MOTAA FINAL REPORT

Submitted to:

OHIO DEPARTMENT OF TRANSPORTATION

ODOT District 4
2088 South Arlington Road
Akron, Ohio 44306

SUM-76/77-CENTRAL INTERCHANGE
Interchange Modifications
MOTAA Final Report

PID: 101402

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JANUARY 2018

SUM-76/77-CENTRAL INTERCHANGE

PID No. 101402

MAINTENANCE OF TRAFFIC ALTERNATIVE ANALYSIS (MOTAA) FINAL REPORT

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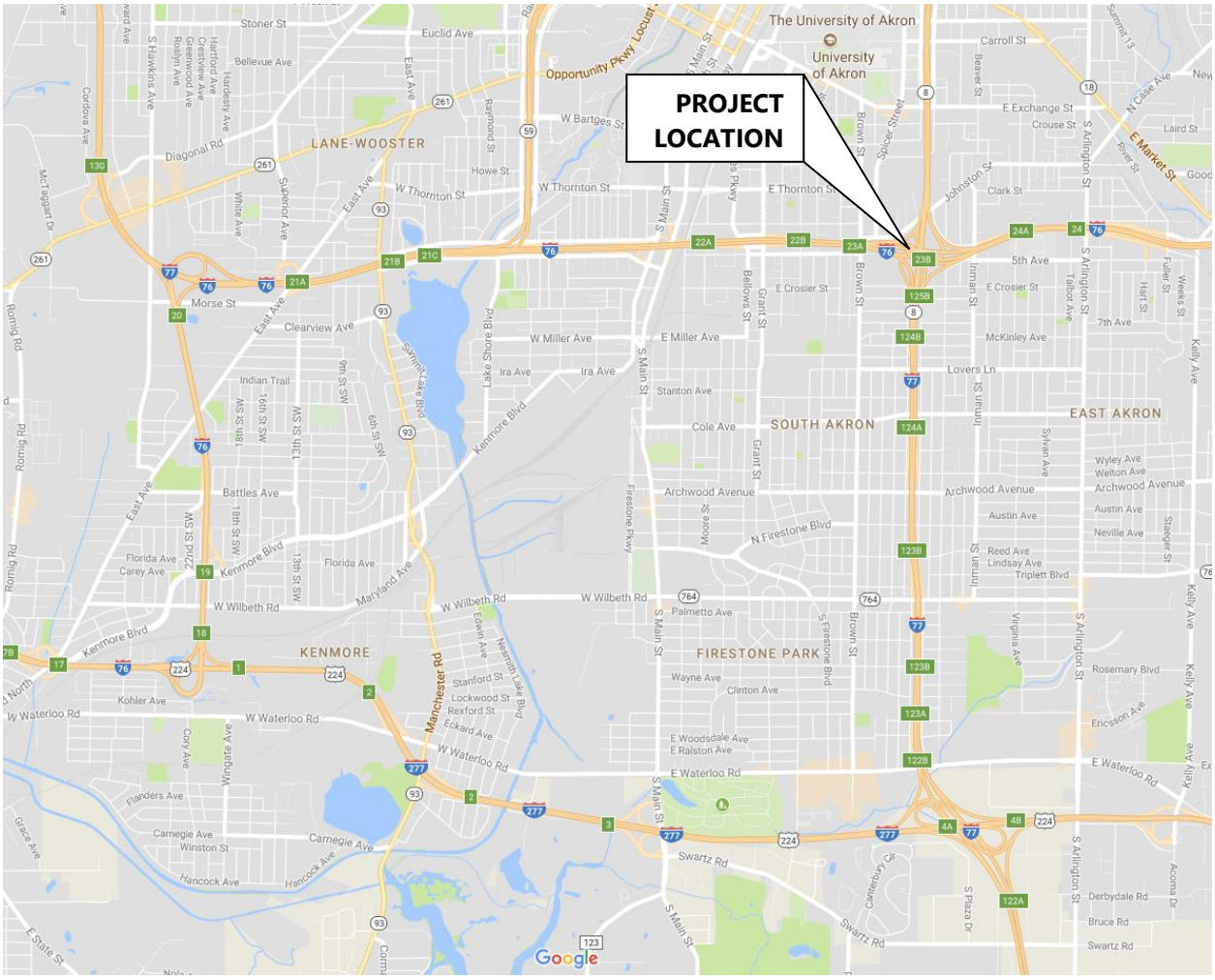
1. PROJECT BACKGROUND

As determined by the SUM-76-10.95 Akron Beltway Planning Study (PID 95831), the I-76/I-77 Central Interchange currently experiences significant congestion in the northbound and westbound directions during the AM peak hour and in the southbound and eastbound directions in the PM peak hour, contributing to a higher than expected amount of crashes. The Beltway Study also identified the left handed exit ramp bridges (SUM-76-1148R and SUM-76-1165L) are functionally obsolete and have sub-standard design ramp geometries. A project location map showing both the Beltway (I-76, I-77, and I-277) and Central Interchange are shown in Figure 1.

Figure 1: Project Location Map



2. PURPOSE

The primary purpose of the project is to address the safety issues associated with 25 mph left handed exit ramps as well as the functionally obsolete bridges associated with the ramps at the Central Interchange.

3. EXISTING ROADWAY CONDITIONS

Bridge Conditions

There are two bridges associated with the left hand ramps from Westbound I-76 to Southbound I-77 (Ramp N) and Eastbound I-76 to Northbound SR 8 (Ramp R). Each have a General Appraisal Rating on a scale of 0-9 of 5 (fair) and the superstructure rating also of 5 (fair). The bridges clearance to the interstate roadway below is less than the 16' clearance required in ODOT's criteria.

Ramp Geometrics

In addition to the bridge conditions outlined above, the ramps do not meet current ODOT standards for:

- deceleration lane lengths,
- inside shoulder widths,
- vertical geometry

Safety

The Beltway Study identified the Central Interchange as the "worst" performing area on the entire beltway System. It is ranked #42 on ODOT's Safety Priority List for Urban Freeways in the State. AMATS Crash Report identifies the Central Interchange as having 6 of the highest ranking freeway segments in the region.

Operations

The ability of the roadway to move vehicles through the area is measured by the Level-Of-Service (LOS). LOS A is the best and represents a free flowing roadway. The worst is LOS F which indicates the roadway is carrying more vehicles than it was designed to carry and long delays are encountered to travel through the area. For Urban Highways, LOS A-LOS D are considered acceptable. LOS E and F are unacceptable.

- East Bound – AM Peak: 1 segment LOS E (2015),
- East Bound – PM Peak: 1 segment LOS E (2040) and 1-segment LOS F (2040)
- West Bound – AM Peak: 2 segments LOS E (2015) and 1 segment LOS F (2015)
- West Bound – PM Peak: 3 segments LOS E (2040) and 2 segment LOS F (2040).

