AECOM Imagine it. Delivered.

DEL-IR 71-3.550 Feasibility Study

PID 76908

Delaware County Engineer

July 2020

Ohio Department of Transportation

AECOM
277 West Nationwide
Boulevard Columbus, OH
43215 aecom.com

The environmental review, consultation, and other actions required by applicable Federal environmental laws for this project are being, or have been, carried-out by ODOT pursuant to 23 U.S.C. 327 and a Memorandum of Understanding dated June 6, 2018, and executed by FHWA and ODOT.

TABLE OF CONTENTS

Appendices

Figures

Tables

1.0 INTRODUCTION

The purpose of this report is to present improved access alternatives to/from IR 71 in southern Delaware County and identify a preferred alternative for detailed engineering design. The project study area (Figure 1) extends along IR 71 from the IR 270 interchange to the US 36/SR 37 interchange, encompassing the Polaris Parkway/Gemini Place interchange. Within the area there is a system interchange with IR 270, a split diamond interchange with collector-distributor roads and a loop ramp at Polaris Parkway/Gemini Place and a standard diamond interchange at US 36/SR 37. The US 36/SR 37 interchange will be improved by providing additional ramps at Sunbury Parkway, just south of the existing diamond interchange, prior to construction of the proposed Big Walnut Road interchange. There is also an existing rest area on IR 71 north of the proposed Big Walnut Road interchange, which will have adequate spacing from the proposed ramps and will not impact operations. Surface streets included in the study area are Lewis Center Road/Big Walnut Road from Bale Kenyon Road to SR 3 and Africa Road from Lewis Center Road/Big Walnut Road to Jaycox Road.

1.1 PROJECT HISTORY

The Delaware County Engineer initiated this study in 2015 to evaluate the potential of improving regional access in southern Delaware County by providing direct access to the freeway for residents. As part of ODOT's Project Development Process, the Office of Roadway Engineering is required to review and approve this Feasibility Study prior to the Interchange Justification Study. It is assumed that the access request will be processed in a two-step process. The first step is a finding of operational and engineering acceptability in accordance with FHWA policy requirements. The second step is final approval of the access request following approval of the NEPA document, anticipated to be a D2 categorical exclusion document. The access request will require re-evaluation by FHWA if it does not progress to construction within 3 years of final approval. The initial operational and engineering acceptability determination can likely utilize existing basemapping and GIS data from this report. A field survey will be conducted during the design phase of work.

2.0 PURPOSE & NEED SUMMARY

The primary purpose of this project is to improve regional access for southern Delaware County by creating system linkage in the regional network and by removing regional traffic from congested local routes. System linkage between the existing primary north/south regional corridor and a new east/west regional corridor will support travel patterns for up to 90% of the county population. Removing congested local roadways from the regional access network will also support those travel patterns. A secondary purpose of this action is to improve access to Alum Creek State Park for visitors from outside the region. The largest attractions within the State Park do not have direct access to the regional access corridors. Improving their direct access will assist with wayfinding for visitors to the region and will reduce the impact of large vehicles on the local county roadway network.

3.0 ALTERNATIVES

3.1 ALTERNATIVES CONSIDERED AND DISMISSED

Four alternatives were developed for improving access within southern Delaware County. The No-Build condition was analyzed to be used as a baseline for comparison to the other three Build alternatives. A traditional diamond interchange was dismissed by the Core Project Team to limit the amount of queuing on Big Walnut Road, in addition to minimizing impacts to the surrounding land. A traditional SB exit ramp in the NW quadrant of the interchange would impact an area of the park similar in size to area needed for both ramps as configured in Alternative 2 connecting with Africa Road. Alternatives 1 and 3 minimize impact to the park property while Alternative 2 minimizes impact to private property. The configuration of traditional diamond interchange ramps for the southbound connections would not significantly reduce the impact to either the park or private property. The three Build alternatives accounted for improvements on Big Walnut Road from Africa Road to SR 3 by adding a second through lane in each direction and turn lanes at the intersections as needed, in addition to freeway access.

3.2 FEASIBLE ALTERNATIVES

No-Build Alternative – This alternative takes no further action to improve the study area beyond the improvements which are already under development. Analyzing the impacts of the No-Build alternative essentially answers the question "What will happen to the study corridor if this study does nothing?" Comparing the impacts of the No-Build alternative to the impacts of the Build alternatives can quantify the real benefits of the Build alternatives apart from the benefits of already scheduled improvements.

