

Central (NE) Interchange Feasibility Study

SUM-76 Akron Central Interchange

PID: 101402

Initiated under: SUM – 76 – 10.95 (Akron Beltway)

PID: 95831



Prepared For:

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District 4
2088 South Arlington Road
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May 3, 2016

REVISED November 23, 2016

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1.0 Introduction/Purpose

In 2014, the Ohio Department of Transportation (ODOT) District 4 began a comprehensive study of the I-76, I-77, I-277 and SR-8 corridors, collectively known as the Akron Beltway located in Akron, Ohio. While previous studies have been completed focusing on other portions of the study area, the approach of the SUM-76-10.95 Akron Beltway Planning Study (PID 95831) provided a holistic representation of traffic conditions in the overall Akron area.

The Central Interchange project (PID 101402) is the first identified project from the Akron Beltway Planning Study and has been advanced prior to the finalization of that study due to the condition of the bridges on the existing left handed exits. These improvements do not preclude potential future improvements with the Central Interchange.

The purpose of this feasibility study to discuss the alternates evaluation completed within the Akron Beltway Planning Study (PID 95831) at the Northeast (Central) Interchange and the recommended preferred alternate for the SUM-76 Central Interchange project (PID 101402).

2.0 Study Area

The Akron Beltway Planning Study area consists of the mainline, interchanges and ramps, and ramp terminal intersections for the freeway facilities on the four sides of the beltway. The study area forms a square south of the Akron city center and includes the following four main system interchanges:

- NE Interchange (I-77, I-76, SR-8)
- NW Interchange (I-77, I-76)
- SW Interchange (I-76, I-277, US-224)
- SE Interchange (I-77, I-277, US-224)

The study area also extends to at least one (1) interchange outside of the Akron Beltway, including portions of US 224, SR 8, SR 59, I-77, and I-76. The Akron Beltway Planning Study area is shown in **Figure 1**.

The Central (NE) Interchange study area is a subarea of the Akron Beltway Study Area and extends along I-76, I-77 and SR-8 to one (1) interchange outside of the Central Interchange as shown on **Figure 1a**.

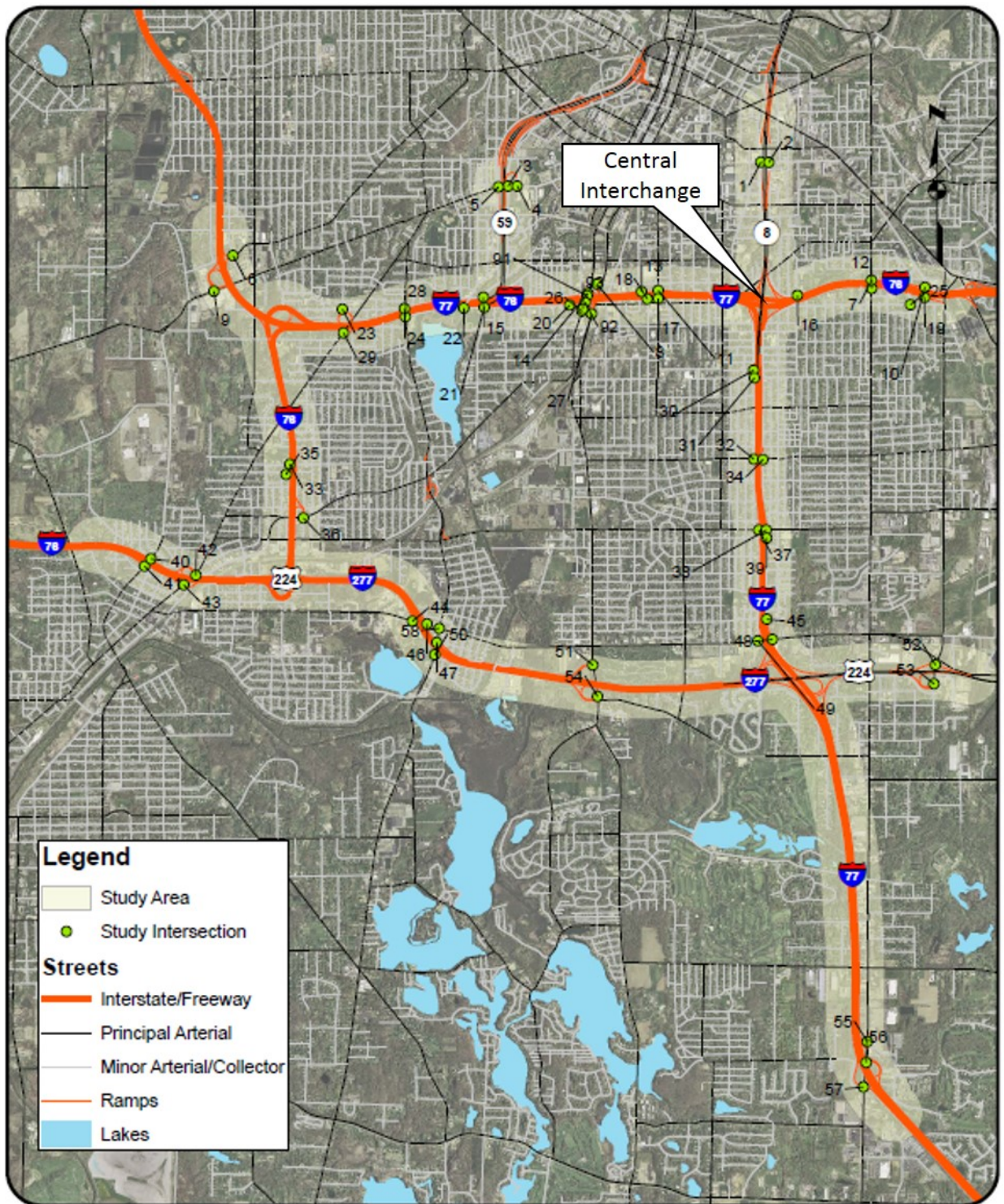


FIGURE 1
Study Area Facilities and Intersections
SUM-76 Akron Beltway Project



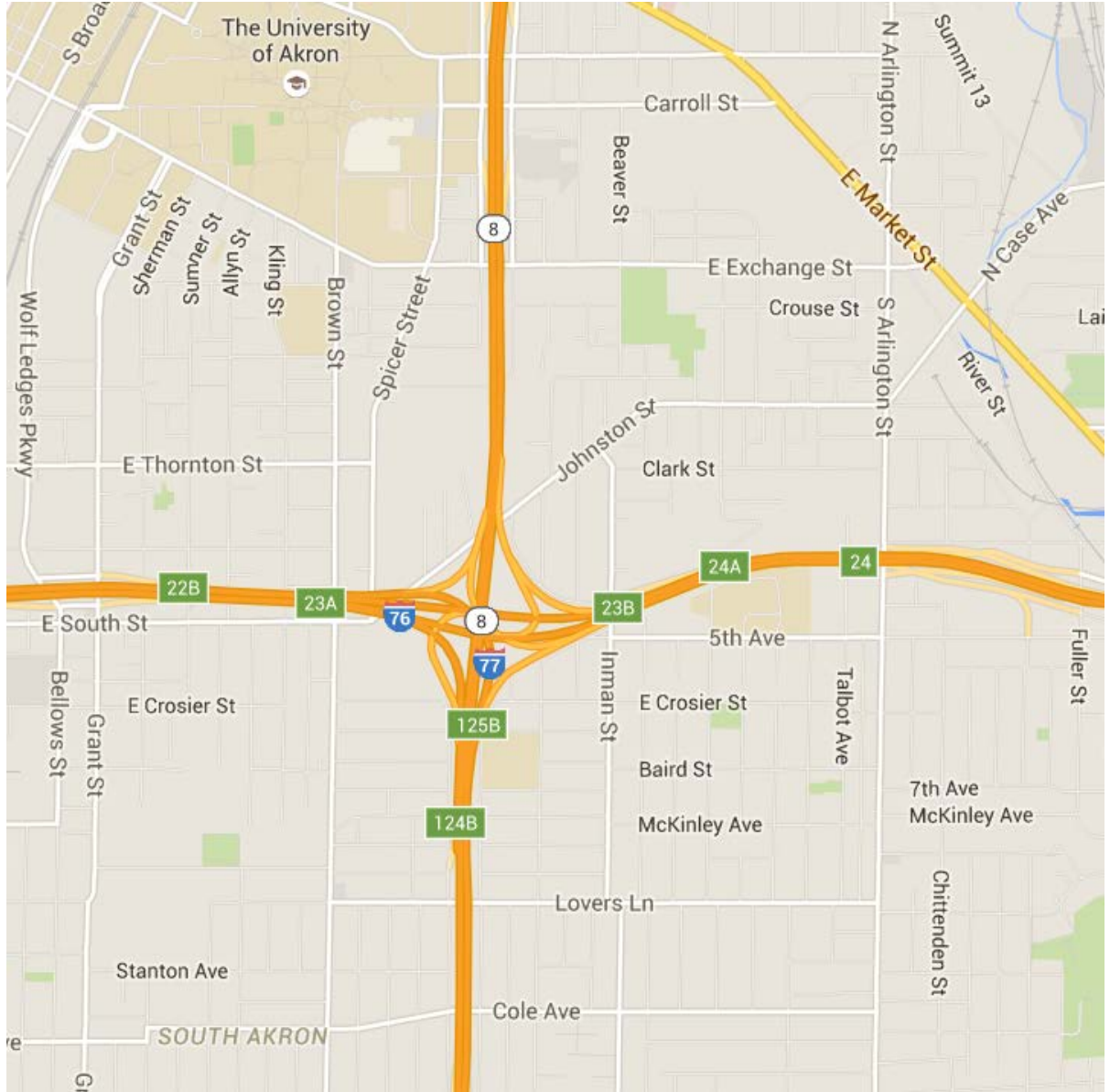


Figure 1a – Central Interchange Study Area

3.0 Existing Conditions

The Akron Beltway Planning Study evaluated safety, traffic congestion/operations, geometrics, and infrastructure condition and determined the following at the Northeast (Central) Interchange:

3.1 Geometrics

A comprehensive geometric review, completed in December 2014, of the entire Akron Beltway identified numerous geometric items that are sub-standard versus current design criteria on the existing ramps at the Northeast (Central) Interchange. Please see the *Summary of Sub-Standard Conditions & Asset Inventory* report dated July 2015 (**Appendix 4**) and the *Development of Proposed Geometric Design Criteria Tables* dated March 2015 (**Appendix 5**) for detailed information regarding the existing geometric conditions and the ODOT design criteria used in the evaluation.

