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Medina IR-71/IR-271 Planning Study (PID 117028)

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Final Report



Prepared by:



1 Preface

This Medina IR-71/IR-271 Planning Study was prepared in 2025 for:

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2 Executive Summary

The Ohio Department of Transportation (ODOT) engaged ADR & Associates, Ltd. to conduct a comprehensive study of the IR-71/IR-271 interchange and surrounding corridors in Medina County, Ohio. The study was performed due to inquiries from members of the public about the absence of ramps connecting IR-271 southbound to IR-71 northbound at the interchange. This critical transportation link was suspected to face challenges due to its partial configuration, which requires two traffic movements to utilize the adjacent SR-3 and SR-94 corridors. The study sought to address these issues by evaluating existing conditions, forecasting future demands, and proposing practical solutions to improve connectivity, safety, and operational efficiency.

The current interchange at IR-71 and IR-271 includes two direct ramps: northbound IR-71 to northbound IR-271 and southbound IR-271 to southbound IR-71. Two movements are not supported by the interchange, southbound IR-271 to northbound IR-71 and southbound IR-71 to northbound IR-271. As a result, traffic for these unsupported movements must travel along the SR-3 and SR-94 corridors, creating a 3.7-mile corridor in which freeway-to-freeway traffic must utilize state roads. As the area developed and traffic increased, some members of the public and public officials suspected that constructing the missing ramps at the IR-71/IR-271 interchange would reduce the congestion and safety concerns along the SR-94/SR-3 corridor. The public requested that ODOT perform a study of the SR-94/SR-3 corridor and the IR-71/IR-271 interchange. The study examined the impact of the IR-71/IR-271 interchange on the SR-94/SR-3 corridor in detail, focusing on system linkage, safety, and operational performance to determine the most effective strategies for improvement. During the study, congestion and safety concerns were found to be the result of inadequate infrastructure on the SR-94/SR-3 corridor, not traffic from IR-71 and IR-271.

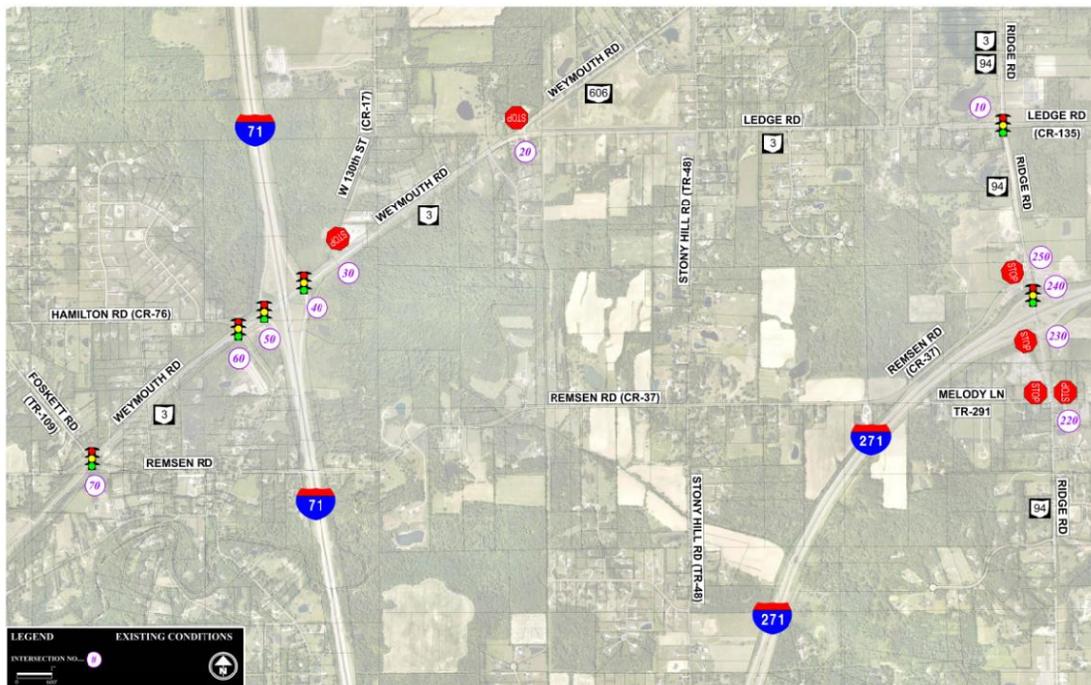


Figure 1: SR-94/SR-3 Existing Conditions



Figure 2: IR-71/IR-271 Interchange Existing Conditions

Safety emerged as a key concern in the study area. Over 300 crashes were recorded in the corridor between January 2020 and August 2023, with 11 resulting in serious injuries. High-crash intersections, such as SR-94/SR-3, and SR-3/Remsen Rd/Foskett Rd, were identified as critical locations requiring attention. These intersections also appear on the state’s Highway Safety Improvement Program (HSIP) priority list, underscoring the urgency of addressing safety deficiencies. The intersection priorities are listed in the **Table 1**.

Table 1: 2024 HSIP Priority Rural Intersections

Rural Intersection	Priority Number
SR-3/Remsen Rd/Foskett Rd	14
SR-94/SR-3/Ledge Rd	64

The operational challenges in the study area are equally pressing. Several intersections, including SR-94/IR-271 NB Ramp, SR-94/IR-271 SB Ramp, and SR-3/IR-71 NB Ramp, currently experience significant delays and failing Levels of Service (LOS). Traffic modeling indicates that without intervention, conditions will continue to deteriorate, with six intersections projected to operate at LOS E or F by 2050. These findings highlight the need for targeted improvements to alleviate congestion and enhance the overall efficiency of the corridor.

A key component of the study was evaluating the feasibility of adding the missing ramps at the IR-71/IR-271 interchange. While this solution initially appeared promising, further analysis revealed the

new ramps would divert only a small portion of traffic from the SR-3 and SR-94 corridors, such that the ramps provided only minor crash and travel time reductions. The diverted traffic also reduces delay along the SR-3/SR-94 corridor. Significantly greater crash reductions and comparable delay reductions could be achieved with surface road improvements for 25% of the cost and with significantly lower property and environmental impacts than installing new interchange ramps at IR-71 and IR-271. Additionally, the construction of these ramps would have significant impacts on nearby neighborhoods, making them an impractical solution. As a result, the study shifted its focus to corridor-specific improvements designed to address the identified challenges directly.

ODOT's Crash Analysis Module (CAM) tool, Economic Crash Analysis Tool (ECAT), Intersection Control Evaluation (ICE) tool, and Highway Capacity Software (HCS) were used to determine the existing and future safety along the corridor as well as the future level of service along the corridor. This process was undertaken for each intersection along the corridor. A spreadsheet developed by ADR, referred to as the In-House Operations Spreadsheet, was used to evaluate the corridor between intersections and the IR-71/IR-271 interchange, as ICE only evaluates intersections.

The proposed improvements are divided into medium- and long-term measures, balancing immediate needs with sustainable, long-term benefits. In the medium term, the study recommends adding a left-turn lane on northbound SR-94 to Remsen Rd. This improvement is both cost-effective and operationally effective, offering a benefit-cost (B/C)¹ ratio of 17.58. For the long term, the study proposes several transformative measures to enhance safety and operations, shown in **Table 2**.

¹B/C stands for Benefit to Cost ratio. It is calculated by dividing the net benefit of improvements over a 20 year design life by the net present cost of improvements. A B/C ratio of greater than one means that the benefits outweigh the costs, a B/C ratio of less than one means that the costs outweigh the benefits over the design life.

Table 2: Recommended Alternative Summary

INTERSECTION	DESCRIPTION	COST	SAFETY B/C	OPERATIONAL B/C
SR-94 WIDTH IMPROVEMENTS	Widen the roadway by an additional lane between SR-94/SR-3 and SR-94/Remsen RD.	\$2,216,000	N/A	N/A
#10: SR-94/SR-3	Construct a roundabout and widen SR-94 south of intersection.	\$4,378,000	0.60	6.86
#30: SR-3/W 130TH ST	Construct a right turn lane on W 130th St at SR-3.	\$80,000	1.45	9.36
#40: SR-3/IR-71 NB RAMP	Construct a second NB left turn lane and a new EB right turn lane on SR-3 to the IR-71 NB ramp. construct a second receiving lane on the IR-71 NB ramp.	\$1,631,000	0.20	5.20
#70: SR-3/REMSEN RD/FOSKETT RD	Add left turn lanes on NB and SB SR-3 to Remsen and Foskett Rd.	\$1,353,000	1.16	-0.44
#230: SR-94/IR-271 NB RAMP	Construct a roundabout at SR-94 and IR-271 NB ramp.	\$3,000,000	0.09	8.61
#240-250: SR-94/IR-271 SB RAMP AND SR-93/REMSEN RD	Construct a Five Point Peanut Roundabout which integrates the SR-94/Remsen Rd and SR-94/IR-271 SB Ramp intersection into one intersection.	\$4,668,000	0.55	19.49

Collectively, these long-term solutions achieve a safety B/C ratio of 0.43 and an operational B/C ratio of 6.44 and are projected to reduce annual crashes by nearly 10 incidents per year. This is a 33% decrease in annual crashes at these intersections. Refer to **Appendix A** for summary sheets of these alternatives, **Appendix B – Refined Matrix** for the safety and operational B/C, and **Appendix C** for the full cost breakdown. Note that the cost of each improvement stated above includes estimated construction, engineering, R/W, and utility costs for the project. The total cost of each improvement was used to determine the benefit/cost ratio for that improvement.

Through these recommendations, the study addresses the core purpose and need of improving system linkage between IR-71 and IR-271 while enhancing safety and mobility along the SR-3 and SR-94 corridors. By prioritizing practical and cost-effective solutions, the proposed improvements offer a balanced approach to resolving the challenges created by the incomplete interchange. This study lays the groundwork for a safer and more efficient transportation network in Medina County, ensuring long-term benefits for the region's motorists and communities.

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- Appendix O In House Interchange Delay Spreadsheet**
- Appendix P Signage and Pavement Marking Inventory, Existing Structures**
- Appendix Q Utility Overlap and Wetland Maps, Utility Inventory and Contact List**
- Appendix R Public Involvement Plan, Meeting Materials, Meeting Summaries**

3 Introduction

Project Introduction

The Ohio Department of Transportation (ODOT) initiated this study to address linkage, safety, and operational challenges in the area around the IR-71/IR-271 interchange in Medina County, Ohio. This critical interchange, a vital link in the state's transportation network, currently features two direct ramps—northbound IR-71 to northbound IR-271 and southbound IR-271 to southbound IR-71. As a result, all traffic movements that seek to travel from southbound IR-71 to northbound IR-271 or southbound IR-271 to northbound IR-71 must traverse the SR-3 and SR-94 corridors, which was suspected to put strain on the corridor and increase traffic.

The primary objective of this study was to evaluate the extent of the challenges created by the interchange's partial configuration and propose practical, cost-effective solutions to improve system linkage, enhance safety, and optimize traffic flow. This involved analyzing the existing safety and operational performance of key intersections, forecasting future conditions under various scenarios, and developing a set of recommended countermeasures to address the identified deficiencies.

The study focused on a 3.4-mile section of SR-3 from the SR-3/Remsen Rd/Foskett Rd intersection to the SR-94/SR-3 intersection, a 1.0-mile section of SR-94 from the SR-94/SR-3 intersection to the SR-94/Remsen Rd/Melody Ln intersection, and the IR-71/IR-271 interchange itself. Particular attention was given to high-priority safety locations, as identified by Ohio's Highway Safety Improvement Program (HSIP), and intersections experiencing or projected to experience failing Levels of Service (LOS). LOS results are recorded in **Table 10**. The HSIP priority intersections and rankings are listed in **Table 1**.

Key elements of the study included:

- A detailed evaluation of crash data using ODOT's Crash Analysis Module (CAM) and Economic Crash Analysis Tool (ECAT) to assess safety performance and identify high-crash locations.
- An operational analysis of traffic flow and delays using ODOT's Intersection Control Evaluation (ICE) tool and capacity modeling, with a focus on addressing congestion and LOS deficiencies.
- A feasibility study of proposed alternatives, including adding missing ramps to the IR-71/IR-271 interchange and making targeted corridor improvements.

Through this process, the study aimed to provide ODOT with actionable insights and recommendations that balance the needs of motorists, local communities, and stakeholders. The findings of this study will guide the development of improvements that address both immediate needs and long-term demands, ensuring that this critical transportation corridor remains safe, efficient, and reliable for years to come.

Intersection Numbering Key

- Intersection #10: SR-94/SR-3
- Intersection #20: SR-606/SR-3
- Intersection #30: SR-3/W 130th St
- Intersection #40: SR-3/IR-71 NB Ramps
- Intersection #50: SR-3/IR-71 SB Ramps
- Intersection #60: SR-3/Hamilton Rd/Weymouth Rd
- Intersection #70: SR-3/Foskett Rd/Remsen Rd
- Intersection #220: SR-94/Remsen Rd/Melody Ln*
- Intersection #230: SR-94/IR-271 NB Ramps
- Intersection #240: SR-94/IR-271 SB Ramps
- Intersection #250: SR-94/Remsen Rd**

*Intersection #220 is located south of IR-271.

**Intersection #250 is located north of IR-271.

Figure 3 is a visual reference of the existing conditions of the intersections listed above. Numbers shown on the figure correspond to the list. **Figure 4** shows the IR-71/IR-271 interchange existing conditions.

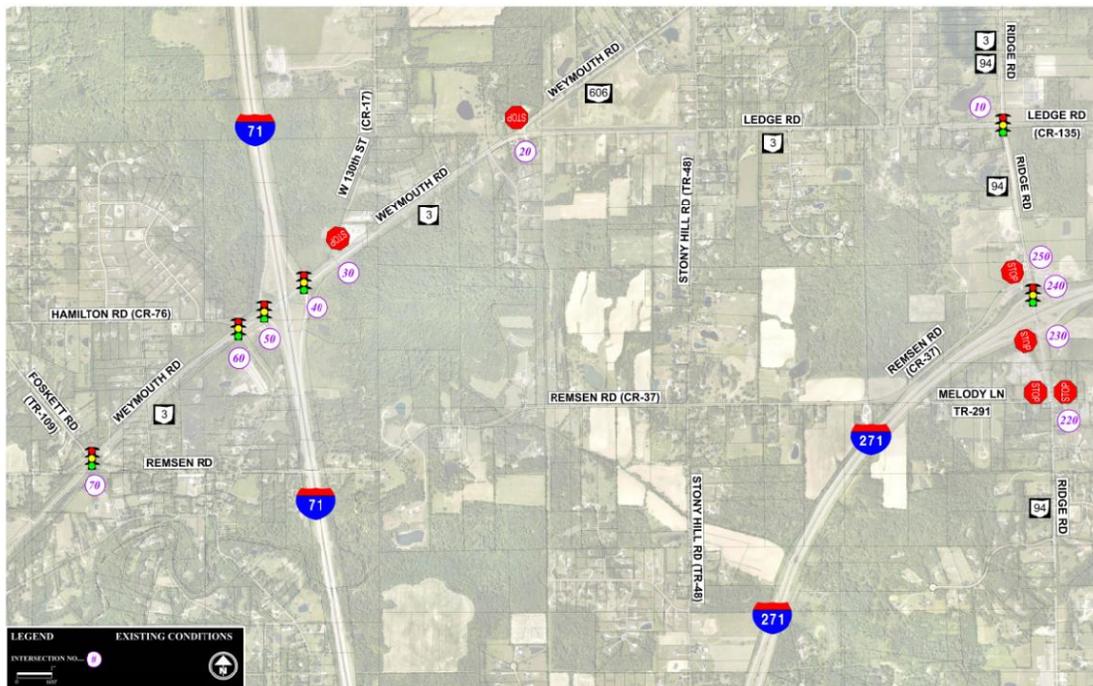


Figure 3: SR-94/SR-3 Existing Conditions



Figure 4: IR-71/IR-271 Interchange Existing Conditions

4 Purpose and Need

The purpose of this study is to enhance the connectivity and functionality of the IR-71/IR-271 interchange and its adjacent corridors in Medina County, Ohio. Specifically, the study seeks to address system linkage deficiencies, improve safety, and mitigate congestion along the SR-3 and SR-94 corridors, which currently serve as a vital connection due to the incomplete configuration of the interchange.

Purpose Statement

The primary goal is to improve system linkage between IR-71 and IR-271. The current interchange includes only two direct ramps—northbound IR-71 to northbound IR-271 and southbound IR-271 to southbound IR-71. This partial configuration forces vehicles traveling between other directions to utilize approximately 3.7 miles along SR-3 and SR-94, increasing travel times and placing additional strain on local intersections and roadways. A detailed map of the study area is provided in **Appendix D**.

Need Elements

System Linkage

The connection of IR-71 and IR-271 through SR-3 and SR-94, required for movements not directly accommodated by the interchange, introduces inefficiencies. Data indicates that 4% of traffic entering the IR-71 northbound on-ramp at SR-3 originates from the IR-271 southbound off-ramp at SR-94. Similarly, 7% of traffic entering the IR-271 northbound on-ramp at SR-94 originates from the IR-71 southbound off-ramp at SR-3. These movements illustrate that there would be some demand for direct southbound to northbound interstate connections. Further details are outlined in the Purpose and Need Statement in **Appendix D**.

Safety

Between January 2020 and August 2023, 312 crashes were reported within the study area, including 11 severe injury crashes. Safety priorities identified through the Highway Safety Improvement Program (HSIP) include the intersections at SR-3/Remsen Rd/Foskett Rd, SR-94/SR-3, and the IR-271/SR-94 ramps. These locations exhibit high crash rates and patterns associated with the existing traffic configurations, such as left-turn collisions and rear-end crashes. A map of HSIP priority locations in Medina County is included in **Appendix J**.

Congestion

Traffic congestion along the SR-3 and SR-94 corridors contributes to delays and declining Levels of Service (LOS). While most intersections currently meet LOS standards, the intersection at SR-94 and the IR-271 northbound ramps are predicted to operate at LOS F in 2030 during both the AM and PM peak hours. Projections for 2050 indicate that without improvements, six intersections in the study area will degrade to unacceptable LOS E or F during peak hours, exacerbating delays and reducing overall corridor efficiency. Detailed traffic and LOS analyses are provided in **Appendix M** and **Appendix N**.

Conclusion

The IR-71/IR-271 interchange plays a pivotal role in the regional transportation network, but its incomplete configuration limits connectivity, burdens adjacent corridors, and exacerbates safety and operational challenges. This study focuses on identifying and prioritizing improvements that address these deficiencies while maintaining a balance between safety, operational efficiency, and cost-effectiveness. Supporting documents, including the Purpose and Need Statement and traffic analyses, are available in **Appendix D, Appendix J, Appendix M, and Appendix N.**

5 Public Involvement

A collaborative and transparent public involvement process was central to the success of the IR-71/IR-271 Planning Study. The Ohio Department of Transportation (ODOT) engaged with stakeholders and the general public through workshops and meetings to ensure the study's findings and proposed alternatives aligned with community needs and values. These interactions provided opportunities to present findings, solicit feedback, and refine recommendations based on stakeholder and public input.

Stakeholder Workshops

The stakeholder workshops brought together representatives from local governments, transportation agencies, and community organizations. These meetings were designed to share technical analyses and foster open dialogue about potential solutions.

1. October 4, 2023: The first workshop introduced stakeholders to the existing conditions, crash data, and operational challenges within the study area. The primary and secondary needs were presented for the purpose and needs. Initial alternatives, such as reverting Remsen Road to its original alignment and installing roundabouts, were discussed. Attendees provided early feedback that affected subsequent refinements.
2. March 27, 2024: The second workshop presented detailed alternatives, including "No Build" and multiple "Build" scenarios. Stakeholders were invited to review visual displays of the alternatives and engage in one-on-one discussions with the project team. Feedback was captured through comment forms and incorporated into the ongoing analysis.
3. July 10, 2024: The third workshop reviewed findings from public surveys and explored advanced alternatives, including cost and safety benefit comparisons. Attendees participated in group discussions and preference-ranking activities to identify consensus on preferred solutions.
4. October 1, 2024: The final workshop summarized all proposed improvement alternatives and focused on selecting a preferred solution for the SR-94/IR-271 interchange area. A structured decision-making activity ensured stakeholder input was captured comprehensively.

Public Meetings

ODOT facilitated public meetings to broaden engagement and gather input from residents and commuters affected by the study area.

1. March 27, 2024: A public meeting introduced the broader community to the study's objectives and potential alternatives. Comment cards were distributed, allowing attendees to provide written feedback. The purpose and need statement was presented to the public along with the primary and secondary needs. Alternatives such as new ramps, rerouted roads, and roundabouts were presented visually to encourage understanding and discussion.
2. June 24, 2025: This open house showcased the preferred alternatives and gathered final input before implementation recommendations were finalized. Comments cards were distributed, allowing attendees to provide written feedback.

Key Outcomes and Community Feedback

The feedback received through workshops and meetings significantly influenced the study's outcomes:

- Community members expressed concerns about the impact of proposed alternatives on neighborhood traffic patterns, safety, and property impacts. A majority of the public, including a large majority of property owners along Nichols Road and McCarren Drive, are against the proposed IR-71/IR-271 ramps.
- Stakeholders emphasized the importance of cost-effective solutions that minimize right-of-way acquisition and environmental impacts.
- The iterative engagement process allowed the project team to refine alternatives and ensure alignment with stakeholder and public priorities.

Meeting materials, summaries, and public comments are included in **Appendix R**. This comprehensive approach underscores ODOT's commitment to an inclusive and transparent planning process, ensuring that the proposed improvements address both technical and community concerns effectively.

6 Existing Conditions

The IR-71/IR-271 Planning Study comprehensively evaluated the safety, operational, and infrastructure characteristics within the study area. This evaluation provided the foundation for identifying deficiencies and proposing targeted improvements to address the unique challenges posed by the incomplete interchange configuration and its effects on the SR-3 and SR-94 corridors.

The study area encompasses portions of SR-3, SR-94, IR-71, and IR-271, including key intersections and critical roadway segments. This region is crucial for local and regional connectivity, serving as a primary connection for movements not accommodated by the incomplete interchange. Persistent issues of high crash frequencies and operational inefficiencies have made this corridor a priority for improvement.

Study Area

Two iterations of the study area were utilized in the feasibility study. The first area was used to determine areas which needed to be improved along the corridor. Crash data and information on roadway deficiencies were aggregated for this larger study area. From this, the study area was refined to a smaller area in which roadway deficiencies and a high crash frequency were found.

Preliminary and Refined Study Areas

The study began with a Preliminary Study Area, shown in **Figure 5**. This broad area provided the framework for initial data collection, including crash data and roadway deficiencies. Analysis of this data informed the definition of a Refined Study Area, which narrowed the focus to locations with critical deficiencies:

- SR-3: From Remsen Rd (SLM* 16.20) to SR-94 (SLM 19.59).
- SR-94: From Melody Ln (SLM 14.22) to SR-3 (SLM 15.15).
- IR-71: The IR-71/IR-271 interchange and adjacent segments (SLM 18.28-19.18) and the IR-71/SR-3 interchange and adjacent segments (SLM 20.37-21.46).
- IR-271: The IR-71/IR-271 interchange and adjacent segments (SLM 0.00–0.85) and the SR-94/IR-271 interchange and adjacent segments (SLM 2.87-4.00).

Maps of both the Preliminary and Refined Study Areas are included in **Figure 5** and **Figure 6**, providing visual context for these delineations.

* SLM stands for straight line mileage. The mileage starts from the origin point of the roadway and extends to the termination point of the roadway. SLM is useful as a quick way to state the approximate location of a proposed improvement.

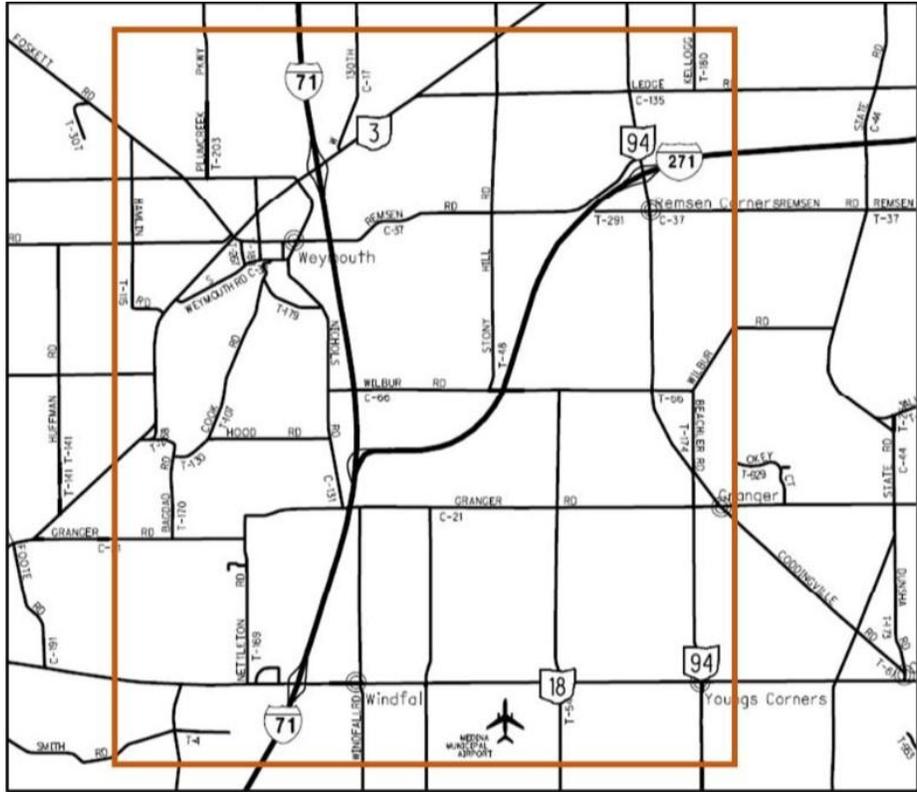


Figure 5: Preliminary Study Area (Study area is in Brown)

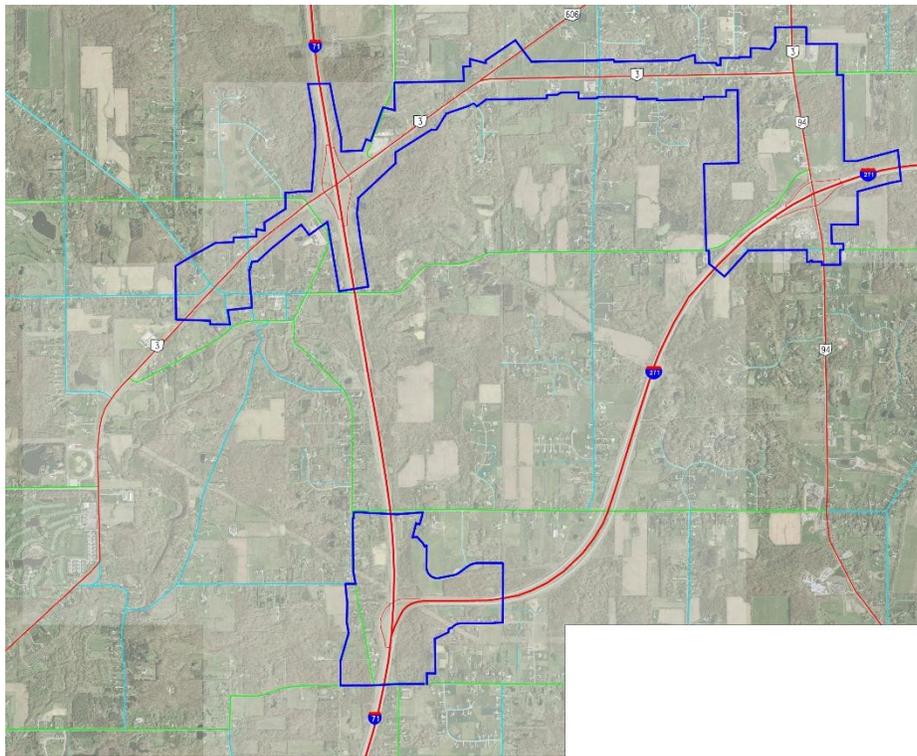


Figure 6: Refined Study Area (Study Area is Dark Blue)

Recent Improvements Within the Study Area

ODOT has completed multiple improvement projects in the study area to address known deficiencies. Notable efforts include:

- SR-3 Pavement Replacement: Extending from SLM 15.05 to 17.84, this project included installation of underdrains, new signage, turn lanes, and traffic signals.
- Intersection Upgrades: Improvements at the SR-3/Remsen Rd/Foskett Rd intersection and SR-3/IR-71 interchange.

Despite these enhancements, persistent safety and operational challenges indicate the need for additional interventions.

Functional Classification and Posted Speed

The functional Classification of each roadway within the study area was depicted in **Figure 7** and were determined using ODOT TIMS. The roadway posted speed was determined using ODOTs Safety Map Viewer through ArcGIS. A summary of the posted speed and classification of each roadway can be found in **Table 3**.

