863	0	1863	3139	1863	1863	3139	0
Link Speed (mph)		30			30			65			65	
Link Distance (ft)		384			236			1273			351	
Travel Time (s)		8.7			5.4			13.4			3.7	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	15%	2%	2%	15%	2%
Adj. Flow (vph)	0	0	0	0	0	0	0	719	0	0	998	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	0	0	0	0	0	0	719	0	0	998	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			60			60	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Stop			Stop			Free			Free	

Intersection Summary	
Area Type: Other	
Control Type: Unsignalized	
Intersection Capacity Utilization 28.2%	ICU Level of Service A
Analysis Period (min) 15	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	1	0	0	0	0	0	0	345	0	1	354	1
Future Volume (vph)	1	0	0	0	0	0	0	345	0	1	354	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt												
Flt Protected		0.950										
Satd. Flow (prot)	0	1770	0	0	1863	0	0	1652	0	0	1653	0
Flt Permitted		0.950										
Satd. Flow (perm)	0	1770	0	0	1863	0	0	1652	0	0	1653	0
Link Speed (mph)		30			30			60			60	
Link Distance (ft)		751			536			1843			682	
Travel Time (s)		17.1			12.2			20.9			7.8	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	15%	2%	2%	15%	2%
Adj. Flow (vph)	1	0	0	0	0	0	0	383	0	1	393	1
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	1	0	0	0	0	0	383	0	0	395	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Stop			Stop			Free			Free	

Intersection Summary		
Area Type:	Other	
Control Type: Unsignalized		
Intersection Capacity Utilization 29.5%		ICU Level of Service A
Analysis Period (min) 15		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	1	0	0	0	0	0	0	343	0	1	352	1
Future Volume (vph)	1	0	0	0	0	0	0	343	0	1	352	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt												
Flt Protected		0.950										
Satd. Flow (prot)	0	1770	0	0	1863	0	0	1652	0	0	1653	0
Flt Permitted		0.950										
Satd. Flow (perm)	0	1770	0	0	1863	0	0	1652	0	0	1653	0
Link Speed (mph)		30			30			60			60	
Link Distance (ft)		485			406			490			1843	
Travel Time (s)		11.0			9.2			5.6			20.9	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	15%	2%	2%	15%	2%
Adj. Flow (vph)	1	0	0	0	0	0	0	381	0	1	391	1
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	1	0	0	0	0	0	381	0	0	393	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Stop			Stop			Free			Free	

Intersection Summary

Area Type: Other

Control Type: Unsignalized

Intersection Capacity Utilization 29.4% ICU Level of Service A

Analysis Period (min) 15

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	43	289	10	54	439	217	27	14	48	132	16	64
Future Volume (vph)	43	289	10	54	439	217	27	14	48	132	16	64
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.996			0.959			0.927			0.959	
Flt Protected		0.994			0.996			0.985			0.970	
Satd. Flow (prot)	0	1791	0	0	1728	0	0	1701	0	0	1733	0
Flt Permitted		0.994			0.996			0.985			0.970	
Satd. Flow (perm)	0	1791	0	0	1728	0	0	1701	0	0	1733	0
Link Speed (mph)		45			45			30			45	
Link Distance (ft)		1590			1013			619			557	
Travel Time (s)		24.1			15.3			14.1			8.4	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	2%	2%	2%	2%	2%	2%
Adj. Flow (vph)	51	340	12	64	516	255	32	16	56	155	19	75
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	403	0	0	835	0	0	104	0	0	249	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Free			Free			Stop			Stop	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	
Intersection Capacity Utilization 72.1%	ICU Level of Service C
Analysis Period (min) 15	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	433	26	19	161	0	0	0	0	43	0	547
Future Volume (vph)	0	433	26	19	161	0	0	0	0	43	0	547
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.992									0.865	
Flt Protected					0.995					0.950		
Satd. Flow (prot)	0	1790	0	0	1792	0	0	0	0	1719	0	0
Flt Permitted					0.995					0.950		
Satd. Flow (perm)	0	1790	0	0	1792	0	0	0	0	1719	0	0
Link Speed (mph)		45			45			30			30	
Link Distance (ft)		1013			889			530			536	
Travel Time (s)		15.3			13.5			12.0			12.2	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Heavy Vehicles (%)	2%	5%	10%	10%	5%	2%	2%	2%	2%	5%	2%	5%
Adj. Flow (vph)	0	509	31	22	189	0	0	0	0	51	0	644
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	540	0	0	211	0	0	0	0	51	644	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Free			Free			Stop			Stop	

Intersection Summary	
Area Type: Other	
Control Type: Unsignalized	
Intersection Capacity Utilization Err%	ICU Level of Service H
Analysis Period (min) 15	

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	117	359	33	117	63	26
Future Volume (vph)	117	359	33	117	63	26
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)		325	0		0	0
Storage Lanes		1	0		1	0
Taper Length (ft)			25		25	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.850			0.960	
Flt Protected				0.989	0.966	
Satd. Flow (prot)	1810	1538	0	1790	1602	0
Flt Permitted				0.989	0.966	
Satd. Flow (perm)	1810	1538	0	1790	1602	0
Link Speed (mph)	45			55	30	
Link Distance (ft)	889			145	420	
Travel Time (s)	13.5			1.8	9.5	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Heavy Vehicles (%)	5%	5%	5%	5%	10%	10%
Adj. Flow (vph)	138	422	39	138	74	31
Shared Lane Traffic (%)						
Lane Group Flow (vph)	138	422	0	177	105	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	0			0	12	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)		9	15		15	9
Sign Control	Free			Free	Stop	

Intersection Summary	
Area Type: Other	
Control Type: Unsignalized	
Intersection Capacity Utilization 36.9%	ICU Level of Service A
Analysis Period (min) 15	

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	139	4	0	149	1	0
Future Volume (vph)	139	4	0	149	1	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.996					
Flt Protected					0.950	
Satd. Flow (prot)	1802	0	0	1810	1770	0
Flt Permitted					0.950	
Satd. Flow (perm)	1802	0	0	1810	1770	0
Link Speed (mph)	55			55	30	
Link Distance (ft)	145			3202	478	
Travel Time (s)	1.8			39.7	10.9	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Heavy Vehicles (%)	5%	5%	5%	5%	2%	2%
Adj. Flow (vph)	164	5	0	175	1	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	169	0	0	175	1	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	0			0	12	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)		9	15		15	9
Sign Control	Free			Free	Stop	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	
Intersection Capacity Utilization 17.8%	ICU Level of Service A
Analysis Period (min) 15	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✣			✣			✣			✣	
Traffic Volume (vph)	1	129	5	2	141	0	0	0	1	0	0	1
Future Volume (vph)	1	129	5	2	141	0	0	0	1	0	0	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.995						0.865			0.865	
Flt Protected					0.999							
Satd. Flow (prot)	0	1800	0	0	1808	0	0	1611	0	0	1611	0
Flt Permitted					0.999							
Satd. Flow (perm)	0	1800	0	0	1808	0	0	1611	0	0	1611	0
Link Speed (mph)		55			55			30			30	
Link Distance (ft)		3202			2284			2605			1665	
Travel Time (s)		39.7			28.3			59.2			37.8	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	2%	2%	2%	2%	2%	2%
Adj. Flow (vph)	1	152	6	2	166	0	0	0	1	0	0	1
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	159	0	0	168	0	0	1	0	0	1	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Free			Free			Stop			Stop	

Intersection Summary	
Area Type: Other	
Control Type: Unsignalized	
Intersection Capacity Utilization 18.7%	ICU Level of Service A
Analysis Period (min) 15	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	43	289	10	54	439	217	27	14	48	132	16	64
Future Volume (vph)	43	289	10	54	439	217	27	14	48	132	16	64
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.996			0.959			0.927			0.959	
Flt Protected		0.994			0.996			0.985			0.970	
Satd. Flow (prot)	0	1791	0	0	1728	0	0	1701	0	0	1733	0
Flt Permitted		0.848			0.942			0.867			0.750	
Satd. Flow (perm)	0	1528	0	0	1635	0	0	1497	0	0	1340	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		4			54			56			30	
Link Speed (mph)		45			45			30			45	
Link Distance (ft)		1590			1013			619			557	
Travel Time (s)		24.1			15.3			14.1			8.4	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	2%	2%	2%	2%	2%	2%
Adj. Flow (vph)	51	340	12	64	516	255	32	16	56	155	19	75
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	403	0	0	835	0	0	104	0	0	249	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (ft)	20	100		20	100		20	100		20	100	
Trailing Detector (ft)	0	0		0	0		0	0		0	0	
Detector 1 Position(ft)	0	0		0	0		0	0		0	0	
Detector 1 Size(ft)	20	6		20	6		20	6		20	6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Detector Phase	4	4		8	8		2	2		6	6	
Switch Phase												

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Minimum Initial (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Minimum Split (s)	23.5	23.5		23.5	23.5		23.5	23.5		23.5	23.5	
Total Split (s)	46.0	46.0		46.0	46.0		24.0	24.0		24.0	24.0	
Total Split (%)	65.7%	65.7%		65.7%	65.7%		34.3%	34.3%		34.3%	34.3%	
Maximum Green (s)	40.5	40.5		40.5	40.5		18.5	18.5		18.5	18.5	
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
All-Red Time (s)	1.5	1.5		1.5	1.5		1.5	1.5		1.5	1.5	
Lost Time Adjust (s)		0.0			0.0			0.0			0.0	
Total Lost Time (s)		5.5			5.5			5.5			5.5	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	None		None	None		Min	Min		Min	Min	
Walk Time (s)	7.0	7.0		7.0	7.0		7.0	7.0		7.0	7.0	
Flash Dont Walk (s)	11.0	11.0		11.0	11.0		11.0	11.0		11.0	11.0	
Pedestrian Calls (#/hr)	0	0		0	0		0	0		0	0	
Act Effct Green (s)		33.4			33.4			14.2			14.2	
Actuated g/C Ratio		0.56			0.56			0.24			0.24	
v/c Ratio		0.47			0.88			0.26			0.73	
Control Delay		10.0			24.2			12.9			33.3	
Queue Delay		0.0			0.0			0.0			0.0	
Total Delay		10.0			24.2			12.9			33.3	
LOS		A			C			B			C	
Approach Delay		10.0			24.2			12.9			33.3	
Approach LOS		A			C			B			C	
Queue Length 50th (ft)		78			226			15			82	
Queue Length 95th (ft)		137			#463			47			147	
Internal Link Dist (ft)		1510			933			539			477	
Turn Bay Length (ft)												
Base Capacity (vph)		1088			1178			531			462	
Starvation Cap Reductn		0			0			0			0	
Spillback Cap Reductn		0			0			0			0	
Storage Cap Reductn		0			0			0			0	
Reduced v/c Ratio		0.37			0.71			0.20			0.54	

Intersection Summary

Area Type: Other
Cycle Length: 70
Actuated Cycle Length: 59.2
Natural Cycle: 70
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.88
Intersection Signal Delay: 21.3 Intersection LOS: C
Intersection Capacity Utilization 74.6% ICU Level of Service D
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 4: Route V/Route C & US Route 160

INTERSECTION SUMMARY

Site: 101 [Route 67 NB Ramps - 2022 AM (Site Folder: General)]

Route 67 NB Ramps
2022 AM
Site Category: (None)
Roundabout

Intersection Performance - Hourly Values		
Performance Measure	**Vehicles**	**Persons**
Travel Speed (Average)	34.9 mph	34.9 mph
Travel Distance (Total)	460.1 veh-mi/h	552.1 pers-mi/h
Travel Time (Total)	13.2 veh-h/h	15.8 pers-h/h
Desired Speed (Program)	40.0 mph	
Speed Efficiency	0.87	
Travel Time Index	8.58	
Congestion Coefficient	1.15	
Demand Flows (Total)	714 veh/h	857 pers/h
Percent Heavy Vehicles (Demand)	5.3 %	
Degree of Saturation	0.461	
Practical Spare Capacity	84.3 %	
Effective Intersection Capacity	1547 veh/h	
Control Delay (Total)	1.42 veh-h/h	1.71 pers-h/h
Control Delay (Average)	7.2 sec	7.2 sec
Control Delay (Worst Lane)	7.4 sec	
Control Delay (Worst Movement)	7.4 sec	7.4 sec
Geometric Delay (Average)	0.0 sec	
Stop-Line Delay (Average)	7.2 sec	
Idling Time (Average)	0.5 sec	
Intersection Level of Service (LOS)	LOS A	
95% Back of Queue - Vehicles (Worst Lane)	0.4 veh	
95% Back of Queue - Distance (Worst Lane)	9.5 ft	
Ave. Queue Storage Ratio (Worst Lane)	0.00	
Total Effective Stops	55 veh/h	66 pers/h
Effective Stop Rate	0.08	0.08
Proportion Queued	0.09	0.09
Performance Index	14.2	14.2
Cost (Total)	291.18 $/h	291.18 $/h
Fuel Consumption (Total)	20.5 gal/h	
Carbon Dioxide (Total)	184.5 kg/h	
Hydrocarbons (Total)	0.015 kg/h	
Carbon Monoxide (Total)	0.214 kg/h	
NOx (Total)	0.421 kg/h	

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Intersection LOS value for Vehicles is based on average delay for all vehicle movements.
Roundabout Capacity Model: US HCM 6.
Delay Model: HCM Delay Formula (Geometric Delay is not included).
Queue Model: HCM Queue Formula.
Site Model Variability Index (Iterations 3 to N): 0.0 %
Number of Iterations: 3 (Maximum: 10)
Largest change in Lane Degrees of Saturation for the last three Flow-Capacity Iterations: 100.0% 93.4% 0.0%

Intersection Performance - Annual Values		
Performance Measure	**Vehicles**	**Persons**
Demand Flows (Total)	342,600 veh/y	411,120 pers/y
Delay	683 veh-h/y	820 pers-h/y
Effective Stops	26,281 veh/y	31,538 pers/y
Travel Distance	220,855 veh-mi/y	265,026 pers-mi/y
Travel Time	6,333 veh-h/y	7,600 pers-h/y

Cost	139,767 $/y	139,767 $/y
Fuel Consumption	9,830 gal/y	
Carbon Dioxide	88,551 kg/y	
Hydrocarbons	7 kg/y	
Carbon Monoxide	103 kg/y	
NOx	202 kg/y	

MOVEMENT SUMMARY

Site: 101 [Route 67 NB Ramps - 2022 AM (Site Folder: General)]

Route 67 NB Ramps
2022 AM
Site Category: (None)
Roundabout

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] ft	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed mph
South: NB Route 67 Ramp														
3	L2	28	10.0	35	10.0	0.061	6.2	LOS A	0.2	5.9	0.57	0.50	0.57	32.0
18	R2	4	10.0	5	10.0	0.061	6.2	LOS A	0.2	5.9	0.57	0.50	0.57	31.2
Approach		32	10.0	40	10.0	0.061	6.2	LOS A	0.2	5.9	0.57	0.50	0.57	31.9
East: WB Ramp 160														
6	T1	36	5.0	45	5.0	0.095	6.1	LOS A	0.4	9.5	0.57	0.52	0.57	34.6
16	R2	18	5.0	23	5.0	0.095	6.1	LOS A	0.4	9.5	0.57	0.52	0.57	33.6
Approach		54	5.0	68	5.0	0.095	6.1	LOS A	0.4	9.5	0.57	0.52	0.57	34.2
West: EB Route 160														
5	L2	434	5.0	543	5.0	0.461	7.4	LOS A	0.0	0.0	0.00	0.00	0.00	35.2
2	T1	51	5.0	64	5.0	0.461	7.4	LOS A	0.0	0.0	0.00	0.00	0.00	35.1
Approach		485	5.0	606	5.0	0.461	7.4	LOS A	0.0	0.0	0.00	0.00	0.00	35.2
All Vehicles		571	5.3	714	5.3	0.461	7.2	LOS A	0.4	9.5	0.09	0.08	0.09	34.9

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
Roundabout Capacity Model: US HCM 6.
Delay Model: HCM Delay Formula (Geometric Delay is not included).
Queue Model: HCM Queue Formula.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

INTERSECTION SUMMARY

Site: 101 [Route 67 SB Ramps - 2022 AM (Site Folder: General)]

Route 67 SB Ramps -
2022 AM
Site Category: (None)
Roundabout

Intersection Performance - Hourly Values		
Performance Measure	**Vehicles**	**Persons**
Travel Speed (Average)	33.8 mph	33.8 mph
Travel Distance (Total)	572.6 veh-mi/h	687.1 pers-mi/h
Travel Time (Total)	16.9 veh-h/h	20.3 pers-h/h
Desired Speed (Program)	40.0 mph	
Speed Efficiency	0.85	
Travel Time Index	8.29	
Congestion Coefficient	1.18	
Demand Flows (Total)	913 veh/h	1095 pers/h
Percent Heavy Vehicles (Demand)	5.5 %	
Degree of Saturation	0.524	
Practical Spare Capacity	62.2 %	
Effective Intersection Capacity	1742 veh/h	
Control Delay (Total)	1.84 veh-h/h	2.20 pers-h/h
Control Delay (Average)	7.2 sec	7.2 sec
Control Delay (Worst Lane)	8.5 sec	
Control Delay (Worst Movement)	8.6 sec	8.6 sec
Geometric Delay (Average)	0.0 sec	
Stop-Line Delay (Average)	7.2 sec	
Idling Time (Average)	6.1 sec	
Intersection Level of Service (LOS)	LOS A	
95% Back of Queue - Vehicles (Worst Lane)	4.1 veh	
95% Back of Queue - Distance (Worst Lane)	106.1 ft	
Ave. Queue Storage Ratio (Worst Lane)	0.03	
Total Effective Stops	43 veh/h	52 pers/h
Effective Stop Rate	0.05	0.05
Proportion Queued	0.15	0.15
Performance Index	23.9	23.9
Cost (Total)	364.67 $/h	364.67 $/h
Fuel Consumption (Total)	24.6 gal/h	
Carbon Dioxide (Total)	221.8 kg/h	
Hydrocarbons (Total)	0.018 kg/h	
Carbon Monoxide (Total)	0.261 kg/h	
NOx (Total)	0.506 kg/h	

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Intersection LOS value for Vehicles is based on average delay for all vehicle movements.
Roundabout Capacity Model: US HCM 6.
Delay Model: HCM Delay Formula (Geometric Delay is not included).
Queue Model: HCM Queue Formula.
Site Model Variability Index (Iterations 3 to N): 0.0 %
Number of Iterations: 3 (Maximum: 10)
Largest change in Lane Degrees of Saturation for the last three Flow-Capacity Iterations: 100.0% 87.9% 0.0%

Intersection Performance - Annual Values		
Performance Measure	**Vehicles**	**Persons**
Demand Flows (Total)	438,000 veh/y	525,600 pers/y
Delay	881 veh-h/y	1,057 pers-h/y
Effective Stops	20,797 veh/y	24,957 pers/y
Travel Distance	274,854 veh-mi/y	329,825 pers-mi/y
Travel Time	8,121 veh-h/y	9,745 pers-h/y

Cost	175,040 $/y	175,040 $/y
Fuel Consumption	11,809 gal/y	
Carbon Dioxide	106,450 kg/y	
Hydrocarbons	9 kg/y	
Carbon Monoxide	125 kg/y	
NOx	243 kg/y	

MOVEMENT SUMMARY

Site: 101 [Route 67 SB Ramps - 2022 AM (Site Folder: General)]

Route 67 SB Ramps -
2022 AM
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] ft	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed mph
East: WB Route 160														
1	L2	7	10.0	9	10.0	0.061	3.4	LOS A	0.0	0.0	0.00	0.00	0.00	37.6
6	T1	57	5.0	71	5.0	0.061	3.2	LOS A	0.0	0.0	0.00	0.00	0.00	37.8
Approach		64	5.5	80	5.5	0.061	3.2	LOS A	0.0	0.0	0.00	0.00	0.00	37.8
North: SB Route 67 Ramps														
7	L2	5	5.0	6	5.0	0.132	4.1	LOS A	0.6	15.3	0.23	0.10	0.23	35.5
14	R2	122	5.0	153	5.0	0.132	4.1	LOS A	0.6	15.3	0.23	0.10	0.23	34.4
Approach		127	5.0	159	5.0	0.132	4.1	LOS A	0.6	15.3	0.23	0.10	0.23	34.4
West: EB Route 160														
2	T1	480	5.0	600	5.0	0.524	8.4	LOS A	4.1	106.1	0.15	0.04	0.15	33.4
12	R2	59	10.0	74	10.0	0.524	8.6	LOS A	4.1	106.1	0.15	0.04	0.15	32.4
Approach		539	5.5	674	5.5	0.524	8.5	LOS A	4.1	106.1	0.15	0.04	0.15	33.3
All Vehicles		730	5.5	913	5.5	0.524	7.2	LOS A	4.1	106.1	0.15	0.05	0.15	33.8

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
Roundabout Capacity Model: US HCM 6.
Delay Model: HCM Delay Formula (Geometric Delay is not included).
Queue Model: HCM Queue Formula.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

INTERSECTION SUMMARY

Site: 101 [Route 67 NB Ramps - 2022 PM (Site Folder: General)]

Route 67 NB Ramps
2022 PM
Site Category: (None)
Roundabout

Intersection Performance - Hourly Values

Performance Measure	Vehicles	Persons
Travel Speed (Average)	35.1 mph	35.1 mph
Travel Distance (Total)	299.5 veh-mi/h	359.4 pers-mi/h
Travel Time (Total)	8.5 veh-h/h	10.2 pers-h/h
Desired Speed (Program)	40.0 mph	
Speed Efficiency	0.88	
Travel Time Index	8.63	
Congestion Coefficient	1.14	
Demand Flows (Total)	467 veh/h	560 pers/h
Percent Heavy Vehicles (Demand)	5.7 %	
Degree of Saturation	0.235	
Practical Spare Capacity	262.4 %	
Effective Intersection Capacity	1991 veh/h	
Control Delay (Total)	0.61 veh-h/h	0.73 pers-h/h
Control Delay (Average)	4.7 sec	4.7 sec
Control Delay (Worst Lane)	4.7 sec	
Control Delay (Worst Movement)	4.7 sec	4.7 sec
Geometric Delay (Average)	0.0 sec	
Stop-Line Delay (Average)	4.7 sec	
Idling Time (Average)	0.8 sec	
Intersection Level of Service (LOS)	LOS A	
95% Back of Queue - Vehicles (Worst Lane)	0.4 veh	
95% Back of Queue - Distance (Worst Lane)	9.9 ft	
Ave. Queue Storage Ratio (Worst Lane)	0.00	
Total Effective Stops	49 veh/h	58 pers/h
Effective Stop Rate	0.10	0.10
Proportion Queued	0.15	0.15
Performance Index	9.5	9.5
Cost (Total)	189.74 $/h	189.74 $/h
Fuel Consumption (Total)	13.5 gal/h	
Carbon Dioxide (Total)	121.7 kg/h	
Hydrocarbons (Total)	0.010 kg/h	
Carbon Monoxide (Total)	0.140 kg/h	
NOx (Total)	0.294 kg/h	

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Intersection LOS value for Vehicles is based on average delay for all vehicle movements.
Roundabout Capacity Model: US HCM 6.
Delay Model: HCM Delay Formula (Geometric Delay is not included).
Queue Model: HCM Queue Formula.
Site Model Variability Index (Iterations 3 to N): 0.0 %
Number of Iterations: 3 (Maximum: 10)
Largest change in Lane Degrees of Saturation for the last three Flow-Capacity Iterations: 100.0% 91.0% 0.0%

Intersection Performance - Annual Values

Performance Measure	Vehicles	Persons
Demand Flows (Total)	224,188 veh/y	269,026 pers/y
Delay	294 veh-h/y	352 pers-h/y
Effective Stops	23,325 veh/y	27,990 pers/y
Travel Distance	143,747 veh-mi/y	172,497 pers-mi/y
Travel Time	4,099 veh-h/y	4,919 pers-h/y

Cost	91,074 $/y	91,074 $/y
Fuel Consumption	6,478 gal/y	
Carbon Dioxide	58,423 kg/y	
Hydrocarbons	5 kg/y	
Carbon Monoxide	67 kg/y	
NOx	141 kg/y	

MOVEMENT SUMMARY

Site: 101 [Route 67 NB Ramps - 2022 PM (Site Folder: General)]