The sub-standard items include, but are not limited to, horizontal ramp curvatures as low as 26 MPH, vertical profiles as low as 25 MPH, sub-standard exit curvatures, sub-standard deceleration lengths, vertical bridge clearances, and lateral bridge clearances. It is the intent of this project to improve the primary criteria components listed above on the two (2) left handed exit ramps and on WB I-76 which is proposed to be re-profiled and reconstructed as described in later sections of this study. It is the intent of this project that the other roadways/ramps within the Central Interchange will remain in their existing configuration.

In **Figure 2** below, the resultant effective speeds on the left handed exits are represented in 'blue' for horizontal and 'purple' for the vertical components which highlight the worst of the most sub-standard geometries in this interchange.

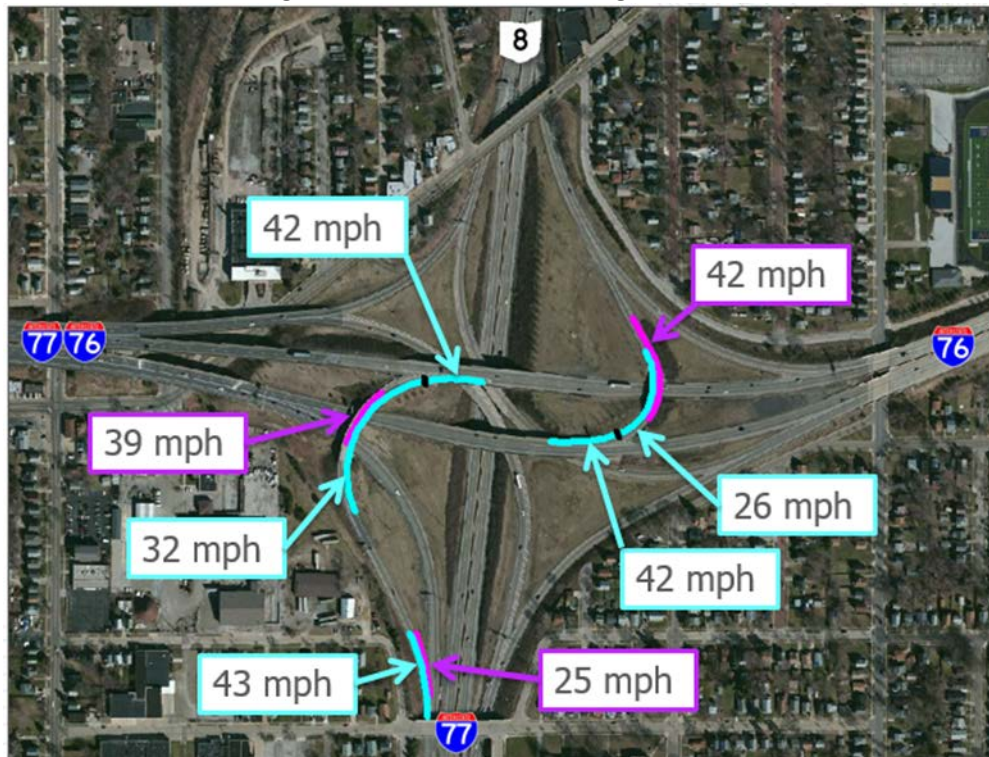


Figure 2 – Effective Left-Hand Ramp Speeds

Within the overall Central Interchange study area, various sub-standard items are present as shown below in **Figures 3 and 3a** pulled from the *Summary of Sub-Standard Conditions & Asset Inventory* report in **Appendix 4**.

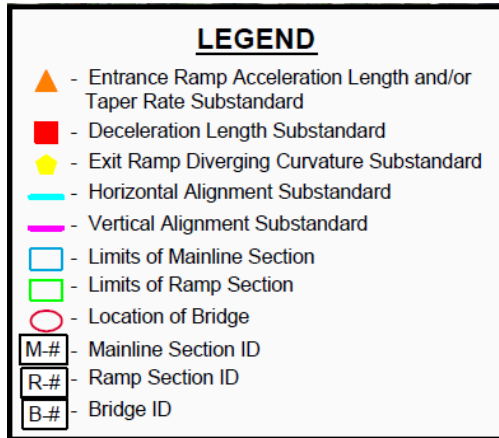


Figure 3 – Sub-Standard Evaluation Legend

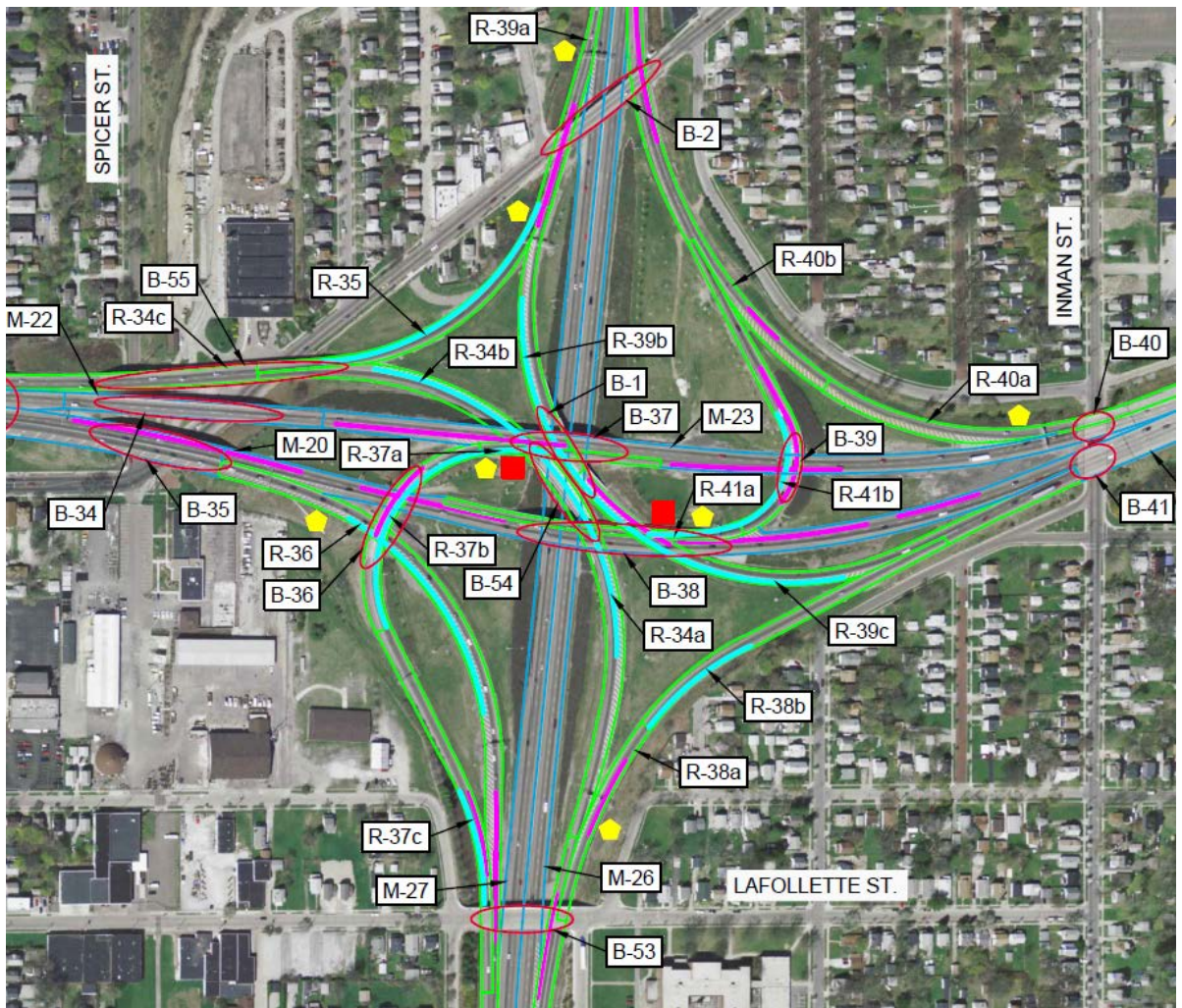


Figure 3a – Central Interchange Sub-Standard Evaluation Reference Map

3.2 Infrastructure Condition

A comprehensive review of available infrastructure inspection reports and condition data was completed in December 2014 as part of the geometric review discussed above for the entire Akron Beltway. This review identified the two (2) left-handed ramp bridges within the Northeast (Central) Interchange as functionally obsolete. District 4 bridge staff also indicated these two (2) bridges have been repeatedly repaired and due to the bridges being slab type structures the rehabilitation methods have been exhausted. As such further repairs are not prudent and total structure replacement is recommended for both left handed ramp bridges. Please see Bridges #36 and #39 in the *Summary of Sub-Standard Conditions & Asset Inventory* report dated July 2015 (**Appendix 4**) for additional information.

Underground utilities were not investigated as part of this study. Record underground drainage maps are included in **Appendix 10** for reference.

3.3 Traffic Operations

The traffic operations of the existing Northeast (Central) Interchange were analyzed using Highway Capacity Software (HCS) and Vissim based on the 2015 existing traffic volumes as well as the 2040 No-Build traffic volumes. It was determined that I-77 and I-76 through the Northeast (Central) Interchange experience congestion and poor levels of service in the AM and PM peak periods. Specifically on I-76, the highest congestion in and around the Northeast (Central) Interchange occurs at the left handed ramp exits to SB I-77 and NB SR-8 respectively. See the *SUM-76-11.48 (PID 101402) Central Interchange - Highway Capacity Software Analysis* report (**Appendix 3**) for additional information.

The HCS analysis identified westbound I-76 in the AM peak and eastbound I-76 in the PM operated at a Level of Service “F” both in the existing 2015 and future No-Build 2040 traffic conditions. See **Figures 4 thru 6** pulled from the HCS report below for the No-Build Year 2040 results.