4. PROPOSED WORK

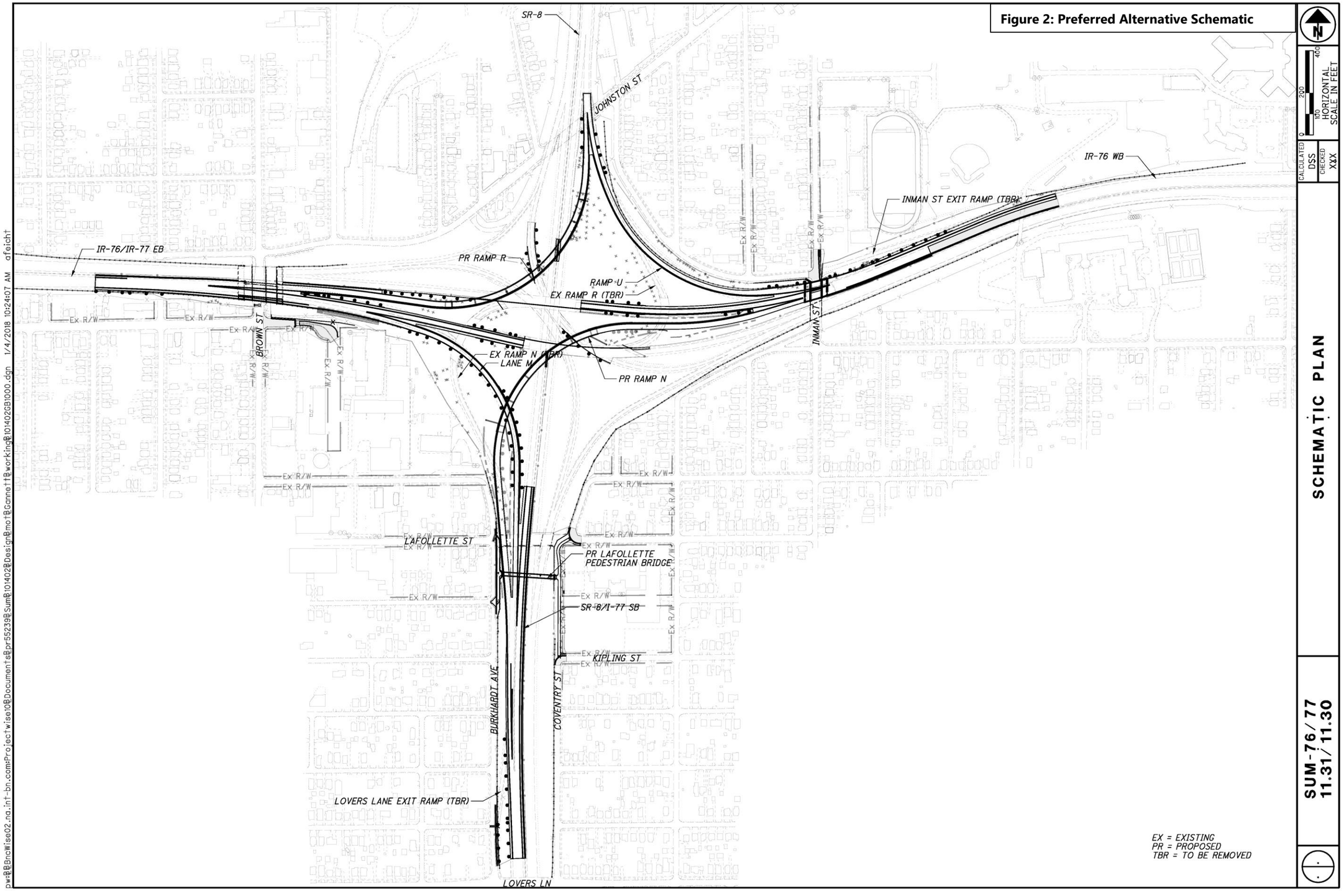
The proposed improvements include replacement of the two existing 25 mph left handed exits with 45 mph design speed flyover ramps to improve safety of the exit ramps. This project will also improve I-77 SB where the I-76 WB and I-76/I-77 SB ramps merge by removing the Lovers Lane exit ramp, which currently creates an unsafe weave area just south of the Central Interchange.

A comprehensive list of the proposed improvements include:

1. Reconstruct the ramp from I-76 WB to I-77 SB (Ramp N) on a new alignment.
2. Reconstruct the ramp from I-76/I-77 EB to SR-8 NB (Ramp R) on a new alignment.
3. Reconstruct the ramp from I-76 WB to SR-8 NB (Ramp U) to accommodate new ramp from I-76/I-77 EB to SR-8 NB (Ramp R).
4. Reconstruct the ramp from I-76/I-77 EB to I-77 SB (Lane M) on a slightly revised alignment
5. Widen I-76/I-77 EB over the Brown Street Bridge.
6. Widen I-76 WB over the Inman Street Bridge.
7. Remove the I-77 SB / Lovers Lane exit ramp.
8. Remove the I-76 WB / Inman Street exit ramp.
9. Replace the existing Lafollette Street Bridge over I-77 with a pedestrian structure approximately 150’ south of the current bridge crossing.
10. Potentially rehabilitate a segment of I-76/I-77 west of the interchange and I-77 south of the interchange.

Figure 2 on the following page is a schematic of the proposed improvements.

Figure 2: Preferred Alternative Schematic



5. MOTAA GENERAL & WORK ZONE CONSIDERATIONS

Maintenance of Traffic Alternative Analysis (MOTAA) was prepared per guidelines from the Traffic Engineering Manual (TEM) Section 630-5. Work zone criteria were uniformly applied and considered in the MOT alternative development. A summary of the work zone criteria and constraints have been outlined in the Work Zone Constraints Table provided in Appendix B. The following Sections 5A-5B outline the assumptions and design minimums used for preliminary MOT alternative development.

5A. Work Zone Design Speed

The existing posted speed limit on I-76, I-77 and SR-8 within the project area is 55 mph. All proposed mainline MOT decision sight distances (DSD), merge and diverge lengths, lane shifts, and reverse curves were calculated/evaluated based on 55 mph. At entrance ramps where the required DSD and merge distances could not be provided for this speed criteria, recommendations were made to either provide temporary pavement (where feasible) or close and detour the ramp. As the project design is advanced, consideration of a Work Zone Speed Zone (WZSZ) reduction will be evaluated.

5B. Lane Configurations and Typical Sections

Per guidelines of Section 630-5 of the TEM, 2ft paved shoulders, 11ft lane widths, a minimum 2ft clearance between the edge of travel lane to toe of barrier and 2ft from the toe of barrier to the work area was the desired typical section in implementing the MOT construction phases.

6. MOT EVALUATION

The non-linear nature of the proposed interchange improvements does not yield the typical assessment of multiple MOT alternatives commonly evaluated on a linear transportation project. Offline, ramp closure, and part-width sequencing alternatives are the primary approaches to constructing the proposed improvements. A contra-flow alternative to construct portions of I-77 SB was summarily discussed with District 4 during a workshop on June 26th, 2017, but was dismissed due to the inability to minimize ramp closures and longer construction duration. During this workshop, it was also determined that several ramps have been closed during past projects and have used the beltway as a proven and effective detour. Therefore, the following ramps will be closed during one construction phase, which are described in greater detail in subsequent sections of this report:

- Lane M (I-76/77 EB to I-77 SB)

- Ramp R (I-76 EB to SR-8 NB)
- Ramp N (I-76 WB to I-77 SB)

System ramp closures of >= 24 hrs and <72 hrs require MOTEC approval. System ramp closures of >= 72 hrs requires PIAC approval.

Several assumptions and constraints were identified that influenced the findings and recommendations of this MOTAA.

- Maximize offline construction.
- Maintain a minimum of 2 lanes in each direction on I-76, I-77 and SR-8, no mainline lane closures required through the project limits. In the existing condition, there are two lanes of traffic in each direction, not including drop, weave and deceleration lanes associated with the ramp movements, on each mainline. These existing lanes will be maintained through the project.
- Short term closures will be used to place beams and remove existing beams.
- Minimum 11′ lanes and 2′ shy distance on both sides of portable barrier.
- MOT based on geometric submittal by B&N dated 5/26/17.
- I-76 WB & EB reconstruction under existing hard left bridges (Ramps R and N) cannot begin until after bridges (i.e. piers) are removed.
- Forward roadway approach of proposed Ramp N cannot begin until after existing Ramp R bridge is removed. Rear roadway approach of proposed Ramp N cannot be completed until existing Ramp N approach is closed.
- Only one lane can remain open under Johnston Street bridge during reconstruction of Ramps R and U.
- Ramp U will remain open at all times as no reasonable and prudent detour exists.
- No operational analyses are necessary for MOT alternatives. No mainline lanes will be closed with this project.
- Pavement type: flexible
- Construction schedule (from ELLIS) – Estimated begin construction 4/1/2021
  Estimated end construction 12/1/2023 (32 months)

These constraints have led to a very specific construction sequencing that includes three phases. Each phase is described below and shown on preliminary MOT sheets included in Appendix A.

Phase 1

Permanent Ramp Closures:

- I-77 SB exit to Lovers Lane

Sequence of Construction:

- Construct Lafollette St Pedestrian Bridge and median drainage improvements before other work begins.
- Shift SR-8, SB and NB lanes to the outside shoulders, north of Lafollette St to north of Johnston St, away from the median piers for proposed Ramp N and R pier construction. Begin offline construction of the new Ramp R and Ramp N bridges and approach work. Relocate median storm sewer trunk line along SR-8.
- Close Lane M and shift I-76/I-77 EB lanes to the inside shoulder over Brown St. Construct the widening to the south of I-76/I-77, widening of the Brown St Bridge and Lane M.
- Close the Lovers Ln Exit Ramp. Close Lafollette Street bridge permanently and remove. Shift SR-8, SB lanes to the inside shoulder between the Ramp N pier work and Lafollette Street. Remove the existing concrete barrier that separates Lane M and SR-8. Reconstruct the SR-8 outside SB lanes/Lane M connection.