Route 67 NB Ramps
2022 PM
Site Category: (None)
Roundabout

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] ft	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed mph
South: NB Route 67 Ramp														
3	L2	46	10.0	54	10.0	0.077	4.7	LOS A	0.3	7.9	0.43	0.31	0.43	32.9
18	R2	13	10.0	15	10.0	0.077	4.7	LOS A	0.3	7.9	0.43	0.31	0.43	32.1
Approach		59	10.0	69	10.0	0.077	4.7	LOS A	0.3	7.9	0.43	0.31	0.43	32.7
East: WB Ramp 160														
6	T1	70	5.0	82	5.0	0.093	4.6	LOS A	0.4	9.9	0.43	0.30	0.43	35.4
16	R2	6	5.0	7	5.0	0.093	4.6	LOS A	0.4	9.9	0.43	0.30	0.43	34.4
Approach		76	5.0	89	5.0	0.093	4.6	LOS A	0.4	9.9	0.43	0.30	0.43	35.4
West: EB Route 160														
5	L2	201	5.0	236	5.0	0.235	4.7	LOS A	0.0	0.0	0.00	0.00	0.00	35.6
2	T1	61	5.0	72	5.0	0.235	4.7	LOS A	0.0	0.0	0.00	0.00	0.00	35.5
Approach		262	5.0	308	5.0	0.235	4.7	LOS A	0.0	0.0	0.00	0.00	0.00	35.6
All Vehicles		397	5.7	467	5.7	0.235	4.7	LOS A	0.4	9.9	0.15	0.10	0.15	35.1

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
Roundabout Capacity Model: US HCM 6.
Delay Model: HCM Delay Formula (Geometric Delay is not included).
Queue Model: HCM Queue Formula.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

INTERSECTION SUMMARY

Site: 101 [Route 67 SB Ramps - 2022 PM (Site Folder: General)]

Route 67 SB Ramps -
2022 PM
Site Category: (None)
Roundabout

Intersection Performance - Hourly Values		
Performance Measure	**Vehicles**	**Persons**
Travel Speed (Average)	34.6 mph	34.6 mph
Travel Distance (Total)	525.2 veh-mi/h	630.2 pers-mi/h
Travel Time (Total)	15.2 veh-h/h	18.2 pers-h/h
Desired Speed (Program)	40.0 mph	
Speed Efficiency	0.87	
Travel Time Index	8.51	
Congestion Coefficient	1.15	
Demand Flows (Total)	841 veh/h	1009 pers/h
Percent Heavy Vehicles (Demand)	5.2 %	
Degree of Saturation	0.339	
Practical Spare Capacity	150.8 %	
Effective Intersection Capacity	2482 veh/h	
Control Delay (Total)	1.27 veh-h/h	1.53 pers-h/h
Control Delay (Average)	5.5 sec	5.5 sec
Control Delay (Worst Lane)	6.5 sec	
Control Delay (Worst Movement)	6.5 sec	6.5 sec
Geometric Delay (Average)	0.0 sec	
Stop-Line Delay (Average)	5.5 sec	
Idling Time (Average)	3.8 sec	
Intersection Level of Service (LOS)	LOS A	
95% Back of Queue - Vehicles (Worst Lane)	1.8 veh	
95% Back of Queue - Distance (Worst Lane)	47.8 ft	
Ave. Queue Storage Ratio (Worst Lane)	0.01	
Total Effective Stops	99 veh/h	119 pers/h
Effective Stop Rate	0.12	0.12
Proportion Queued	0.22	0.22
Performance Index	20.0	20.0
Cost (Total)	329.64 $/h	329.64 $/h
Fuel Consumption (Total)	22.6 gal/h	
Carbon Dioxide (Total)	203.5 kg/h	
Hydrocarbons (Total)	0.017 kg/h	
Carbon Monoxide (Total)	0.241 kg/h	
NOx (Total)	0.455 kg/h	

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Intersection LOS value for Vehicles is based on average delay for all vehicle movements.
Roundabout Capacity Model: US HCM 6.
Delay Model: HCM Delay Formula (Geometric Delay is not included).
Queue Model: HCM Queue Formula.
Site Model Variability Index (Iterations 3 to N): 0.0 %
Number of Iterations: 3 (Maximum: 10)
Largest change in Lane Degrees of Saturation for the last three Flow-Capacity Iterations: 100.0% 88.6% 0.0%

Intersection Performance - Annual Values		
Performance Measure	**Vehicles**	**Persons**
Demand Flows (Total)	403,765 veh/y	484,518 pers/y
Delay	612 veh-h/y	734 pers-h/y
Effective Stops	47,682 veh/y	57,218 pers/y
Travel Distance	252,087 veh-mi/y	302,505 pers-mi/y
Travel Time	7,278 veh-h/y	8,734 pers-h/y

Cost	158,227 $/y	158,227 $/y
Fuel Consumption	10,841 gal/y	
Carbon Dioxide	97,669 kg/y	
Hydrocarbons	8 kg/y	
Carbon Monoxide	116 kg/y	
NOx	218 kg/y	

MOVEMENT SUMMARY

Site: 101 [Route 67 SB Ramps - 2022 PM (Site Folder: General)]

Route 67 SB Ramps -
2022 PM
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] ft	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed mph
East: WB Route 160														
1	L2	8	10.0	9	10.0	0.104	3.7	LOS A	0.0	0.0	0.00	0.00	0.00	37.8
6	T1	108	5.0	127	5.0	0.104	3.6	LOS A	0.0	0.0	0.00	0.00	0.00	38.0
Approach		116	5.3	136	5.3	0.104	3.6	LOS A	0.0	0.0	0.00	0.00	0.00	37.9
North: SB Route 67 Ramps														
7	L2	11	5.0	13	5.0	0.339	6.5	LOS A	1.8	47.8	0.37	0.23	0.37	34.2
14	R2	316	5.0	372	5.0	0.339	6.5	LOS A	1.8	47.8	0.37	0.23	0.37	33.2
Approach		327	5.0	385	5.0	0.339	6.5	LOS A	1.8	47.8	0.37	0.23	0.37	33.2
West: EB Route 160														
2	T1	251	5.0	295	5.0	0.250	5.0	LOS A	1.3	33.7	0.12	0.04	0.12	35.2
12	R2	21	10.0	25	10.0	0.250	5.1	LOS A	1.3	33.7	0.12	0.04	0.12	34.0
Approach		272	5.4	320	5.4	0.250	5.0	LOS A	1.3	33.7	0.12	0.04	0.12	35.1
All Vehicles		715	5.2	841	5.2	0.339	5.5	LOS A	1.8	47.8	0.22	0.12	0.22	34.6

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
Roundabout Capacity Model: US HCM 6.
Delay Model: HCM Delay Formula (Geometric Delay is not included).
Queue Model: HCM Queue Formula.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

INTERSECTION SUMMARY

Site: 101 [Route 67 NB Ramps - 2042 AM (Site Folder: General)]

Route 67 NB Ramps
2042 AM
Site Category: (None)
Roundabout

Intersection Performance - Hourly Values		
Performance Measure	**Vehicles**	**Persons**
Travel Speed (Average)	34.7 mph	34.7 mph
Travel Distance (Total)	611.7 veh-mi/h	734.0 pers-mi/h
Travel Time (Total)	17.6 veh-h/h	21.2 pers-h/h
Desired Speed (Program)	40.0 mph	
Speed Efficiency	0.87	
Travel Time Index	8.53	
Congestion Coefficient	1.15	
Demand Flows (Total)	949 veh/h	1139 pers/h
Percent Heavy Vehicles (Demand)	5.3 %	
Degree of Saturation	0.614	
Practical Spare Capacity	38.3 %	
Effective Intersection Capacity	1544 veh/h	
Control Delay (Total)	2.58 veh-h/h	3.09 pers-h/h
Control Delay (Average)	9.8 sec	9.8 sec
Control Delay (Worst Lane)	10.1 sec	
Control Delay (Worst Movement)	10.1 sec	10.1 sec
Geometric Delay (Average)	0.0 sec	
Stop-Line Delay (Average)	9.8 sec	
Idling Time (Average)	0.7 sec	
Intersection Level of Service (LOS)	LOS A	
95% Back of Queue - Vehicles (Worst Lane)	0.6 veh	
95% Back of Queue - Distance (Worst Lane)	14.9 ft	
Ave. Queue Storage Ratio (Worst Lane)	0.00	
Total Effective Stops	90 veh/h	109 pers/h
Effective Stop Rate	0.10	0.10
Proportion Queued	0.10	0.10
Performance Index	19.9	19.9
Cost (Total)	388.68 $/h	388.68 $/h
Fuel Consumption (Total)	27.3 gal/h	
Carbon Dioxide (Total)	245.9 kg/h	
Hydrocarbons (Total)	0.020 kg/h	
Carbon Monoxide (Total)	0.285 kg/h	
NOx (Total)	0.562 kg/h	

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Intersection LOS value for Vehicles is based on average delay for all vehicle movements.
Roundabout Capacity Model: US HCM 6.
Delay Model: HCM Delay Formula (Geometric Delay is not included).
Queue Model: HCM Queue Formula.
Site Model Variability Index (Iterations 3 to N): 0.0 %
Number of Iterations: 3 (Maximum: 10)
Largest change in Lane Degrees of Saturation for the last three Flow-Capacity Iterations: 100.0% 94.7% 0.0%

Intersection Performance - Annual Values		
Performance Measure	**Vehicles**	**Persons**
Demand Flows (Total)	455,400 veh/y	546,480 pers/y
Delay	1,238 veh-h/y	1,485 pers-h/y
Effective Stops	43,411 veh/y	52,094 pers/y
Travel Distance	293,606 veh-mi/y	352,327 pers-mi/y
Travel Time	8,460 veh-h/y	10,152 pers-h/y

Cost	186,566 $/y	186,566 $/y
Fuel Consumption	13,105 gal/y	
Carbon Dioxide	118,052 kg/y	
Hydrocarbons	10 kg/y	
Carbon Monoxide	137 kg/y	
NOx	270 kg/y	

MOVEMENT SUMMARY

Site: 101 [Route 67 NB Ramps - 2042 AM (Site Folder: General)]

Route 67 NB Ramps
2042 AM
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] ft	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed mph
South: NB Route 67 Ramp														
3	L2	37	10.0	46	10.0	0.102	8.1	LOS A	0.4	9.5	0.64	0.64	0.64	31.2
18	R2	6	10.0	8	10.0	0.102	8.1	LOS A	0.4	9.5	0.64	0.64	0.64	30.5
Approach		43	10.0	54	10.0	0.102	8.1	LOS A	0.4	9.5	0.64	0.64	0.64	31.1
East: WB Ramp 160														
6	T1	46	5.0	58	5.0	0.153	8.2	LOS A	0.6	14.9	0.64	0.64	0.64	33.5
16	R2	24	5.0	30	5.0	0.153	8.2	LOS A	0.6	14.9	0.64	0.64	0.64	32.6
Approach		70	5.0	88	5.0	0.153	8.2	LOS A	0.6	14.9	0.64	0.64	0.64	33.2
West: EB Route 160														
5	L2	581	5.0	726	5.0	0.614	10.1	LOS B	0.0	0.0	0.00	0.00	0.00	35.1
2	T1	65	5.0	81	5.0	0.614	10.1	LOS B	0.0	0.0	0.00	0.00	0.00	35.1
Approach		646	5.0	808	5.0	0.614	10.1	LOS B	0.0	0.0	0.00	0.00	0.00	35.1
All Vehicles		759	5.3	949	5.3	0.614	9.8	LOS A	0.6	14.9	0.10	0.10	0.10	34.7

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
Roundabout Capacity Model: US HCM 6.
Delay Model: HCM Delay Formula (Geometric Delay is not included).
Queue Model: HCM Queue Formula.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

INTERSECTION SUMMARY

Site: 101 [Route 67 SB Ramps - 2042 AM (Site Folder: General)]

Route 67 SB Ramps -
2042 AM
Site Category: (None)
Roundabout

Intersection Performance - Hourly Values		
Performance Measure	**Vehicles**	**Persons**
Travel Speed (Average)	32.4 mph	32.4 mph
Travel Distance (Total)	744.7 veh-mi/h	893.6 pers-mi/h
Travel Time (Total)	23.0 veh-h/h	27.6 pers-h/h
Desired Speed (Program)	40.0 mph	
Speed Efficiency	0.81	
Travel Time Index	7.88	
Congestion Coefficient	1.24	
Demand Flows (Total)	1186 veh/h	1424 pers/h
Percent Heavy Vehicles (Demand)	5.4 %	
Degree of Saturation	0.695	
Practical Spare Capacity	22.4 %	
Effective Intersection Capacity	1708 veh/h	
Control Delay (Total)	3.40 veh-h/h	4.08 pers-h/h
Control Delay (Average)	10.3 sec	10.3 sec
Control Delay (Worst Lane)	12.4 sec	
Control Delay (Worst Movement)	12.5 sec	12.5 sec
Geometric Delay (Average)	0.0 sec	
Stop-Line Delay (Average)	10.3 sec	
Idling Time (Average)	8.7 sec	
Intersection Level of Service (LOS)	LOS B	
95% Back of Queue - Vehicles (Worst Lane)	7.8 veh	
95% Back of Queue - Distance (Worst Lane)	202.6 ft	
Ave. Queue Storage Ratio (Worst Lane)	0.05	
Total Effective Stops	93 veh/h	111 pers/h
Effective Stop Rate	0.08	0.08
Proportion Queued	0.23	0.23
Performance Index	36.2	36.2
Cost (Total)	491.03 $/h	491.03 $/h
Fuel Consumption (Total)	32.5 gal/h	
Carbon Dioxide (Total)	293.3 kg/h	
Hydrocarbons (Total)	0.025 kg/h	
Carbon Monoxide (Total)	0.345 kg/h	
NOx (Total)	0.666 kg/h	

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Intersection LOS value for Vehicles is based on average delay for all vehicle movements.
Roundabout Capacity Model: US HCM 6.
Delay Model: HCM Delay Formula (Geometric Delay is not included).
Queue Model: HCM Queue Formula.
Site Model Variability Index (Iterations 3 to N): 0.0 %
Number of Iterations: 3 (Maximum: 10)
Largest change in Lane Degrees of Saturation for the last three Flow-Capacity Iterations: 100.0% 88.2% 0.0%

Intersection Performance - Annual Values		
Performance Measure	**Vehicles**	**Persons**
Demand Flows (Total)	569,400 veh/y	683,280 pers/y
Delay	1,634 veh-h/y	1,960 pers-h/y
Effective Stops	44,521 veh/y	53,426 pers/y
Travel Distance	357,439 veh-mi/y	428,927 pers-mi/y
Travel Time	11,041 veh-h/y	13,249 pers-h/y

Cost	235,694 $/y	235,694 $/y
Fuel Consumption	15,620 gal/y	
Carbon Dioxide	140,782 kg/y	
Hydrocarbons	12 kg/y	
Carbon Monoxide	165 kg/y	
NOx	320 kg/y	

MOVEMENT SUMMARY

Site: 101 [Route 67 SB Ramps - 2042 AM (Site Folder: General)]

Route 67 SB Ramps -
2042 AM
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] ft	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed mph
East: WB Route 160														
1	L2	9	10.0	11	10.0	0.079	3.5	LOS A	0.0	0.0	0.00	0.00	0.00	37.6
6	T1	74	5.0	93	5.0	0.079	3.4	LOS A	0.0	0.0	0.00	0.00	0.00	37.8
Approach		83	5.5	104	5.5	0.079	3.4	LOS A	0.0	0.0	0.00	0.00	0.00	37.8
North: SB Route 67 Ramps														
7	L2	6	5.0	8	5.0	0.164	4.5	LOS A	0.7	19.5	0.27	0.14	0.27	35.3
14	R2	148	5.0	185	5.0	0.164	4.5	LOS A	0.7	19.5	0.27	0.14	0.27	34.2
Approach		154	5.0	193	5.0	0.164	4.5	LOS A	0.7	19.5	0.27	0.14	0.27	34.2
West: EB Route 160														
2	T1	640	5.0	800	5.0	0.695	12.4	LOS B	7.8	202.6	0.24	0.07	0.24	31.6
12	R2	72	10.0	90	10.0	0.695	12.5	LOS B	7.8	202.6	0.24	0.07	0.24	30.6
Approach		712	5.5	890	5.5	0.695	12.4	LOS B	7.8	202.6	0.24	0.07	0.24	31.5
All Vehicles		949	5.4	1186	5.4	0.695	10.3	LOS B	7.8	202.6	0.23	0.08	0.23	32.4

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
Roundabout Capacity Model: US HCM 6.
Delay Model: HCM Delay Formula (Geometric Delay is not included).
Queue Model: HCM Queue Formula.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

INTERSECTION SUMMARY

Site: 101 [Route 67 NB Ramps - 2042 PM (Site Folder: General)]

Route 67 NB Ramps
2042 PM
Site Category: (None)
Roundabout

Intersection Performance - Hourly Values

Performance Measure	Vehicles	Persons
Travel Speed (Average)	34.9 mph	34.9 mph
Travel Distance (Total)	394.6 veh-mi/h	473.5 pers-mi/h
Travel Time (Total)	11.3 veh-h/h	13.6 pers-h/h
Desired Speed (Program)	40.0 mph	
Speed Efficiency	0.87	
Travel Time Index	8.58	
Congestion Coefficient	1.15	
Demand Flows (Total)	615 veh/h	738 pers/h
Percent Heavy Vehicles (Demand)	5.8 %	
Degree of Saturation	0.309	
Practical Spare Capacity	175.2 %	
Effective Intersection Capacity	1992 veh/h	
Control Delay (Total)	0.94 veh-h/h	1.13 pers-h/h
Control Delay (Average)	5.5 sec	5.5 sec
Control Delay (Worst Lane)	5.6 sec	
Control Delay (Worst Movement)	5.6 sec	5.6 sec
Geometric Delay (Average)	0.0 sec	
Stop-Line Delay (Average)	5.5 sec	
Idling Time (Average)	1.0 sec	
Intersection Level of Service (LOS)	LOS A	
95% Back of Queue - Vehicles (Worst Lane)	0.5 veh	
95% Back of Queue - Distance (Worst Lane)	14.2 ft	
Ave. Queue Storage Ratio (Worst Lane)	0.00	
Total Effective Stops	86 veh/h	103 pers/h
Effective Stop Rate	0.14	0.14
Proportion Queued	0.17	0.17
Performance Index	12.9	12.9
Cost (Total)	251.43 $/h	251.43 $/h
Fuel Consumption (Total)	17.9 gal/h	
Carbon Dioxide (Total)	161.4 kg/h	
Hydrocarbons (Total)	0.013 kg/h	
Carbon Monoxide (Total)	0.186 kg/h	
NOx (Total)	0.391 kg/h	

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Intersection LOS value for Vehicles is based on average delay for all vehicle movements.
Roundabout Capacity Model: US HCM 6.
Delay Model: HCM Delay Formula (Geometric Delay is not included).
Queue Model: HCM Queue Formula.
Site Model Variability Index (Iterations 3 to N): 0.0 %
Number of Iterations: 3 (Maximum: 10)
Largest change in Lane Degrees of Saturation for the last three Flow-Capacity Iterations: 100.0% 91.9% 0.0%

Intersection Performance - Annual Values

Performance Measure	Vehicles	Persons
Demand Flows (Total)	295,341 veh/y	354,409 pers/y
Delay	452 veh-h/y	543 pers-h/y
Effective Stops	41,180 veh/y	49,416 pers/y
Travel Distance	189,408 veh-mi/y	227,290 pers-mi/y
Travel Time	5,431 veh-h/y	6,517 pers-h/y

Cost	120,686	$/y	120,686	$/y
Fuel Consumption	8,589	gal/y		
Carbon Dioxide	77,454	kg/y		
Hydrocarbons	6	kg/y		
Carbon Monoxide	89	kg/y		
NOx	188	kg/y		

MOVEMENT SUMMARY

Site: 101 [Route 67 NB Ramps - 2042 PM (Site Folder: General)]

Route 67 NB Ramps
2042 PM
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] ft	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed mph
South: NB Route 67 Ramp														
3	L2	62	10.0	73	10.0	0.116	5.6	LOS A	0.4	12.0	0.50	0.41	0.50	32.5
18	R2	18	10.0	21	10.0	0.116	5.6	LOS A	0.4	12.0	0.50	0.41	0.50	31.7
Approach		80	10.0	94	10.0	0.116	5.6	LOS A	0.4	12.0	0.50	0.41	0.50	32.3
East: WB Ramp 160														
6	T1	90	5.0	106	5.0	0.133	5.5	LOS A	0.5	14.2	0.50	0.41	0.50	35.0
16	R2	8	5.0	9	5.0	0.133	5.5	LOS A	0.5	14.2	0.50	0.41	0.50	33.9
Approach		98	5.0	115	5.0	0.133	5.5	LOS A	0.5	14.2	0.50	0.41	0.50	34.9
West: EB Route 160														
5	L2	268	5.0	315	5.0	0.309	5.5	LOS A	0.0	0.0	0.00	0.00	0.00	35.5
2	T1	77	5.0	91	5.0	0.309	5.5	LOS A	0.0	0.0	0.00	0.00	0.00	35.5
Approach		345	5.0	406	5.0	0.309	5.5	LOS A	0.0	0.0	0.00	0.00	0.00	35.5
All Vehicles		523	5.8	615	5.8	0.309	5.5	LOS A	0.5	14.2	0.17	0.14	0.17	34.9

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
Roundabout Capacity Model: US HCM 6.
Delay Model: HCM Delay Formula (Geometric Delay is not included).
Queue Model: HCM Queue Formula.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

INTERSECTION SUMMARY

Site: 101 [Route 67 SB Ramps - 2042 PM (Site Folder: General)]

Route 67 SB Ramps -
2042 PM
Site Category: (None)
Roundabout

Intersection Performance - Hourly Values		
Performance Measure	**Vehicles**	**Persons**
Travel Speed (Average)	34.2 mph	34.2 mph
Travel Distance (Total)	665.0 veh-mi/h	798.1 pers-mi/h
Travel Time (Total)	19.5 veh-h/h	23.3 pers-h/h
Desired Speed (Program)	40.0 mph	
Speed Efficiency	0.85	
Travel Time Index	8.38	
Congestion Coefficient	1.17	
Demand Flows (Total)	1065 veh/h	1278 pers/h
Percent Heavy Vehicles (Demand)	5.2 %	
Degree of Saturation	0.428	
Practical Spare Capacity	98.4 %	
Effective Intersection Capacity	2485 veh/h	
Control Delay (Total)	1.90 veh-h/h	2.28 pers-h/h
Control Delay (Average)	6.4 sec	6.4 sec
Control Delay (Worst Lane)	7.9 sec	
Control Delay (Worst Movement)	7.9 sec	7.9 sec
Geometric Delay (Average)	0.0 sec	
Stop-Line Delay (Average)	6.4 sec	
Idling Time (Average)	4.5 sec	
Intersection Level of Service (LOS)	LOS A	
95% Back of Queue - Vehicles (Worst Lane)	2.5 veh	
95% Back of Queue - Distance (Worst Lane)	65.3 ft	
Ave. Queue Storage Ratio (Worst Lane)	0.02	
Total Effective Stops	172 veh/h	207 pers/h
Effective Stop Rate	0.16	0.16
Proportion Queued	0.27	0.27
Performance Index	26.6	26.6
Cost (Total)	421.93 $/h	421.93 $/h
Fuel Consumption (Total)	28.8 gal/h	
Carbon Dioxide (Total)	259.3 kg/h	
Hydrocarbons (Total)	0.022 kg/h	
Carbon Monoxide (Total)	0.307 kg/h	
NOx (Total)	0.579 kg/h	

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Intersection LOS value for Vehicles is based on average delay for all vehicle movements.
Roundabout Capacity Model: US HCM 6.
Delay Model: HCM Delay Formula (Geometric Delay is not included).
Queue Model: HCM Queue Formula.
Site Model Variability Index (Iterations 3 to N): 0.0 %
Number of Iterations: 3 (Maximum: 10)
Largest change in Lane Degrees of Saturation for the last three Flow-Capacity Iterations: 100.0% 89.2% 0.0%

Intersection Performance - Annual Values		
Performance Measure	**Vehicles**	**Persons**
Demand Flows (Total)	511,059 veh/y	613,271 pers/y
Delay	914 veh-h/y	1,096 pers-h/y
Effective Stops	82,644 veh/y	99,172 pers/y
Travel Distance	319,220 veh-mi/y	383,065 pers-mi/y
Travel Time	9,339 veh-h/y	11,207 pers-h/y

Cost	202,527	$/y	202,527	$/y
Fuel Consumption	13,815	gal/y		
Carbon Dioxide	124,460	kg/y		
Hydrocarbons	10	kg/y		
Carbon Monoxide	147	kg/y		
NOx	278	kg/y		

MOVEMENT SUMMARY

Site: 101 [Route 67 SB Ramps - 2042 PM (Site Folder: General)]

