Tuscarawas IR 77 / US 250 / SR 39
Final Interchange Feasibility Study

Tuscarawas
Economic Development Corporation

BURGESS & NIPLE

January 2025

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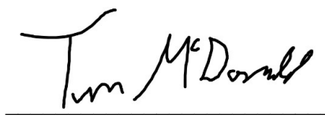
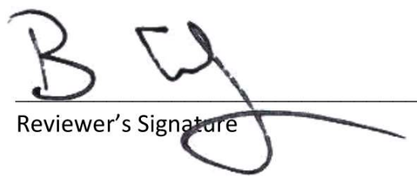
Signature Page

This Feasibility Study was prepared by Burgess & Niple, Inc. Signatures and contact information for the primary report author and reviewer appear below.



Preparer's Signature



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CHAPTER 1: EXECUTIVE SUMMARY

The interchange of IR 77, US 250 & SR 39 in Tuscarawas County is the primary access to New Philadelphia and is in eastern Ohio. The interchange is a complex configuration providing full access between IR 77 and SR 39 (full interchange) and partial access between IR 77 and US 250 (partial interchange) within the same footprint. This shared footprint forces freeway-to-freeway (system) ramp traffic between IR 77 and US 250 to mix with local (service) ramp traffic between IR 77 and SR 39. To travel from IR 77 North to US 250 east, you have to exit the freeway at SR 39, turn left towards the west, then turn left again onto the southbound ramp, to access the US 250 east ramp. Also, to travel from US 250 West to IR 77 South, you have to exit the freeway at SR 39, turn left toward the west, then turn left again onto the southbound IR 77 southbound ramp. This condition creates increased congestion and crashes in the SR 39 corridor. Additionally, the intersections immediately adjacent to this interchange create additional challenges for the corridor. The SR 39 and Stonecreek Rd intersection is located less than 200 feet west of the IR 77 SB ramp terminal intersection, creating operational challenges. The SR 39 and Bluebell Drive intersection, east of the interchange, is one of the major connections for local retail and hotels, generating significant traffic in the area.

Additionally, US 250 is an important economic corridor in the region, providing connectivity to Uhrichsville, Cadiz and ultimately Pittsburgh via US 22. US 250 has been identified by ODOT as part of their Strategic Freight system. This system is critical for the health of Ohio's industries statewide. SR 39 provides connectivity to local retail, commercial and industrial development through downtown New Philadelphia and is essential to the vitality of the region. Additionally, there is the potential for additional economic development west of the interchange along Stonecreek Rd and SR 39 and in the Bluebell Drive area. These areas are currently being considered for various types of new development.

Conceptual "Build" alternatives were studied at three different locations, focusing on improving safety and congestion, while reducing circuitous travel. These three different locations are categorized as the following:

- IR 77 & US 250 System Interchange
- IR 77 & SR 39 Service Interchange
- East of the River (Including Bluebell Drive)

IR 77 & US 250 System Interchange

These improvements were developed to replace the two missing direct movements (IR 77 NB to US 250 EB and the US 250 WB to IR 77 SB) at the existing IR 77 and US 250 interchange. Four proposed Build alternatives were developed for these missing direct movements. Three of the Build alternatives are to accommodate the US 250 WB to IR 77 SB direct movement and one of the Build alternatives is to accommodate the IR 77 NB to US 250 EB movement.

Based on the comparison of the alternatives, shown in the evaluation matrix (see **Table 1**), *Alternative 2* (Texas U) scores very well in all the categories and provides the best benefit/cost ratio of the proposed WB to SB ramp alternatives. *Alternative 1* scores the best in safety performance and traffic operations but is likely cost prohibitive to implement and higher environmental impacts when compared to *Alternative 2* that provides the same functionality. *Alternative 4* (NB to EB) is the only proposed alternative evaluated for the reciprocating movement that completes the IR 77 and US 250 system interchange. Based on this, ***Alternative 2*** *(Texas U)* **and** ***Alternative 4*** *(NB to EB)* **are determined to be the Recommended Alternatives to carry forward into the next phase of project development once funding is identified for the completion of the IR 77 and US 250 system interchange based on the analysis completed as part of this study**.

IR 77 & US 250 System Interchange

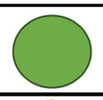
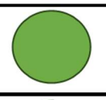
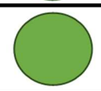
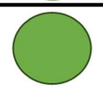
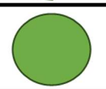
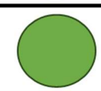
Evaluation Criteria	Alternative 1 Flyover	Alternative 2 Texas U	Alternative 3 Loop	Alternative 4 NB to EB	Alternative 5 No Build
Safety Performance					
Traffic Operations					
Environmental Impacts					
Stakeholder Input					
Right-of-way Impacts					
Construction Costs	$32.9 M	$26.8 M	$65.8 M	$25.4 M	$0.0

Table 1 – IR 77 & US 250 System Interchange Evaluation Matrix

IR 77 & SR 39 Service Interchange

These alternatives were developed to alleviate the congestion and safety concerns at the IR 77 and SR 39 interchange. Specifically, these alternatives evaluated improvement alternatives at the IR 77 NB ramp terminal intersection (east of IR 77), the IR 77 SB ramp terminal intersection (west of IR 77), and the SR 39 and Stonecreek Road intersection, located immediately west of the IR 77 SB ramp terminal intersection. Three of the Build alternatives focused on addressing the close intersection spacing on the west side of IR 77 and one of the Build alternatives focused on the IR 77 NB ramp terminal intersection east of IR 77.

Based on the comparison of the alternatives, Alternative 1 is the highest ranked. Alternative 1 is equal to or better than the other Alternatives except in Right of way impacts. Right of way impacts are increased due to the relocation of the southbound off ramp. This appears to impact only a single parcel of land.

In the next phase of the new intersections at the southbound off-ramp and Stone Creek drive will be evaluated to determine the best intersection controls. This could include a roundabout or a traditional signal. **Based on the overall ranking Alternative 1 is proposed to move forward as the recommended strategy.**

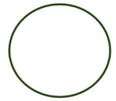
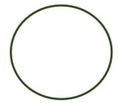
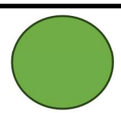
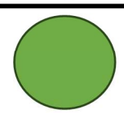
	I-77 Ramps & SR 39 & Service Interchange				
	Alternative 1 Relocated SB Off Ramp	Alternative 2 Double Roundabout	Alternative 3 Peanut Roundabout	Alternative 4 NB Ramp Roundabout	Alternative 5 No Build
Safety Performance					
Traffic Operations					
Environmental Impacts					
Stakeholder Input					
Right-of-way Impacts					
Construction Costs	$6.8 M	$5.5 M	$18.9 M	$3.8 M	$0.0

Table 2 – IR 77 & SR 39 Service Interchange Evaluation Matrix

East of the River (Including Bluebell Drive)

These alternatives were developed to improve the safety, congestion, and overall vehicular throughput along SR 39 east of the interchange and the Tuscarawas River. In this section of SR 39 between the river and Bluebell Drive, several driveways exist, and traffic congestion is prevalent, creating safety concerns. Five Build alternatives were developed in this section of the corridor to address safety, congestion, and access concerns.

Many of the proposed alternatives build off each other and continue to add value to the area as the alternatives increase in number. Based on the comparison of the alternatives, shown in the evaluation matrix (see **Table 3**), *Alternative 3* (Median) scores very well in all categories but there was concern about how the businesses along the SR 39 corridor would react with left turn movements being eliminated. Adding *Alternative 1* (Backage Roads) provides the ability for indirect left turns to be made throughout this segment of the corridor. *Alternative 5* (Roundabout) scores equal to or better than *Alternative 4* to improve the SR 39 and Bluebell Drive intersection in every category and pairs well with *Alternative 3* as it allows for a U-turn maneuver to be made for traffic from the southern properties and eastbound traffic to make an indirect left turn using the roundabout as well as the backage roads. Based on this, ***Alternative 1*** *(Backage Roads, with variation of adding a left-in at the SR 39 and northern backage road intersection),* ***Alternative 3*** *(Median),* **and** ***Alternative 5*** *(Roundabout)* **are determined to be the Recommended Alternatives to carry forward into the next phase of project development once funding is identified for segment of the corridor east of the river based on the analysis completed as part of this study.** All the Recommended Alternatives identified in this study are shown on one large plan view exhibit in ***Appendix K***.

East of the River including Bluebell Drive						
Evaluation Criteria	**Alternative 1 Backage Roads**	**Alternative 2 Right-in/Right-out**	**Alternative 3 Median**	**Alternative 4 Turnlanes**	**Alternative 5 Roundabout**	**Alternative 6 No Build**
Safety Performance						
Traffic Operations						
Environmental Impacts						
Stakeholder Input						
Right-of-way Impacts						
Construction Costs	**$2.7 M**	**$0.1 M**	**$1.0 M**	**$3.8 M**	**$3.7 M**	**$0.0**

Table 3 – East of River (including Bluebell Drive) Evaluation Matrix

Construction cost estimates were prepared for all the alternatives. The cost estimate for all of the alternatives utilized 2023 bid tabs for unit costs, and the entire estimate was inflated for 2029 year of construction. A 30% contingency was applied to the construction cost subtotal due to the level of uncertainty that still exists with the current stage of design. Cost estimates do not include right-of-way acquisition costs. The next phase of project development will identify improved alternative locations to provide an estimate of these impacts and costs.

Phasing/Implementation Plan

Based on the recommended alternatives the following is a summary of the **proposed Implementation Strategy** for the improvements from this study:

- **Phase 1**
  - *Phase 1A* – Construct the backage roads and median east of the river.
  - *Phase 1B* – Construct roundabout at SR 39 and Bluebell Drive intersection (combine with Phase 1A if funding is available)
- **Phase 2**
  - *Phase 2A* – Relocated southbound off-ramp.
  - *Phase 2B* – realign and replace SR 39 southbound across from I-77 southbound on-ramps to improve intersection.
- **Phase 3**
  - Construct the Texas U-Turn (US 250 WB to IR 77 SB) and the IR 77 NB to US 250 EB system ramps to complete the IR 77 and US 250 interchange.

CHAPTER 2: INTRODUCTION

Existing Conditions: The interchange of IR 77, US 250 & SR 39 in Tuscarawas County is the primary access to New Philadelphia and is located in eastern Ohio, 36 miles north of IR 70 (see **Figure** 1). The current interchange is complex, providing a full interchange with SR 39 and a partial US 250 system interchange. US 250 is a limited access freeway and the movements to and from IR 77 south require vehicles to go through multiple signalized intersections. This forces the freeway-to-freeway (system) ramp traffic between IR 77 and US 250 to mix with the local (service) ramp traffic between IR 77 and SR 39. To travel from IR 77 North to US 250 east you have to exit the freeway at SR 39 and turn left, towards the west, then turn left again on the southbound ramp and only then do you get onto the US 250 east ramp. This condition creates increased congestion and crashes in the corridor. Additionally, the intersections immediately adjacent create additional challenges for the corridor. The Stonecreek Rd intersection is located less than 200 feet west of the IR 77 SB ramp terminal intersection creating operational challenges. The Bluebell Drive intersection east of the interchange is one of the major connections for local retail and hotels, generating significant traffic in the area.

US 250 is an important economic corridor in the region, providing connectivity to Uhrichsville, Cadiz and ultimately Pittsburgh via US 22. US 250 has been identified by ODOT as part of their Strategic Freight system. This system is critical for the health of Ohio's industries statewide. SR 39 provides connectivity to local retail, commercial and industrial development through downtown New Philadelphia and is essential to the vitality of the region. Additionally, there is the potential for additional economic development west of the interchange along Stonecreek Rd and SR 39. This area is currently being considered for various types of new development.

The interchange is located about 80 miles south of Cleveland and 100 miles east of the Columbus. Various industries continue to develop across Ohio and improving these vital connections will allow New Philadelphia to maximize the connectivity of these opportunities such as Intel, Battle Motors, and many others.

An Alternatives Analysis Report (AAR) was developed in 2014 that reviewed the existing IR 77/US 250/SR 39 interchange configuration and discussed five alternatives to address transportation needs for the study area. The report identified excessive queueing on the IR 77 Southbound (SB) exit ramp and congested-related crash patterns on SR 39 partially attributed to the incomplete system interchange within the interchange area. In addition to the No-Build option, the AAR discussed several proposed solutions, including optimizing the signal timing/phasing at the ramp terminal intersections along SR 39, turn lane additions, installing a roundabout to serve one or multiple intersections on the west side of the interchange, adding the "missing" freeway-to-freeway system ramps, and modifying the southbound ramp configuration in a way that re-routes SR 39 traffic bound for US 250. The 2014 report identified optimizing signal timing/phasing and adding turn lanes at the IR 77 and SR 39 ramp terminal intersections as the recommended solution based on cost/benefit and environmental impact considerations. Two of the three recommended turn lane additions from that study, a SB right turn lane at the SR 39 & CR 21 intersection and a NB left turn lane at the IR 77/US 250 NB & SR 39 ramp intersection, have since been implemented.

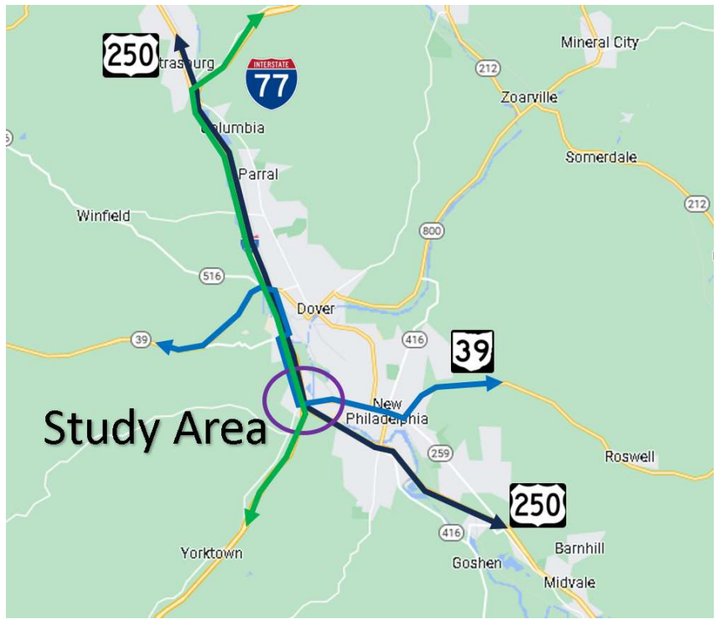


Figure 1 – Project Overview Map

The Vision Plan for The City of New Philadelphia, prepared by Michael McInturf Architects, was finalized in March 2021.. Some of the key objectives of the Vision Plan include identifying key infrastructure improvements to road, streetscapes, and gateways; specifying priorities; and stating the city's long-range perspective. The Vision Plan explains that the US 250 corridor east of IR 77 provides important access to the New Town mall area, water works recreation area, and residential areas on the south side of the city. Also noted is that the Ohio Mid-Eastern Governments Association (OMEGA) identified improving traffic flow at the IR 77/SR 39 interchange and providing connection between US 250 Westbound (WB) and IR 77 SB as two of four prioritized roadway projects.

The purpose of this study is to identify, develop, and analyze feasible alternatives to address the congestion and safety issues at this interchange and adjacent intersections by improve east-west connectivity along SR 39 and improving the IR 77 / US 250 connectivity. This Study area will include all ramps to and from the IR 77, US 250 & SR 39 interchange and the adjacent intersections of Stonecreek Rd and Bluebell Dr.

Purpose and Need Statement

Purpose Statement: The purpose of the project is to reduce the circuity of travel, improve safety, and reduce congestion within the IR 77/US 250/SR 39 interchange area and adjacent intersections.

Need Elements

Reduce Circuity of Travel

The existing IR 77/US250/SR 30 interchange is the principal access point for the City of New Philadelphia, which serves as the Tuscarawas County seat. US 250 serves as a Freeway Principal Arterial connecting the city and surrounding communities to the Interstate Highway System while SR 39 provides access to the city's Central Business District. The importance of this connection to the City of New Philadelphia and Tuscarawas County underlines the disconnect of two missing movements within the freeway-to-freeway system interchange. This interchange lacks direct freeway-to-freeway movement between northbound IR 77 and eastbound US 250 and between westbound US 250 and southbound IR 77. The lack of this direct access between freeways impacts traffic using IR 70, 40 miles to the south, as well as negatively impacting traffic associated with communities south of New Philadelphia.

To serve the traffic movement between the south and east legs of the interchange, traffic must use a combination of the ramps to/from IR 77, SR 39, and ramps to/from US 250. Traffic traveling north on IR 77 must follow a counterclockwise path by exiting at SR 39, turning left and traveling SR 39 west to another intersection, then turning left on the entrance ramp to IR 77 SB before slipping off that ramp prior to accessing IR 77 to access US 250 EB. The reverse movement, US 250 WB to IR 77 SB, requires using the same intersections along SR 39 in the same counterclockwise circulation around the interchange. For drivers unfamiliar with the area, this maneuver causes wayfinding confusion. It also encourages drivers to use SR 39, which is a city street, instead of using the US 250 freeway to access points east of IR 77. This choice increases safety and congestion concerns on SR 39.

Improve Safety

Burgess & Niple prepared collision diagrams and Economic Crash Analysis Tool (ECAT) analyses for the study area. The half-mile segment of SR 39 experienced 160 crashes between 2020 and 2022, which is nearly two-thirds of the crashes for the entire study area. The SR 39 crash experience was relatively consistent across the 3-year period. On SR 39, crashes were mostly clustered at three locations: at the signalized Bluebell Drive intersection east of the interchange, the 0.25-mile segment of SR 39 between Bluebell Drive and the IR 77 northbound ramps, and IR 77 southbound ramp intersection. The ECAT analysis indicates that these three locations experienced excess crashes across all severity levels compared to similar facilities. The rest of the SR 39 corridor experienced excess Property Damage Only crashes but not excess injury or fatal crashes.