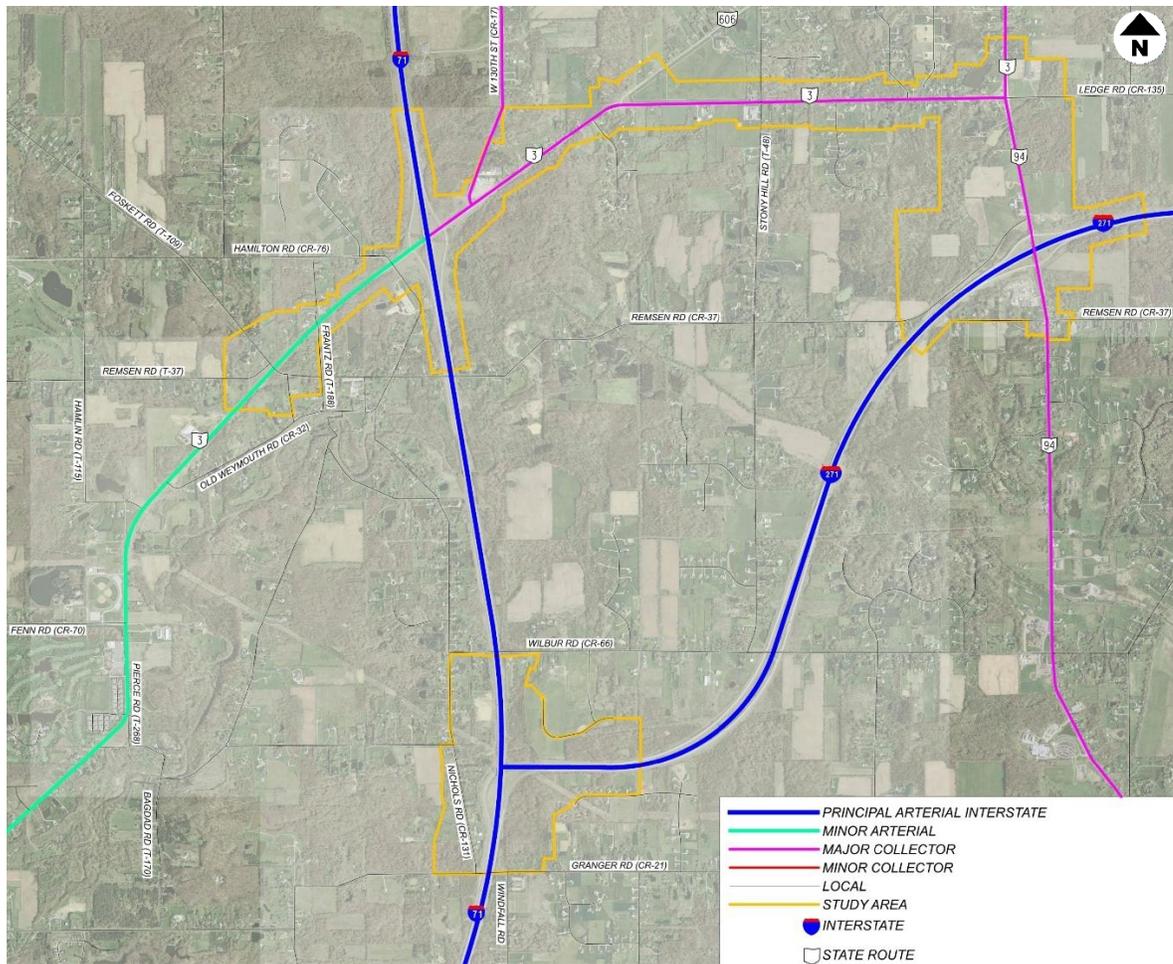


Figure 7: Roadway Functional Classification

Table 3: Roadway Classification

ROADWAY CLASSIFICATIONS		
ROAD	Posted Speed	Functional Classification
SR-3 (EAST OF IR-71)	50	Rural Major Collector
SR-3 (WEST OF IR-71)	50	Rural Minor Arterial
SR-94	45	Rural Major Collector
IR-71	70	Principal Arterial Interstate
IR-271	70	Principal Arterial Interstate
REMSEN RD (CR-37)	45	Rural Local
W 130TH ST (CR-17)	45	Rural Major Collector

Roadway Details

The refined study area incorporates key sections of SR-3 and SR-94, which serve as the primary connection between IR-71 and IR-271. These roadways exhibit varying characteristics:

SR-3: A mix of two-lane and four-lane segments, with widening at intersections to accommodate turning movements. Within the corridor, SR-3 is a two-lane segment with turn lanes at some intersections and an interchange with IR-71, plus two lanes southbound at IR-71.

SR-94: Predominantly a two-lane corridor with narrow shoulders.

IR-71: A six lane divided highway, with twelve-foot lanes and ten-foot shoulders.

IR-271: A four lane divided highway, with twelve-foot lanes and ten-foot shoulders.

Detailed characteristics, including lane configurations, are in **Appendix P**.

Culvert Inventory

Based on ODOT TIMS information, there are approximately twenty-seven (27) existing culverts within the study area ranging in size and material composition. Refer to **Appendix P** for maps of these structures obtained from the TIMS mapping portal.

Bridges

The following structure information was obtained from ODOT TIMS for the study area. These structures include any bridge with a span longer than 10 feet. Refer to **Appendix P** for maps of these structures obtained from the TIMS mapping portal. The following structural file numbers (SFN) are:

- SFN: 5203937 (on IR-71 SB crossing SR-3)
- SFN: 5203961 (on IR-71 NB crossing SR-3)
- SFN: 5200245 (on SR-3 crossing under IR-71 and over Plum River)
- SFN: 5203902 (on IR-71 NB exit ramp to SR-3 and over Plum River)
- SFN: 5203996 (on IR-71 SB exit ramp to SR-3 and over Plum River)
- SFN: 5203694 (on IR-71 SB crossing IR-271)
- SFN: 5203724 (on IR-71 NB crossing IR-271)
- SFN: 5207290 (on IR-271 near Melody Ln)

- SFN: 5205735 (on SR-94 crossing IR-271)

Existing Sign Inventory and Pavement Markings

A record plan and Google Earth review, as well as a detailed video log, was completed in July 2023 to inventory the existing traffic signage and pavement markings in the study area. Several schematics were developed based on this review to show all relevant traffic control measures, see **Appendix P** for illustrations along the study corridor. No deficiencies in signage and pavement markings were identified along the corridor.

Preliminary Geotechnical

Thirty-seven soil types exist within the study area, as well as a small amount of surface water in the form of rivers, small ponds, and small wetlands. No more than fifteen percent of the area is composed of one soil type. A web soil survey soil report is in **Appendix G** and is included in the Ohio Valley Archeology, Inc. (OVAI) Cultural Resource Records Review.

Environmental Assessment

A literature review (review of online resources and databases) was conducted of the study area for ecological resources (natural features and protected areas), including threatened and endangered species. The review included cataloging 4(f) resources (publicly owned parks, recreation areas, and historic sites), 6(f) resources (purchased or improved with US Park Service Land and Water Conservation funds), and conducting a Regulated Materials Review (RMR). The review was conducted utilizing several environmental databases to identify known environmental conditions/resources. A summary of known environmental resources can be found in **Appendix H**, along with exhibits documenting locations of wetlands and streams, section 4(f) and 6(f) resources, and RMR locations.

Historical and Archeological Inventory

No archeological sites are located within the study area, however there are several historical era buildings within one mile of the study area. No historical sites within the study area have the potential to be impacted by improvements. A total list of properties is in **Appendix G** in the Cultural Resource Records Review.

Utility Coordination

In June 2023, utility coordination was initiated using the I-Dig system provided by the Ohio Utility Protection Service (OUPS) to request utility information for the study area. A series of OUPS ticket requests were processed, and preliminary information was obtained through this process. Additionally, record plan information was requested from the utility companies to acquire detailed utility layouts. The utility owners in the area who responded to the OUPS requests include:

- FirstEnergy Service Company
- Columbia Gas
- Aspire Energy
- Energex Power Inc.
- Verizon Business
- Ohio Department of Transportation (ODOT) (Surveying and Mapping, Lighting, Traffic Signals)
- Medina County Sanitary Engineers
- AT&T Transmission
- Sunoco

Other registered utility companies in the area that did not respond to the utility requests are:

- G & O Resources LTD
- Spectrum/Time Warner
- Medina County Fiber Network
- MCI WorldCom
- Armstrong Cable

The presence of these companies in the project area does not necessarily imply interference with any of the proposed alternatives, as the initial study area was considerably larger when the utility requests were submitted.

I-Dig requests were submitted for both above-ground and below-ground utilities. The study area generally extended within 100 feet of the centerline of the roadway, including intersections within the study area limits. Table 4 contains each OUPS ticket and the corresponding area of concern:

Table 4: OUPS Ticket List and Description

OUPS TICKET	DESCRIPTION
A317303493-00A	SR-94 from IR-271 to SR-3
A317400845-00A	SR-3 from SR-606 to SR-94
B317400438-00B	SR-3 from SR-606 to Granger Rd
A317401047-00A	SR-94 from IR-271 to Granger Rd
A317401110-00A	IR-271 from IR-71 to SR-94
A317401160-00A	IR-71 from IR-271 to SR-3
A317401282-00A	IR-71 from IR-271 to SR-18
A319301325-00A	3,000 feet of roadway along Remsen Rd, North of IR-271, starting at the intersection with SR-94

Since the OUPS requests were submitted and the traffic data was acquired, the scope of the project has been significantly refined to focus on specific areas of concern. Consequently, not all utilities identified may be impacted by the proposed improvements.

The utility information obtained is displayed on the various improvement alternative exhibits and is documented in **Appendix Q**. Utilities that are expected to be impacted by the proposed improvements are also included in **Appendix Q**.

Bus and Bike Routes

A designated bike route runs through the study area along Stony Hill Rd, intersecting with SR-3. This existing bike route is not expected to be affected by the proposed improvements. However, Remsen Rd has been identified as a local bike route, even though it does not appear on official database maps. Therefore, any improvements along Remsen Rd should incorporate design features that accommodate cyclists, such as bike lanes, signage, and safe crossings.

In September 2023, Medina County transitioned from traditional fixed-route bus services to a ride-share system known as MC Flex. As there are no set bus routes within the study area, the proposed improvements are not anticipated to impact public bus services. Nonetheless, considerations for the MC Flex ride-share operations should be included in the planning and design phases to ensure seamless integration with the local transportation network.

Highway Safety Improvement Program Safety Priority

The Highway Safety Improvement Program (HSIP) released a priority map in 2024 highlighting high-crash intersections and roadway segments across Ohio, ranking them based on the urgency for safety improvements.

Within the study area, the HSIP map identified three priority locations:

Rural Intersections:

Priority Number 14: Remsen Rd and SR-3.

Priority Number 64: SR-94 and SR-3.

Rural Freeway Segments:

Priority Number 212: IR-271 from SLM 3.5 to SLM 4.0. SLM 3.5 is 750 feet after the start of the IR-271 northbound exit ramp to SR-94. SLM 4.0 is 250 feet after the end of the IR-271 northbound entrance ramp from SR-94.

These priority rankings have significantly influenced the selection and advancement of proposed improvements, as they indicate areas posing a higher risk to motorists. Addressing these locations is crucial to enhance safety and reduce the frequency and severity of crashes within the study area. Proposed improvements should focus on mitigating identified safety issues, such as enhancing signage, improving intersection geometry, and implementing advanced traffic control measures.

For detailed information and visual representation, the HSIP map for Medina County is included in **Appendix J**.

Social and Economic Resources

The Social and Economic Resources Report was developed to ensure that the Ohio Department of Transportation (ODOT) engages in fair planning practices for all community populations while considering safety and traffic flow improvements as part of the IR-71/IR-271 Planning Study. This report identifies potentially vulnerable populations, evaluates the impacts of the Preferred Alternatives on these populations, and incorporates engagement feedback specific to identified populations gathered throughout the project development process. Vulnerable populations, including minorities and low-income groups, often face disproportionate impacts from transportation projects, making their inclusion in equal planning processes essential.

Identification of Vulnerable Populations

Using Census Block Group data and the EPA's Tools, vulnerable populations were identified within the project area. The study confirmed the presence of vulnerable populations in several areas, with potential impacts analyzed to ensure minimal adverse effects. The detailed findings of this analysis are presented in the report and documented in **Appendix I**.

Preferred Alternatives and Potential Vulnerable Population Impacts

The analysis of the Preferred Alternatives indicates no anticipated significant impacts on vulnerable populations, except at two locations:

1. SR-94 and IR-271 Southbound/Remsen Rd North of the SR-94/IR-271 Interchange (ID #240-250)
 - Potential Impact: A driveway will need to be relocated and additional right-of-way acquisition is required.
 - Mitigation: Efforts will focus on minimizing impacts through design adjustments and communication with affected property owners.
2. SR-3 and W 130th Street
 - Potential Impact: Construction limits extend beyond the existing right-of-way.
 - Mitigation: Design considerations aim to minimize right-of-way needs and address any property-specific concerns.

Where avoidance of impacts to vulnerable populations is not feasible, ODOT emphasizes the implementation of mitigation measures to reduce adverse effects. The Social and Economic Resources Report in **Appendix I** also outlines strategies for addressing potential concerns raised by these communities during the public engagement process.

Commitment to Equitable Transportation

The Social and Economic Resources Report demonstrates ODOT's dedication to balancing infrastructure improvements with social equality considerations. By engaging with vulnerable populations and ensuring that project benefits extend to all users, ODOT underscores its goal of fostering a safer, more efficient transportation system that prioritizes equality and inclusivity.

For comprehensive details on the vulnerable population analysis and findings, refer to **Appendix I**. This appendix includes data sources, methodology, and maps detailing vulnerable population concentrations and the impacts of proposed alternatives.

Traffic Counts

Eight-hour intersection traffic counts were conducted throughout the study area and provided by ODOT for this project, capturing peak traffic activity within the study area. ODOT directed the use of a consistent peak hour for the study area: 7:15-8:15 AM for the morning peak and 4:45-5:45 PM for the afternoon peak. The collected counts were further expanded to a 24-hour dataset using ODOT's expansion spreadsheet, which employs functional class-specific and seasonal adjustment factors.

2030 and 2050 traffic modeling data, covering 24-hour, AM, and PM peak periods for each intersection, were provided by the Northeast Ohio Areawide Coordinating Agency (NOACA). This data was utilized to analyze future traffic scenarios under both "No-Build" and "Build" conditions.

Traffic Analysis Methodology

- The National Cooperative Highway Research Program (NCHRP) 255 spreadsheet was employed to address unbalanced traffic volumes at intersections. The outputs were balanced with adjacent intersections to ensure consistency and reliability.
- Weaving volumes for freeway segments were analyzed using ODOT's Travel Demand Model-Based Weave Estimate Computation spreadsheet. This analysis focused on traffic movements between ramps and mainlines, identifying critical patterns and volumes.

Traffic Count Scenarios and Key Findings (IR-71 and IR-271 Interchange)

No-Build Traffic Scenario:

This traffic modeling scenario models the traffic volumes in the study area in the years 2030 and 2050 if the existing conditions of all roads in the corridor are maintained. Traffic volumes, including AM and PM peak hour flows, were derived from the existing counts and modeling data. Details are documented in **Appendix F** of the report.

Build Traffic Scenario:

This traffic modeling scenario models the traffic volumes in the study area in the years 2030 and 2050 if the IR-71/IR-271 interchange has the two additional movements installed, IR-71 SB to IR-271 NB and IR-271 SB to IR-71 NB. Traffic forecasts under this scenario indicate minor changes in traffic patterns in the SR-3/SR-94 corridor due to the introduction of new ramps. Diversion patterns were estimated using StreetLight data for enhanced accuracy. The resulting traffic adjustments and analyses are detailed in **Appendix F**.

Individual Ramp Traffic Scenarios:

These traffic modeling scenarios models the traffic volumes in the study area in the years 2030 and 2050 if the IR-71/IR-271 interchange has only one of the additional movements installed, IR-71SB to IR-271 NB or IR-271 SB to IR-71 NB. Traffic forecasts under this scenario indicate minor changes in traffic patterns, particularly in the SR-94 corridor, due to the introduction of a new ramp, however these alternatives are less impactful than the build traffic scenario. Diversion patterns were estimated using StreetLight data for enhanced accuracy. The resulting traffic adjustments and analyses are detailed in **Appendix F**.

Summary:

The analysis of traffic counts for the No-Build, Ramp Build, and Individual Ramp scenarios provides a comprehensive understanding of the existing and anticipated traffic conditions in the study area. The refined methodologies ensure that the findings accurately reflect potential impacts and benefits of the proposed improvements, aiding in informed decision-making. Detailed traffic data and analyses are available in **Appendix F**, including all supporting spreadsheets and forecasting exhibits.

Signal Warrant Analysis

Signal warrant analyses were performed at the intersections shown in **Table 5**. There is a total of 9 warrants in the Ohio Manual of Uniform Traffic Control Devices, 2012 Edition (OMUTCD). Typically, signals installed based on traffic volume are installed on the Eight-Hour and Four-Hour warrants, so these were the warrants analyzed. If any of these are met, a signal is “warranted.” If a signal is warranted, it means the traffic in the intersection is above the minimum level that a signal is desirable and may be recommended for installation. A list of the 9 warrants are below. Warrants analyzed are in bold.

- **Warrant #1: Eight-Hour Vehicular Volume**
- **Warrant #2: Four-Hour Vehicular Volume**
- **Warrant #3: Peak Hour**
- Warrant #4: Pedestrian Volume
- Warrant #5: School Crossing
- Warrant #6: Coordinated Signal System
- Warrant #7: Crash Experience
- Warrant #8: Roadway Network
- Warrant #9: Intersection Near a Grade Crossing

For the vehicular volume-based warrants (Warrant #1, #2, and #3), the OMUTCD specifies two levels of volume criteria depending on the 85th percentile speed and the population of the municipality. The volumes necessary are lower for speeds greater than 40 MPH or for communities with a population less than 10,000. For the higher speed or lower population criteria, traffic volumes required to meet the warrants are 70 percent of the volumes required for a lower speed or high population community. When speed data is not collected as part of the study, it is common practice to use the speed limit. Although the speed limits in the study area were above 40 MPH and would qualify for a 70% threshold reduction per the Ohio Manual of Uniform Traffic Control Devices, the signal warrants for new signals are based on the 100% threshold value. See below paragraph from Section 402-3.2 of the ODOT *Traffic Engineering Manual*:

“For new ODOT signals, Warrants #1, #2 and #3 shall be based on the 100 percent values (OMUTCD Chapter 4C) and right-turn reduction factors except in the following circumstance. If there are five or more crashes in one year that can be corrected with the addition of a signal, and the speed exceeds 40 miles per hour on the major street, Warrants #1, #2 and #3 may be based on the 70 percent values combined with engineering judgment and right-turn reduction factors.”

The OMUTCD states under “guidance” that engineering judgment should be used to determine what portion of the right-turn vehicles from the minor street approach should be deducted in the analysis.

The right turn reduction factors found in the ODOT Traffic Engineering Manual (TEM) were considered in the analysis.

The existing traffic volumes were entered into the ODOT signal warrant spreadsheet published by the Office of Traffic Operations publish date January 2022. The spreadsheet has a toggle to consider the right reduction factors. The results showed that all existing intersections met the signal warrants and none of the unsignalized intersections met the signal warrants. The warrant worksheets are in **Appendix K. Table 5** shows the study intersections and whether a signal is warranted at the intersection.

Table 5: Signal Warrant Analysis

INTERSECTION	DOES A SIGNAL CURRENTLY EXIST AT THIS INTERSECTION?	IS A SIGNAL WARRANTED AT THIS INTERSECTION?
SR-94/SR-3	Yes	Yes
SR-3/W 130TH ST	No	No
SR-3/IR-71 NB RAMP	Yes	Yes
SR-3/IR-71 SB RAMP	Yes	Yes
SR-3/HAMILTON RD/WEYMOUTH RD	Yes	Yes
SR-3/REMSEN RD/FOSKETT RD	Yes	Yes
SR-94/IR-271 NB RAMP	No	No
SR-94/IR-271 SB RAMP	Yes	Yes
SR-94/REMSEN RD	No	No

Capacity Analysis

Unsignalized Capacity Analysis

Unsignalized capacity analyses were conducted for all existing two-way stop-controlled intersections in the study area using traffic data for the existing conditions. Unsignalized capacity analysis was undertaken for the intersections below. The results of this analysis are presented in the respective intersections proposed countermeasures, and the full analysis is in **Appendix M**.

- Intersection #30: SR-3/W 130th St
- Intersection #220: SR-94/Remsen Rd/Melody Ln
- Intersection #230: SR-94/IR 271 NB Ramp
- Intersection #250: SR-94/Remsen Rd

These analyses focused on delays for specific movements, which correspond to Level of Service (LOS) ratings ranging from “A” to “F.” LOS A is the best possible LOS, and LOS F is the worst possible LOS. LOS A through D are typically considered acceptable levels of service in urbanized MPO (Metropolitan

Planning Organization) areas like the NOACA (Northeast Ohio Areawide Coordinating Agency) region, in which Medina County is situated. For two-way stop control conditions, LOS results are provided only for movements that must wait for gaps in traffic, such as:

- Left turns from the major street.
- Minor street movements.

Other movements, such as through traffic on the major street, are not delayed and thus operate at free flow.

The LOS criteria for two-way stop control, based on delay per vehicle, are shown in **Table 6**.

Table 6: Level of Service Criteria for Unsignalized Intersections

LEVEL OF SERVICE	DELAY (SECONDS/VEHICLE)
A	<10
B	> 10 and ≤ 15
C	> 15 and ≤ 25
D	> 25 and ≤ 35
E	> 35 and ≤ 50
F	> 50

Source: *Highway Capacity Manual 2010*

Methodology

- HCS2024 software was used for the analysis.
- Heavy vehicle percentages were applied to each approach, as documented in the No Build Traffic Plates 10-12.
- Peak Hour Factors were included for all movements, based on the same traffic.

HCS2024 does not directly calculate average intersection delay for unsignalized intersections, which is required for certain safety analyses. In such cases, the weighted average delay was calculated, factoring in free-flow movements. Detailed results, including summary tables and *HCS2024* reports, are provided in **Appendix M**.

Signalized Capacity Analysis

Signalized capacity analyses were conducted for all existing signalized intersections in the study area using traffic data for the existing conditions. This analysis was not undertaken for any proposed alternatives as no new signals were proposed. All signalized intersections are listed in **Table 5**. These analyses calculated delays for each movement, corresponding to LOS ratings. The acceptable threshold for signalized intersections is LOS “D” or better. LOS criteria differ from unsignalized intersections due to variations in driver expectations and traffic control types. The LOS criteria for signalized intersections are in **Table 7**.

Table 7: Level of Service Criteria for Signalized Intersections

LEVEL OF SERVICE	DELAY (SECONDS/VEHICLE)
A	<10
B	> 10 and ≤ 20
C	> 20 and ≤ 35
D	> 35 and ≤ 55
E	> 55 and ≤ 80
F	> 80

Source: *Highway Capacity Manual 2010*

Methodology

- HCS2024 software was used to perform the analysis.
- The existing lane configurations and phasing was applied for the ‘No Build’ analysis.
- Existing clearance intervals were used for analysis.
- Heavy vehicle percentages and Peak Hour Factors were applied per Traffic Plates 10-12.
- A saturation flow rate of 1750 pc/hr/ln was used, in accordance with the ODOT Analysis and Traffic Simulation (OATS) Manual.

Detailed LOS summaries and full *HCS2024* reports are included in **Appendix M**.

Roundabout Capacity Analysis

Roundabout capacity analyses were performed at locations where roundabouts were proposed as improvement alternatives. These locations are listed below.

- Intersection #10: SR-94/SR-3
- Intersection #30: SR-3/W 130th St
- Intersection #220: SR-94/Remsen Rd/Melody Ln
- Intersection #230: SR-94/IR-271 NB Ramps
- Intersection #240: SR-94/IR-271 SB Ramps
- Intersection #250: SR-94/Remsen Rd

In the roundabout capacity analyses, delays are computed which correspond to a Level of Service (LOS) “A” through “F”. The LOS criteria for roundabouts are shown in **Table 8**.

Table 8: Level of Service Criteria for Roundabouts.

LEVEL OF SERVICE	DELAY (SECONDS/VEHICLE)
A	<10
B	> 10 and ≤ 15
C	> 15 and ≤ 25
D	> 25 and ≤ 35
E	> 35 and ≤ 50
F	> 50

Source: *Highway Capacity Manual 2010*

The following comprises the background of the roundabout capacity analysis:

- HCS2024 software was utilized for typical roundabout configurations.
- TransModeler was used for atypical configurations such as peanut and dual roundabouts.
- Heavy vehicle percentages and Peak Hour Factors were consistent with the No Build scenario.
- Design inputs reflected projected traffic flows and roundabout geometry.

Summary tables as well as the *HCS2024* reports are in the **Appendix M**.

Turn Lane Length Analyses

Turn lane lengths were analyzed for extensions of existing or proposed turn lanes based on Section 400 of the ODOT Location & Design (L&D) Manual. Design speeds were determined according to the roadway-specific criteria. Intersection #40 was found to have a deficient left turn lane due to high queuing lengths. No other turn lane lengths were found to be inadequate for the study area based on the design. Proposed turn lane analysis will be presented with the proposed turn lanes in their respective sections. Intersections with proposed turn lanes are listed below.

- Intersection #10: SR-94/SR-3
- Intersection #30: SR-3/W 130th St
- Intersection #40: SR-3/IR-71 NB Ramps
- Intersection #70: SR-3/Foskett Rd/Remsen Rd
- Intersection #240: SR-94/IR-271 SB Ramps
- Intersection #250: SR-94/Remsen Rd

Turn Lane Warrants

Turn lane warrants were analyzed for free flow sections of unsignalized intersections. The results of this analysis are presented in **Table 9**. The turn lane warrant analysis is in **Appendix M**.

Table 9: SR-94 Turn Lane Warrant Analysis

INTERSECTION	LEFT TURN NB AND EB WARRANT	LEFT TURN SB AND WB WARRANT	RIGHT TURN NB AND EB WARRANT	RIGHT TURN SB AND WB WARRANT
SR-94/REMSSEN RD/MELODY LN	Warrant Met (175' Warranted)	Warrant Met (195' Warranted)	Warrant Not Met	Warrant Not Met
SR-94/IR-271 NB RAMP	N/A	Warrant Met (595' Warranted)	Warrant Met (245' Warranted)	N/A
SR-94/REMSSEN RD	Warrant Met (295' Warranted)	N/A	N/A	Warrant Not Met
SR-3/W 130TH ST	Warrant Met (585' Existing, 265' Warranted)	N/A	N/A	Warrant Met (235' Warranted)
SR-3/SR-606	Warrant Met (225' Existing, 265' Warranted)	N/A	N/A	Warrant Not Met

Red highlighted boxes are locations where warrants were met but a turn lane does not currently exist there. Green highlighted boxes are locations where warrants were met, and a turn lane already exists there. Yellow highlighted boxes are locations where warrants weren't met. Note that the lengths quoted in the table exclude the 50' diverging taper.

Alternatives at SR-94/IR-271 NB Ramp and SR-94/Remsen Rd address these warrants by the proposed alternatives that convert the intersection to a roundabout. The SR-94/Remsen Rd/Melody Ln capacity analysis showed that the delays were acceptable under 2050 existing conditions, and there were very low intersection crashes. The SR-3/W 130th St intersection has two WB lanes on SR-3, meaning through traffic can pass any vehicles making right turn movements.

2050 Level of Service

The LOS for the year 2050 was projected based on capacity analyses provided by Smart Services, focusing on both the AM and PM peak periods. The analysis included No Build and Build scenarios.

Key Findings (Failing LOS are in Red)

Table 10: HCS Capacity Analysis: No-Build Scenario

INTERSECTION	2030 AM PEAK LOS	2030 PM PEAK LOS	2050 AM PEAK LOS	2050 PM PEAK LOS
#10 (SR-94/SR-3)	F	E	F	E
#20 (SR-3/SR-606)	-	-	B	B
#30 (SR-3/W 130TH STREET)	D (impeded movements)	E (impeded movements)	E (impeded movements)	F (impeded movements)
#40 (SR-3/IR-71 NB RAMP)	E	C	E	C
#70 (SR-3/REMSEN RD)	C	B	C	C
#220 (SR-94/REMSEN RD/MELODY LN)	-	-	D (impeded movements)	D (impeded movements)
#230 (SR-94/IR-271 NB RAMP)	C (F for EB movements)	A (F for EB movements)	C	A (F for EB movements)
#240 (SR-94/IR-271 SB RAMP)	E	F	E	F
#250 (SR-94/REMSEN RD)	F (impeded movements)	F (impeded movements)	F (impeded movements)	F (impeded movements)

Impeded movements are movements which are controlled by a stop sign. Detailed analysis and documentation are included in **Appendix M**.

Design Deficiencies

The study area exhibits several design deficiencies, primarily involving shoulder widths that do not meet the minimum standards specified in the ODOT Location and Design Manual, Volume 1 (L&D Manual), and sight distance limitations that also do not meet the L&D standards at various intersections.

Key Deficiencies

1. Shoulder Widths:

- Many sections along SR-94, SR-3, and Weymouth Rd feature shoulder widths below the required 4-foot minimum as outlined in the L&D Manual. This issue affects both the left and right sides of the roadway in multiple areas.
- Narrow shoulder widths reduce the recovery area for vehicles, posing risks for drivers and pedestrians.

2. Sight Distance

- The SR-94/Remsen Road/Melody Lane intersection sight distance is deficient in its current state.

3. Intersection Spacing:

- Two intersections along the corridor do not meet the minimum intersection distance requirements of 600 feet as specified in the L&D Manual. For example:
 - The intersection of SR-94 and Remsen Rd has an intersection distance of only 375 feet from the SR-94/IR-271 SB Ramp Intersection.
 - The intersection of SR-3, Hamilton Rd, and Weymouth Rd has an intersection distance of only 540 feet from the SR-3/IR-71 SB Ramp Intersection.

4. Driveway Spacing:

- Inadequate driveway spacing was observed, particularly along SR-3, where spacing measures such as 28 feet and 36 feet fall short of the 75-foot minimum distance recommended by the L&D Manual. An inadequate distance of 68 feet was also observed on SR-94 230 feet north of the SR-94/Remsen Rd/Melody Ln intersection on the left side of the roadway. Inadequate spacing can cause backups due to multiple turning movements in a short distance.

5. Ramp Design:

- The design speed for both the IR-71 North to IR-271 North Ramp and the IR-271 South to IR-71 South is 45 mph, which is below the 50 mph minimum recommended by the L&D Manual. This deficiency may impact ramp operations and safety.

Documentation and Graphics

A comprehensive set of graphics and photographs detailing these deficiencies is included in **Appendix E**. Key exhibits and photos highlight specific locations where these design elements fall short of the required standards, offering a visual reference for the identified issues.

Implications

These design deficiencies impact overall corridor functionality and safety, particularly for vulnerable road users and at high-traffic intersections. Addressing these issues will require targeted design modifications to bring the corridor into compliance with ODOT standards, improve operational efficiency, and enhance safety.

Moving Forward

Mitigation strategies could involve the following:

- Widening shoulders to meet the 4-foot minimum.
- Improving sight distances at the SR-94/Remsen Road/Melody Lane intersection.
- Adjusting driveway spacing and left turn overlaps to align with the L&D Manual.

By addressing these deficiencies, the corridor can achieve improved safety, efficiency, and compliance with modern design standards. Detailed visual and technical documentation supporting these findings is provided in **Appendix E**.

7 Safety and Operations Analysis

Crash Diagrams

Several diagrams were created in July 2023 using the Ohio GIS Crash Analysis Tool (GCAT). These diagrams formed the basis of determining what intersections and corridors need improvements and which are not posing a safety issue. The diagrams are in **Appendix J**. A summary of important intersections is included below.

SR-94 and SR-3 Intersection

The SR-3 and SR-94 intersection had eighteen total crashes between 2020 and 2024. The crash data is displayed in **Figure 8**.