Construction to be Completed:

- Lafollette Street pedestrian bridge and adjacent local street modifications.
- I-76 EB outside lanes and Brown Street bridge widening.
- Proposed Ramp R bridge and offline roadway approach work (continues in next Phase)
- Proposed Ramp N bridge and offline roadway approach work (continues in next Phase)
- Demolition of Lafollette Street Bridge (Centerline Median Pier to be removed in Phase 2)
- Relocate median storm sewer trunk line along SR-8.
- SR-8 outside SB lanes/Lane M connection.
- Lane M

Lane/Ramp/Street Impacts:

- Lane M closed, use west beltway detour (I-76, I-277 & I-77/SR-8).
- Lafollette Street bridge closed and removed (local streets remain open).
- Lovers Lane exit ramp permanently closed.

Duration: 8 months

Phase 2

Permanent Ramp Closures:

- I-76 WB exit ramp to Inman Street.

Sequence of Construction:

- Complete the offline work on Ramp N and Ramp R. Shift I-76/I-77 EB lanes to the new pavement completed in Phase 1 and re-open Lane M. Construct the I-76/I-77 EB inside lanes and shoulder along with the proposed Ramp R terminal.

- Shift SR-8 SB lanes to the newly completed pavement placed in Phase 1. Construct the SR-8/I-77 SB inside lanes. Remove the remaining existing median pier for the Lafollette Street Bridge.

- Close and remove I-76 WB exit ramp to Inman Street, Inman Street to remain open. Shift I-76 WB traffic to the median shoulder between the Holy Cross Pedestrian Bridge and the existing Ramp R bridge over I-76. Maintain two lanes for I-76 WB traffic and one lane for Ramp U traffic west of the Inman Street bridge using temporary pavement. Construct widening for I-76 and Inman Street Bridge along with temporary pavement.

Construction to be Completed:

- I-76 EB inside lanes and Brown Street bridge.
- I-76 EB Ramp R terminal.
- Proposed Ramp R bridge.
- Proposed Ramp N bridge.
- SR-8 SB inside lanes and shoulder.
- Widening of I-76 WB and the Inman Street Bridge.
- Remove exit ramp to Inman Street from I-76 WB.

Lane/Ramp/Street Impacts:

- Inman Street ramp removed
- Burkhardt closed for Pedestrian Bridge/wall construction
- Coventry permanently closed between Lafollette St and Kipling St

Duration: 10 months

Phase 3A

Sequence of Construction:

- Close Ramp R (60 day max includes work began at end of Phase 3A). Shift Ramp U exiting lane to the outside shoulder using the newly completed permanent and temporary pavement for I-76 WB lanes and Inman Street Bridge placed in Phase 2.

- Construct Ramp U with part-width construction. Construct the adjoining portions of Ramp R and Ramp U at the entrance to SR-8 NB. Construct the outside lanes and shoulder of I-76 WB along with temporary pavement immediately past the I-76/Ramp U gore area. Remove existing Ramp R and bridge.

Construction to be Completed:

- Part-width, west half, Ramp R/Ramp U entrance to SR-8 NB.
- WB I-76 middle section.
- Remove existing Ramp R.
- Part width Ramp U, west half.
- Temporary widening of I-76, WB west of the I-76/Ramp U gore area.

Ramp Impacts:

- Ramp R closed (60 day max) – use west beltway detour
- Closure of entrance ramp from Fuller Street to I-76 WB – use Innovation Way/3rd Avenue entrance ramp as detour.

Duration: 12 months (includes Phases 3A, 3B, 3C)

Phase 3B

Sequence of Construction:

- Shift Ramp U onto newly completed pavement placed in Phase 3A, construct the remaining portion of Ramp U. Ramp R is to remain closed until construction is complete (60 day max including work in Phase 3A).

- Close Ramp N (6 month max). Shift I-76 WB lanes (two) onto newly completed permanent and temporary pavement placed in Phase 3A. Construct the inside lanes and shoulder of I-76 WB. Construct connections from I-76 WB and I-77/SR-8 SB to Ramp N, built in Phase 1. Remove existing Ramp N and bridge.

Construction to be Completed:

- East half of Ramp R/Ramp U entrance to SR-8 NB.
- Inside lanes and shoulder of I-76 WB.
- Ramp N connections to I-77/SR-8 SB and I-76 WB.
- Remove existing Ramp N and bridge.
- Remove existing exit ramp to Lovers Lane.

Ramp/Street Impacts:

- Ramp N closed – use west beltway detour
- Ramp R closed (60 day max) – use west beltway detour
- Close entrance ramp from Fuller Street to I-76 EB to avoid entrance ramp merge within construction zone lane shift– use Innovation Way/3rd Avenue entrance ramp as detour.

Duration: 12 months (includes Phases 3A, 3B, 3C)

Phase 3C

Sequence of Construction:

- Shift I-76 WB lanes onto newly constructed pavement (inside lanes and shoulder) placed in Phase 3B, west of I-76 WB/Ramp U gore area. Complete construction of I-76 WB west of I-76 WB/Ramp U gore area using part-width sub phasing and temporary pavement.

- Complete construction of I-76 EB from Lane M gore and east to bridge over SR-8 using part-width sub phasing and temporary pavement.

Construction to be Completed:

- I-76 WB outside lanes west of Ramp U gore.
- I-76 EB at Lane M gore and east to bridge over SR-8.

Duration: 12 months (includes Phases 3A, 3B, 3C)

7. DRAINAGE

Pavement drainage has been evaluated to determine impacts to the MOT layouts. Section 1010 of the Location and Design Manual, Vol. 2 specifies that a 10-foot dry lane is required for each

traveled lane using a two-year design frequency. This requirement is satisfied throughout the MOT phasing except for two segments. Pavement spread and inlet grates have been found to encroach on the desired MOT layouts along the existing median barrier on I-76 WB and I-77 SB.

Grates on the existing inlet structures along the median shoulders of I-76 WB and I-77 SB protrude 3' from the base of the barrier to the edge of the grate. Using the desired 2-foot offset from the barrier to the travelled lane leaves the grate in the wheel path of traffic. There are two inlet structures on I-76, and six inlet structures on I-77 where the grates will be in the travel lane if traffic is not shifted farther away from the median.

Pavement spread calculations along the I-76 WB median produce spreads of 6 feet at STA. 556+00 and 4.16 feet just before the Inman St Bridge. To provide a 10' dry lane, traffic will need to be shifted an additional 3' to the north. This will result in an additional 3' width (210 SY) of temporary pavement and embankment. No additional widening of the Inman St Bridge is required beyond what is currently being proposed.

The existing spread along the median barrier on I-77 SB reaches maximum width of 5.7 feet roughly 100' south of Lafollette Street. Two options have been investigated to meet the spread requirements: adding additional temporary pavement to the west side between Ramp M and I-77 and along I-77 SB or adding additional median drainage structures. Adding additional temporary pavement will cause Decision Sight Distance issues and will impact with the abutment for the new pedestrian bridge.

The new pedestrian bridge will be constructed prior to Phase 1 and will require storm sewer relocations to allow for the median pier foundation. This relocation will be designed and Stage 2 Design following SUE to determine the extents of the relocation. Additional median inlets will be provided to reduce the median spread to meet the design standards in Stage 2.

Feedback from ODOT on the inlet grates and spread in the travelled way is requested.

Spread calculations using CDSS are included in Appendix F.