SR 39 & Bluebell Drive Intersection: This intersection experienced an average of 6.4764 excess crashes per year compared to the number of crashes predicted for this location. The Potential for Safety Improvement (PSI) is remarkable for this specific location and can be attributed to 7 crash types totaling 65 crashes. The most common was 32 (49%) rear end crashes. The eastbound through/right turn lane experienced at least twice the number rear end crashes, 9, of any other lane movement. The next highest crash types were 12 (18%) left turn crashes and 9 (14%) angle crashes. These crashes indicate that congestion may be a contributing factor to the crash experience at this intersection. Other types of crashes occurring in the intersection area included 5 (8%) sideswipe-passing crashes, 3 (5%) right turn crashes, 3 (5%) backing crashes, and 1 (2%) fixed object crash.

SR 39 between IR 77 northbound ramps and Bluebell Drive: This section of SR 39 experienced an average of 4.6319 excess crashes per year compared to the number of crashes predicted for this area. Most of the crashes in this section occurred in the 550 feet of roadway between the bridge over the Tuscarawas River and the Bluebell Drive intersection area where there are 13 commercial driveway approaches. There are 8 driveways on the south side and 5 driveways on the north side of SR 39 that serve gas stations, restaurants, and a hotel. This 550-foot-long section of roadway experienced a total of 36 crashes consisting of 7 crash types. The most common type here was 17 (47%) rear end crashes, followed by 6 (17%) left turn crashes, 5 (14%) sideswipe-passing crashes, and 4 (11%) angle crashes. These crashes indicate that congestion may be a contributing factor to the crash experience at this intersection. The remaining crashes included 2 (6%) right turn crashes, 1 (3%) pedalcycle crash, and 1 (3%) "other" crash.

SR 39 and IR 77 southbound ramps: This intersection experienced an average of 1.0672 excess crashes per year compared to the number of crashes predicted for this location. This intersection experienced a total of 27 crashes consisting of 5 crash types. The most common type was 19 (70%) rear end crashes; 10 of these crashes occurred on the WB SR 39 approach. The high proportion of rear end crashes suggests that congestion is a contributing factor to the crash experience at this intersection. In addition to the rear end crashes, there were 3 (11%) improper backing crashes, 3 (11%) sideswipe-passing crashes, 1 (4%) right turn crash, and 1 (4%) fixed object crash.

The IR 77/US 250 portion of the study area, including the ramps serving SR 39 and US 250, experienced a total of 92 crashes during the three-year study period; however, 36 (39%) of those crashes were animal crashes. A review of the freeway collision diagrams shows that these animal crashes – purportedly all deer-related – occurred throughout the study area on the freeway mainline and ramp elements. The ECAT analysis excludes animal crashes for the average crash frequency calculations, and therefore only considered the remaining 56 crashes. All the freeway segments and ramps are experiencing crash rates close to what is predicted for each element. Of the remaining 56 crashes, there were 20 fixed object crashes and 17 sideswipe-passing crashes. Two ramps, southbound IR 77 to EB US 250 and WB US 250 to northbound IR 77, presented somewhat of a pattern for these two crash types. For both ramps, the fixed object and sideswipe-passing crashes occur on curved overpass bridges. The objects struck appear to be bridge parapets or guardrail runs attached to the parapets, while most sideswipe crashes appear to be

related to cars not maintaining their lanes while navigating curves. A few of the sideswipe passing crashes could be related to inappropriate lane changes.

Reduce Congestion

Burgess & Niple prepared Highway Capacity Analyses of the signalized intersections in the study area using existing signal phasing and timing. These locations include SR 39 & Stonecreek Road, SR 39 & southbound IR 77 ramps, SR 39 & northbound IR 77 ramps, and SR 39 & Bluebell Drive.

SR 39 &Stonecreek Road intersection and SR 39 & southbound IR 77 ramp intersection: These intersections are less than 200 feet apart. To avoid trapping cars between the intersections, the signal heads for both are operated by a single signal controller using a unique timing configuration. This results in a very long cycle length and a significant amount of lost time throughout the cycle. In the PM Peak Hour, the southbound IR 77 exit ramp operates at LOS F due to excessive delay for the southbound left turn movement and this congestion appears to be related to the 7 rear end crashes on this approach. The southbound ramp queues can extend to the collector-distributor road that also serves the southbound IR 77 to EB US 250 traffic, creating a conflict between high-speed vehicles on the C-D road and stopped vehicles on the ramp. WB SR 39 also experiences excessive delay for the left-turn movement, and queues for this movement sometimes extend through the northbound IR 77 ramp intersection. The 10 rear end crashes and 4 sideswipe passing crashes on this approach could be related to congestion with this movement.

SR 39 & northbound IR 77 ramp intersection: This intersection operates at LOS B during both AM and PM peak hours. Accordingly, the crash experience at this location is also within predicted range.

SR 39 & Bluebell Drive intersection: This intersection operates at acceptable levels of service on all approaches; however, the left turn lanes on the northbound and southbound approaches are not long enough to serve the demand volume. The southbound left turn lane Queue Storage Ratio during the PM Peak Hour is 1.41, and the northbound left turn lane Queue Storage Ratio is 2.11. This means that the turn lane queue exceeds the available storage by 40% and 110%, respectively, during the PM Peak Hour. The queueing spillback will block the southbound and northbound through and right turn movements and cause delay that is not reflected in the capacity analyses. The number of rear end crashes on these approaches – 9 on southbound Bluebell Drive and 7 on northbound Bluebell Drive – appear to be related to this issue.

Logical Termini and Independent Utility: The logical termini are along SR 39 between the intersections of Stonecreek Road to the west and Bluebell Drive to the east; along US 250 between the SR 416 interchange and the IR 77 interchange; and along IR 77 between the SR 211 interchange to the north and approximately 1 mile south of the existing SR 39/US 250 interchange. The selection of these termini allows for a range of design considerations.

The proposed project does not rely on any other project's improvement to meet the established Purpose and Need. The improvements proposed as part of this project are considered a single and complete project that meet the independent utility test. In addition, the project should not have a negative effect on any other planned projects.

CHAPTER 3: ALTERNATIVES CONSIDERED

IR 77 is a 4-lane divided, high-speed, rural interstate facility with a 70-mph posted speed limit through this section. In this segment, IR 77 is part of the National Highway System (NHS). US 250 is a high-speed, 4-lane freeway to the east and combines with IR 77 north of the SR 39 interchange. SR 39 is an east-west Principal Arterial traveling under US 250 and IR 77 through the interchange area. The posted speed limit along US 250 is 70 mph. The posted speed limit along SR 39 is 35 mph. SR 39 east of the interchange is a Federal-Aid Primary (FAP) route. IR 77 and US 250 traverse SR 39 via three 3-span bridges (SFN #7904746, 7902883, 7902913).

Conceptual "Build" alternatives were studied at three different locations, focusing on improving safety and congestion, while reducing circuitous travel. Three alternatives were considered for the westbound US 250 to southbound IR 77 movement and one alternative was considered for the northbound IR 77 to eastbound US 250 movement to complete the IR 77 & US 250 system interchange. Three alternatives were considered for the SR 39/IR 77 southbound ramp terminal intersection, and one alternative was examined for the SR 39/IR 77 northbound ramp terminal intersection. Four alternatives were considered at the SR 39/Bluebell Drive intersection. All alternatives were then compared to the No-Build alternative at each location. For this report, these three different locations are categorized as the following:

- IR 77 & US 250 System Interchange
- IR 77 & SR 39 Service Interchange
- East of the River (Including Bluebell Drive)

The ODOT Location and Design (L&D) Manual, Volume 1, served as the source of roadway and geometric design criteria for the conceptual alignments. The following design criteria have been set and were followed for the studied build alternatives:

- <u>IR 77</u>
  - Functional Classification = Rural Interstate (NHS/National Truck Network Route)
  - Design Speed = 75 mph
  - Posted Speed = 70 mph
  - Lane Width = 12'-0"
  - Treated Shoulder Width = 4'-0" left, 10'-0" right
- <u>SR 39</u>
  - Functional Classification = Principle Arterial
  - Design Speed = 40 mph
  - Posted Speed = 35 mph
  - Lane Width = 12'-0"
  - Treated Shoulder Width = 4'-0" left, 8'-0" right
- <u>Ramps to and from SR 39 are Single Lane Ramps</u>
  - Functional Classification = Ramp
  - Design Speed = Varies
  - Posted Speed = N/A
  - Lane Width = 16'-0"
  - Shoulder Width = 3'-0" left (4'-0" adjacent to barrier) and 6'-0" right
- <u>US 250</u>
  - Functional Classification = Freeway
  - Design Speed = 75 mph
  - Posted Speed = 70 mph
  - Lane Width = 12'-0"
  - Treated Shoulder Width = 4'-0" left, 10'-0" right
- Bluebell Drive
  - Functional Classification = Major Collector
  - Design Speed = 30 mph
  - Posted Speed = 25 mph
  - Lane Width = 11'-0"
  - Treated Shoulder Width = 1'-0"
- Stonecreek Road
  - Functional Classification = Major Collector
  - Design Speed = 40 mph
  - Posted Speed = 35 mph
  - Lane Width = 11'-0"
  - Treated Shoulder Width = 1'-0"

All alternatives were compared based on the following criteria, which is explained in more detail in Chapter 4 of this report. Chapter 5 describes how the alternatives compare to one another with respect to these criteria.

- Safety Performance
- Traffic Operations
- Environmental Impacts
- Stakeholder Input
- Right-of-Way Impacts

Construction cost estimates were developed for each of the alternatives, and can be found in ***Appendix H***. All alternatives are depicted in ***Appendix A*** and discussed in further detail in the next section of the report.

IR 77 & US 250 System Interchange Alternative 1 - Flyover

These improvements were developed to replace the two missing direct movements at the existing IR 77 and US 250 interchange. These are the IR 77 NB to US 250 EB and the US 250 WB to IR 77 SB movements. Currently, these movements are made through a circuitous route that involves traveling through the existing IR 77 and SR 39 interchange through a series of left turns at the ramp terminal intersections. Four proposed Build alternatives were developed for these missing direct movements. Three of the Build alternatives are to accommodate the US 250 WB to IR 77 SB direct movement and one of the Build alternatives is to accommodate the IR 77 NB to US 250 EB movement.

Alternative 1: Flyover – *Alternative 1* in the *System Interchange* group of alternatives utilizes a large-radius alignment for the US 250 WB to IR 77 SB that utilizes a flyover structure for the connection. In *Alternative 1*, the new ramp diverges from US 250 WB approximately 2,000 feet east of IR 77 and climbs over both directions of US 250 and both directions of IR 77 before dropping down vertically to connect with IR 77 SB approximately 1,800 feet south of US 250. The ramp is grade-separated from US 250 and IR 77 utilizing a 1,300-foot-long bridge. This alternative will be located close to the Tuscarawas River just east of IR 77. An evaluation would need to be done to determine if the bridge should be extended farther east through this area or if a retaining wall on the north side of the ramp can be placed with acceptable disturbance to the river. This alternative would have minimal disruption to existing US 250 and IR 77 other than placing bridge piers in the medians to support the bridge over both roadways. ***Figure 2*** shows the plan view of *Alternative 1*, utilizing a 45-mph design horizontal and vertical alignment for the flyover ramp.

During development of this alternative, a concept was developed that utilized the medians of US 250 and IR 77 for the ramp connections, creating a left side entrance and exit ramp along these two routes. It was believed that doing this would result in significant retaining wall costs as the ramp elevated within the median with minimal bridge reduction. With the expected added construction cost, the alternative to utilize the median for the ramp was dismissed without further evaluation.

Figure 2 – Plan View of Alternative 1, System Interchange

IR 77 & US 250 System Interchange Alternative 2 - Texas U-turn

Alternative 2 in the *System Interchange* group of alternatives utilizes a low-speed Texas U-Turn movement within the interchange area to facilitate the US 250 WB to IR 77 SB direct movement. In *Alternative 2*, the new ramp diverges from US 250 WB west of the existing diverge to SR 39/IR 77NB on the right side to create successive diverges along US 250 WB. This ramp travels over the existing IR 77NB to SR 39 ramp, likely via widening the existing structure but could be a separate structure to avoid impacting the existing movement. After traveling over the existing IR 77 NB to SR 39 ramp, the new ramp dives vertically and turns 180 degrees horizontally using two 25-mph horizontal curves to the left south of existing SR 39. This new ramp would not connect to SR 39 but would be separated by concrete curbing or barrier to eliminate conflict with two-way traffic on SR 39. Once west of IR 77, the new ramp turns southward to travel under the US 250 eastbound structure. The ramp would be placed in the area labeled as "A" in Figure 3 to connect to IR 77 SB on-ramp prior to merging with IR 77 southbound traffic.

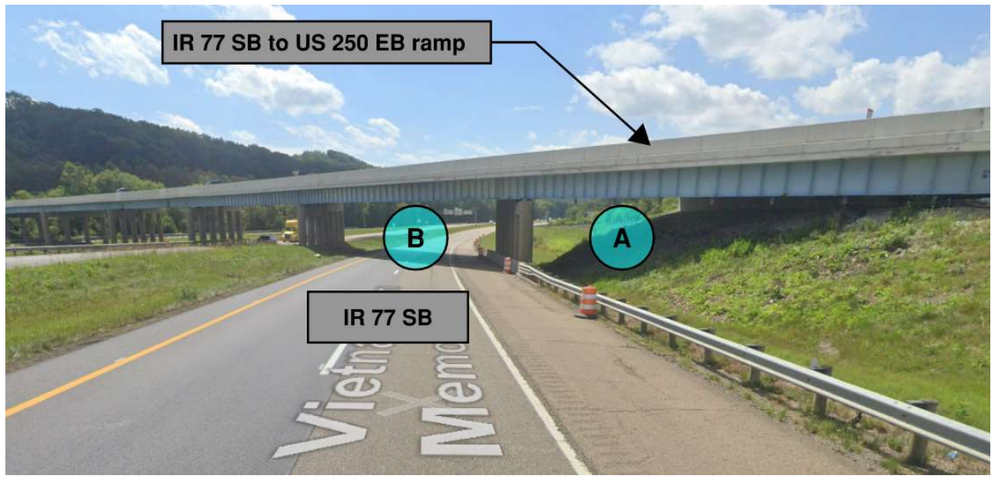


Figure 3 – View of Span Arrangement of Existing IR 77 SB to US 250 EB Ramp Bridge

Alternative 2 would require the replacement of the IR 77 bridges over SR 39 because the existing Texas U-Turn alignment would not be able to fit within the main span. A brief structural review of these two bridges was completed that determined it would not be economical to push the ramp alignment through their end spans because of their spread footings, and instead more economical to replace the bridges given their age and condition. Coordination with ODOT would be needed to confirm that these bridges should be evaluated for replacement. ***Figure 4*** shows the plan view of *Alternative 2*, utilizing 25 mph design for the horizontal curves.

Figure 4 - Plan View of Alternative 2, System Interchange

The Texas U-Turn configuration is utilized in several locations throughout the United States. This is a common treatment in Texas where frontage roads run parallel to the freeways to accommodate access to adjacent interchanges. See ***Figure 5*** for an example of a Texas U-Turn interchange plan view configuration and ***Figure 6*** for a street view of the same location, with the ramp separated by a concrete curb from the arterial, at I-69 and Collingsworth Street in Houston, Texas.

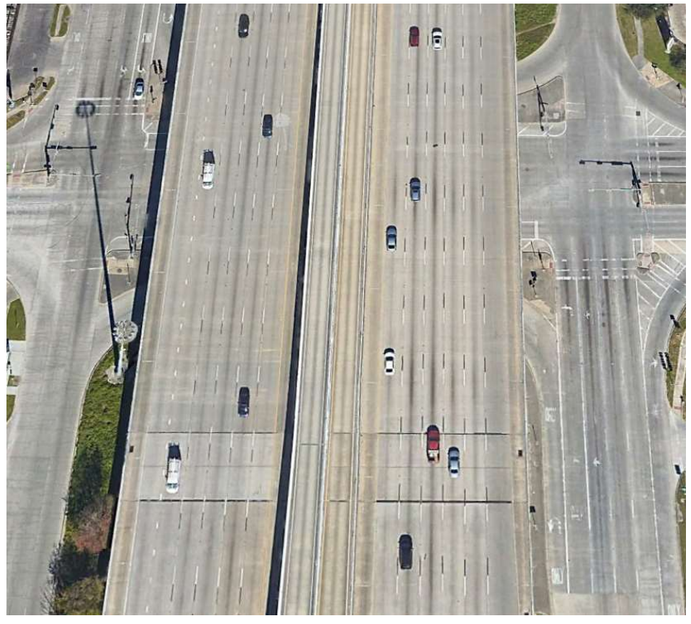


Figure 5 – Texas U-Turn interchange plan view configuration at I-69 and Collingsworth Street

During development of this alternative, a concept was developed that kept the new ramp parallel to IR 77 SB west of the freeway, merged US 250 directly with IR 77 (labeled as “B” in ***Figure 3***). It was determined the safer alternative was to merge the US 250 traffic with the ramp traffic prior to the mainline merger. This would be a lower speed merge and therefore an improved condition.