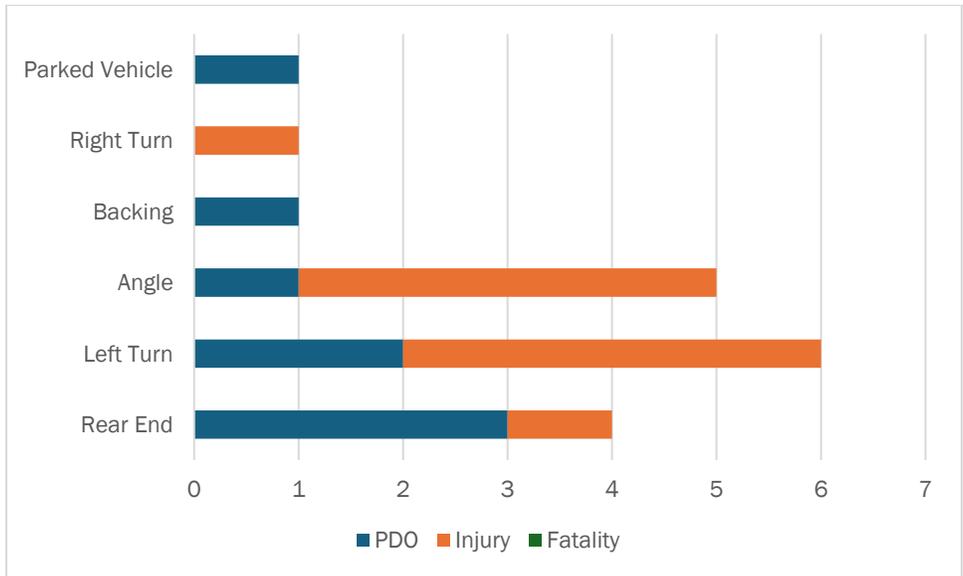


Figure 8: SR-94/SR-3 Crash Data

SR-3 and W 130th St Intersection

The SR-3 and W 130th St intersection had six total crashes between 2020 and 2024. The crash data is displayed in **Figure 9**.

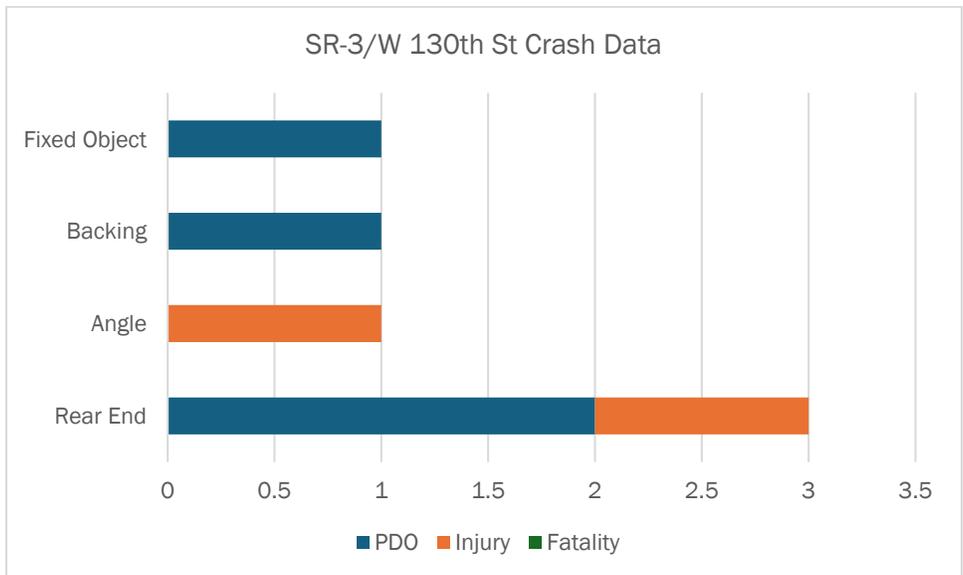


Figure 9: SR-3/W 130th St Crash Data

SR-3 and IR-71 NB Ramp Intersection

The SR-3 and IR-71 NB Ramp intersection had eleven total crashes from 2020 to 2024. The crash data is displayed in **Figure 10**.

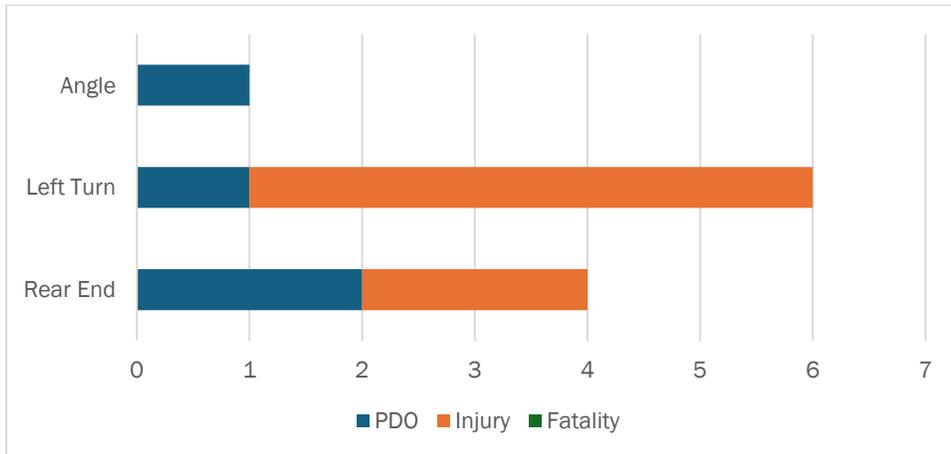


Figure 10: SR-3/IR-71 NB Ramp Crash Data

SR-3, Remsen Rd, and Foskett Rd Intersection

The SR-3 and Remsen Rd intersection had fifteen total crashes between 2022 and 2024. The years 2020 and 2021 were not included due to recent signalization of the intersection. The crash data is display in **Figure 11**.

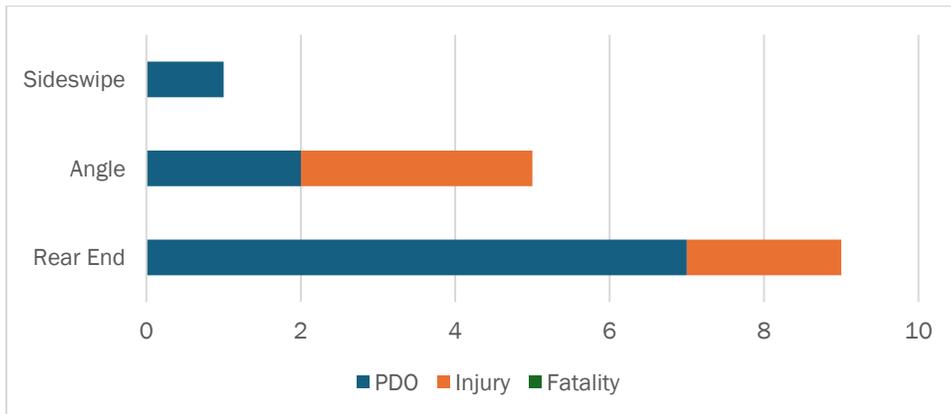


Figure 11: SR-3/Remsen Rd/Foskett Rd Crash Data

SR-94, Remsen Rd, and Melody Ln Intersection

The SR-94, Remsen Rd, and Melody Ln intersection had two total crashes between 2020 and 2024, both left turn crashes and each resulting in injury.

SR-94 and IR-271 NB Ramp Intersection

The SR-94 and IR-271 NB ramp intersection had nine total crashes between 2020 and 2024. The crash data is displayed in **Figure 12**.

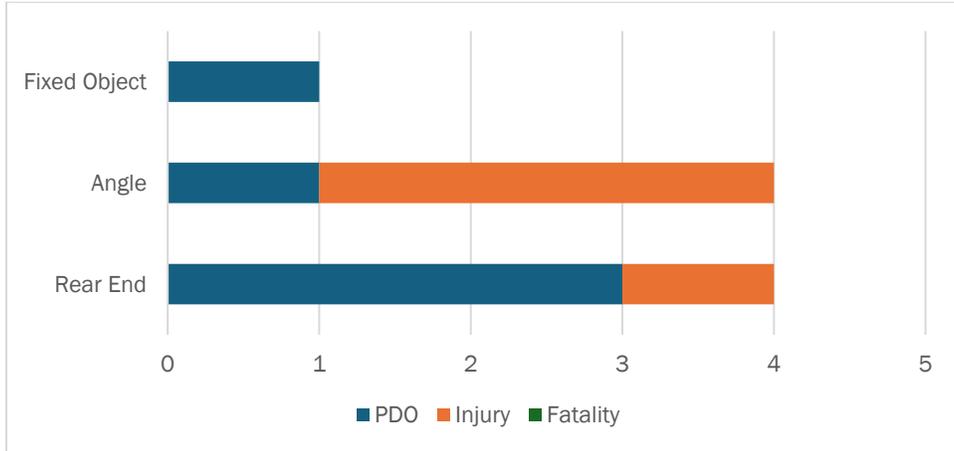


Figure 12: SR-94/IR-271 NB Ramp Crash Data

SR-94 and IR-271 SB Ramp Intersection

The SR-93 and IR-271 SN ramp intersection had twelve total crashes between 2020 and 2024. The crash data is displayed in **Figure 13**.

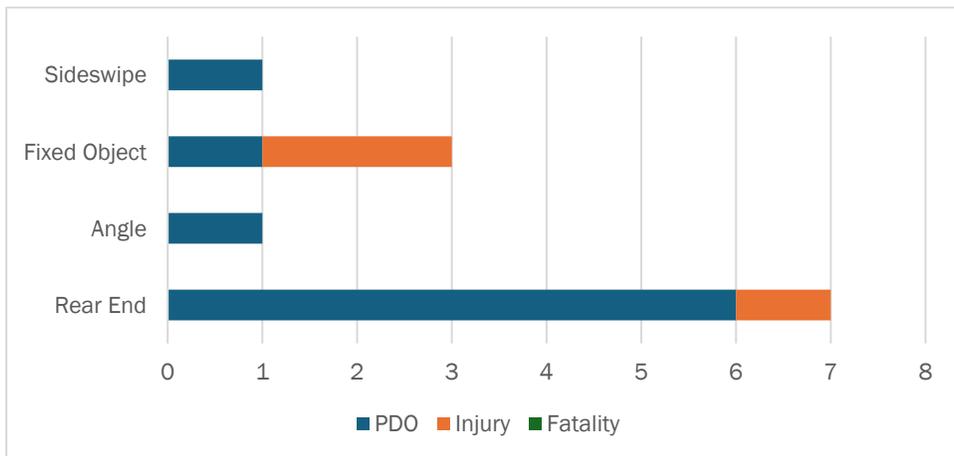


Figure 13: SR-94/IR-271 SB Ramp Crash Data

SR-94 and Remsen Rd Intersection

The SR-94 and Remsen Rd Intersection north of IR-271 had four total crashes between 2020 and 2024. The crash data is displayed in **Figure 14**.

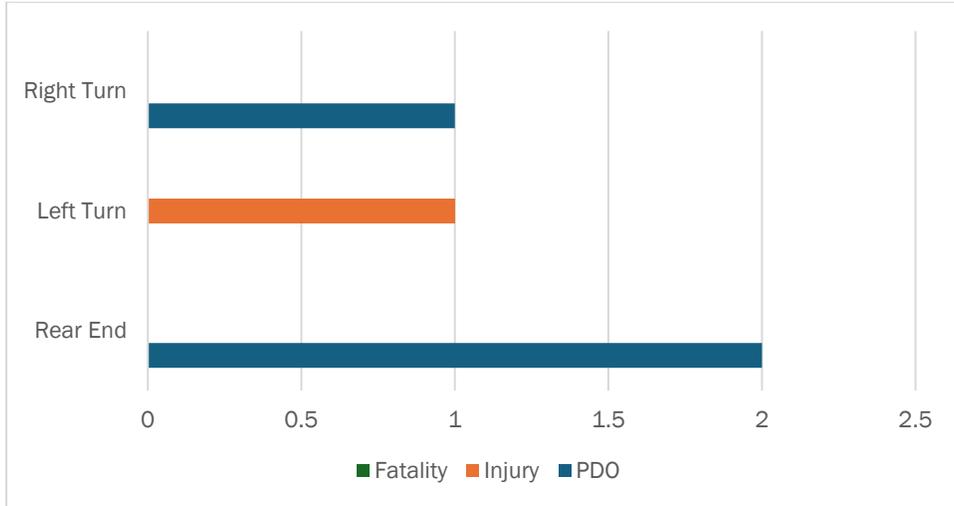


Figure 14: SR-94/Remsen Rd Crash Data

Other Crash Diagrams

Crash diagrams for all intersections along the corridor were developed, each of them recording various crash instances along the corridor. However, no improvements were considered at these intersections, as their crash frequencies were low, and they operated with an Acceptable LOS.

Benefit to Cost Ratios

Two of the analysis programs used in this study provide a benefit to cost ratio (B/C ratio) for each alternative. These ratios are a helpful way to compare the effectiveness of each alternative. B/C ratios take the value of the benefits over the 20-year design life and divide it by the cost of the alternative. How these monetary benefits are calculated is shown in **Table 12** for ECAT analysis and **Table 13** for ICE analysis. B/C ratios vary between each alternative, **Table 11** displays the criteria for good and bad B/C ratios.

Table 11: B/C Ratio Categories*

B/C RATIO	CATEGORY	DESCRIPTION
>1	Excellent	The alternative performs excellently over the design life and fully pays back the cost of the alternative.
0.5-1	Good	The alternative performs well over the design life and mostly pays back the cost of the alternative.
0.0-0.5	Fair	The alternative performs marginally better than the existing conditions over the design life but doesn't pay back the cost of the alternative.
<0	Poor	The alternative makes conditions worse than the existing conditions over the design life.

* This planning-level interpretation of B/C ratios is intended to support a qualitative comparison of alternatives. It reflects general practices used by ODOT in safety study evaluations, where a B/C ratio of ≥ 1.0 is considered the threshold for cost-effectiveness as it pays back the cost through its operational efficiency and safety.

ECAT Analysis

The historic crash data assembled using the GCAT was assembled and expanded on using ODOT's Economic Crash Analysis Tool (ECAT). This tool uses historic crash data to generate predicted and expected annual crash frequency for future years where the average daily traffic has been calculated, so the alternatives were evaluated for a 20-year design life, from 2030 to 2050. This tool also predicts the effects of each alternative on future annual crashes and assigns a monetary value to each crash. The more crashes that were prevented through an alternative, the more valuable the alternative was considered. Unit costs for different crash severities are in **Table 12**. ECAT also generated a benefit to cost (B/C) ratio to compare the estimated cost of the alternative to its monetary benefit from reducing crashes.

Table 12: ECAT Tool Unit Crash Costs

CODE	CRASH SEVERITY	COST PER VEHICLE
KA	Fatal & Incapacitating Injury	\$496,443
B	Non-Incapacitating Injury	\$74,163
C	Possible Injury	\$50,268
O	Property Damage Only	\$0

ECAT analysis was performed* for each alternative, and all results from ECAT are aggregated in the Preliminary Safety and LOS Matrix in **Appendix B**. The analysis for each alternative is also presented with their respective alternative. In the case of IR-71/IR-271 interchange alternatives 3, 4, and 5, two crash decreases are listed, as the addition of these ramps increase crashes at the interchange by adding additional movements but reduce crashes along the SR-94/SR-3 corridor by diverting traffic from it, which is important for understanding the impact of these alternatives. The ECAT excel printouts are in **Appendix L**.

* ECAT analysis was initially performed in June of 2024 and was updated in October of 2025 to reflect updates to the software. The only change between 2024 and 2025 per the update log was higher crash costs, which are reflected within this report.

ICE Analysis

The peak hour traffic counts for 2030 and 2050, as well as the average vehicle delays at each intersection, which was assembled by Smart Services Inc., was input into ODOT’s Intersection Control Evaluation (ICE) tool. This tool uses traffic counts and delay data to calculate the delay benefit for each alternative on the corridor. The more time saved for each vehicle, the more valuable an alternative was considered. Unit travel time costs are in **Table 13**. ICE also generates a B/C ratio in the same way as ECAT does.

Table 13: ICE Tool Unit Travel Time Costs

VEHICLE TYPE	UNIT COST (PER HOUR)
CARS	\$23.12
TRUCKS	\$64.68

ICE analysis was performed* for each intersection alternative, except for alternatives B-2 and B-2a at the intersection of SR-94/Remsen Rd and SR-94/IR-271 SB Ramp, as these alternatives were too complicated for ICE to perform an analysis on. For these alternatives Smart Services Inc. utilized the program TransModeler to obtain this data. All ICE results are aggregated in the same matrix as the ECAT results, in the preliminary matrix in **Appendix B**. ICE excel printouts are in **Appendix N**.

ADR Custom Operations Analysis

ODOT’s ICE tool is only designed for intersections, so to determine the operational benefit of the IR-71/IR-271 interchange ramps, an in-house operations spreadsheet was assembled for use within this study. Methodology similar to the ICE analysis tool methodology was used to create this spreadsheet and addressed the time savings of vehicles traveling on both the SR-94/SR-3 corridor and the IR-71/IR-271 corridor. This spreadsheet is in **Appendix O**, and is split into the following parts:

- *IR-71/IR-271 Ramp Diversions*. This section quantified the operations benefits from the time travel savings for traffic using the new ramps (Alternatives 3 and 4). The total benefits were calculated using the following key information:
 - Diverted traffic volumes
 - Approximate travel times along the IR-71/IR-271 corridor and the SR-94/SR-3 corridor
- *SR-94/SR-3 Corridor*. This section quantified the operations benefits from the time travel savings for traffic using the existing state routes. The total benefits were calculated using the following key information:
 - Traffic volumes on the SR-94/SR-3 corridor, traveling through these intersections:
 - #10 – SR-3 (Ledge Rd) & SR-94 (Ridge Rd)
 - #30 – SR-3 (Weymouth Rd) & W. 130th St
 - #40 – SR-3 (Weymouth Rd) & IR-71 northbound ramps
 - #50 – SR-3 (Weymouth Rd) & IR-71 southbound ramps
 - #230 – SR-94 (Ridge Rd) & IR-271 northbound ramps

* ICE analysis was initially performed in June of 2024 and was updated in October of 2025 to reflect updates to the software. The only change between 2024 and 2025 per the update log was higher crash costs, which are reflected within this report.

- #240 – SR-94 (Ridge Rd) & IR-271 southbound ramps
- #250 – SR-94 (Ridge Rd) & Remsen Rd (north)
- Average intersection delays for peak hours in each intersection listed above

8 Conceptual Estimate of Probable Cost

A conceptual estimate of probable cost to implement each countermeasure was prepared using rough costs for each item provided by ODOT District Three, estimates from record plans in the area, and land prices from the Medina County Auditor. The estimates include the cost of design, right of way, and construction. Estimated construction costs were developed using estimated quantities for items that would be needed for or impacted by implementation of the recommended countermeasures. The following assumptions were used to develop the cost estimates.

- Rough costs of improvements provided by ODOT District 3 and internal unit prices were assumed to be conservative. Costs were in 2024 dollars.
- An engineering estimate of 25% was applied for each countermeasure.
- A contingency of 50% was applied for each countermeasure.
- All right of way takes were adjusted for the assumed highest and best use cost of the land and then doubled.
- Roundabouts were estimated as lump sums and referred to recent planning studies to estimate cost.
- The cost of each improvement was bundled together for each improvement and was used to determine the benefit/cost ratio for that improvement.

Refer to **Appendix C** for rough unit costs and full cost estimate breakdowns.

9 Visual Alternative Matrices

To assist stakeholders in the decision-making process, the alternatives were presented to the stakeholders in the form of visual matrices. These matrices are in **Appendix R** under stakeholder workshop #4 and public meeting #2. Each intersection matrix is presented in the report with the alternative advanced for the intersection/interchange. In addition, a final summary matrix will be presented in the Conclusions and Recommendations section. The legend for these matrices is depicted in **Figure 15**.

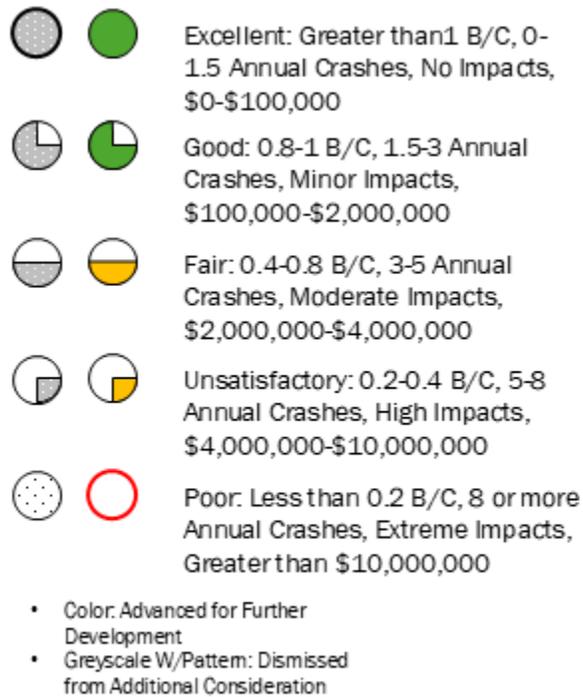


Figure 15: Visual Alternative Matrix Legend

10 Alternatives Considered and Dismissed

A description and impact study of each alternative that was considered and dismissed is discussed below. Exhibits of these alternatives are in **Appendix B**.

Alternatives 1-7: Various IR-71/IR-271 Interchange Realignments/New Ramps

The numbered alternatives 1-7 depicted in **Figure 16** correspond to the numbers of the alternatives discussed in the subsequent report sections.

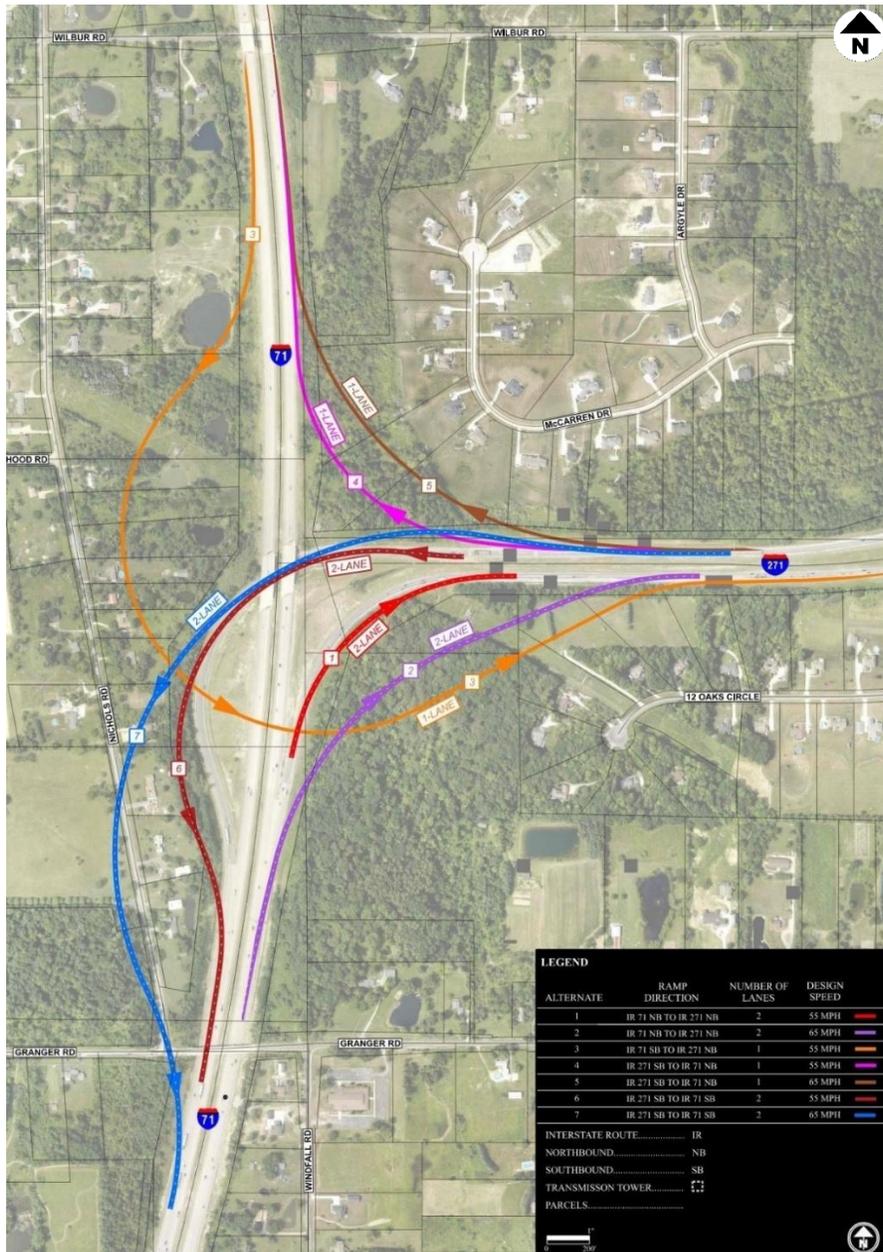


Figure 16: IR-71/IR-271 Interchange Alternatives

Visual Alternative Matrix

The visual alternative comparison matrix is shown below in **Figure 17**. Refer to **Appendix R** for the matrices presented in that stakeholder workshop.

Alternatives	IR-71/IR-271 Interchange	SR-3/SR-94	IR-71 NB to IR-271 NB		IR-71 SB to IR-271 NB	IR-271 SB to IR-71 NB		IR-271 SB to IR-71 SB	
	Interchange No Build	Corridor Build	Alternative 1: Smooth to 55 MPH	Alternative 2: Smooth to 65 MPH	Alternative 3: New 55 MPH Ramp	Alternative 4: New 55 MPH Ramp	Alternative 5: New 65 MPH Ramp	Alternative 6: Smooth to 55 MPH	Alternative 7: Smooth to 65 MPH
Traffic Analysis			Not Available	Not Available			Not Available	Not Available	Not Available
Safety Analysis									
Environmental Analysis									
Right-of-Way Impacts									
Utility Impacts									
Public Involvement									
Preliminary Construction Cost	N/A	\$15,209,000	\$4,060,000	\$11,348,000	\$54,564,000	\$6,836,000	\$9,192,000	\$11,615,000	\$23,107,000

Excellent: Greater than 1 B/C, 0-1.5 Annual Crashes, No Impacts, \$0-\$100,000

Good: 0.8-1 B/C, 1.5-3 Annual Crashes, Minor Impacts, \$100,000-\$2,000,000

Fair: 0.4-0.8 B/C, 3-5 Annual Crashes, Moderate Impacts, \$2,000,000-\$4,000,000

Unsatisfactory: 0.2-0.4 B/C, 5-8 Annual Crashes, High Impacts, \$4,000,000-\$10,000,000

Poor: Less than 0.2 B/C, 8 or more Annual Crashes, Extreme Impacts, Greater than \$10,000,000

- Color: Advanced for Further Development
- Greyscale W/Pattern: Dismissed from Additional Consideration

Figure 17: IR-71/IR-271 Ramp Alternative Comparison Matrix

Alternative 1: Smooth IR-71 NB to IR-271 NB Horizontal Curve to 55 MPH Design Speed

Description

This proposed change involves smoothing the horizontal curve to a 55 MPH design speed. An exhibit of this alternative is located in **Appendix B**.

Conceptual Estimate of Probable Cost

The preliminary cost estimate of this improvement is \$4,060,000, calculated as described in the Conceptual Estimate of Probable Cost section. Refer to **Appendix C** for the full cost estimate.

Utility Impacts

Overhead electric transmission lines are near the project area. Transmission towers run east west through the affected area. One tower may be impacted by the construction of this alternative.

For exhibits with this feature refer to **Appendix Q**.

Safety Benefits

ECAT was used to evaluate the safety benefits of this alternative. The alternative was predicted to provide a safety B/C ratio of 0.02. The ECAT analysis is in **Appendix L**. **Figure 18** presents the findings from ECAT. Refer to **Table 12** for an explanation of the crash categories shown below.

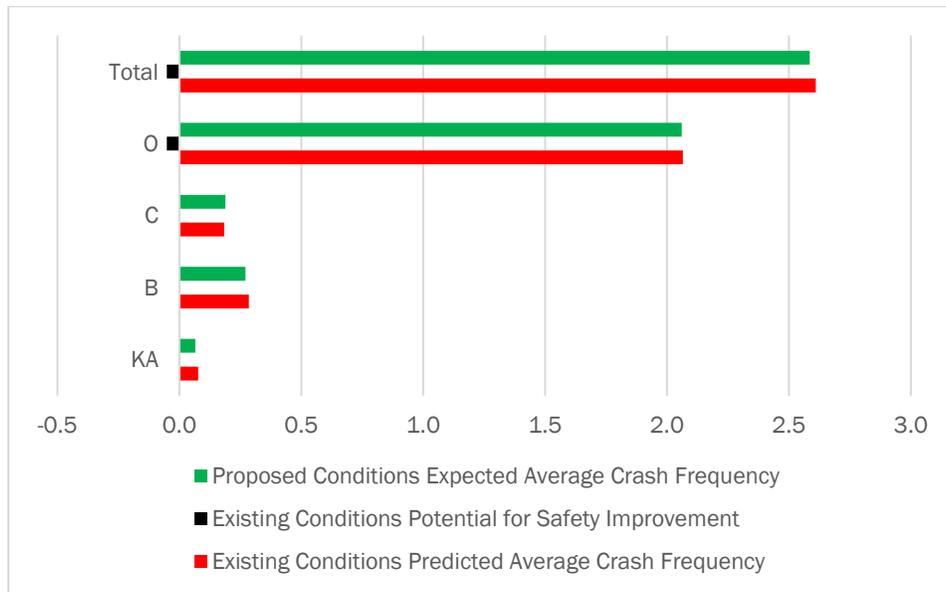


Figure 18: Alternative 1 Crash Summary

Operational Benefits

Operational analysis was not conducted for this alternative as it was dismissed before the operations analyses were conducted and this alignment change would have a negligible effect on operations.

Right of Way Impacts

This alternative would have minor impacts on two properties located near the interchange.

Reason For Dismissal

This alternative was dismissed because the project would be impactful and provide an exceptionally low return on investment and does not adequately meet the primary need statement. The existing ramp is also sufficient to support the current traffic on the interchange.

Alternative 2: Smooth IR-71 NB to IR-271 NB Horizontal Curve to 65 MPH Design Speed

Description

A second proposed change suggests smoothing the horizontal curve to a 65 MPH design speed. An exhibit of this alternative is located in **Appendix B**.

Conceptual Estimate of Probable Cost

The preliminary cost estimate for this improvement is \$11,348,000, calculated as described in the Conceptual Estimate of Probable Cost section. Refer to **Appendix C** for the full cost estimate.

Utility Impacts

Overhead electric transmission lines are near the project area. Transmission towers run east west through the affected area. One tower may be impacted by the construction of this alternative.

For exhibits with this feature refer to **Appendix Q**.

Safety Benefits

ECAT was used to evaluate the safety benefits of this alternative. The alternative was predicted to provide a safety B/C ratio of 0.01. The ECAT analysis is in **Appendix L**. **Figure 19** presents the findings from ECAT. Refer to **Table 12** for an explanation of the crash categories shown below.