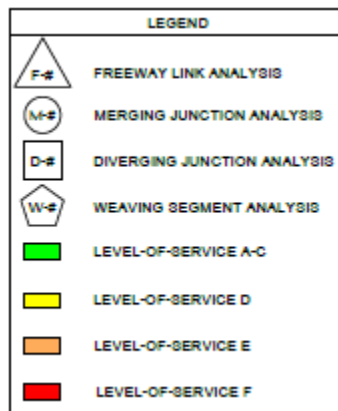


Figure 4 – HCS legend

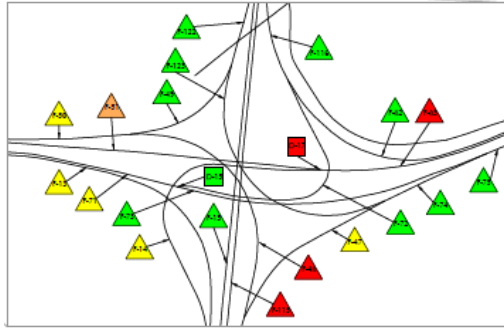


Figure 5 – No-Build Year 2040 AM Peak

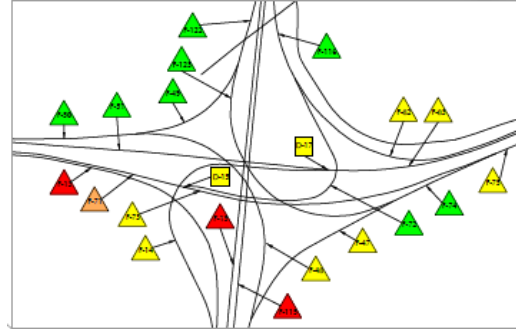


Figure 6 – No-Build Year 2040 PM Peak

Additionally, the Akron Beltway Planning Study performed preliminary Vissim analysis which validated the Northeast Interchange (Central Interchange) HCS results as shown in the Vissim congestion profiles below which represent the average speed across all lanes of a freeway segment. The congestion profiles are directionally and time-of-day based and represent the speed along a specific movement as it travels through the Akron Beltway. The speeds are displayed in colored graphics as shown in **Figure 7** below which was pulled from Vissim memos.

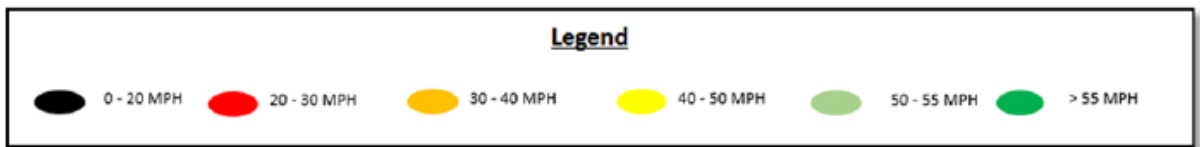


Figure 7 – Congestion Speed Profile Legend

See **Figures 8 thru 11** pulled from the Vissim memo for the congestion profiles of the No-Build year 2040 volumes at the Central Interchange for I-76 and I-77 in the AM and PM peak periods.

I-77 NORTHBOUND CONGESTION PROFILE - 2040 NO BUILD
AM PEAK PERIOD (7:00 AM - 9:30 AM)

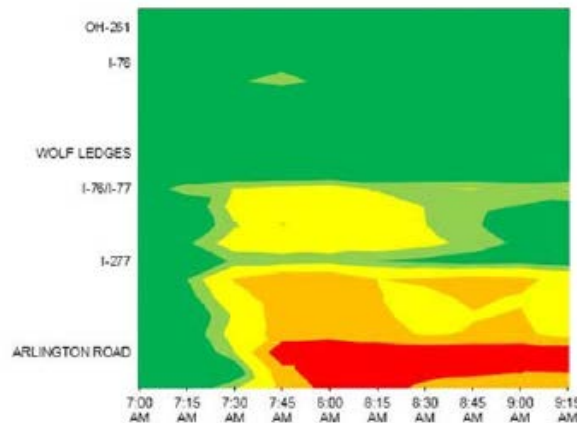


Figure 8 – No-Build Year 2040 AM Peak (Northbound I-77)

I-76 WESTBOUND CONGESTION PROFILE - 2040 NO BUILD
AM PEAK PERIOD (7:00 AM - 9:30 AM)

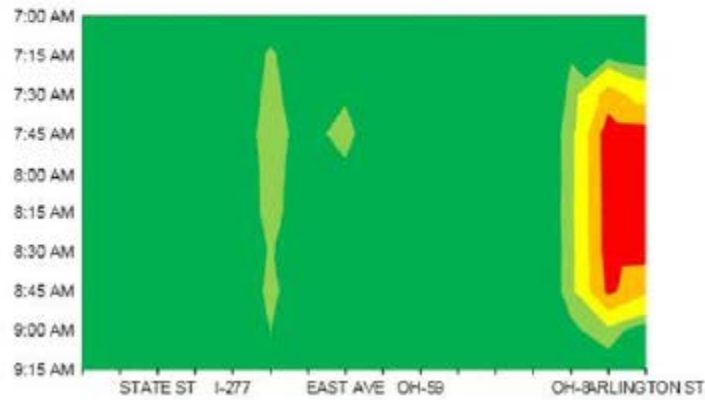


Figure 9 – No-Build Year 2040 AM Peak (Westbound I-76)

I-77 SOUTHBOUND CONGESTION PROFILE - 2040 NO BUILD
PM PEAK PERIOD (3:45 PM - 6:15 PM)

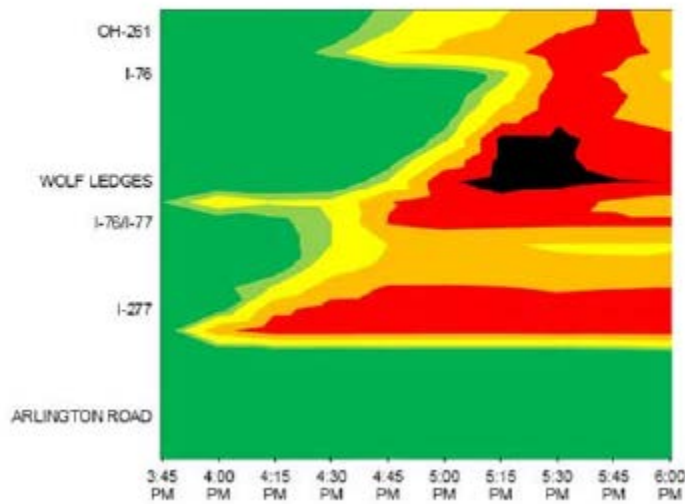


Figure 10 – No-Build Year 2040 PM Peak (Southbound I-77)

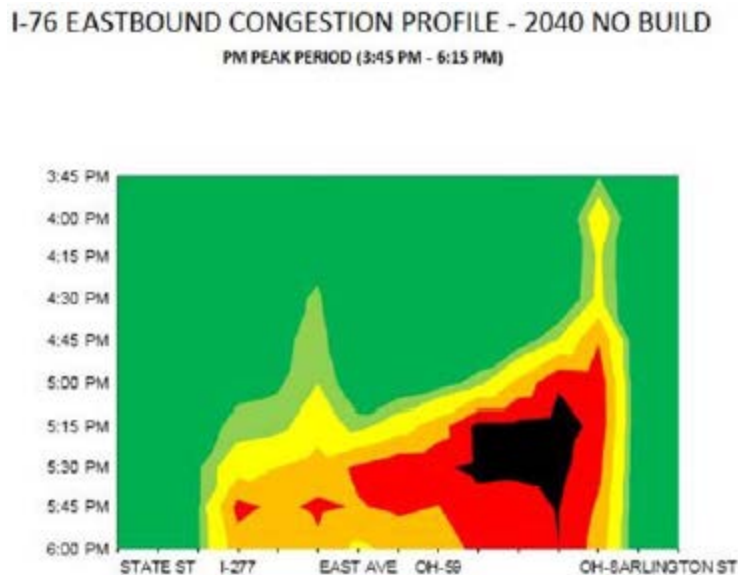


Figure 11 – No-Build Year 2040 PM Peak (Eastbound I-76)

3.4 Safety

A comprehensive safety review, completed in 2015, of the entire Akron Beltway identified the Northeast Interchange (Central Interchange) as the “worst” safety performing area on the entire Beltway system. Furthermore, multiple sections of I-76, near the Northeast Interchange (Central Interchange), have been listed on ODOT’s Safety Priority List since 2009. The Akron Metropolitan Areawide Transportation Study (AMATS) crash report, which is based upon 2014 data, states that the Northeast Interchange (Central Interchange) has six of the highest ranking freeway segments within the AMATS area.

Two (2) safety summary memorandums were prepared as part of the Akron Beltway Planning Study for the Northeast (Central) Interchange. The first being the [SUM-76-11.48 \(PID 101402\) Northeast Interchange Safety Study Summary Memo](#) dated September 2015 (see **Appendix 1**) which analyzed the Northeast (Central) Interchange for highway safety funding. The second was the [SUM-76 Akron Beltway Project \(PID 95831\) – Northeast Interchange Safety Summary](#) dated January 2016 (see **Appendix 2**) which analyzed and compared the existing and future interchange safety operations. Please refer to these memorandums for additional information.

For the Northeast Interchange (Central Interchange), Interchange Safety Analysis Tool – Enhanced (ISATe) which is a predictive model based upon the AASHTO Highway Safety Manual for freeways and interchanges, calculated the year 2015 Predicted Crash frequency and the year 2015 Expected Crash frequencies for multiple freeway mainline and ramp segments. As shown below in **Figure 12** pulled from the Northeast Interchange Safety Summary noted above, the freeway segments associated with the existing left-hand exit ramps from Westbound I-76 to Southbound I-77 and Eastbound I-76 to Northbound SR 8 had the greatest difference between Expected Crash frequency and Predicted crash frequency, indicating those segments may have a safety benefit from the proposed improvements.



Figure 12 – Northeast (Central) Interchange Expected and Predicted Crashes

3.5 Structures

The following existing bridges within the Central Interchange are anticipated to be impacted by the project as shown in **Figure 3a** above and **Table 1** below. For more detailed information, see the *Summary of Sub-Standard Conditions & Asset Inventory* included in **Appendix 4**.