Route 67 SB Ramps -
2042 PM
Site Category: (None)
Roundabout

Vehicle Movement Performance															
Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] ft	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed mph
East: WB Route 160														
1	L2	10	10.0	12	10.0	0.136	4.0	LOS A	0.0	0.0	0.00	0.00	0.00	37.8
6	T1	142	5.0	167	5.0	0.136	3.9	LOS A	0.0	0.0	0.00	0.00	0.00	38.0
Approach		152	5.3	179	5.3	0.136	3.9	LOS A	0.0	0.0	0.00	0.00	0.00	37.9
North: SB Route 67 Ramps														
7	L2	13	5.0	15	5.0	0.428	7.9	LOS A	2.5	65.3	0.47	0.32	0.47	33.4
14	R2	382	5.0	449	5.0	0.428	7.9	LOS A	2.5	65.3	0.47	0.32	0.47	32.5
Approach		395	5.0	465	5.0	0.428	7.9	LOS A	2.5	65.3	0.47	0.32	0.47	32.5
West: EB Route 160														
2	T1	332	5.0	391	5.0	0.331	5.9	LOS A	1.9	49.3	0.15	0.05	0.15	34.7
12	R2	26	10.0	31	10.0	0.331	6.0	LOS A	1.9	49.3	0.15	0.05	0.15	33.6
Approach		358	5.4	421	5.4	0.331	5.9	LOS A	1.9	49.3	0.15	0.05	0.15	34.7
All Vehicles		905	5.2	1065	5.2	0.428	6.4	LOS A	2.5	65.3	0.27	0.16	0.27	34.2

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
Roundabout Capacity Model: US HCM 6.
Delay Model: HCM Delay Formula (Geometric Delay is not included).
Queue Model: HCM Queue Formula.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

INTERSECTION SUMMARY

Site: 101 [Route 67 NB Ramps - 2042 AM - Freeway (Site Folder: General)]

Route 67 NB Ramps
2042 AM - Freeway
Site Category: (None)
Roundabout

Intersection Performance - Hourly Values		
Performance Measure	**Vehicles**	**Persons**
Travel Speed (Average)	34.1 mph	34.1 mph
Travel Distance (Total)	837.0 veh-mi/h	1004.4 pers-mi/h
Travel Time (Total)	24.5 veh-h/h	29.4 pers-h/h
Desired Speed (Program)	40.0 mph	
Speed Efficiency	0.85	
Travel Time Index	8.36	
Congestion Coefficient	1.17	
Demand Flows (Total)	1304 veh/h	1565 pers/h
Percent Heavy Vehicles (Demand)	5.3 %	
Degree of Saturation	0.788	
Practical Spare Capacity	7.9 %	
Effective Intersection Capacity	1656 veh/h	
Control Delay (Total)	5.58 veh-h/h	6.69 pers-h/h
Control Delay (Average)	15.4 sec	15.4 sec
Control Delay (Worst Lane)	15.9 sec	
Control Delay (Worst Movement)	15.9 sec	15.9 sec
Geometric Delay (Average)	0.0 sec	
Stop-Line Delay (Average)	15.4 sec	
Idling Time (Average)	1.8 sec	
Intersection Level of Service (LOS)	LOS C	
95% Back of Queue - Vehicles (Worst Lane)	1.7 veh	
95% Back of Queue - Distance (Worst Lane)	45.1 ft	
Ave. Queue Storage Ratio (Worst Lane)	0.01	
Total Effective Stops	209 veh/h	251 pers/h
Effective Stop Rate	0.16	0.16
Proportion Queued	0.15	0.15
Performance Index	31.6	31.6
Cost (Total)	538.81 $/h	538.81 $/h
Fuel Consumption (Total)	37.6 gal/h	
Carbon Dioxide (Total)	338.5 kg/h	
Hydrocarbons (Total)	0.028 kg/h	
Carbon Monoxide (Total)	0.392 kg/h	
NOx (Total)	0.776 kg/h	

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Intersection LOS value for Vehicles is based on average delay for all vehicle movements.
Roundabout Capacity Model: US HCM 6.
Delay Model: HCM Delay Formula (Geometric Delay is not included).
Queue Model: HCM Queue Formula.
Site Model Variability Index (Iterations 3 to N): 0.0 %
Number of Iterations: 3 (Maximum: 10)
Largest change in Lane Degrees of Saturation for the last three Flow-Capacity Iterations: 100.0% 95.9% 0.0%

Intersection Performance - Annual Values		
Performance Measure	**Vehicles**	**Persons**
Demand Flows (Total)	625,800 veh/y	750,960 pers/y
Delay	2,678 veh-h/y	3,213 pers-h/y
Effective Stops	100,507 veh/y	120,609 pers/y

Travel Distance	401,779	veh-mi/y	482,134	pers-mi/y
Travel Time	11,778	veh-h/y	14,134	pers-h/y
Cost	258,627	$/y	258,627	$/y
Fuel Consumption	18,034	gal/y		
Carbon Dioxide	162,466	kg/y		
Hydrocarbons	14	kg/y		
Carbon Monoxide	188	kg/y		
NOx	373	kg/y		

MOVEMENT SUMMARY

Site: 101 [Route 67 NB Ramps - 2042 AM - Freeway (Site Folder: General)]

Route 67 NB Ramps
2042 AM - Freeway
Site Category: (None)
Roundabout

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] ft	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed mph
South: NB Route 67 Ramp														
3	L2	38	10.0	48	10.0	0.202	11.9	LOS B	0.7	18.7	0.71	0.71	0.71	30.3
18	R2	29	10.0	36	10.0	0.202	11.9	LOS B	0.7	18.7	0.71	0.71	0.71	29.5
Approach		67	10.0	84	10.0	0.202	11.9	LOS B	0.7	18.7	0.71	0.71	0.71	30.0
East: WB Ramp 160														
6	T1	65	5.0	81	5.0	0.385	14.0	LOS B	1.7	45.1	0.74	0.81	0.97	30.8
16	R2	83	5.0	104	5.0	0.385	14.0	LOS B	1.7	45.1	0.74	0.81	0.97	30.0
Approach		148	5.0	185	5.0	0.385	14.0	LOS B	1.7	45.1	0.74	0.81	0.97	30.3
West: EB Route 160														
5	L2	712	5.0	890	5.0	0.788	15.9	LOS C	0.0	0.0	0.00	0.00	0.00	35.3
2	T1	116	5.0	145	5.0	0.788	15.9	LOS C	0.0	0.0	0.00	0.00	0.00	35.3
Approach		828	5.0	1035	5.0	0.788	15.9	LOS C	0.0	0.0	0.00	0.00	0.00	35.3
All Vehicles		1043	5.3	1304	5.3	0.788	15.4	LOS C	1.7	45.1	0.15	0.16	0.18	34.1

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
Roundabout Capacity Model: US HCM 6.
Delay Model: HCM Delay Formula (Geometric Delay is not included).
Queue Model: HCM Queue Formula.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

INTERSECTION SUMMARY

Site: 101 [Route 67 SB Ramps - 2042 AM - Freeway (Site Folder: General)]

Route 67 SB Ramps -
2042 AM - Freeway
Site Category: (None)
Roundabout

Intersection Performance - Hourly Values		
Performance Measure	**Vehicles**	**Persons**
Travel Speed (Average)	28.9 mph	28.9 mph
Travel Distance (Total)	936.2 veh-mi/h	1123.5 pers-mi/h
Travel Time (Total)	32.4 veh-h/h	38.9 pers-h/h
Desired Speed (Program)	40.0 mph	
Speed Efficiency	0.72	
Travel Time Index	6.92	
Congestion Coefficient	1.38	
Demand Flows (Total)	1490 veh/h	1788 pers/h
Percent Heavy Vehicles (Demand)	5.4 %	
Degree of Saturation	0.880	
Practical Spare Capacity	-3.4 %	
Effective Intersection Capacity	1693 veh/h	
Control Delay (Total)	7.70 veh-h/h	9.24 pers-h/h
Control Delay (Average)	18.6 sec	18.6 sec
Control Delay (Worst Lane)	23.8 sec	
Control Delay (Worst Movement)	24.0 sec	24.0 sec
Geometric Delay (Average)	0.0 sec	
Stop-Line Delay (Average)	18.6 sec	
Idling Time (Average)	14.7 sec	
Intersection Level of Service (LOS)	LOS C	
95% Back of Queue - Vehicles (Worst Lane)	16.0 veh	
95% Back of Queue - Distance (Worst Lane)	418.4 ft	
Ave. Queue Storage Ratio (Worst Lane)	0.11	
Total Effective Stops	460 veh/h	552 pers/h
Effective Stop Rate	0.31	0.31
Proportion Queued	0.62	0.62
Performance Index	61.4	61.4
Cost (Total)	680.54 $/h	680.54 $/h
Fuel Consumption (Total)	43.8 gal/h	
Carbon Dioxide (Total)	394.2 kg/h	
Hydrocarbons (Total)	0.034 kg/h	
Carbon Monoxide (Total)	0.460 kg/h	
NOx (Total)	0.897 kg/h	

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Intersection LOS value for Vehicles is based on average delay for all vehicle movements.
Roundabout Capacity Model: US HCM 6.
Delay Model: HCM Delay Formula (Geometric Delay is not included).
Queue Model: HCM Queue Formula.
Site Model Variability Index (Iterations 3 to N): 0.0 %
Number of Iterations: 3 (Maximum: 10)
Largest change in Lane Degrees of Saturation for the last three Flow-Capacity Iterations: 100.0% 88.6% 0.0%

Intersection Performance - Annual Values		
Performance Measure	**Vehicles**	**Persons**
Demand Flows (Total)	715,200 veh/y	858,240 pers/y
Delay	3,697 veh-h/y	4,436 pers-h/y
Effective Stops	220,975 veh/y	265,170 pers/y

Travel Distance	449,395	veh-mi/y	539,274	pers-mi/y
Travel Time	15,544	veh-h/y	18,653	pers-h/y
Cost	326,658	$/y	326,658	$/y
Fuel Consumption	21,007	gal/y		
Carbon Dioxide	189,225	kg/y		
Hydrocarbons	16	kg/y		
Carbon Monoxide	221	kg/y		
NOx	430	kg/y		

MOVEMENT SUMMARY

Site: 101 [Route 67 SB Ramps - 2042 AM - Freeway (Site Folder: General)]

Route 67 SB Ramps -
2042 AM - Freeway
Site Category: (None)
Roundabout

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] ft	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed mph
East: WB Route 160														
1	L2	10	10.0	13	10.0	0.098	3.7	LOS A	0.0	0.0	0.00	0.00	0.00	37.7
6	T1	93	5.0	116	5.0	0.098	3.5	LOS A	0.0	0.0	0.00	0.00	0.00	37.9
Approach		103	5.5	129	5.5	0.098	3.5	LOS A	0.0	0.0	0.00	0.00	0.00	37.8
North: SB Route 67 Ramps														
7	L2	37	5.0	46	5.0	0.245	5.4	LOS A	1.2	31.3	0.33	0.19	0.33	34.4
14	R2	187	5.0	234	5.0	0.245	5.4	LOS A	1.2	31.3	0.33	0.19	0.33	33.4
Approach		224	5.0	280	5.0	0.245	5.4	LOS A	1.2	31.3	0.33	0.19	0.33	33.5
West: EB Route 160														
2	T1	791	5.0	989	5.0	0.880	23.8	LOS C	16.0	418.4	0.77	0.38	0.77	27.3
12	R2	74	10.0	93	10.0	0.880	24.0	LOS C	16.0	418.4	0.77	0.38	0.77	26.5
Approach		865	5.4	1081	5.4	0.880	23.8	LOS C	16.0	418.4	0.77	0.38	0.77	27.2
All Vehicles		1192	5.4	1490	5.4	0.880	18.6	LOS C	16.0	418.4	0.62	0.31	0.62	28.9

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
Roundabout Capacity Model: US HCM 6.
Delay Model: HCM Delay Formula (Geometric Delay is not included).
Queue Model: HCM Queue Formula.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

INTERSECTION SUMMARY

Site: 101 [Route 160 & Route C/V - 2042 AM (Site Folder: General)]

Route 160 & Route C/V
2042 AM
Site Category: (None)
Roundabout

Intersection Performance - Hourly Values		
Performance Measure	**Vehicles**	**Persons**
Travel Speed (Average)	29.8 mph	29.8 mph
Travel Distance (Total)	990.9 veh-mi/h	1189.0 pers-mi/h
Travel Time (Total)	33.3 veh-h/h	40.0 pers-h/h
Desired Speed (Program)	40.0 mph	
Speed Efficiency	0.74	
Travel Time Index	7.15	
Congestion Coefficient	1.34	
Demand Flows (Total)	1566 veh/h	1880 pers/h
Percent Heavy Vehicles (Demand)	4.3 %	
Degree of Saturation	0.840	
Practical Spare Capacity	1.2 %	
Effective Intersection Capacity	1865 veh/h	
Control Delay (Total)	6.76 veh-h/h	8.11 pers-h/h
Control Delay (Average)	15.5 sec	15.5 sec
Control Delay (Worst Lane)	23.1 sec	
Control Delay (Worst Movement)	23.1 sec	23.1 sec
Geometric Delay (Average)	0.0 sec	
Stop-Line Delay (Average)	15.5 sec	
Idling Time (Average)	7.2 sec	
Intersection Level of Service (LOS)	LOS C	
95% Back of Queue - Vehicles (Worst Lane)	23.6 veh	
95% Back of Queue - Distance (Worst Lane)	613.7 ft	
Ave. Queue Storage Ratio (Worst Lane)	0.15	
Total Effective Stops	1300 veh/h	1560 pers/h
Effective Stop Rate	0.83	0.83
Proportion Queued	0.69	0.69
Performance Index	104.4	104.4
Cost (Total)	705.58 $/h	705.58 $/h
Fuel Consumption (Total)	46.1 gal/h	
Carbon Dioxide (Total)	414.2 kg/h	
Hydrocarbons (Total)	0.037 kg/h	
Carbon Monoxide (Total)	0.483 kg/h	
NOx (Total)	0.834 kg/h	

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Intersection LOS value for Vehicles is based on average delay for all vehicle movements.
Roundabout Capacity Model: US HCM 6.
Delay Model: HCM Delay Formula (Geometric Delay is not included).
Queue Model: HCM Queue Formula.
Site Model Variability Index (Iterations 3 to N): 0.0 %
Number of Iterations: 3 (Maximum: 10)
Largest change in Lane Degrees of Saturation for the last three Flow-Capacity Iterations: 100.0% 95.6% 0.0%

Intersection Performance - Annual Values		
Performance Measure	**Vehicles**	**Persons**
Demand Flows (Total)	751,800 veh/y	902,160 pers/y
Delay	3,245 veh-h/y	3,894 pers-h/y
Effective Stops	624,180 veh/y	749,016 pers/y

Travel Distance	475,615	veh-mi/y	570,738	pers-mi/y
Travel Time	15,987	veh-h/y	19,184	pers-h/y
Cost	338,680	$/y	338,680	$/y
Fuel Consumption	22,124	gal/y		
Carbon Dioxide	198,813	kg/y		
Hydrocarbons	18	kg/y		
Carbon Monoxide	232	kg/y		
NOx	400	kg/y		

MOVEMENT SUMMARY

Site: 101 [Route 160 & Route C/V - 2042 AM (Site Folder: General)]

Route 160 & Route C/V
2042 AM
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] ft	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed mph
South: NB Route V														
3	L2	9	2.0	11	2.0	0.208	11.4	LOS B	0.8	19.5	0.72	0.72	0.72	31.7
8	T1	9	2.0	11	2.0	0.208	11.4	LOS B	0.8	19.5	0.72	0.72	0.72	31.7
18	R2	55	2.0	69	2.0	0.208	11.4	LOS B	0.8	19.5	0.72	0.72	0.72	30.8
Approach		73	2.0	91	2.0	0.208	11.4	LOS B	0.8	19.5	0.72	0.72	0.72	31.0
East: WB Route 160														
1	L2	22	5.0	28	5.0	0.283	5.5	LOS A	1.5	39.0	0.23	0.10	0.23	34.7
6	T1	185	5.0	231	5.0	0.283	5.5	LOS A	1.5	39.0	0.23	0.10	0.23	34.7
16	R2	72	5.0	90	5.0	0.283	5.5	LOS A	1.5	39.0	0.23	0.10	0.23	33.7
Approach		279	5.0	349	5.0	0.283	5.5	LOS A	1.5	39.0	0.23	0.10	0.23	34.4
North: SB Route C														
7	L2	174	2.0	218	2.0	0.269	6.2	LOS A	1.3	33.5	0.48	0.37	0.48	32.5
4	T1	1	2.0	1	2.0	0.269	6.2	LOS A	1.3	33.5	0.48	0.37	0.48	32.4
14	R2	43	2.0	54	2.0	0.269	6.2	LOS A	1.3	33.5	0.48	0.37	0.48	31.5
Approach		218	2.0	273	2.0	0.269	6.2	LOS A	1.3	33.5	0.48	0.37	0.48	32.3
West: EB Route 160														
5	L2	31	5.0	39	5.0	0.840	23.1	LOS C	23.6	613.7	0.95	1.29	1.98	27.5
2	T1	640	5.0	800	5.0	0.840	23.1	LOS C	23.6	613.7	0.95	1.29	1.98	27.4
12	R2	12	5.0	15	5.0	0.840	23.1	LOS C	23.6	613.7	0.95	1.29	1.98	26.8
Approach		683	5.0	854	5.0	0.840	23.1	LOS C	23.6	613.7	0.95	1.29	1.98	27.4
All Vehicles		1253	4.3	1566	4.3	0.840	15.5	LOS C	23.6	613.7	0.69	0.83	1.25	29.8

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
Roundabout Capacity Model: US HCM 6.
Delay Model: HCM Delay Formula (Geometric Delay is not included).
Queue Model: HCM Queue Formula.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

INTERSECTION SUMMARY

Site: 101 [Route 67 NB Ramps - 2042 PM - Freeway (Site Folder: General)]

Route 67 NB Ramps
2042 PM - Freeway
Site Category: (None)
Roundabout

Intersection Performance - Hourly Values		
Performance Measure	**Vehicles**	**Persons**
Travel Speed (Average)	34.7 mph	34.7 mph
Travel Distance (Total)	538.4 veh-mi/h	646.1 pers-mi/h
Travel Time (Total)	15.5 veh-h/h	18.6 pers-h/h
Desired Speed (Program)	40.0 mph	
Speed Efficiency	0.87	
Travel Time Index	8.53	
Congestion Coefficient	1.15	
Demand Flows (Total)	841 veh/h	1009 pers/h
Percent Heavy Vehicles (Demand)	5.6 %	
Degree of Saturation	0.426	
Practical Spare Capacity	99.5 %	
Effective Intersection Capacity	1974 veh/h	
Control Delay (Total)	1.63 veh-h/h	1.95 pers-h/h
Control Delay (Average)	7.0 sec	7.0 sec
Control Delay (Worst Lane)	7.2 sec	
Control Delay (Worst Movement)	7.2 sec	7.2 sec
Geometric Delay (Average)	0.0 sec	
Stop-Line Delay (Average)	7.0 sec	
Idling Time (Average)	1.4 sec	
Intersection Level of Service (LOS)	LOS A	
95% Back of Queue - Vehicles (Worst Lane)	1.0 veh	
95% Back of Queue - Distance (Worst Lane)	25.2 ft	
Ave. Queue Storage Ratio (Worst Lane)	0.01	
Total Effective Stops	154 veh/h	185 pers/h
Effective Stop Rate	0.18	0.18
Proportion Queued	0.19	0.19
Performance Index	18.4	18.4
Cost (Total)	343.48 $/h	343.48 $/h
Fuel Consumption (Total)	24.3 gal/h	
Carbon Dioxide (Total)	219.0 kg/h	
Hydrocarbons (Total)	0.018 kg/h	
Carbon Monoxide (Total)	0.253 kg/h	
NOx (Total)	0.522 kg/h	

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Intersection LOS value for Vehicles is based on average delay for all vehicle movements.
Roundabout Capacity Model: US HCM 6.
Delay Model: HCM Delay Formula (Geometric Delay is not included).
Queue Model: HCM Queue Formula.
Site Model Variability Index (Iterations 3 to N): 0.0 %
Number of Iterations: 3 (Maximum: 10)
Largest change in Lane Degrees of Saturation for the last three Flow-Capacity Iterations: 100.0% 93.1% 0.0%

Intersection Performance - Annual Values		
Performance Measure	**Vehicles**	**Persons**
Demand Flows (Total)	403,765 veh/y	484,518 pers/y
Delay	781 veh-h/y	937 pers-h/y
Effective Stops	73,891 veh/y	88,669 pers/y

Travel Distance	258,453	veh-mi/y	310,144	pers-mi/y
Travel Time	7,447	veh-h/y	8,936	pers-h/y
Cost	164,871	$/y	164,871	$/y
Fuel Consumption	11,659	gal/y		
Carbon Dioxide	105,112	kg/y		
Hydrocarbons	9	kg/y		
Carbon Monoxide	121	kg/y		
NOx	250	kg/y		

MOVEMENT SUMMARY

Site: 101 [Route 67 NB Ramps - 2042 PM - Freeway (Site Folder: General)]

Route 67 NB Ramps
2042 PM - Freeway
Site Category: (None)
Roundabout

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] ft	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed mph
South: NB Route 67 Ramp														
3	L2	63	10.0	74	10.0	0.152	6.9	LOS A	0.6	15.5	0.58	0.54	0.58	32.1
18	R2	26	10.0	31	10.0	0.152	6.9	LOS A	0.6	15.5	0.58	0.54	0.58	31.2
Approach		89	10.0	105	10.0	0.152	6.9	LOS A	0.6	15.5	0.58	0.54	0.58	31.8
East: WB Ramp 160														
6	T1	117	5.0	138	5.0	0.229	7.2	LOS A	1.0	25.2	0.59	0.55	0.59	34.0
16	R2	33	5.0	39	5.0	0.229	7.2	LOS A	1.0	25.2	0.59	0.55	0.59	33.0
Approach		150	5.0	176	5.0	0.229	7.2	LOS A	1.0	25.2	0.59	0.55	0.59	33.8
West: EB Route 160														
5	L2	359	5.0	422	5.0	0.426	6.9	LOS A	0.0	0.0	0.00	0.00	0.00	35.6
2	T1	117	5.0	138	5.0	0.426	6.9	LOS A	0.0	0.0	0.00	0.00	0.00	35.6
Approach		476	5.0	560	5.0	0.426	6.9	LOS A	0.0	0.0	0.00	0.00	0.00	35.6
All Vehicles		715	5.6	841	5.6	0.426	7.0	LOS A	1.0	25.2	0.19	0.18	0.19	34.7

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
Roundabout Capacity Model: US HCM 6.
Delay Model: HCM Delay Formula (Geometric Delay is not included).
Queue Model: HCM Queue Formula.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

INTERSECTION SUMMARY

Site: 101 [Route 67 SB Ramps - 2042 PM - Freeway (Site Folder: General)]

Route 67 SB Ramps -
2042 PM - Freeway
Site Category: (None)
Roundabout

Intersection Performance - Hourly Values		
Performance Measure	**Vehicles**	**Persons**
Travel Speed (Average)	32.4 mph	32.4 mph
Travel Distance (Total)	903.4 veh-mi/h	1084.1 pers-mi/h
Travel Time (Total)	27.9 veh-h/h	33.4 pers-h/h
Desired Speed (Program)	40.0 mph	
Speed Efficiency	0.81	
Travel Time Index	7.89	
Congestion Coefficient	1.23	
Demand Flows (Total)	1446 veh/h	1735 pers/h
Percent Heavy Vehicles (Demand)	5.2 %	
Degree of Saturation	0.663	
Practical Spare Capacity	28.1 %	
Effective Intersection Capacity	2180 veh/h	
Control Delay (Total)	3.93 veh-h/h	4.72 pers-h/h
Control Delay (Average)	9.8 sec	9.8 sec
Control Delay (Worst Lane)	13.3 sec	
Control Delay (Worst Movement)	13.3 sec	13.3 sec
Geometric Delay (Average)	0.0 sec	
Stop-Line Delay (Average)	9.8 sec	
Idling Time (Average)	6.1 sec	
Intersection Level of Service (LOS)	LOS A	
95% Back of Queue - Vehicles (Worst Lane)	8.3 veh	
95% Back of Queue - Distance (Worst Lane)	215.8 ft	
Ave. Queue Storage Ratio (Worst Lane)	0.05	
Total Effective Stops	538 veh/h	645 pers/h
Effective Stop Rate	0.37	0.37
Proportion Queued	0.44	0.44
Performance Index	47.5	47.5
Cost (Total)	601.19 $/h	601.19 $/h
Fuel Consumption (Total)	40.6 gal/h	
Carbon Dioxide (Total)	365.8 kg/h	
Hydrocarbons (Total)	0.031 kg/h	
Carbon Monoxide (Total)	0.429 kg/h	
NOx (Total)	0.821 kg/h	