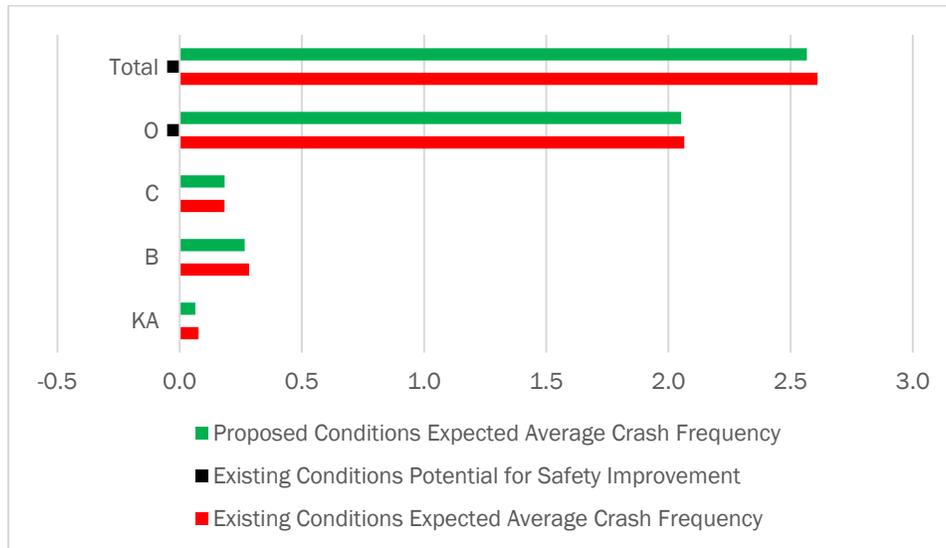


Figure 19: Alternative 2 Crash Summary

Operational Benefits

Operational analysis was not conducted for this alternative as it was dismissed before the operations analyses were conducted and this alignment change would have a negligible effect on operations.

Right of Way Impacts

This alternative would have major impacts on multiple properties including one total property would have to be acquired (total take), and five other properties would have to be partially acquired (partial take).

Reason For Dismissal

This alternative was dismissed because the project would be impactful and provide an exceptionally low return on investment and does not adequately meet the primary need statement. The existing ramp was also sufficient to support the current traffic on the interchange.

Alternative 3: Construct a New IR-71 SB to IR-271 NB Single Lane Ramp with a 55 MPH Design Speed

Description

The proposed alternative involves constructing a new single-lane ramp with a 55 MPH design speed and a bridge over IR-71. This would divert traffic from the SR-94/SR-3 corridor, slightly reducing crashes and providing a high operational benefit. An exhibit of this alternative is located in **Appendix B**.

Conceptual Estimate of Probable Cost

The preliminary cost estimate for this improvement is \$54,564,000, calculated as described in the Conceptual Estimate of Probable Cost section. Refer to **Appendix C** for the full cost estimate.

Utility and Environmental Impacts

A few utilities run through the construction area, which is a serious concern for construction of this alternative. These are below.

- Electrical transmission lines run east to west through the affected area, two towers are close to the alternative area. These are close enough to the interchange that they would have to be relocated for this alternative.
- A gas main runs underneath the interchange that may need to be relocated.
- Six registered ponds/wetlands are encroaching in the proposed alternative area.

For exhibits with these features refer to **Appendix Q**.

Safety Benefits

ECAT was used to evaluate the safety benefits of this alternative. The alternative was predicted to provide a safety benefit to cost ratio of 0.003. The ECAT analysis is in **Appendix L**. This safety benefit was not adequate to meet the primary need statement for safety. In addition, while this alternative does reduce fatal crashes, it increases serious, minor injury, and property damage crashes. **Figure 20** presents the findings from ECAT. Note that **Figure 20** shows total crashes on the SR-94/SR-3 corridor and crashes on the proposed ramp. Refer to **Table 12** for an explanation of the crash categories shown below.

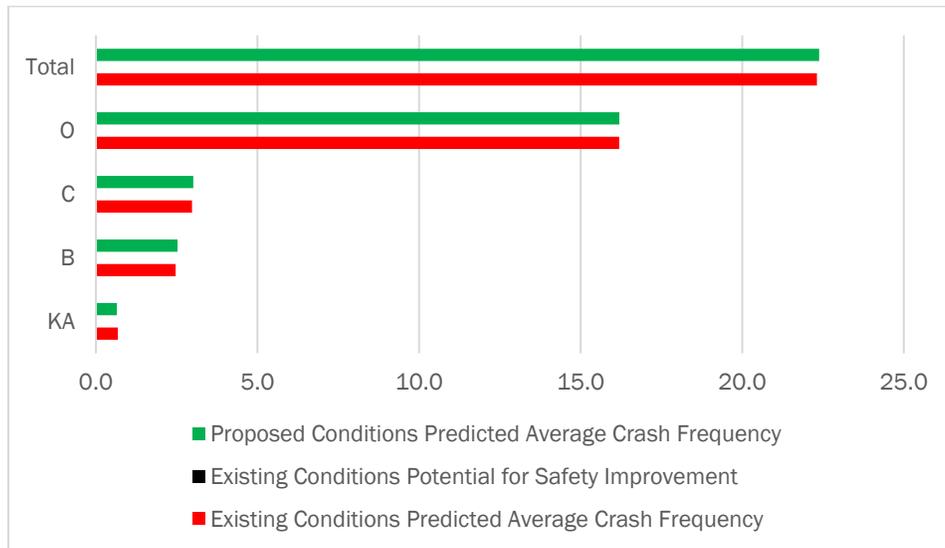


Figure 20: Alternative 3 Crash Summary

Individual Operational Benefits

Operational analysis was conducted for alternative 3 separate from alternative 4. The operational B/C ratio was 2.06. This means that over a 20-year design life this alternative repays its cost twofold in operational returns. This operational analysis was undertaken using the in-house spreadsheet developed for this project, located in **Appendix O**. This operational benefit was considered to meet the primary need statement for system linkage.

Right of Way Impacts

This alternative would have major impacts on multiple properties such that eight total takes are required, and partial takes would be required on twelve properties.

Reason For Dismissal

Although this alternative met the purpose and need statement for operations, this alternative was dismissed because the project would be extremely impactful and other considered alternatives achieved comparable safety and operational benefits with fewer impacts and expenses. The R/W takes are significant and displace multiple families. Crashes are also a net increase between the alternative and the SR-94/SR-3 corridor, and increases severe injury, minor injury, and property damage crashes, and the operations performance on the SR-94/SR-3 corridor was not significantly improved.

Alternative 4: Construct a New IR-271 SB to IR-71 NB Single Lane Ramp with a 55 MPH Design Speed

Description

The first proposed alternative for this movement involves constructing a new single-lane ramp with a 55 MPH design speed. This would divert traffic from the SR-94/SR-3 corridor, slightly reducing crashes and improving the LOS. An exhibit of this alternative is located in **Appendix B**.

Conceptual Estimate of Probable Cost

The preliminary cost estimate of this improvement is \$6,836,000, calculated as described in the Conceptual Estimate of Probable Cost section. Refer to **Appendix C** for the full cost estimate.

Utility and Environmental Impacts

One utility runs through the construction area which may be affected by the construction of this alternative as well as a registered wetland.

- A gas main runs underneath the interchange that may need to be relocated.
- A registered wetland is encroaching on the proposed alternative.

For exhibits with these features refer to **Appendix Q**.

Safety Benefits

ECAT was used to evaluate the safety benefits of this alternative. The alternative was predicted to provide a safety B/C ratio of 0.002. The ECAT analysis is in **Appendix L**. This safety benefit was not adequate to meet the primary need statement for safety. In addition, the alternative has been predicted to increase fatal crashes instead of decreasing them. **Figure 21** presents the findings from ECAT. Note that **Figure 21** shows total crashes on the SR-94/SR-3 corridor and on the proposed ramp. Refer to **Table 12** for an explanation of the crash categories shown below.

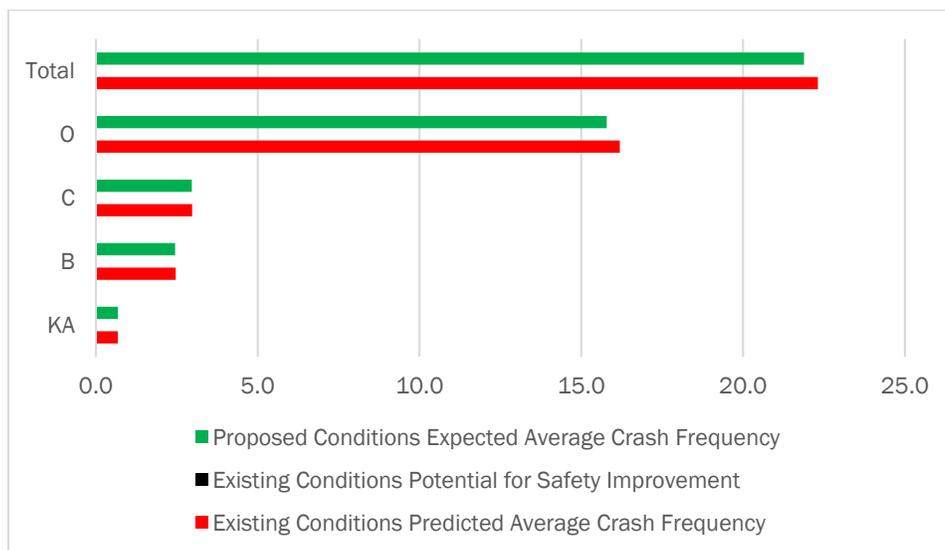


Figure 21: Alternative 4 Crash Summary

Individual Operational Benefits

Operational analysis was conducted for alternative 4 separate from alternative 3. The operational B/C ratio was -0.35. This means that over a 20-year design life this alternative does not repay its cost over the 20-year design life at all. This operational analysis was undertaken using the in-house spreadsheet developed for this project, located in **Appendix O**.

Combined Operational Benefits

Operational analysis was conducted for a package of alternatives 3 and 4. The combined operational B/C ratio was 1.79. This means significant delay reductions happen when implementing alternatives 3 and 4. The operational analysis was undertaken using the in-house operations spreadsheet developed for this project, located in **Appendix O**. This operational benefit was considered to meet the primary need statement for system linkage.

Right of Way Impacts

This alternative would have a small impact on R/W such that four partial takes are required.

Reason For Dismissal

This alternative was dismissed because the project would be impactful and other considered alternatives achieved comparable safety and operational benefits with fewer property and environmental impacts and expenses. The operational B/C ratio is too low for the ramp to be individually effective and the crash analysis results are not high enough to consider installation for safety.

Alternative 5: Construct a New IR-271 SB to IR-71 NB Single Lane Ramp with a 65 MPH Design Speed

Description

A second proposed alternative for this movement suggests constructing a new single-lane ramp with a 65 MPH design speed. This would provide a higher design speed and divert traffic from the SR-94/SR-3 corridor, slightly reducing crashes and improving LOS. An exhibit of this alternative is in **Appendix B**.

Conceptual Estimate of Probable Cost

The preliminary cost estimate of this improvement is \$9,192,000, calculated as described in the Conceptual Estimate of Probable Cost section. Refer to **Appendix C** for the full cost estimate.

Utility and Environmental Impacts

One utility runs through the construction area which may be affected by the construction of this alternative as well as a registered wetland.

- A gas main runs underneath the interchange that may need to be relocated.
- A registered wetland is encroaching on the proposed alternative.

For exhibits with these features refer to **Appendix Q**.

Safety Benefits

ECAT was used to evaluate the safety benefits of this alternative. The alternative was predicted to provide a safety B/C ratio of 0.004. The ECAT analysis is in **Appendix L**. This safety benefit was not adequate to meet the primary need statement for safety. **Figure 22** presents the findings from ECAT. Note that **Figure 22** shows total crashes on the SR-94/SR-3 corridor and on the proposed ramp. Refer to **Table 12** for an explanation of the crash categories shown below.

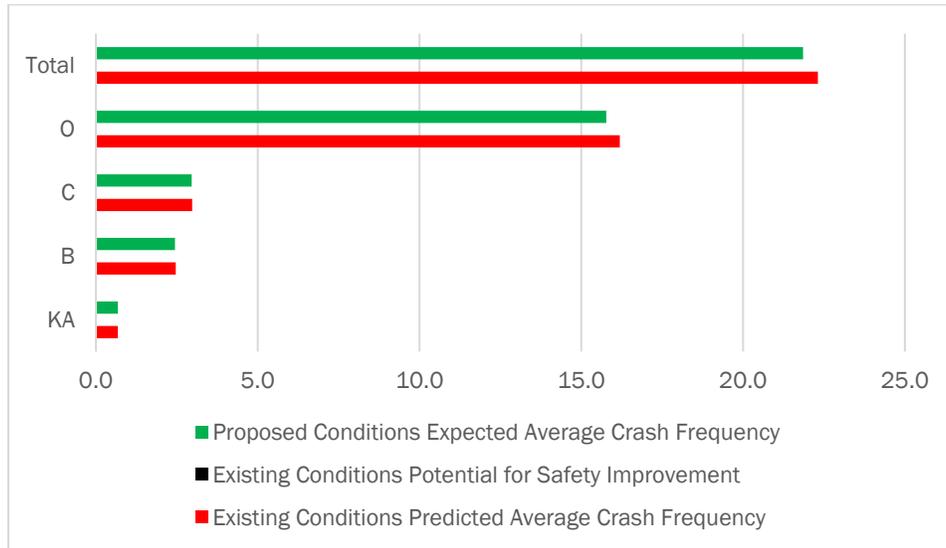


Figure 22: Alternative 5 Crash Summary

Operational Benefits

Operational analysis was not performed for this alternative as it was dismissed before the operations analyses were conducted.

Right of Way Impacts

This alternative would have a high impact on R/W such that the nine partial takes are required. These takes include most of four properties.

Reason For Dismissal

This alternative was dismissed because it provided the same operational benefit as Alternative 4 and performed the same function but was more costly and caused more impacts to the surrounding area.

Alternative 6: Smooth IR-271 SB to IR-71 SB Horizontal Curve to 55 MPH Design Speed

Description

This proposed change involves smoothing the horizontal curve to a 55 MPH design speed, resulting in a slight decrease in crashes. An exhibit of this alternative is located in **Appendix B**.

Conceptual Estimate of Probable Cost

The preliminary cost estimate of this improvement is \$11,615,000, calculated as described in the Conceptual Estimate of Probable Cost section. Refer to **Appendix C** for the full cost estimate.

Utility Impacts

No utilities run through the construction area.

Safety Benefits

ECAT was used to evaluate the safety benefits of this alternative. The alternative was predicted to provide a safety B/C ratio of 0.0004. The ECAT analysis is in **Appendix L**. This safety benefit was not adequate to meet the primary need statement for safety. **Figure 23** presents the findings from ECAT. Refer to **Table 12** for an explanation of the crash categories shown below.

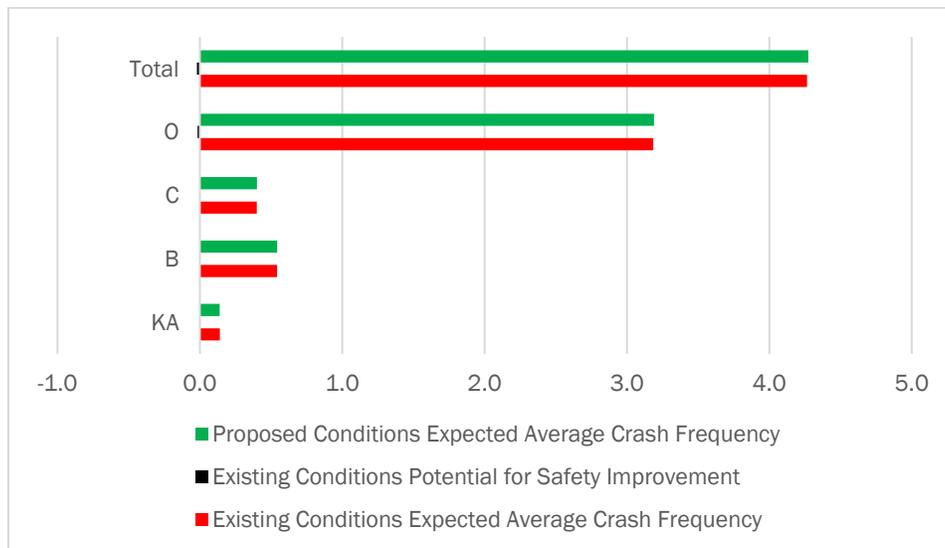


Figure 23: Alternative 6 Crash Summary

Operational Benefits

Operational analysis was not conducted for this alternative as it was dismissed before the operations analyses were conducted and this alignment change would have a negligible effect on operations.

Right of Way Impacts

This alternative would have a substantial impact on R/W such that four partial takes are required and three total takes are required.

Reason For Dismissal

This alternative was dismissed because the project would be impactful and provide a low return on investment, as well as having a large effect on R/W and having a limited safety return. The existing ramp is also sufficient to support the current traffic on the interchange. The alternative was not found to meet the primary need statement.

Alternative 7: Smooth IR-271 SB to IR-71 SB Horizontal Curve to 65 MPH Design Speed

Description

This proposed change suggests smoothing the curve to a 65 MPH design speed. An exhibit of this alternative is located in **Appendix B**.

Conceptual Estimate of Probable Cost

The preliminary cost estimate for this improvement was \$23,107,000, calculated as described in the Conceptual Estimate of Probable Cost section. Refer to **Appendix C** for the full cost estimate.

Utility Impacts

Multiple utilities and a roadway run through the construction area are a serious concern for construction of this alternative.

- A power line runs along Nichols Rd which would have to be relocated.
- Electrical transmission lines run east to west through the affected area, and one tower is close to the alternative area. This tower is close enough to the interchange that it would have to be relocated for this alternative.

For exhibits with these features refer to **Appendix Q**.

Safety Benefits

ECAT was used to evaluate the safety benefits of this alternative. The alternative was predicted to provide a safety B/C ratio of -0.003. The ECAT analysis is in **Appendix L**. This safety benefit was not adequate to meet the primary need statement for safety. **Figure 24** presents the findings from ECAT. Refer to **Table 12** for an explanation of the crash categories shown below.

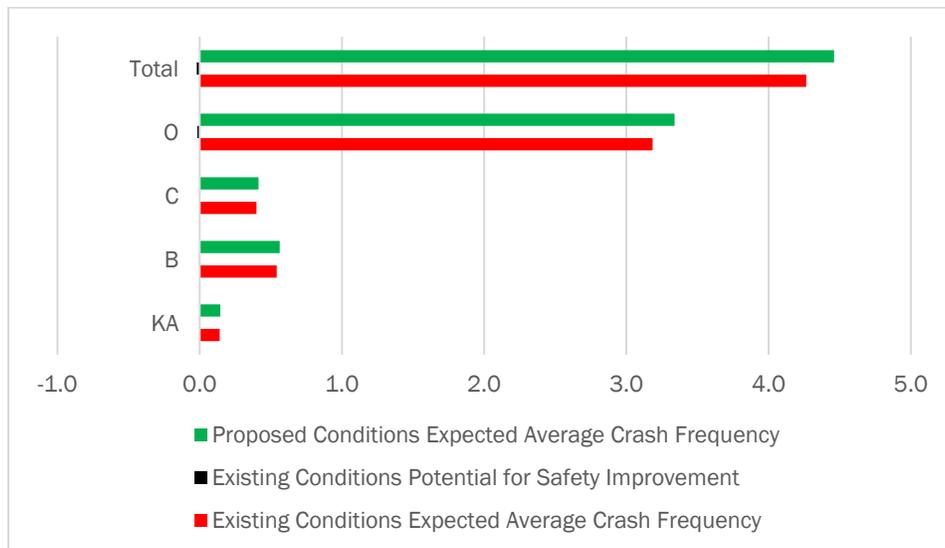


Figure 24: Alternative 7 Crash Summary

Operational Benefits

Operational analysis was not conducted for this alternative as it was dismissed before the operations analyses were conducted and this alignment change would have a negligible effect on operations.

Right of Way Impacts

This alternative would have a substantial impact on R/W such that five total takes and thirteen partial takes are required. Some of these takes are required to realign Nichols Rd.

Reason for Dismissal

The expected increase in crashes as well as extensive R/W takes and rerouting of Nichols Rd resulted in the dismissal of this alternative. The existing ramp was also sufficient to support the current traffic on the interchange. The alternative was not found to meet the primary need statement.

Various SR-94/SR-3 Alternatives

Alternative A: Intersection of SR-94, SR-3, and Ledge Rd (CR-135) (Intersection 10)

Description

This potential solution was to adjust the signal phasing and lengthen the right-turn lane on SR-3 NB (EB at this intersection). This alternative is depicted in **Figure 25**. An exhibit of this alternative is located in **Appendix B**.



Figure 25: SR-94/SR-3 Right Turn Extension

Turn Lane Length Design

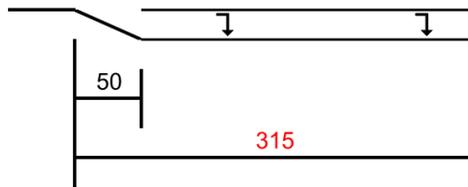
The data used to find the required length of the right turn lane is presented in **Table 14**. The full design is in the HCS results in **Appendix M**.

Table 14: SR-94/SR-3 Alternative A Right Turn Lane Design

INTERSECTION	SR-94/SR-3
INTERSECTION TYPE	Signalized
SPEED	55 MPH
CYCLE LENGTH	120 Seconds
DECELERATION TAPER	165 Feet
STORAGE LENGTH	500 Feet
NO BLOCK DISTANCE	150 Feet
CALCULATED TURN LANE LENGTH (CONDITION C: NO BLOCK DISTANCE + DECELERATION TAPER)	315 Feet

Figure 26 shows the configuration of the turn lane based on the calculated values in **Table 14**.

Figure 26: SR-94/SR-3 Alternative A Right Turn Lane Design Depiction



Conceptual Estimate of Probable Cost

The preliminary cost estimate of this improvement is \$167,000, calculated as described in the Conceptual Estimate of Probable Cost section. Refer to **Appendix C** for the full cost estimate.

Utility Impacts

Utility impacts were not studied for this alternative, as it was dismissed before utility impacts were studied.

Safety Benefits

ECAT was used to evaluate the safety benefits of this alternative. The alternative was predicted to decrease annual crashes by 0.071 crashes per year, with a safety B/C ratio of 0.20. The ECAT analysis is in **Appendix L**. **Figure 27** presents the findings from ECAT. Refer to **Table 12** for an explanation of the crash categories shown below.

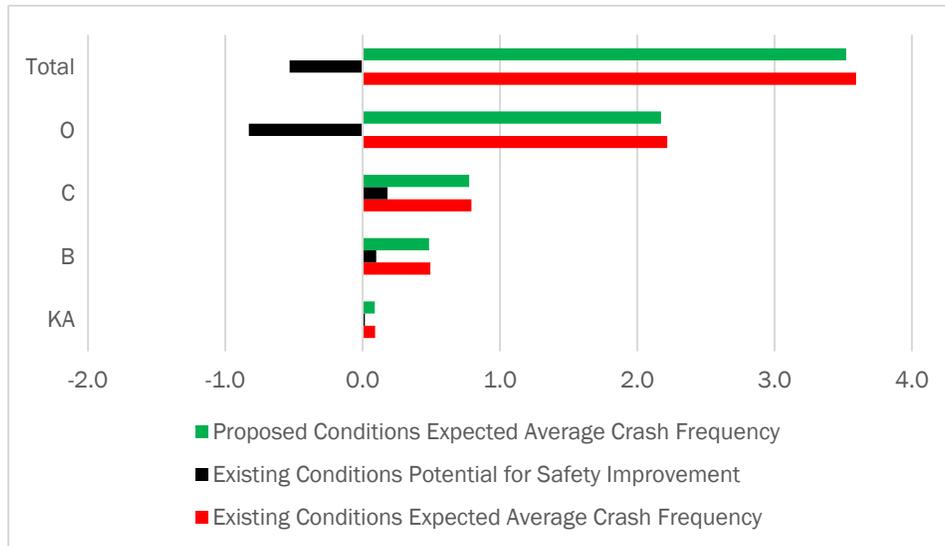


Figure 27: SR-94/SR-3 Alternative A Crash Summary

HCS Analysis

HCS Analysis was undertaken for this alternative to determine the delay improvement. The intersection delay was not improved, as shown below.

Table 15: SR-94/SR-3 Alternative A HCS Results

DESIGN YEAR	PEAK HOUR	EXISTING CONDITIONS LOS	PROPOSED CONDITIONS LOS
2030	AM	91.8 Sec (LOS F)	171.1 Sec (LOS F)
	PM	55.9 Sec (LOS E)	119.5 Sec (LOS F)
2050	AM	90.0 Sec (LOS F)	187.8 Sec (LOS F)
	Pm	55.4 Sec (LOS E)	133.3 Sec (LOS F)

The full HCS capacity analysis summary is in **Appendix M**.

Operational Benefits

ICE was used to evaluate the operational benefits of this alternative. The alternative was predicted to increase delays by a significant margin and provides an operational B/C ratio of -207.26. This analysis is in **Appendix N**.

Right of Way Impacts

This alternative has no impact on R/W.

Reason for Dismissal

This alternative was dismissed because it also did not improve the LOS, which was already at LOS F, causing significant backups at the intersection.

Roundabout: Intersection of SR-3 and SR-606 South (Intersection 20)

A roundabout was initially proposed at this intersection but was quickly dismissed due to a good existing level of service and low crash counts at the intersection.

Alternative B: Intersection SR-3 and W 130th St (Intersection 30)

Description

An option to increase Level of Service on W 130th St was to maintain two southbound SR-3 through lanes and add a roundabout. This would improve the LOS to A for W 130th St from LOS F for the controlled approaches. This alternative is depicted in **Figure 28**. An exhibit of this alternative is located in **Appendix B**.



Figure 28: SR-3/W 130th St Roundabout

Conceptual Estimate of Probable Cost

The preliminary cost estimate of this improvement is \$3,500,000, calculated as described in the Conceptual Estimate of Probable Cost section. Refer to **Appendix C** for the full cost estimate.

Utility Impacts

Utility impacts were not studied for this alternative, as it was dismissed before utility impacts were studied.

Safety Benefits

ECAT was used to evaluate the safety benefits of this alternative. The alternative was predicted to decrease annual crashes by 0.219 crashes per year, with a safety B/C ratio of 0.10. The ECAT analysis is in **Appendix L**. **Figure 29** presents the findings from ECAT. Refer to **Table 12** for an explanation of the crash categories shown below.

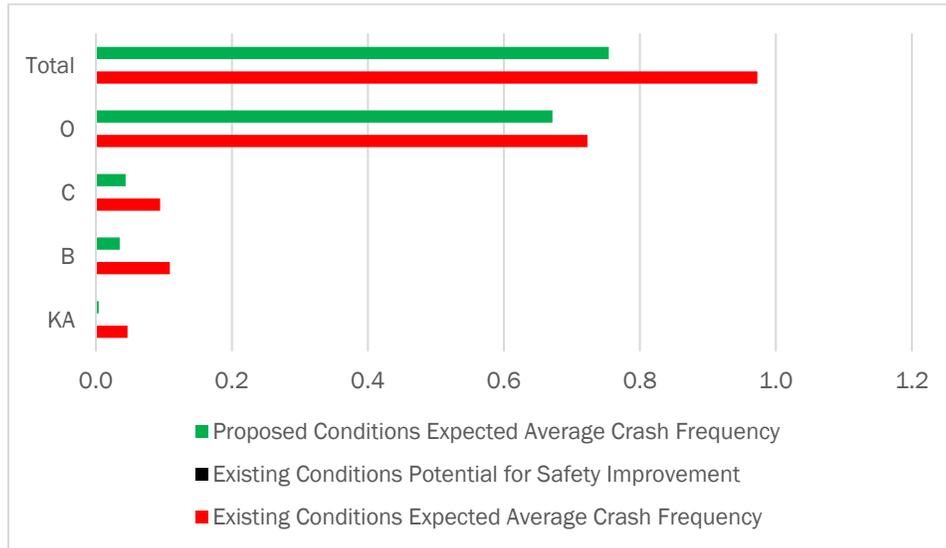


Figure 29: SR-3/W 130th St Alternative B Crash Summary

HCS Analysis

HCS Analysis was undertaken for this alternative to determine the delay improvement. The intersection delay was improved as shown in **Table 16** below.

Table 16: SR-3/W 130th St Alternative B HCS Results

DESIGN YEAR	PEAK HOUR	EXISTING CONDITIONS LOS	PROPOSED CONDITIONS LOS
2030	AM	31.5 Sec (LOS D)	6.6 Sec (LOS A)
	PM	38.0 Sec (LOS E)	6.8 Sec (LOS A)
2050	AM	37.1 Sec (LOS E)	7.0 Sec (LOS A)
	PM	60.9 Sec (LOS F)	7.4 Sec (LOS A)

Note that this alternative improves the LOS of W 130th St but increases delays from through traffic on SR-3. The full HCS capacity analysis summary is in **Appendix M**.

Operational Benefits

ICE was used to evaluate the operational benefits of this alternative. The alternative was predicted to decrease delays by a small margin and provide an operational B/C ratio of 0.04. This analysis is in **Appendix N**.

Right of Way Impacts

This alternative was not predicted to have impacts on the R/W, however during construction a small portion of the neighboring park may be impacted, depending on the required subgrade build up. Preliminary design results predict that it is possible to keep design within the current R/W.

Reason for Dismissal

The alternative was dismissed as it would insignificantly decrease predicted crashes, offer low operational benefits, and have potential R/W takes from a county park, adding to the high construction cost. In addition, while the roundabout does improve the LOS for W 130th St, it also decreases the LOS for SR-3. The recommended alternative presented on page 78 provides higher operational benefits while avoiding impeding traffic on SR-3. Obtaining funding for this countermeasure would be challenging because there are not significant existing safety or operational issues.

Alternative A: Northbound Left Turn Lane on SR-3 and a Receiving Lane on the IR-71 Northbound on Ramp (Intersection #40)

Description

This intersection had a low predicted LOS for 2050 for the No-Build condition, because too many vehicles turn left onto the IR-71 NB ramp. Adding a second left turn lane and second receiving lane improves the LOS and reduces crashes in the intersection. The improvements are depicted in **Figure 30**. An exhibit of this alternative is located in **Appendix B**. A similar (alternative A-1) alternative is being advanced on page 83.



Figure 30: SR-3/IR-71 NB Ramp Double Turn Lanes

Turn Lane Length Design

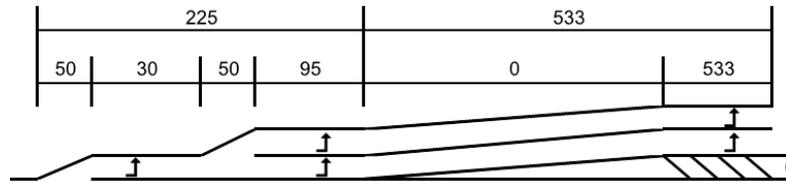
The data used to find the required length of the proposed northbound left turn lanes are presented in **Table 17**.

Table 17: SR-3/IR-271 NB Ramp Alternative A Left Turn Lane Design

INTERSECTION	SR-3/REMSEN RD/FOSKETT RD
INTERSECTION TYPE	Signalized
SPEED	50 MPH
CYCLE LENGTH	120 Seconds
NUMBER OF LANES	2
STORAGE LENGTH	533 Feet per lane
DECELERATION (LANE 1)	225 Feet
DECELERATION (LANE 2)	145 Feet

Figure 31 shows the configuration of the left turn lanes based on the calculated values in **Table 17**. The full design is in the HCS results in **Appendix M**.