IR 71 within the study area is comprised of three lanes in both the northbound and southbound direction from the Gemini Place interchange all the way north to the existing US 36/SR 37 interchange. Big Walnut Road is one-lane road in each direction from the intersection of Big Walnut Road/Bale Kenyon Road to the intersection of Big Walnut Road/SR 3 with auxiliary turn lanes provided at most intersection throughout the study area. Africa Road is a one-lane road in each direction with turn lanes at the Big Walnut intersection.

For the purposes of this study, the No-Build alternative assumes the proposed modification of projects FRA/DEL-71-27.77/0.00 (Gemini Parkway Interchange), PID 106741 and DEL-71-7.91, PID 90200 (US 36/SR 37 Interchange). The Gemini Parkway Interchange project will be constructed to widen IR 71 Southbound by providing an additional lane from the Gemini Place/Polaris Parkway Interchange to the IR 270 Westbound ramp. An additional lane will also be added on the IR 270 Westbound ramp from IR 71 Southbound. In addition to this widening, an opening from the Gemini Place on-ramp to IR 71 Southbound will be constructed. Currently a barrier wall separates this on-ramp. The US 36/SR 37 Interchange project will involve construction of a new interchange, south of the existing US 36/SR 37 interchange. This interchange will carry the new Sunbury Parkway over IR 71 and run east and west of the interstate, operating in conjunction with the existing interchange to the north at US 36/SR 37. Access to US 36/SR 37 and

Sunbury Parkway from northbound IR 71 will be accommodated by a collector/distributor road. On-ramps to IR 71 Southbound will be provided from Sunbury Parkway eastbound and westbound.

Alternative 1 – This alternative provides new access to IR 71 at Big Walnut Road for both northbound and southbound motorists. The southbound ramps will be located on Big Walnut Road in the southwest quadrant of the interchange, and the northbound ramps will be located on Big Walnut Road just east of the IR 71 bridge over Big Walnut Road. This alternative has a folded diamond configuration, with standard diamond ramps for access to northbound IR 71, a loop ramp for exit from southbound IR 71, and a diamond ramp adjacent to the loop ramp for entrance to southbound IR 71. Alternative 1A has a roundabout at the NB ramp terminal and Alternative 1B is signalized at the NB ramp terminal. The bypass lane for the roundabout option gets merged in between Medan Drive and Highland Hills Drive. Necessary improvements to Big Walnut Road and Africa Road have been incorporated into the design.

Alternative 2 – This alternative provides new access to IR 71 at Big Walnut Road for both northbound and southbound motorists. The southbound ramps will be located on Africa Road in the northwest quadrant of the interchange, and the northbound ramps will be located on Big Walnut Road just east of the IR 71 bridge over Big Walnut Road. The configuration is basically a standard diamond, but with access provided from separate roadways due to the southwest-to-northeast direction of the freeway. Alternative 2A has a roundabout at the NB ramp terminal and Alternative 2B is signalized at the NB ramp terminal. The bypass lane for the roundabout option gets merged in between Medan Drive and Highland Hills Drive. Necessary improvements to Big Walnut Road and Africa Road have been incorporated into the design.

Alternative 3 – This alternative provides new access to IR 71 at Big Walnut Road for both northbound and southbound motorists. The southbound ramps will be located on Africa Road in the southwest quadrant of the interchange, and the northbound ramps will be located on Big Walnut Road just east of the IR 71 bridge over Big Walnut Road. Alternative 3A has a roundabout at the NB ramp terminal and Alternative 3B is signalized at the NB ramp terminal. The bypass lane for the roundabout option gets merged in between Medan Drive and Highland Hills Drive. Necessary improvements to Big Walnut Road and Africa Road have been incorporated into the design.

Each alternative has advantages and disadvantages. The geometric layouts of both Alternative 1 and Alternative 3 require an entrance ramp in the southwest quadrant of the interchange. This quadrant has the only remaining developable land, which would be more attractive located immediately adjacent to the interchange ramps. However, further development in the area would also induce more new traffic to a freeway system that is already overcapacity. Alternative 2, consists of the southbound ramps in the northwest quadrant which is surrounded by the Army Corps of Engineers and would not allow for development adjacent to the interchange. Minimizing potential of future development is preferred given the congestion that already exists in the area. In addition, Alternative 2 provides more storage capacity on the ramps and Africa Road, compared to Alternatives 1 or 3.