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Intersection LOS value for Vehicles is based on average delay for all vehicle movements.
Roundabout Capacity Model: US HCM 6.
Delay Model: HCM Delay Formula (Geometric Delay is not included).
Queue Model: HCM Queue Formula.
Site Model Variability Index (Iterations 3 to N): 0.0 %
Number of Iterations: 3 (Maximum: 10)
Largest change in Lane Degrees of Saturation for the last three Flow-Capacity Iterations: 100.0%   89.5%   0.0%

Intersection Performance - Annual Values		
Performance Measure	**Vehicles**	**Persons**
Demand Flows (Total)	694,024 veh/y	832,828 pers/y
Delay	1,888 veh-h/y	2,265 pers-h/y
Effective Stops	258,184 veh/y	309,821 pers/y

Travel Distance	433,648	veh-mi/y	520,378	pers-mi/y
Travel Time	13,377	veh-h/y	16,053	pers-h/y
Cost	288,570	$/y	288,570	$/y
Fuel Consumption	19,497	gal/y		
Carbon Dioxide	175,597	kg/y		
Hydrocarbons	15	kg/y		
Carbon Monoxide	206	kg/y		
NOx	394	kg/y		

MOVEMENT SUMMARY

Site: 101 [Route 67 SB Ramps - 2042 PM - Freeway (Site Folder: General)]

Route 67 SB Ramps -
2042 PM - Freeway
Site Category: (None)
Roundabout

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] ft	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed mph
East: WB Route 160														
1	L2	19	10.0	22	10.0	0.162	4.2	LOS A	0.0	0.0	0.00	0.00	0.00	37.6
6	T1	161	5.0	189	5.0	0.162	4.1	LOS A	0.0	0.0	0.00	0.00	0.00	37.8
Approach		180	5.5	212	5.5	0.162	4.1	LOS A	0.0	0.0	0.00	0.00	0.00	37.8
North: SB Route 67 Ramps														
7	L2	43	5.0	51	5.0	0.663	13.3	LOS B	8.3	215.8	0.68	0.65	0.93	30.9
14	R2	547	5.0	644	5.0	0.663	13.3	LOS B	8.3	215.8	0.68	0.65	0.93	30.0
Approach		590	5.0	694	5.0	0.663	13.3	LOS B	8.3	215.8	0.68	0.65	0.93	30.1
West: EB Route 160														
2	T1	433	5.0	509	5.0	0.446	7.6	LOS A	2.9	75.2	0.31	0.15	0.31	33.9
12	R2	26	10.0	31	10.0	0.446	7.7	LOS A	2.9	75.2	0.31	0.15	0.31	32.8
Approach		459	5.3	540	5.3	0.446	7.6	LOS A	2.9	75.2	0.31	0.15	0.31	33.8
All Vehicles		1229	5.2	1446	5.2	0.663	9.8	LOS A	8.3	215.8	0.44	0.37	0.56	32.4

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
Roundabout Capacity Model: US HCM 6.
Delay Model: HCM Delay Formula (Geometric Delay is not included).
Queue Model: HCM Queue Formula.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

INTERSECTION SUMMARY

Site: 101 [Route 160 & Route C/V - 2042 PM (Site Folder: General)]

Route 160 & Route C/V
2042 PM
Site Category: (None)
Roundabout

Intersection Performance - Hourly Values		
Performance Measure	**Vehicles**	**Persons**
Travel Speed (Average)	31.5 mph	31.5 mph
Travel Distance (Total)	1004.5 veh-mi/h	1205.4 pers-mi/h
Travel Time (Total)	31.9 veh-h/h	38.2 pers-h/h
Desired Speed (Program)	40.0 mph	
Speed Efficiency	0.79	
Travel Time Index	7.65	
Congestion Coefficient	1.27	
Demand Flows (Total)	1592 veh/h	1910 pers/h
Percent Heavy Vehicles (Demand)	4.3 %	
Degree of Saturation	0.705	
Practical Spare Capacity	20.5 %	
Effective Intersection Capacity	2256 veh/h	
Control Delay (Total)	4.84 veh-h/h	5.81 pers-h/h
Control Delay (Average)	11.0 sec	11.0 sec
Control Delay (Worst Lane)	13.5 sec	
Control Delay (Worst Movement)	13.5 sec	13.5 sec
Geometric Delay (Average)	0.0 sec	
Stop-Line Delay (Average)	11.0 sec	
Idling Time (Average)	8.0 sec	
Intersection Level of Service (LOS)	LOS B	
95% Back of Queue - Vehicles (Worst Lane)	7.0 veh	
95% Back of Queue - Distance (Worst Lane)	183.0 ft	
Ave. Queue Storage Ratio (Worst Lane)	0.05	
Total Effective Stops	654 veh/h	784 pers/h
Effective Stop Rate	0.41	0.41
Proportion Queued	0.57	0.57
Performance Index	61.2	61.2
Cost (Total)	677.54 $/h	677.54 $/h
Fuel Consumption (Total)	44.6 gal/h	
Carbon Dioxide (Total)	400.8 kg/h	
Hydrocarbons (Total)	0.035 kg/h	
Carbon Monoxide (Total)	0.476 kg/h	
NOx (Total)	0.787 kg/h	

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Intersection LOS value for Vehicles is based on average delay for all vehicle movements.
Roundabout Capacity Model: US HCM 6.
Delay Model: HCM Delay Formula (Geometric Delay is not included).
Queue Model: HCM Queue Formula.
Site Model Variability Index (Iterations 3 to N): 0.0 %
Number of Iterations: 3 (Maximum: 10)
Largest change in Lane Degrees of Saturation for the last three Flow-Capacity Iterations: 100.0% 93.0% 0.0%

Intersection Performance - Annual Values		
Performance Measure	**Vehicles**	**Persons**
Demand Flows (Total)	764,047 veh/y	916,857 pers/y
Delay	2,326 veh-h/y	2,791 pers-h/y
Effective Stops	313,740 veh/y	376,488 pers/y

Travel Distance	482,150	veh-mi/y	578,580	pers-mi/y
Travel Time	15,291	veh-h/y	18,350	pers-h/y
Cost	325,217	$/y	325,217	$/y
Fuel Consumption	21,402	gal/y		
Carbon Dioxide	192,384	kg/y		
Hydrocarbons	17	kg/y		
Carbon Monoxide	229	kg/y		
NOx	378	kg/y		

MOVEMENT SUMMARY

Site: 101 [Route 160 & Route C/V - 2042 PM (Site Folder: General)]

Route 160 & Route C/V
2042 PM
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] ft	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed mph
South: NB Route V														
3	L2	27	2.0	32	2.0	0.138	6.2	LOS A	0.6	14.3	0.57	0.52	0.57	33.7
8	T1	14	2.0	16	2.0	0.138	6.2	LOS A	0.6	14.3	0.57	0.52	0.57	33.7
18	R2	48	2.0	56	2.0	0.138	6.2	LOS A	0.6	14.3	0.57	0.52	0.57	32.7
Approach		89	2.0	105	2.0	0.138	6.2	LOS A	0.6	14.3	0.57	0.52	0.57	33.2
East: WB Route 160														
1	L2	54	5.0	64	5.0	0.705	13.5	LOS B	7.0	183.0	0.56	0.33	0.56	30.9
6	T1	439	5.0	516	5.0	0.705	13.5	LOS B	7.0	183.0	0.56	0.33	0.56	30.9
16	R2	217	5.0	255	5.0	0.705	13.5	LOS B	7.0	183.0	0.56	0.33	0.56	30.1
Approach		710	5.0	835	5.0	0.705	13.5	LOS B	7.0	183.0	0.56	0.33	0.56	30.6
North: SB Route C														
7	L2	132	2.0	155	2.0	0.355	9.7	LOS A	1.7	43.4	0.68	0.70	0.74	31.3
4	T1	16	2.0	19	2.0	0.355	9.7	LOS A	1.7	43.4	0.68	0.70	0.74	31.3
14	R2	64	2.0	75	2.0	0.355	9.7	LOS A	1.7	43.4	0.68	0.70	0.74	30.5
Approach		212	2.0	249	2.0	0.355	9.7	LOS A	1.7	43.4	0.68	0.70	0.74	31.1
West: EB Route 160														
5	L2	43	5.0	51	5.0	0.393	7.7	LOS A	2.1	55.5	0.50	0.38	0.50	33.5
2	T1	289	5.0	340	5.0	0.393	7.7	LOS A	2.1	55.5	0.50	0.38	0.50	33.4
12	R2	10	5.0	12	5.0	0.393	7.7	LOS A	2.1	55.5	0.50	0.38	0.50	32.5
Approach		342	5.0	402	5.0	0.393	7.7	LOS A	2.1	55.5	0.50	0.38	0.50	33.4
All Vehicles		1353	4.3	1592	4.3	0.705	11.0	LOS B	7.0	183.0	0.57	0.41	0.58	31.5

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
Roundabout Capacity Model: US HCM 6.
Delay Model: HCM Delay Formula (Geometric Delay is not included).
Queue Model: HCM Queue Formula.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

EXISTING / NO-BUILD INTERSECTION RESULTS

		2020 AM				2020 PM			
		Delay (sec) - LOS		Avg Queue	Max Queue	Delay (sec) - LOS		Avg Queue	Max Queue
Route 160 & Route C / V	NB Route V	11.6	B	2	68	18.3	C	5	96
	SB Route C	11.2	B	2	59	19.5	C	8	97
	EB Route 160	0.5	A	0	60	0.8	A	0	60
	WB Route 160	1.2	A	1	71	0.8	A	0	80
	Intersection	2.0	A			4.1	A		
Route 160 & SB Ramps	EB Route 160	1.0	A	0	94	0.6	A	0	34
	WB Route 160	0.2	A	0	6	0.3	A	0	0
	SB US 67 Ramps	8.8	A	8	164	16.0	C	43	321
	Intersection	2.3	A			7.7	A		
Route 160 & NB Ramps	EB Route 160	0.8	A	0	0	0.5	A	0	0
	WB Route 160	0.0	#N/A	0	0	0.0	A	0	0
	NB US 67 Ramps	8.2	A	0	2	8.4	A	0	2
	Intersection	1.1	A			0.0	A		
Route 158 & Hawkeye	EB Route 160	0.0	A	0	0	0.0	A	0	0
	WB Route 160	0.4	A	0	0	0.1	A	0	0
	NB Hawkeye	6.0	A	0	29	6.3	A	0	23
	Intersection	0.3	A			0.0	A		
Route 158 & CR 343	EB Route 158	0.5	A	0	0	0.5	A	0	2
	WB Route 158	0.7	A	0	0	0.7	A	0	0
	NB CR 343	5.3	A	0	58	#DIV/0!	#DIV/0!	0	0
	SB CR 343	5.7	A	0	57	6.5	A	0	24
	Intersection	1.1	A			0.0	A		
US Route 67 & Route C / CR 323	NB Route 67	0.2	A	0	37	0.1	A	0	34
	SB Route 67	1.7	A	7	208	1.6	A	4	159
	EB Route C	23.5	C	10	158	39.8	E	16	168
	WB CR 323	8.4	A	1	53	11.6	B	1	49
	Intersection	3.4	A			0.0	A		
US Route 67 & CR 360	NB Route 67	0.0	A	0	0	0.0	A	0	0
	SB Route 67	0.0	A	0	0	0.1	A	0	0
	EB CR 360	#DIV/0!	#DIV/0!	0	0	#DIV/0!	#DIV/0!	0	0
	WB CR 360	#DIV/0!	#DIV/0!	0	0	#DIV/0!	#DIV/0!	0	0
	Intersection	0.0	A			0.0	A		
US Route 67 & CR 338	NB Route 67	1.2	A	0	7	1.1	A	0	0
	SB Route 67	1.0	A	0	0	1.1	A	0	4
	EB CR 338	1.8	A	0	6	2.3	A	0	10
	WB CR 338	0.3	A	0	0	#DIV/0!	#DIV/0!	0	0
	Intersection	1.1	A			0.0	A		

EXISTING / NO-BUILD INTERSECTIO

		2022 AM				2022 PM			
		Delay (sec) - LOS		Avg Queue	Max Queue	Delay (sec) - LOS		Avg Queue	Max Queue
Route 160 & Route C / V	NB Route V	11.3	B	2	65	20.3	C	6	102
	SB Route C	11.1	B	2	54	19.6	C	9	100
	EB Route 160	0.6	A	0	33	1.0	A	0	72
	WB Route 160	1.1	A	0	79	0.9	A	1	102
	Intersection	2.0	A			4.4	A		
Route 160 & SB Ramps	EB Route 160	0.9	A	0	59	0.6	A	0	30
	WB Route 160	0.2	A	0	8	0.3	A	0	2
	SB US 67 Ramps	8.4	A	8	155	17.4	C	49	354
	Intersection	2.2	A			8.4	A		
Route 160 & NB Ramps	EB Route 160	0.8	A	0	0	0.5	A	0	0
	WB Route 160	0.0	#N/A	0	0	0.0	#N/A	0	0
	NB US 67 Ramps	8.5	A	0	2	8.6	A	0	4
	Intersection	0.0	A			0.0	A		
Route 158 & Hawkeye	EB Route 160	0.0	#N/A	0	0	0.0	A	0	0
	WB Route 160	0.4	A	0	0	0.1	A	0	0
	NB Hawkeye	6.1	A	0	29	5.8	A	0	23
	Intersection	0.0	A			0.0	A		
Route 158 & CR 343	EB Route 158	0.5	A	0	0	0.4	A	0	2
	WB Route 158	0.7	A	0	2	0.7	A	0	2
	NB CR 343	5.4	A	0	58	4.4	A	0	14
	SB CR 343	5.6	A	0	57	5.4	A	0	24
	Intersection	0.0	A			0.0	A		
US Route 67 & Route C / CR 323	NB Route 67	0.2	A	0	37	0.1	A	0	35
	SB Route 67	1.8	A	9	231	1.6	A	6	192
	EB Route C	24.6	C	11	162	37.0	E	16	156
	WB CR 323	8.4	A	1	60	12.0	B	1	39
	Intersection	0.0	A			0.0	A		
US Route 67 & CR 360	NB Route 67	0.0	A	0	0	0.0	A	0	0
	SB Route 67	0.1	A	0	0	0.1	A	0	2
	EB CR 360	#DIV/0!	#DIV/0!	0	0	#DIV/0!	#DIV/0!	0	0
	WB CR 360	#DIV/0!	#DIV/0!	0	0	#DIV/0!	#DIV/0!	0	0
	Intersection	0.0	A			0.0	A		
US Route 67 & CR 338	NB Route 67	1.1	A	0	7	1.1	A	0	0
	SB Route 67	1.0	A	0	0	1.0	A	0	0
	EB CR 338	1.2	A	0	2	1.1	A	0	0
	WB CR 338	0.2	A	0	0	#DIV/0!	#DIV/0!	0	0
	Intersection	0.0	A			0.0	A		

EXISTING / NO-BUILD INTERSECTIC

		2042 AM				2042 PM			
		Delay (sec) - LOS		Avg Queue	Max Queue	Delay (sec) - LOS		Avg Queue	Max Queue
Route 160 & Route C / V	NB Route V	18.8	C	5	108	56.8	F	27	212
	SB Route C	15.8	C	5	58	62.4	F	45	205
	EB Route 160	0.8	A	0	105	1.3	A	1	102
	WB Route 160	1.9	A	1	100	1.3	A	1	124
	Intersection	3.1	A			12.3	B		
Route 160 & SB Ramps	EB Route 160	1.6	A	1	176	1.1	A	0	55
	WB Route 160	0.2	A	0	19	0.4	A	0	8
	SB US 67 Ramps	10.8	B	12	177	38.8	E	148	560
	Intersection	2.9	A			17.6	C		
Route 160 & NB Ramps	EB Route 160	1.1	A	0	0	0.6	A	0	0
	WB Route 160	0.1	A	0	0	0.0	#N/A	0	0
	NB US 67 Ramps	8.8	A	0	13	9.3	A	0	4
	Intersection	0.0	A			0.0	A		
Route 158 & Hawkeye	EB Route 160	0.0	A	0	0	0.0	A	0	0
	WB Route 160	0.4	A	0	0	0.1	A	0	0
	NB Hawkeye	6.2	A	0	32	5.9	A	0	23
	Intersection	0.0	A			0.0	A		
Route 158 & CR 343	EB Route 158	0.5	A	0	0	0.4	A	0	0
	WB Route 158	0.7	A	0	0	0.7	A	0	2
	NB CR 343	5.6	A	0	58	4.4	A	0	14
	SB CR 343	5.9	A	0	63	5.4	A	0	24
	Intersection	0.0	A			0.0	A		
US Route 67 & Route C / CR 323	NB Route 67	0.2	A	0	59	0.1	A	1	61
	SB Route 67	2.5	A	96	405	1.8	A	85	378
	EB Route C	70.3	F	67	328	127.9	F	91	329
	WB CR 323	14.7	B	3	102	15.4	C	2	74
	Intersection	0.0	A			0.0	A		
US Route 67 & CR 360	NB Route 67	0.0	A	0	0	0.0	A	0	0
	SB Route 67	0.1	A	0	0	0.1	A	0	15
	EB CR 360	#DIV/0!	#DIV/0!	0	0	#DIV/0!	#DIV/0!	0	0
	WB CR 360	#DIV/0!	#DIV/0!	0	0	#DIV/0!	#DIV/0!	0	0
	Intersection	0.0	A			0.0	A		
US Route 67 & CR 338	NB Route 67	1.2	A	0	2	1.2	A	0	0
	SB Route 67	1.0	A	0	4	1.2	A	0	0
	EB CR 338	1.6	A	0	8	1.5	A	0	4
	WB CR 338	0.2	A	0	0	#DIV/0!	#DIV/0!	0	0
	Intersection	0.0	A			0.0	A		

EXISTING / NO-BUILD INTERSECTI(

		2042 AM-FREEWAY				2042 PM - FREEWAY			
		Delay (sec) - LOS		Avg Queue	Max Queue	Delay (sec) - LOS		Avg Queue	Max Queue
Route 160 & Route C / V	NB Route V	19.6	C	6	102	43.0	E	19	156
	SB Route C	624.4	F	513	587	665.9	F	504	582
	EB Route 160	1.0	A	1	99	1.4	A	1	101
	WB Route 160	5.2	A	8	220	3.6	A	8	217
	Intersection	65.0	F			67.1	F		
Route 160 & SB Ramps	EB Route 160	1.9	A	2	157	1.5	A	1	110
	WB Route 160	0.3	A	0	8	0.5	A	0	33
	SB US 67 Ramps	97.5	F	230	715	112.3	F	1529	1714
	Intersection	20.4	C			47.9	E		
Route 160 & NB Ramps	EB Route 160	1.7	A	0	0	0.7	A	0	0
	WB Route 160	0.4	A	0	0	0.1	A	0	0
	NB US 67 Ramps	11.2	B	0	53	11.4	B	0	21
	Intersection	0.0	A			0.0	A		
Route 158 & Hawkeye	EB Route 160	0.0	A	0	0	0.0	A	0	0
	WB Route 160	0.9	A	0	0	0.4	A	0	0
	NB Hawkeye	6.4	A	0	32	#DIV/0!	#DIV/0!	0	0
	Intersection	0.0	A			0.0	A		
Route 158 & CR 343	EB Route 158	0.5	A	0	0	0.5	A	0	0
	WB Route 158	0.7	A	0	0	0.7	A	0	0
	NB CR 343	#DIV/0!	#DIV/0!	0	0	#DIV/0!	#DIV/0!	0	0
	SB CR 343	#DIV/0!	#DIV/0!	0	0	#DIV/0!	#DIV/0!	0	0
	Intersection	0.0	A			0.0	A		
US Route 67 & Route C / CR 323	NB Route 67	0.0	A	0	0	0.0	A	0	0
	SB Route 67	1.2	A	0	0	1.3	A	0	0
	EB Route C	#DIV/0!	#DIV/0!	0	0	#DIV/0!	#DIV/0!	0	0
	WB CR 323	#DIV/0!	#DIV/0!	0	0	#DIV/0!	#DIV/0!	0	0
	Intersection	0.0	A			0.0	A		
US Route 67 & CR 360	NB Route 67	0.0	A	0	0	0.0	A	0	0
	SB Route 67	0.1	A	0	0	0.1	A	0	2
	EB CR 360	#DIV/0!	#DIV/0!	0	0	#DIV/0!	#DIV/0!	0	0
	WB CR 360	#DIV/0!	#DIV/0!	0	0	#DIV/0!	#DIV/0!	0	0
	Intersection	0.0	A			0.0	A		
US Route 67 & CR 338	NB Route 67	1.2	A	0	2	1.2	A	0	0
	SB Route 67	1.0	A	0	0	1.4	A	0	2
	EB CR 338	3.0	A	0	10	1.6	A	0	4
	WB CR 338	0.2	A	0	0	#DIV/0!	#DIV/0!	0	0
	Intersection	0.0	A			0.0	A		

ALT 1 - DIAMOND - INTERSECTION RESULTS

		2022 AM				2022 PM			
		Delay (sec) - LOS		Avg Queue	Max Queue	Delay (sec) - LOS		Avg Queue	Max Queue
Route 160 & Route C / V	NB Route V	14.2	B	2	82	24.6	C	7	104
	SB Route C	12.0	B	3	54	18.0	C	8	91
	EB Route 160	0.7	A	0	83	0.9	A	0	66
	WB Route 160	1.1	A	0	77	0.9	A	1	91
	Intersection	2.3	A			4.6	A		
Route 160 & SB Ramps	EB Route 160	0.8	A	0	0	0.2	A	0	0
	WB Route 160	0.6	A	0	22	0.7	A	0	13
	SB US 67 Ramps	8.4	A	6	132	21.0	C	56	388
	Intersection	2.1	A			9.9	A		
Route 160 & NB Ramps	EB Route 160	3.5	A	1	109	2.3	A	0	34
	WB Route 160	-0.2	#N/A	0	0	-0.1	#N/A	0	0
	NB US 67 Ramps	20.0	C	3	101	11.9	B	4	99
	Intersection	4.1	A			3.3	A		
Route 158 & Hawkeye	EB Route 160	0.0	#N/A	0	0	0.0	#N/A	0	0
	WB Route 160	0.7	A	0	0	0.2	A	0	0
	NB Hawkeye	6.1	A	0	31	6.0	A	0	19
	Intersection	0.5	A			0.2	A		
Route 158 & CR 343	EB Route 158	0.5	A	0	0	0.4	A	0	0
	WB Route 158	0.7	A	0	0	0.7	A	0	0
	NB CR 343	5.4	A	0	58	4.5	A	0	14
	SB CR 343	5.6	A	0	57	5.4	A	0	24
	Intersection	1.0	A			0.6	A		
US Route 67 & Route C / CR 323	NB Route 67	0.1	A	0	42	0.1	A	0	35
	SB Route 67	1.9	A	6	227	1.6	A	3	157
	EB Route C	22.5	C	10	159	35.1	E	15	153
	WB CR 323	12.1	B	2	64	13.0	B	1	40
	Intersection	3.5	A			3.6	A		

ALT 1 - DIAMOND - INTERSECTION RESULTS

		2042 AM				2042 PM			
		Delay (sec) - LOS		Avg Queue	Max Queue	Delay (sec) - LOS		Avg Queue	Max Queue
Route 160 & Route C / V	NB Route V	32.6	D	11	151	78.7	F	40	206
	SB Route C	20.8	C	6	76	45.1	E	29	145
	EB Route 160	0.8	A	0	68	1.3	A	1	98
	WB Route 160	1.7	A	1	94	1.3	A	1	126
	Intersection	4.2	A			12.3	B		
Route 160 & SB Ramps	EB Route 160	1.1	A	0	0	0.3	A	0	0
	WB Route 160	1.0	A	0	34	0.9	A	0	21
	SB US 67 Ramps	11.3	B	12	187	69.1	F	347	837
	Intersection	2.8	A			30.7	D		
Route 160 & NB Ramps	EB Route 160	4.7	A	3	230	2.8	A	1	81
	WB Route 160	-0.2	#N/A	0	0	-0.1	#N/A	0	0
	NB US 67 Ramps	32.3	D	8	121	16.7	C	8	139
	Intersection	5.8	A			4.4	A		
Route 158 & Hawkeye	EB Route 160	0.0	A	0	0	0.0	#N/A	0	0
	WB Route 160	0.8	A	0	0	0.2	A	0	0
	NB Hawkeye	6.8	A	0	31	6.1	A	0	19
	Intersection	0.6	A			0.2	A		
Route 158 & CR 343	EB Route 158	0.5	A	0	0	0.5	A	0	11
	WB Route 158	0.7	A	0	2	0.6	A	0	0
	NB CR 343	5.6	A	0	58	4.4	A	0	14
	SB CR 343	6.0	A	0	63	5.4	A	0	24
	Intersection	1.1	A			0.6	A		
US Route 67 & Route C / CR 323	NB Route 67	0.2	A	0	43	0.1	A	1	64
	SB Route 67	2.4	A	78	376	1.8	A	65	342
	EB Route C	60.5	F	59	314	102.0	F	71	289
	WB CR 323	19.4	C	6	118	17.1	C	2	73
	Intersection	8.0	A			8.4	A		