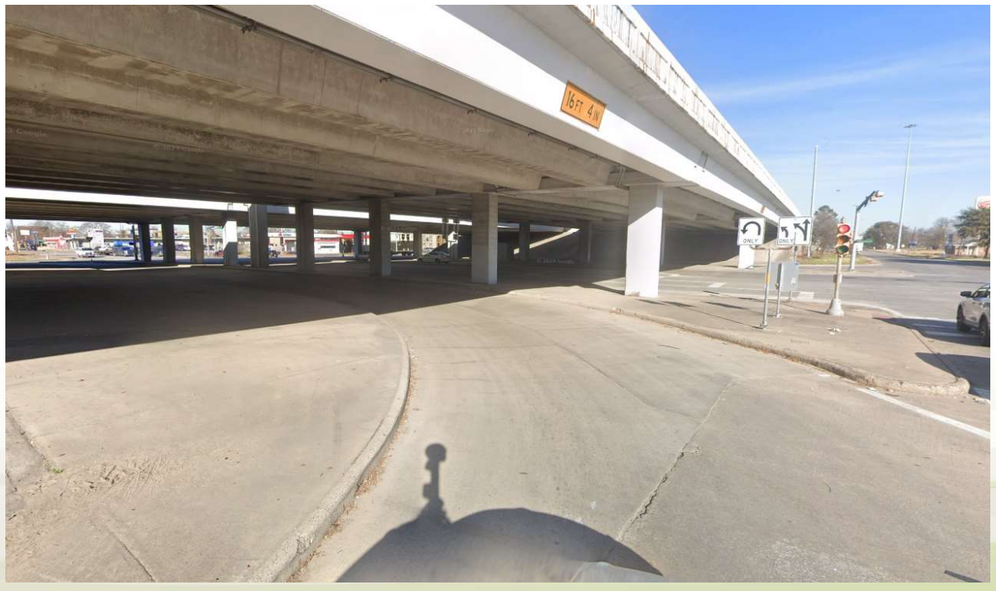


Figure 6 – Texas U-Turn interchange street view at I-69 and Collingsworth Street

IR 77 & US 250 System Interchange Alternative 3: Loop Ramp

Alternative 3 in the *System Interchange* group of alternatives utilizes a low-speed loop ramp located in the middle of the interchange to facilitate the US 250 WB to IR 77 SB movement. The loop ramp is a 120-foot radius horizontal curve which meets 25 mph design standards and is placed west of IR 77 and south of SR 39. In *Alternative 3*, the new ramp diverges from US 250 WB west of the US 250 WB to IR 77 NB ramp on the left side, travels over IR 77 on a new structure immediately north and parallel to the existing IR 77 SB to US 250 EB ramp bridge, then loops toward the south over 180 degrees before running parallel to IR 77 SB and merging into IR 77 SB under the existing IR 77 SB to US 250 EB ramp bridge. This alternative would require the relocation of the existing IR 77 SB to US 250 EB ramp alignment and bridge over SR 39 to make room for the proposed loop ramp.

Like *Alternative 2*, this alternative anticipates that IR 77 SB could be shifted toward the median and that IR 77 and the entrance gore and ramp from US 250 WB could fit under the existing main span of the bridge over IR 77, labeled as "B" in ***Figure 3.*** And like *Alternative 2*, a concept could be developed that keeps the new ramp parallel to IR 77 SB west of the freeway, pushes it through the end span (labeled as "A" in ***Figure 3***), then merges it with the existing SR 39 to IR 77 SB ramp prior to merging onto IR 77 SB. ***Figure 7*** shows the plan view of *Alternative 3*, utilizing 25 mph design for the horizontal loop ramp.

Figure 7 - Plan View of Alternative 3, System Interchange

IR 77 & US 250 System Interchange Alternative 4: NB to EB ramp

Alternative 4 in the *System Interchange* group of alternatives is the only alternative proposed to accommodate a direct IR 77 NB to US 250 EB connection. This alternative utilizes a 45-mph design horizontal ramp alignment that diverges from IR 77 NB on the right side south of US 250, cuts into the hillside in the southeast quadrant of the interchange and enters US 250 EB on the right side east of IR 77. While this study proposed a 45-mph design, other design speeds could be evaluated for this ramp connection if this ramp is determined to be advanced. ***Figure 8*** shows the plan view of *Alternative 4*, utilizing 45 mph design for the horizontal alignment.

Figure 8 - Plan View of Alternative 4, System Interchange

IR 77 & US 250 System Interchange Alternative 5: No Build

Alternative 5 in the *System Interchange* group of alternatives does not make any changes to the existing IR 77 and US 250 interchange and maintains the existing direct movements and ramp arrangements.

IR 77 & SR 39 Service Interchange

These alternatives were developed to alleviate the congestion and safety concerns at the IR 77 and SR 39 interchange. Specifically, these alternatives evaluated improvement alternatives at the IR 77 NB ramp terminal intersection (east of IR 77), the IR 77 SB ramp terminal intersection (west of IR 77), and the SR 39 and Stonecreek Road intersection, located immediately west of the IR 77 SB ramp terminal intersection. The spacing of the Stonecreek Road intersection to the ramp intersection, currently less than 200 feet west, creates congestion issues because of the inefficient signal timing and operation along SR 39. Four proposed Build alternatives were developed to improve traffic flow along SR 39 through the interchange. Three of the Build alternatives focused on addressing the close intersection spacing on the west side of IR 77 and one of the Build alternatives focused on the IR 77 NB ramp terminal intersection east of IR 77.

IR 77 & SR 39 Service Interchange Alternative 1: Relocated SB off-ramp

Alternative 1 in the *Service Interchange* group of alternatives relocates the IR 77 SB exit ramp intersection to SR 39 north of Stonecreek Road, creating a new intersection along SR 39 about 1100 feet north of Stonecreek Road, west of IR 77. By shifting the ramp terminal intersection north of Stonecreek Road, it allows the intersections along SR 39 west of IR 77 to be consolidated to a single four leg intersection, with Stonecreek Road to the west, the IR 77 SB/US 250 EB ramp to the south, and SR 39 to the north and the east. ***Figure 9*** shows the plan view of *Alternative 1*, utilizing a single intersection west of IR 77. This SB off-ramp is showing a traditional intersection. However, in the next phase of development both the SB off-ramp and SB on-ramp intersections will be considered for **roundabouts.**

Figure 9 - Plan View of Alternative 1, Service Interchange

IR 77 & SR 39 Service Interchange Alternative 2: Double Roundabout

Alternative 2 in the *Service Interchange* group of alternatives utilizes a pair of roundabouts along SR 39 to address the closely spaced intersections west of IR 77. This alternative proposes a 2x1 (two lanes in the north, west, and south portion and one lane in the east portion) roundabout at the IR 77 SB ramp terminal intersection and a similar 2x1 roundabout at the SR 39 and Stonecreek Road intersection. Both roundabouts utilize an Inscribed Circle Diameter (ICD) of 200 feet. To increase the spacing between these roundabouts, the IR 77 SB ramp terminal intersection is shifted approximately 200 feet east closer to IR 77. This alternative would require the relocation of the IR 77 SB to US 250 EB ramp alignment and the bridge over SR 39 to the west, so it crosses SR 39 between the two roundabouts. The ramps to the south connecting SR 39 to IR 77 SB and US 250 EB would also require realignment to connect to the new location of the IR 77 SB ramp terminal intersection. An example of a double roundabout configuration like this one was constructed in Livingston, Michigan at the US 23, and Lee Road interchange, shown in ***Figure 9***. ***Figure 10*** shows the plan view of *Alternative 2*, utilizing a double roundabout configuration along SR 39 west of IR 77.

Figure 9 – Plan View of Double Roundabout at US 23 & Lee Road Interchange, Livingston, MI

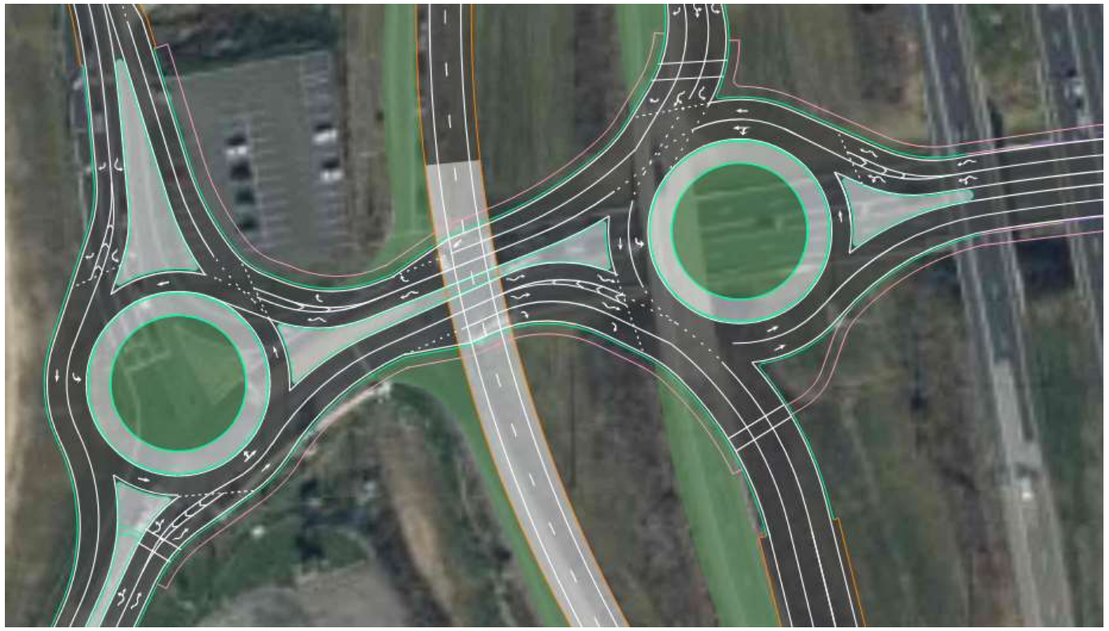


Figure 10 - Plan View of Alternative 2, Service Interchange

IR 77 & SR 39 Service Interchange Alternative 3: Peanut Roundabout

Alternative 3 in the *Service Interchange* group of alternatives proposes a single, peanut-shaped, roundabout to combine the two closely spaced intersections along SR 39 west of IR 77 into a single intersection. This alternative combines the SR 39 and Stonecreek Road intersection and the IR 77 SB ramp terminal intersection and maintains their intersection location west of the IR 77 SB to US 250 EB ramp. Using a peanut-shaped roundabout allows these intersections to be shifted closer together than what was proposed in *Alternative 2*, reducing the impact to the existing ramps while maintaining the proven safety benefits of a roundabout. The peanut-shape minimizes R/W impacts along SR 39 and maintains low speeds through the roundabout. Like *Alternative 2*, this alternative utilizes a 2x1 roundabout lane configuration, with 180-foot ICDs for each half of the peanut. A peanut-shaped roundabout was recently constructed in Delaware County, Ohio at the intersection of SR 61 and SR 656, shown in ***Figure 11***. ***Figure 12*** shows the plan view of *Alternative 3*, utilizing a peanut-shape roundabout configuration along SR 39 west of IR 77.

Figure 11 – Plan View of Peanut-Shape Roundabout at SR 61 & SR 656, Delaware County, OH

Figure 12 - Plan View of Alternative 3, Service Interchange

IR 77 & SR 39 Service Interchange Alternative 4: Roundabout

Alternative 4 in the *Service Interchange* group of alternatives is the only alternative proposed to improve the IR 77 NB ramp terminal intersection along SR 39. This intersection is impacted by the adjacent intersection traffic operations, and the analysis shows that once the adjacent intersections along SR 39 are improved, this existing intersection will operate sufficiently. Therefore, the only alternative evaluated to improve the safety at the intersection is a 2x1 roundabout to determine if it could fit given the spacing of the interstate to the west and the river to the east. The roundabout proposed in *Alternative 4* utilizes a 180-foot ICD. ***Figure 13*** shows the plan view of *Alternative 4*, utilizing a roundabout configuration along SR 39 east of IR 77.

Figure 13 - Plan View of Alternative 4, Service Interchange

IR 77 & SR 39 Service Interchange Alternative 5: No Build

Alternative 5 in the Service Interchange group of alternatives does not make any changes to the existing IR 77 and SR 39 interchange and maintains the existing number of lanes, ramp arrangements, and ramp locations.

East of River (including Bluebell Drive)

These alternatives were developed to improve the safety, congestion, and overall vehicular throughput along SR 39 east of the interchange and Tuscarawas River. In this section of SR 39 between the river and Bluebell Drive, several driveways exist, and traffic congestion is prevalent, creating safety concerns. Five Build alternatives were developed in this section of the corridor to address the safety, congestion, and access concerns.

East of River Alternative 1: Backage Roads

Alternative 1 in the *East of River* group of alternatives proposes backage roads in the northwest and southwest quadrants of the SR 39 and Bluebell Drive intersection. The intent of this alternative is to reduce the number of left turns in and out of the numerous driveways along SR 39 between the Tuscarawas River and Bluebell Drive. The backage road on the north side follows an existing circulation roadway that access Bluebell Drive about 600 feet north of SR 39 between the Tractor Supply Company and the Hampton Inn. The backage road travels east-west parallel to SR 39 then turns south just east of the Hampton Inn and connects to SR 39 via a full-movement intersection about 500 feet west of Bluebell Drive. The backage road on the south side intersects Bluebell Drive in the existing horizontal curve about 900 feet south of SR 39, follows the river to the west, then travels north, passing east of the TownePlace Suites, to intersect SR 39 via a full-movement intersection about 475 feet west of Bluebell Drive. Other than the addition of the intersections at the new backage road locations, no changes are anticipated to the existing 13 access drives along SR 39 or at the intersection of Bluebell Drive with this alternative. ***Figure 14*** shows the plan view of *Alternative 1*, utilizing backage roads in the northwest and southwest quadrants of the Bluebell Drive intersection to facilitate access.

Figure 14 - Plan View of Alternative 1, East of River, Seen in combination with Alternative 2

East of River Alternative 2: Right-in/Right-out

Alternative 2 in the *East of River* group of alternatives leverages the backage roads developed in *Alternative 1* and improves access along SR 39 by replacing the new full intersections between the backage roads and SR 39 with right-in/right-out intersections. This reduces the number of left turns in the corridor which removes conflict points that can lead to high severity crashes. ***Figure 15*** shows the backage road intersections with SR 39 as right-in/right-out intersections.

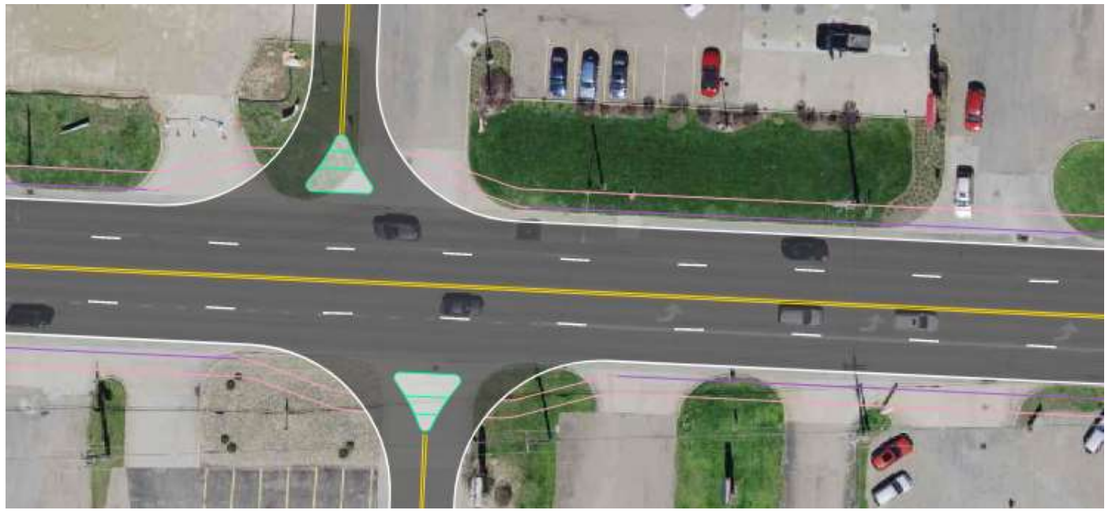


Figure 15 - Plan View of Alternative 2, East of River

East of River Alternative 3: Median

Alternative 3 in the *East of River* group of alternatives utilizes the backage roads from *Alternative 1* and closes the median along SR 39 to eliminate left turns into and out of the business drives between the river and Bluebell Drive. For this alternative, the southern backage road connects to SR 39 as a right-in/right-out intersection, like the business drives. However, a left-in is provided to the northern backage road. The median is created using a 6-foot-wide raised curb. In the existing condition, by allowing left turns into the driveways, the left turn lane to Bluebell Drive becomes the same lane to facilitate the left turns into the businesses, which creates confusion as to whether drivers are in the left turn lane to turn left at Bluebell Drive or turn left short of that at Burger King or Sheetz. With the median in place, the eastbound left turn lane approaching Bluebell Drive is better defined as only drivers turning left at Bluebell Drive will be in this lane, providing a situation that is expected approaching an intersection. ***Figure 16*** shows the closed median along SR 39 with all accesses between the river and Bluebell Drive being right-in/right-out except for the inclusion of a left-in to the northern backage road.

Figure 16 - Plan View of Alternative 3, East of River Shown in combination with Alternative 4

East of River Alternative 4: Turn Lanes

Alternative 4 in the *East of River* group of alternatives utilizes the backage roads from *Alternative 1* and the closed median from *Alternative 3* and improves the lane utilization at the SR 39 and Bluebell Drive intersection by adding an eastbound right turn lane and a northbound right turn lane. The eastbound right turn lane provides 300 feet of storage length, and the northbound right turn lane provides 400 feet of storage length. ***Figure 17*** shows the plan view of the improved SR 39 and Bluebell Drive intersection with the addition of right turn lanes in the eastbound and northbound directions.