Local road improvements were also investigated as part of the build alternatives. An additional

through lane in each direction on Big Walnut Road was analyzed along with turn lanes as needed at 10 intersection surrounding the proposed interchange at IR 71/Big Walnut Road. Conceptual layouts of all the alternatives are provided in Appendix A.

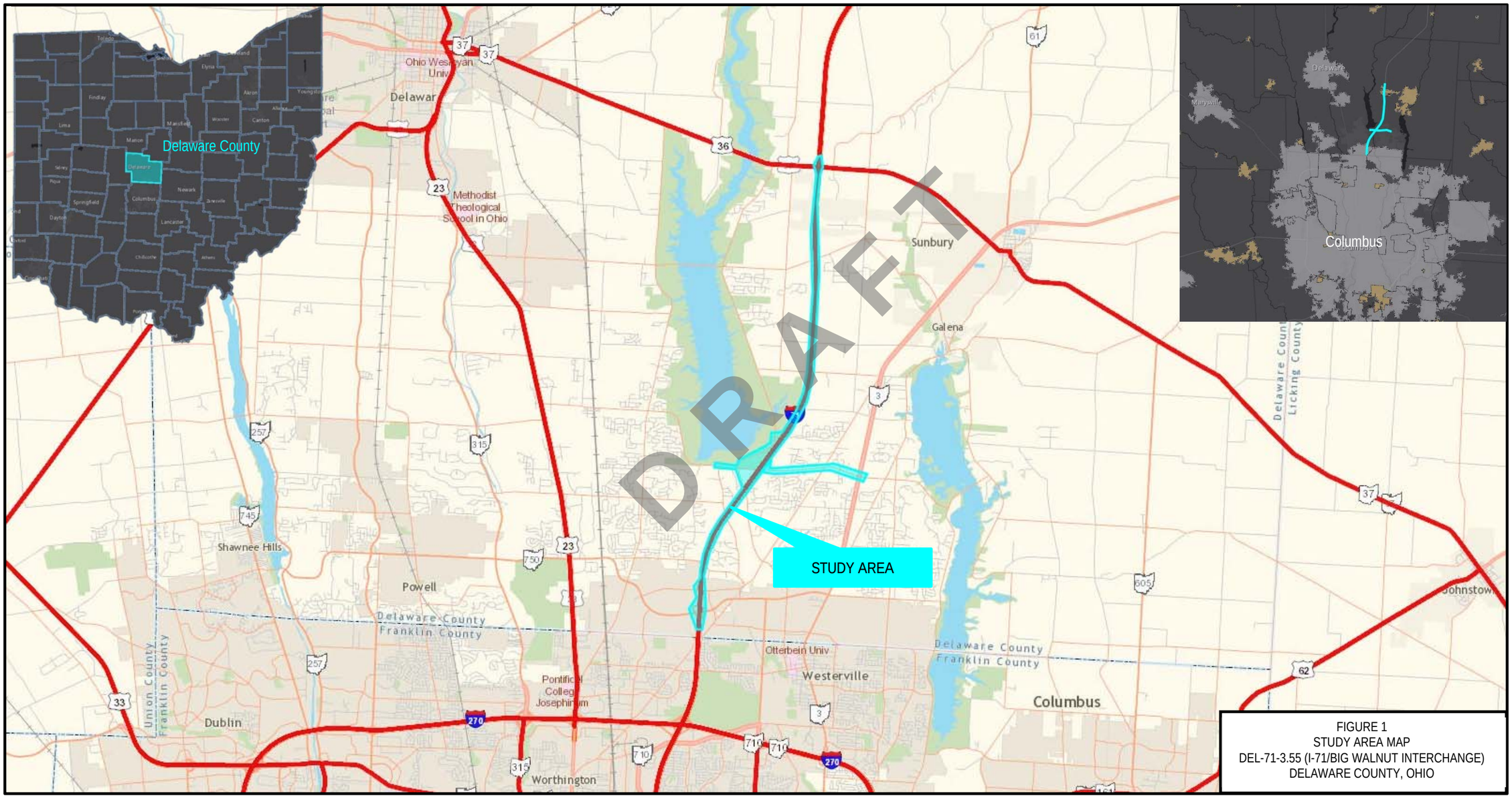


FIGURE 1
STUDY AREA MAP
DEL-71-3.55 (I-71/BIG WALNUT INTERCHANGE)
DELAWARE COUNTY, OHIO

4.0 KEY ISSUES

4.1 TRAFFIC ANALYSIS

Traffic Volumes

Certified traffic plates were prepared by ODOT Traffic Modeling & Forecasting on December 1, 2016, for the mainline IR 71 segments, existing ramps, proposed ramps and intersections immediately adjacent to the proposed interchange. No-Build and Build volumes were provided for 2040 Design Year traffic, and the Build traffic includes all three alternatives within the immediate vicinity of the proposed interchange. Updated certified traffic plates for Alternative 2 were