BRIDGE ID	BRIDGE NUMBER	S.F.N.	DESCRIPTION	TYPE	NO. OF SPANS	MAX. SPAN (FT.)	OVERALL LENGTH (FT.)	ALIGNMENT
B-36	SUM-00076-1148R	7705972	RAMP FROM WB I-76 TO SB I-77 OVER EB I-76 AND RAMP TO SB I-77	CONCRETE SLAB	5	52.23	240.2	CURVED
B-37	SUM-00076-1150L	7706006	WB I-76 OVER SR-8, RAMP FROM NB I-77 TO WB I-76/NB I-77, AND RAMP FROM SB SR-8 TO EB I-76	PLATE GIRDERS	4	104.4	354.42	CURVED
B-39	SUM-00076-1165L	7706065	RAMP FROM EB I-76 TO NB SR-8 OVER WB I-76	CONCRETE SLAB	3	49.53	138.86	CURVED
B-53	SUM-00077-1184	7702949	LAFOLLETTE AVE. OVER I-77, RAMPS FROM I-76 TO SB I-77, AND RAMPS FROM NB I-77 TO I-76	ROLLED BEAMS	4	59.85	218.57	TANGENT

Table 1 – Structure Data

As noted above, the Akron Beltway Planning Study determined that the Central Interchange contained slab type ramp bridges that have exhausted their rehabilitation potential on the geometrically sub-standard existing left-handed ramps. Additionally the study identified traffic safety and congestion associated with the left handed exit ramps within the Central Interchange on EB and WB I-76. As such, the Akron Beltway Planning Study identified that the proposed alternates should be evaluated in an effort to improve the condition, safety and congestion on I-76 and the existing left handed ramps to NB SR-8 and SB I-77.

4.0 Identification and Evaluation of Alternates

Through a series of design workshops including Federal Highway Administration (FHWA), ODOT Office of Roadway Engineering (ORE), ODOT District 4, Akron Metropolitan Area Transportation Study (AMATS), Summit County Engineer's Office, and the City of Akron, the Akron Beltway Planning Study initiated geometric, operations and safety analysis of potential changes to the Northeast (Central) Interchange to improve traffic operations, safety, and infrastructure conditions. See **Appendix 6** for workshop meeting agenda and minutes. See **Appendix 5** for the design criteria used.

4.1 Geometrics

The evaluation began with geometric concepts of the two (2) left handed exit ramps to determine the impacts associated with improving their design speed as well as potentially converting them to traditional right-handed exits. Two (2) primary alternate configurations were investigated. The first being options that retained the exits as left-handed but with improved geometrics, called Northeast Option A (aka NEA). The second being options that reconfigured the ramps to right-handed exits with fly-over ramps, called Northeast Option B (aka NEB). Through the design workshops these primary options were further refined as sub-options with the addition of a numeric character added to the option name. The final alternates prepared and contrasted were **NEA3** and **NEB3**, respectively. Below is a brief summary of the refinement process deriving NEA3 and NEB3. See **Appendix 7** for detailed information regarding the NEA and NEB options.

NOTE: All of the options discussed below assumed the closure of partial interchanges (individual exit ramps) at Inman Street on the northeast quadrant of the interchange and Lovers Lane on the southwest quadrant. The closure of Inman Street allowed the existing pedestrian bridge at Akron Hoban High School to remain intact and reduced the project R/W impact along the football stadium. Stakeholder involvement has been critical throughout the project development to date but no public meeting has been held. A public meeting was not advanced in the process to be performed during the feasibility development of alternatives since there was active participation from the stakeholders. These closures were also presented with a previous project intended to rebuild and reconfigure the entire Central (NE) Interchange but that improvement was never completed due to cost (PID 77270 / SUM-76-11.20). The closures were presented to the public in 2005 and 2006. A public meeting will be held to discuss the alternatives and the public's input will be addressed as any improvements are further developed.

4.1.1 Northeast Option A (NEA) – retain left hand exits

The initial geometric alternates (NEA1 and NEA2) both included the left-hand exits remaining as deceleration lanes similar to the existing conditions but with improved geometry. The initial NEA1 and NEA2 alternates provided 40 MPH design speeds for the ramps from EB I-76 and WB I-76 to NB SR-8; and the 45 MPH for the ramp from WB I-76 to SB I-77. These options were presented at Workshop #1 on 02/12/15. The difference between NEA1 and NEA2 is that NEA1 uses low speed merge criteria for the ramp-to-ramp gore areas and ends prior to the existing Johnston Street Bridge, and NEA2 used high speed criteria which pushes the improvements north and would need a design exception for shoulder width to not impact the existing Johnston Street Bridge. As stated in the Design Workshop #2 Agenda on 02/26/15 which contains design criteria directives received via email from ODOT Central Office, Office of Roadway Engineering on 2-19-15, low speed exit and entrance conditions are acceptable for diverging and converging ramps provided all the curves leading into the merge are lower speed.

Due to increased traffic capacity associated with diverging lane drops in comparison to deceleration exit ramps, these initial options were replaced at Workshop #2 with NEA3 which converted the left-hand exits into drop lanes which provides an additional lane through the middle of the Central Interchange. By converting the ramp deceleration exits in Alternatives NEA 1 and NEA 2 to drop lanes with NEA 3, this option provides operational improvements in addition to the geometric improvements. Additionally the design speed of the proposed ramp from WB I-76 to NB SR-8 was increased from 40 MPH to 45 MPH to avoid a design exception. Due to geometric spatial constraints between EB I-76, SR-8 and the existing Johnston Street bridge, the proposed ramp from EB I-76 to NB SR-8 is proposed at a 40 MPH design speed, which requires a design exception for speed. At Design Work Shop #3 it was noted that the design exception for the ramp from EB I-76 to NB SR-8 was reasonable based on avoiding impact to the existing Johnston Street bridge (replacement estimated at \$4 million). NEA3 utilizes low speed ramp-to-ramp merges similar to NEA1 near the Johnston Street bridge due to the merge point between the ramps moving further northward as a result of the design speed increase of the ramp from WB I-76 to NB SR-8 as noted above. A design exception for shoulder width is also required to avoid impacting the existing Johnston Street bridge over SR-8.

In the existing configuration, both EB and WB I-76 are bottlenecked to 2-lanes through the Central Interchange between the right hand exit ramps (WB I-76 to NB SR-8 and EB I-76 to SB I-77) and the left hand exits (WB I-76 to SB I-77 and EB I-76 to NB SR-8). See **Figure 13** below for the existing lane configuration.

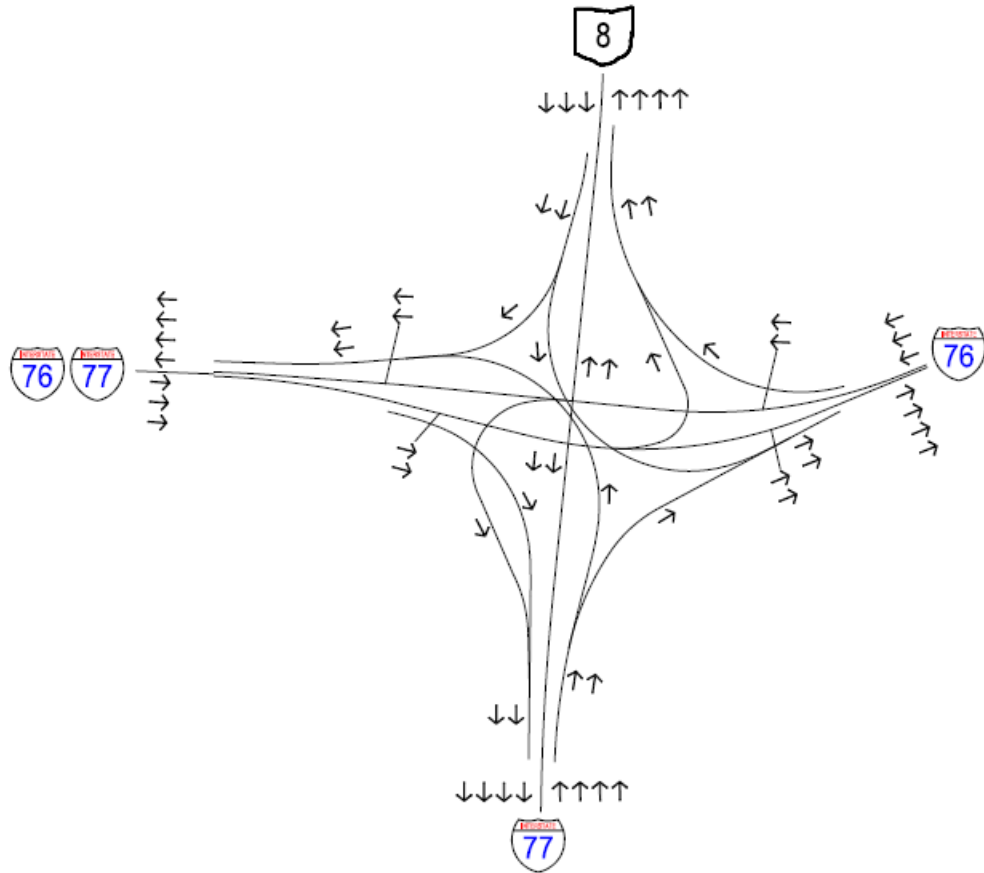


FIGURE 13 – Existing lane configuration

In the proposed configuration of NEA3, an additional lane through this segment is utilized to improve traffic flow by converting the left-hand exits into lane drops. This is facilitated on EB I-76 through the restriping of existing pavement. On WB I-76, the current auxiliary lane that exits to Inman Street is extended westward to become the lane drop to NB SR-8, thereby allowing the inside (median) lane on WB I-76 to be a lane drop to SB I-77. See **Figure 14** below for the proposed lane assignments.