Figure 17 - Plan View of Alternative 4, East of River

East of River Alternative 5: Roundabout

The final alternative to consider is a roundabout at Bluebell and SR 39 intersection. This roundabout would be designed with 2 lanes on the east/west directions and 1 lane in the north/south directions. The roundabout shown is currently centered on the intersection. The roundabout lends itself to being moved in one of the 4 directions north, south, east, or west. It will impact 2 of the corners of the intersection depending on the preferred way to place the roundabout. The exact location and the detailed impacts will be identified in the next phase of the project development.

Alternative 5 in the *East of River* group of alternatives utilizes the backage roads from *Alternative 1* and the closed median from *Alternative 3* and improves the SR 39 and Bluebell Drive intersection by converting it to a 2x1 (two lanes in the north, east, and south portion and one lane in the west portion) roundabout. This roundabout utilizes an Inscribed Circle Diameter (ICD) of 180 feet. With the inclusion of the roundabout, eastbound SR 39 traffic wishing to turn left into the drives or traffic leaving the drives on the south side of SR 39 wishing to travel west toward the intersection have the option to utilize the roundabout at Bluebell Drive to perform the indirect movement. As shown for this study, the roundabout is centered at the existing intersection and impacts all four quadrants of the intersection equally. If this alternative is desired to advance, an evaluation should be done to determine the best location of the roundabout that minimizes impacts to the critical parcels in the intersection area. ***Figure 18*** shows the plan view of the roundabout at the SR 39 and Bluebell Drive intersection.

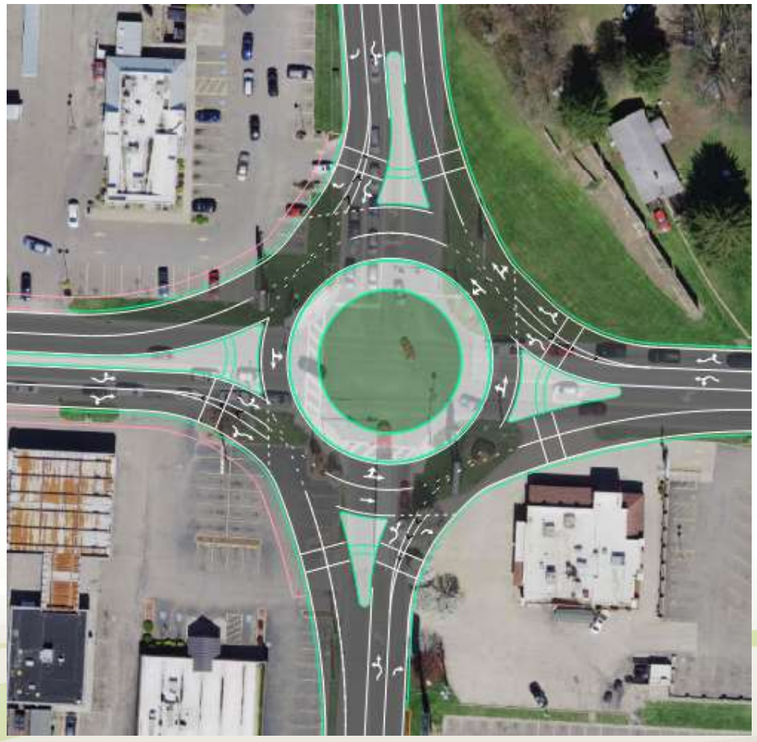


Figure 18 - Plan View of Alternative 5, East of River

East of River Alternative 6: No-Build

Alternative 6 in the *East of River* group of alternatives does not make any changes to the existing SR 39 corridor between the Tuscarawas River and Bluebell Drive and maintains the existing number of lanes and access points along SR 39 and Bluebell Drive. This alternative does not make any changes to the existing interchange configuration and maintains the existing number of lanes and interchange ramp arrangement along I-71 NB and SR 48 through the interchange.

Pedestrian & Bike Accommodations

It was determined that providing bicycle and pedestrian accommodations along SR 39 east of the river is consistent with the long-range plans for Tuscarawas County and the City of New Philadelphia. For this reason, it is assumed that they would be provided in each of the Build Alternatives in the *East of River* group of alternatives. This study evaluated two separate options for pedestrian improvements in this section of the corridor.

Sidewalks and Bike Lanes – This option proposes sidewalks and bike lanes on both sides of SR 39. For this option, the bike lane is proposed to be 5 feet wide and adjacent to the travel lanes along SR 39, and the sidewalks are proposed to be 6 feet wide adjacent to the bike lanes separated by a curb.

Multiuse Path – This option proposes a sidewalk on the south side and a multiuse path on the north side. For this option, the south side sidewalk is proposed to be 6 feet wide adjacent to the travel lanes separated by a curb. The north side multiuse path is proposed to be 11 feet wide to meet the ODOT Multimodal Design Guide (MMDG) standards for multiuse paths. The exception to this width being proposed is across the bridge over the Tuscarawas River, where the width constraints limits the width of the multiuse path to 8 feet wide, which is acceptable per ODOT's MMDG in constrained conditions such as this. Using this reduced width it is likely the path could be constructed without widingthe structure over the Tuscarawas River.

Both alternatives would require strip R/W takes but are not expected to require structure takes or relocations to be necessary. The impacts and costs of these facilities appear to be comparable and likely will come down to local's desires.

The bottleneck width along SR 39 is the bridge over the river. Per preliminary evaluation of the bridge, it appears that no more than 2 feet of additional width can be provided without adding beam lines. This bridge should be further evaluated once the desired pedestrian accommodations are confirmed to determine what specifically needs to be done to accommodate the width.

CHAPTER 4: KEY ISSUES

Additional assessment was completed on the conceptual alternatives being proposed for this interchange reconfiguration. The objective of this additional analysis was to determine the feasibility of each alternative as well as identifying those elements critical to the implementation of each alternative that need to be addressed with further analysis. This effort helped identify the costs and benefits of each alternative. A summary of the key analyses and assessments is provided in the next section of this report.

Safety Performance

Existing Safety Analysis

IR 77/US 250/SR 39 Interchange

Crash data for the IR 77/US 250/SR 39 interchange was obtained from ODOT's GIS Crash Analysis Tool (GCAT) for years 2020-2022. This data was analyzed using ODOT's Crash Analysis Module (CAM) tool. In total, 76 crashes were reported within the study period. Note, this number excludes five crashes which were reported as animal related. Crash breakdown by type, severity and location are summarized in ***Figure 19*** through ***Figure 21***.

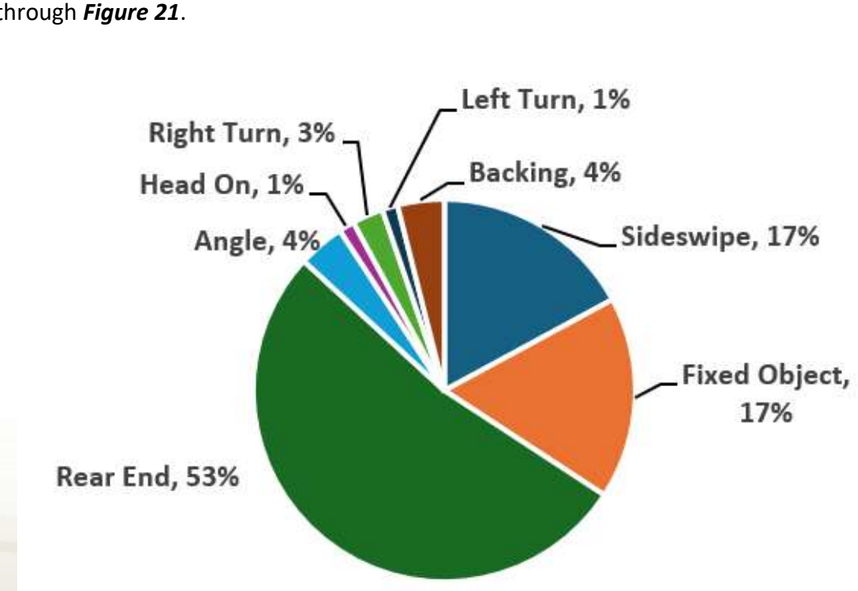
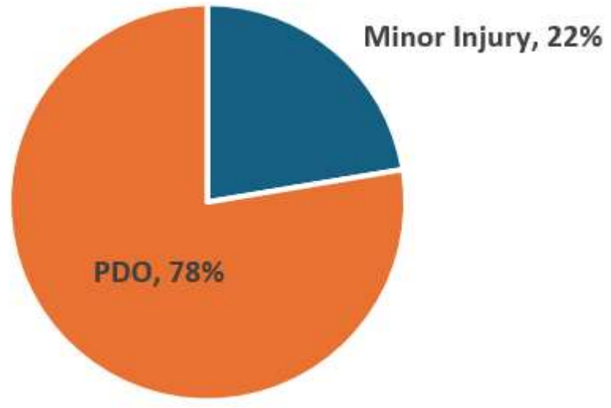


Figure 19: Crash Breakdown by Type, Interchange

Figure 19 shows the most prevalent crash type reported at the interchange was Rear End (40 crashes), followed by Sideswipe and Fixed Object (each with 13 crashes). No fatal or serious injury crashes were reported during the study period, but 17 crashes did result in minor injuries. **Figure 21** shows that crashes were primarily focused at the ramp terminal intersections along SR 39. The northbound ramp terminal



experienced 23 crashes and the southbound ramp terminal experienced 26 crashes. Crash patterns at the ramp terminal intersections mirror trends within the entire study area - nearly 70% of the ramp terminal crashes were reported as rear end and less than 20% resulted in minor injury only.

Figure 20: Crash Breakdown by Severity, Interchange

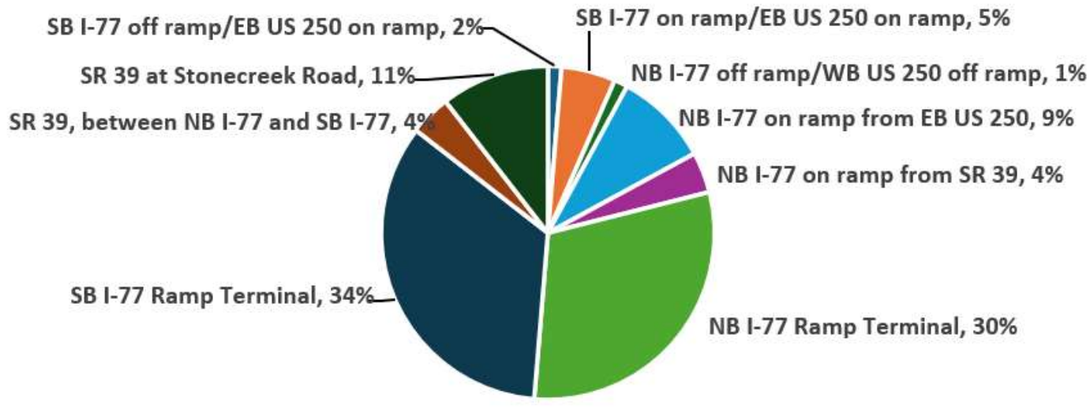


Figure 21: Crash Breakdown by Location, Interchange

Highway Safety Manual methodology was applied using ODOT's Economic Crash Analysis Tool (ECAT). This process allows users to assess the existing safety performance of a location based on a combination of historical crash data, existing roadway characteristics, and traffic volumes. The analysis output is provided via three values, defined below.

Predicted Crash Frequency (NPREDICTED) – defined as how a site would be expected to perform relative to 1,000 sites with comparable roadway characteristics and traffic volumes. This value is presented using units of crashes per year, and commonly broken down according to injury severity level.

Expected Crash Frequency (NEXPECTED) – defined as the average performance of a site, normalized over an extended period based on actual crash history. This value is presented using units of crashes per year, and commonly broken down according to injury severity level.

Potential for Safety Improvement (NPSI) – Difference between Expected Crash Frequency and Predicted Crash Frequency. A positive value indicates that the location is performing poorly compared to similar locations and safety improvements would likely have a significant impact on reducing crash frequency.

Injury Severity Levels are based on FHWA's KABCO rating scale where: K= fatal injury crash, A = incapacitating injury crash, B= non-incapacitating injury crash, C= possible injury, O= no injury/property damage only.

HSM Results for the interchange study area is summarized in ***Table 4***.

	KA	B	C	O	TOTAL
TOTAL $N_{PREDICTED}$	0.5492	2.5057	3.4684	17.9027	24.426
TOTAL $N_{EXPECTED}$	0.5351	2.4428	3.3742	17.7832	24.1353
TOTAL N_{PSI}	-0.0141	-0.0629	-0.0942	-0.1195	-0.2907

Table 4: Overall Existing Condition HSM Results, Interchange

Findings show that overall, the interchange is performing better than would be predicted based on the roadway characteristics and traffic volumes. The interchange experiences approximately 0.29 fewer crashes per year. PSI is further broken down by intersection or ramp location in ***Table 5***.

LOCATION	KA	B	C	O	TOTAL
SB IR 77 off ramp/EB US 250 on ramp	-0.0037	-0.0131	-0.0154	-0.4381	-0.4703
SB IR 77 on ramp/EB US 250 on ramp	-0.0061	-0.0101	-0.01	-0.3523	-0.3785
NB IR 77 off ramp/WB US 250 off ramp	0	0.0003	-0.0103	-0.2806	-0.2906
NB IR 77 on ramp from EB US 250	-0.0002	-0.0025	-0.0029	-0.0412	-0.0468
NB IR 77 on ramp from SR 39	0.0021	-0.011	-0.0151	-0.4787	-0.5027
NB IR 77 Ramp Terminal	-0.0086	-0.0355	-0.0549	0.3316	0.2326
SB IR 77 Ramp Terminal	0.0058	0.0235	0.0362	1.0017	1.0672
SR 39, between NB IR 77 and SB IR 77	-0.0016	-0.0041	-0.0039	0.1725	0.1629
SR 39 at Stonecreek Road	-0.0018	-0.0104	-0.0179	-0.0344	-0.0645

Table 5: Summary of PSI by Interchange Location

These results show that although the interchange as a whole is performing better than would be predicted, there are localized areas with room for improvement. This includes the northbound IR 77 ramp terminal which experiences 0.23 more crashes per year, the southbound IR 77 ramp terminal which experiences 1.07 more crashes per year, and SR 39 between these ramp terminals which experiences 0.16 more crashes per year.

SR 39 at Bluebell Intersection

Crash data for SR 39 between the NB IR 77 ramp terminal and Bluebell intersection was obtained from ODOT's GCAT, and analyzed with the CAM tool, for years 2020-2022. In total, 100 crashes were reported within the 0.25-mile section of roadway and intersection. Crash breakdown by type, severity, and location are summarized in ***Figure 22*** through ***Figure 24***.

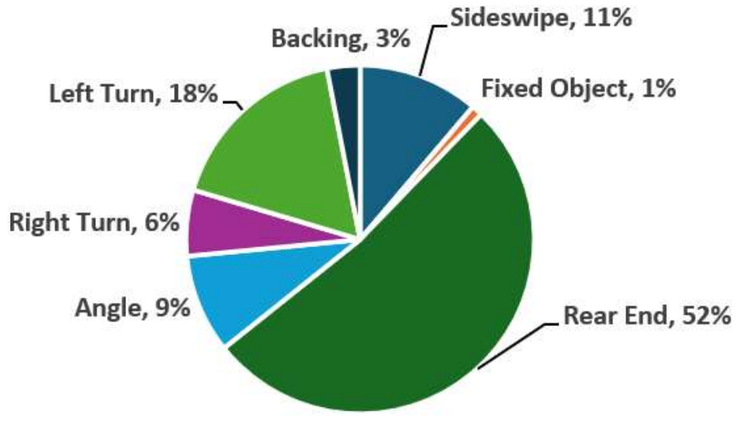
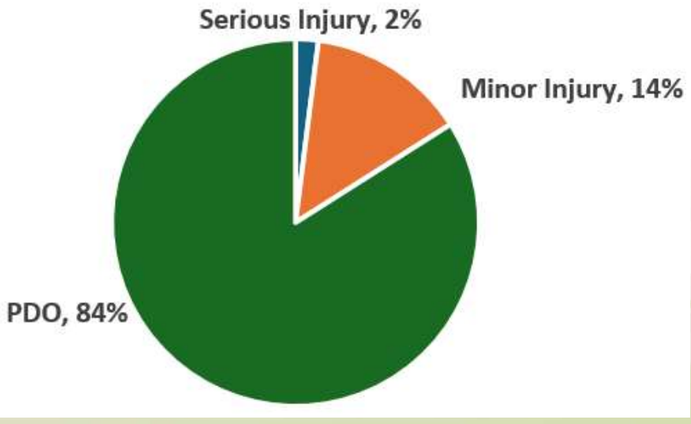


Figure 22 Crash Breakdown by Type, SR 39

Figure 23 Crash Breakdown by Severity, SR 39



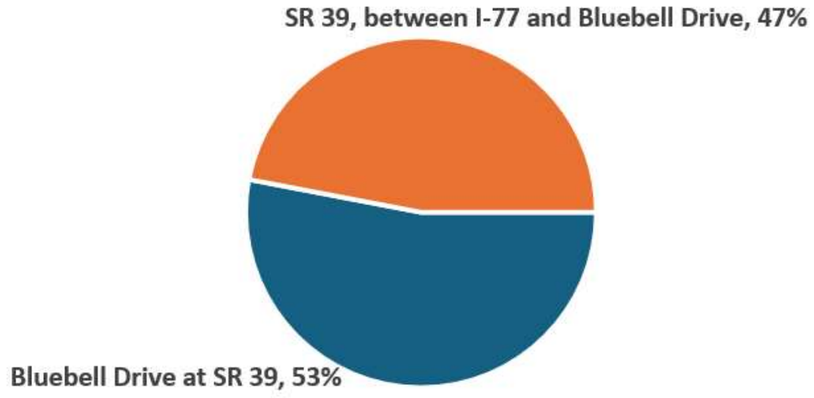


Figure 24 Crash Breakdown by Location, SR 39

Figure 22 shows the most prevalent crash type reported within the study area was Rear End (51 crashes), followed by Left Turn (17 crashes), and Sideswipe (11 crashes). Two serious injury crashes were reported during the study period, both while turning left. The first occurred on SR 39 at the access drives west of Bluebell Drive, and the second occurred at the Bluebell Drive intersection. **Figure 24** shows that crashes were relatively evenly split between the SR 39 roadway segment and the Bluebell Drive intersection.