ALT 1 - DIAMOND - INTERSECTION RESULTS

		2042 AM-FREEWAY				2042 PM - FREEWAY			
		Delay (sec) - LOS		Avg Queue	Max Queue	Delay (sec) - LOS		Avg Queue	Max Queue
Route 160 & Route C / V	NB Route V	33.9	D	11	141	52.9	F	24	168
	SB Route C	644.0	F	511	590	594.7	F	501	585
	EB Route 160	1.0	A	1	120	1.6	A	1	102
	WB Route 160	4.3	A	5	170	3.2	A	6	185
	Intersection	65.0	F			68.7	F		
Route 160 & SB Ramps	EB Route 160	1.5	A	1	47	0.3	A	0	0
	WB Route 160	1.7	A	1	33	1.0	A	0	38
	SB US 67 Ramps	87.9	F	207	684	127.3	F	1567	1714
	Intersection	18.4	C			51.0	F		
Route 160 & NB Ramps	EB Route 160	9.1	A	33	469	3.4	A	2	114
	WB Route 160	-0.1	#N/A	0	0	0.0	#N/A	0	0
	NB US 67 Ramps	40.5	E	18	180	24.0	C	14	150
	Intersection	9.8	A			5.4	A		
Route 158 & Hawkeye	EB Route 160	0.1	A	0	0	0.0	A	0	0
	WB Route 160	1.7	A	0	0	0.8	A	0	0
	NB Hawkeye	6.7	A	0	31	6.4	A	0	19
	Intersection	1.0	A			0.5	A		
Route 158 & CR 343	EB Route 158	0.6	A	0	0	0.6	A	0	0
	WB Route 158	0.8	A	0	0	0.7	A	0	0
	NB CR 343	6.1	A	0	58	4.4	A	0	14
	SB CR 343	0.7	A	0	0	0.6	A	0	0
	Intersection	0.8	A			0.7	A		
US Route 67 & Route C / CR 323	NB Route 67	0.0	A	0	0	0.0	A	0	0
	SB Route 67	0.0	A	0	0	0.0	A	0	0
	EB Route C	#DIV/0!	#DIV/0!	0	0	#DIV/0!	#DIV/0!	0	0
	WB CR 323	#DIV/0!	#DIV/0!	0	0	#DIV/0!	#DIV/0!	0	0
	Intersection	0.0	A			0.0	A		

ALT 1 - DIAMOND Improved - INTERSECTION RESULTS

		2042 AM-FREEWAY				2042 PM - FREEWAY			
		Delay (sec) - LOS		Avg Queue	Max Queue	Delay (sec) - LOS		Avg Queue	Max Queue
Route 160 & Route C / V	NB Route V	18.8	B	5	102	19.9	B	7	132
	SB Route C	36.5	D	50	295	30.1	C	36	211
	EB Route 160	14.3	B	55	583	12.5	B	20	292
	WB Route 160	14.5	B	21	331	17.0	B	78	696
	Intersection	18.6	B			18.2	B		
Route 160 & SB Ramps	EB Route 160	9.1	A	31	529	15.6	B	39	410
	WB Route 160	8.5	A	3	108	18.5	B	14	219
	SB US 67 Ramps	24.5	C	36	373	14.7	B	47	571
	Intersection	11.9	B			15.6	B		
Route 160 & NB Ramps	EB Route 160	20.5	C	102	721	14.9	B	32	348
	WB Route 160	13.4	B	14	201	9.7	A	8	171
	NB US 67 Ramps	29.7	C	13	160	21.8	C	12	169
	Intersection	20.1	C			14.7	B		
Route 158 & Hawkeye	EB Route 160	0.2	A	0	0	0.2	A	0	0
	WB Route 160	5.6	A	1	83	2.1	A	0	8
	NB Hawkeye	14.9	B	0	31	6.2	A	0	19
	Intersection	3.2	A			1.2	A		
Route 158 & CR 343	EB Route 158	0.8	A	0	2	0.7	A	0	0
	WB Route 158	0.8	A	0	5	0.7	A	0	2
	NB CR 343	5.9	A	0	58	4.4	A	0	14
	SB CR 343	0.7	A	0	0	0.6	A	0	0
	Intersection	0.9	A			0.7	A		
US Route 67 & Route C / CR 323	NB Route 67	0.0	A	0	0	0.0	A	0	0
	SB Route 67	0.0	A	0	0	0.0	A	0	0
	EB Route C	#DIV/0!	#DIV/0!	0	0	#DIV/0!	#DIV/0!	0	0
	WB CR 323	#DIV/0!	#DIV/0!	0	0	#DIV/0!	#DIV/0!	0	0
	Intersection	0.0	A			0.0	A		

ALT 2 - FOLDED -
INTERSECTION RESULTS

		2022 AM				2022 PM			
		Delay (sec) - LOS		Avg Queue	Max Queue	Delay (sec) - LOS		Avg Queue	Max Queue
Route 160 & Route C / V	NB Route V	14.4	B	2	82	30.8	D	10	130
	SB Route C	11.3	B	2	52	17.1	C	7	91
	EB Route 160	0.6	A	0	58	1.0	A	0	66
	WB Route 160	1.0	A	0	80	0.9	A	1	81
	Intersection	2.3	A			4.9	A		
Route 160 & SB Ramps	EB Route 160	0.7	A	0	0	0.2	A	0	0
	WB Route 160	0.6	A	0	22	0.7	A	0	11
	SB US 67 Ramps	8.6	A	7	138	21.2	C	55	388
	Intersection	2.1	A			10.1	B		
Route 160 & NB Ramps	EB Route 160	4.4	A	1	77	0.2	A	0	19
	WB Route 160	0.9	A	0	9	0.6	A	0	0
	NB US 67 Ramps	3.5	A	0	40	3.5	A	1	69
	Intersection	1.3	A			1.0	A		
Route 158 & Hawkeye	EB Route 160	0.0	#N/A	0	40	-0.1	#N/A	0	44
	WB Route 160	0.5	A	0	0	0.2	A	0	0
	NB Hawkeye	2.8	A	0	25	0.5	A	0	4
	Intersection	0.3	A			0.0	A		
Route 158 & CR 343	EB Route 158	0.5	A	0	0	0.4	A	0	0
	WB Route 158	0.7	A	0	0	0.7	A	0	0
	NB CR 343	5.3	A	0	58	4.5	A	0	14
	SB CR 343	5.7	A	0	57	6.5	A	0	24
	Intersection	1.0	A			0.6	A		
US Route 67 & Route C / CR 323	NB Route 67	0.2	A	0	53	0.1	A	0	33
	SB Route 67	1.8	A	6	217	1.6	A	4	161
	EB Route C	22.4	C	11	166	34.3	D	14	153
	WB CR 323	11.0	B	1	66	12.5	B	1	38
	Intersection	3.4	A			3.5	A		

ALT 2 - FOLDED -
INTERSECTION RESULTS

		2042 AM				2042 PM			
		Delay (sec) - LOS		Avg Queue	Max Queue	Delay (sec) - LOS		Avg Queue	Max Queue
Route 160 & Route C / V	NB Route V	31.2	D	10	146	94.9	**F**	52	232
	SB Route C	20.9	C	6	75	46.7	E	31	151
	EB Route 160	0.8	A	0	92	1.4	A	1	110
	WB Route 160	1.5	A	1	99	1.1	A	1	106
	Intersection	4.1	A			13.8	B		
Route 160 & SB Ramps	EB Route 160	1.0	A	0	0	0.3	A	0	0
	WB Route 160	1.0	A	0	34	1.0	A	0	23
	SB US 67 Ramps	11.7	B	12	203	67.6	**F**	338	822
	Intersection	2.7	A			30.0	D		
Route 160 & NB Ramps	EB Route 160	10.5	B	4	90	0.4	A	0	37
	WB Route 160	1.2	A	0	26	0.7	A	0	0
	NB US 67 Ramps	14.6	B	4	109	4.9	A	2	94
	Intersection	2.7	A			1.3	A		
Route 158 & Hawkeye	EB Route 160	0.0	#N/A	0	21	-0.1	#N/A	0	79
	WB Route 160	1.2	A	0	8	0.2	A	0	0
	NB Hawkeye	2.5	A	0	23	0.3	A	0	2
	Intersection	0.6	A			0.1	A		
Route 158 & CR 343	EB Route 158	0.5	A	0	0	0.5	A	0	0
	WB Route 158	0.7	A	0	4	0.7	A	0	2
	NB CR 343	5.6	A	0	58	4.4	A	0	14
	SB CR 343	5.8	A	0	63	5.5	A	0	24
	Intersection	1.1	A			0.6	A		
US Route 67 & Route C / CR 323	NB Route 67	0.2	A	0	53	0.1	A	1	52
	SB Route 67	2.3	A	63	377	1.8	A	72	336
	EB Route C	53.2	**F**	50	299	101.7	**F**	71	287
	WB CR 323	18.3	C	5	111	15.9	C	2	65
	Intersection	7.1	A			8.4	A		

ALT 2 - FOLDED -
INTERSECTION RESULTS

		2042 AM				2042 PM			
		Delay (sec) - LOS		Avg Queue	Max Queue	Delay (sec) - LOS		Avg Queue	Max Queue
Route 160 & Route C / V	NB Route V	32.6	D	22	171	52.5	F	25	168
	SB Route C	598.1	F	510	575	581.2	F	496	578
	EB Route 160	0.9	A	53	276	1.7	A	2	111
	WB Route 160	3.9	A	4	159	3.6	A	8	233
	Intersection	64.3	F			68.7	F		
Route 160 & SB Ramps	EB Route 160	1.0	A	46	119	0.2	A	0	0
	WB Route 160	1.4	A	0	36	1.1	A	0	40
	SB US 67 Ramps	59.1	F	160	613	124.8	F	1565	1713
	Intersection	12.7	B			50.2	F		
Route 160 & NB Ramps	EB Route 160	62.1	F	141	235	3.0	A	3	78
	WB Route 160	1.6	A	38	86	0.9	A	0	0
	NB US 67 Ramps	1710.8	F	907	1528	21.2	C	12	183
	Intersection	19.4	C			4.2	A		
Route 158 & Hawkeye	EB Route 160	0.2	A	15	67	0.0	#N/A	0	84
	WB Route 160	194.3	F	317	774	0.5	A	0	0
	NB Hawkeye	178.4	F	6	45	1.5	A	0	9
	Intersection	111.1	F			0.3	A		
Route 158 & CR 343	EB Route 158	0.5	A	0	0	0.6	A	0	0
	WB Route 158	0.8	A	0	0	0.7	A	0	0
	NB CR 343	6.0	A	0	58	4.5	A	0	14
	SB CR 343	0.7	A	0	0	0.6	A	0	0
	Intersection	0.8	A			0.7	A		
US Route 67 & Route C / CR 323	NB Route 67	0.0	A	0	0	0.0	A	0	0
	SB Route 67	0.0	A	0	0	0.0	A	0	0
	EB Route C	#DIV/0!	#DIV/0!	0	0	#DIV/0!	#DIV/0!	0	0
	WB CR 323	#DIV/0!	#DIV/0!	0	0	#DIV/0!	#DIV/0!	0	0
	Intersection	0.0	A			0.0	A		

ALT 2 - FOLDED Improved - INTERSECTION RESULTS

		2042 AM				2042 PM			
		Delay (sec) - LOS		Avg Queue	Max Queue	Delay (sec) - LOS		Avg Queue	Max Queue
Route 160 & Route C / V	NB Route V	17.5	B	5	96	17.8	B	6	124
	SB Route C	36.3	D	48	282	24.8	C	28	197
	EB Route 160	9.7	A	30	495	12.4	B	19	278
	WB Route 160	8.8	A	9	249	16.2	B	75	719
	Intersection	14.7	B			16.7	B		
Route 160 & SB Ramps	EB Route 160	8.7	A	31	594	6.3	A	10	225
	WB Route 160	11.5	B	5	114	7.3	A	4	114
	SB US 67 Ramps	14.3	B	20	269	23.5	C	113	771
	Intersection	10.0	B			14.7	B		
Route 160 & NB Ramps	EB Route 160	18.2	B	17	166	8.8	A	6	123
	WB Route 160	6.7	A	13	367	3.8	A	4	186
	NB US 67 Ramps	18.3	B	7	129	14.1	B	7	134
	Intersection	9.0	A			6.1	A		
Route 158 & Hawkeye	EB Route 160	0.4	A	0	93	0.3	A	0	78
	WB Route 160	3.7	A	1	55	1.4	A	0	16
	NB Hawkeye	7.9	A	0	26	1.7	A	0	9
	Intersection	2.2	A			0.9	A		
Route 158 & CR 343	EB Route 158	0.8	A	0	0	0.7	A	0	0
	WB Route 158	0.8	A	0	5	0.7	A	0	0
	NB CR 343	6.0	A	0	58	4.5	A	0	14
	SB CR 343	0.7	A	0	0	0.6	A	0	0
	Intersection	0.9	A			0.7	A		
US Route 67 & Route C / CR 323	NB Route 67	0.0	A	0	0	0.0	A	0	0
	SB Route 67	0.0	A	0	0	0.0	A	0	0
	EB Route C	#DIV/0!	#DIV/0!	0	0	#DIV/0!	#DIV/0!	0	0
	WB CR 323	#DIV/0!	#DIV/0!	0	0	#DIV/0!	#DIV/0!	0	0
	Intersection	0.0	A			0.0	A		

ALT 3 - ROUNDABOUTS - INTERSECTION RESULTS

		2022 AM				2022 PM			
		Delay (sec) - LOS		Avg Queue	Max Queue	Delay (sec) - LOS		Avg Queue	Max Queue
Route 160 & Route C / V	NB Route V	14.8	B	2	73	16.4	C	4	89
	SB Route C	10.9	B	2	54	14.3	B	5	80
	EB Route 160	0.6	A	0	66	1.1	A	1	79
	WB Route 160	1.2	A	0	65	1.3	A	1	94
	Intersection	2.3	A			3.8	A		
Route 160 & SB Ramps	EB Route 160	1.5	A	0	81	1.2	A	0	56
	WB Route 160	0.7	A	0	14	0.8	A	0	30
	SB US 67 Ramps	0.9	A	0	49	1.5	A	1	82
	Intersection	1.3	A			1.3	A		
Route 160 & NB Ramps	EB Route 160	1.6	A	0	29	1.2	A	0	20
	WB Route 160	2.8	A	0	67	1.5	A	0	62
	NB US 67 Ramps	5.4	A	1	80	2.6	A	1	70
	Intersection	1.9	A			1.4	A		
Route 158 & Hawkeye	EB Route 160	0.2	A	0	0	0.2	A	0	0
	WB Route 160	1.1	A	0	0	1.1	A	0	0
	NB Hawkeye	5.8	A	0	32	5.5	A	0	20
	Intersection	0.8	A			0.7	A		
Route 158 & CR 343	EB Route 158	0.4	A	0	0	0.4	A	0	0
	WB Route 158	0.7	A	0	0	0.7	A	0	0
	NB CR 343	5.3	A	0	58	4.4	A	0	14
	SB CR 343	5.9	A	0	57	5.6	A	0	24
	Intersection	1.0	A			0.6	A		
US Route 67 & Route C / CR 323	NB Route 67	0.1	A	0	39	0.1	A	0	36
	SB Route 67	1.8	A	7	224	1.6	A	4	147
	EB Route C	22.2	C	10	153	34.0	D	14	151
	WB CR 323	12.0	B	2	67	13.2	B	1	38
	Intersection	3.4	A			3.5	A		

ALT 3 - ROUNDABOUTS - INTERSECTION RESULTS

		2042 AM				2042 PM			
		Delay (sec) - LOS		Avg Queue	Max Queue	Delay (sec) - LOS		Avg Queue	Max Queue
Route 160 & Route C / V	NB Route V	27.4	D	9	130	32.2	D	13	146
	SB Route C	16.3	C	5	69	24.5	C	14	129
	EB Route 160	0.8	A	0	92	1.6	A	1	112
	WB Route 160	1.9	A	1	129	2.0	A	2	172
	Intersection	3.6	A			6.6	A		
Route 160 & SB Ramps	EB Route 160	2.0	A	1	145	1.4	A	0	69
	WB Route 160	0.9	A	0	40	0.9	A	0	32
	SB US 67 Ramps	1.1	A	0	69	2.1	A	1	128
	Intersection	1.8	A			1.6	A		
Route 160 & NB Ramps	EB Route 160	1.9	A	0	17	1.4	A	0	21
	WB Route 160	5.1	A	2	86	2.0	A	1	62
	NB US 67 Ramps	10.1	B	2	104	4.1	A	1	90
	Intersection	2.6	A			1.9	A		
Route 158 & Hawkeye	EB Route 160	0.2	A	0	0	0.2	A	0	8
	WB Route 160	1.3	A	0	0	1.1	A	0	0
	NB Hawkeye	6.6	A	0	32	5.7	A	0	20
	Intersection	0.9	A			0.7	A		
Route 158 & CR 343	EB Route 158	0.5	A	0	0	0.5	A	0	2
	WB Route 158	0.7	A	0	7	0.7	A	0	4
	NB CR 343	5.7	A	0	58	4.4	A	0	14
	SB CR 343	6.0	A	0	63	5.4	A	0	24
	Intersection	1.1	A			0.6	A		
US Route 67 & Route C / CR 323	NB Route 67	0.2	A	0	38	0.1	A	1	66
	SB Route 67	2.4	A	66	364	1.8	A	53	336
	EB Route C	53.2	**F**	48	276	96.3	**F**	66	282
	WB CR 323	19.9	C	6	111	16.9	C	2	64
	Intersection	7.2	A			8.0	A		

ALT 3 - ROUNDABOUTS - INTERSECTION RESULTS

		2042 AM				2042 PM			
		Delay (sec) - LOS		Avg Queue	Max Queue	Delay (sec) - LOS		Avg Queue	Max Queue
Route 160 & Route C / V	NB Route V	35.3	E	12	158	62.4	F	31	197
	SB Route C	587.0	F	514	591	600.5	F	505	587
	EB Route 160	1.0	A	0	100	3.1	A	4	163
	WB Route 160	4.8	A	6	199	8.0	A	35	738
	Intersection	65.8	F			64.6	F		
Route 160 & SB Ramps	EB Route 160	2.5	A	2	176	1.9	A	1	110
	WB Route 160	1.1	A	0	69	1.2	A	0	68
	SB US 67 Ramps	1.4	A	0	97	3.8	A	7	304
	Intersection	2.1	A			2.7	A		
Route 160 & NB Ramps	EB Route 160	2.0	A	0	28	1.5	A	0	51
	WB Route 160	6.9	A	8	144	2.7	A	2	132
	NB US 67 Ramps	15.6	C	7	155	5.1	A	2	117
	Intersection	3.7	A			2.3	A		
Route 158 & Hawkeye	EB Route 160	0.2	A	0	3	0.2	A	0	16
	WB Route 160	4.2	A	1	51	1.6	A	0	13
	NB Hawkeye	8.7	A	0	32	5.8	A	0	20
	Intersection	2.4	A			1.0	A		
Route 158 & CR 343	EB Route 158	0.5	A	0	0	0.6	A	0	0
	WB Route 158	0.7	A	0	0	0.7	A	0	0
	NB CR 343	6.6	A	0	25	6.3	A	0	14
	SB CR 343	#DIV/0!	#DIV/0!	0	0	#DIV/0!	#DIV/0!	0	0
	Intersection	0.7	A			0.7	A		
US Route 67 & Route C / CR 323	NB Route 67	0.0	A	0	0	0.0	A	0	0
	SB Route 67	1.2	A	0	0	1.2	A	0	0
	EB Route C	#DIV/0!	#DIV/0!	0	0	#DIV/0!	#DIV/0!	0	0
	WB CR 323	#DIV/0!	#DIV/0!	0	0	#DIV/0!	#DIV/0!	0	0
	Intersection	0.4	A			0.7	A		

ALT 3 - ROUNDABOUTS
Improved -
INTERSECTION RESULTS

		2042 AM				2042 PM			
		Delay (sec) - LOS		Avg Queue	Max Queue	Delay (sec) - LOS		Avg Queue	Max Queue
Route 160 & Route C / V	NB Route V	11.8	B	3	77	4.8	A	1	70
	SB Route C	3.3	A	1	132	8.9	A	8	167
	EB Route 160	7.2	A	25	549	4.0	A	4	169
	WB Route 160	9.0	A	15	299	10.5	B	55	734
	Intersection	7.1	A			8.2	A		
Route 160 & SB Ramps	EB Route 160	2.5	A	2	181	2.0	A	1	110
	WB Route 160	1.1	A	0	64	1.2	A	0	58
	SB US 67 Ramps	1.4	A	1	105	4.1	A	9	337
	Intersection	2.2	A			2.9	A		
Route 160 & NB Ramps	EB Route 160	2.3	A	0	91	1.7	A	0	51
	WB Route 160	9.2	A	14	183	3.3	A	3	130
	NB US 67 Ramps	20.2	C	9	158	7.3	A	4	119
	Intersection	4.4	A			2.7	A		
Route 158 & Hawkeye	EB Route 160	0.2	A	0	8	0.2	A	0	4
	WB Route 160	7.8	A	3	130	1.8	A	0	18
	NB Hawkeye	17.0	C	0	33	6.1	A	0	20
	Intersection	4.3	A			1.1	A		
Route 158 & CR 343	EB Route 158	0.5	A	0	0	0.6	A	0	0
	WB Route 158	0.7	A	0	0	0.7	A	0	0
	NB CR 343	6.6	A	0	25	6.2	A	0	14
	SB CR 343	#DIV/0!	#DIV/0!	0	0	#DIV/0!	#DIV/0!	0	0
	Intersection	0.7	A			0.7	A		
US Route 67 & Route C / CR 323	NB Route 67	0.0	A	0	0	0.0	A	0	0
	SB Route 67	0.0	A	0	0	0.0	A	0	0
	EB Route C	#DIV/0!	#DIV/0!	0	0	#DIV/0!	#DIV/0!	0	0
	WB CR 323	#DIV/0!	#DIV/0!	0	0	#DIV/0!	#DIV/0!	0	0
	Intersection	0.0	A			0.0	A		

Speed - No Build Alternative

	2020	2020	2022	2022	2042	2042	2042-Freeway	2042-Freeway
	AM	**AM**	**AM**	**PM**	**AM**	**PM**	**AM**	**PM**
SOUTHBOUND US 67								
North of Route C	*59.8*	*58.9*	*59.8*	*59.0*	*59.6*	*58.6*	*61.3*	*61.2*
Route C to Route 160 Off-Ramp	*63.9*	*63.8*	*63.9*	*63.8*	*63.9*	*63.7*	*63.9*	*16.4*
Route 160 Off to Route 160 On	*63.9*	*63.3*	*63.8*	*62.9*	*63.6*	*62.9*	*63.2*	*46.0*
Route 160 On to CR 360	*60.1*	*61.0*	*60.1*	*60.7*	*60.0*	*60.6*	*60.0*	*59.5*
CR 360 to CR 338	*58.4*	*58.2*	*58.3*	*58.2*	*58.3*	*58.1*	*58.3*	*57.9*
South of CR 338	*56.0*	*55.8*	*56.2*	*56.0*	*56.1*	*55.1*	*56.3*	*53.9*
TOTAL	***61.6***	***61.6***	***61.6***	***61.5***	***61.5***	***61.4***	***61.6***	***38.4***
NORTHBOUND US 67								
South of CR 338	*56.6*	*56.7*	*56.6*	*56.6*	*56.5*	*56.5*	*56.5*	*56.5*
CR 338 to CR 360	*58.5*	*58.6*	*58.5*	*58.6*	*58.4*	*58.4*	*58.4*	*58.4*
CR 360 to Route 160 Off	*59.3*	*59.2*	*59.3*	*59.2*	*59.2*	*59.1*	*59.2*	*59.1*
Route 160 Off to Route 160 On	*59.1*	*59.2*	*59.1*	*59.2*	*59.0*	*59.1*	*59.0*	*59.1*
Route 160 On to Route C	*63.2*	*63.5*	*63.1*	*63.5*	*63.1*	*63.5*	*63.0*	*63.4*
North of Route C	*59.1*	*59.3*	*59.2*	*59.2*	*58.9*	*59.2*	*64.2*	*64.3*
TOTAL	***61.0***	***61.2***	***61.0***	***61.2***	***60.9***	***61.1***	***61.1***	***61.3***