8. SUMMARY

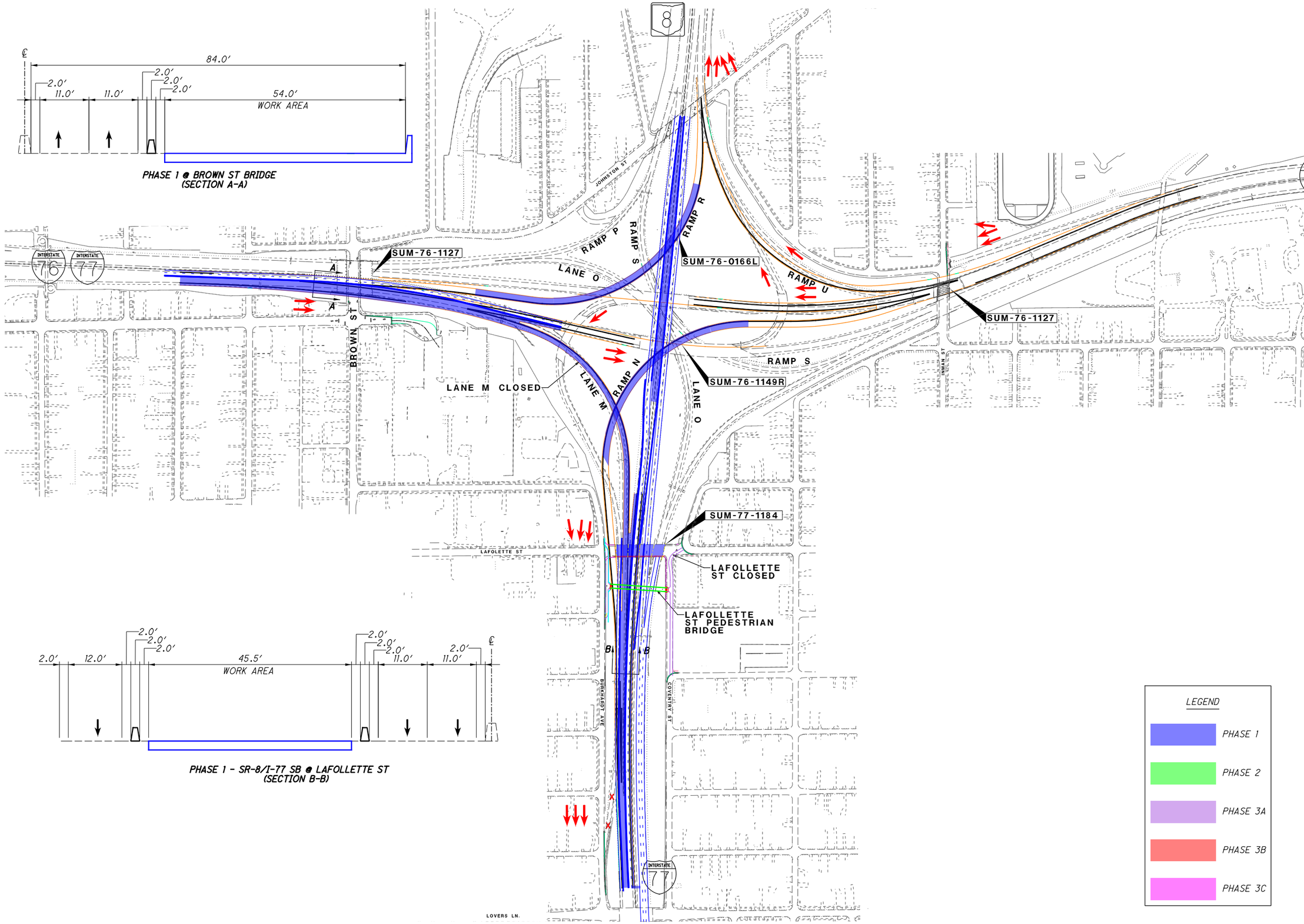
This report documents the preliminary MOT approach to meet the unique restrictions and objectives of this interchange improvement project. The content of this report is slightly different than MOTAA's for conventional linear projects in that the MOT phasing is more detailed while the alternatives analysis is limited due to past ramp closures at this interchange and the limited methods to construct tie-ins at interchange ramps. This project will take three construction seasons to complete the improvements. Three ramps will be detoured for one construction phase, but all other traffic will remain open throughout the project duration. Forms

696-1a, 696-2a, 696-3a, and 696-4a are included in this report as Appendicies B-E to support the findings of this report.

APPENDIX A

Lane Configuration Diagrams

PHASE 1 @ BROWN ST BRIDGE
(SECTION A-A)



PHASE 1 - SR-8/I-77 SB @ LAFOLLETTE ST
(SECTION B-B)

LEGEND

- PHASE 1
- PHASE 2
- PHASE 3A
- PHASE 3B
- PHASE 3C

HORIZONTAL SCALE IN FEET
0 100 200 400

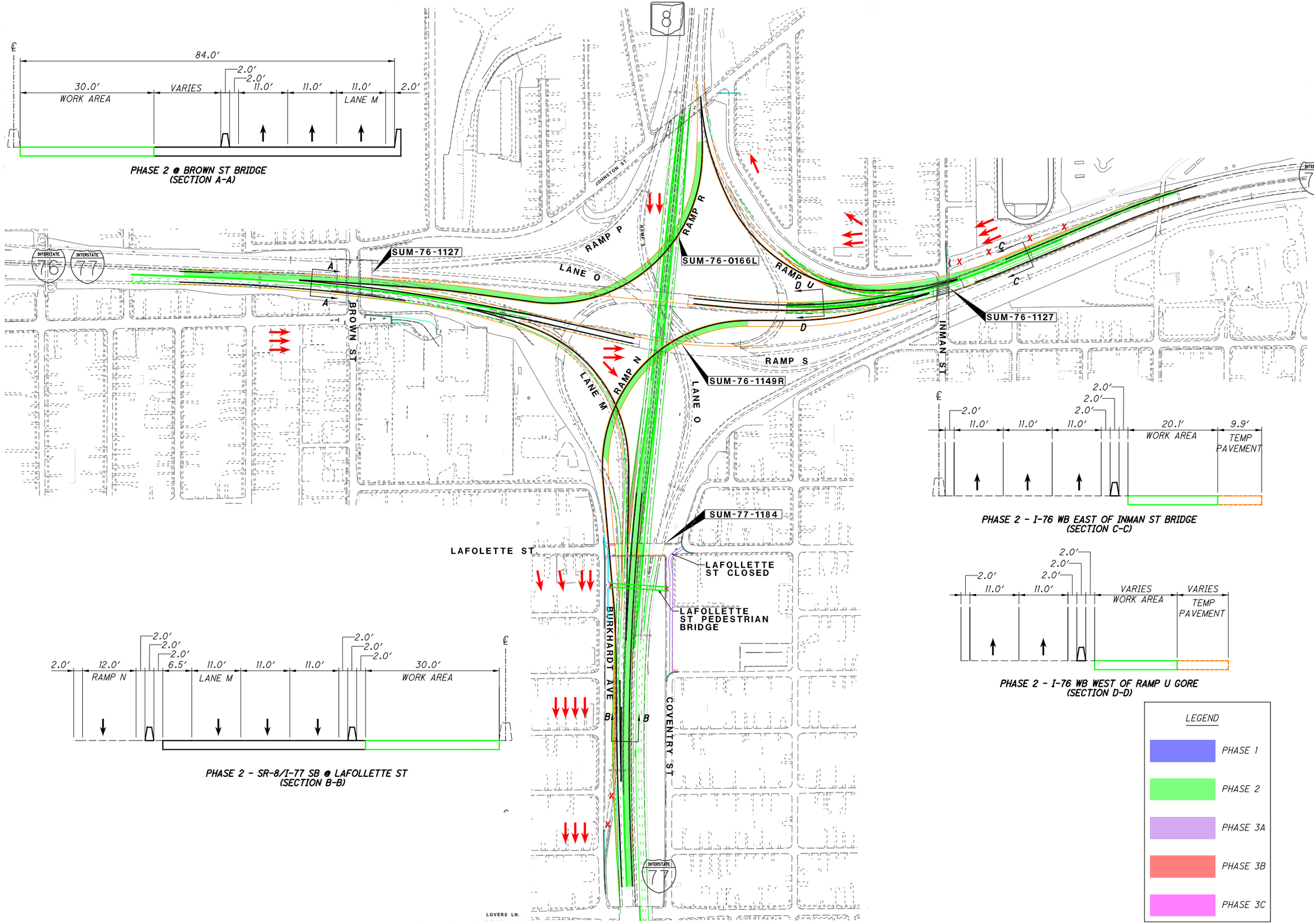
CALCULATED AAF
CHECKED XXX

MAINTENANCE OF TRAFFIC
PHASE 1 - CONCEPTUAL PLAN

SUM-76/77-CI

1/5

PHASE 2 @ BROWN ST BRIDGE
(SECTION A-A)