Like the interchange, Highway Safety Manual methodology was applied to assess the existing safety performance of the site. Results are summarized in ***Table 6***.

	KA	B	C	O	TOTAL
TOTAL $N_{PREDICTED}$	0.2001	0.9638	1.4471	6.881	9.492
TOTAL $N_{EXPECTED}$	0.2651	1.2038	1.796	17.3354	20.6003
TOTAL N_{PSI}	0.065	0.24	0.3489	10.4544	11.1083

Table 6: Overall Existing Condition HSM Results, SR 39 at Bluebell

Findings show that the study area is performing worse than would be predicted based on the roadway characteristics and traffic volumes. The study area as a whole experiences over 11 more crashes per year. PSI is further broken down by intersection and roadway segment in ***Table 7***.

LOCATION	KA	B	C	O	TOTAL
SR 39 Arterial Road	0.0417	0.1046	0.1013	4.3843	4.6319
Bluebell Drive at SR 39 Intersection	0.0233	0.1354	0.2476	6.0701	6.4764

Table 7: Summary of PSI by SR 39 Location

Findings show both the SR 39 roadway segment, and the Bluebell Drive intersection show a potential for safety improvement. SR 39 is experiencing just under five more crashes per year, and the Bluebell Drive intersection is experiencing just over six more crashes per year.

Proposed Safety Analysis

For the purposes of this study, a qualitative only safety analysis was performed for the alternatives. Findings are summarized here.

IR 77 & US 250 System Interchange

Alternative 1 – Flyover provides a direct route between WB US 250 and SB IR 77. The flyover would reduce congestion on SR 39 and eliminate the blending of freeway and local traffic on SR 39. By removing the freeway traffic from SR 39, left turn movements at the two ramp terminal intersections would also be reduced. Left turn movements are arguably one of the most dangerous situations for drivers, especially when not protected. Drivers commonly struggle to adequately identify gaps in traffic and when crashes do occur, they tend to be more severe.

Sideswipe crashes may increase on SB IR 77 due to the addition of another ramp merge point but overall, this is the best alternative for WB US 250/SB IR 77 from a qualitative safety performance perspective. In addition to the safety improvements expected along SR 39, this alternative allows drivers to maintain relatively consistent speeds between US 250, the ramp, and SB IR 77 merge.

Alternative 2 – Texas U-Turn Just like Alternatives 1 and 2, this alternative is predicted to improve safety on SR 39 and the ramp terminal intersections but degrade safety on SB IR 77. Much research has been done on this interchange design within the state of Texas, although commonly included interchange designs with frontage roads and access driveways that serve both freeway and local traffic. The research for these design types suggests that Texas U-Turns can reduce crash frequency by over 76%. In the case of IR 77 and US 250, it can reasonably be assumed that a Texas U-turn would perform equally or better than what research suggests because there is no frontage road, access points, or local traffic within the single lane U-turns. Because of this, less turbulence and conflict points are expected, which should result in fewer crashes.

Drivers will still be expected to slow relatively significantly to travel through the U-turn design, but it does maintain the driver expected right side off ramp. For these reasons it is assumed to be slightly less favorable than Alternative 1 – Flyover, but better than Alternative 2 – Loop Ramp.

Alternative 3 – Loop Ramp provides similar safety benefits and drawbacks as those noted for Alternative 1 – Flyover. This includes:

- Safety improvements along SR 39 due to reduced congestion,
- Safety improvements at the two ramp terminal intersections due to reduced congestion and reduced left turn volumes, and
- Possible negative safety impacts on SR IR 77 caused by the addition of another merge point.

From a qualitative safety perspective, this alternative is predicted to perform slightly worse than Alternative 1 – Flyover for two reasons. First, the tight horizontal curve forces drivers to slow down to safely traverse the curve, but drivers commonly don't slow enough – especially when traveling on a high-speed roadway. This can result in an increase in fixed object or run off the road crashes. Second, negative safety impacts on US 250 may increase because of the addition of a left side exit ramp, which goes against driver expectancy. Safety research in this space suggests that left side off ramps may cause up to 49% more crashes compared to a right side off ramp.

Alternative 4 – NB to EB provides a direct route between NB IR 77 and EB US 250. The free flow ramp would reduce congestion on SR 39 and eliminate the blending of freeway and local traffic on SR 39. By removing the freeway traffic from SR 39, left turn movements at the two ramp terminal intersections would also be reduced. Left turn movements are arguably one of the most dangerous situations for drivers, especially when not protected. Drivers commonly struggle to adequately identify gaps in traffic and when crashes do occur, they tend to be more severe.

Sideswipe crashes may increase on EB US 250 due to the addition of another ramp merge point but overall, this is the best alternative for NB IR 77 /EB US 250 from a qualitative safety performance perspective. In addition to the safety improvements expected along SR 39, this alternative allows drivers to maintain relatively consistent speeds between IR 77, the ramp, and EB US 250 merge.

IR 77 & SR 39 Service Interchange

Alternative 1 – Relocated SB Off Ramp creates a new intersection on SR 39 approximately 1100 feet north of Stonecreek Road. Adding a new intersection where one does not currently exist will increase crash frequency on SR 39 because the number of conflict points are increased. The new intersection alignment also reduces the SB IR 77 deceleration lane length, which could result in a slight increase in rear end crashes. Could introduce the potential if wrong way crashes unless intersection is a roundabout.

This alternative also realigns the SR 39/Stonecreek Road and IR 77 ramp terminal intersections into one four-way intersection. Generally, converting two offset intersections into one will result in safety benefits only if the through cross traffic is high. This is because the reconfiguration increases the number of conflict points. In the case of SB IR 77 at SR 39, nearly 70% of traffic traveling EB on SR 39 travels through the IR 77 SB ramp terminal towards Bluebell Drive. Additionally, over 80% of the IR 77 SB off-ramp traffic turns left to travel EB on SR 39 towards Bluebell Drive. If the IR 77 off-ramp were to be reconfigured as proposed in Alternative 1, this heavy SB to EB movement would require two left turns as opposed to just one in the existing condition. As previously mentioned, left turns are arguably one of the most dangerous situations for drivers so anything that reduces left turn movements is usually recommended. From a qualitative perspective, this is the least favorable alternative for the SB IR 77 ramp terminal.

Alternative 2 – Double Roundabout According to FHWA, roundabouts are a proven safety countermeasure to reduce fatal and serious injury crashes. Research suggests an approximately 26% reduction in overall crash frequency, and a 71% reduction in fatal and serious injury crashes. Speeds are reduced by using channelized curved approaches and conflict points are reduced with circulating traffic movements. In some instances, especially multi-lane roundabouts like those proposed along SR 39, roundabouts can cause an increase in PDO crashes. This alternative proposes two multi-lane roundabouts within 400 feet of one another in a location that currently has zero roundabouts within a ten-mile radius. This could be too much for drivers to comprehend and result in a negative safety impact.

Alternative 3 – Peanut Roundabout essentially consolidates the two double roundabouts into one large 5-leg roundabout. Unlike Alternative 2 – Double Roundabout, this alternative maintains the existing US 250 EB overpass and continues to keep this traffic off the local street network.

The peanut roundabout has similar safety concerns as the double roundabout, such as increased number of PDO crashes caused by introduction of the multi-lane design in an area unfamiliar with roundabouts. Despite this, from a qualitative safety perspective it is believed to perform better than the double roundabout due to the reduced number of decision points.

Alternative 4 – NB Roundabout As previously noted, roundabouts are a proven safety countermeasure for reducing fatal and serious injury crashes but sometimes result in an increased number of PDO crashes. This is especially true with multi-lane roundabouts in locations where drivers may be new or unfamiliar with driving them.

The existing safety analysis results at the NB ramp terminal intersection show the intersection is performing slightly worse than would be predicted compared to locations with similar traffic volumes and roadway characteristics, and there is room for improvement. Each of the proposed system interchange alternatives will unintentionally result in positive safety benefits at the ramp terminal intersection because of reduced traffic volumes and left turn movements. Because of this, the team recommends proceeding with the system interchange improvements and re-evaluating the NB ramp terminal intersection once construction is complete and traffic has had a chance to adjust to the new configuration.

East of River (Including Bluebell Drive)

Alternative 1 – Backage Roads Safety benefits for this alternative would likely be minimal. By offering an alternative access point in to and out of the properties, backage roads would help to alleviate some congestion, and thus rear end crashes, along SR 39. Safety benefits are predicted to be minimal because without closure, modification, or relocation of any of the existing access points along SR 39 in such a way that forces use, it is difficult to predict how much traffic would use the backage roads.

If the backage roads do become heavily used, they could cause crashes to increase along Bluebell Drive due to the increase in traffic volumes.

Alternative 2 – Right-In/Right-Out Restrictions combined with Alternative 1 – Backage Roads will help to encourage backage road use, which was discussed as a potential issue if Alternative 1 were implemented by itself. Along with reduced congestion and rear end crashes on SR 39, right-in/right-out install will also reduce the number of left turn crashes. Research suggests that right-in/right-out conditions can reduce total crash frequency by 45%.

Without converting the other driveways along SR 39 to also be right-in/right-out only, complete benefits will likely not be realized because drivers may attempt to avoid the right-in/right-out only access point by using one of the other driveways. Like Alternative 1, crash frequency on Bluebell Drive would likely increase due to the increase in traffic volumes.

Alternative 3 – Median This alternative restricts all drives along SR 39 to right-in/right-out only, which was previously noted as a barrier to safety benefits in Alternatives 1 and 2. Research findings suggest that installation of a raised median can reduce overall crash frequency by over 70%.Due to the prevalence of left turn crashes along SR 39, this alternative is preferred from a qualitative safety perspective.

This alternative should be coupled with either Alternative 1- Backage Roads or Alternative 5 – Roundabout to maintain both eastbound and westbound access to/from each property. With backage roads, crashes will increase on Bluebell Drive as previously noted as a possibility in Alternatives 1 and 2.

Alternative 4 – Added Turn Lanes Research suggests that adding right turn lanes to a four-leg signalized intersection can reduce overall crash frequency by 8% when installed on two approaches. Alternative 4 proposes the addition of right turn lanes on the EB and NB approaches. A right turn lane already exists on the SB approach.

Alternative 5 – Roundabout According to FHWA, roundabouts are a proven safety countermeasure to reduce fatal and serious injury crashes. Research suggests an approximately 26% reduction in overall crash frequency, and a 71% reduction in fatal and serious injury crashes. Speeds are reduced by using channelized curved approaches and conflict points are reduced with circulating traffic movements. In some instances, especially multi-lane roundabouts like that proposed at the Bluebell Drive intersection, roundabouts can cause an increase in PDO crashes. This could be too much for drivers to comprehend and result in a negative safety impact.

From a quantitative safety perspective, a roundabout is predicted to perform better than a signalized intersection with turn lane improvements. Qualitatively, TCTID must consider how the surrounding communities will perceive a roundabout, especially given that there is not a single roundabout within a 10-mile radius of the project study area and traffic volumes require such a large design.

Traffic Operations

The Traffic Analysis study area consists of 4 intersections along the SR-39 corridor between Stonecreek Road and Bluebell Drive. The following intersections were included in the traffic analysis:

- SR 39 & Stonecreek Road
- SR 39 & IR 77 Southbound Ramps
- SR 39 & IR 77 Northbound Ramps
- SR 39 & Bluebell Drive

Data Collected

Turning movements were conducted using Miovision at the study intersections on Wednesday, August 16, 2023. The AM peak for the study area was identified as 8:45-9:45 AM and the PM peak hour was determined to be 3:45-4:45 PM. A seasonal adjustment factor has been applied to the counts to determine AADT in accordance with the procedures outlined by Modeling and Forecasting. Copies of the traffic counts are in ***Appendix D***. Figures showing the 2023 Existing traffic volumes are contained in ***Appendix E***.

Traffic Volume Projections

Design Year Intersection Traffic Forecasts

Future year No-Build traffic forecasts were developed by Burgess & Niple. The ODOT TFMS program was used to determine the annual growth rate along the SR 39 corridor. TFMS predicts that the corridor will have a nearly flat annual growth rate of 0.1%. Copies of the TFMS report for SR 39 are provided in ***Appendix E***. In addition to the annual growth rate, a Design Hour Volume (DHV) factor was applied to every location in the study area. The DVH factor converts the peak hour volume to the 30th highest hour volume. The DHV factor selected for this project was the average of the factors for an Urban Principal Arterial and Urban Freeway using ODOT's Peak Hour to Design Hour Factor Report. Based on counts being conducted on a Wednesday in August the Urban Principal Arterial has a DHV factor of 1.12 and the Urban Freeway has a DHV factor of 1.08. The average used for the corridor was 1.10.

With the application of the annual growth rate and DHV factor, the 2023 peak hour traffic counts were increased to 2050 design hour volumes using the following calculations:

- All SR 39 intersections = 0.1% per year x 27 years x 1.10 = **2.97% increase**

In addition to the growth rate calculated above, a proposed mixed used development is planned for the west side of the interchange bordering Stonecreek Road and SR 39. The trips generated from this size development were determined using the ITE Trip Generation Manual as well as looking at similar size developments in Ohio. Internal capture reductions and pass-by trip reductions were applied to the generated trips. Assuming a full build out by 2050, the site is expected to generate 1215 trips in the AM peak and 1939 trips in the PM peak, which is higher than the existing traffic volume on SR 39 through the commercial area east of the interchange. Given the flat growth expected in the area, this is an extremely large increase in traffic that is not expected to be realized. Given this, engineering judgement was applied to reduce the square footage of some of the developments and adjust the land use types as well. It is likely that some of the parcels in the development will shift from commercial to warehousing, which generates a lower number of vehicles. Given these assumptions, we estimate that the site would generate 530 trips in the AM peak and 800 trips in the PM peak. These trips would be added on top of the 2050 design hour volumes calculated using the TFMS growth rate. The ratio of entering/exiting trips for the new development is 63%/37% in the AM peak and 45%/55% in the PM peak. A single entrance used by all trips to enter or exit the development is located on Stonecreek Road. Entering or exiting vehicles from development trips were applied proportionally at all intersections based on the 2023 counts. ITE trip generation assumptions and calculations are shown in ***Appendix E***.

Capacity Analysis

Capacity Analysis for the four intersections was conducted for the 2050 No-Build and Build alternatives. *Highway Capacity Software (HCS), version 2023* was used for the analysis. Based on the ODOT Analysis and Traffic Simulation Manual guidelines, the operational goals for the traffic analysis are that the overall intersection operates with a Level of Service (LOS) of D or better, each approach at LOS E or better, a volume

to capacity (v/c) ratio of less than 0.93, and a queue storage ratio (QSR) of less than 1.0. Intersection capacity results are discussed below and detailed outputs of the *HCS* analysis are contained in ***Appendix F.***

SR 39 & SB IR 77 and Stonecreek Intersections

The intersections of SR 39 & SB IR 77 and SR 39 & Stonecreek Road are separated by approximately 200 feet. This distance makes signal coordination between the two intersections very challenging. To control the vehicle queuing between the intersections, the signals are running together. However, this has created a very long cycle length and excess delay. Existing observations show that queues on the westbound approach at the SB IR 77 ramp intersection occasionally extend upstream through the NB IR 77 ramp intersection. As traffic volumes continue to grow, delay and queue lengths are expected to significantly increase. ***Table 8*** through ***Table 11*** shows the results of the capacity analysis for the AM and PM peak at each of the study intersections for the No-Build, Build Alternative 1 and Build Alternative 2 conditions. As shown in the tables, some movements in the No-Build condition are expected to operate at LOS F, especially in the PM peak. To improve the operation, it is necessary to either increase the distance between the two intersections or eliminate one of the intersections.

Alternative 1 eliminates the SB IR 77 intersection by relocating the SB IR 77 off-ramp to tie into SR 39, north of the Stonecreek intersection. As shown in the tables, this alternative is expected to have a substantial improvement to the operation of the intersections. Overall intersections will operate at LOS B and C and queueing is not expected to be a concern.