provided on November 20, 2019, which includes the metering of the southbound entrance ramp to IR 71 from Africa Road during the AM period. These metered volumes were also used for alternatives 1 and 3. Per ODOT's LDM Section 102.2, only the 2040 Design Year traffic was analyzed for this report. Figure 2 shows the Traffic Pattern Change Map and compares the 2040 No-Build volumes and the 2040 Build volumes.

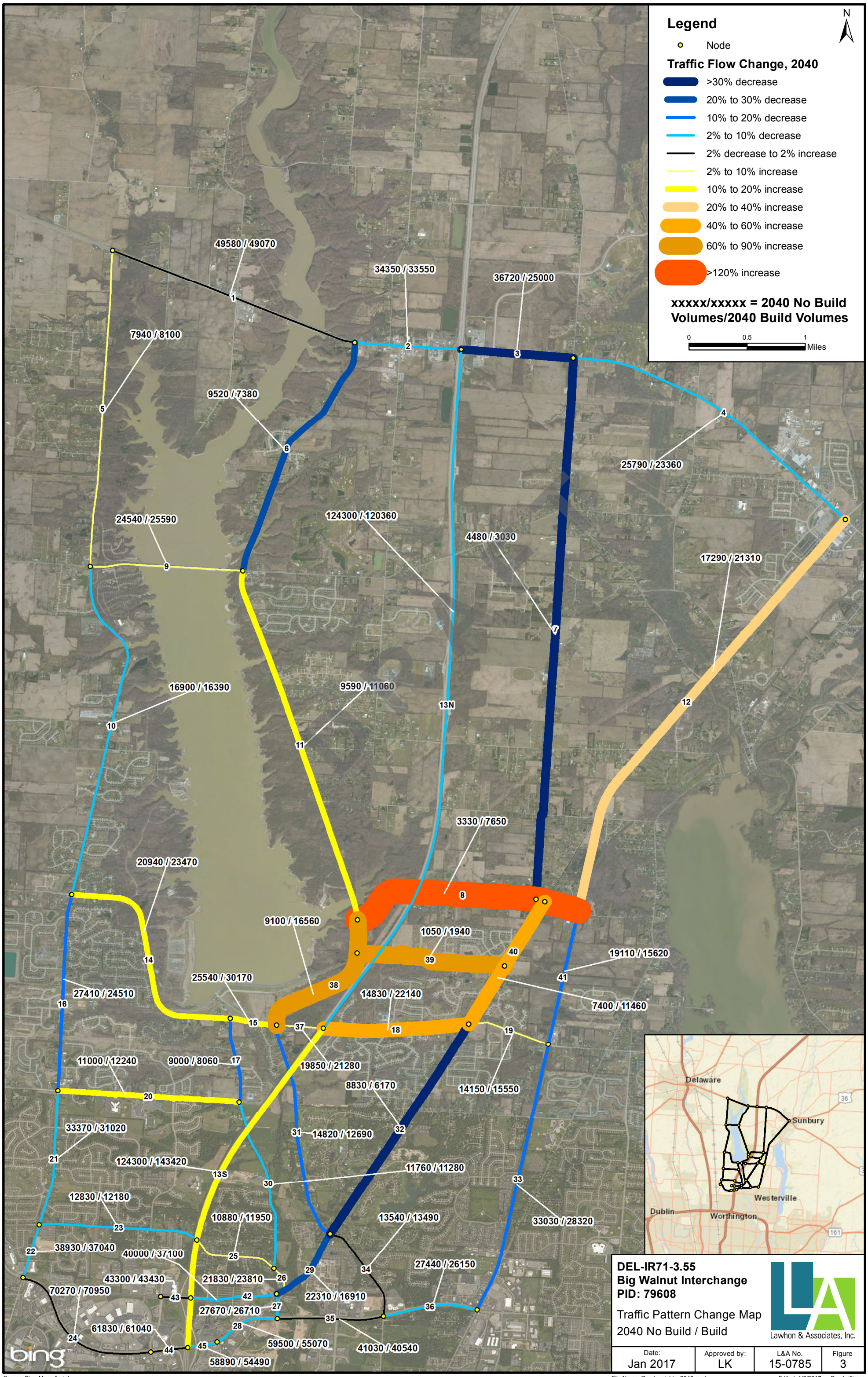
AECOM conducted turning movement traffic counts at the remaining local intersections along Big Walnut Road in February 2016 and used growth rates from the certified traffic to expand the volumes to 2040 Design Year. Volumes on local streets serving fully built residential neighborhoods did not have growth factors applied since no further development is anticipated. Copies of the certified traffic plates are provided in Appendix B, along with calculated volumes for the local intersections and modified freeway volumes due to constrained traffic.