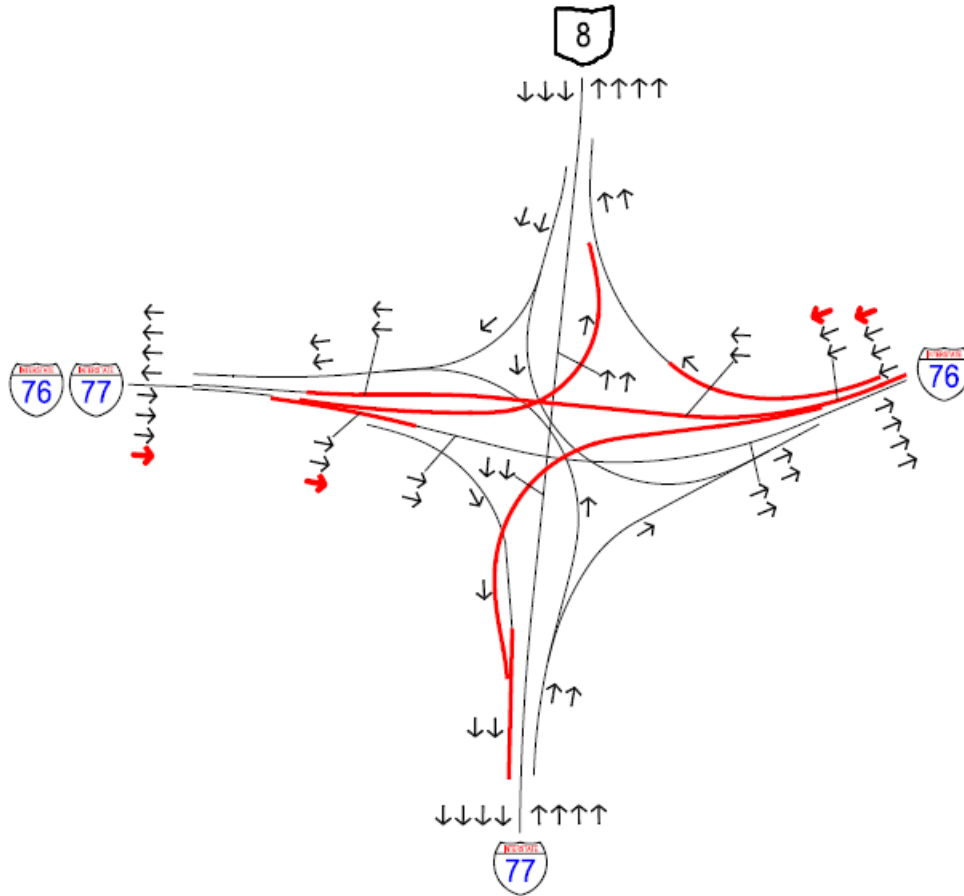


FIGURE 14– Proposed lane configuration

Further geometric refinement of the NEA options revealed that the proposed ramp from WB I-76 to SB I-77 conflicts vertically and horizontally with the existing LaFollette Street bridge over I-77 on the south end of the interchange. Therefore the existing LaFollette Street bridge will need to be removed in its current configuration. The need to replace the local connection, which has not been determined within this study, will be further discussed with stakeholders and the public. If it is determined that the local connection is a vital element, preliminary alternatives have been developed to replace the connection. The construction of a new local connection is not precluded by the feasible alternatives to improve the ramps. This study identified three (3) sub-options of NEA3 for future consideration. Refer to **Appendix 7** for additional details. At Workshop #4 on 03/26/15 preliminary construction costs were provided.

NEA3-1: option w/new bridge at Kipling St. (\$44.3M in 2020 dollars)

NEA3-2: option w/new bridge at LaFollette St. (\$45.1M in 2020 dollars)

NEA3-3: option w/o bridge replacement (\$39.5M in 2020 dollars)

The NEA3 improvements are shown below in **Figure 15**. It should be noted that the existing overpass bridge on LaFollette Street over I-77 is shown here, for this diagram although undecided, as being reconstructed two (2) blocks south at Kipling Street.

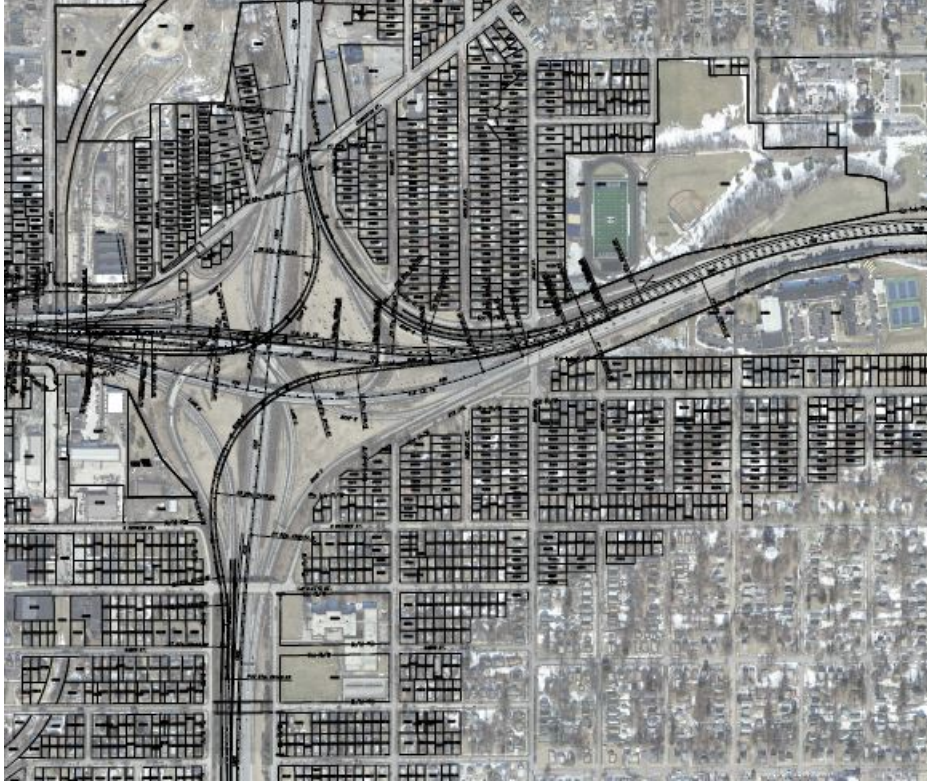


FIGURE 15 - Option NEA3-1 Improvements

The Lovers Lane ramp gore is located approximately 500' south of the vertical profile tie in point for the new ramp from WB I-76 to SB I-77, thereby creating a likely weave problem with the I-77 ramp. Both the Inman Street and Lovers Lane exit ramps do not meet current interchange spacing requirements and are partial interchanges (1/4 of a full interchange) with no returning traffic movement, meaning traffic that exits the freeway has no direct access to return to the freeway. Note that partial interchanges are not approved by FHWA. Therefore both the Inman Street and Lovers Lane ramps are recommended to be closed.

If later environmental studies or public involvement deem the Inman Street exit should remain open, the Akron Beltway Planning Study preliminarily evaluated the impact of doing so by creating an additional alternate called **Option NEA4**. This additional alternate mimics NEA3 except that a WB exit ramp is constructed to Inman Street. As noted above, the ramp requires the reconstruction of the pedestrian bridge connecting Akron Hoban High School to its athletic fields, additional grading and pavement resulting in approximately a \$2.5M increase over the respective NEA3 option.

Of the NEA options evaluated, NEA3 is most prudent to carry forward because it provides operational improvements and reduces the need for geometric design exceptions versus NEA1 or NEA2. NEA3 is carried forward to evaluate as an alternative to NEB described below.

4.1.2 Northeast Option B (NEB) – construct right hand exit

In this option the existing left hand exits are replaced with right hand exits. The initial alternates presented at Workshop #1 on 02/21/15 were called NEB1 and NEB2. They both included right-hand exits from EB and WB I-76 to SB I-77 and NB SR 8, respectively. The only difference between NEB1 and NEB2 is the alignment and profile for the ramp from EB I-76 to SB SR 8. The ramp in both NEB1 and NEB2 created right-of-way impacts and potential displacement of the existing industrial facility at the corner of Johnston St. and SR 8. Further refinement of the ramp from EB I-76 to NB SR-8 to minimize impacts to the industrial facility created NEB3.

NEB3 tightened the ramp from EB I-76 to NB SR-8 and the ramp from WB I-76 to NB SR-8 by reducing right shoulder widths and ramp gore geometry in order to narrow the cross section width along SR 8. These two (2) ramps continued as add lanes on NB SR 8, with the ramp from EB I-76 to NB SR-8 serving as an auxiliary lane to the Carroll St./Buchtel Avenue exit.

NEB3 geometry is outside of the existing right-of-way limits on the NE quadrant of the interchange near Lumiere Street and on the SW quadrant near Crosier Street. Similar to the NEA options, the I-76 EB exit lanes to I-77 SB and SR 8 NB become drop lanes. Construction of right hand exits minimizes disruption to existing traffic on the mainline and ramps because the majority of new construction is off-line. The existing Johnston Street structure would be reconstructed in this option due to conflict with the ramp from EB-I-76 to NB SR-8. With this option, reconstructing the Johnston Street Bridge is unavoidable as a result of the widening along NB SR-8 under the Johnston Street Bridge for the connection of the realigned WB I-76 to NB SR-8 ramp. Similar to the NEA options, the Lover's Lane and Inman Street exit ramps are closed. Similar to the NEA Options the existing Lafollette Avenue structure would be reconstructed. This option was presented at Workshop #4 and construction is estimated at approximately **\$83,000,000 in 2020 dollars**. The main contributors to the increased cost are the larger flyover ramp bridges and the additional retaining walls compared to Option NEA3. The NEB3 improvements are shown below in **Figure 16**.