Table 8 –SR 39 & Stonecreek Rd Capacity Results AM Peak

AM		Eastbound Stonecreek Rd		Westbound SR 39		Northbound	Southbound SR 39	
No-Build	**Overall**	**Signalized**						
		LT	TH	TH	RT		LT	RT
LOS	B	E	A	B	A		C	C
Delay	17.8	60.3	6.6	17.2	0.0		33.4	26.3
v/c		0.59	0.16	0.45			0.29	0.20
QSR		0.67	0.21	2.04			0.05	0.31
95th %ile Queue		134'	64'	265'			103'	82'
		B - 17.4		B - 11.5			C - 31.2	
Alternative 1	**Overall**	**Signalized**						
		LT	TH RT	LT	TH RT		LT	TH RT
LOS	B	C	B	B	B		C	C
Delay	18.0	27.8	15.0	11.2	14.6		21.2	28.4
v/c		0.60	0.33	0.47	0.44		0.40	0.55
QSR		0.29	0.27	0.20	0.15		0.16	0.17
95th %ile Queue		58'	80'	91'	119'		116'	158'
		B - 17.6		B - 13.5			C - 23.6	
Alternative 2	**Overall**	**Roundabout**						
		LT TH	TH	TH	RT		LT	RT
LOS	A	A	A	A	A		A	A
Delay	5.8	5.4	5.7	6.3	4.4		6.9	4.8
v/c		0.20	0.22	0.36	0.17		0.25	0.10
95th %ile Queue		18'	23'	40'	15'		25'	8'
		A - 5.5		A - 5.7			A - 6.2	

Table 9 –SR 39 & Stonecreek Rd Capacity Results PM Peak

PM		Eastbound Stonecreek Rd		Westbound SR 39		Northbound	Southbound SR 39	
No-Build	Overall	**Signalized**						
		LT	TH	TH	RT		LT	RT
LOS	C	F	A	B	A		E	D
Delay	27.2	92.7	4.8	14.1	0.0		70.9	48.7
v/c		0.82	0.26	0.48			0.81	0.44
QSR		1.33	0.43	2.93			0.16	0.89
95th %ile Queue		266'	128'	382'			327'	232'
		B - 19.1		A - 9.5			E - 64.5	
Alternative 1	Overall	**Signalized**						
		LT	TH RT	LT	TH RT		LT	TH RT
LOS	C	D	D	C	C		C	B
Delay	27.4	47.9	38.0	27.3	24.0		23.4	13.1
v/c		0.80	0.83	0.93	0.53		0.47	0.61
QSR		0.76	1.10	0.78	0.36		0.22	0.11
95th %ile Queue		152'	329'	353'	278'		161'	100'
		D - 39.6		C - 25.4			B - 19.7	
Alternative 2	Overall	**Roundabout**						
		LT TH	TH	TH	RT		LT	RT
LOS	A	A	A	A	A		B	A
Delay	8.8	8.8	9.7	8.4	5.2		11.9	6.8
v/c		0.42	0.47	0.49	0.24		0.52	0.21
95th %ile Queue		53'	65'	70'	25'		75'	20'
		A - 9.3		A - 7.4			B - 10.4	

Table 10 – SR 39 & SB IR 77 Capacity Results AM Peak

AM		Eastbound SR 39		Westbound SR 39		Northbound SB I-77 ON	Southbound SB I-77 OFF	
No-Build	Overall	**Signalized**						
		TH	TH RT	LT	TH		LT	TH RT
LOS	C	B	B	E	A		F	D
Delay	33.9	19.0	19.2	61.8	5.7		82.6	48.5
v/c		0.32	0.32	0.91	0.21		0.92	0.47
QSR		2.37	2.24	1.02	0.13		0.47	0.90
95th %ile Queue		237'	211'	347'	98'		448'	180'
		B - 19.1		C - 24.4			E - 71.9	
		Eastbound		Westbound SB I-77 OFF		Northbound SR 39	Southbound SR 39	
Alternative 1	Overall	**Signalized**						
				LT	RT	TH	RT	
LOS	B			B	B	A	B	
Delay	11.3			16.3	19.2	2.3	11.4	
v/c				0.50	0.21	0.3	0.36	
QSR				0.22	0.09	0.0	0.05	
95th %ile Queue				132'	60'	20'	105'	
				B - 17.1		A - 2.3	B - 11.4	
		Eastbound SR 39		Westbound SR 39		Northbound SB I-77 ON	Southbound SB I-77 OFF	
Alternative 2	Overall	**Roundabout**						
		TH	RT	LT TH	TH RT		LT	RT
LOS	A	A	A	A	A		A	A
Delay	6.8	8.0	5.4	5.3	5.7		9.3	6.9
v/c		0.28	0.16	0.29	0.33		0.27	0.17
95th %ile Queue		28'	15'	30'	35'		28'	15'
		A - 7.2		A - 5.6			A - 8.6	

Alternative 2 increases the distance between the two intersection and replaces the traffic signals with roundabouts. As shown in the tables, this alternative is expected to have very good operations. The roundabouts are expected to operate at LOS A and B and queues are not expected to be a concern between the two roundabouts.

Table 11 – SR 39 & SB IR 77 Capacity Results PM Peak

PM		Eastbound SR 39		Westbound SR 39		Northbound SB I-77 ON	Southbound SB I-77 OFF	
No-Build	Overall	**Signalized**						
		TH	TH RT	LT	TH		LT	TH RT
LOS	E	C	C	F	A		F	E
Delay	74.5	33.3	33.7	142.5	6.4		216.2	55.9
v/c		0.65	0.65	1.16	0.26		1.30	0.55
QSR		5.76	5.27	2.54	0.18		1.11	1.27
95th %ile Queue		576'	523'	864'	136'		1057'	253'
		C - 33.5		E - 62.6			F - 172.0	

		Eastbound		Westbound SB I-77 OFF		Northbound SR 39	Southbound SR 39
Alternative 1	Overall	**Signalized**					
				LT	RT	TH	RT
LOS	C			D	D	B	B
Delay	23.8			39.8	45.9	12.2	10.2
v/c				0.88	0.74	0.30	0.48
QSR				0.57	0.48	0.21	0.11
95th %ile Queue				342'	326'	196'	241'
				D - 42.6		B - 12.2	B - 10.2

		Eastbound SR 39		Westbound SR 39		Northbound SB I-77 ON	Southbound SB I-77 OFF	
Alternative 2	Overall	**Roundabout**						
		TH	RT	LT TH	TH RT		LT	RT
LOS	B	C	B	A	A		C	A
Delay	13.5	22.3	10.0	6.5	7.2		20.4	9.2
v/c		0.68	0.43	0.41	0.47		0.55	0.27
95th %ile Queue		130'	55'	53'	63'		80'	28'
		C - 18.4		A - 6.9			C - 17.5	

A final alternative, the Peanut Roundabout, was developed to combine the two intersections into a single roundabout. Because HCS is unable to evaluate roundabouts with five legs, TransModeler was used to evaluate this alternative. TransModeler showed the Peanut operated at LOS F. To improve the operation, an indirect westbound SR 39 to SB IR 77 left turn was modeled. In this option, the crossover movement at the NB IR 77 ramp intersection is expected to operate at LOS C and the Peanut roundabout is expected to operate at LOS A. The Peanut roundabout with an indirect left is expected to operate at a very good LOS, however, it is a very new concept to the area and will take some time for drivers to become familiar. TransModeler results for the conventional peanut roundabout are shown in ***Table 12***. TransModeler results for the peanut roundabout with the indirect left-turn are shown in ***Table 13***.

Table 12 – TransModeler Peanut Roundabout Capacity Results PM Peak

		Northeastbound Stonecreek Rd		Westbound SR 39		Southbound SB I-77 OFF		Southeastbound SR 39	
Peanut Roundabout		LT TH	TH RT	LT TH	RT	LT	LT TH RT	LT	TH RT
	Overall								
LOS	F	F	E	B	A	F	F	F	F
Delay	137.0	68.6	40.1	10.2	2.1	262.7	282.1	504.5	448.2
95th %ile Queue		394'	367'	50'	0'	1395'	1771'	2005'	2687'

		Eastbound SR 39		Westbound SR 39		Northbound NB I-77 OFF		Southbound NB I-77 ON	
Peanut Roundabout		LT	TH RT	LT	TH RT	LT TH	RT		
	Overall								
LOS	B	D	A	C	C	D	C		
Delay	19.5	36.4	6.0	23.4	20.8	38.2	24.2		
95th %ile Queue		109'	81'	270'	290'	157'	195'		
		A - 9.9		C - 21.9		C - 29.4			

Table 13 – TransModeler Peanut Roundabout with Indirect Left Capacity Results PM Peak

		Northeastbound Stonecreek Rd		Westbound SR 39		Southbound SB I-77 OFF		Southeastbound SR 39	
Peanut with Indirect Left		LT TH	TH RT	LT TH	RT	LT	LT TH RT	LT	TH RT
	Overall								
LOS	A	B	A	A	A	A	A	B	B
Delay	7.9	11.2	5.8	2.8	1.7	9.5	8.5	15.0	13.3
95th %ile Queue		100'	67'	7'	0'	54'	80'	83'	140'

		Eastbound SR 39		Westbound SR 39		Northbound NB I-77 OFF		Southbound NB I-77 ON	
Peanut with Indirect Left		LT	TH RT	LT	TH RT	LT TH	RT		
	Overall								
LOS	C	E	C	D	B	E	C		
Delay	30.2	55.1	24.6	50.5	16.9	58.7	27.5		
95th %ile Queue		138'	270'	267'	350'	272'	212'		
		C - 28.4		C - 26.1		D - 40.9			

SR 39 & NB IR 77 Intersection

Capacity results for the SR 39 & NB IR 77 intersection are shown in ***Table 14*** for the AM Peak and ***Table 15*** for the PM Peak. As shown in the tables, the No-Build condition at the intersections is very close to meeting the operational goals. The northbound right turn movement in the PM peak has a v/c ratio of 0.97, which is just above the goal of 0.93 or less. In Alternative 1, the intersection is converted to a roundabout. As shown in the tables, the roundabout is expected to meet all the operational goals.

Table 14 – IR 77 NB Ramps & SR 39 Capacity Results AM Peak

AM		Eastbound SR 39		Westbound SR 39		Northbound NB I-77 OFF		Southbound NB I-77 ON
No-Build	**Overall**	**Signalized** LT	TH	TH RT		LT	RT	
LOS	B	B	A	B		B	C	
Delay	14.2	11.3	6.8	15.6		18.8	22.8	
v/c		0.25	0.31	0.64		0.37	0.82	
QSR		0.07	0.09	0.16		0.10	0.20	
95th %ile Queue		22'	68'	186'		72'	165'	
		A - 7.4		B - 15.6		C - 20.8		
Alternative 1	**Overall**	**Roundabout** LT TH	TH	TH	TH RT	LT	RT	
LOS	A	A	A	A	A	B	B	
Delay	7.8	4.6	4.9	8.1	8.9	10.8	10.1	
v/c		0.23	0.26	0.39	0.44	0.39	0.39	
95th %ile Queue		23'	25'	48'	58'	45'	48'	
		A - 4.7		A - 8.5		B - 10.4		

Table 15 – IR 77 NB Ramps & SR 39 Capacity Results PM Peak

PM		Eastbound SR 39		Westbound SR 39		Northbound NB I-77 OFF		Southbound NB I-77 ON
No-Build	**Overall**	**Signalized** LT	TH	TH RT		LT	RT	
LOS	C	C	B	D		C	E	
Delay	34.4	21.1	13.2	41.9		22.9	62.4	
v/c		0.61	0.50	0.93		0.30	0.97	
QSR		0.22	0.26	0.48		0.17	0.68	
95th %ile Queue		68'	199'	578'		125'	557'	
		B - 14.2		D - 41.9		D - 52.4		
Alternative 1	**Overall**	**Roundabout** LT TH	TH	TH	TH RT	LT	RT	
LOS	C	A	A	C	C	D	D	
Delay	16.6	6.2	6.9	15.1	19.1	28.9	34.9	
v/c		0.40	0.45	0.67	0.76	0.70	0.80	
95th %ile Queue		48'	60'	135'	188'	130'	188'	
		A - 6.6		C - 17.2		D - 32.3		

SR 39 & Bluebell Drive Intersection

Capacity results for the SR 39 & Bluebell Drive intersection are show in ***Table 16*** for the AM peak and ***Table 17*** for the PM peak. As shown in the tables, capacity analysis for the No-Build, Alternative 4 (signal) and Alternative 5 (roundabout) will generally operate at LOS C and D. The best alternative at the intersection will really depend on what access management changes are made along the SR 39 corridor. A backage road system will increase turning movements at the Bluebell intersection. The increased volumes would benefit from the additional turn lanes in Alternative 4. If a median option is used, the roundabout in Alternative 5 would provide an opportunity to make U-turns at the intersection, which would improve connectivity in the corridor.

Table 16 - SR 39 & Bluebell Dr Capacity Results AM Peak

AM		Eastbound SR 39			Westbound SR 39		Northbound Bluebell Dr			Southbound Bluebell Dr		
No-Build	Overall	Signalized										
		LT	TH RT		LT	TH RT	LT	TH RT		LT	TH	RT
LOS	C	B	C		B	C	C	D		C	C	C
Delay	27.7	16.6	26.6		18.1	24.9	33.5	44.3		31.0	34.1	28.1
v/c		0.50	0.63		0.34	0.45	0.30	0.81		0.70	0.32	0.43
QSR		0.12	0.30		0.26	0.46	1.15	0.11		1.02	0.23	0.37
95th %ile Queue		139'	357'		52'	245'	104'	217'		214'	116'	184'
		C - 23.3			C - 24.1		D - 40.5			C - 30.6		
Alternative 4	Overall	Signalized										
		LT	TH	RT	LT	TH RT	LT	TH	RT	LT	TH	RT
LOS	C	B	B	B	B	C	D	D	D	C	D	C
Delay	25.4	15.4	18.9	12.5	16.0	24.6	37.1	45.3	37.3	33.2	37.7	28.6
v/c		0.66	0.38	0.17	0.17	0.44	0.36	0.67	0.30	0.67	0.40	0.44
QSR		0.16	0.19	0.26	0.26	0.46	0.55	0.07	0.19	0.64	0.25	0.37
95th %ile Queue		191'	219'	77'	51'	244'	110'	136'	77'	224'	123'	186'
		B - 16.3			C - 23.5		D - 40.4			C - 32.5		
Alternative 5	Overall	Roundabout										
		LT TH	TH RT		LT TH	TH RT	LT TH	RT		LT TH	RT	
LOS	A	A	A		A	B	B	A		B	A	
Delay	10.0	9.0	9.9		9.2	10.1	12.9	7.1		12.1	7.3	
v/c		0.42	0.47		0.39	0.44	0.41	0.12		0.49	0.26	
95th %ile Queue		53'	65'		48'	58'	50'	10'		70'	25'	
		A - 9.5			A - 9.7		B - 11.4			B - 10.3		

Table 17 - SR 39 & Bluebell Dr Capacity Results PM Peak

PM		Eastbound SR 39			Westbound SR 39		Northbound Bluebell Dr			Southbound Bluebell Dr		
No-Build	Overall	Signalized										
		LT	TH RT		LT	TH RT	LT	TH RT		LT	TH	RT
LOS	D	C	D		C	C	D	D		D	D	C
Delay	37.1	20.8	45.1		27.0	31.4	45.4	53.4		37.1	39.7	34.2
v/c		0.69	0.90		0.43	0.58	0.58	0.81		0.79	0.39	0.62
QSR		0.16	0.64		0.32	0.74	2.63	0.12		1.46	0.38	0.64
95th %ile Queue		190'	752'		64'	394'	236'	239'		306'	189'	322'
		D - 38.5			C - 31.0		D - 49.3			D - 36.4		
Alternative 4	Overall	Signalized										
		LT	TH	RT	LT	TH RT	LT	TH	RT	LT	TH	RT
LOS	C	C	C	B	B	C	D	D	D	D	D	C
Delay	28.3	21.4	25.5	13.3	19.2	32.5	41.3	44.9	35.7	47.8	38.3	30.5
v/c		0.84	0.65	0.22	0.24	0.66	0.64	0.58	0.24	0.79	0.51	0.63
QSR		0.19	0.34	0.34	0.27	0.69	0.21	0.07	0.16	0.91	0.33	0.56
95th %ile Queue		223'	396'	102'	55'	365'	43'	135'	63'	320'	167'	281'
		C - 22.1			C - 31.2		D - 41.5			D - 38.7		
Alternative 5	Overall	Roundabout										
		LT TH	TH RT		LT TH	TH RT	LT TH	RT		LT TH	RT	
LOS	C	B	C		B	C	D	A		E	B	
Delay	20.5	14.3	17.3		14.6	17.3	33.3	9.2		37.1	14.7	
v/c		0.62	0.70		0.59	0.66	0.75	0.13		0.85	0.53	
95th %ile Queue		113'	150'		98'	125'	153'	13'		175'	78'	
		C - 15.9			C - 16.0		D - 29.1			D - 27.9		

Environmental Overview

A study area around the interchange of IR 77, US 250, and SR 39 was evaluated for potential environmental issues based upon existing data sources. A county map, USGS topographic map, and aerial map of the study area are included in Appendix G Environmental Data.

The resources identified within the larger study area are summarized below. Each topic area includes an analysis of which resources may be impacted by the alternatives and which are avoided by all alternatives. For clarity, a summary is provided at the end of this section to highlight the differences among the alternatives that may influence the comparison.

Ecological Resources

The potential for ecological resources was assessed based upon aerial photography, USGS Streamstats, and ODOT TIMS mapping.

IR 77/US250 crosses Sugar Creek just south of W. 3rd Street in Dover. Tuscarawas River parallels IR 77 on the east side and US 250 on the north side. Both Sugar Creek and Tuscarawas River are Group 1 streams in the Ohio Mussel Survey Protocol, meaning state-listed species may be present. Any impacts to these waterways will require completion of a mussel survey. ODOT TIMS maps showing the location of the listed State-listed mussel species is included in Appendix G.

Stone Creek, which approaches Tuscarawas River southeast within the southeast part of the interchange, has a drainage area of 38.8 square miles and would also require a mussel survey if the creek is impacted. USGS StreamStats indicates several tributaries crossing the study area. USGS Streamstats mapping is included in Appendix G.

The National Wetland Inventory (NWI) indicates the presence of wetlands in the undeveloped areas between Tuscarawas River and IR 77/US 250 and between IR 77 and Stone Creek. The NWI map is located in Appendix G.