PHASE 2 - SR-8/I-77 SB @ LAFOLLETTE ST
(SECTION B-B)

PHASE 2 - I-76 WB EAST OF INMAN ST BRIDGE
(SECTION C-C)

PHASE 2 - I-76 WB WEST OF RAMP U GORE
(SECTION D-D)

LEGEND

- PHASE 1
- PHASE 2
- PHASE 3A
- PHASE 3B
- PHASE 3C

N

HORIZONTAL SCALE IN FEET
0 100 200 400

CALCULATED AAF
CHECKED XXX

MAINTENANCE OF TRAFFIC
PHASE 2 - CONCEPTUAL PLAN

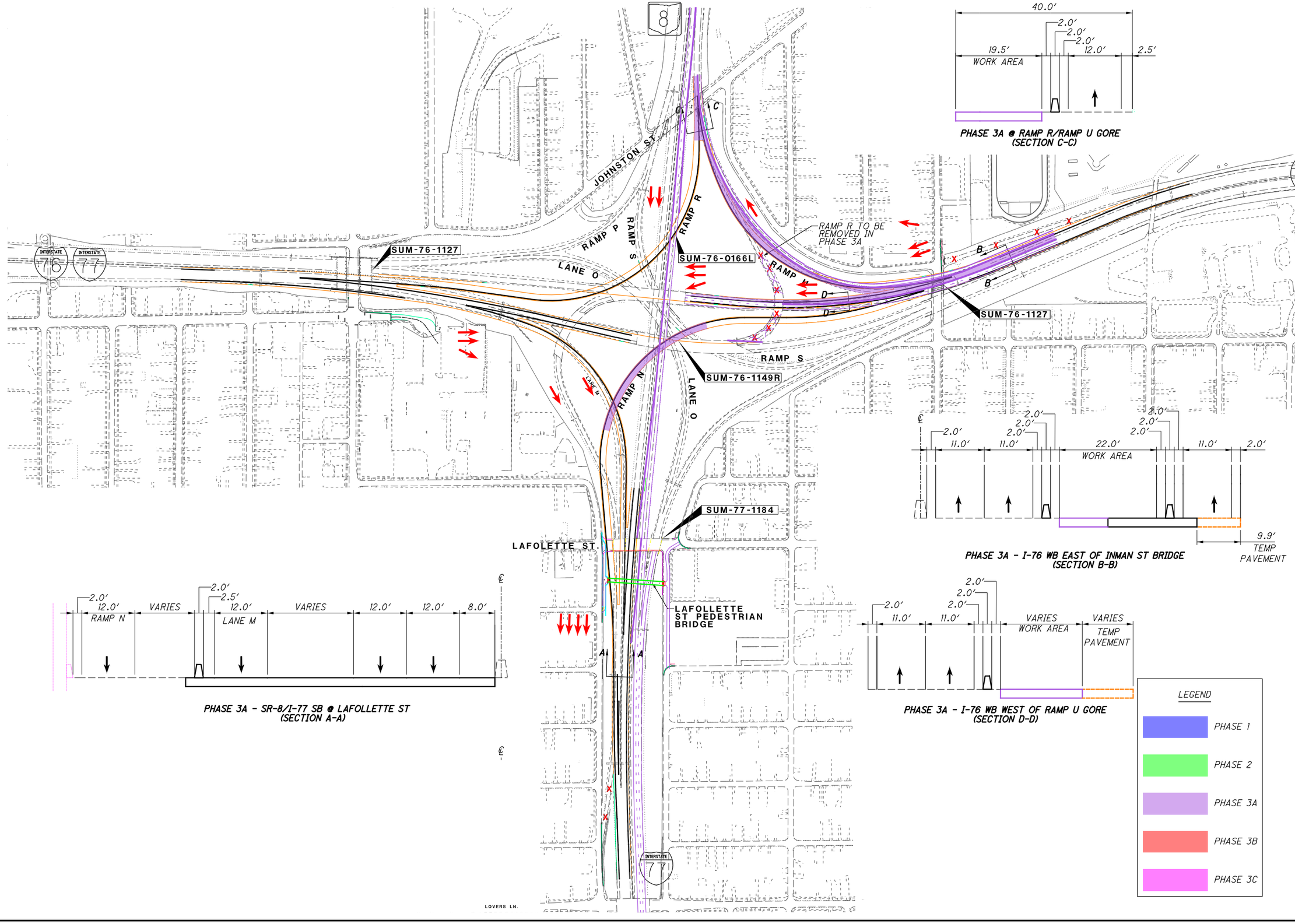
SUM-76/77-CI

2
5

MAINTENANCE OF TRAFFIC
PHASE 3A - CONCEPTUAL PLAN
SUM-76/77-CI

CALCULATED AAF | CHECKED XXX

HORIZONTAL SCALE IN FEET
0 100 200 400



PHASE 3A @ RAMP R/RAMP U GORE
(SECTION C-C)

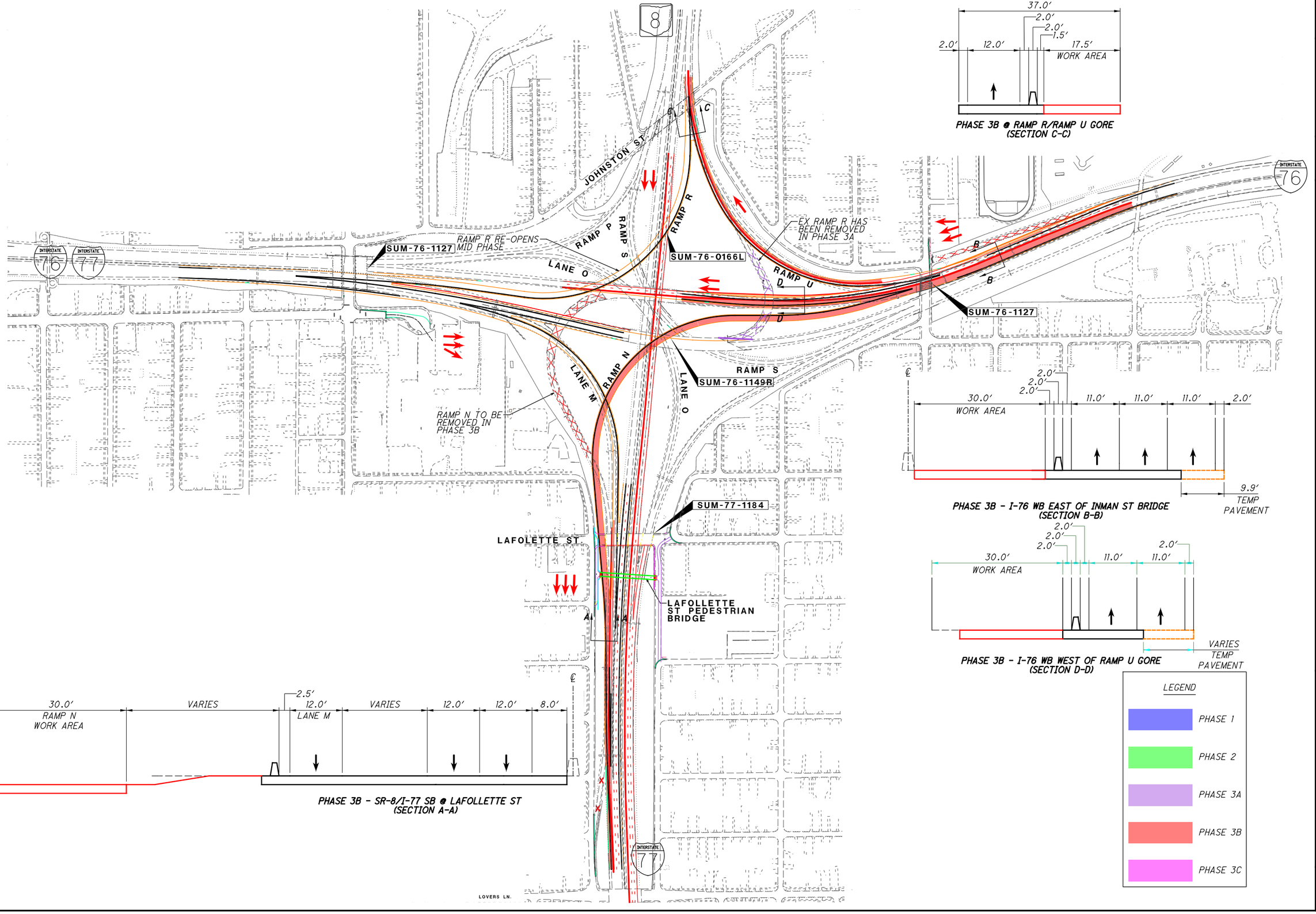
PHASE 3A - I-76 WB EAST OF INMAN ST BRIDGE
(SECTION B-B)