Figure 31: SR-3/IR-271 NB Ramp Alternative A Left Turn Lane Design Depiction



Note that due to the space limitations caused by the geometric constraints of the SR-3/IR-71 Interchange means that these lengths could not be met. The second left turn lane straight length that was achieved in design was 170 feet, with a 100 foot taper, to conform the turn lane to the central median. Nevertheless, this design improves the intersections turning capacity, even though it does not meet the calculated design.

Conceptual Estimate of Probable Cost

The preliminary cost estimate for this improvement was \$1,327,000, calculated as described in the Conceptual Estimate of Probable Cost section. Refer to **Appendix C** for the full cost estimate.

Utility Impacts and Existing Structures

A gas line runs on the north side of SR-3. One culvert runs underneath SR-3 that would be impacted if the pavement had to be extended.

For exhibits of these utilities refer to **Appendix Q**.

Safety Benefits

ECAT was used to evaluate the safety benefits of this alternative. The alternative was predicted to reduce annual crashes by 0.67 crashes per year, with a safety benefit to cost ratio of 0.25. The ECAT analysis is in **Appendix L**. **Figure 32** presents the findings from ECAT. Refer to **Table 12** for an explanation of the crash categories shown below.

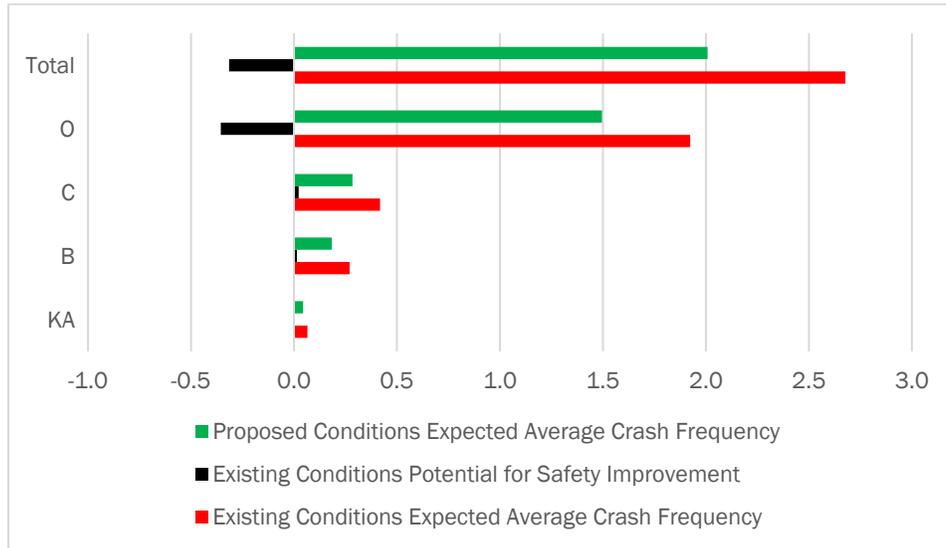


Figure 32: SR-3/IR-71 NB Ramp Alternative A Crash Summary

HCS Analysis

Intersection Delay

HCS Analysis was undertaken for this alternative was completed to determine the delay improvement. The intersection delay was improved as shown in **Table 18** below. While the intersection delay was not improved in the PM peak, the main concern at this intersection was the delay at the AM peak, which was significantly reduced by this alternative

Table 18: SR-3/IR-271 NB Ramp Left Turn Lane HCS Results

DESIGN YEAR	PEAK HOUR	EXISTING CONDITIONS LOS	PROPOSED CONDITIONS LOS
2030	AM	62.1 Sec (LOS E)	35.1 Sec (LOS D)
	PM	21.1 Sec (LOS C)	26.5 Sec (LOS C)
2050	AM	74.6 Sec (LOS E)	35.8 Sec (LOS D)
	PM	25.2 Sec (LOS C)	27.2 Sec (LOS C)

Queuing

The intersection queuing is shown in **Figure 33**. The critical length in red is the maximum queuing length allowable in that direction. Any bar that exceeds the critical length means that vehicles will be queuing into approach intersections.

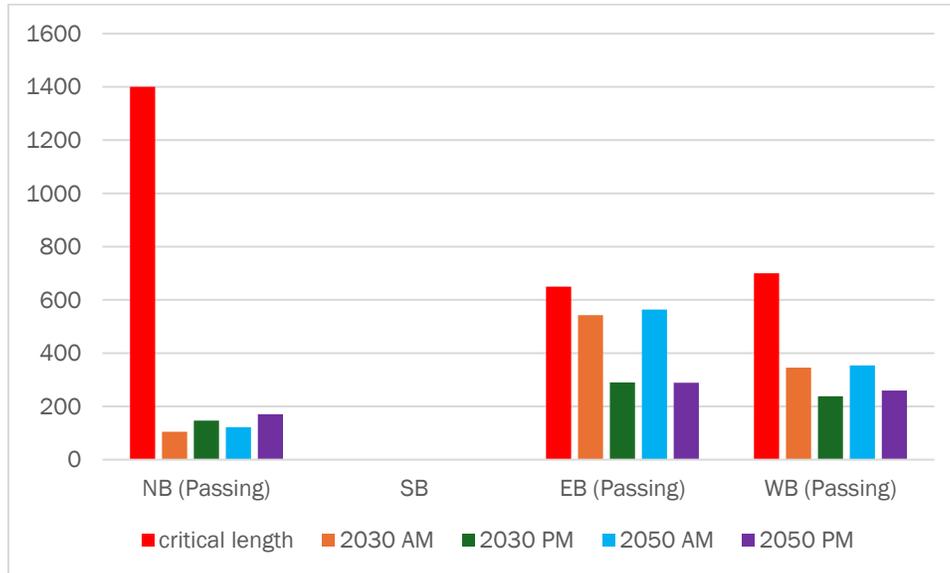


Figure 33: SR-3/IR-71 Alternative A Queuing Lengths

The full HCS capacity analysis summary is in **Appendix M**.

Operational Benefits

ICE was used to evaluate the operational benefits of this alternative. The alternative was predicted to reduce delays by a significant margin, improving the LOS from LOS F to LOS D, which is in the acceptable range. The alternative provides an operational benefit to cost ratio of 5.96. This analysis is in **Appendix N**.

Right of Way Impacts

This solution only requires a small amount of pavement widening and repainting, such that it may be contained in the existing right of way. Preliminary cross sections are in **Appendix B**.

Reason for Dismissal

This alternative was revised after public meeting #2 when public comments pointed out that lane usage on southbound SR-3 caused backups due to the lack of a dedicated right turn lane. An expanded alternative was added to the study which added a right turn lane to the improvements proposed in this alternative. This alternative is presented on page 83 and was considered as alternative A-1.

Improvements at the SR-94 and IR-271 SB Ramp and Remsen Road

Intersections 240 (SR-94/IR-271 SB Ramp) and 250 (SR-94/Remsen Rd) are too close for them to be considered separately when making improvements, as during the peak hour southbound traffic at the SR-94/IR-271 SB Ramp intersection backs up into the SR-94/Remsen Rd intersection. This condition emerged as a high priority concern, as no single intersection alternative remedied this improvement, so the two intersections had to be evaluated together. Several alternatives were proposed to remedy problems at these intersections.

Alternative A: Intersections of SR-94/IR-271 SB Ramp and SR-94/Remsen Rd (Intersection 240-250)

Description

This alternative involves adding a roundabout at SR-94 and Remsen Rd with two NB through lanes on SR-94 and adding a second right turn lane to the IR-271 SB exit ramp. This alternative is depicted in **Figure 34**. An exhibit of this alternative is located in **Appendix B**. Due to the location of these two intersections, this alternative limits access to a private property on the east side of the SR-94/Remsen Rd intersection and a gas station on the northwest side of the same intersection.



Figure 34: SR-94/Remsen Rd/IR-271 SB Exit Ramps Double Right Turn Lane and Roundabout

Turn Lane Length Design

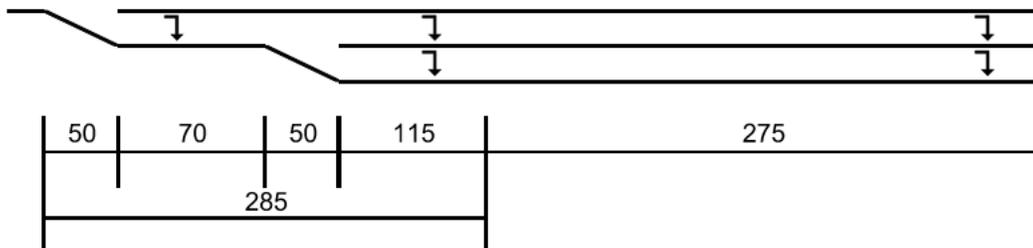
The data used to find the required length of the proposed right turn lane is presented in **Table 19**.

Table 19: SR-94/IR-271 SB Ramp Alternative A Right Turn Lane Design

INTERSECTION	SR-94/IR-271 SB RAMP
INTERSECTION TYPE	Signalized
SPEED	55 MPH
CYCLE LENGTH	60 Seconds
# OF TURNING LANES	2
DECELERATION TAPER (LANE 1)	165 Feet
DECELERATION TAPER (LANE 2)	285 Feet
STORAGE LENGTH	275 Feet Each Lane

Figure 35 shows the configuration of the turn lanes based on the calculated values in **Table 19**. The full design is in the HCS results in **Appendix M**.

Figure 35: SR-94/IR-271 SB Ramp Alternative A Right Turn Lane Design Depiction



Conceptual Estimate of Probable Cost

The preliminary cost estimate for this improvement was \$3,724,000, calculated as described in the Conceptual Estimate of Probable Cost section. Refer to **Appendix C** for the full cost estimate.

Utility Impacts and Existing Structures

A few different utilities run through the intersections which would have to be considered in designing and constructing this alternative:

- Multiple power lines run through the intersections.
- A potable water conduit runs north-south through the east side of the intersections.
- A fiber utility box exists on the northwest corner of the SR-94/Remsen Rd intersection. This is sufficiently set back from the intersection such that it should be possible to avoid, but it must be considered.
- A culvert exists running perpendicular to SR-94 between the two intersections.

For exhibits of these utilities refer to **Appendix Q**.

Safety Benefits

ECAT was used to evaluate the safety benefits of this alternative. The alternative was predicted to reduce annual crashes by 2.40 crashes per year, with a safety benefit to cost ratio of 0.55. The ECAT

analysis is in **Appendix L**. **Figure 36** presents the findings from ECAT. Refer to **Table 12** for an explanation of the crash categories shown below.

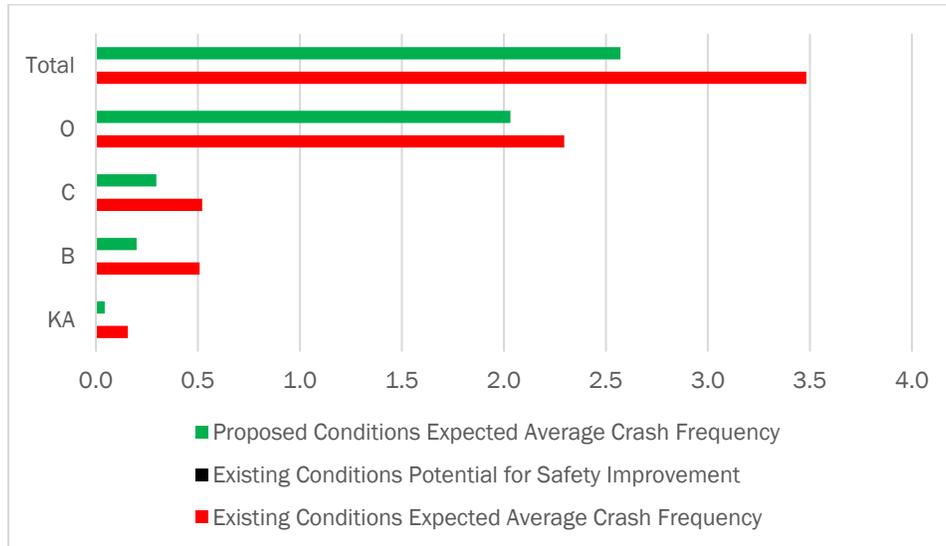


Figure 36: SR-94/IR-271 SB Ramp and SR-94/Remsen Rd Alternative A Crash Summary

HCS Analysis

HCS Analysis was undertaken for this alternative to determine the delay improvement.

Intersection Delay

The intersection delay was improved as shown in **Table 20** below.

Table 20: SR-94/IR-271 SB Ramp and SR-94/Remsen Rd Alternative A HCS Results

INTERSECTION	DESIGN YEAR	PEAK HOUR	EXISTING CONDITIONS LOS	PROPOSED CONDITIONS LOS
SR-94/REMSEN RD	2030	AM	63.6 Sec (LOS F)	12.6 Sec (LOS B)
		PM	540.4 Sec (LOS F)	9.4 Sec (LOS A)
	2050	AM	107.8 Sec (LOS F)	15.5 Sec (LOS C)
		PM	3485.0 Sec (LOS F)	10.6 Sec (LOS B)
SR-94/IR-271 SB RAMP	2030	AM	58.9 Sec (LOS E)	19.9 Sec (LOS B)
		PM	157.4 Sec (LOS F)	20.1 Sec (LOS C)
	2050	AM	79.1 Sec (LOS E)	24.5 Sec (LOS C)
		PM	217.6 Sec (LOS F)	23.4 Sec (LOS A)

Queuing

The intersection queuing for both intersections are shown in **Figure 37** and **Figure 38**. The critical length in red is the maximum queuing length allowable in that direction. Any bar that exceeds the critical length means that vehicles will be queuing into approach intersections.

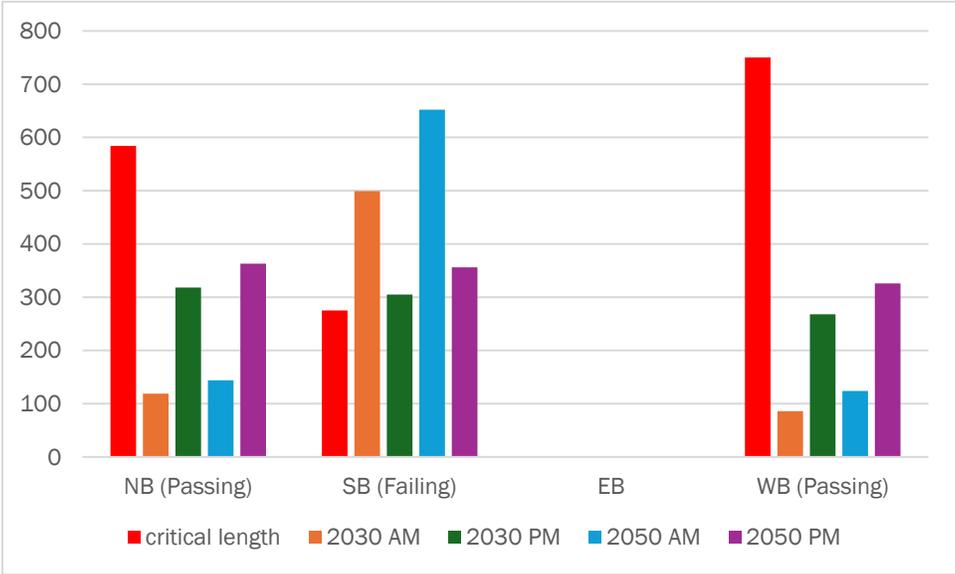


Figure 37: SR-94/IR-271 SB Ramp Alternative A Queuing Lengths

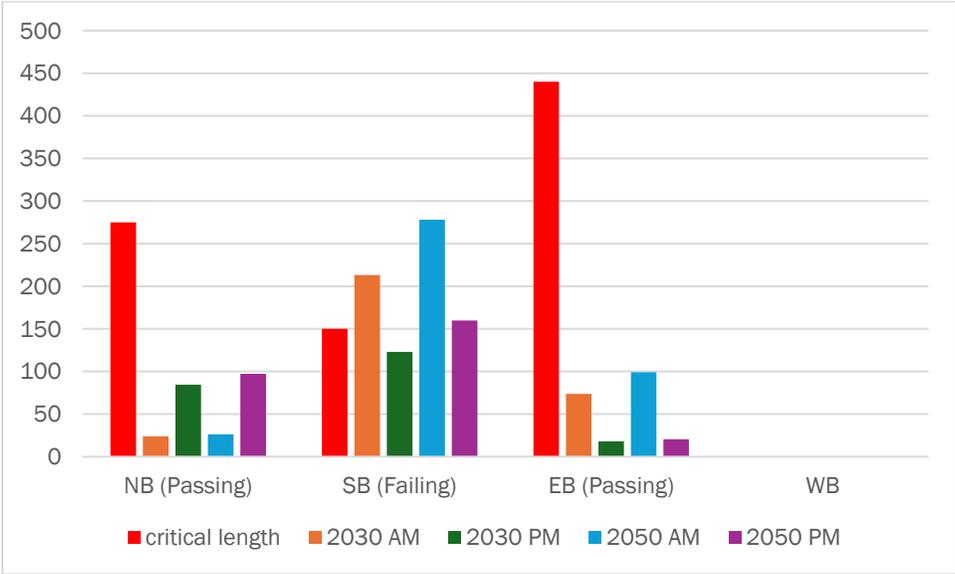


Figure 38: SR-94/Remsen Rd Alternative A Queuing Lengths

The full HCS capacity analysis summary is in **Appendix M**.

Operational Benefits

ICE was used to evaluate the operational benefits of this alternative. The alternative was predicted to reduce delays by a significant margin, improving LOS to C or better. The alternative provides an operational benefit to a cost ratio of 21.52. This analysis is in **Appendix N**.

Right of Way Impacts

This solution has a small impact on multiple properties. A conservative estimate of this area was used for the cost estimate, however further design would be required to find the exact space required.

Reason for Dismissal

Though this alternative had lower right of way, utility, and financial impacts than other alternatives at this intersection, the lack of adequate operational improvement at intersection 240 (SR-94/IR-271 NB Ramp) causes queuing to back into intersection 250 (SR-94/Remsen Rd), which was a failing condition for this location. Due to this failure, the alternative was dismissed from consideration.

Alternative B-1: Intersections of SR-94 and the IR-271 SB Ramp and SR-94 and Remsen Rd (Intersection 240-250)

Description

This alternative involves adding a roundabout at SR-94 and Remsen Rd and adding another roundabout at the IR-271 NB exit ramp and SR-94 intersection, with two through lanes to SR-94, one of which is a bypass lane to bypass both roundabouts to SR-94. This alternative is depicted in **Figure 39**. An exhibit of this alternative is located in **Appendix B**. Due to the location of these two intersections, this alternative limits access to a private property on the east side of the SR-94/Remsen Rd intersection and a gas station on the northwest side of the same intersection.



Figure 39: SR-94/Remsen Rd/IR-271 SB Exit Ramps Dual Roundabout

Conceptual Estimate of Probable Cost

The preliminary cost estimate for this improvement was \$5,088,000, calculated as described in the Conceptual Estimate of Probable Cost section. Refer to **Appendix C** for the full cost estimate.

Utility Impacts and Existing Structures

A few different utilities run through the intersections which would have to be considered in designing and constructing this alternative:

- Multiple power lines run through the intersections.
- A potable water conduit runs north-south through the east side of the intersections.
- A fiber utility box exists on the northwest corner of the SR-94/Remsen Rd intersection. This is sufficiently set back from the intersection such that it should be possible to avoid, but it must be considered.
- A culvert exists running perpendicular to SR-94 between the two intersections.

For exhibits of these utilities, refer to **Appendix Q**. For the culvert location refer to **Appendix P**.

Safety Benefits

ECAT was used to evaluate the safety benefits of this alternative. The alternative was predicted to reduce annual crashes by 2.97 crashes per year, with a safety benefit to cost ratio of 0.50. The ECAT analysis is in **Appendix L**. **Figure 40** presents the findings from ECAT. Refer to **Table 12** for an explanation of the crash categories shown below.

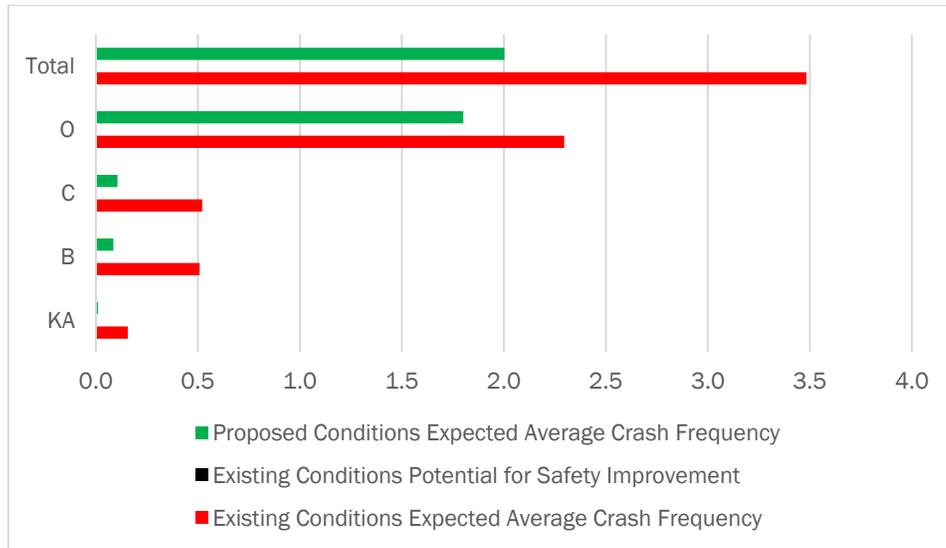


Figure 40: SR-94/IR-271 SB Ramp and SR-94/Remsen Rd Alternative B-1 Crash Summary

HCS Analysis

HCS Analysis was undertaken for this alternative to determine the delay improvement.

Intersection Delay

The intersection delay was improved as shown in **Table 21** below.

Table 21: SR-94/IR-271 SB Ramp and SR-94/Remsen Rd Alternative B-1 HCS Results

INTERSECTION	Design Year	PEAK HOUR	EXISTING CONDITIONS LOS	PROPOSED CONDITIONS LOS
SR-94/REMSEN RD	2030	AM	63.6 Sec (LOS F)	12.6 Sec (LOS A)
		PM	540.4 Sec (LOS F)	9.4 Sec (LOS A)
	2050	AM	107.8 Sec (LOS F)	15.5 Sec (LOS C)
		PM	3485.0 Sec (LOS F)	10.6 Sec (LOS B)
SR-94/IR-271 SB RAMP	2030	AM	58.9 Sec (LOS E)	12.4 Sec (LOS B)
		PM	157.4 (LOS F)	4.3 Sec (LOS A)
	2050	AM	79.1 Sec (LOS E)	15.6 Sec (LOS C)
		PM	217.6 Sec (LOS F)	4.8 Sec (LOS A)

Queuing

The intersection queuing for both intersections are shown in **Figure 41** and **Figure 42**. The critical length in red is the maximum queuing length allowable in that direction. Any bar that exceeds the critical length means that vehicles will be queuing into approach intersections.

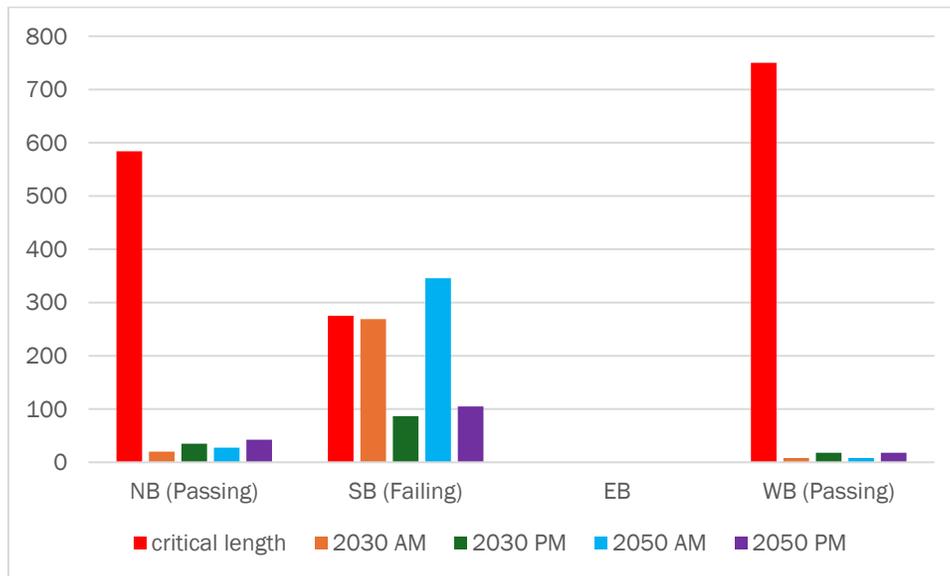


Figure 41: SR-94/IR-271 SB Ramp Alternative B-1 Queuing Lengths

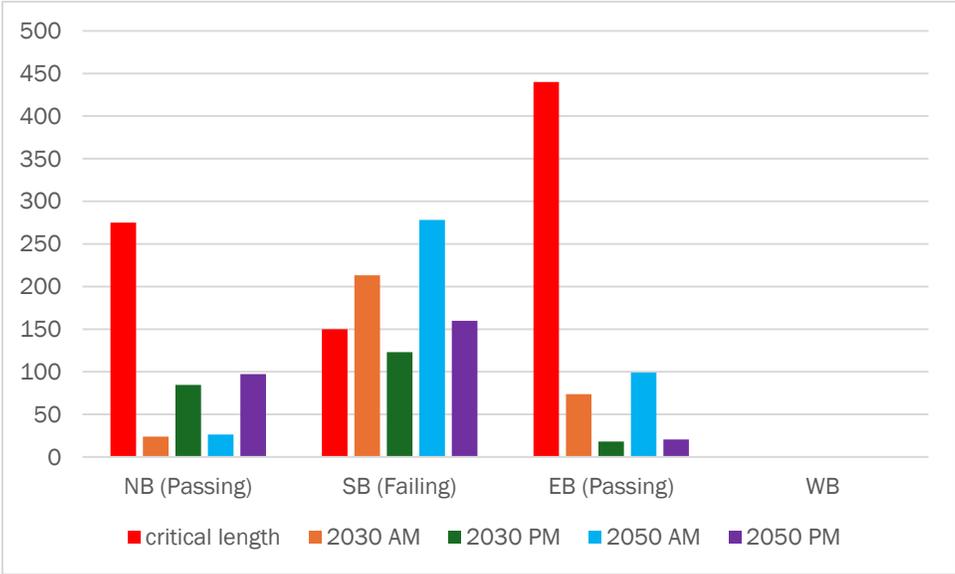


Figure 42: SR-94/Remsen Rd Alternative B-1 Queuing Lengths

The full HCS capacity analysis summary is in **Appendix M**. TransModeler analysis was also undertaken for this intersection, but the HCS Analysis was prioritized per ODOT Request. The TransModeler results are also located in **Appendix M**.

Operational Benefits

ICE was used to evaluate the operational benefits of this alternative. The alternative was predicted to reduce delays by a significant margin, improving to LOS C or above. The alternative provides an operational benefit to cost ratio of 16.84. This analysis is in **Appendix N**.

Right of Way Impacts

This solution has a small impact on multiple properties. A conservative estimate of this area was used for the cost estimate, however further design would be required to find the exact space required.

Reason for Dismissal

Though this double roundabout setup significantly improves the LOS and decreases crash frequency, this alternative had the largest footprint of the alternatives proposed, barring the IR-71/IR-271 interchange ramps. Additionally, the HCS results reveal that southbound traffic at intersection 240 (SR-94/IR-271 Exit Ramp) is expected to back into intersection 250 (SR-94/Remsen Rd), which was a failing condition for this location. These impacts resulted in the decision to dismiss the alternative.

Alternative B-2: Intersections of SR-94 and the IR-271 SB Ramp and SR-94 and Remsen Rd (Intersection 240-250)

Description

This option was to create a 5-point oval roundabout, combining the SR-94/Remsen Rd and SR-94/IR-271 SB ramp intersection into one large intersection. This alternative did reduce crashes, but due to its complexity the LOS analysis was delayed and the alternative was dismissed before it was completed. The alternative is depicted in **Figure 43**. An exhibit of this alternative is located in **Appendix B**. A peanut roundabout recommended on page 97 operates in the same capacity but is less costly and causes less property impacts. Additionally, peanut roundabouts reduce vehicle speed and improve overall intersection safety.



Figure 43: SR-94/Remsen Rd/IR-271 SB Exit Ramps Oval Roundabout

Conceptual Estimate of Probable Cost

The preliminary cost estimate of this improvement is \$5,905,000, calculated as described in the Conceptual Estimate of Probable Cost section. Refer to **Appendix C** for the full cost estimate.

Utility Impacts

Utility impacts were not studied for this alternative, as it was dismissed before utility impacts were studied.

Safety Benefits

ECAT was used to evaluate the safety benefits of this alternative. The alternative was predicted to decrease annual crashes by 2.68 crashes per year, with a safety B/C ratio of 0.43. The ECAT analysis is in **Appendix L**. **Figure 44** presents the findings from ECAT. Refer to **Table 12** for an explanation of the crash categories shown below.

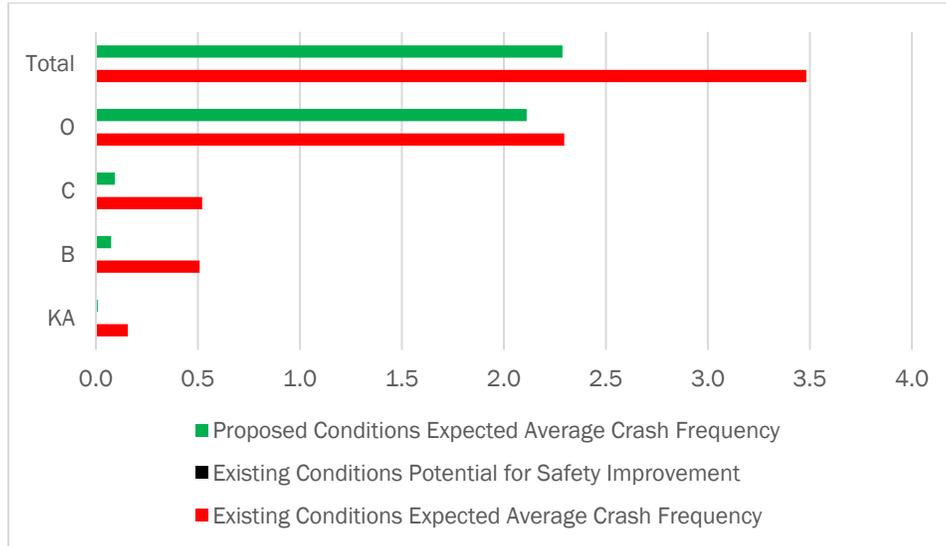


Figure 44: SR-94/IR-271 SB Ramp and SR-94/Remsen Rd Alternative B-2 Crash Summary

HCS Analysis

HCS Analysis was not undertaken for this alternative, as it was too complicated to model. TransModeler was suggested for this alternative, but was not included as the alternative was dismissed before results were completed.