NWI mapping also shows a possible drainage connection across IR 77 on the north half of the interchange that may connect to a captured stream that does not appear on Streamstats. This would need to be field verified if the area were to be impacted. Only the IR 77 SB & SR 39 Intersection Alternative 1 appears to have impacts in the vicinity.

Publicly available aerial and street view photography suggests that there may be wetlands in the undeveloped areas impacted by the backage road south of SR 39 (High Avenue). This would need to be field verified in future project development.

The ramp alternatives in the south and east quadrant of the interchange would require widening the existing or adding a new crossing of Stone Creek. The flyover ramp alternative may encroach upon the Tuscarawas River. Sugar Creek and other streams appear to be avoided by all alternatives.

Threatened and Endangered (T&E) species records have not been requested from USFWS or ODNR at this time; however, the study area contains suitable wooded habitat for the federally listed Indiana bat, northern long-eared bat, and several state-listed bat species. Tree cutting is likely to be prohibited from April 1st through October 1st.

Loss of wooded habitat, particularly along riparian corridors, may have an impact that requires mitigation, even with the seasonal tree cutting restriction in place. System Interchanges Alternative 1 (possibly) and Alternative 4 (likely) fall within this condition.

Air Quality and Noise

ODOT's Office of Environmental Services (OES) provides flowcharts for ease in evaluating whether air quality studies or noise analyses are required. The first step is to assess whether there are air quality or noise sensitive receivers within 500 feet of the project limits. Sensitive receivers typically include residences, hospitals, parks, daycares, restaurants with patios, or similar properties that have exterior areas of frequent human use.

Within 500-ft of the roadway, there are these areas:

- Charles Drive – residential area north of SR 39 at the far north end of the study area
- Commercial Ave/ Blake Ave/Canal Ave – residential areas south of US 250 at eastern end of the study area
- Waterworks Ball Fields – recreational area north of US 250 at far eastern end
- Bluebell Drive – Commercial properties with exterior seating (Starbucks, Chipotle) or outdoor uses (Travelodge)
- High Avenue – residence east of Bluebell Drive
- High Avenue – residential area east of railroad tracks to the far east end of study area

If sensitive receivers are present, then noise analyses are required if the project adds a new roadway, realigns a roadway, widens to be 50% closer, substantially alters a vertical alignment, or adds through travel lanes where receivers are present. Based upon this analysis, it appears that that the backage roads would trigger the need for a noise analysis.

Once a feasible alternative is chosen, a noise analysis is required to cover the entire NEPA study area, even if the other components would not have otherwise triggered an analysis. When moving forward into NEPA, the definition of the complete NEPA action will need to be clarified for that purpose.

Floodplains

The study area contains the floodplains of Tuscarawas River and Sugar Creek. TIMS floodplain mapping and a FEMA Firmette close-up of the interchange are provided in Appendix G. All System Interchange alternatives (to different extents), the IR 77 NB & SR 39 Intersection alternative, and all SR 39 & Bluebell Drive alternatives are within the Special Flood Hazard Area (SFHA). Floodplain coordination and permitting will be required in future project development.

Regulated Materials

The Ohio Regulated Properties Search (ORPS) Tool indicates that the study area passes within the 300-ft buffer of one historic/abandoned landfill (Union Camp Sludge Fill Site) and one Superfund site (Reilly Tar & Chemical). There are dozens of Bureau of Underground Storage Tanks (BUSTR) Leaking Underground Storage Tank (LUST) locations. The ORPS report is included in Appendix G.

None of the alternatives appear to fall within the Superfund or landfill buffers. The System Interchange alternatives and all but one of the IR 77 ramps intersection alternatives appear to avoid any suspect properties. The IR 77 SB & SR 39 Intersection Alternative 1 appears to impact Buckeye Tire (not on the ORPS list). All the SR 39 (High Avenue) & Bluebell Drive alternatives contain numerous, but typical, regulated materials sites.

A Regulated Materials Review (RMR) Screening will be required in future project development to quantify concerns and develop recommendations for management of regulated materials. No regulated materials sites are expected to influence comparison of the alternatives.

Cultural Resources

Cultural resources records were requested from the Ohio State Historic Preservation Office (SHPO). No historic or archaeological sites within the study area have been determined to be eligible for the National Register of Historic Places (NRHP). Some sites have been recorded on the Ohio Archaeology Inventory (OAI) north of the existing interchange. Some buildings have been recorded on the Ohio Historic Inventory (OHI) near US 250 at the far eastern end of the study area. None of the alternatives impact any previously recorded sites. Note that much of the area has not been previously inventoried. Once a feasible alternative is identified, further studies may be required to verify that no historic or archaeological resources are present. The SHPO mapping is included in Appendix G.

Farmlands

According to the TIGERweb census mapping, the project is mostly within the urbanized area. The area east of IR 77, south of SR 39, and south of Tuscarawas River is outside the urbanized area. If there are property impacts outside the urbanized boundary, farmland screening and possibly farmland coordination will be required. TIGERweb mapping is included in Appendix G.

System Interchange Alternatives 1 and 4 and IR 77 NB & SR 39 Intersection Alternative 1 are outside the urbanized boundary.

Drinking Water

The study area contains a Drinking Water Source Water Protection Area around the New Philadelphia Water Treatment Plant. The Drinking Water Source Protection Map is included in Appendix G. None of the alternatives impact this area.

Parks and Recreation

Based upon a review of aerial mapping and the City of New Philadelphia Parks & Recreation website, it appears that the Waterworks Ball Fields are the only publicly owned park in the study area. The park is not affected by any of the alternatives.

Tuscarawas River is an ODNR designated Ohio Water Trail and is subject to protection under Section 4(f). Coordination will be required with ODNR for any alternatives that would have impacts on the river, including temporary access restrictions. None of the alternatives appear to have work over the river. System Interchange Alternative 1 contains a flyover ramp that may encroach on the river.

The ODNR Boater Access & Amenities mapping, included in Appendix G, shows paddling access and motorized launch facilities near Waterworks Ball Fields. These areas will not be impacted by any alternative.

Environmental Justice and Traditionally Underrepresented Populations

The project is located within the City of New Philadelphia and Tuscarawas County. Based upon a review of census data available in TIMS, the census tract west of IR 77 is comprised of 3% minority, 38% low income,

1% limited English proficiency (LEP), and 19% older adults. The census track east of Tuscarawas River is 24% minority, 62% low income, 17% LEP, and 11% older adults.

Public outreach efforts will need to consider how best to encourage participation from these populations that traditionally are underrepresented. Based upon the project details and public involvement to date, no environmental justice impacts are anticipated.

Storm Water Permits

Best management practices (BMPs) for stormwater management will be determined during subsequent design activities. It is anticipated that the alternatives will require more than one acre of disturbance and will be subject to the requirements of NPDES.

Summary of Impacts by Alternative

The following summary focuses on the differences that may have an influence on the comparison of alternatives and does not recount all issues above.

IR 77 & US 250 System Interchange:

- *Alternative 1* would add a flyover ramp adjacent to Tuscarawas River and may encroach and impact the river. *Alternative 1* also requires crossing Stone Creek and just south of existing ramps. The flyover ramp might be possible to construct without in-stream work but may impact wetlands adjacent to the streams. If there is any in-stream work, mussel surveys will be required. Loss of wooded bat habitat, especially along the riparian corridors, may have an impact that requires mitigation.
- *Alternative 2* uses a Texas U-turn ramp and System Interchange *Alternative 3* uses a low speed, loop ramp within the interchange footprint. Both would require widening the bridge over Stone Creek. If this cannot be done without in-stream work, a mussel survey will be required.
- *Alternative 4* uses a 45-mph ramp cutting through the hillside between IR 77 NB and US 250 EB. It would require a new crossing of Stone Creek and would impact wetlands along Stone Creek. If in-stream work is not avoidable, a mussel survey would be required. This alternative would also have substantial impacts on suitable wooded habitat for bat species. Loss of wooded bat habitat may require mitigation.

IR 77 SB & SR 39 Service Interchange:

- *Alternative 1* moves the IR 77 SB off-ramp farther north to exit to SR 39 and realigns the SR 39/Stonecreek Road intersection. This alternative impacts an area that may be a captured stream. It does not appear to impact any wetlands. This alternative would eliminate the current Park N Ride lot, however there would be an opportunity to relocate the Park N Ride lot to the location of the existing southbound off ramp.
- *Alternative 2* constructs two closely spaced roundabouts to separate the Stonecreek Road intersections with SR 39 and IR 77 SB ramps. IR 77 SB & SR 39 Intersection *Alternative 3* constructs a peanut-shaped single roundabout to accommodate these movements. These two options have similar impacts. They do not appear to impact any streams or wetlands. These would greatly reduce the size of or eliminate the existing Park N Ride lot.
- *Alternative 4* replaces the existing intersection with a roundabout. It would be constructed within the existing interchange footprint and does not appear to have any impacts other than mown right-of-way.

East of River (including Bluebell Drive):

- *Alternative 1* would reduce traffic on the 13 access points on SR 39 between Tuscarawas River and Bluebell Drive by installing service drives behind the developments (AKA backage roads) that provide access to Bluebell Drive. The backage road south of SR 39 is likely to impact wetlands.
- *Alternative 2* would modify *Alternative 1* to restrict the backage road access points on SR 39 to right-in/right-out. SR 39 (High Avenue) & Bluebell Drive *Alternative 3* would further install a center median on SR 39 to physically restrict driveway movements to eliminate left turns, other than a left turn from SR 39 eastbound to the northern backage road. The environmental issues for options 2 and 3 would be like *Alternative 1*.
- Drive *Alternative 4* adds right turn lanes on the eastbound and northbound approaches to the Bluebell Drive intersection. SR 39 (High Avenue) & Bluebell Drive *Alternative 5* would replace the SR 39/Bluebell Drive intersection with a roundabout. These alternatives appear to increase the encroachment on a gas station, which would need to be evaluated in the regulated materials studies.

Appendix G

Table of Contents:

Stakeholder Outreach

Extensive outreach has already been completed for this project. Coordination meetings have occurred during this phase of the study with the stakeholders and key businesses in the project area. Below is a summary of the meetings that occurred with the stakeholders and the coordination meetings with Tuscarawas TID to develop the alternatives:

- **Check-In Meeting with Tuscarawas TID** - 8/25/23 Met at Tuscarawas Economic Development with TCEDC, OMEGA, ODOT District 11, Kimble, City of Newcomers, and County Engineer. The purpose of this meeting was to discuss the Feasibility Study process for the IR 77, US 250, and SR 39 interchange in Tuscarawas County with the key stakeholders and elicit their thoughts, opinions, challenges and concerns they have in the project area.
- **Stakeholder Meeting #1** (9/21/23) Met at First Federal Community Bank in Dover Ohio with the Board of Tuscarawas Economic Development Corps. The purpose of this meeting was to discuss the Feasibility Study process for the IR 77, US 250, and SR 39 interchange in Tuscarawas County with the broader group of stakeholders and elicit their thoughts, opinions, challenges and concerns they have in the project area.

  In attendance were the following individuals:
  - Bruce James - CEO Union Hospital
  - Joel Day – City of New Philadelphia
  - Kerry Metzger – Retired Ohio Representative
  - Chris Abbuhl – Tuscarawas County commissioner
  - Scott Robinson – Tuscarawas Chamber of Commerce
  - Wendy Zucal – Dennison Railroad Museum
  - Marc Nolen – Dover Chemical
  - Sarah Andreas – Kent State Tuscarawas
  - Mike Hovan – COO Lauren International
  - Brad Bielski – Kent State Tuscarawas
  - Mike Lauber – CEO Tusco Display and Manufacturing
  - Rick Kimble – Kimble Companies
  - Jon Fondriest – Tuscarawas County
  - Marla Akridge - Tusc TID
  - John Kelly - Tusc TID
  - JC Shively – Tusc TID
- **Check-In Meeting with Tuscarawas TID -** 12/12/23 via Microsoft Teams virtual platform with Tuscarawas TID, OMEGA and ODOT Central Office, and the Study Team – purpose of this meeting was to discuss the status of the project and float interchange improvement ideas in front of the TID to identify any impacts and challenges of the draft alternatives.
- **Stakeholder Meeting #2** -12/19/23 Met at First Federal Community Bank in Dover Ohio with the Board of Tuscarawas Economic Development Corps, Economic Development and Finance Alliance of Tuscarawas and Tuscarawas County Community Improvement Corporation. The purpose of this meeting was discussing the Feasibility study draft alternatives for the IR 77, US 250, and SR 39 interchange in Tuscarawas County with the broader group of stakeholders and elicit their thoughts, opinions, challenges and concerns they with the Draft alternatives.

  In attendance were the following individuals:
  - Chad Merkel – Prettl Company
  - Bruce James – CEO Union Hospital
  - Jason Ricker – Kimble Companies
  - Steve Stokey – Executive VP Allied Machine and Engineering Corp
  - Alan Bambeck- Bambeck & Associates
  - Dave Hanhart – Hanhart Law
  - Marc Nolan – Dover Chemical
  - Jason Johnson – Tuscarawas Business Owner
  - Ted Gentsch - CIO Lauren International
  - Wendy Zucal – Dennison Railroad Museum
  - Ron McAbier – City of New Philadelphia
  - Joel Day – City of New Philadelphia
  - Perci Garner – Society for Children & Adults, Inc
  - Bill Beisel – Kent State University Tuscarawas
  - Bob Alsept – Buckeye Career Center
  - Brad Hillyer – Retired
  - Robin Waltz – United Way, New Philadelphia
  - Jeff Mathias – Howard Hanna Real Estate

- Rhonda Hoffmeyer – Tuscarawas County
- Brooke Yates – Tuscarawas County
- Ashley Rogers – Local Business Owner
- Ed Lee – Kimble Companies
- Tom Simmelink – New Philadelphia City Council
- Scott Reynolds – Tuscarawas County
- Dee Grossman - Tuscarawas County Visitor Center
- Fred Vogel – ODOT Economic Development
- Joshua Mathias – City of New Philadelphia
- John Kelly – Tusc TID
- Marla Akridge – Tusc TID
- JC Shively – Tusc TID

Right-of-Way Impacts

System Interchange - Potential Right-of-Way Impacts with the systems interchange alternatives varies greatly. The flyover ramp would require some amount of right-of-way along US 250 between US 250 and the river. It will also require right-of-way along IR 77 between IR 77 and Stonecreek Road, this would be strip takes on the back of 3 different parcels behind piedmont Gas and County Veterans Services buildings. These impacts could be minimized with retaining walls, but that is a tradeoff with increased costs. This could be optimized if this alternative was to move forward. The Texas U-turn alternative does not require additional right of way as proposed. The loop ramp would require right of way by pushing out the existing Stonecreek Rd and Southbound off-ramp intersections further to the west. This would require a significant portion of the Truck Stop property. The final ramp being considered in the northbound to eastbound ramp and it would require significant right-of-way and significant earthwork/retaining walls to construct.

SR 39 interchange intersections – The first alternative moves the SB off ramp to the north and would require a parcel owned by Stocker Sand & Gravel and appears to be vacant, a piece of the used car lot and go through the center of the park-n-ride lot. The second alternative is the dual roundabouts and would require some minor right-of-way west of SR 39 and a portion of the park-n-ride lot. The Peanut roundabout would require a large portion of the park-n-ride lot. The northbound off ramp roundabout may require a small amount of right-of-way in the southeast quadrant.

SR 39 near Bluebell Dr – The impacts of the backage roads would be off the backside of 3 different parcels on the southside and 3 additional property owners on the north side. The median and bike/pedestrian accommodations would require strip takes off all parcels between Bluebell and the river.

SR 39 & Bluebell Intersection – The two alternatives specific to this interchange both have right-of-way impacts. The additional turn lanes and the west and southside of the intersection would require strip takes off the parcels. However, the roundabout will require a larger amount of right-of-way and could potentially take structures off one or more quadrants of the intersection. Further engineering will be required to optimize these right-of-way takes and identify the best location for the roundabout.

Utility Impacts

Utilities within the study area include various overhead electric transmission and distribution lines that traverse east and west over IR-77 through the interchange along SR 39. There are additional overhead AEP electrical lines supplying various businesses surrounding the Bluebell Dr area and down Stonecreek Rd. The intersection of Stonecreek Rd and SR 39 has overhead lines on three sides of the interchange. Along SR 39, the electrical lines are predominantly on the south side of the roadway but travel overhead to make various connections to the businesses. Dominion Energy also has underground gas lines that follow SR 39 and Stonecreek Rd through the entire project area.

The system interchange alternatives will mostly have impacts within the SR 39 interchange area. These impacts are likely to occur with most alternatives; however, the loop ramp would push the Stonecreek Rd intersection further to the west and increase the impacts over the other alternatives.

The reconstruction of the intersections along SR 39 at Stonecreek Rd and the IR 77 SB off-ramp will require relocations of various overhead electrical lines. With the double roundabout, the existing SR 39 intersections will need to be pushed further to the west, resulting in some increased impacts to the overhead utilities compared to the other alternatives.

In the SR 39 and Bluebell Dr intersection area, the electrical lines are predominantly on the south side of the roadway. All alternatives will require some relocation work, but these impacts do not significantly differentiate the alternatives.

CHAPTER 5: COMPARISON OF ALTERNAIVES

For this project we have broken the analysis into 3 distinct areas for comparison:

- IR 77 & US 250 System Interchange
- IR 77 & SR 39 Serviced Interchange
- East of the River (including Bluebell Drive)

Each alternative, including the No-Build, was compared to each other based on the following categories:

- Safety Performance
- Traffic Operations
- Environmental Impacts
- Stakeholder Input
- Right-of-Way Impacts

Safety Performance– This category evaluates the improvement to the safety performance for each alternative.