PHASE 3A - SR-8/I-77 SB @ LAFOLLETTE ST
(SECTION A-A)

PHASE 3A - I-76 WB WEST OF RAMP U GORE
(SECTION D-D)

LEGEND

- PHASE 1
- PHASE 2
- PHASE 3A
- PHASE 3B
- PHASE 3C



PHASE 3B @ RAMP R/RAMP U GORE
(SECTION C-C)

PHASE 3B - I-76 WB EAST OF INMAN ST BRIDGE
(SECTION B-B)

PHASE 3B - I-76 WB WEST OF RAMP U GORE
(SECTION D-D)

PHASE 3B - SR-8/I-77 SB @ LAFOLLETTE ST
(SECTION A-A)

LEGEND

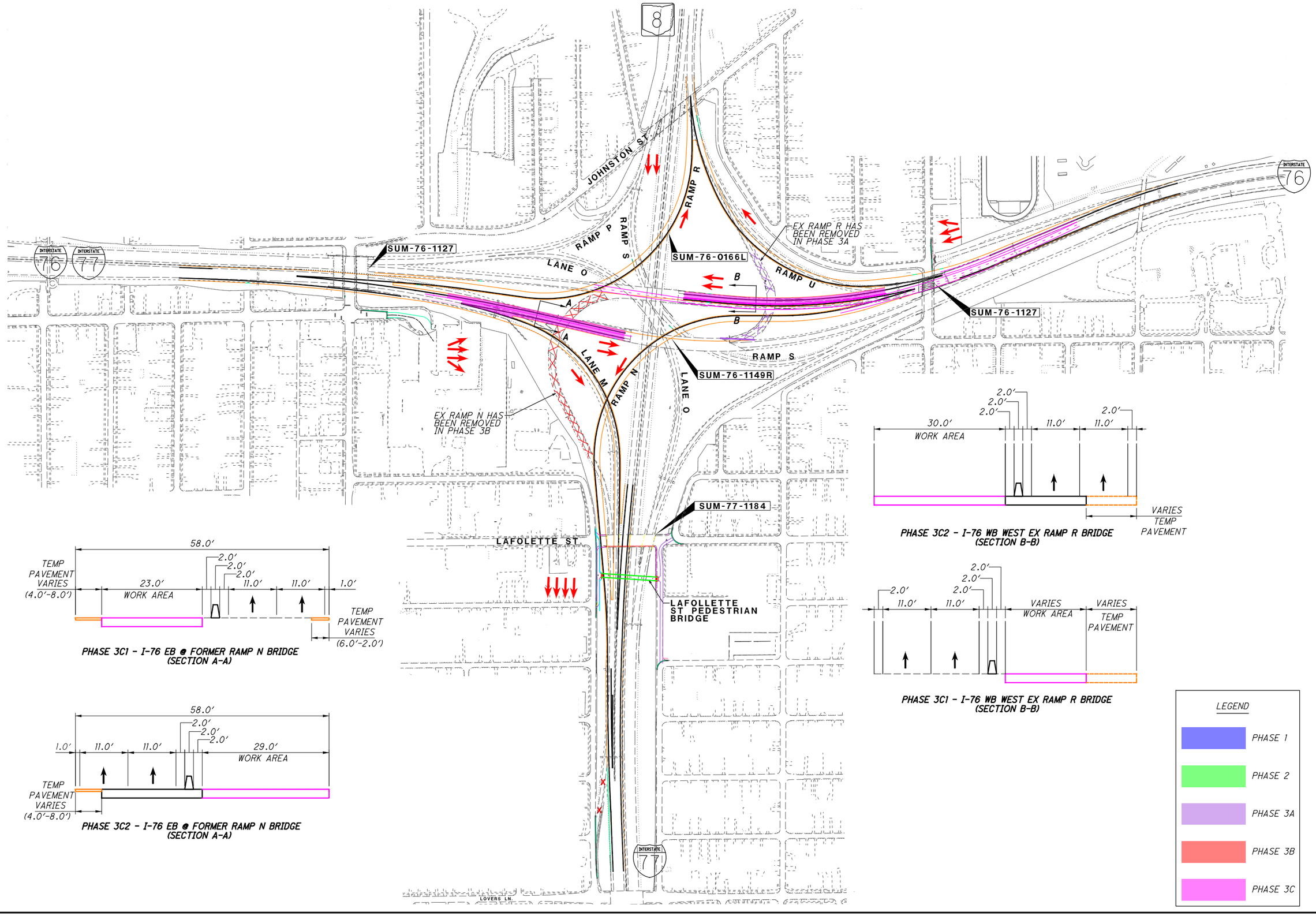
- PHASE 1
- PHASE 2
- PHASE 3A
- PHASE 3B
- PHASE 3C

HORIZONTAL SCALE IN FEET
0 100 200 400

CALCULATED AAF
CHECKED XXX

MAINTENANCE OF TRAFFIC
PHASE 3B - CONCEPTUAL PLAN

SUM-76/77-CI



PHASE 3C1 - I-76 EB @ FORMER RAMP N BRIDGE
(SECTION A-A)

PHASE 3C2 - I-76 EB @ FORMER RAMP N BRIDGE
(SECTION A-A)

PHASE 3C2 - I-76 WB WEST EX RAMP R BRIDGE
(SECTION B-B)

PHASE 3C1 - I-76 WB WEST EX RAMP R BRIDGE
(SECTION B-B)

HORIZONTAL SCALE IN FEET
0 100 200 400

CALCULATED AAF
CHECKED XXX

MAINTENANCE OF TRAFFIC
PHASE 3C - CONCEPTUAL PLAN

SUM-76/77-CI

5/5

APPENDIX B

Work Zone Constraints Table (696-1a)