Methodology and Software

Per ODOT methodology, Highway Capacity Software version 7.80 (HCS7), analyses were performed using the freeway facilities module for basic freeway segment and ramp merge/diverge segments within the study area with Design Year 2040 AM and PM peak hour volumes. HCS7 was also used to analyze the intersections along Lewis Center Road/Big Walnut Road and Africa Road. For purposes of this study intersection analysis was used to determine the number of lanes, cycle lengths and signal phasing needed to provide optimized operations at the study intersections.

Freeway Segment and Ramp Analysis

In order to determine any negative operational impacts of the proposed interchange on the existing interstate, the IR 71 basic freeway, ramp merge and diverge segments were analyzed in the freeway facilities module using HCS7 for the Design Year (2040) No-Build and Build conditions. The analysis included both AM and PM peak hours. Results of the freeway analysis for the No-Build and Build conditions are shown in Tables 1 and 2.



Source: Bing Maps Aerial

File Name: Road weights_2040.mxd

Edited: 1/9/2017 By: dwilliams

Table 1 – IR 71 2040 AM Freeway Capacity Analysis

I-71 Northbound	2040 AM Peak Hour (Constraint Volumes)															
	No-Build				Build Alternative 1				Build Alternative 2				Build Alternative 3			
	LOS	v/c	d/c	Density	LOS	v/c	d/c	Density	LOS	v/c	d/c	Density	LOS	v/c	d/c	Density
btwn I-270 and Polaris/Gemini 5-lane (Basic)	C	0.70	0.70	25.0	C	0.66	0.66	23.5	C	0.66	0.66	23.5	C	0.66	0.66	23.5
btwn I-270 and Polaris/Gemini 6-lane (Basic)	C	0.58	0.58	20.2	C	0.55	0.55	19.2	C	0.55	0.55	19.2	C	0.55	0.55	19.2
at Polaris/Gemini (Diverge)*	E	0.87	-	36.4	D	0.75	-	31.2	D	0.75	-	31.2	D	0.75	-	31.2
CD at Polaris (Diverge)*	E	0.89/0.72	0.89/0.72	37.0/41.2	E	0.77/0.70	0.77/0.70	32.0/37.7	E	0.77/0.70	0.77/0.70	32.0/37.7	E	0.77/0.70	0.77/0.70	32.0/37.7
CD at Polaris (Basic)	D	0.64	0.64	26.4	C	0.48	0.48	19.8	C	0.48	0.48	19.8	C	0.48	0.48	19.8