Operational Benefits

Operational impacts were not studied for this alternative.

Right of Way Impacts

This alternative would have major impacts on R/W, including requiring a total property take and requiring a private drive to be rerouted.

Reason for Dismissal

This alternative was dismissed as it would have the most disturbed area of the alternatives considered at these intersections and the highest cost with the potential for requiring acquisition of a full property on the west side of SR-94, while also decreasing crashes less than other comparable alternatives at the intersections. In addition, from an operations perspective it was expected to behave exactly like the peanut roundabout, which was the alternative that was ultimately proposed for these intersections.

Alternative C: Renssen Road Realignment

Description

This alternative encompassed multiple intersection improvements and one roadway realignment. The main difference between this alternative and other proposed improvements was the Renssen Rd realignment. Intersection #220 would be converted to a roundabout, and intersection #250 would be removed, with Renssen Rd then terminating in a cul-de-sac. On the south side of IR-271, Melody Ln would be lengthened with a bridge over IR-271 and connecting to Renssen Rd. This description is depicted in **Figure 45**. An exhibit of this alternative is located in **Appendix B**.



Figure 45: Renssen Rd Diversion and Cul-de-sac

Conceptual Estimate of Probable Cost

The preliminary cost estimate of this improvement is \$21,413,000, calculated as described in the Conceptual Estimate of Probable Cost section. Refer to **Appendix C** for the full cost estimate.

Utility Impacts

Utility impacts were not studied for this alternative, as it was dismissed before utility impacts were studied.

Safety Benefits

ECAT was used to evaluate the safety benefits of this alternative. The alternative was predicted to decrease annual crashes by 4.8991 crashes per year, with a safety B/C ratio of 0.20. The ECAT analysis is in **Appendix L. Figure 46** presents the findings from ECAT. Refer to **Table 12** for an explanation of the crash categories shown below.



Figure 46: Alternative C Crash Summary

HCS Analysis

HCS Analysis was not conducted for this alternative as the alternative was dismissed before the analysis was conducted.

Operational Benefits

Operational analysis was not performed for this alternative.

Right of Way Impacts

This alternative has significant impacts on R/W such which includes seven total takes and eleven partial takes.

Reason for Dismissal

This alternative was dismissed due to it requiring multiple R/W takes, including total takes due to buildings close to intersection #220 (SR-94/Remsen Rd/ Melody Ln). Additionally, the improvements might divert traffic from the existing corridor to a road that cannot support high through traffic. Constructing a new bridge to re-route Melody Ln over IR-271 had a high impact on properties in the area.

11 Proposed Countermeasures

Short Term

Due to the nature of this project, no short-term countermeasures were considered.

Medium Term

Intersection #250: Left Turn Lane on NB SR-94 to Remsen Rd.

Description

The only medium-term countermeasure considered was a left turn lane to relieve congestion on SR-94. NB travelers on SR-94 could be delayed by a person trying to turn onto Remsen Rd, causing a significant backup. A left turn lane would decrease backups at the Remsen Rd intersection and could be implemented in the interim before long-term improvements could be completed. This alternative is depicted in **Figure 47**. An exhibit of this alternative is located in **Appendix B**. This alternative is not adequate for deceleration for a permanent left turn lane. The goal of this alternative is to provide medium-term congestion relief while a more comprehensive solution is prepared.



Figure 47: SR-94/Remsen Rd Left Turn Lane

Turn Lane Length Design

The data used to find the required length of the proposed right-turn lane is presented in **Table 22**.

Table 22: SR-94/Remsen Rd Medium Term Alternative Left Turn Lane Design

INTERSECTION	SR-94/REMSSEN RD
INTERSECTION TYPE	Unsignalized
SPEED	50 MPH
DECELERATION TAPER	175 Feet
STORAGE LENGTH	0 Feet
CALCULATED TURN LANE LENGTH (HIGH SPEED DECELERATION ONLY)	175 Feet

The turn lane is a condition B turn lane with a 50 MPH design speed, so the required length was 175 feet, and the maximum length possible in the existing space is 55 feet. This is considered acceptable as this alternative is only meant as a medium term solution, not a long term solution.

Conceptual Estimate of Probable Cost

The preliminary cost estimate of this improvement is \$544,688, calculated as described in the Conceptual Estimate of Probable Cost section. Refer to **Appendix C** for the full cost estimate.

Utility Impacts

As a medium-term improvement with little roadway development, this improvement intercepts with very few utilities. However, there are a few areas of concern:

- A fiber utility box lies near the gas station west of the improvements.
- Overhead electric and telecom lines are in the area.
- Underground water conduits are in the area.

For exhibits with these utilities, refer to **Appendix Q**.

Safety Benefits

ECAT was used to evaluate the safety benefits of this alternative. The alternative was predicted to reduce annual crashes by 0.96 crashes per year, with a safety benefit to cost ratio of 0.93. This analysis is in **Appendix L**. **Figure 48** presents the findings from ECAT. Refer to **Table 12** for an explanation of the crash categories shown below.

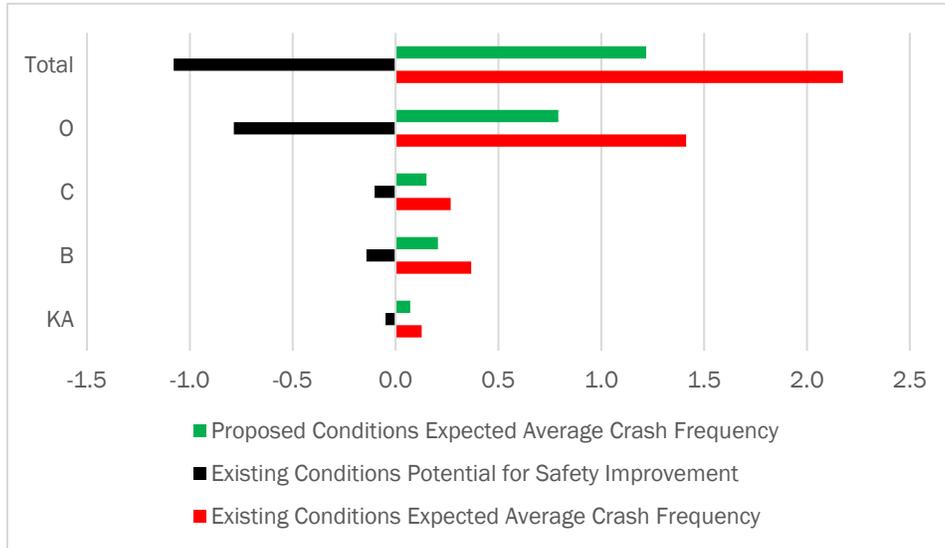


Figure 48: SR-94/Remsen Rd Medium Term Crash Summary

HCS Analysis

Intersection Delay

HCS Analysis was undertaken for this alternative was completed to determine the delay improvement. The intersection delay was improved as shown in **Table 23** below. The alternative was not analyzed for 2050 performance as it was a medium-term improvement. Although the LOS was not improved at the intersection, the delay was significantly reduced during the PM peak hour due to its implementation.

Table 23: SR-94/Remsen Rd Medium Term Alternative

DESIGN YEAR	PEAK HOUR	EXISTING CONDITIONS LOS	PROPOSED CONDITIONS LOS
2030	AM	63.6 Sec (LOS F)	62.5 (LOS F)
	PM	540.4 Sec (LOS F)	100.6 Sec (LOS F)
2050	AM	-	-
	PM	-	-

Queuing

The intersection queuing is shown in **Figure 49**. The critical length in red is the maximum queuing length allowable in that direction. Any bar that exceeds the critical length means that vehicles will be queuing into approach intersections.

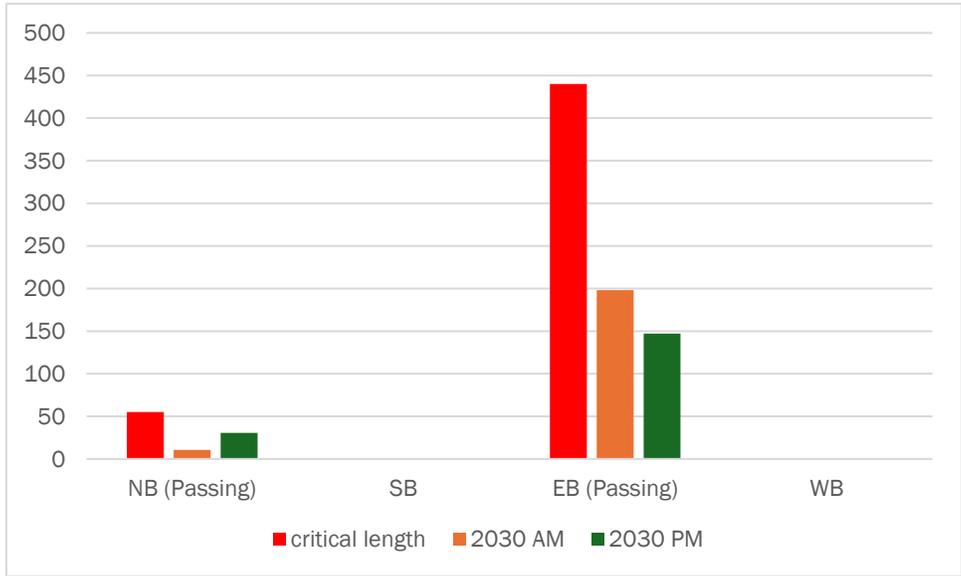


Figure 49: SR-94/Remsen Rd Medium Term Alternative Queuing Lengths

The full HCS capacity analysis summary is in **Appendix M**.

Operational Benefits

ICE was used to evaluate the operational benefits of this alternative. The alternative was predicted to reduce delays by a significant margin and provides an operational benefit to cost ratio of 27.82. This analysis is in **Appendix N**.

Right of Way Impacts

This solution requires a small amount of pavement widening and repainting, such that it should be contained in the existing right of way.

Medium Term Countermeasure Summary

Table 24 Summarizes the cost, safety, and operational benefit for the medium-term countermeasures, as well as notes on utility and R/W impacts.

Table 24: Medium Term Countermeasure Summary

INTERSECTION	250
COST	\$692,000
CRASH REDUCTION	-0.957 Annual Crashes
SAFETY BENEFIT	\$645,407
SAFETY B/C	0.93
OPERATIONAL BENEFIT	\$19,249,267
OPERATIONAL B/C	27.82
UTILITY NOTES	None
RIGHT OF WAY NOTES	None

Long Term

SR-94: Corridor Widening

Description

Due to the nature of the suggested improvements on SR-94, a second northbound lane is required to support the improvements. This lane would extend from the intersection of SR-94 and Remsen Rd to the intersection of SR-94 and SR-3. The corridor improvements are depicted in **Figure 50**. An exhibit of this alternative is in **Appendix B**.



Figure 50: SR-94 Corridor Width Improvements

Conceptual Estimate of Probable Cost

The preliminary cost estimate of this improvement is \$2,216,000, calculated as described in the Conceptual Estimate of Probable Cost section. Refer to **Appendix C** for the full cost estimate.

Utility Impacts

A few utilities run beside and across the roadway in the improvement area:

- Both overhead electrical lines and telecom lines run on both sides of the roadway
- Underground water conduits are in the area

For exhibits with these utilities refer to **Appendix Q**.

Safety Benefits

ECAT was not used to evaluate this improvement, as it was necessary to support the improvements at the SR-94 and SR-3 intersection and the SR-94 and Remsen Rd/IR-271 SB Ramp intersection.

HCS Analysis

HCS Analysis was not undertaken for this improvement, as HCS works off intersection delay and corridor design speed. The design speed did not change so the analysis would show no improvement.

Operational Benefits

Operational analysis was not conducted for this improvement, as it works off of delay improvements provided by HCS analysis, and that was not measurable for this improvement.

Right of Way Impacts

This solution only requires a small amount of pavement widening and repainting, but to maintain existing drainage conditions the right of way to the east would need to be widened slightly. This would impact two properties. Preliminary cross sections of this alternative are in **Appendix B**.

Future Development – Two Way Left Turn Lane

If development occurs in the future along SR 94, the proposed three lanes of pavement could be restriped for a two way left turn lane (TWLTL) if development volumes do not increase the volumes in the through lane near saturation flow rate (1900 pc/h/ln). This was tested by setting up a *Synchro* Model of two lanes coming together and applying *ODOT L&D Manual 402-1* for lane drops after an intersection. This is 300 feet of two lane and then a lane drop (for lane drop taper which was modeled as a left turn lane). The critical PM Peak volumes were used in the analysis. **Figure 51** shows the model and volumes. No queues occurred in the model simulation. ECAT analysis showed this configuration only improves safety by less than 0.1 annual crashes with the current quantity of left turns on the roadway, but if more development occurred on the corridor, left-turning traffic would increase.



Figure 51: Synchro TWLTL Model

Alternative B: Roundabout at the Intersection of SR-94, SR-3, and Ledge Rd (Intersection #10)

Description

This intersection was a high priority for improvements due to its high crash frequency. The 2024 Highway Safety Improvement Program ranked the intersection as 64th out of 414 high priority intersections. Due to this ranking and the existing infrastructure causing significant delays, see **Appendix J**, a roundabout was considered at this intersection. This roundabout was designed to have two NB lanes on SR-94 from the southern approach to allow for a dedicated NB left turn lane, necessitating lane widening on SR-94 leading up to the intersection. The roundabout is depicted in **Figure 52**. An exhibit of this alternative is located in **Appendix B**.

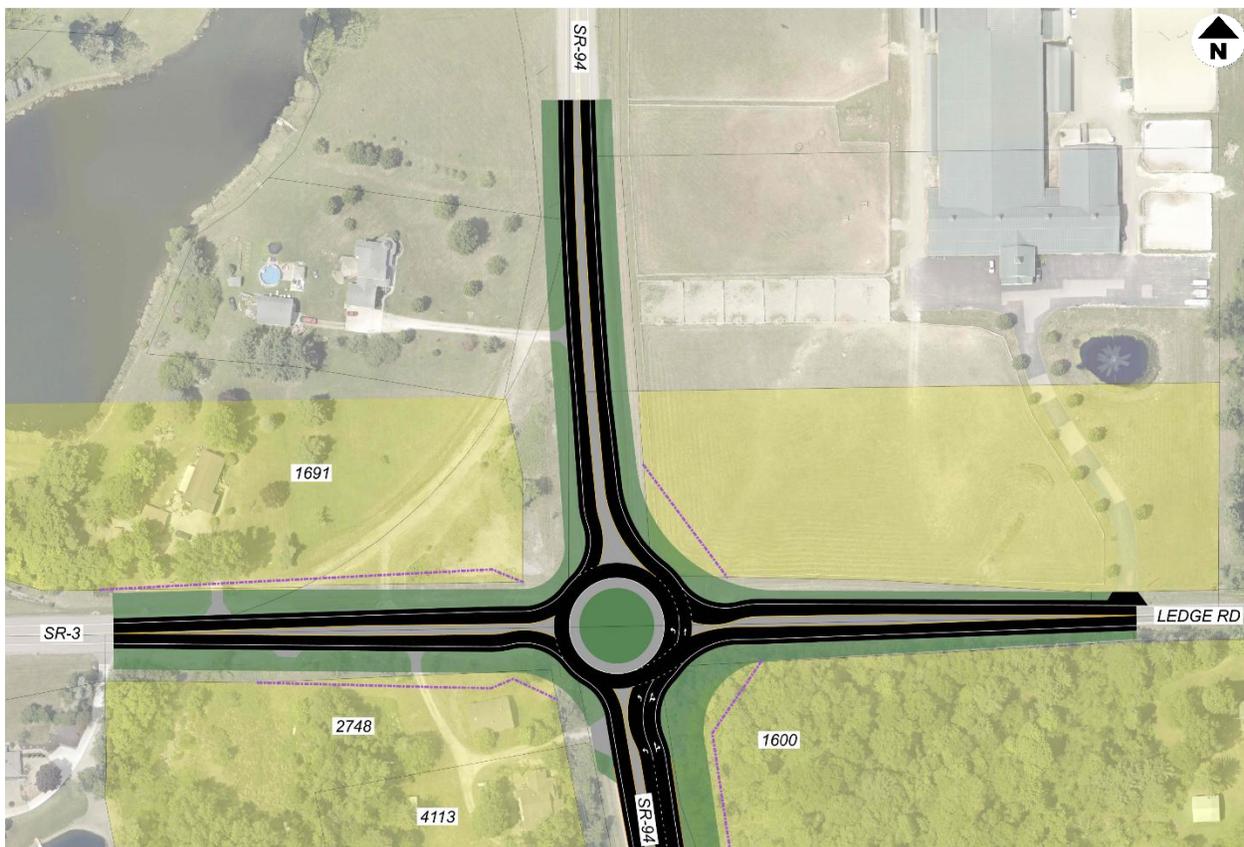


Figure 52: SR-94/SR-3 Roundabout

Visual Alternative Comparison Matrix

The visual alternative comparison matrix is shown in **Figure 53**. Refer to **Appendix R** for the matrices presented in that stakeholder workshop.

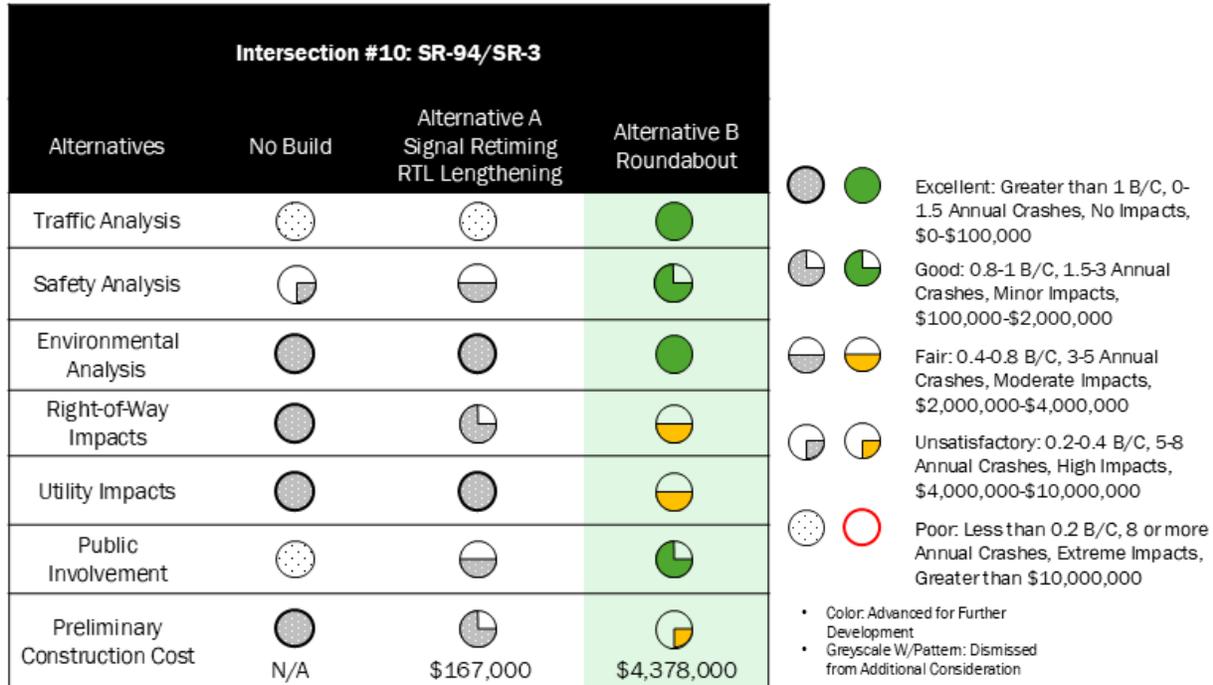


Figure 53: SR-94/SR-3 Visual Alternative Matrices

Information on alternative A can be found on page 47.

Conceptual Estimate of Probable Cost

The preliminary cost estimate for this improvement was \$4,378,000, calculated as described in the Conceptual Estimate of Probable Cost section. Refer to **Appendix C** for the full cost estimate.

Utility Impacts

A few different utilities run through the intersection which would have to be considered in designing and constructing a roundabout:

- Multiple power lines run through the intersection, and the existing traffic signals would require removal.
- A potable water conduit runs east-west through the south side of the intersection and branches off to travel south.
- A gas line runs through the intersection.

For exhibits of these utilities refer to **Appendix Q**.

Safety Benefits

ECAT was used to evaluate the safety benefits of this alternative. The alternative was predicted to reduce annual crashes by 6.00 crashes per year, with a safety benefit to cost ratio of 0.60. The

intersection mostly has property damage only crashes, of which the crash frequency was predicted to be reduced dramatically, however ECAT does not assign any monetary value to these crashes, which is why the ratio is so low. The ECAT analysis is in **Appendix L**. **Figure 54** presents the findings from ECAT. Refer to **Table 12** for an explanation of the crash categories shown below.

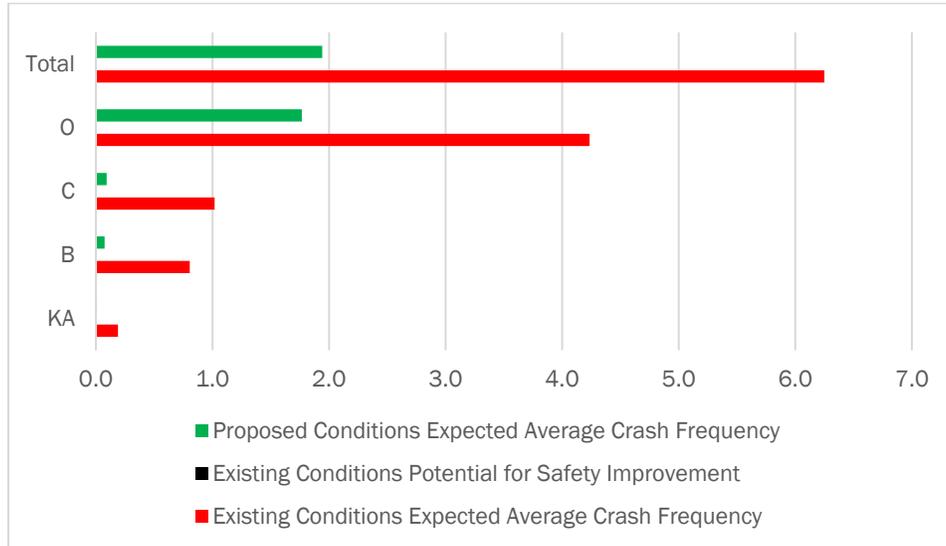


Figure 54: SR-94/SR-3 Alternative B Crash Summary

HCS Analysis

Intersection Delay

HCS Analysis was undertaken for this alternative was completed to determine the delay improvement. The intersection delay was improved as shown in **Table 25** below.

Table 25: SR-94/SR-3 Roundabout HCS Results

DESIGN YEAR	PEAK HOUR	EXISTING CONDITIONS LOS	PROPOSED CONDITIONS LOS
2030	AM	91.8 Sec (LOS F)	6.5 Sec (LOS A)
	PM	55.9 Sec (LOS E)	8.4 Sec (LOS A)
2050	AM	90.0 Sec (LOS F)	9.4 Sec (LOS A)
	PM	55.4 Sec (LOS E)	9.0 Sec (LOS A)

Queuing

The intersection queuing is shown in **Figure 55**. The critical length in red is the maximum queuing length allowable in that direction. Any bar that exceeds the critical length means that vehicles will be queuing into approach intersections.

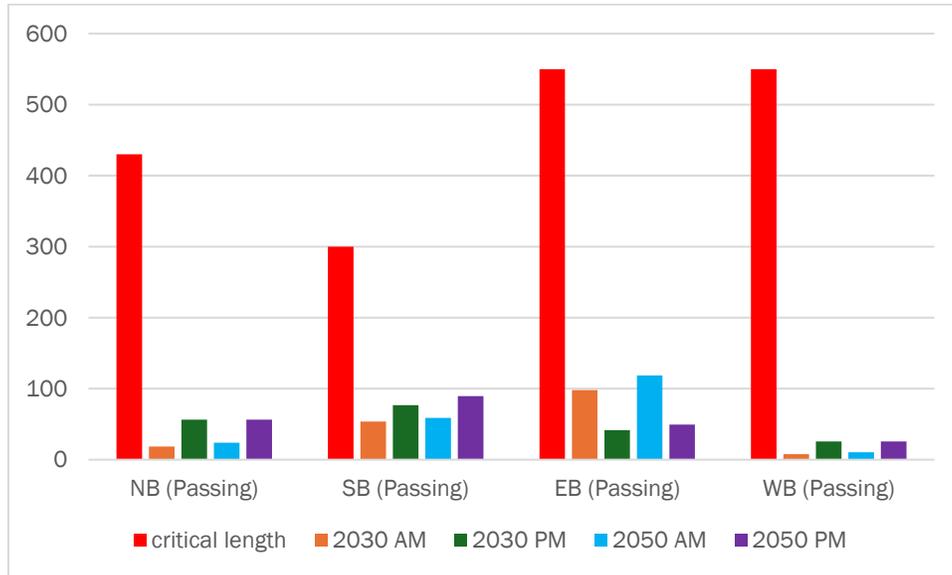


Figure 55: SR-94/SR-3 Alternative B Queuing Lengths

The full HCS capacity analysis summary is in **Appendix M**.

Operational Benefits

ICE was used to evaluate the operational benefits of this alternative. The alternative was predicted to reduce delays by a significant margin, improving the LOS to A. The alternative provides an operational benefit to cost ratio of 6.86. This analysis is in **Appendix N**.

Right of Way Impacts

This solution has a small impact on multiple properties due to the lane widening requirements on SR-94 and the intersection area increase. A conservative estimate of this area was used for the cost estimate, however further design would be required to find the exact space required. Preliminary cross sections of this alternative are in **Appendix B**.

Alternative A: Southbound Right Turn Lane on W 130th Street to SR-3 (Intersection #30)

Description

This intersection was not a high priority for improvements, however adding a right turn lane was shown to decrease crashes and delays for a low price. The turn lane is depicted in **Figure 56**. An exhibit of this alternative is located in **Appendix B**.



Figure 56: SR-3/W 130th St Right Turn Lane

Turn Lane Length Design

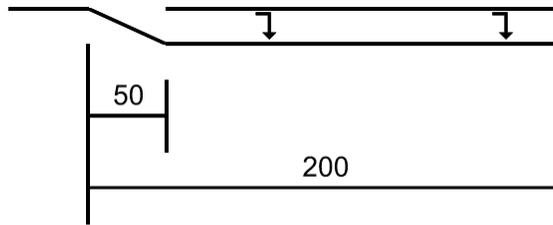
The data used to find the required length of the proposed right turn lane is presented in **Table 26**. The full design is in the HCS results in **Appendix M**.

Table 26: SR-3/W 130th St Alternative A Right Turn Lane Design

INTERSECTION	SR-3/W 130TH ST
INTERSECTION TYPE	Unsignalized
SPEED	50 MPH
CYCLE LENGTH	60 Seconds
DECELERATION TAPER	50 Feet
STORAGE LENGTH	150 Feet
CALCULATED TURN LANE LENGTH (CONDITION A: STORAGE LENGTH + DECELERATION TAPER)	200 Feet

Figure 57 shows the configuration of the turn lane based on the calculated values in **Table 26**.

Figure 57: SR-3/W 130th St Alternative A Right Turn Lane Design Depiction



Visual Alternative Comparison Matrix

The visual alternative comparison matrix is shown below in **Figure 58**. Refer to **Appendix R** for the matrices presented in that stakeholder workshop.

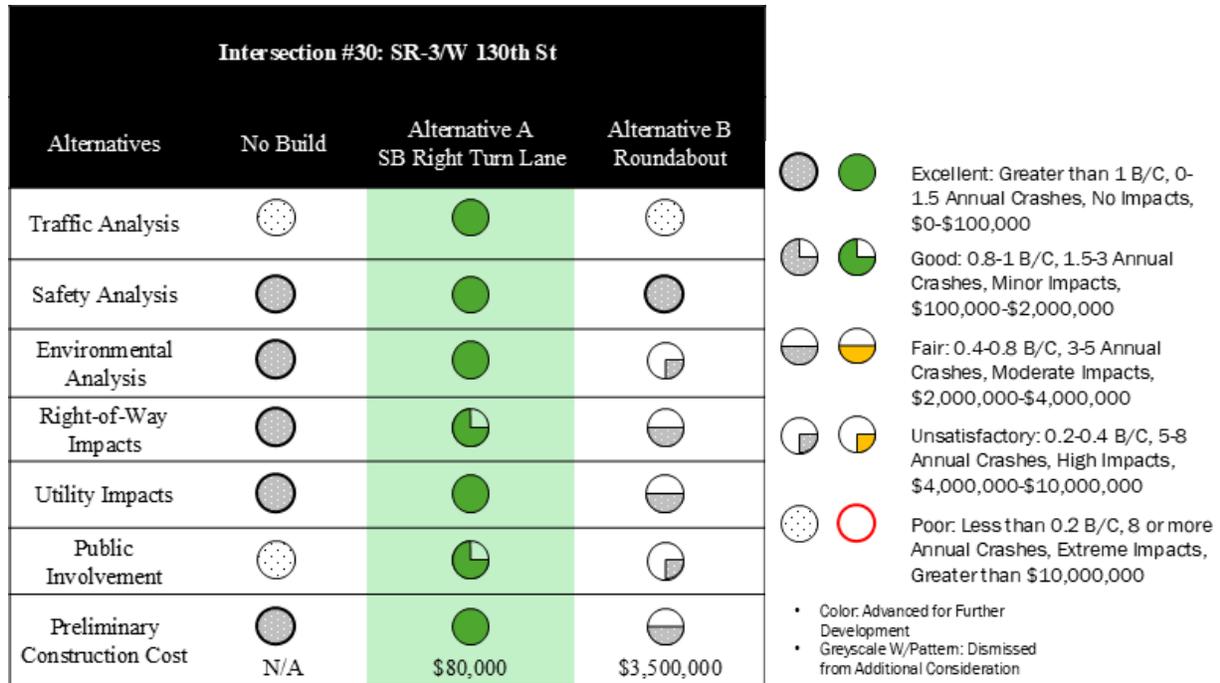


Figure 58: SR-3/W 130th St Visual Alternative Matrices

Information on alternative B can be found on page 50.

Conceptual Estimate of Probable Cost

The preliminary cost estimate for this improvement was \$80,000, calculated as described in the Conceptual Estimate of Probable Cost section. Refer to **Appendix C** for the full cost estimate.

Utility Impacts

Due to the small impact area of the improvement, only one utility was expected to be impacted, however power lines and water lines do run nearby. The utility that was expected to be impacted was a gas line that runs parallel to the roadway on the SB side of W 130th Street.

For an exhibit depicting this utility and other utilities refer to **Appendix Q**.

Safety Benefits

ECAT was used to evaluate the safety benefits of this alternative. The alternative was predicted to reduce annual crashes by 0.16 crashes per year, with a safety benefit to cost ratio of 1.45. The ECAT analysis is in **Appendix L**. **Figure 59** presents the findings from ECAT. Refer to **Table 12** for an explanation of the crash categories shown below.