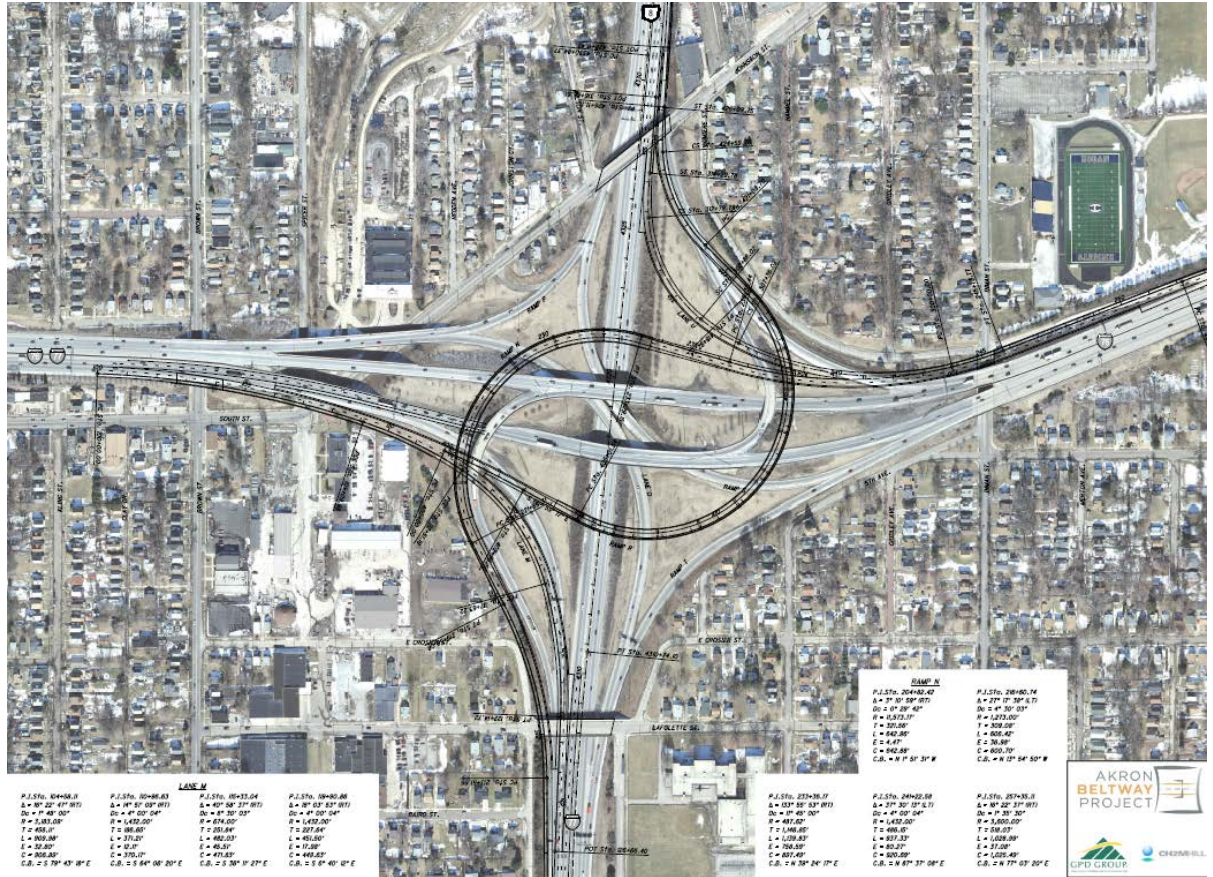


FIGURE 16 - Option NEB3 Improvements

4.1.3 Comparison of NEA3 (left exits) versus NEB3 (right exits)

Based on the difference in construction cost (approx. \$40M), it was determined at Workshop #4 that Option NEA3 is the preliminary alternate recommended for further development.

4.1.4 Geometrics for the Recommended Alternate

The proposed geometrics for Option NEA3 include:

- A design speed of 45 MPH was achieved for Ramp N (WB I-76 to SB I-77) to the south & Ramp U (WB I-76 to NB SR-8) to the north.
- A 40 MPH design speed is recommended for Ramp R (EB I-76 to NB SR-8) to the north in order to avoid the existing Johnston Street Bridge. Requires design exception (NDC = 45 mph).
- Left hand exits change from deceleration lanes to drop lanes. Right hand exits remain drop lanes.
- Westbound I-76 is shifted to the north and elevated to allow Ramp R (EB I-76 to NB SR-8) to pass under westbound I-76 and Ramp N (WB I-76 to SB I-77) to cross over eastbound I-76.
- Due to the raised profile of WB I-76, the existing I-76 bridge over Inman Street will be replaced.

- Ramp N (WB I-76 to SB I-77) requires concrete barrier separation where it begins to align adjacent to Ramp M (SB I-77) because the difference in vertical alignments.
- The existing concrete barrier between the lanes from SB SR-8 and the two southbound ramps (Ramp M & N) is proposed to be perpetuated, though the existing shoulder widths along the barrier are substandard. The shoulder widths could be improved but likely not to standard widths without impacting the existing Lovers Lane Bridge to the south. A Design Exception for shoulder width is anticipated to be needed.
- The existing Johnston Street over SR 8 structure to the north could remain but will require substandard shoulder width where ramps R & U merge at the bridge. A Design Exception for shoulder width is anticipated to be needed.

See NEA3 option summaries in **Appendix 7** for additional information.

4.2 Infrastructure Condition for the Recommended Alternate

As part proposed improvements, the two (2) left-handed ramp bridges identified to have exhausted their rehabilitation potential (see section 3.4 above) will be replaced with new structures on new, improved geometries. The realignment of the left handed ramps and WB I-76 will include reconstruction pavements. See **Appendix 7** for additional information.

4.3 Traffic Operations for the Recommended Alternate

Vissim was used to model the proposed improvements of Option NEA3. The Vissim model performed was Akron Beltway Build Condition BC01, which also includes geometric improvements at the Northwest Interchange in addition to the left-handed ramp improvements at the Central (NE) Interchange. The BC01 improvements at the NW interchange included braiding single lane ramps to eliminate the weave on the westside of the Beltway. The NW interchange did not include any lane addition or other capacity improvements at the interchange or the connecting freeway segments. The improvements at the NE and NW interchanges were analyzed together for purely for simplicity of Vissim modeling since the operation of the interchanges is independent of each other. The proposed alternatives at the NE do not require any improvements at the NW interchange.

It was determined that traffic congestion was noticeably reduced on WB I-76 approaching the interchange in controlling AM peak period. EB I-76 in the PM peak, NB I-77 in the AM peak, and SB I-77 in the PM peak all realized marginal improvements in traffic congestion or remained essentially unchanged. As identified in the Vissim modeling completed by the Akron Beltway Planning Study, converting the left-hand exits from deceleration lanes to lane drops and improving the ramp speed provides improvement in traffic operations on WB I-76. Noticeable improvements on NB I-77 and SB I-77/EB I-76 traffic operations are not realized due to traffic constraints elsewhere around the Akron Beltway freeway network, therefore the marginal improvements identified with the proposed Central Interchange project were deemed acceptable provided that the proposed alternatives at the Central (NE) Interchange do not prohibit future improvements. Refer to **Appendix 9**. Further analysis by the Akron Beltway Planning Study may include improvements that benefit the NB I-77 and

SB I-77/EB I-76 traffic movements that were not realized from the Central Interchange project alone.

See **Figures 17 thru 20** pulled from the Vissim summary noted above for Vissim congestion profiles comparing the 2040 No-Build versus 2040 BC01 results for the controlling AM and PM peak periods. See **Figure 7** above for legend.

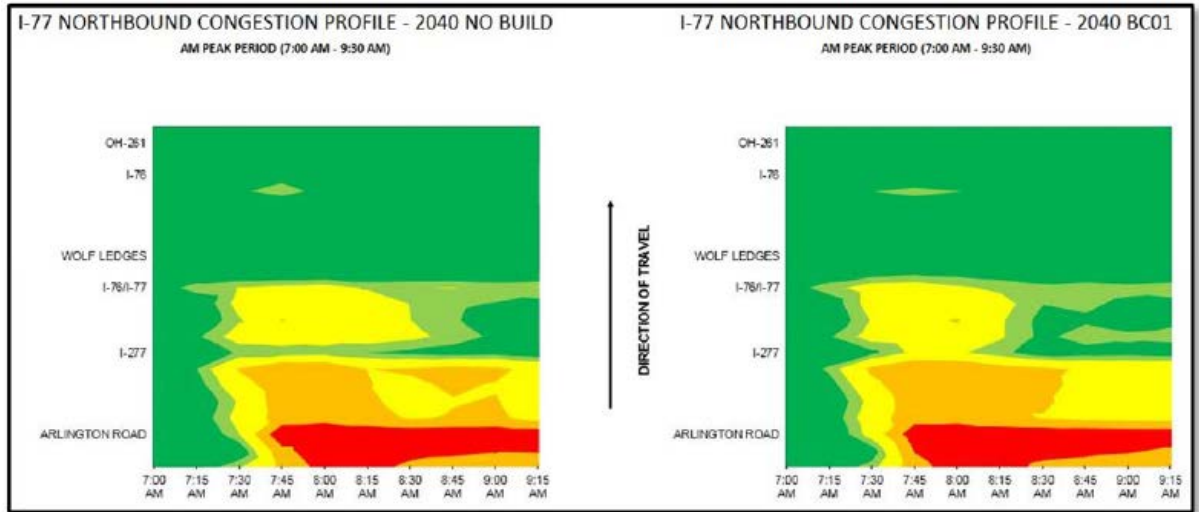


Figure 17 – Year 2040 AM Peak (Northbound I-77)

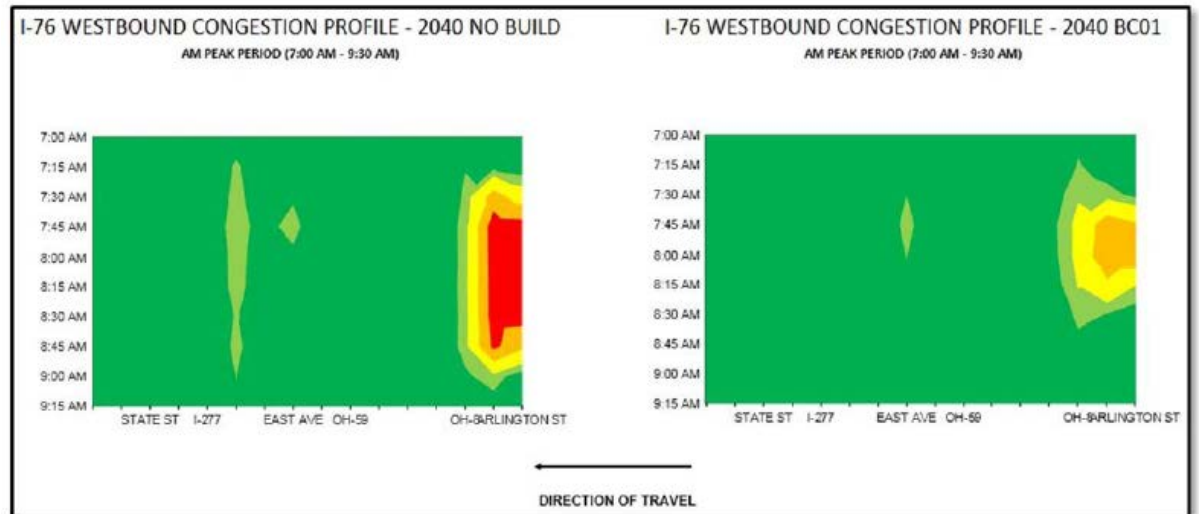


Figure 18 – 2040 AM Peak (Westbound I-76)