CD at Polaris (Merge)*	B	0.43/0.05	0.43/0.05	16.5/-	B	0.36/0.16	0.36/0.16	13.8/-	B	0.36/0.16	0.36/0.16	13.8/-	B	0.36/0.16	0.36/0.16	13.8/-
at Polaris/Gemini 4 lane (Basic)	A	0.23	0.23	7.9	A	0.25	0.25	8.7	A	0.25	0.25	8.7	A	0.25	0.25	8.7
at Polaris/Gemini 3 lane (Basic)	A	0.30	0.30	10.5	-	-	-	-	-	-	-	-	-	-	-	-
at Polaris/Gemini (Merge)*	B	0.34/0.15	0.34/0.15	12.6/10.1	B	0.29/0.20	0.29/0.20	10.7/12.2	B	0.29/0.20	0.29/0.20	10.7/12.2	B	0.29/0.20	0.29/0.20	10.7/12.2
btwn Polaris/Gemini and Big Walnut (Basic)	B	0.35	0.35	11.3	A	0.30	0.30	9.7	A	0.30	0.30	9.7	A	0.30	0.30	9.7
at Big Walnut (Diverge)*	-	-	-	-	A	0.30/0.18	0.30/0.18	9.5/2.0	A	0.30/0.18	0.30/0.18	9.5/2.0	A	0.30/0.18	0.30/0.18	9.5/2.0
at Big Walnut (Basic)	-	-	-	-	A	0.21	0.21	6.9	A	0.21	0.21	6.9	A	0.21	0.21	6.9
at Big Walnut (Merge)*	-	-	-	-	A	0.25/0.18	0.25/0.18	8.6/8.5	A	0.25/0.18	0.25/0.18	8.6/8.5	A	0.25/0.18	0.25/0.18	8.6/8.5
btwn Big Walnut and Sunbury/US36/SR37 4 lane(Basic)	-	-	-	-	A	0.25	0.25	8.3	A	0.25	0.25	8.3	A	0.25	0.25	8.3
btwn Big Walnut and Sunbury/US36/SR37 3 lane (Basic)	B	0.35	0.35	11.3	B	0.34	0.34	11.1	B	0.34	0.34	11.1	B	0.34	0.34	11.1
at Sunbury/US36/SR37 (Diverge)*	A	0.35/0.20	0.35/0.20	11.7/4.6	A	0.34/0.18	0.34/0.18	11.3/4.0	A	0.34/0.18	0.34/0.18	11.3/4.0	A	0.34/0.18	0.34/0.18	11.3/4.0
CD at Sunbury (Diverge)*	A	0.20/0.20	0.20/0.20	8.2/0.0	A	0.18/0.18	0.18/0.18	7.5/0.0	A	0.18/0.18	0.18/0.18	7.5/0.0	A	0.18/0.18	0.18/0.18	7.5/0.0
CD at Sunbury (Basic)	A	0.10	0.10	4.2	A	0.10	0.10	4.0	A	0.10	0.10	4.0	A	0.10	0.10	4.0
CD at Sunbury (Merge)*	A	0.13/0.05	0.13/0.05	5.1/4.9	A	0.12/0.05	0.12/0.05	4.9/4.7	A	0.12/0.05	0.12/0.05	4.9/4.7	A	0.12/0.05	0.12/0.05	4.9/4.7
at Sunbury/US36/SR37 (Basic)	A	0.22	0.22	7.3	A	0.22	0.22	7.3	A	0.22	0.22	7.3	A	0.22	0.22	7.3
at Sunbury/US36/SR37 (Merge)*	B	0.34/0.37	0.34/0.37	11.8/13.8	B	0.34/0.38	0.34/0.38	11.9/13.9	B	0.34/0.38	0.34/0.38	11.9/13.9	B	0.34/0.38	0.34/0.38	11.9/13.9
btwn US36/SR37 and SR61 (Basic)	A	0.33	0.33	10.9	A	0.34	0.34	11.0	A	0.34	0.34	11.0	A	0.34	0.34	11.0