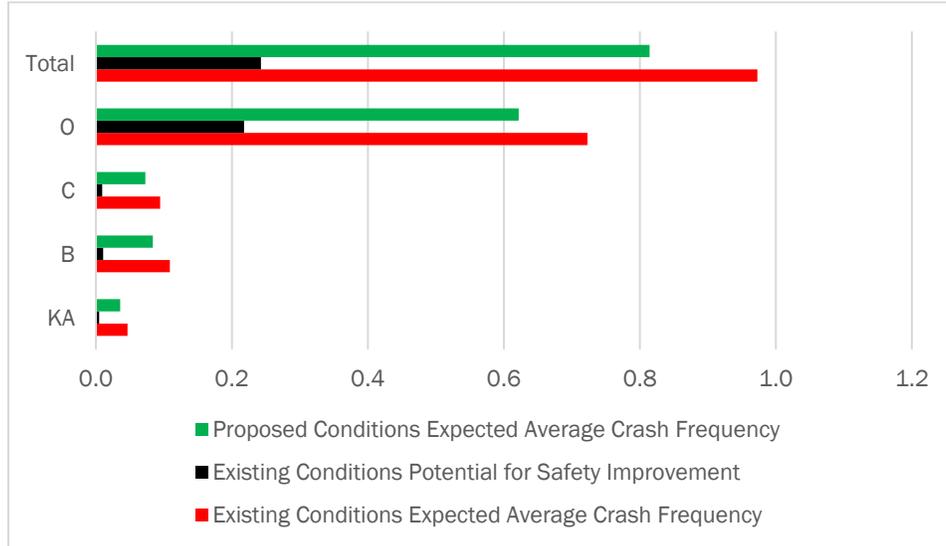


Figure 59: SR-3/W 130th St Alternative A Crash Summary

HCS Analysis

Intersection Delay

HCS Analysis was undertaken for this alternative was completed to determine the delay improvement. The intersection delay was improved as shown in **Table 27** below. Note that the overall delay was improved, though splitting the left turn and right turn lanes shows an increase of delay for the left turn lane.

Table 27: SR-3/W 130th St Right Turn Lane HCS Results

DESIGN YEAR	PEAK HOUR	EXISTING CONDITIONS LOS	LEFT TURN W 130TH ST PROPOSED CONDITIONS LOS	RIGHT TURN W 130TH ST PROPOSED CONDITIONS LOS
2030	AM	31.5 Sec (LOS D)	40.0 Sec (LOS E)	10.1 Sec (LOS B)
	PM	38.0 Sec (LOS D)	61.6 Sec (LOS F)	12.5 Sec (LOS B)
2050	AM	37.1 Sec (LOS E)	47.1 Sec (LOS E)	10.4 Sec (LOS B)
	PM	60.9 Sec (LOS F)	91.8 Sec (LOS F)	13.1 Sec (LOS B)

Queuing

The intersection queuing is shown in **Figure 60**. The critical length in red is the maximum queuing length allowable in that direction. Any bar that exceeds the critical length means that vehicles will be queuing into approach intersections.

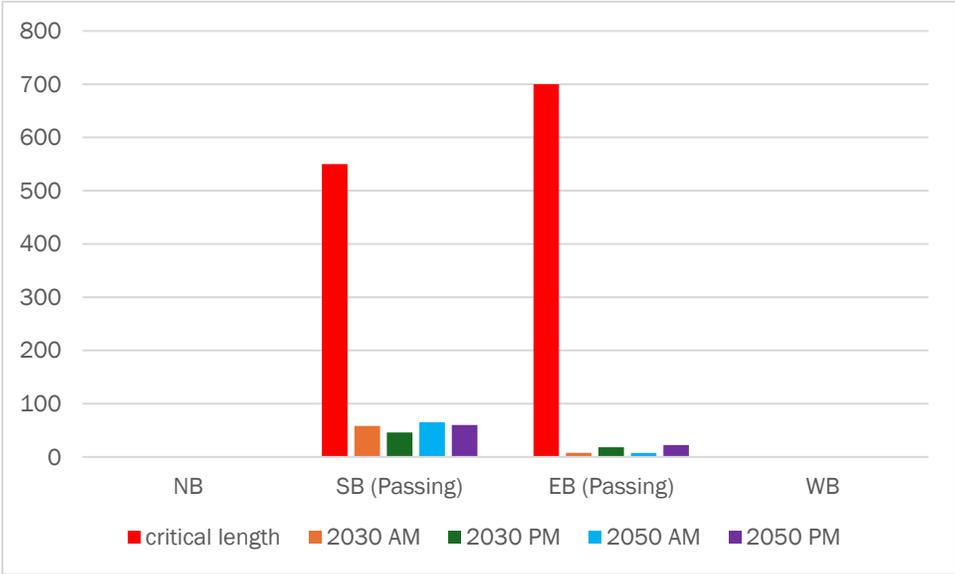


Figure 60: SR-3 W 130th St Alternative A Queuing Lengths

The full HCS capacity analysis summary is in **Appendix M**.

Operational Benefits

ICE was used to evaluate the operational benefits of this alternative. The alternative was predicted to reduce delays by a significant margin. The alternative provides an operational benefit to cost ratio of 9.36. This analysis is in **Appendix N**.

Right of Way Impacts

This solution requires a small amount of pavement widening and repainting, however steep grading on the western side of the intersection would require more fill and a wider build-up, which pushes the construction boundaries outside of the existing right of way. Shifting the intersection to the east may remedy this, however this would conflict with the existing drive situated there. Preliminary Cross Sections of this alternative are in **Appendix B**.

Alternative A-1: Northbound Left Turn Lane and Southbound Right Turn Lane on SR-3 and a Receiving Lane on the IR-71 Northbound on ramp (Intersection #40)

Description

This intersection had a poor predicted LOS for 2050 for the No-Build condition, due to too many vehicles turning left onto the IR-71 NB ramp. Adding a second left turn lane to NB SR-3, a right turn lane to SB SR-3, and second receiving lane improves the LOS and reduces crashes in the intersection. The right turn lane helps to relieve poor lane utilization and was requested via public comments. The improvements are depicted in **Figure 61**. An exhibit of this alternative is located in **Appendix B**.



Figure 61: SR-3/IR-71 NB Ramp Double Turn Lanes

Turn Lane Length Design

The data used to find the required length of the proposed northbound and southbound turn lanes are presented in **Table 28**. Both the northbound and southbound directions have the same criteria for design, so they have the same length requirements.

Table 28: SR-3/IR-271 NB Ramp Alternative A Turn Lane Design

INTERSECTION	SR-3/REMSSEN RD/FOSKETT RD
INTERSECTION TYPE	Signalized
SPEED	50 MPH
CYCLE LENGTH	120 Seconds
NUMBER OF LANES (LEFT)	2
NUMBER OF LANES (RIGHT)	1
STORAGE LENGTH (LEFT TURN)	533 Feet per lane
STORAGE LENGTH (RIGHT TURN)	250 Feet
DECELERATION (LEFT TURN LANE 1)	225 Feet
DECELERATION (LEFT TURN LANE 2)	145 Feet
DECELERATION (RIGHT TURN LANE)	165 Feet

Figure 62 shows the configuration of the left turn lanes and

Figure 63 shows the configuration of the right turn lane based on the calculated values in **Table 28**. The full design is in the HCS results in **Appendix M**.

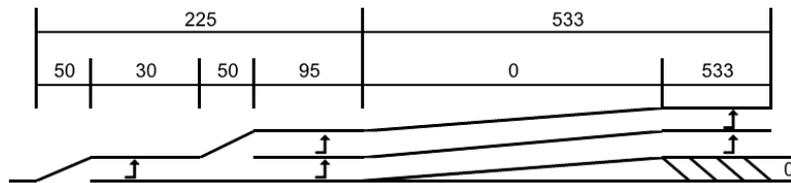


Figure 62: SR-3/IR-271 NB Ramp Alternative A-1 Left Turn Lane Design Depiction

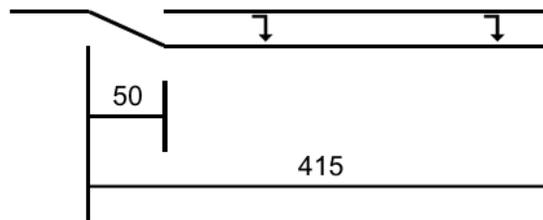


Figure 63: SR-3/IR-271 NB Ramp Alternative A-1 Right Turn Lane Design Depiction

Note that due to the space limitations caused by the geometric constraints of the SR-94/IR-271 Interchange, the left turn lane design lengths could not be met. The second left turn lane straight length that was achieved in design was 170 feet, with a 100 foot taper, to conform the turn lane to

the central median. Nevertheless, this design improves the intersections turning capacity, even though it does not meet the calculated design.

Visual Alternative Comparison Matrix

The visual alternative comparison matrix is shown below in **Figure 64**. Refer to **Appendix R** for the matrices presented in that stakeholder workshop.

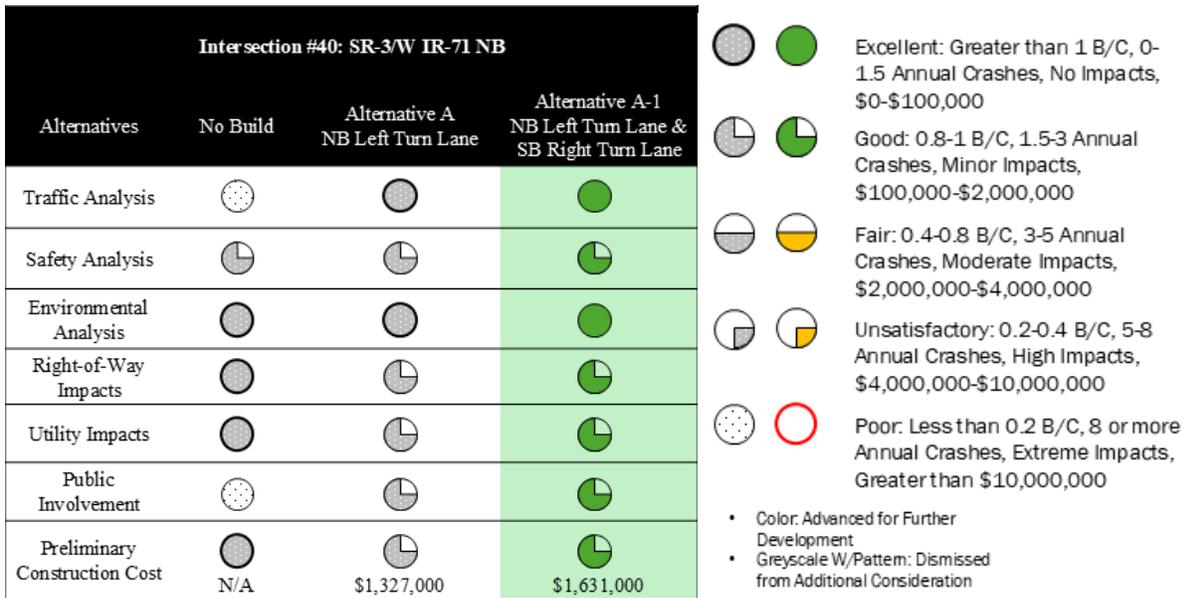


Figure 64: SR-3/IR-71 NB Ramp Visual Alternative Matrix

While the visual alternative matrix shows no change between the two alternatives, the additional right turn lane included in A-1 reduces delay for the right turning movement on southbound SR-3. This does not appear as impactful in the benefit cost analysis as delays are averaged over the entire intersection.

Conceptual Estimate of Probable Cost

The preliminary cost estimate for this improvement was \$1,631,000, calculated as described in the Conceptual Estimate of Probable Cost section. Refer to **Appendix C** for the full cost estimate.

Utility Impacts and Existing Structures

A gas line runs on the north side of SR-3 and one culvert runs underneath SR-3 would be impacted if the pavement had to be extended.

For exhibits of these utilities refer to **Appendix Q**.

Safety Benefits

ECAT was used to evaluate the safety benefits of this alternative. The alternative was predicted to reduce annual crashes by 0.67 crashes per year, with a safety benefit to cost ratio of 0.20. The ECAT analysis is in **Appendix L**. **Figure 65** presents the findings from ECAT. Refer to **Table 12** for an explanation of the crash categories shown below.

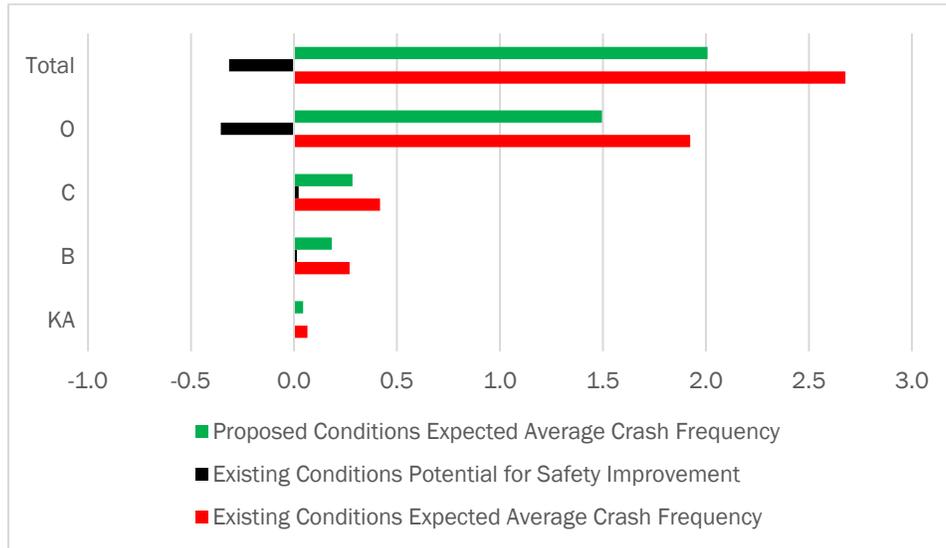


Figure 65: SR-3/IR-71 NB Ramp Alternative A-1 Crash Summary

HCS Analysis

Intersection Delay

HCS Analysis was undertaken for this alternative was completed to determine the delay improvement. The intersection delay was improved as shown in **Table 29** below. While the intersection delay was not improved in the PM peak, the main concern at this intersection was the delay at the AM peak, which was significantly reduced by this alternative

Table 29: SR-3/IR-271 NB Ramp Left Turn Lane HCS Results

DESIGN YEAR	PEAK HOUR	EXISTING CONDITIONS LOS	PROPOSED CONDITIONS LOS
2030	AM	62.1 Sec (LOS E)	33.9 Sec (LOS D)
	PM	21.1 Sec (LOS C)	25.6 Sec (LOS C)
2050	AM	74.6 Sec (LOS E)	34.5 Sec (LOS C)
	PM	25.2 Sec (LOS C)	26.2 Sec (LOS C)

Queuing

The intersection queuing is shown in **Figure 66**. The critical length in red is the maximum queuing length allowable in that direction. Any bar that exceeds the critical length means that vehicles will be queuing into approach intersections.

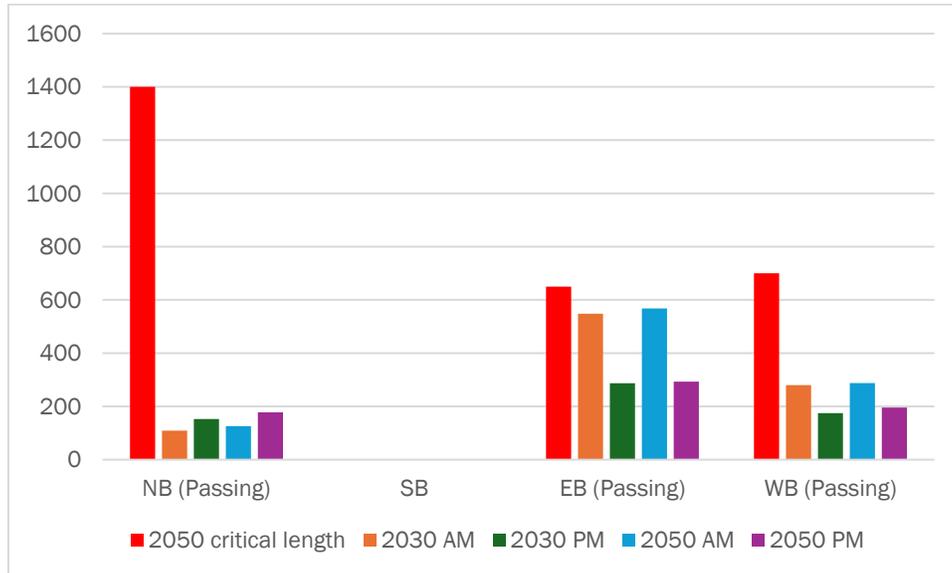


Figure 66: SR-3/IR-71 Alternative A-1 Queuing Lengths

The full HCS capacity analysis summary is in **Appendix M**.

Operational Benefits

ICE was used to evaluate the operational benefits of this alternative. The alternative was predicted to reduce delays by a significant margin, improving the LOS from LOS F to LOS D, which is in the acceptable range. The alternative provides an operational benefit to cost ratio of 5.20. This analysis is in **Appendix N**.

Right of Way Impacts

This solution only requires a small amount of pavement widening and repainting, such that it may be contained in the existing right of way. Preliminary cross sections are in **Appendix B**. Note that these cross sections were completed before the right turn lane was added to the alternative, so the added pavement was not included in the cross sections.

Alternative A: Add Left Turn Lanes at the Intersection of SR-3 and Remsen Rd/Foskett Rd (Intersection #70)

Description

This intersection was a high priority for improvements due to its high crash frequency. The 2024 Highway Safety Improvement Program ranked the intersection 14th out of 414 high priority intersections. Stoplights were recently installed, but further improvements may help the safety issues. Due to this ranking left turn lanes were considered at this intersection. A prior safety study concluded that a single lane roundabout would operate poorly at this intersection due to high traffic on SR-3. The improvements are depicted in **Figure 67**. An exhibit of this alternative is located in **Appendix B**.

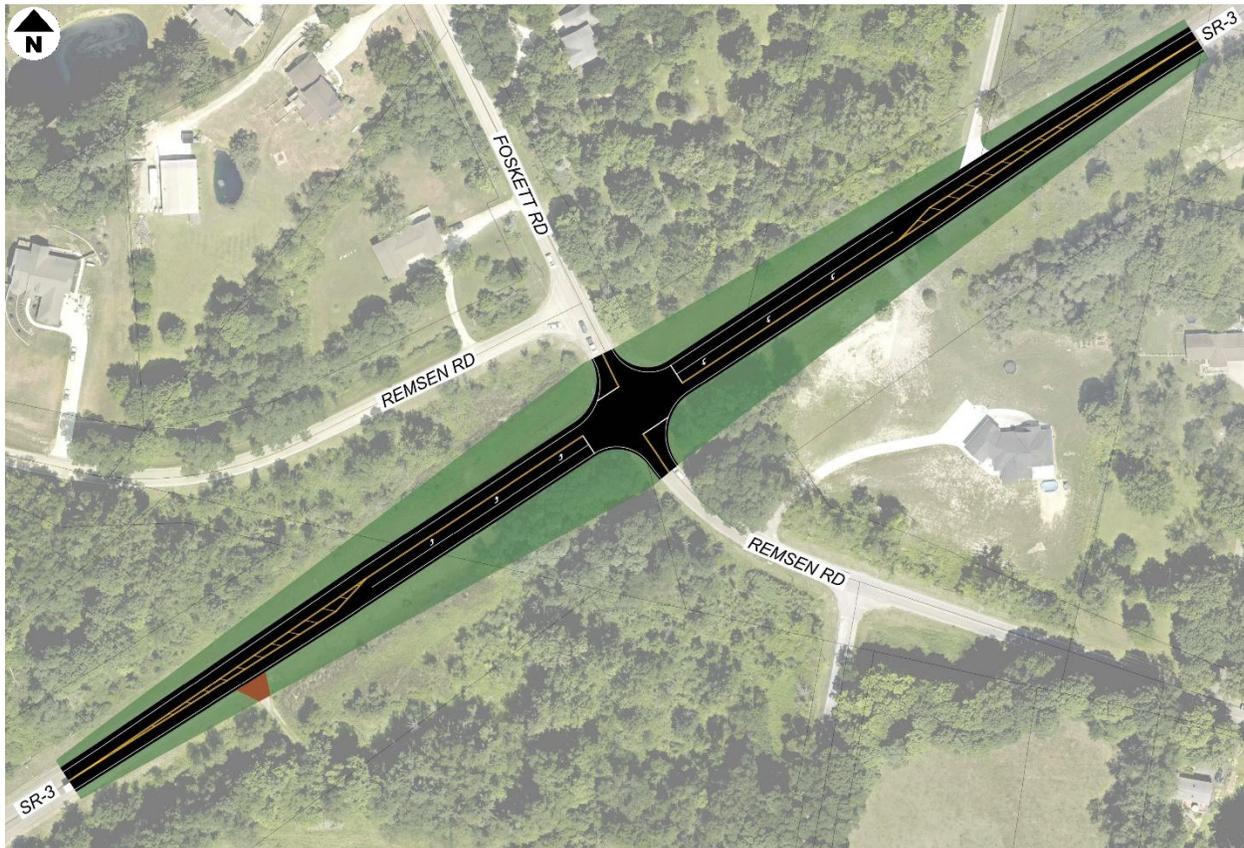


Figure 67: SR-3/Remsen Rd/Foskett Rd Left Turn Lanes

Turn Lane Length Design

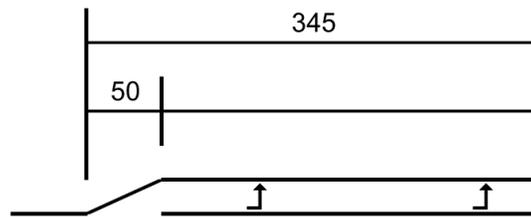
The data used to find the required length of the proposed northbound and southbound left turn lanes are presented in **Table 30**. Both the northbound and southbound directions have the same criteria for design, so they have the same length requirements. The full design is in the HCS results in **Appendix M**.

Table 30: SR-3/Remsen Rd/Foskett Rd Alternative A NB and SB Left Turn Lane Design

INTERSECTION	SR-3/REMSEN RD/FOSKETT RD
INTERSECTION TYPE	Signalized
SPEED	60 MPH
CYCLE LENGTH	120 Seconds
DECELERATION TAPER	345 Feet
STORAGE LENGTH	50 Feet
TURN LANE LENGTH (CONDITION B: DECELERATION ONLY)	345 Feet

Figure 68 shows the configuration of the left turn lanes based on the calculated values in **Table 30**.

Figure 68: SR-94/Remsen Rd/Foskett Rd Alternative A NB and SB Left Turn Lane Design Depiction



Visual Alternative Comparison Matrix

The visual alternative comparison matrix is shown in **Figure 69**. Refer to **Appendix R** for the matrices presented in that stakeholder workshop.

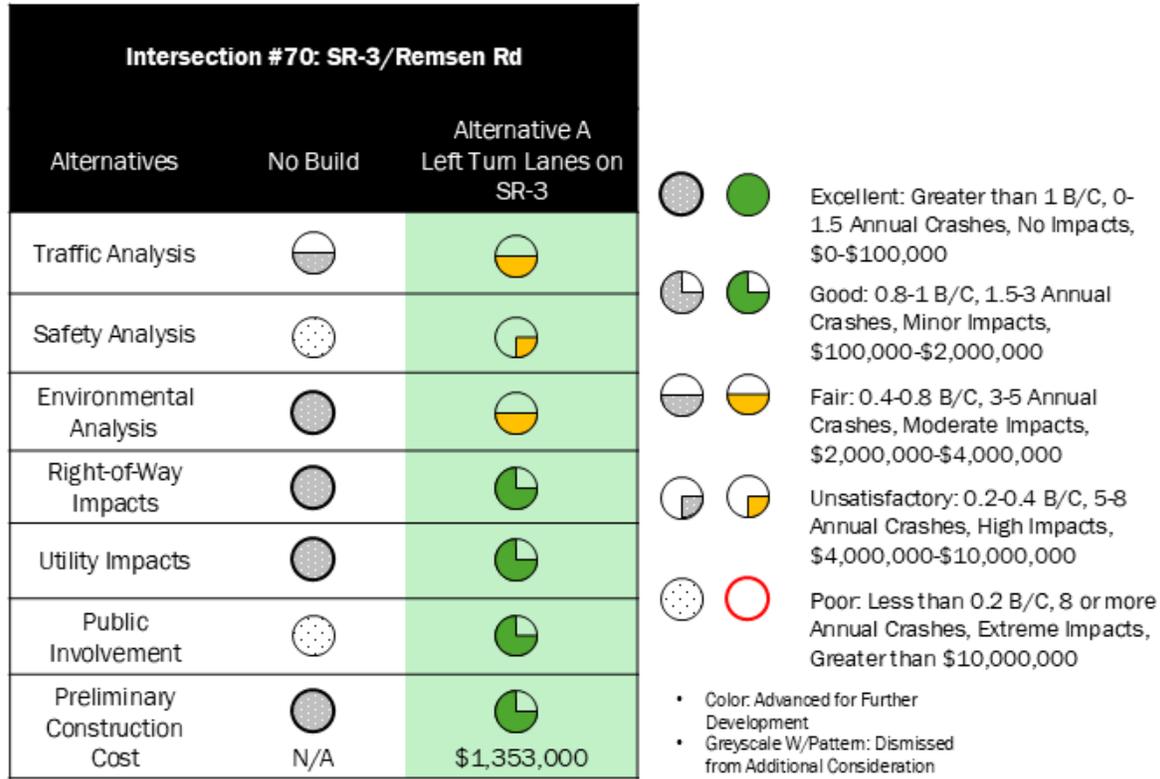


Figure 69: SR-3/Remsen Rd Visual Alternative Matrix

Conceptual Estimate of Probable Cost

The preliminary cost estimate for this improvement was \$1,353,000, calculated as described in the Conceptual Estimate of Probable Cost section. Refer to **Appendix C** for the full cost estimate.

Utility and Environmental Impacts

A few different utilities run through the intersection which would have to be considered in designing and constructing left turn lanes:

- Multiple power lines run through the intersection.
- A potable water conduit runs through the intersection.
- A wetland exists on the west side of the intersection.

For exhibits of these impacts refer to **Appendix Q**.

Safety Benefits

ECAT was used to evaluate the safety benefits of this alternative. The alternative was predicted to reduce annual crashes by 3.48 crashes per year, with a safety benefit to cost ratio of 1.10. The ECAT analysis is in **Appendix L. Figure 70** presents the findings from ECAT. Refer to **Table 12** for an explanation of the crash categories shown below.

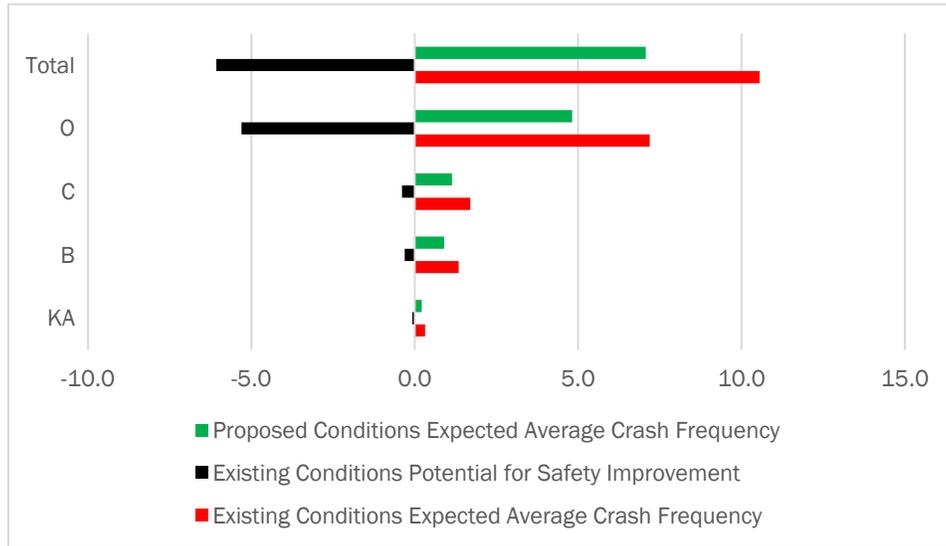


Figure 70: SR-3/Remsen Rd/Foskett Rd Alternative A Crash Summary

HCS Analysis

Intersection Delay

HCS Analysis was undertaken for this alternative was completed to determine the delay improvement. The intersection delay was not improved as shown in **Table 31** below.

Table 31: SR-3/Remsen Rd/Foskett Rd Left Turn Lanes HCS Results

DESIGN YEAR	PEAK HOUR	EXISTING CONDITIONS LOS	PROPOSED CONDITIONS LOS
2030	AM	21.6 Sec (LOS C)	23.0 Sec (LOS C)
	PM	19.6 Sec (LOS B)	20.3 Sec (LOS C)
2050	AM	26.7 Sec (LOS C)	27.4 Sec (LOS C)
	PM	22.7 Sec (LOS C)	24.1 Sec (LOS C)

Note that this alternative was proposed primarily for safety improvements, not LOS improvements. Left turn lanes on SR-3 allow left turning vehicles to leave the primary through lane, reducing backups, and allowing traffic flow freely.

Queuing

The intersection queuing is shown in **Figure 71**. The critical length in red is the maximum queuing length allowable in that direction. Any bar that exceeds the critical length means that vehicles will be queuing into approach intersections.

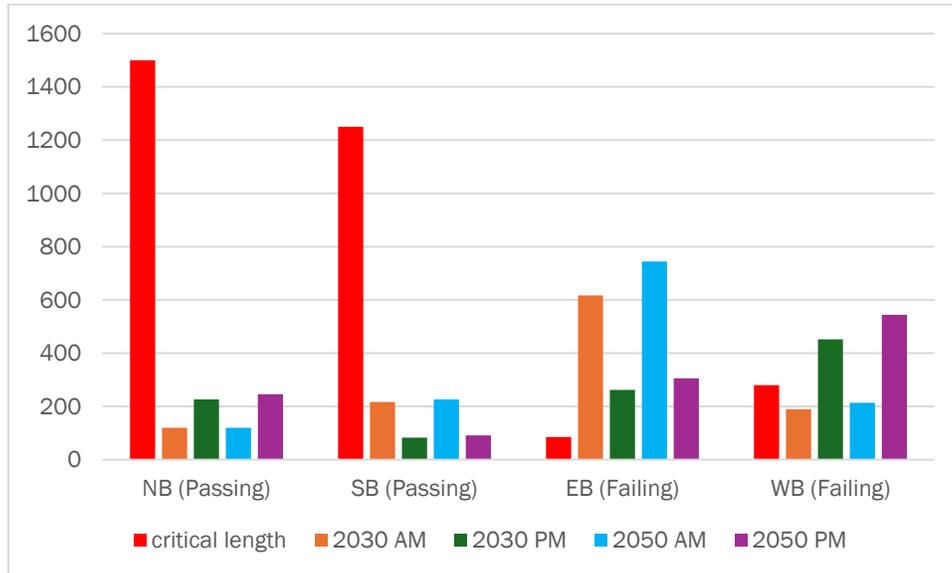


Figure 71: SR-3/Remsen Rd/Foskett Rd Alternative A Queuing Lengths

The full HCS capacity analysis summary is in **Appendix M**.