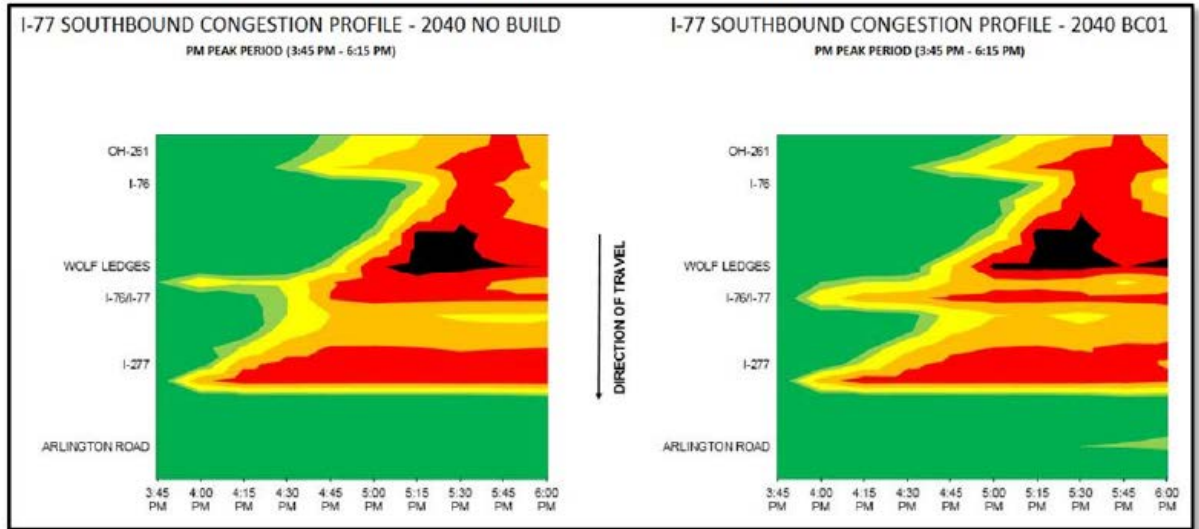


Figure 19 – 2040 PM Peak (Southbound I-77)

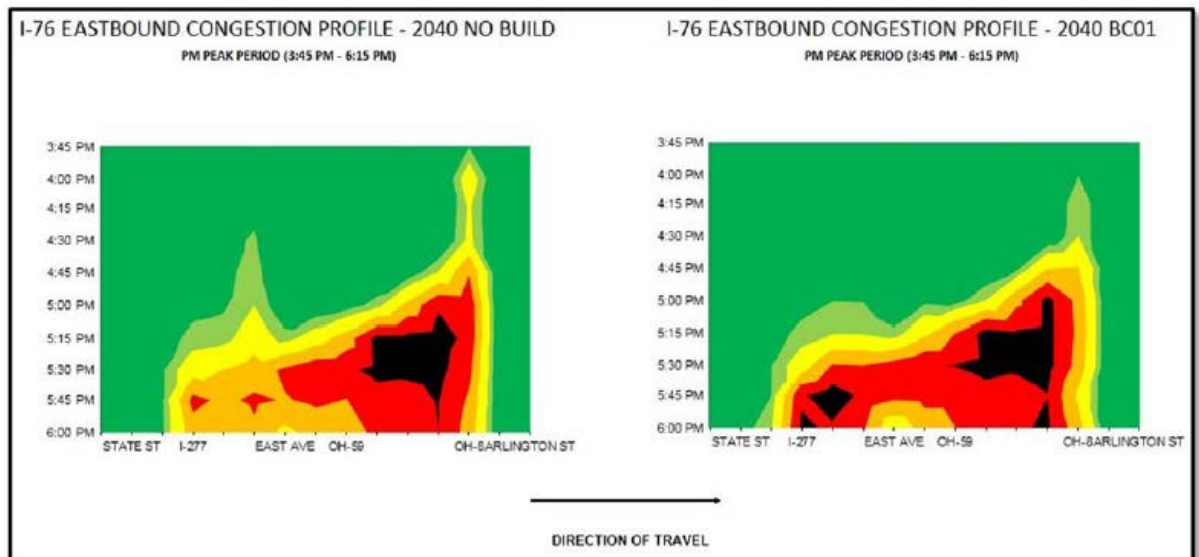


Figure 20 – 2040 PM Peak (Eastbound I-76)

4.4 Safety for the Recommended Alternate

Interchange Safety Analysis Tool – Enhanced (ISATe) was used to evaluate the safety performance of the proposed improvements of Option NEA3 and compare them to the existing conditions. See the *SUM-76 Akron Beltway Project (PID 95831) – Northeast Interchange Safety Summary* dated January 2016 in **Appendix 2** for detailed information.

Using Highway Safety Manual methodologies, Interchange Safety Analysis Tool – Enhanced (ISATe) enables prediction of the safety performance of interchanges, including mainline segments, ramp segments, and ramp terminal intersections. Using ISATe, the project team calculated the year predicted (average number anticipated crashes, as compared to similar sites) for the existing and proposed NEA3 configurations.

As shown below in **Table 2** and **Figure 21**, both pulled from the NE Interchange Safety Summary noted above, the predicted crashes for the proposed NEA 3 build condition are less than those predicted for the existing condition. There are two (2) specific locations however where there is a slight increase in predicted crashes over the existing conditions. These occur at the ramp from WB I-76 to SB I-77 (Ramp N) the ramp from EB I-76 to NB SR-8 (Ramp R). On the ramp from WB I-76 to SB I-77 (Ramp N) the number of crashes per year is predicted to increase with 0.16 fatal and injury and 0.27 property damage only crashes per year. On the ramp from EB I-76 to NB SR-8 (Ramp R) the number of the crashes per year is predicted to increase with 0.06 fatal and injury and 0.02 property damage only crashes per year. This negligible increase could be attributed to the longer ramp length in Alternative NEA3, approximately 1500', and increased exposure to roadside barrier due to the longer ramp.

2015 Existing Condition Predicted Crashes per Year	I-76	Ramp M	Ramp N	Ramp R	Ramp U
Total Fatal and Injury Crashes (KABC)	3.65	0.92	0.34	0.40	0.77
Total Property Damage Only Crashes (PDO)	11.33	1.62	0.54	0.70	1.30
Total Crashes (KABCO)	14.98	2.54	0.88	1.10	2.07
2015 Build Condition (Alt. NEA3) Predicted Crashes per Year					
Total Fatal and Injury Crashes (KABC)	2.53	0.86	0.50	0.46	0.46
Total Property Damage Only Crashes (PDO)	8.01	1.59	0.81	0.72	0.79
Total Crashes (KABCO)	10.54	2.45	1.32	1.18	1.25

Table 2 – Crash Summary

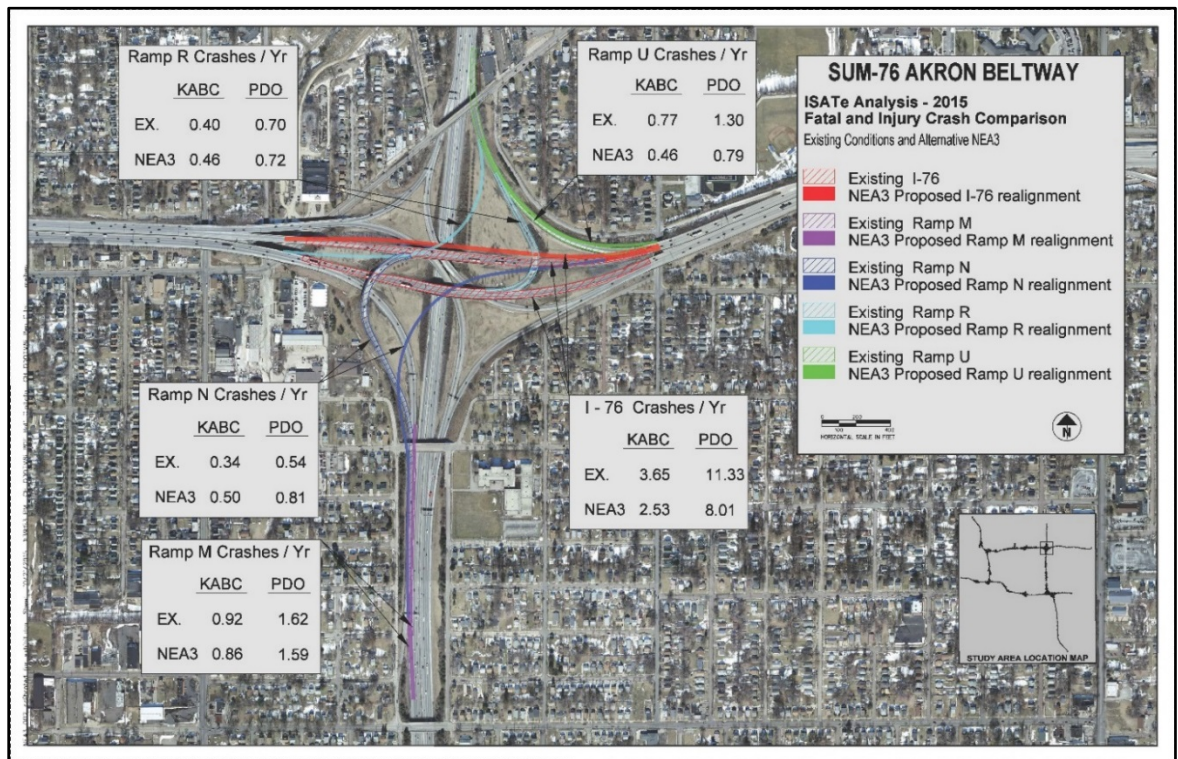


Figure 21 – Existing and Alternate NEA3 Crash Comparison

4.5 Structures

As part of the geometric evaluation described in an earlier section of this report, it has been conceptually determined that the following structures will be impacted by the proposed improvements. Bridge identification notations (B-##) reference the *Summary of Sub-Standard Conditions & Asset Inventory* included in **Appendix 4**.

- Ramp from WB-76 to SB-77 (B-36): complete replacement on new alignment
- WB-76 over SR-8 (B-37): complete replacement on new alignment
- Ramp from EB-76 to NB-8 (B-39): complete replacement on new alignment
- Lafollette Street over I-77 (B-53): to be determined. See Geometrics Section 4.1.1

Note that this Feasibility Study did not perform any geotechnical investigations, span arrangement or structure type studies to evaluate the proposed structures. For the purposed of evaluating the proposed profile grades of overpassing roadways and ramps, an estimated structure depth of 3.2% of the assumed span length was used as per AASHTO LRFD bridge specifications for constant depth steel I-beams.

4.6 Environmental for the Recommended Alternate

The Akron Beltway Planning Study reviewed previous project studies from the SUM-76-11.20 Central Interchange (PID 77270), SUM-76-10.00 Main/Broadway Interchange (PID 77269) and SUM-76/77-11.27/12.12 Spicer/Johnston Street (PID 86979); as well as available environmental data to prepare an environmental summary of the known resources in the Central Interchange project area. This data is summarized in the *SUM-76 Central Interchange (PID 101402) Environmental Overview* dated April 2016 (see **Appendix 8**).