Density - No Build Alternative

	2020		2022		2042		2042-Freeway	
	AM	**AM**	**AM**	**PM**	**AM**	**PM**	**AM**	**PM**
SOUTHBOUND US 67								
North of Route C	*2.3-A*	*5.1-A*	*2.3-A*	*5.1-A*	*2.9-A*	*6.3-A*	*2.6-A*	*5.5-A*
Route C to Route 160 Off-Ramp	*2.5-A*	*5.6-A*	*2.6-A*	*5.7-A*	*3.2-A*	*6.9-A*	*3.1-A*	*6.6-A*
Route 160 Off to Route 160 On	*2.1-A*	*4.4-A*	*2.2-A*	*4.5-A*	*2.7-A*	*5.4-A*	*3.2-A*	*26.7-D*
Route 160 On to CR 360	*3.6-A*	*4.2-A*	*3.7-A*	*4.6-A*	*4.5-A*	*5.7-A*	*4.4-A*	*4.5-A*
CR 360 to CR 338	*3.3-A*	*3.8-A*	*3.3-A*	*4.2-A*	*4.1-A*	*5.1-A*	*4-A*	*4.1-A*
South of CR 338	*3.7-A*	*4.4-A*	*3.8-A*	*4.8-A*	*4.6-A*	*5.9-A*	*4.5-A*	*4.7-A*
TOTAL	***2.6-A***	***4.4-A***	***2.6-A***	***4.5-A***	***3.2-A***	***5.5-A***	***3.5-A***	***18.1-C***
NORTHBOUND US 67								
South of CR 338	*3.9-A*	*4.1-A*	*4.1-A*	*4.3-A*	*5.6-A*	*5.8-A*	*5.6-A*	*5.8-A*
CR 338 to CR 360	*3.9-A*	*4-A*	*4-A*	*4.1-A*	*5.4-A*	*5.7-A*	*5.4-A*	*5.7-A*
CR 360 to Route 160 Off	*3.5-A*	*3.6-A*	*3.6-A*	*3.7-A*	*4.9-A*	*5.1-A*	*4.9-A*	*5.1-A*
Route 160 Off to Route 160 On	*3.4-A*	*3.1-A*	*3.5-A*	*3.2-A*	*4.7-A*	*4.3-A*	*4.3-A*	*4.2-A*
Route 160 On to Route C	*4.9-A*	*3-A*	*5.1-A*	*3-A*	*6.9-A*	*4.1-A*	*7.7-A*	*4.5-A*
North of Route C	*6.3-A*	*4-A*	*6.5-A*	*4-A*	*8.9-A*	*5.4-A*	*7.7-A*	*4.6-A*
TOTAL	***4.6-A***	***3.3-A***	***4.8-A***	***3.3-A***	***6.5-A***	***4.5-A***	***7-A***	***4.8-A***

Speed - ALT 1 -Diamond

	2022		2042		2042-Freeway	
	AM	**PM**	**AM**	**PM**	**AM**	**PM**
SOUTHBOUND US 67						
North of Route C	*59.8*	*59.0*	*59.7*	*58.6*	*64.4*	*64.4*
Route C to Route 160 Off-Ramp	*63.9*	*63.8*	*63.9*	*63.8*	*64.3*	*19.3*
Route 160 Off to Route 160 On	*64.3*	*64.4*	*64.3*	*64.4*	*64.3*	*55.4*
Route 160 to CR 338	*63.6*	*63.7*	*63.6*	*63.7*	*63.6*	*63.4*
South of CR 338	*58.0*	*57.9*	*57.9*	*57.6*	*58.1*	*57.7*
TOTAL	***63.4***	***63.3***	***63.3***	***63.2***	***63.8***	***43.1***
NORTHBOUND US 67						
South of CR 338	*59.9*	*59.9*	*59.8*	*59.8*	*59.8*	*59.8*
CR 338 to Route 160 Off	*63.7*	*63.7*	*63.6*	*63.6*	*63.6*	*63.6*
Route 160 Off to Route 160 On	*63.4*	*63.4*	*63.1*	*63.0*	*63.1*	*63.1*
Route 160 On to Route C	*63.9*	*64.2*	*63.9*	*64.1*	*63.9*	*64.1*
North of Route C	*59.3*	*59.4*	*59.1*	*59.3*	*64.2*	*64.3*
TOTAL	***63.2***	***63.3***	***63.1***	***63.2***	***63.4***	***63.4***

Density - ALT 1 -Diamond

	2022		2042		2042-Freeway	
	AM	**PM**	**AM**	**PM**	**AM**	**PM**
SOUTHBOUND US 67						
North of Route C	*2.6-A*	*5.7-A*	*3.2-A*	*6.9-A*	*3.1-A*	*6.7-A*
Route C to Route 160 Off-Ramp	*2.1-A*	*4.4-A*	*2.6-A*	*5.3-A*	*3.1-A*	*29.3-D*
Route 160 Off to Route 160 On	*1.2-A*	*2-A*	*1.5-A*	*2.4-A*	*1.5-A*	*2-A*
Route 160 to CR 338	*1.7-A*	*2.1-A*	*2-A*	*2.6-A*	*2-A*	*1.9-A*
South of CR 338	*3.8-A*	*4.8-A*	*4.7-A*	*5.9-A*	*4.6-A*	*4.4-A*
TOTAL	***1.9-A***	***3.4-A***	***2.4-A***	***4.1-A***	***2.6-A***	***14.6-B***
NORTHBOUND US 67						
South of CR 338	*3.9-A*	*4.1-A*	*5.4-A*	*5.6-A*	*5.4-A*	*5.6-A*
CR 338 to Route 160 Off	*1.8-A*	*1.9-A*	*2.5-A*	*2.6-A*	*2.5-A*	*2.6-A*
Route 160 Off to Route 160 On	*1.6-A*	*1.5-A*	*2.2-A*	*2-A*	*2-A*	*2-A*
Route 160 On to Route C	*4.8-A*	*2.9-A*	*6.6-A*	*3.9-A*	*7.5-A*	*4.4-A*
North of Route C	*6.5-A*	*4-A*	*8.9-A*	*5.4-A*	*7.7-A*	*4.6-A*
TOTAL	***3.5-A***	***2.5-A***	***4.8-A***	***3.4-A***	***5.2-A***	***3.6-A***

Speed - ALT 1 - DIAMOND IMPROVED

	2042-Freeway	
	AM	**PM**
SOUTHBOUND US 67		
North of Route C	*64.4*	*64.4*
Route C to Route 160 Off-Ramp	*64.3*	*64.2*
Route 160 Off to Route 160 On	*64.3*	*64.3*
Route 160 to CR 338	*63.6*	*63.7*
South of CR 338	*58.1*	*57.6*
TOTAL	***63.8***	***63.7***
NORTHBOUND US 67		
South of CR 338	*59.8*	*59.8*
CR 338 to Route 160 Off	*63.6*	*63.6*
Route 160 Off to Route 160 On	*63.1*	*63.1*
Route 160 On to Route C	*63.8*	*64.0*
North of Route C	*64.1*	*64.2*
TOTAL	***63.3***	***63.4***

Density - ALT 1 - DIAMOND IMPROVED

	2042-Freeway	
	AM	**PM**
SOUTHBOUND US 67		
North of Route C	*3.1-A*	*6.7-A*
Route C to Route 160 Off-Ramp	*3.1-A*	*6.6-A*
Route 160 Off to Route 160 On	*1.5-A*	*2.3-A*
Route 160 to CR 338	*2-A*	*2.6-A*
South of CR 338	*4.7-A*	*5.9-A*
TOTAL	***2.6-A***	***4.7-A***
NORTHBOUND US 67		
South of CR 338	*5.4-A*	*5.6-A*
CR 338 to Route 160 Off	*2.5-A*	*2.6-A*
Route 160 Off to Route 160 On	*2-A*	*2-A*
Route 160 On to Route C	*8-A*	*4.8-A*
North of Route C	*8.3-A*	*5-A*
TOTAL	***5.5-A***	***3.8-A***

Speed - ALT 2 - FOLDED

	2022		2042		2042-Freeway	
	AM	**PM**	**AM**	**PM**	**AM**	**PM**
SOUTHBOUND US 67						
North of Route C	*59.8*	*59.0*	*59.7*	*58.6*	*64.4*	*64.4*
Route C to Route 160 Off-Ramp	*63.9*	*63.8*	*63.9*	*63.8*	*64.0*	*19.6*
Route 160 Off to Route 160 On	*64.3*	*64.4*	*64.3*	*64.4*	*64.2*	*55.5*
Route 160 to CR 338	*63.6*	*63.7*	*63.6*	*63.7*	*63.6*	*63.4*
South of CR 338	*58.0*	*57.9*	*57.9*	*57.6*	*58.1*	*57.6*
TOTAL	***63.4***	***63.3***	***63.4***	***63.2***	***63.6***	***43.3***
NORTHBOUND US 67						
South of CR 338	*59.9*	*59.9*	*59.8*	*59.8*	*59.8*	*59.8*
CR 338 to Route 160 Off	*63.7*	*63.7*	*63.6*	*63.6*	*63.3*	*63.6*
Route 160 Off to Route 160 On	*63.4*	*63.4*	*63.1*	*63.0*	*63.1*	*63.0*
Route 160 On to Route C	*63.6*	*63.9*	*63.6*	*63.8*	*63.5*	*63.8*
North of Route C	*59.3*	*59.3*	*59.1*	*59.3*	*64.2*	*64.3*
TOTAL	***63.1***	***63.3***	***63.0***	***63.1***	***63.1***	***63.3***

Density - ALT 2 - FOLDED

	2022		2042		2042-Freeway	
	AM	**PM**	**AM**	**PM**	**AM**	**PM**
SOUTHBOUND US 67						
North of Route C	*2.6-A*	*5.7-A*	*3.2-A*	*6.9-A*	*3.1-A*	*6.7-A*
Route C to Route 160 Off-Ramp	*2.1-A*	*4.4-A*	*2.6-A*	*5.3-A*	*3.2-A*	*29.1-D*
Route 160 Off to Route 160 On	*1.2-A*	*2-A*	*1.5-A*	*2.4-A*	*1.5-A*	*2-A*
Route 160 to CR 338	*1.7-A*	*2.1-A*	*2-A*	*2.6-A*	*2-A*	*2-A*
South of CR 338	*3.8-A*	*4.8-A*	*4.7-A*	*5.9-A*	*4.5-A*	*4.5-A*
TOTAL	***1.9-A***	***3.4-A***	***2.4-A***	***4.1-A***	***2.6-A***	***14.5-B***
NORTHBOUND US 67						
South of CR 338	*3.9-A*	*4.1-A*	*5.4-A*	*5.6-A*	*5.4-A*	*5.6-A*
CR 338 to Route 160 Off	*1.8-A*	*1.9-A*	*2.5-A*	*2.6-A*	*2.5-A*	*2.6-A*
Route 160 Off to Route 160 On	*1.6-A*	*1.5-A*	*2.2-A*	*2-A*	*2-A*	*2-A*
Route 160 On to Route C	*4.8-A*	*2.9-A*	*6.5-A*	*3.9-A*	*7.1-A*	*4.4-A*
North of Route C	*6.5-A*	*4-A*	*8.9-A*	*5.4-A*	*7.5-A*	*4.6-A*
TOTAL	***3.7-A***	***2.6-A***	***5-A***	***3.5-A***	***5.3-A***	***3.7-A***

Speed - ALT 2 - FOLDED IMPROVED

	2042-Freeway	
	AM	**PM**
SOUTHBOUND US 67		
North of Route C	*64.4*	*64.4*
Route C to Route 160 Off-Ramp	*64.3*	*64.2*
Route 160 Off to Route 160 On	*64.3*	*64.3*
Route 160 to CR 338	*63.6*	*63.7*
South of CR 338	*58.1*	*57.7*
TOTAL	***63.8***	***63.7***
NORTHBOUND US 67		
South of CR 338	*59.8*	*59.8*
CR 338 to Route 160 Off	*63.6*	*63.6*
Route 160 Off to Route 160 On	*63.1*	*63.0*
Route 160 On to Route C	*63.5*	*63.7*
North of Route C	*64.1*	*64.2*
TOTAL	***63.2***	***63.3***

Density - ALT 2 - FOLDED IMPROVED

	2042-Freeway	
	AM	**PM**
SOUTHBOUND US 67		
North of Route C	*3.1-A*	*6.7-A*
Route C to Route 160 Off-Ramp	*3.1-A*	*6.6-A*
Route 160 Off to Route 160 On	*1.5-A*	*2.3-A*
Route 160 to CR 338	*2-A*	*2.6-A*
South of CR 338	*4.7-A*	*5.9-A*
TOTAL	***2.6-A***	***4.7-A***
NORTHBOUND US 67		
South of CR 338	*5.4-A*	*5.6-A*
CR 338 to Route 160 Off	*2.5-A*	*2.6-A*
Route 160 Off to Route 160 On	*2-A*	*2-A*
Route 160 On to Route C	*7.9-A*	*4.8-A*
North of Route C	*8.3-A*	*5-A*
TOTAL	***5.7-A***	***3.9-A***

Speed - ALT 3 - ROUNDABOUT

	2022		2042		2042-Freeway	
	AM	PM	AM	PM	AM	PM
SOUTHBOUND US 67						
North of Route C	*59.8*	*59.0*	*59.7*	*58.6*	*61.3*	*61.2*
Route C to Route 160 Off-Ramp	*63.9*	*63.8*	*63.9*	*63.8*	*63.9*	*63.8*
Route 160 Off to Route 160 On	*64.3*	*64.4*	*64.4*	*64.4*	*64.3*	*64.3*
Route 160 to CR 338	*63.6*	*63.7*	*63.6*	*63.7*	*63.6*	*63.6*
South of CR 338	*57.9*	*58.0*	*57.9*	*57.7*	*58.0*	*57.6*
TOTAL	***63.4***	***63.3***	***63.3***	***63.2***	***63.5***	***63.4***
NORTHBOUND US 67						
South of CR 338	*59.9*	*59.9*	*59.8*	*59.8*	*59.8*	*59.8*
CR 338 to Route 160 Off	*63.7*	*63.7*	*63.6*	*63.6*	*63.6*	*63.6*
Route 160 Off to Route 160 On	*63.4*	*63.4*	*63.1*	*63.0*	*63.1*	*63.1*
Route 160 On to Route C	*63.9*	*64.1*	*63.9*	*64.1*	*63.9*	*64.1*
North of Route C	*59.3*	*59.4*	*59.1*	*59.3*	*64.4*	*64.4*
TOTAL	***63.2***	***63.3***	***63.1***	***63.2***	***63.3***	***63.4***

Density - ALT 3 - ROUNDABOUT

	2022		2042		2042-Freeway	
	AM	**PM**	**AM**	**PM**	**AM**	**PM**
SOUTHBOUND US 67						
North of Route C	*2.6-A*	*5.7-A*	*3.2-A*	*6.9-A*	*3.3-A*	*7.2-A*
Route C to Route 160 Off-Ramp	*2.1-A*	*4.4-A*	*2.6-A*	*5.3-A*	*3.1-A*	*6.7-A*
Route 160 Off to Route 160 On	*1.2-A*	*2-A*	*1.5-A*	*2.4-A*	*1.5-A*	*2.3-A*
Route 160 to CR 338	*1.7-A*	*2.1-A*	*2-A*	*2.6-A*	*2-A*	*2.5-A*
South of CR 338	*3.8-A*	*4.8-A*	*4.7-A*	*5.9-A*	*4.6-A*	*5.8-A*
TOTAL	***1.9-A***	***3.4-A***	***2.4-A***	***4.1-A***	***2.6-A***	***4.7-A***
NORTHBOUND US 67						
South of CR 338	*3.9-A*	*4.1-A*	*5.4-A*	*5.6-A*	*5.4-A*	*5.6-A*
CR 338 to Route 160 Off	*1.8-A*	*1.9-A*	*2.5-A*	*2.6-A*	*2.5-A*	*2.6-A*
Route 160 Off to Route 160 On	*1.6-A*	*1.5-A*	*2.2-A*	*2-A*	*2-A*	*2-A*
Route 160 On to Route C	*4.8-A*	*2.9-A*	*6.6-A*	*4-A*	*7.5-A*	*4.5-A*
North of Route C	*6.5-A*	*4-A*	*8.9-A*	*5.4-A*	*7.8-A*	*4.6-A*
TOTAL	***3.5-A***	***2.5-A***	***4.8-A***	***3.5-A***	***5.2-A***	***3.7-A***

Speed - ALT 3 - ROUNDABOUT-Improved

	2042-Freeway	
	AM	**PM**
SOUTHBOUND US 67		
North of Route C	*64.4*	*64.5*
Route C to Route 160 Off-Ramp	*64.3*	*64.2*
Route 160 Off to Route 160 On	*64.3*	*64.3*
Route 160 to CR 338	*63.6*	*63.7*
South of CR 338	*58.1*	*57.7*
TOTAL	***63.8***	***63.7***
NORTHBOUND US 67		
South of CR 338	*59.8*	*59.8*
CR 338 to Route 160 Off	*63.6*	*63.6*
Route 160 Off to Route 160 On	*63.1*	*63.1*
Route 160 On to Route C	*63.8*	*64.0*
North of Route C	*64.2*	*64.3*
TOTAL	***63.3***	***63.4***

Density - ALT 3 - ROUNDABOUT-Improved

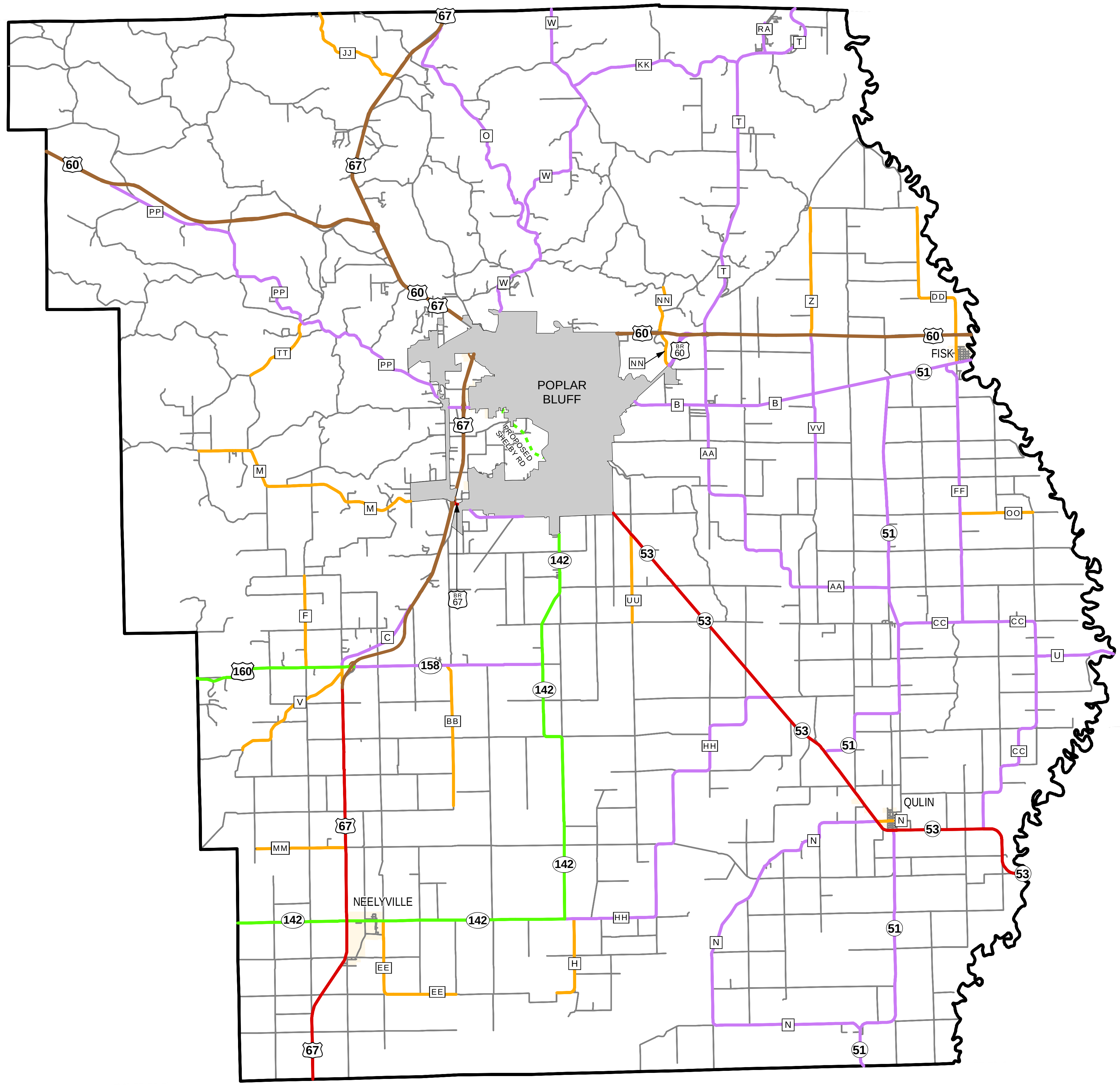
	2042-Freeway	
	AM	**PM**
SOUTHBOUND US 67		
North of Route C	*3.1-A*	*6.7-A*
Route C to Route 160 Off-Ramp	*3.1-A*	*6.6-A*
Route 160 Off to Route 160 On	*1.5-A*	*2.3-A*
Route 160 to CR 338	*2-A*	*2.6-A*
South of CR 338	*4.7-A*	*5.9-A*
TOTAL	***2.6-A***	***4.7-A***
NORTHBOUND US 67		
South of CR 338	*5.4-A*	*5.6-A*
CR 338 to Route 160 Off	*2.5-A*	*2.6-A*
Route 160 Off to Route 160 On	*2-A*	*2-A*
Route 160 On to Route C	*8-A*	*4.8-A*
North of Route C	*8.3-A*	*5-A*
TOTAL	***5.5-A***	***3.8-A***

Appendix F

Rural Functional Classification

BUTLER COUNTY

Missouri



FUNCTIONAL CLASS

- Interstate
- Other Freeway and Expressway
- Other Principal Arterial
- Minor Arterial
- Major Collector
- Minor Collector
- Local

- CITY
- URBAN AREA

Federal-Aid highways exclude local roads and rural minor collectors.