IR 77 & US 250 System interchange Alternatives all have a similar safety benefit of removing traffic from a congested segment of SR 39. They all introduced an additional merge on IR 77 for potential conflicts, but this is the safest way to make this movement. The Texas-U and Loop ramp slow the ramp traffic slow down the ramp traffic more than the flyover and may have some crashes associated with the tightness of the ramps. The Loop ramp also introduces a left hand off ramp which can violate driver expectancy and may increase crashes.

I-77 & SR 39 System Interchange The roundabout alternatives would both improve safety. However, the roundabouts would have a challenge of introducing complex roundabout an area inexperienced with roundabouts. The relocated SB ramp option introduces an additional intersection and movements while improving intersection spacing. This makes the relocated ramp alternative somewhat safety neutral.

East of the River (including Bluebell Drive) The roundabout coupled with the median treatment have the greatest potential safety benefits. The various other elements such as the backage roads will make the median more viable from an access standpoint.

Traffic Operation Performance – This category evaluates the improvements to the overall traffic flow and performance for each alternative.

IR 77 & US 250 System interchange All alternatives will have a positive impact on the IR 77 to US 250 movements and improve SR 39 by removing the traffic using the IR 77 and SR 39 interchange simply to gain access with US 250. The difference is the higher speed ramps will allow the movements to be made more quickly.

I-77 & SR 39 System Interchange The closely spaced intersections along SR 39 at Stonecreek and the IR 77 SB ramps is well over capacity. Of the alternatives presented, *Alternative 1* and *Alternative 2* are the best options from a traffic operations standpoint. Given the variation in analysis results for the peanut-shaped roundabout and the potential need to use an indirect left turn movement, this alternative would not be an operational improvement over *Alternative 1* and *Alternative 2*.

At the IR 77 NB intersection, the No-Build condition is close to meeting all the operational goals. The roundabout improves the operation at the intersection and meets all the operational goals. If a median is constructed on SR 39 east of the interchange, the roundabout would improve connectivity by allowing for U-turns.

East of the River (including Bluebell Drive) For the Bluebell Drive intersection, the No-Build, *Alternative 4* and *Alternative 5* all provide similar operational results. However, the roundabout in *Alternative 5* has a little less delay and provides more flexibility for access management along the corridor.

Stakeholder Input – This Category evaluates these impacts to right-of-way for the various alternatives.

IR 77 & US 250 System interchange – Only one alternative appeared to have local challenges in this area. The Loop Ramp was seen as less desirable by the stakeholders. The right-of-way impacts west of the interchange were a concern to them as well. The loop ramp would slow traffic down more than the other alternatives. Also, the increased costs on moving the overhead US 250 EB structure and moving the roadways to the west to accommodate this ramp were seen as negatives.

I-77 & SR 39 System Interchange – Some stakeholders were concerned about the double roundabout alternative. This is due to this being the first location of implementing a roundabout in the county and its first being a complex type of roundabout was a concern. Additionally, the additional length vehicles would have to travel with the relocated SB off ramp and on SR 39 was concerning.

East of the River (including Bluebell Drive) – Increasing capacity to allow for future development was expressed in our discussions. The roundabout at the SR 39 and Bluebell Drive intersection improves the overall the capacity of the corridor without needing to add additional through lanes, which was viewed positively by the stakeholders..

Right-of-way Impacts – This Category evaluates these impacts to right-of-way for the various alternatives.

IR 77 & US 250 System interchange – The main differentiator on the alternatives is the loop ramp impacts right-of- way west of SR 39 and the Flyover and Northbound to Eastbound ramp have strip takes. However, these right-of-way impacts do not rise to the level of concern where they are a significant differentiator for these alternatives.

I-77 & SR 39 System Interchange – All the alternatives have impacts to the park-n-ride lot and some minor impacts to adjacent parcels. The one difference is the relocated southbound off ramp would also require land north of the current businesses and structures.

East of the River (including Bluebell Drive) – The largest impact would be the placement of a roundabout at the SR 39 and Bluebell Drive intersection. The construction of a roundabout would have impacts on 2 of the 4 quadrants of the intersection. These takes would possibly include structures and business relocations as currently developed for this study. The optimized location of the roundabout and the extent of the right-of-way required would need to be established in the next phase of project development. The additional lanes would also result in strip takes in front of Denny's and El San Jose restaurant on the south side of SR 39. The bicycle and pedestrian accommodations would require strip takes from the properties in the area.

Utilities impacts This Category evaluates these impacts to utilities for the various alternatives.

Although there are various utilities throughout the corridor, we do not see utility impacts as a significant differentiator between alternatives. All alternatives will have some level of Electrical and communication lines needing to be relocated.

Estimated Construction costs

IR 77 US 250 System Interchange	**Cost**
Flyover ramp	$32.9 million
Texas U	$26.8 million
Loop Ramp	$65.8 million
IR 77 NB to US 250 EB	$25.4 million
IR 77 & SR 39 Service Interchange	**Cost**
Relocated SB off ramp	$6.8 million
Peanut Roundabout	$5.5 million
Double Roundabout	$18.9 million
IR 77 NB off-ramp Roundabout	$3.8 million
SR 39 East of River to Bluebell	**Cost**
Bluebell Dr Roundabout	$3.7 million
Bluebell Turn lanes and reconstruction	$3.8 million
Median	$2.0 million
Backage roads	$2.7 million
Bike/Pedestrian Facilities*	**Cost**
Bike lanes and side walks	$9 million
Multiuse path on Northside and Sidewalk on south	$2.8 million

**Estimates do not include utility relocations or right-of-way costs*

Table 18 – Construction Cost Matrix

Cost Comparisons This Category evaluates these impacts to utilities for the various alternatives.

The most cost-effective solution considered for the System interchange is the Texas U turn paired with IR 77NB to US 250 EB. The Texas U turn alternative include reconstruction of the IR 77 NB and SB mainline bridges over SR 39. They IR 77 NB to US 250 EB bridge includes significant earthwork and retaining walls.

The Peanut and Relocated SB ramp have the most cost-effective solutions for improving the existing service interchange.

In the area of SR 39 and Bluebell, the roundabout would have the greatest cost effectiveness as it is similar cost to the turn lane improvements but adds additional capacity for additional future growth.

Cost for bicycle and pedestrian accommodations would be more cost effective with the Multiuse path on the north side and sidewalk on the south side of SR 39. The dual sidewalks and dual bike lanes would require widening the structure over the Tuscarawas River.

CHAPTER 6: CONCLUSION AND NEXT STEPS

The IR 77/US 250/SR 39 interchange is a complex configuration that provides a full IR 77 and SR 39 interchange and a partial IR 77 and US 250 interchange in the same footprint. This shared footprint forces the freeway-to-freeway (system) ramp traffic between IR 77 and US 250 to mix with the local (service) ramp traffic between IR 77 and SR 39. Additionally, the proximity of Stonecreek Road to the west of the interchange creates additional congestion and pressure on the interchange. Finally, the section of SR 39 east of the river shows safety and congestion concerns with numerous access points approaching Bluebell Drive, a major intersection for local retail and hotel access. With the new economic development opportunities identified in the Bluebell Drive intersection area and west of the interchange on SR 39, it is anticipated that if nothing is done in this corridor, the safety and congestion concerns will continue to grow.

Conceptual "Build" alternatives were studied at three different locations, focusing on improving safety and congestion, while reducing circuitous travel. Three alternatives were considered for the westbound US 250 to southbound IR 77 movement and one alternative was considered for the northbound IR 77 to eastbound US 250 movement to complete the IR 77 & US 250 system interchange. Three alternatives were considered for the SR 39/IR 77 southbound ramp terminal intersection, and one alternative was examined for the SR 39/IR 77 northbound ramp terminal intersection. Four alternatives were considered at the SR 39/Bluebell Drive intersection. All alternatives were then compared to the No-Build alternative at each location based on the following criteria:

- Safety Performance
- Traffic Operations
- Environmental Impacts
- Right of Way Impacts
- Stakeholder Input
- Estimated Construction Cost

For this report, these three different locations are categorized as the following:

- IR 77 & US 250 System Interchange
- IR 77 & SR 39 Service Interchange
- East of the River (Including Bluebell Drive)

IR 77 & US 250 System Interchange

These improvements were developed to replace the two missing direct movements (IR 77 NB to US 250 EB and the US 250 WB to IR 77 SB) at the existing IR 77 and US 250 interchange. Currently, these movements are made through a circuitous route that involves traveling through the existing IR 77 and SR 39 interchange through a series of left turns at the ramp terminal intersections. Four proposed Build alternatives were developed for these missing direct movements. Three of the Build alternatives are to accommodate the US 250 WB to IR 77 SB direct movement and one of the Build alternatives is to accommodate the IR 77 NB to US 250 EB movement.

Based on the comparison of the alternatives, shown in the evaluation matrix provided in ***Appendix I***, *Alternative 2* (Texas U) scores very well in all the categories and provides the best benefit/cost ratio of the proposed WB to SB ramp alternatives and reduced environmental impacts along the river. *Alternative 1* scores the best in safety performance and traffic operations but is likely cost prohibitive to implement when compared to *Alternative 2* that provides the same functionality. *Alternative 4* (NB to EB) is the only proposed alternative evaluated for the reciprocating movement that completes the IR 77 and US 250 system interchange. Based on this, ***Alternative 2*** *(Texas U)* **and** ***Alternative 4*** *(NB to EB)* **are determined to be the Recommended Alternative to carry forward into the next phase of project development once funding is identified for the completion of the IR 77 and US 250 system interchange based on the analysis completed as part of this study**.

IR 77 & SR 39 Service Interchange

These alternatives were developed to alleviate the congestion and safety concerns at the IR 77 and SR 39 interchange. Specifically, these alternatives evaluated improvement alternatives at the IR 77 NB ramp terminal intersection (east of IR 77), the IR 77 SB ramp terminal intersection (west of IR 77), and the SR 39 and Stonecreek Road intersection, located immediately west of the IR 77 SB ramp terminal intersection. Three of the Build alternatives focused on addressing the close intersection spacing on the west side of IR 77 and one of the Build alternatives focused on the IR 77 NB ramp terminal intersection east of IR 77.

Based on the comparison of the alternatives, shown in the evaluation matrix provided in ***Appendix I***, *Alternative 1* (Relocated SB off ramp) scores very well in all of the categories.

Alternative 2 and *Alternative 3*, both construct complex roundabouts. Since this would be the first location for a roundabout in Tuscarawas County there is some hesitation to start with these complexities.

One of the key issues in the service interchange is the number of left turning vehicles coming from the IR 77 SB to SR 39 EB, the SR 39 SB to SR 39 EB, and the SR 39 WB to IR 77 SB. This causes congestion during the peak period in the western portion of the peanut-shaped roundabout. *Alternative 1* and *Alternative 2* split those three left turn movements into two separate intersections as opposed to combining them into a single intersection as created in *Alternative 3*.

Based on the benefits and costs, ***Alternative 1*** **(relocated SB off-ramp*)* and the No-Build at the northern ramp terminal intersection are determined to be the Recommended Alternative to carry forward into**

the next phase of project development once funding is identified for the IR 77 & SR 39 Service Interchange based on the analysis completed as part of this study.

East of the River (Including Bluebell Drive)

These alternatives were developed to improve the safety, congestion, and overall vehicular throughput along SR 39 east of the interchange and Tuscarawas River. In this section of SR 39 between the river and Bluebell Drive, several driveways exist, and traffic congestion is prevalent, creating safety concerns. Five Build alternatives were developed in this section of the corridor to address the safety, congestion, and access concerns.

Many of the proposed alternatives build off each other and continue to add value to the area as the alternatives increase in number. Based on the comparison of the alternatives, shown in the evaluation matrix provided in ***Appendix I***, *Alternative 3* (Median) scores very well in all categories but there was concern about how the businesses along the SR 39 corridor would react with left turn movements being eliminated. Adding *Alternative 1* (Backage Roads) provides the ability for indirect left turns to be made throughout this segment of the corridor. A left-in is recommended to accommodate the EB to NB turn into Sheetz at the northern backage road intersection with SR 39, making this a right-in/right-out/left-in and still not allowing a left out at this location. The other intersections and drives between the river bridge and Bluebeam would be right-in/right-out with the inclusion of the median. *Alternative 5* (Roundabout) scores equal to or better than *Alternative 4* to improve the SR 39 and Bluebell Drive intersection in every category and pairs well with *Alternative 3* as it allows for a U-turn maneuver to be made for traffic from the southern properties and eastbound traffic to make an indirect left turn using the roundabout as well as the backage roads. Based on this, ***Alternative 1*** *(Backage Roads, with variation of adding a left-in at the SR 39 and northern backage road intersection),* ***Alternative 3*** *(Median),* **and** ***Alternative 5*** *(Roundabout)* **are determined to be the Recommended Alternative to carry forward into the next phase of project development once funding is identified for segment of the corridor east of the river based on the analysis completed as part of this study.** All the Recommended Alternatives identified in this study are shown on one large plan view exhibit in ***Appendix K***.

Phasing/Implementation Plan

This report identified improvements at three separate areas within the project area. These three areas were used to propose a phasing strategy as they can be treated as mutually exclusive areas within the corridor. Based on the proposed revisions recommended, here is a **proposed Implementation Strategy** for all the improvements from this study:

- **Phase 1**
  - *Phase 1A* – Construct the backage roads and median east of the river.
  - *Phase 1B* – Construct roundabout at SR 39 and Bluebell Drive intersection (combine with Phase 1A if funding is available)
  - *Justification* – This phase offers a lot of "bang for the buck" because it addresses a lot of the safety concerns identified in the corridor and cleans up the excessive access points along SR 39 east of the river. This area is independent of the interchange and offers a lower cost solution that likely could be delivered with multiple funding partners, including potentially the ODOT Office of Safety. This also allows the locals to develop a good bicycle and pedestrian network in advance of greater development occurring west of the interchange.
- **Phase 2**
  - Construct the relocated SB off-ramp from IR 77 to SR 39 and Stonecreek intersections
  - *Justification* – This phase provides an improvement to a portion of the corridor that interacts with IR 77 and has congestion concerns that backs up along the IR 77 SB exit ramp. This can lead to a significant safety concern if more development occurs in the area and traffic volumes increase. These improvements will likely be higher costs and likely will require funding partners and navigation through ODOT's Project Development Process, including completion and approval of an Interchange Modification Study. With the lead time needed to determine funding partners and obtain the funding, this project planning can start soon but would need some time before design could begin.
- **Phase 3**
  - Construct the Texas U-Turn (US 250 WB to IR 77 SB) and the IR 77 NB to US 250 EB system ramps to complete the IR 77 and US 250 interchange.
  - *Justification:* This project would likely need to show greater traffic volumes, likely from future development, to be cost effective. With the potential partnership with ODOT, the timing of this contract may have to sync up with ODOT's funding strategy for replacement of the two IR 77 bridges over SR 39. Finally, this project would likely need to obtain funding from the Transportation Review Advisory Committee (TRAC) which requires lead time for applying for and obtaining funding of the amount necessary for this project.

NEXT STEPS

Depending on which alternative described in this study is carried forward into the next phase of project development, further investigation and information gathering may be necessary to confirm impacts and meet the needs established by the design process. Here are our recommendations for next steps:

- Review and confirm the proposed phasing plan for the improvements and develop an implementation strategy.
    - *Timing:* Now
- Identify potential funding partners (ODOT District 11) and obtain funding for the improvements. Potential sources include ODOT Safety Program, TRAC, ODOT Jobs and Commerce fund, ODOT Small Cities, ODOT Transportation Alternatives Program (TAP), ODOT District 11, Federal Grant opportunities (Safe Streets for All, RAISE, etc.), OMEGA and Local Funding opportunities.
    - *Timing:* Now
- Develop Certified Traffic to confirm the volume usage on the backage roads (Phase 1) and the missing system ramps (Phase 3).
    - *Timing:* Now
- *Analyze intersections of southbound on and off*-ramps alternatives to determine if roundabouts are a viable solution.
    - *Timing:* Now
- Develop detailed horizontal and vertical geometry of the Recommended Alternative and evaluated/optimize the right-of-way impacts.
    - *Timing:* Prior to each phase
- Advance the Recommended Alternative into the ODOT Project Development Process (PDP).
    - *Timing:* Prior to each phase
- Determine the appropriate treatment of the proposed bicycle and pedestrian facilities (multiuse path vs bicycle lanes and sidewalk on the north side of SR 39.
    - *Timing:* Prior to Phase 1
- Evaluate the SR 39 bridge over the Tuscarawas River to determine how to accommodate the extra width required for the bicycle and pedestrian facilities.
    - *Timing:* Prior to Phase 1
- Complete a roundabout geometric evaluation to determine the best location for the proposed roundabout at the intersection of SR 39 and Bluebell Drive in Phase 1.
    - *Timing:* Prior to Phase 1
- Obtain detailed survey mapping of the existing IR 77 SB to US 250 EB bridge over IR 77 to confirm the lateral clearance under the bridge and through the end span for the Texas U-Turn alternative (Phase 3).
    - *Timing:* Prior to Phase 3
- Coordinate with ODOT District 11 to determine whether ODOT funds could be leveraged in Phase 3 to replace the IR 77 bridges over SR 39.
    - *Timing:* Prior to Phase 3
- Evaluate the need to extend the bridge carrying the proposed US 250 WB to IR 77 SB east to minimize impacts to the river if the flyover alternative is advanced in Phase 3.
    - *Timing:* Prior to Phase 3
- Study the various options to combine ramps and merge into IR 77 SB if the Texas U-Turn is advanced in Phase 3.
    - *Timing:* Prior to Phase 3
- Evaluate and compare use of different design speeds for the IR 77 NB to US 250 EB ramp in Phase 3.
    - *Timing:* Prior to Phase 3