Form 696-1a - Work Zone Constraints

Constraints	Work Zone Alternatives
Ability to meet Work Zone Policy	**Impact: Low** Two lanes of traffic will be maintained in each direction on I-76 at all times throughout the project length. Lane shifts and merges to be designed for 55 mph. There are no mainline lane closures.
Ability to Maintain All Access	Ramps N and R and Lane M will be temporarily closed during ramp reconfiguration. An intentional effort was put forth to not have concurrent ramp closures that would use the same directional detour along the Beltway and potentially impair operations. See Ramp Information table in Appendix D.
Ability to Provide Required On-Ramp Merge Decision Sight Distance	**Impact: Low** All ramp merge decision dsght distances meet the required 1135' for the 55 MPH design.
Right-of-Way Impacts	**Impact: None**
Environmental Impacts	**Impact: None**
Bridge Widths	**Impact: Low** The WB I-76 Bridge over Inman Street will need to be widened to maintain 11' lanes and a 2' shy distance. Other structures; Lafollette St Bridge over I-77, Ramp R over I-77, Ramp N over I-76 will need to be removed prior to the work under them can be completed, but they are to be removed or replaced as a permanent improvement.
Significant Impacts for Construction Duration and/or Construction Costs	**Impact: Medium** This project is proposed to be phased over 3 full construction seasons. The tall flyover bridges for Ramps N and R have driven the durations throughout the project requiring long construction times due to their height and lengths. To minimize ramp closure durations, the existing ramps are being kept in service as long as possible yet this does delay the widening of I-76 that is proposed to be completed during Phase 3C.
Significant Impacts to Earthwork, Retaining Walls, Pier Clearances, Profile Differences, etc.	**Impact: Medium** Additional embankment will be required on the north side of I-76 WB (running parallel to the existing Inman Street off-ramp) for the placement of temporary pavement.
Ability to Maintain Existing Drainage and Lighting Systems	**Impact: Medium** Existing lighting can be maintained throughout all phases of MOT opperations. Median inlets along I-76 WB and I-77 SB can be maintained but may require mitigation efforts to meet the flow requirements.
Constructability; and Construction Equipment Access	All methods of construction will require at least one phase of construction where traffic will be maintained next to the work zone, however contractor access can be provided. In Phase 1, traffic is maintained on both sides of construction on SR-8/I-77/Lane M are constructed, access can be provided from the north end of the construction zone. In Phase 3A, traffic will be maintained on both side of construction on I-76 WB, equipment access can be provided from the west end of the constructon zone. In all other phases, construction access can be maintained per Standard Construction Drawing MT-103.10. Access points will be designed in detailed design.
Location of Crossovers (e.g., Can crossovers be located near the project?)	**Impact: None** No Crossovers Needed.
What are the Access Impacts to Important Traffic Generators such as Hospitals, Fire Departments, Industries, Sports Arenas, etc.	There are major traffic generators in the Akron area including the University of Akron and Summa Hospital, but proposed ramp closures have been in place on past projects and District 4 was pleased with the beltway's operational performance to facilitate those detours. During prior detours, the traffic generator have not expierence any issues with traffic opperation.
For Concrete Pavements, the Longitudinal Joints must be Located at the Lane Lines.	**Impact: Low** Joints on lane line will not be possible on Ramp U, I-76 and I-77 unless additional temporary widening is used. Therefore, flexible pavement is currently being proposed.
Ramps - Can the existing number of ramp lanes be maintained?	**Impact: Low** All existing ramps are single lane ramps. The following ramps will be closed (duration): Ramp R (60 days), Ramp N (6 months), and Lane M (8 months).

APPENDIX C

Bridge Information Form (696-2a)

Bridge Information

								MOT			
BRIDGE NAME	STATION	EXTENT OF WORK	TYPE OF BRIDGE	LENGTH OF BRIDGE	PIER SPACING	EXISTING BRIDGE WIDTH	FUTURE BRIDGE WIDTH	ADDITIONAL WIDTH NEEDED	COST OF 32" PCB BRIDGE MOUNTED	COST OF RETAINING WALLS	COST OF ADDITIONAL BRIDGE WIDENING
SUM-76-1149R New Ramp N (WB to SB)		New	Ramp	635'	Varies, 137' max.	33'-8" t/t/ barrier	30' t/t/ barrier	0	$0	$0	$0
SUM-76-1149R Ex Ramp N		Removal	Ramp	139'	49'-6"	34'-4"		0	$0	$0	$0
SUM-76-0166L New Ramp R (EB to NB)		New	Ramp	848'	Varies, 157' max.	33'-8" t/t/ barrier	30' t/t/ barrier	0	$0	$0	$0
SUM-76-0166L Ex Ramp R		Removal	Ramp	240'	52'-1" over I-76 EB 52'-2" over Ramp M	34'-4"		0	$0	$0	$0
SUM-76-1127 Brown St		Widening	Mainline	160'	66' - 6"	Varies 68'-3" to 71'-6"	Varies 84'-3" to 89'-6"	0	$5,280	$0	$0
SUM-76-1179L Inman St		Widening	Mainline	59'	N/A	55' t/t/ barrier	Varies 80'-1 1/2" to 83'-8 3/4"	5 FT	$5,280	$0	$60,000
SUM-77-1184 Lafollette Pedestrian		New	Pedestrian	249'	116'-5 1/2" over 1-77 SB 132'-9 3/4" over 1-77 NB	NA	14' f/f/ railing	0	$0	$0	$0
SUM-77-1184 Ex Lafollette St		Removal	Local	218'-6"	53'-0" over Ramp N and Lane M 51'-2" Over SR-8	44'-0"	NA	0	$0	$0	$0
									$10,560	**$0**	**$60,000**
Overhead bridges below require no improvement to facilitate MOT traffic pattern <u>WEST OF WORK AREA</u>											
Overhead bridges below require no improvement to facilitate MOT traffic pattern <u>EAST OF WORK AREA</u>											

APPENDIX D

Ramp Information Form (696-3a)

Ramp Information

INTERCHANGE	RAMP DESIGNATION	NUMBER OF LANES	RAMP VOLUME (%Trucks)	RAMP CLOSURE							DETOUR
				PHASE 1	PHASE 2	PHASE 3A	PHASE 3B	PHASE 3C	DURATION OF CLOSURE (months)	DECISION SIGHT DISTANCE (FT)	
Central Interchange (I-76, I-77, & SR-8)	WB I-76 to NB SR-8 (Ramp U)	1	12100 (6%)	N	N	N	N	N	N/A	ADD LANE	N/A
	WB I-76 to SB I-77 (Ramp N)	1	14590 (5%)	N	N	N	Y	N	6	1150	WEST BELTWAY
	EB I-76 to NB SR-8 (Ramp R)	1	15570 (8%)	N	N	Y	Y	N	2	ADD LANE	WEST BELTWAY
	EB I-76 to SB I-77 (Lane M)	1	21800 (3%)	Y	N	N	N	N	8	ADD LANE	WEST BELTWAY
	SB SR-8 to WB I-76/I-77	1	16700 (4%)	N	N	N	N	N	N/A	ADD LANE	NO IMPACT
	SB SR-8 to EB I-76	1	10960 (5%)	N	N	N	N	N	N/A	ADD LANE	NO IMPACT
	NB I-77 to WB I-76/I-77	1	19470 (1%)	N	N	N	N	N	N/A	ADD LANE	NO IMPACT
	NB I-77 to EB I-76	1	13750 (6%)	N	N	N	N	N	N/A	ADD LANE	NO IMPACT
Arlington Ave/Fuller St & I-76	WB I-76 to Fuller Street	1	5730 (4%)	N	N	N	N	N	N/A	N/A	NO IMPACT
	Fuller Street to WB I-76	1	5680 (6%)	N	N	Y	Y	N	12	1500	INNOVATION WAY/3RD AVENUE RAMP

NOTE: ALL OTHER RAMPS (NOT LISTED) AT THE INTERCHANGE ARE EXPECTED TO REMAIN OPEN DURING CONSTRUCTION.

APPENDIX E

Cost Comparison Form (696-4a)

MOT Cost

	Cost
Additional Right-of-Way	$0
Temporary Walls	$0
Additional Bridge Deck Width	$60,000
32" PCB Bridge Mounted	$10,560
Cut/Fill/Shoring	$0
Lighting	$0
Drainage	$0
Temporary Pavement	$100,000
Portable Concrete Barrier	$390,000
Subtotal:	$560,560
15% Contingency	$84,084
MOT RELATED COST	**$650,000**

APPENDIX F

Spread Calculations

INLET SPACING DESIGN

PID : 55239 **Date :** 10/02/2007 **Project :** SUM-76/77 CI **Location :** IR76 (EB) - Brown St Overpass

Description : Phase 1 - IR76 (EB) at Brown St Overpass (Exisitng Inlet Spacing) **Designer :** GF - PEK

Rainfall Area: A **Storm Frequency (yr.) :** 2 **Total Allow. Spread (ft.) :** 3.00 **Allowable Depth (ft.)** 0.13

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	RUNOFF AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	TIME USED (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH FLOW (ft.)	PAVT. SPREAD (ft.)
0+00	Begin																	
6+20	I-3C	620.00	0.90	0.14	1.88	4.32	10.00	0.0400	0.0420	0.0156	2.00	0.1670	3.60	0.45	0.00	0.45	0.106	3.39
9+60	I-3C	340.00	0.90	0.16	2.75	2.33	10.00	0.0400	0.0420	0.0156	2.00	0.0167	3.60	0.44	0.08	0.52	0.110	3.70
13+40	I-3C	380.00	0.90	0.26	2.75	3.24	10.00	0.0192	0.0420	0.0156	2.00	0.1670	3.60	0.92	0.00	0.92	0.149	6.19

INLET SPACING DESIGN

PID : 55239 **Date :** 10/02/2007 **Project :** SUM-76/77 CI **Location :** IR77 (SB) Inside Lanes