Transportation Planning

105 W. Capitol Ave.
Jefferson City, MO 65102
Phone (573) 526-5478
Fax (573) 526-8052

Approved December 18, 2015

J9P3663 - Roadway Design Criteria Table	US-67	West Outer Road	East Outer Road	US-160 / MO-158	County Roads 338 and 360	Ramp 1 (NB On-Ramp)	Ramp 2 (SB Off-Ramp)	Ramp 3 (NB Off-Ramp)	Ramp 4 (SB On-Ramp)
Functional Classification	Other Freeway and Expressway / Principal Arterial (Present) Interstate (Future)	Minor Collector			Local	Ramp			
Typical Section	D-61F(2) Interstate	D-64F Minor Rural Roadway			D-66F Low Volume Local Roadway	D-50H(2) Diamond / Directional Ramp			
AADT (2042 Design Year) (vpd)	15,500 (North of Interchange)* 7,100 (South of Interchange)*	500	350	11,600	< 100	8,000	5,900	900	750
Design Speed	70 mph	55 mph			55 mph	50 mph			

* Volumes assume Closure of Route C intersection with US67 near Cane Creek and diversion of traffic south to US160 interchange

MISSOURI DEPARTMENT OF TRANSPORTATION
PAY ITEMS AND UNIT COSTS

PROJECT: Route 67, Butler County, Widening and Realignement of US-67 from US-160 to County Road 338
MODOT PROJECT NO. J9P3663

CONCEPTUAL ENGINEER'S OPINION OF PROBABLE COST - DECEMBER 9, 2020

SECTION	**ROADWAY ITEMS**				G2 Option 1 Roundabout Interchange	Baseline Option 2 Diamond Interchange	G1 Option 3 Parclo Interchange	Widening		G2 Option 1 Roundabout Interchange	Baseline Option 2 Diamond Interchange	G1 Option 3 Parclo Interchange	Widening	
	Item Number	**Description**	**Unit**	**Accuracy**	**Quantity**	**Quantity**	**Quantity**	**Quantity**	**Unit Price**	**Amount**	**Amount**	**Amount**	**Amount**	**Remarks**
1	2035000	UNCLASSIFIED EXCAVATION	(CUYD)	1.00	23,184	23,184	30,591	152,265	$ 9.00	$ 208,656.00	$ 208,656.00	$ 275,319.00	$ 1,370,385.00	
1	2035500	EMBANKMENT IN PLACE	(CUYD)	1.00	811	811	0	24,170	$ 20.00	$ 16,220.00	$ 16,220.00	$ -	$ 483,400.00	
1	2036000	COMPACTING EMBANKMENT	(CUYD)	1.00	19,706	19,706	26,003	129,425	$ 4.00	$ 78,824.00	$ 78,824.00	$ 104,012.00	$ 517,700.00	
4	2063000	CLASS 3 EXCAVATION	(CUYD)	1.00	1,038	1,038	1,260	3,300	$ 20.00	$ 20,760.00	$ 20,760.00	$ 25,200.00	$ 66,000.00	
2	3040506	TYPE 5 AGGREGATE FOR BASE (6 IN. THICK)	(SQYD)	1.00	31,865	31,865	38,569	119,155	$ 11.00	$ 350,515.00	$ 350,515.00	$ 424,259.00	$ 1,310,705.00	includes geogrid
2	2051010	MODIFIED SUBGRADE	(SQYD)	1.00	31,865	31,865	38,569	119,155	3.50		$ 111,527.50	$ 134,991.50	$ 417,042.50	
2	5021332	CONCRETE PAVEMENT (8 1/2 IN. NON-REINFORCED, 15 FT. JOINTS)	(SQYD)	0.10	5,657.0	5,657.0	6,903.0	0.0	$ 42.00	$ 237,594.00	$ 237,594.00	$ 289,926.00	$ -	MO-158
2	5021333	CONCRETE PAVEMENT (9 1/2 IN. NON-REINFORCED, 15 FT. JOINTS)	(SQYD)	0.10	14,366.7	14,366.7	14,777.0	59,663.1	$ 42.00	$ 603,401.40	$ 603,401.40	$ 620,634.00	$ 2,505,850.20	mainline & ramp pavement
2	5021307	CONCRETE PAVEMENT (7 IN. NON-REINFORCED, 15 FT. JOINTS)	(SQYD)	0.10	3,867.1	3,867.1	4,914.0	28,119.8	$ 42.00	$ 162,418.20	$ 162,418.20	$ 206,388.00	$ 1,181,031.60	Outer Roads
2	5029905(1)	8 IN. TRUCK APRON (PIGMENTED & TEXTURED)	(SQYD)	0.10	678.6	0.0	0.0	0.0	$ 80.00	$ 54,288.00	$ -	$ -	$ -	
2	5021340	TYPE A2 SHOULDER	(SQYD)	0.10	6,654.5	6,654.5	11,334.0	30,797.9	$ 35.00	$ 232,907.50	$ 232,907.50	$ 396,690.00	$ 1,077,926.50	
11	6061040	GUARDRAIL TYPE D	(LF)	1.00	0	0	0	150	$ 25.00	$ -	$ -	$ -	$ 3,750.00	where county roads tee into outer roads
11	6061060	MGS GUARDRAIL	(LF)	1.00	437	437	637	5,032	$ 25.00	$ 10,925.00	$ 10,925.00	$ 15,925.00	$ 125,800.00	
11	6061080	MGS END ANCHOR	(EA)	1.00	0	0	0	1	$ 1,100.00	$ -	$ -	$ -	$ 1,100.00	
11	6063014	TYPE A CRASHWORTHY END TERMINAL (MASH)	(EA)	1.00	2	2	4	3	$ 2,000.00	$ 4,000.00	$ 4,000.00	$ 8,000.00	$ 6,000.00	
11	6063019	TYPE E CRASHWORTHY END TERMINAL	(EA)	1.00	0	0	0	1	$ 3,000.00	$ -	$ -	$ -	$ 3,000.00	south end of concrete median
3	6083006	6 IN. CONCRETE MEDIAN STRIP	(SQYD)	0.10	585.3	200.0	200.0	0.0	$ 65.00	$ 38,044.50	$ 13,000.00	$ 13,000.00	$ -	
2	6085008	PAVED APPROACH, 8 IN.	(SQYD)	0.10	641.4	641.4	641.4	573.7	$ 70.00	$ 44,898.00	$ 44,898.00	$ 44,898.00	$ 40,159.00	driveways
3	6091052	CURB AND GUTTER TYPE B	(LF)	1.00	4,063	4,063	3,663	0	$ 35.00	$ 142,205.00	$ 142,205.00	$ 128,205.00	$ -	curbs along MO158, stand in for all curbs
3	6091041	CONCRETE GUTTER TYPE A	(LF)	1.00	300	300	300	0	$ 65.00	$ 19,500.00	$ 19,500.00	$ 19,500.00	$ -	
4	6141120	CURVED VANE GRATE AND FRAME (2 FT. X 2 FT. OR 600MM X 600MM)	(EA)	1.00	8	8	12	5	$ 450.00	$ 3,600.00	$ 3,600.00	$ 5,400.00	$ 2,250.00	
3	6173000	CONCRETE TRAFFIC BARRIER, TYPE C	(LF)	1.00	388	388	1,055	1,250	$ 80.00	$ 31,040.00	$ 31,040.00	$ 84,400.00	$ 100,000.00	
10	6181020	ADDITIONAL MOBILIZATION FOR SEEDING	(EA)	1.00	5	5	5	10	$ 600.00	$ 3,000.00	$ 3,000.00	$ 3,000.00	$ 6,000.00	
4	6143010	MANHOLE FRAME AND COVER, TYPE 1-A	(EA)	1.00	0	0	0	1	$ 600.00	$ -	$ -	$ -	$ 600.00	
10	8051000A	SEEDING - COOL SEASON MIXTURES	(ACRE)	0.10	15.0	15.0	16.0	21.5	$ 2,200.00	$ 33,000.00	$ 33,000.00	$ 35,200.00	$ 47,300.00	
4	7261018	18 IN. PIPE GROUP A	(LF)	1.00	370	370	570	1,125	$ 60.00	$ 22,200.00	$ 22,200.00	$ 34,200.00	$ 67,500.00	
4	7261024	24 IN. PIPE GROUP A	(LF)	1.00	121	121	121	972	$ 66.00	$ 7,986.00	$ 7,986.00	$ 7,986.00	$ 64,152.00	
4	7261030	30 IN. PIPE GROUP A	(LF)	1.00	40	40	40	801	$ 85.00	$ 3,400.00	$ 3,400.00		$ 68,085.00	
4	7261048	48 IN. PIPE GROUP A	(LF)	1.00	0	0	0	72	$ 120.00	$ -	$ -		$ 8,640.00	
4	7261054	54 IN. PIPE GROUP A	(LF)	1.00	88	88	88	0	$ 150.00	$ 13,200.00	$ 13,200.00		$ -	
4	7261060	60 IN. PIPE GROUP A	(LF)	1.00	28	28	28	0	$ 200.00	$ 5,600.00	$ 5,600.00		$ -	
4	7261066	66 IN. PIPE GROUP A	(LF)	1.00	230	230	230	0	$ 225.00	$ 51,750.00	$ 51,750.00		$ -	
4	7261078	78 IN. PIPE GROUP A	(LF)	1.00	57	57	57	0	$ 300.00	$ 17,100.00	$ 17,100.00		$ -	
4	7320618a	18 IN. OR ALLOWED SUBSTITUTE GROUP A FLARED END SECTION	(EA)	1.00	12	12	16	7	$ 1,000.00	$ 12,000.00	$ 12,000.00		$ 7,000.00	
4	7320624a	24 IN. OR ALLOWED SUBSTITUTE GROUP A FLARED END SECTION	(EA)	1.00	2	2	2	38	$ 1,500.00	$ 3,000.00	$ 3,000.00		$ 57,000.00	
4	7320630a	30 IN. OR ALLOWED SUBSTITUTE GROUP A FLARED END SECTION	(EA)	1.00	3	2	2	20	$ 1,500.00	$ 4,500.00	$ 3,000.00		$ 30,000.00	
4	7320648a	48 IN. OR ALLOWED SUBSTITUTE GROUP A FLARED END SECTION	(EA)	1.00	4	4	4	3	$ 2,600.00	$ 10,400.00	$ 10,400.00		$ 7,800.00	includes safety slope end sections (typ.)
4	7320654a	54 IN. OR ALLOWED SUBSTITUTE GROUP A FLARED END SECTION	(EA)	1.00	3	3	3	0	$ 2,800.00	$ 8,400.00	$ 8,400.00		$ -	
4	7320660a	60 IN. OR ALLOWED SUBSTITUTE GROUP A FLARED END SECTION	(EA)	1.00	2	2	2	0	$ 3,000.00	$ 6,000.00	$ 6,000.00		$ -	
4	7320666a	66 IN. OR ALLOWED SUBSTITUTE GROUP A FLARED END SECTION	(EA)	1.00	4	4	4	0	$ 3,200.00	$ 12,800.00	$ 12,800.00		$ -	
4	7320678a	78 IN. OR ALLOWED SUBSTITUTE GROUP A FLARED END SECTION	(EA)	1.00	2	2	2	0	$ 3,500.00	$ 7,000.00	$ 7,000.00		$ -	
4	7310072	PRECAST CONCRETE MANHOLE - 72 IN.	(FT)	1.00	0	0	0	8	$ 800.00	$ -	$ -		$ 6,400.00	
4	7311022	PRECAST CONCRETE DROP INLET 2 FT X 2 FT	(FT)	1.00	8	8	24	23	$ 450.00	$ 3,600.00	$ 3,600.00		$ 10,350.00	assume 4.5' deep
12	7269903(4)	DOUBLE 10' x 5' BOX CULVERT	(LF)	1.00	0	0	0	130	$ 1,500.00	$ -	$ -		$ 195,000.00	CR338 over Epps Ditch
12	7039904(1)	EXISTING US67 BRIDGE WIDENING	(SF)	1.00	0	0	1	0	$ 180.00	$ -	$ -	$ 180.00	$ -	
7	6205902A	6 IN. WHITE HIGH BUILD WATERBORNE PAVEMENT MARKING PAINT, TYPE L BEADS	(LF)	1.00	47,110	45,110	49,660	89,958	$ 0.50	$ 23,555.00	$ 22,555.00	$ 24,830.00	$ 44,979.00	stand in for all types of pavement markings
2	6262000A	PORTLAND CEMENT CONCRETE SHOULDER RUMBLE STRIP	(STA)	0.10	156.4	156.4	156.4	425.2	$ 3,000.00	$ 469,200.00	$ 469,200.00	$ 469,200.00	$ 1,275,600.00	
	SUBTOTAL									**$ 2,977,487.60**	**$ 3,007,182.60**	**$ 3,371,343.50**	**$ 11,108,505.80**	

LUMP SUM ITEMS

	Item Number	Description	Unit	Accuracy	Quantity (G2 Option 1 Roundabout Interchange)	Quantity (Baseline Option 2 Diamond Interchange)	Quantity (G1 Option 3 Parclo Interchange)	Quantity (Widening)	Unit Price	Amount (G2 Option 1 Roundabout Interchange)	Amount (Baseline Option 2 Diamond Interchange)	Amount (G1 Parclo Interchange)	Amount (Widening)	Remarks
18	2022010	REMOVAL OF IMPROVEMENTS	(LS)	1.00	$ 415,000.00	$ 414,300.00	$ 476,980.00	$ 196,500.00	1	$ 415,000.00	$ 414,300.00	$ 476,980.00	$ 196,500.00	
13	6169901(1)	TEMPORARY TRAFFIC CONTROL	(LS)	1.00	$ 238,625.00	$ 235,900.00	$ 235,900.00	$ 15,460.00	1	$ 238,625.00	$ 235,900.00	$ 235,900.00	$ 15,460.00	
14	6181000	MOBILIZATION	(LS)	1.00	$ 148,874.38	$ 150,359.13	$ 168,567.18	$ 555,425.29	1	$ 148,874.00	$ 150,359.00	$ 168,567.00	$ 555,425.00	5% of Subtotal
14	6274000	CONTRACTOR FURNISHED SURVEYING AND STAKING	(LS)	1.00	$ 29,774.88	$ 30,071.83	$ 33,713.44	$ 111,085.06	1	$ 29,775.00	$ 30,072.00	$ 33,713.00	$ 111,085.00	1% of Subtotal
8	9039901(1)	SIGNING	(LS)	1.00	$ 50,024.00	$ 50,024.00	$ 50,024.00	$ 7,056.00	1	$ 50,024.00	$ 50,024.00	$ 50,024.00	$ 7,056.00	
10	8069901(1)	EROSION CONTROL	(LS)	1.00	$ 48,444.00	$ 48,444.00	$ 48,844.00	$ 99,139.24	1	$ 48,444.00	$ 48,444.00	$ 48,844.00	$ 99,139.00	
6	9019901(3)	LIGHTING	(LS)	1.00	$ 150,230.00	$ 99,610.00	$ 99,610.00	$ -	1	$ 150,230.00	$ 99,610.00	$ 99,610.00	$ -	
5	9029901(2)	TRAFFIC SIGNAL	(LS)	1.00	$ -	$ 157,520.00	$ 157,520.00	$ -	1	$ -	$ 157,520.00	$ 157,520.00	$ -	

	G2 Option 1 Roundabout Interchange	Baseline Option 2 Diamond Interchange	G1 Parclo Interchange	Widening
SUBTOTAL	**$ 665,972.00**	**$ 771,929.00**	**$ 794,178.00**	**$ 788,165.00**
SUBTOTAL	**$ 4,058,459.60**	**$ 4,193,411.60**	**$ 4,642,501.50**	**$ 12,093,170.80**

MISCELLANEOUS ITEMS

	Item Number	Description	Unit	Accuracy	Quantity	Quantity	Quantity	Quantity	Unit Price	Amount	Amount	Amount	Amount	Remarks
15	1099901(1)	CONTINGENCY	(LS)	1.00	$ 405,845.96	$ 419,341.16	$ 464,250.15	$ 1,209,317.08	$ 1.00	$ 405,846.00	$ 419,341.00	$ 464,250.00	$ 1,209,317.00	10% of Subtotal
17	1099901(2)	UTILITY RELOCATIONS	(LS)	1.00	$ -	$ -	$ 177,600.00	$ 1,005,360.00	1	$ -	$ -	$ 177,600.00	$ 1,005,360.00	
16		RIGHT OF WAY ACQUISITION	(AC)	0.01	1.01	1.01	1.53	50.17	$ 7,040.00	$ 7,110.40	$ 7,110.40	$ 10,771.20	$ 353,196.80	

TOTAL CONSTRUCTION COST	**$ 4,471,416.00**	**$ 4,619,863.00**	**$ 5,295,122.70**	**$ 14,661,044.60**

ITEMS INCLUDED IN CONTINGENCY

Item Number	Description
6097000	ROCK LINING
2013000	CLEARING AND GRUBBING
2063500	CULVERT CLEANOUT
6044011	PIPE COLLAR, TYPE A
6054020	OUTLET PIPES AND SPLASH PADS
6053030A	PIPE AGGREGATE PAVEMENT EDGE DRAIN
6096020	FURNISHING TYPE 2 ROCK DITCH LINER
6096042	PLACING TYPE 2 ROCK DITCH LINER
6113020	FURNISHING TYPE 2 ROCK BLANKET
6113040	PLACING TYPE 2 ROCK BLANKET
6161008	ADVANCED WARNING RAIL SYSTEM
6161009	FLAG ASSEMBLY
6161040	FLASHING ARROW PANEL
6191000	PAVEMENT EDGE TREATMENT
8061001	SEDIMENT BASIN EXCAVATION
8061002	SEDIMENT BASIN ROCK
8061003	SEDIMENT TRAP EXCAVATION
8061004	SEDIMENT TRAP ROCK
6123000A	TRUCK OR TRAILER MOUNTED ATTENUATOR (TMA)
	PIPE REMOVALS
	UPDATES / ADDITIONS TO ITS NETWORK

		Interchange	Widening	Total
Option 1	**Roundabout Interchange**	**$ 4,470,000**	**$ 14,660,000**	**$ 19,130,000**
Option 2	**Diamond Interchange**	**$ 4,620,000**	**$ 14,660,000**	**$ 19,280,000**
Option 3	**Parclo Interchange**	**$ 5,300,000**	**$ 14,660,000**	**$ 19,960,000**

LIGHTING LUMP SUM BACKUP

Item Number	Description	Unit	Accuracy	G2 Option 1 Roundabout Interchange Quantity	Baseline Option 2 Diamond Interchange Quantity	G1 Option 3 Parclo Interchange Quantity	Widening Quantity	Unit Price	G2 Option 1 Roundabout Interchange Amount	Baseline Option 2 Diamond Interchange Amount	G1 Parclo Interchange Amount	Widening Amount	Remarks
9011064	LIGHTING POLE, 45 FT. OR 13.5 M, TYPE AT DESIGN 3	(EA)	1.00	12	6	6	0	$ 3,500.00	$ 42,000.00	$ 21,000.00	$ 21,000.00	$ -	
9018610	POWER SUPPLY ASSEMBLY, TYPE 1, 240/120 VOLT SERVICE, LIGHTING ONLY	(EA)	1.00	2	0	0	0	$ 2,000.00	$ 4,000.00	$ -	$ -	$ -	
9012230	BASE MOUNTED CONTROL STATION 240 VOLT - 4 CIRCUIT	(EA)	1.00	2	1	1	0	$ 6,000.00	$ 12,000.00	$ 6,000.00	$ 6,000.00	$ -	
9018245	POLE FOUNDATION (45 FT. OR 13.5 M MOUNTING HEIGHT)	(EA)	1.00	12	6	6	0	$ 1,100.00	$ 13,200.00	$ 6,600.00	$ 6,600.00	$ -	
9011115	BRACKET ARM, 15 FT. OR 4.6 M	(EA)	1.00	12	6	6	0	$ 750.00	$ 9,000.00	$ 4,500.00	$ 4,500.00	$ -	
9017110	CABLE, 10 AWG 1 CONDUCTOR, POLE AND BRACKET	(LF)	10.00	720	360	360	0	$ 1.00	$ 720.00	$ 360.00	$ 360.00	$ -	
9017407	CABLE-CONDUIT, 1 IN., 2 CONDUCTORS AND 1 BARE NEUTRAL, 8 AWG	(LF)	10.00	7,570	7,570	7,570	0	$ 3.00	$ 22,710.00	$ 22,710.00	$ 22,710.00	$ -	
9015010	TRENCHING TYPE I	(LF)	1.00	7,570	7,570	7,570	0	$ 4.00	$ 30,280.00	$ 30,280.00	$ 30,280.00	$ -	
9011312	LUMINAIRE, LED-B	(EA)	1.00	12	6	6	0	$ 610.00	$ 7,320.00	$ 3,660.00	$ 3,660.00	$ -	
9016110	PULL BOX, PREFORMED CLASS 1	(EA)	1.00	12	6	6	0	$ 750.00	$ 9,000.00	$ 4,500.00	$ 4,500.00	$ -	

SUBTOTAL $ **150,230.00** $ **99,610.00** $ **99,610.00** $ **-**

EROSION CONTROL LUMP SUM BACKUP

Item Number	Description	Unit	Accuracy	Quantity	Quantity	Quantity	Quantity	Unit Price	Amount	Amount	Amount	Amount	Remarks
8061005	ROCK DITCH CHECK	(LF)	1.00	810	810	810	2,490	$ 13.00	$ 10,530.00	$ 10,530.00	$ 10,530.00	$ 32,370.00	assume 15 LF/each
8061019	SILT FENCE	(LF)	1.00	10,050	10,050	10,050	19,328	$ 2.58	$ 25,929.00	$ 25,929.00	$ 25,929.00	$ 49,866.24	
8061007A	CURB INLET CHECK	(EACH)	1.00	10	10	10	0	$ 175.00	$ 1,750.00	$ 1,750.00	$ 1,750.00	$ -	
8061017	TEMPORARY SEEDING AND MULCHING	(ACRE)	0.10	3.8	3.8	4.0	5.4	$ 2,000.00	$ 7,600.00	$ 7,600.00	$ 8,000.00	$ 10,800.00	
8061016	SEDIMENT REMOVAL	(CUYD)	1.00	155	155	155	359	$ 17.00	$ 2,635.00	$ 2,635.00	$ 2,635.00	$ 6,103.00	

SUBTOTAL $ **48,444.00** $ **48,444.00** $ **48,844.00** $ **99,139.24**

TRAFFIC CONTROL LUMP SUM BACK UP

Item Number	Description	Unit	Accuracy	Quantity	Quantity	Quantity	Quantity	Unit Price	Amount	Amount	Amount	Amount	Remarks
6173700B	TEMPORARY TRAFFIC BARRIER ANCHORED, CONTRACTOR FURNISHED / RETAINED	(LF)	1.00	4,000	4,000	4,000	0	$ 30.00	$ 120,000.00	$ 120,000.00	$ 120,000.00	$ -	
6175011B	RELOCATING TEMPORARY TRAFFIC BARRIER ANCHORED	(LF)	1.00	4,000	4,000	4,000	0	$ 20.00	$ 80,000.00	$ 80,000.00	$ 80,000.00	$ -	
6161025	CHANNELIZER (TRIM LINE)	(EA)	1.00	250	200	200	200	$ 20.00	$ 5,000.00	$ 4,000.00	$ 4,000.00	$ 4,000.00	
6161030	TYPE III MOVEABLE BARRICADE	(EA)	1.00	5	4	4	8	$ 125.00	$ 625.00	$ 500.00	$ 500.00	$ 1,000.00	
6122019	IMPACT ATTENUATOR (19 SAND BARRELS)	(EA)	1.00	1	1	1	0	$ 4,000.00	$ 4,000.00	$ 4,000.00	$ 4,000.00	$ -	
6122020	REPLACEMENT SAND BARREL	(EA)	1.00	10	10	10	0	$ 350.00	$ 3,500.00	$ 3,500.00	$ 3,500.00	$ -	
6161005	CONSTRUCTION SIGNS	(SQFT)	1.00	800	600	600	320	$ 8.00	$ 6,400.00	$ 4,800.00	$ 4,800.00	$ 2,560.00	
6122030	IMPACT ATTENUATOR (RELOCATION)	(EA)	1.00	3	3	3	0	$ 1,100.00	$ 3,300.00	$ 3,300.00	$ 3,300.00	$ -	
6161033	DIRECTIONAL INDICATOR BARRICADE	(EA)	1.00	40	40	40	20	$ 45.00	$ 1,800.00	$ 1,800.00	$ 1,800.00	$ 900.00	
6161099	CHANGEABLE MESSAGE SIGN WITH COMMUNICATION INTERFACE, CONTRACTOR	(EA)	1.00	4	4	4	2	$ 3,500.00	$ 14,000.00	$ 14,000.00	$ 14,000.00	$ 7,000.00	

SUBTOTAL $ **238,625.00** $ **235,900.00** $ **235,900.00** $ **15,460.00**

SIGNING LUMP SUM BACK UP

Item Number	Description	Unit	Accuracy	G2 Option 1 Roundabout Interchange Quantity	Baseline Option 2 Diamond Interchange Quantity	G1 Option 3 Parclo Interchange Quantity	Widening Quantity	Unit Price	G2 Option 1 Roundabout Interchange Amount	Baseline Option 2 Diamond Interchange Amount	G1 Parclo Interchange Amount	Widening Amount	Remarks
9031270A	2 IN. PSST POST - 12 GA.	(LF)	1.00	992	992	992	128	$ 12.50	$ 12,400.00	$ 12,400.00	$ 12,400.00	$ 1,600.00	
9031271	POST ANCHOR FOR 2 IN. PSST - 12 GA.	(LF)	1.00	260	260	260	40	$ 50.00	$ 13,000.00	$ 13,000.00	$ 13,000.00	$ 2,000.00	
9035004A	SH-FLAT SHEET	(SQFT)	1.00	912	912	912	128	$ 27.00	$ 24,624.00	$ 24,624.00	$ 24,624.00	$ 3,456.00	

SUBTOTAL $ 50,024.00 $ 50,024.00 $ 50,024.00 $ 7,056.00

SIGNAL LUMP SUM BACK UP

Item Number	Description	Unit	Accuracy	Quantity	Quantity	Quantity	Quantity	Unit Price	Amount	Amount	Amount	Amount	Remarks
9020833	SH-FLAT SHEET - SIGNAL SIGN	(SF)	1.00		24	24		$ 35.00	$ -	$ 840.00	$ 840.00	$ -	
9020513	SIGNAL HEAD, TYPE 3B	(EA)	1.00		4	4		$ 800.00	$ -	$ 3,200.00	$ 3,200.00	$ -	
9020514	SIGNAL HEAD, TYPE 4B	(EA)	1.00		2	2		$ 900.00	$ -	$ 1,800.00	$ 1,800.00	$ -	
9020834	SIGNAL SIGN, MOUNTING HARDWARE	(EA)	1.00		2	2		$ 105.00	$ -	$ 210.00	$ 210.00	$ -	
9023230	POST, TYPE C, 30 FT. ARM OR 9.1 M ARM	(EA)	1.00		2	2		$ 7,000.00	$ -	$ 14,000.00	$ 14,000.00	$ -	
9023340	POST, TYPE B, LONGEST ARM 40 FT. OR 12.2 M	(EA)	1.00		2	2		$ 16,000.00	$ -	$ 32,000.00	$ 32,000.00	$ -	
9024281	CONTROLLER ASSEMBLY HOUSING, KEYBOARD ENTRY, 8 PHASE NEMA CONTROLLER	(EA)	1.00		1	1		$ 15,000.00	$ -	$ 15,000.00	$ 15,000.00	$ -	
9024975	VIDEO DETECTION SYSTEM	(EA)	1.00		2	2		$ 25,000.00	$ -	$ 50,000.00	$ 50,000.00	$ -	
9025300	CONDUIT, 3 IN., TRENCH WITH TRACER WIRE	(LF)	1.00		863	863		$ 15.00	$ -	$ 12,945.00	$ 12,945.00	$ -	stand in for all conduit
9018613	POWER SUPPLY ASSEMBLY, TYPE 2, 240/120 VOLT SERVICE, LIGHTING AND SIGNALS	(EA)	1.00		1	1		$ 7,500.00	$ -	$ 7,500.00	$ 7,500.00	$ -	
9028311	CABLE, 16 AWG 7 CONDUCTOR	(LF)	10.00		1,294	1,294		$ 2.50	$ -	$ 3,225.00	$ 3,225.00	$ -	
9028810	PULL BOX, PREFORMED CLASS 1	(EA)	1.00		6	6		$ 800.00	$ -	$ 4,800.00	$ 4,800.00	$ -	
9029100	BASE, CONCRETE	(CUYD)	0.10		12	12		$ 1,000.00	$ -	$ 12,000.00	$ 12,000.00	$ -	