Operational Benefits

ICE was used to evaluate the operational benefits of this alternative. The alternative provides an operational benefit to cost ratio of -0.44. However, a significant reduction in crashes was the reason for the improvements, not the LOS. This analysis is in **Appendix N**.

Right of Way Impacts

This solution only requires a small amount of pavement widening and repainting, such that it may be contained in the existing right of way, however considerations about which side of the road to widen should consider the small wetland on the northwest side of the road. Preliminary cross sections of this alternative are in **Appendix B**.

Alternative A: Add a Roundabout at the Intersection of SR-94 and the IR-271 NB Ramp (Intersection #230)

Description

This alternative proposed adding a roundabout at this intersection, as the intersection had a poor LOS for vehicles turning off the IR-271 NB Ramp. Adding a roundabout significantly improves intersection operation while decreasing crashes slightly. The proposed improvements are depicted in **Figure 72**. An exhibit of this alternative is located in **Appendix B**.



Figure 72: SR-94/IR-271 NB Ramp

Visual Alternative Comparison Matrix

The visual alternative comparison matrix is shown below in **Figure 73**. Refer to **Appendix R** for the matrices presented in that stakeholder workshop.

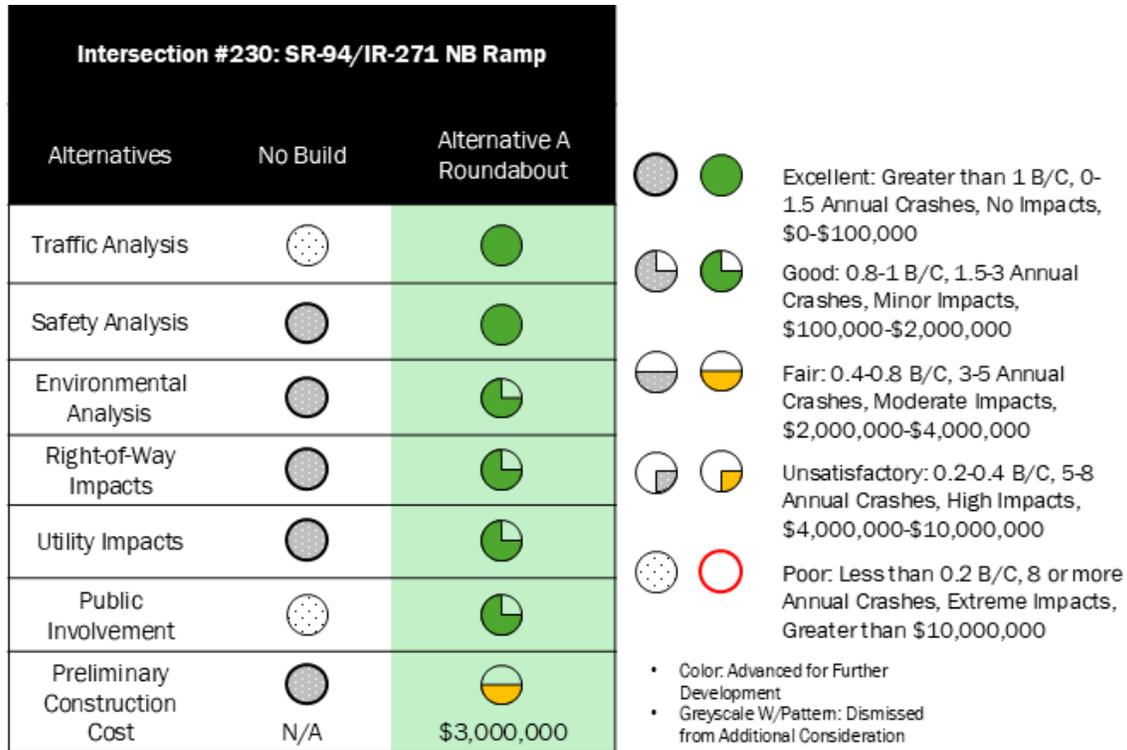


Figure 73: SR-94/IR-271 NB Ramp Visual Alternative Matrix

Conceptual Estimate of Probable Cost

The preliminary cost estimate for this improvement was \$3,000,000, calculated as described in the Conceptual Estimate of Probable Cost section. Refer to **Appendix C** for the full cost estimate.

Utility Impacts

A few utilities run through the intersection which would have to be considered in designing and constructing the roundabout:

- A power line runs along the west side of SR-94 through the intersection.
- A gas conduit runs along the east side of SR-94 through the intersection.
- A water conduit runs along the east side of SR-94 near the intersection.

For exhibits of these utilities refer to **Appendix Q**.

Safety Benefits

ECAT was used to evaluate the safety benefits of this alternative. The alternative is predicted to reduce annual crashes by 0.38 crashes per year, with a safety benefit to cost ratio of 0.09. The ECAT analysis is in **Appendix L**. **Figure 74** presents the findings from ECAT. Refer to **Table 12** for an explanation of the crash categories shown below.

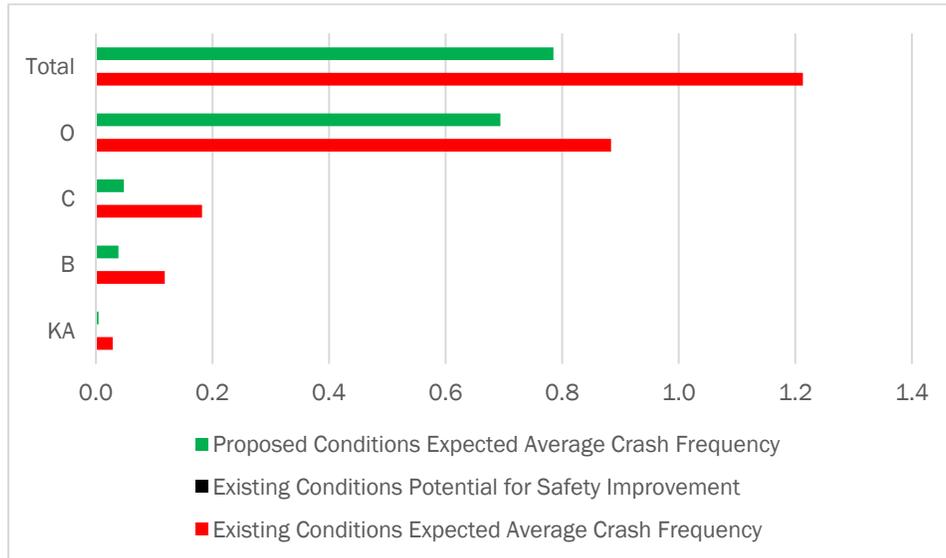


Figure 74: SR-94/IR-271 NB Ramp Alternative A Crash Summary

HCS Analysis

HCS Analysis was undertaken for this alternative was to determine the delay improvement. The intersection delay was improved as shown in **Table 32** below.

Table 32: IR-271 NB Ramp/SR-94 HCS Results

DESIGN LIFE	PEAK HOUR	EXISTING CONDITIONS LOS	PROPOSED CONDITIONS LOS
2030	AM	14,549.0 Sec (LOS F) *	21.2 Sec (LOS C)
	PM	153.4 (LOS F)	8.7 (LOS A)
2050	AM	14,549.0 Sec (LOS F) *	13.8 Sec (LOS B)
	PM	361.7 Sec (LOS F)	8.7 Sec (LOS A)

*Note that this number is based on theoretical calculations, based on existing conditions, and does not model human variance, nor is there a limit on the amount of time that a delay can be. As this delay exceeds the peak hour, it could not actually happen, however it is useful to demonstrate the serious LOS failure at this intersection.

Queuing

The intersection queuing is shown in **Figure 75**. The critical length in red is the maximum queuing length allowable in that direction. Any bar that exceeds the critical length means that vehicles will be queuing into approach intersections.

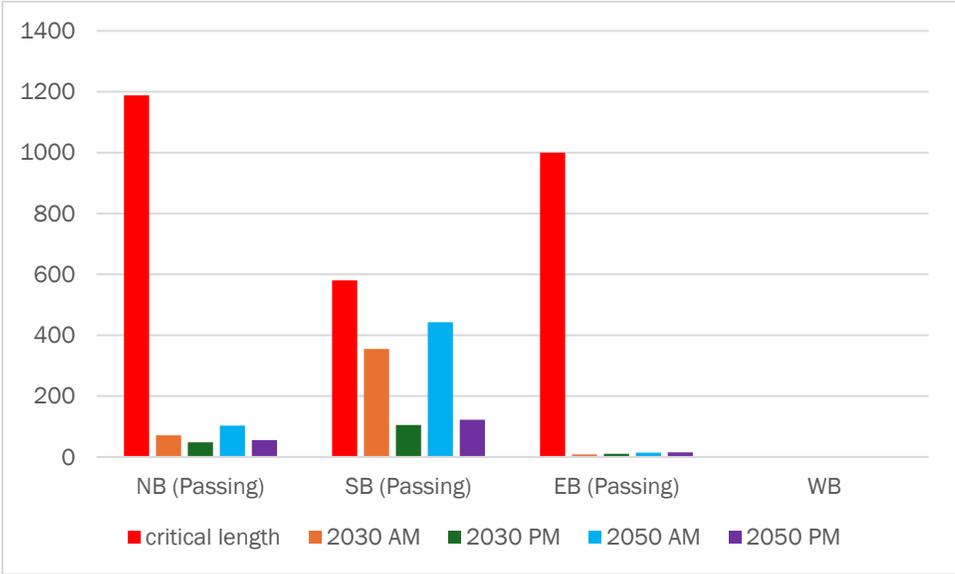


Figure 75: SR-94/IR-271 NB Ramp Alternative A Queuing Lengths

The full HCS capacity analysis summary is in **Appendix M**.

Operational Benefits

ICE was used to evaluate the operational benefits of this alternative. The alternative was predicted to reduce delays by a significant margin, improving the LOS from LOS F to LOS D, which was in the acceptable range. The alternative provides an operational benefit to cost ratio of 8.61. This analysis is in **Appendix N**.

Right of Way Impacts

This solution only requires pavement widening and repainting, but due to ample existing right of way it can be contained in the existing right of way. Preliminary cross sections of this alternative are in **Appendix B**.

Alternative B-2a: Convert Both Intersections into a Combined Five-Point Peanut Roundabout (Intersection #240-250)

Description

Intersections 240 (SR-94/IR-271 SB Ramp) and 250 (SR-94/Remsen Rd) are too close for them to be considered separately when making improvements, as during the peak hour southbound traffic at the SR-94/IR-271 SB Ramp intersection backs up into the SR-94/Remsen Rd intersection. This condition emerged as a high priority concern, as no single intersection alternative remedied this improvement, so the two intersections had to be evaluated together. Several alternatives were proposed to remedy problems at these intersections. This alternative involves adding a large, five-point peanut roundabout at SR-94, Remsen Rd, and the IR-271 SB Ramps, with an extra bypass lane from IR-271 to SR-94, and a left turn lane to support traffic into the existing gas station. This alternative is depicted in **Figure 76**. An exhibit of this alternative is located in **Appendix B**.



Figure 76: SR-94/Remsen Rd/IR-271 SB Exit Ramp Peanut Roundabout

Visual Alternative Comparison Matrix

The visual alternative comparison matrix is shown below in **Figure 77**. Refer to **Appendix R** for the matrices presented in that stakeholder workshop.

Intersection #240-250: SR-94/IR-271 SB Ramp, Remsen Rd North						
Alternatives	No Build	Alternative A 2 Right Turn Lanes and Roundabout	Alternative B-1 Double Roundabout	Alternative B-2 Oval Roundabout	Alternative B-2a: Peanut Roundabout	Alternative C Roundabout, Cu-De-Sac
Traffic Analysis				Not Available		Not Available
Safety Analysis						
Environmental Analysis						
Right-of-Way Impacts						
Utility Impacts						
Public Involvement				Not available		
Preliminary Construction Cost	N/A	\$3,000,000	\$5,088,000	\$5,905,000	\$4,668,000	\$21,413,000

<p> Excellent: Greater than 1 B/C, 0-1.5 Annual Crashes, No Impacts, \$0-\$100,000</p> <p> Good: 0.8-1 B/C, 1.5-3 Annual Crashes, Minor Impacts, \$100,000-\$2,000,000</p> <p> Fair: 0.4-0.8 B/C, 3-5 Annual Crashes, Moderate Impacts, \$2,000,000-\$4,000,000</p>	<p> Unsatisfactory: 0.2-0.4 B/C, 5-8 Annual Crashes, High Impacts, \$4,000,000-\$10,000,000</p> <p> Poor: Less than 0.2 B/C, 8 or more Annual Crashes, Extreme Impacts, Greater than \$10,000,000</p> <ul style="list-style-type: none"> • Color: Advanced for Further Development • Greyscale W/Pattern: Dismissed from Additional Consideration
--	---

Figure 77: SR-94/IR-271 SB Ramp, Remsen Rd North Visual Alternative Matrix

Alternatives A, B-1, B-2, and C are all covered in the Alternatives Considered and Dismissed section, on pages 56, 60, 64, and 66, respectively.

Conceptual Estimate of Probable Cost

The preliminary cost estimate for this improvement was \$4,668,000, calculated as described in the Conceptual Estimate of Probable Cost section. Refer to **Appendix C** for the full cost estimate.

Utility Impacts

A few utilities run through the intersections which would have to be considered in designing and constructing this alternative:

- Multiple power lines run through the intersections.
- A potable water conduit runs north-south through the east side of the intersections.
- A fiber utility box exists on the northwest corner of the SR-94/Remsen Rd intersection. This is sufficiently set back from the intersection such that it should be possible to avoid, but it must be considered.

For exhibits of these utilities refer to **Appendix Q**.

Safety Benefits

ECAT was used to evaluate the safety benefits of this alternative. The alternative was predicted to reduce annual crashes by 2.69 crashes per year, with a safety benefit to cost ratio of 0.55. The ECAT analysis is in **Appendix L**. **Figure 78** presents the findings from ECAT. Refer to **Table 12** for an explanation of the crash categories shown below.

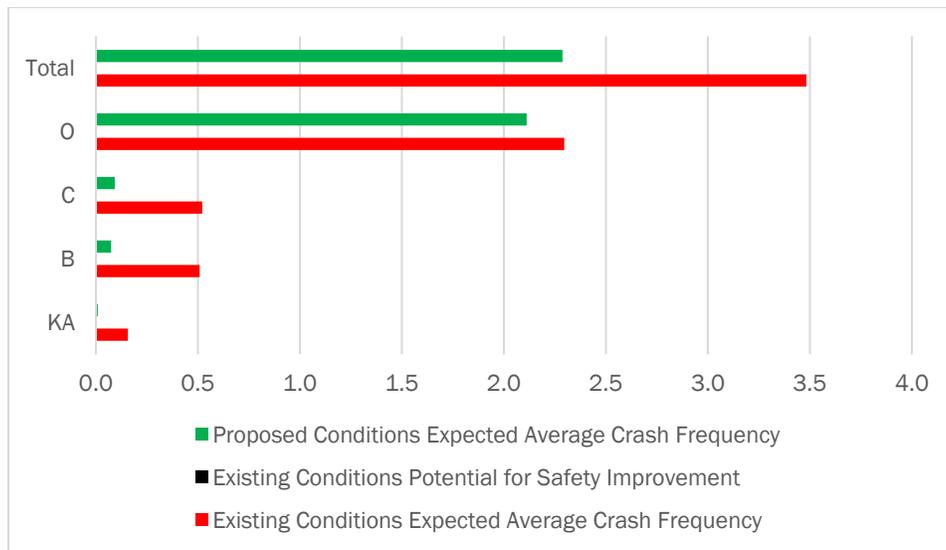


Figure 78: SR-94/IR-271 NB Ramp and SR-94/Remsen Rd Alternative B-2a Crash Summary

TransModeler Analysis

Intersection Delay

TransModeler Analysis was undertaken for this alternative to determine the delay improvement. The intersection delay was improved as shown in **Table 33** below. 2030 Opening Year analysis was not completed for this alternative.

Table 33: SR-94/IR-271 SB Ramp Peanut Roundabout HCS Results

INTERSECTION	DESIGN YEAR	PEAK HOUR	EXISTING CONDITIONS LOS	PROPOSED CONDITIONS LOS
SR-94/REMSEN RD	2030	AM	63.6 (LOS F)	-
		PM	540.4 (LOS F)	-
	2050	AM	107.8 (LOS F)	7.4 (LOS A)
		PM	3485.0 (LOS F)	4.7 (LOS A)
SR-94/IR-271 SB RAMP	2030	AM	58.9 (LOS E)	-
		PM	157.4 (LOS F)	-
	2050	AM	79.1 (LOS F)	7.4 (LOS A)
		PM	217.6 (LOS F)	4.7 (LOS A)

Queuing

The intersection queuing is shown in **Figure 79**. The critical length in red is the maximum queuing length allowable in that direction. Any bar that exceeds the critical length means that vehicles will be queuing into approach intersections.

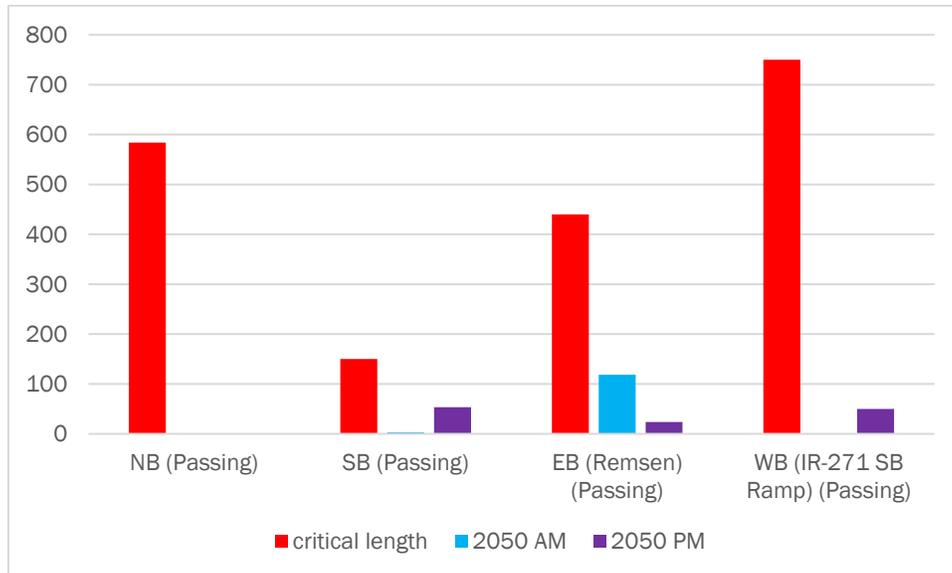


Figure 79: SR-94/IR-271 SB Ramp and SR-94/Remsen Rd Alternative B-2a Queuing Lengths

The full TransModeler analysis is in **Appendix M**.

Operational Benefits

ICE was used to evaluate the operational benefits of this alternative. The alternative was predicted to reduce delays by a significant margin, improving to LOS A. The alternative provides an operational benefit to cost ratio of 19.49. This analysis is in **Appendix N**.

Right of Way Impacts

This solution has a moderate impact on two properties and limits access to one. If implemented, a private drive would have to be relocated on the east side of the Remsen Rd intersection. Preliminary cross sections were undertaken to find the footprint of the roundabout, however further design is suggested to find the exact space required. These preliminary cross sections are in **Appendix B**.

Long Term Countermeasure Summary

Table 34 summarizes the cost, safety, and operational benefits for the long-term countermeasures, as well as notes on utility and right of way impacts. **Figure 80** is the summary visual alternative comparison matrix, **Figure 81** is an aerial summary of the improvements on SR-3, and **Figure 82** is an aerial summary of the improvements on SR-94. Note that the SR-94 width improvements were not included in this table as it does not improve safety or operations but rather supports other improvements along SR-94. The cost of this improvement is \$2,216,000.

Table 34: Long Term Countermeasure Summary

INT. #	10	30	40	70	230	240-250
INT. NAME	SR-94/SR-3	SR-3/W 130th St	SR-3/IR-71 NB Ramp	SR-3/ Remsen Rd/Foskett Rd	SR-94/IR-271 NB Ramp	SR-94/IR-271 SB Ramp and SR-94/ Remsen Rd North
COUNTERMEASURE	Roundabout	RTL on W 130th St	2nd LTL, new RTL, and Receiving Lane	Dual LTLs on SR-3	Roundabout	5-Point Peanut Roundabout
COST	\$4,378,000	\$80,000	\$1,631,000	\$1,353,000	\$3,000,000	\$4,668,000
ANNUAL CRASH REDUCTION	-6.00	-0.16	-0.67	-3.48	-0.38	-2.69
SAFETY BENEFIT	\$2,610,874	\$116,011	\$329,032	\$1,568,107	\$267,468	\$2,558,624
SAFETY B/C	0.60	1.45	0.20	1.10	0.09	0.55
2050 EXISTING CONDITIONS LOS	AM: LOS F PM: LOS E	AM: LOS E PM: LOS F	AM: LOS E PM: LOS C	AM: LOS C PM: LOS C	AM: LOS C PM: LOS A	AM: LOS F PM: LOS F
2050 PROPOSED CONDITIONS LOS	AM: LOS A PM: LOS A	AM: LOS E PM: LOS F	AM: LOS D PM: LOS C	AM: LOS C PM: LOS C	AM: LOS D PM: LOS A	AM: LOS A PM: LOS A
OPERATIONAL BENEFIT	\$30,039,018	\$748,669	\$8,478,090	-\$596,682	\$25,834,770	\$90,978,887
OPERATIONAL B/C	6.86	9.36	5.20	-0.44	8.61	19.49
POSSIBLE UTILITY, EXISTING STRUCTURE, AND ENVIRONMENTAL IMPACTS	-Power Lines -1 Gas Main -1 Water Main -2 Culverts	-1 Gas Main	-1 Gas Main -1 Culvert	-Power Lines -1 Water Main -Wetland -1 Culvert	-Power Lines -1 Water Main -1 Gas Main -1 Culvert	-Power Lines -1 Water Main -1 Gas Main -1 Culvert
RIGHT OF WAY NOTES	Partial takes of nearby properties required	No or minor impact	No impact	Partial takes of nearby properties required	No or minor impact	Partial takes of nearby properties required

SR-3/SR-94 Preferred Corridor Alternatives						
Intersection	10: SR-3/SR-94	30: SR-3/W 130th St	40: SR-3/IR-71 NB Ramp	70: SR-3/Remsen Rd	230: SR-94/IR-271 NB Ramp	240-250: SR- 94/IR-271 SB Ramp, Remsen Rd North
Alternatives	B: Roundabout	A: SB Right Turn Lane	A: NB Left Turn Lane and SB Right Turn Lane	A: Left Turn Lanes on SR-3	A: Roundabout	B-2a: 5 Point Peanut Roundabout
Traffic Analysis						
Safety Analysis						
Environmental Analysis						
Right-of-Way Impacts						
Utility Impacts						
Public Involvement						
Preliminary Construction Cost						
	\$4,378,000	\$80,000	\$1,631,000	\$1,353,000	\$3,000,000	\$4,668,000

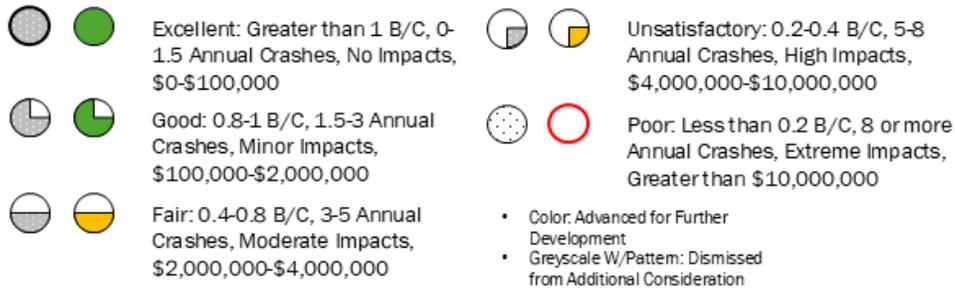


Figure 80: Final Summary Visual Alternative Matrix



Figure 81: SR-3 Improvements

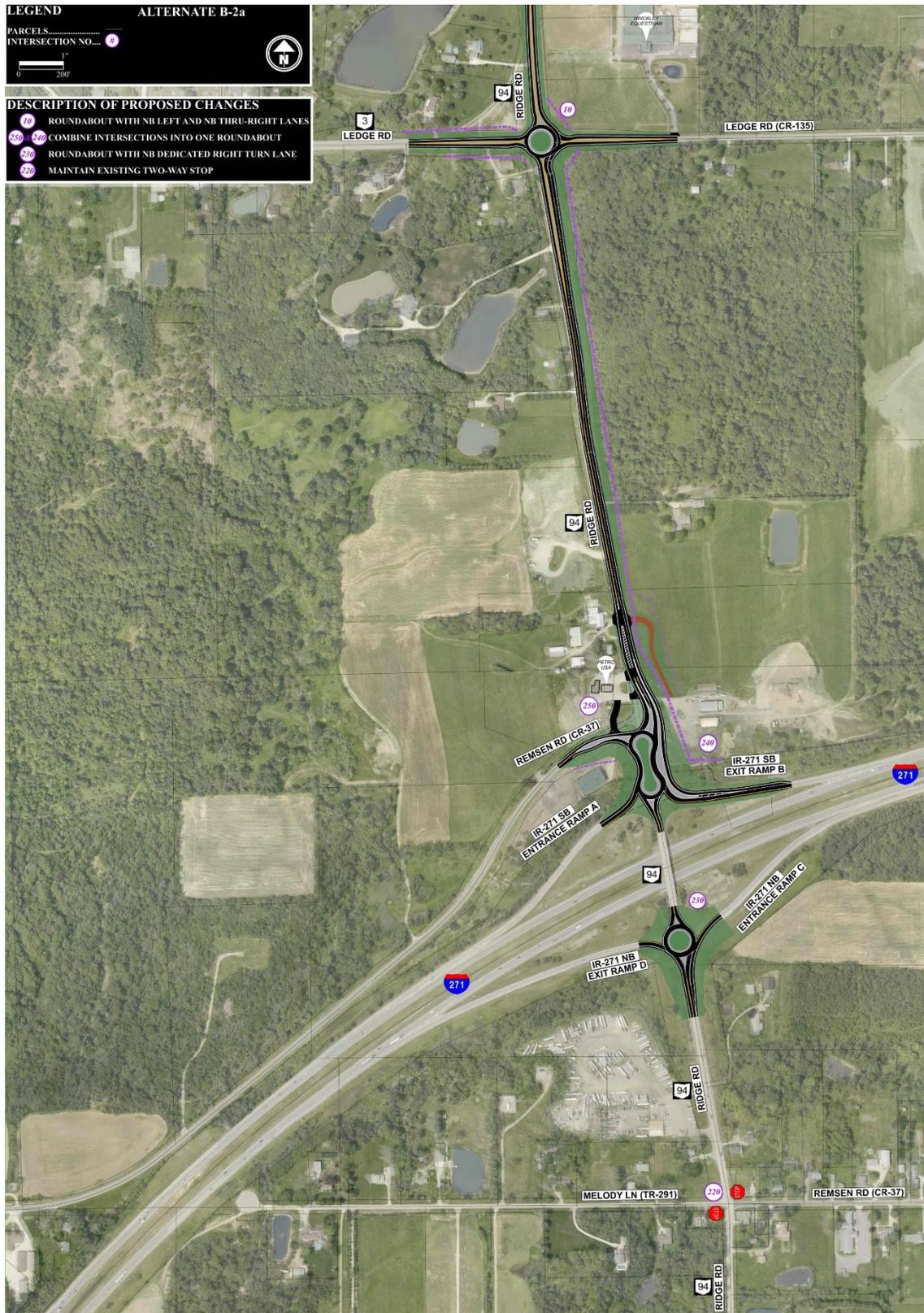


Figure 82: SR-94 Improvements

12 Conclusions and Recommendations

ODOT ECAT, ODOT ICE, HCS, and other delay benefit calculation tools were used to evaluate multiple alternatives, and several recommended alternatives were selected based on their performance within these tools. The benefit to cost ratio for both the operational benefit and the safety benefit, as well as each recommended alternative and its cost is in **Table 35**.

Table 35: Recommended Preferred Alternatives

INTERSECTION	ALTERNATIVE	COST	CRASH REDUCTION	SAFETY B/C	OPERATIONAL B/C
10 (SR-94/SR-3)	Roundabout	\$4,378,000	-5.996	0.60	6.86
30 (SR-3/W 130TH ST)	SB right turn lane on 130th St	\$80,000	-0.159	1.45	9.36
40 (SR-3/IR-71 NB RAMP)	2nd NB left turn lane and new SB Right turn lane on SR-3 and receiving lane on IR-71 NB Ramp	\$1,631,000	-0.673	0.20	5.20
70 (SR-3/REMSEN RD/FOSKETT RD)	Left turn lanes on NB and SB SR-3	\$1,353,000	-3.483	1.16	-0.44
230 (SR-94/IR-271 NB RAMP)	Roundabout	\$3,000,000	-0.378	0.09	8.61
240-250 (SR-94/IR-271 SB RAMP AND SR-94/REMSEN RD)	Five point peanut roundabout	\$4,668,000	-2.689	0.55	19.49
250 (SR-94/REMSEN RD)	Left turn lane on SR-94 to Remsen Rd	\$692,000	-0.862	0.93	27.82
SR-94 WIDTH IMPROVEMENTS	Widen the roadway by an additional lane between SR-94/SR-3 and SR-94/Remsen Rd.	\$2,216,000	N/A	N/A	N/A

Each alternative has a positive safety benefit and most have a positive operational benefit. For most intersections the operational benefit overwhelmingly justifies the improvements. The positive impacts of these improvements will more than justify the cost of construction for most of the improvements.

Surface road improvements were chosen instead of new interchange ramps because while the ramps provided some crash reductions along the SR-94/SR-3 corridor and provided good delay reductions, significantly greater crash reductions and comparable delay reductions could be achieved with surface road improvements for 25% of the cost and with significantly lower property and environmental impacts.

Intersection 70 (SR-3/Remsen Rd), while having a negative operational benefit, is still recommended due to the positive safety benefit, as well as its classification as a high safety priority intersection. The safety improvement of this alternative is the second highest in the study and justifies the improvement to reduce crashes.

If the medium-term countermeasure at intersection 250 (SR-94/Remsen Rd) is implemented, it is recommended that the long-term countermeasure at the same intersection is still implemented at a future date. Further improvements at the intersection would further improve the safety and operational benefits. Therefore, all the long-term countermeasures are justified from a safety and service perspective.



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