Description : Phase 1 - IR77 SB, Inside Lanes (Exisitng Inlet Spacing) **Designer :** GF - PEK

Rainfall Area: A **Storm Frequency (yr.) :** 2 **Total Allow. Spread (ft.) :** 3.00 **Allowable Depth (ft.)** 0.13

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	RUNOFF AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	TIME USED (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH FLOW (ft.)	PAVT. SPREAD (ft.)	
0+00	Begin																		
3+85	I-3A	385.00	0.90	0.28	2.26	2.69	10.00	0.0250	0.0400	0.0156	3.00	0.1670	3.60	0.91	0.00	0.91	0.147	4.74*	
8+65	I-3A	480.00	0.90	0.37	2.26	3.22	10.00	0.0250	0.0400	0.0156	3.00	0.1670	3.60	1.13	0.07	1.20	0.162	5.69*	
10+80	I-3A	215.00	0.90	0.17	2.26	1.60	10.00	0.0250	0.0400	0.0156	3.00	0.1670	3.60	0.62	0.00	0.62	0.129	3.55*	
13+70	I-3A	290.00	0.90	0.06	1.55	2.65	10.00	0.0250	0.0400	0.0156	3.00	0.1670	3.60	0.19	0.00	0.19	0.083	2.08	
17+95	I-3A	425.00	0.90	0.09	1.55	4.77	10.00	0.0120	0.0400	0.0156	10.00	0.1670	3.60	0.29	0.00	0.29	0.111	2.78	
18+85	I-3A	90.00	0.90	0.02	1.55	1.95	10.00	0.0050	0.0400	0.0156	10.00	0.1670	3.60	******	******	0.06	0.074	1.86	Sag
33+15	Begin																		
31+45	I-3A	170.00	0.90	0.03	1.55	1.91	10.00	0.0220	0.0400	0.0156	10.00	0.1670	3.60	0.10	0.00	0.10	0.066	1.64	
26+45	I-3A	500.00	0.90	0.09	1.55	4.45	10.00	0.0220	0.0400	0.0156	10.00	0.1670	3.60	0.29	0.00	0.29	0.099	2.48	
23+35	I-3A	310.00	0.90	0.06	1.55	2.99	10.00	0.0220	0.0400	0.0156	10.00	0.1670	3.60	0.19	0.00	0.19	0.085	2.13	
22+45	I-3A	90.00	0.90	0.02	1.55	1.39	10.00	0.0120	0.0400	0.0156	10.00	0.1670	3.60	0.06	0.00	0.06	0.063	1.58	
18+85	I-3A	360.00	0.90	0.07	1.55	6.08	10.00	0.0050	0.0400	0.0156	10.00	0.1670	3.60	******	******	0.23	0.119	2.98	End

SUMP DATA

*Additional Structures to be added in Stage 2 design to reduce spread.

Total Flow (cfs) : 0.29 **Ponded Depth (ft.) :** 0.000 **Spread on Pavement (ft.) :** 0.00

INLET SPACING DESIGN

PID : 55239 **Date :** 10/02/2007 **Project :** SUM-76/77 CI **Location :** IR77 (SB) Outside Lanes

Description : Phase 1 - IR77 SB, Outside Lanes (Exisitng Inlet Spacing) **Designer :** GF - PEK

Rainfall Area: A **Storm Frequency (yr.) :** 2 **Total Allow. Spread (ft.) :** 3.00 **Allowable Depth (ft.)** 0.50

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	RUNOFF AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	TIME USED (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH FLOW (ft.)	PAVT. SPREAD (ft.)	
0+00	Begin																		
13+70	CB-3A	1370.00	0.85	0.32	0.86	9.02	10.00	0.0250	0.0400	0.0156	10.00	0.0000	3.60	0.80	0.17	0.98	0.152	3.81	
17+95	CB-3A	425.00	0.75	0.83	1.55	2.74	10.00	0.0120	0.0400	0.0156	10.00	0.0000	3.60	1.53	0.88	2.41	0.245	6.14	
18+85	CB-3	90.00	0.75	0.22	1.55	0.93	10.00	0.0050	0.0400	0.0156	10.00	0.0000	3.60	******	******	1.47	0.240	6.01	Sag
29+40	Begin																		
26+40	CB-3A	300.00	0.75	0.34	1.55	1.93	10.00	0.0220	0.0400	0.0156	10.00	0.0000	3.60	0.76	0.16	0.92	0.152	3.81	
22+65	CB-3A	375.00	0.75	0.54	1.55	2.11	10.00	0.0220	0.0400	0.0156	10.00	0.0000	3.60	1.18	0.44	1.62	0.188	4.71	
19+90	CB-3A	275.00	0.75	0.37	1.55	2.03	10.00	0.0120	0.0400	0.0156	10.00	0.0000	3.60	1.05	0.39	1.44	0.202	5.05	
18+85	CB-3	105.00	0.75	0.17	1.55	1.24	10.00	0.0050	0.0400	0.0156	10.00	0.0000	3.60	******	******	0.85	0.195	4.88	End

SUMP DATA

Total Flow (cfs) : 2.32 **Ponded Depth (ft.) :** 0.182 **Spread on Pavement (ft.) :** 5.94

INLET SPACING DESIGN

PID : 55239 **Date :** 10/02/2007 **Project :** SUM-76/77 CI **Location :** IR76 (WB) - Inman St Overpass

Description : Phase 2 - IR76 (WB) at Inman St Overpass (Exisitng Inlet Spacing) **Designer :** GF - PEK

Rainfall Area: A **Storm Frequency (yr.) :** 2 **Total Allow. Spread (ft.) :** 3.00 **Allowable Depth (ft.)** 0.13

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	RUNOFF AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	TIME USED (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH FLOW (ft.)	PAVT. SPREAD (ft.)
0+00	Begin																	
4+00	I-3C	400.00	0.90	0.25	2.60	3.58	10.00	0.0180	0.0420	0.0156	2.00	0.1670	3.60	0.81	0.00	0.81	0.145	5.92
9+50	I-3C	550.00	0.90	0.13	2.60	5.46	10.00	0.0180	0.0420	0.0156	2.00	0.1670	3.60	0.42	0.00	0.42	0.118	4.16
10+75	I-3C	125.00	0.90	0.01	2.60	2.01	10.00	0.0180	0.0420	0.0156	2.00	0.1670	3.60	0.03	0.00	0.03	0.046	1.10

INLET SPACING DESIGN

PID : 55239 **Date :** 10/02/2007 **Project :** SUM-76/77 CI **Location :** IR76 (EB) - Johnston St Overpass

Description : Phase 3 - Lane U (EB/NB) at Johnston St Overpass (Exisitng Inlet Spacing) **Designer :** GF - PEK

Rainfall Area: A **Storm Frequency (yr.) :** 2 **Total Allow. Spread (ft.) :** 3.00 **Allowable Depth (ft.)** 0.13

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	RUNOFF AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	TIME USED (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH FLOW (ft.)	PAVT. SPREAD (ft.)	
0+00	Begin																		
0+55	CB-3A	55.00	0.90	0.03	1.75	0.45	10.00	0.0300	0.0800	0.0800	2.00	0.0000	3.60	0.10	0.00	0.10	0.080	1.00	
2+60	CB-3A	205.00	0.90	0.10	1.75	1.27	10.00	0.0300	0.0800	0.0800	2.00	0.0000	3.60	0.32	0.00	0.32	0.126	1.58	
3+70	I-3C	110.00	0.90	0.05	1.75	1.27	10.00	0.0090	0.0800	0.0800	2.00	0.1670	3.60	******	******	0.16	0.122	1.52	Sag
7+30	Begin																		
4+60	I-3C	270.00	0.90	0.13	2.95	2.78	10.00	0.0100	0.0500	0.0500	2.00	0.1670	3.60	0.42	0.00	0.42	0.143	2.87	
3+70	I-3C	90.00	0.09	0.04	1.93	2.08	10.00	0.0080	0.0800	0.0800	2.00	0.1670	3.60	******	******	0.01	0.048	0.60	End

SUMP DATA

Total Flow (cfs) : 0.17 **Ponded Depth (ft.) :** 0.032 **Spread on Pavement (ft.) :** 0.19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