SUBTOTAL $ - $ 157,520.00 $ 157,520.00 $ -

REMOVAL OF IMPROVEMENTS LUMP SUM BACK UP

Item Number	Description	Unit	Accuracy	Quantity	Quantity	Quantity	Quantity	Unit Price	Amount	Amount	Amount	Amount	Remarks
	INLETS	(EA)	1.00	15	15	15	0	$ 500.00	$ 7,500.00	$ 7,500.00	$ 7,500.00	$ -	
	PAVEMENT REMOVAL	(SY)	1.00	29,680	29,680	35,888	19,550	$ 10.00	$ 296,800.00	$ 296,800.00	$ 358,880.00	$ 195,500.00	
	SAWCUTS	(LF)	1.00	8,400	8,400	8,520	200	$ 5.00	$ 42,000.00	$ 42,000.00	$ 42,600.00	$ 1,000.00	
	BARRIER	(LF)	1.00	1,700	1,700	1,700	0	$ 40.00	$ 68,000.00	$ 68,000.00	$ 68,000.00	$ -	

SUBTOTAL $ 414,300.00 $ 414,300.00 $ 476,980.00 $ 196,500.00

UTILITY RELOCATIONS LUMP SUM BACK UP

Item Number	Description	Unit	Accuracy	Quantity	Quantity	Quantity	Quantity	Unit Price	Amount	Amount	Amount	Amount	Remarks
	PWSD 12" WATERMAIN	(LF)	1.00			663		$ 200.00	$ -	$ -	$ 132,600.00	$ -	
	ShoMe POWER - TRANSMISSION TOWER RELOCATION	(EA)	1.00				2	$ 80,000.00	$ -	$ -	$ -	$ 160,000.00	
	CELL TOWER	(EA)	1.00				1	$ 390,000.00	$ -	$ -	$ -	$ 390,000.00	Could be included in ROW negotiations
	OZARK BORDER ELECTRIC - POLE RELOCATION	(EA)	1.00			3	25	$ 15,000.00	$ -	$ -	$ 45,000.00	$ 375,000.00	
	WINDSTREAM FIBER RELOCATION	(LF)	1.00				9,800	$ 8.20	$ -	$ -	$ -	$ 80,360.00	includes other fiber/telephone running in the same corridor, may be non-reimbursable

SUBTOTAL $ - $ - $ 177,600.00 $ 1,005,360.00

Route 67 Design Hour Volumes Development Summary October 12, 2020

EXISTING TRAFFIC VOLUMES

Various traffic data sources were reviewed to determine the appropriate design hour volumes for the Route 67 and Route 160 interchange. The relevant traffic data includes:

> **2019 MoDOT Datazone ADT and Peak Hour Counts** - Existing segment traffic counts from 2019 were reviewed for roadway segments within the study area. The exact count location is unknown from the website.
>
> **2020 MoDOT Traffic Counts (Feb. 2020)** – Existing segment traffic counts from 2020 (Pre-COVID) were provided on Route 67 0.5 miles south of Route V for both northbound and southbound Route 67.
>
> **2020 Peak Hour Turning Movement Counts (Sept. 2020)** – AM and PM peak hour turning movement counts from 2020 (potentially COVID impacted) were collected at the following intersections:

- Route 160 & Route V/C
- Route 160 & SB Route 67 Ramps
- Route 160 & NB Route 67 Ramps
- Route 160 & CR 343
- Route 67 & Route C/CR 323

The turning movement counts that were collected were compared to the 2020 pre-COVID counts provided on Route 67 south of the interchange and the 2019 MoDOT Datazone counts. Comparison of the counts shows little reduction in the September 2020 traffic counts from the other sources, with the exception of a slight decrease in mainline Route 67 counts during the AM peak hour. To better replicate the other data sources an additional 24 southbound and 58 northbound trips were added to mainline Route 67 during the AM peak hour.

PROPOSED TRAFFIC VOLUMES

The 2020 traffic projections provided by MoDOT include an annual growth rate of 1.47% for northbound Route 67 and 0.96% for southbound Route 67. These growth percentages were applied to mainline through trips and any turning movement to/from these directions. For turning movements not accessing Route 67 (i.e., through trips on Route 160) the average annual growth rate of 1.22% was used.

2042 Build Scenario – When Route 67 is converted to a freeway, the existing at-grade crossing at Route C / CR 323 will be closed. Bases upon the EIS documents, the connection to Route 67 will be removed and all traffic will be diverted to the Route 160 interchange for access to Route 67. The diversion of these trips has been accounted for in the 2042 Build scenario.

Truck Percentages

Truck percentages were reviewed from the 2020 peak hour turning movement counts and are estimated as the following for the analysis:

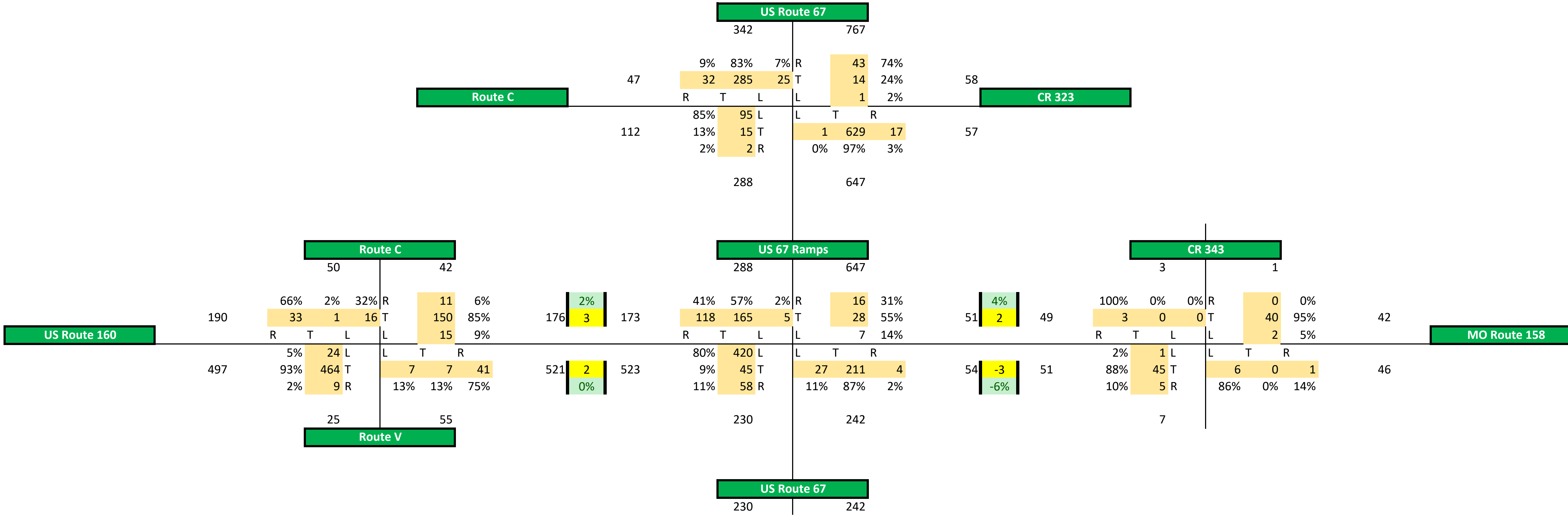
- US Route 67 Mainline = 15%
- US Route 160 = 5%
- Ramps (to/from north) = 5%
- Ramps (to/from south) = 10%
- Other Routes = 2%

Peak Hour Factor

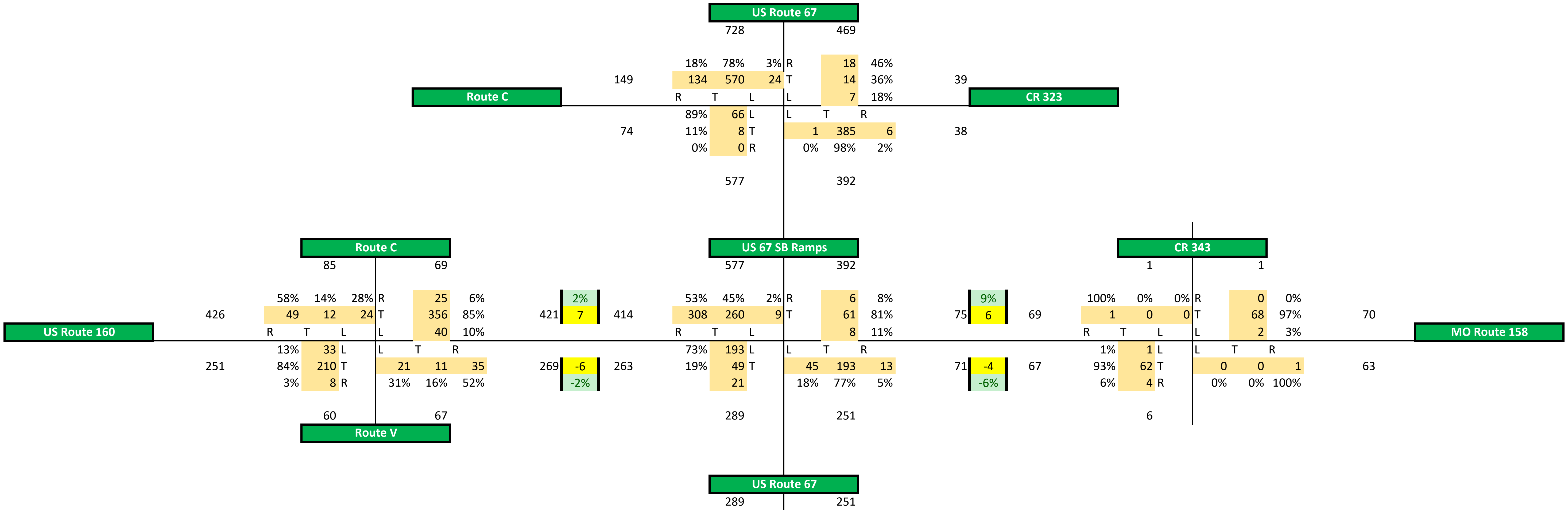
Existing peak hour factors were reviewed from the 2020 peak hour turning movement counts and are estimated as the following for the analysis:

- Route 67 Mainline
    - AM = 0.86
    - PM = 0.90
- Other Routes / Ramps
    - AM = 0.80
    - PM = 0.85

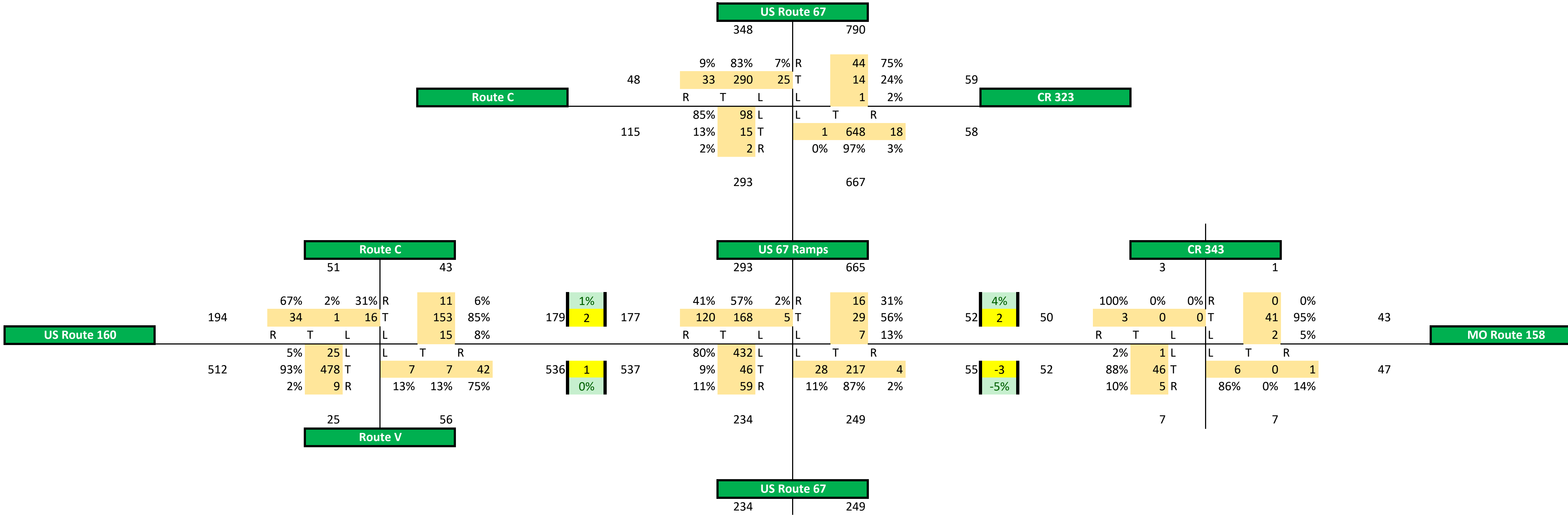
2020 AM Peak Hour Volumes



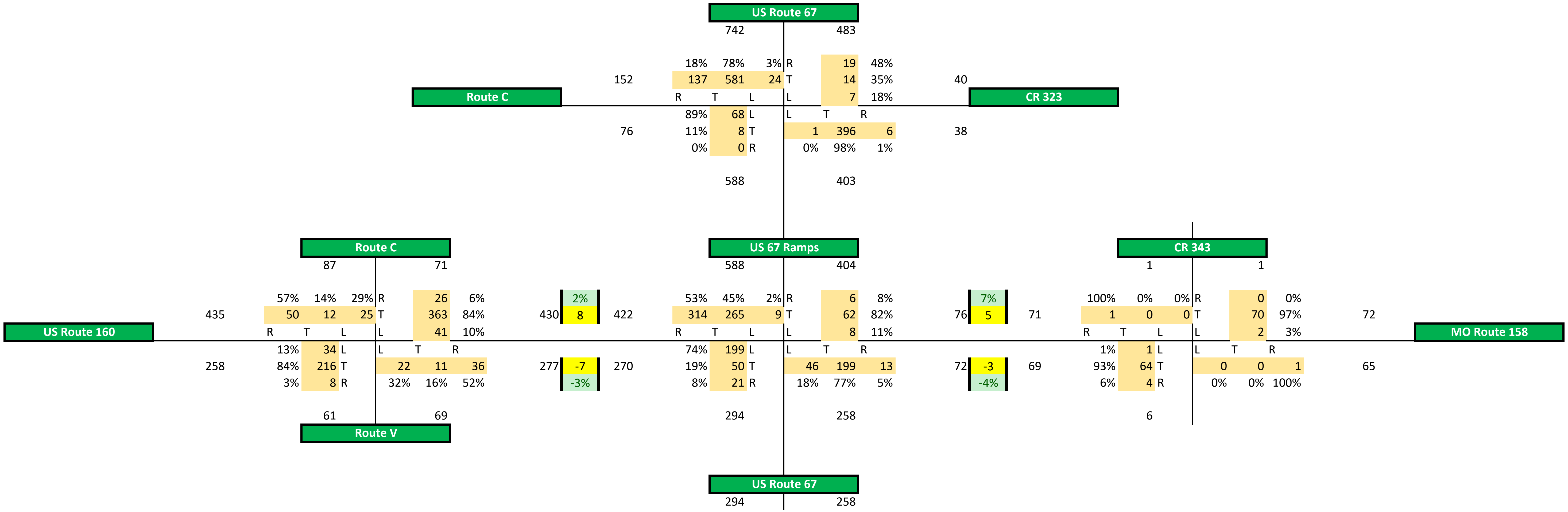
2020 PM Peak Hour Volumes



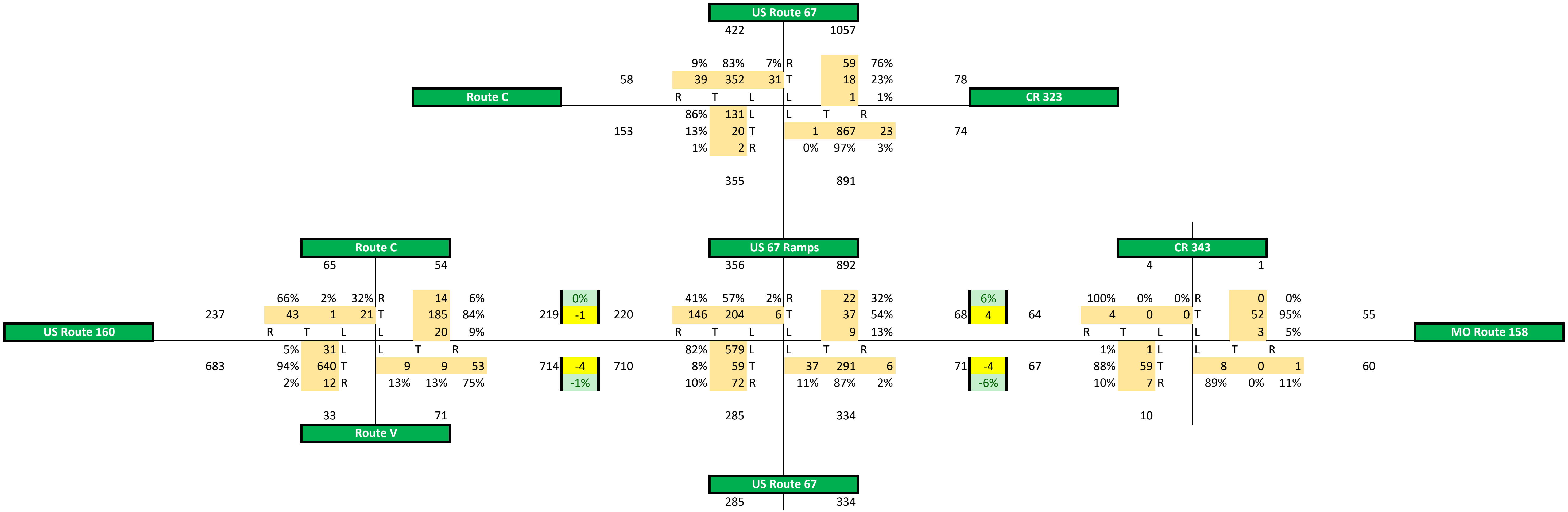
2022 AM Peak Hour Volumes



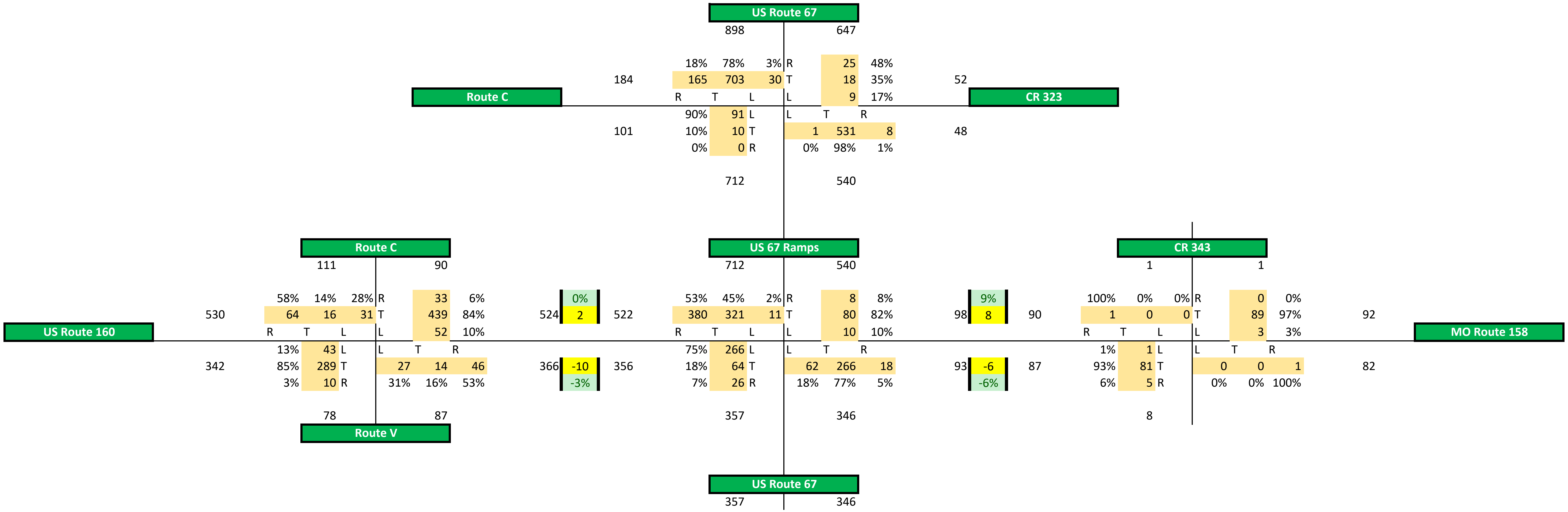
2022 PM Peak Hour Volumes



2042 AM Peak Hour Volumes

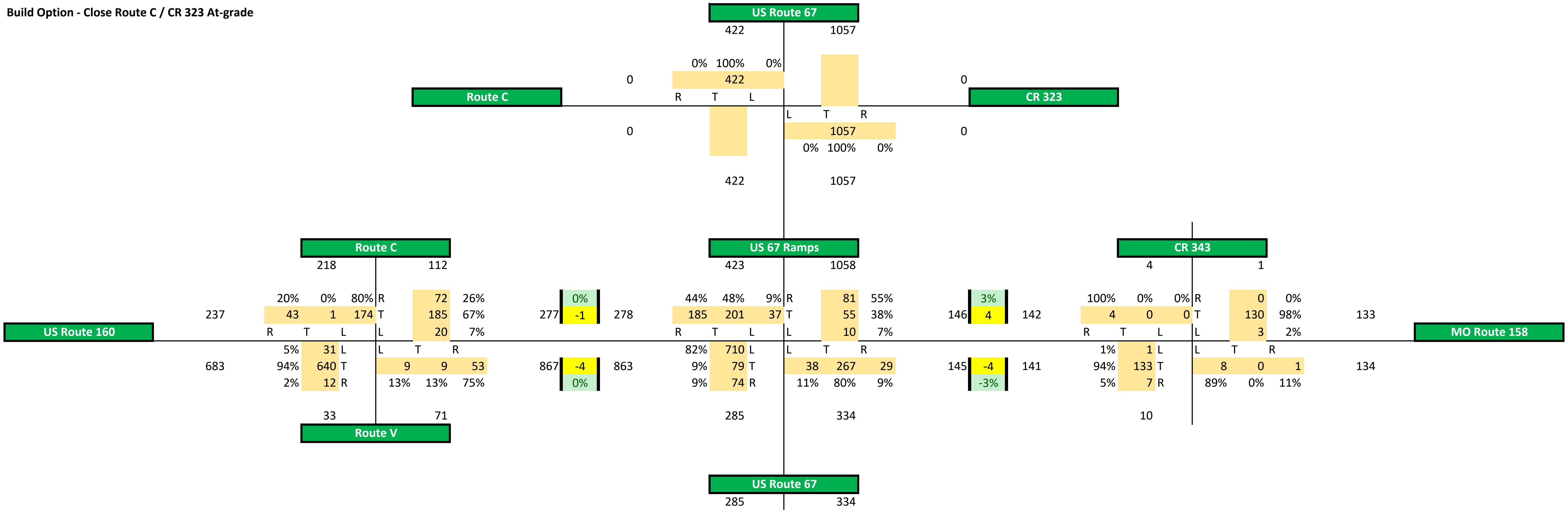


2042 PM Peak Hour Volumes



2042 AM Peak Hour Volumes

Build Option - Close Route C / CR 323 At-grade



2042 PM Peak Hour Volumes
Build Option - Close Route C / CR 323 At-grade