Based on the known environmental resources within the Central Interchange study area, impacts to potential environmental resources did not influence the alternative decision making completed within the Feasibility Study.

The Central Interchange study area is shown below in **Figure 22** pulled from the environmental overview noted above.

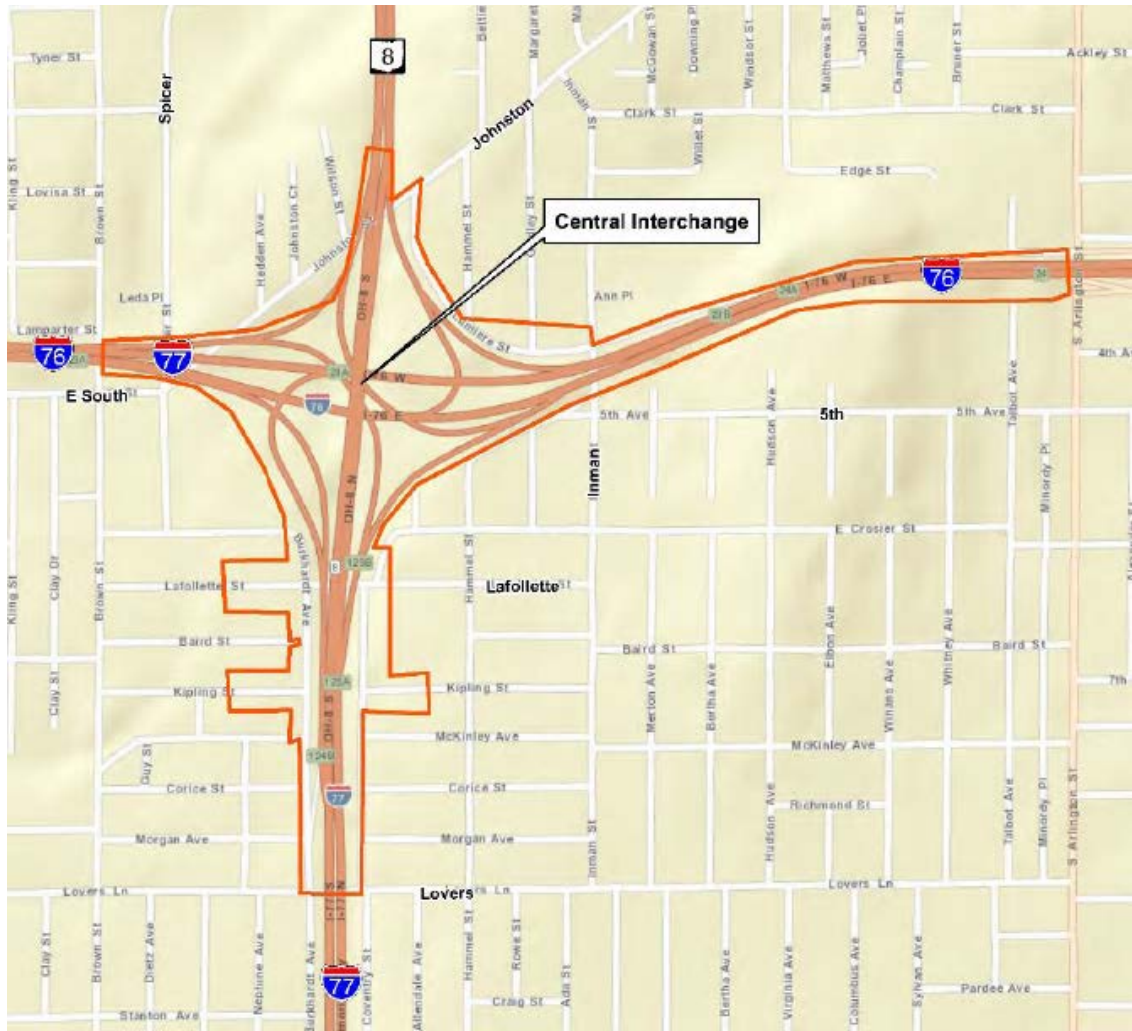


Figure 22 – Central Interchange Environmental Study Area

4.7 Right-of-Way Impacts for the Recommended Alternate

As part proposed improvements, the various potential right-of-way impacts have been identified. This study has not performed retaining wall justifications so the right-of-way impacts discussed herein are conceptual.

The extension of the auxiliary 4th lane on WB I-76 to become the lane drop into NB SR-8 (Ramp U) realigns the ramp northward of its current location, thereby causing the relocation of Lumiere Street northward or the construction of a retaining wall.

The potential reconstruction of the LaFollette Street at either its current location or at Kipling Street as discussed above in Section 4.1.1 will include right-of-way impacts associated with the estimated vertical profile necessary to provide proper vertical under the new structures.

See NEA3 Option summaries in **Appendix 7** for more information.

5.0 Conclusions and Recommendations

Based on the level of planning data available at the time, the Akron Beltway Planning Study identified the need to reconfigure and improve the safety and congestion of the left-handed exit ramps on both EB and WB I-76 in the Northeast (Central) Interchange area. The project improvements in the Northeast (Central) Interchange area, identified as Option NEA3 in the Akron Beltway Planning Study and programmed for design as SUM-76 Akron Central Interchange (PID 101402), include the following:

- Due to construction cost, the left-hand exits remain as left-hand exits opposed to being converted to right-hand exits.
- Due to improved traffic capacity on I-76, the systems exit ramps on EB and WB I-76 will be drop lanes.
- Due to existing bridge condition of the slab structure, reconstruct the ramp from WB I-76 to SB I-77 with a minimum 45 MPH design speed.
- Due to existing bridge condition of the slab structure, reconstruct the ramp from EB I-76/I-77 to NB SR-8 NB with a minimum 40 MPH design speed with a Design Exception.
- Reconstruct the ramp from WB I-76 to NB SR-8 to accommodate new EB I-76/I-77 to SR-8 ramp alignment with a minimum 45 MPH design speed.
- Reconstruct the WB I-76 Bridge through the Central Interchange on new profile for minimum 60 MPH design speed to cross over the proposed left handed ramps.
- Confirm via Interchange Modification Study/Public Involvement the removal of the SB I-77 exit ramp to Lovers Lane since it is a partial interchange.
- Confirm via Interchange Modification Study/Public Involvement the removal of the WB I-76 exit ramp to Inman Street since it is a partial interchange and retaining it would require the reconstruction of the pedestrian bridge at Akron Hoban High School.
- Based on preliminary determination of vertical and horizontal conflict with new ramp from WB I-76 to SB I-77, remove the existing LaFollette Street Bridge over I-77 and evaluate via further study (Local Connectivity/Public Involvement) replacing at LaFollette Street or Kipling Street, or eliminating the crossing.

The proposed improvements identified within this Feasibility Study do not preclude additional Akron Beltway improvements nor future improvements at the Central Interchange. The preliminary options prepared within this study geometrically span the existing two lane State Route 8 section. Future design elements, including structure pier placement, should consider accommodation of potential future widening of State Route 8 section and other ramp capacity improvements as shown below on **Figure 23** which was pulled from the *Central (Northeast) Interchange – Akron Beltway Future Improvement Summary Memo* dated March 2016 included in **Appendix 9**

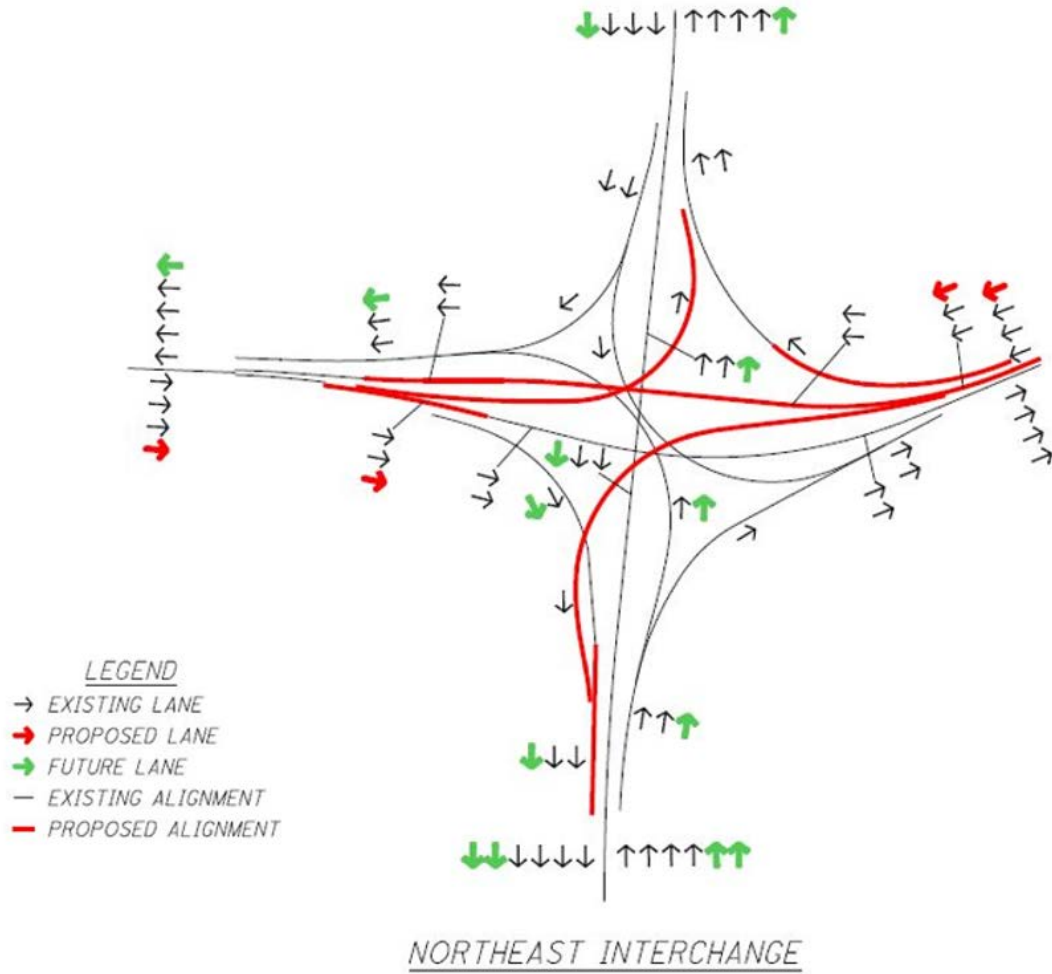


Figure 23 – Potential Future Improvements at the Central Interchange