I-71 Southbound	2040 AM Peak Hour															
	No-Build				Build Alternative 1				Build Alternative 2				Build Alternative 3			
	LOS	v/c	d/c	Density	LOS	v/c	d/c	Density	LOS	v/c	d/c	Density	LOS	v/c	d/c	Density
btwn SR61 and US36/SR37 (Basic)	C	0.60	0.60	20.1	C	0.64	0.64	22.0	C	0.63	0.63	21.4	C	0.66	0.66	22.7
at US36/SR37 (Diverge)*	C	0.60/0.32	0.60/0.32	20.2/21.5	C	0.64/0.34	0.64/0.34	21.8/23.0	C	0.63/0.34	0.63/0.34	21.4/22.6	C	0.66/0.34	0.66/0.34	22.4/23.6
at US36/SR37 (Basic)	B	0.51	0.51	16.5	B	0.54	0.55	18.0	B	0.53	0.54	17.5	C	0.56	0.57	18.6
at US36/SR37 (Merge)*	C	0.65/0.46	0.65/0.46	23.1/24.3	C	0.69/0.48	0.69/0.48	25.0/25.9	C	0.67/0.48	0.68/0.48	24.5/25.5	C	0.70/0.48	0.71/0.48	25.7/26.5
btwn US36/SR37 and Sunbury (Basic)	C	0.65	0.65	21.8	C	0.69	0.70	23.8	C	0.67	0.68	23.2	C	0.70	0.71	24.6
at Sunbury WB (Merge)	C	0.73/0.31	0.73/0.31	26.8/26.2	C	0.75/0.23	0.76/0.23	27.6/26.5	C	0.74/0.23	0.75/0.23	27.1/26.1	C	0.77/0.23	0.78/0.23	28.4/27.1
at Sunbury (Basic)	C	0.73	0.74	25.8	D	0.75	0.76	26.9	D	0.74	0.75	26.2	D	0.77	0.78	27.8
at Sunbury EB (Merge)	F	1.00/0.94	1.02/0.94	47.8/39.2	F	1.00/0.86	1.03/0.86	46.5/38.7	F	1.00/0.86	1.01/0.86	46.5/38.7	F	0.99/0.86	1.04/0.86	45.9/38.6
btwn Sunbury and Big Walnut (Basic)	F	1.00	1.02	44.9	F	1.00	1.03	44.9	F	1.00	1.01	44.9	F	0.94	1.04	47.5
at Big Walnut (Diverge)*	-	-	-	-	F	1.00/0.21	1.04/0.21	35.4/29.4	F	1.00/0.20	1.02/0.20	35.4/29.4	F	0.94/0.18	1.05/0.18	52.7/32.8
at Big Walnut (Basic)	-	-	-	-	E	0.94	0.98	39.2	E	0.94	0.97	39.3	F	0.88	1.00	60.1
at Big Walnut (Merge)*	-	-	-	-	F	0.99/0.18	1.03/0.18	39.8/34.1	F	0.99/0.18	1.02/0.18	39.9/34.2	F	0.93/0.18	1.06/0.18	36.0/32.2
btwn Big Walnut and Gemini (Basic)	F	1.00	1.02	44.9	F	0.99	1.02	44.3	F	0.99	1.01	44.5	F	0.93	1.05	38.6
at Gemini (Diverge)*	F	1.00/0.39	1.02/0.39	36.5/37.5	F	0.99/0.45	1.02/0.45	36.4/37.1	F	0.99/0.39	1.01/0.39	36.4/37.2	F	0.93/0.45	1.05/0.45	34.1/34.3
at Gemini (Basic)	E	0.89	0.90	35.5	D	0.86	0.89	34.0	E	0.88	0.90	35.4	D	0.80	0.92	30.2
at Gemini (Merge)*	E	0.96/0.28	0.98/0.28	40.6/35.4	D	0.94/0.27	0.96/0.27	39.0/34.4	E	0.96/0.27	0.97/0.27	40.4/35.2	D	0.87/0.30	0.99/0.30	35.7/32.3
btwn Gemini and Polaris (Basic)	E	0.97	0.99	42.2	E	0.95	0.97	40.1	E	0.97	0.99	42.0	F	0.88	1.00	35.3
at Polaris WB Ramp (Basic)	E	0.68	-	38.3	D	0.59	-	33.0	E	0.68	-	38.3	D	0.59	-	33.0
at Polaris EB Ramp (Basic)	E	0.71	-	39.7	E	0.67	-	37.7	E	0.71	-	39.7	E	0.67	-	37.7
at Polaris (Merge)*	E	0.83/0.69	0.84/0.69	40.1/43.8	E	0.79/0.63	0.81/0.63	35.2/41.3	E	0.83/0.69	0.84/0.69	39.9/43.7	E	0.76/0.63	0.83/0.63	33.2/40.8
btwn Polaris and I-270 (Basic)	D	0.84	0.86	32.4	D	0.80	0.83	30.2	D	0.84	0.86	32.4	D	0.76	0.84	28.2

*Freeway/Ramp

Legend

LOS F, v/c & d/c > 1.0, Density > 45.0

LOS E, v/c & d/c = 0.9 to 1.0, Density = 35.0 to 45.0

LOS D, Density = 26.0 (28.0 for ramps) to 35.0

Table 2 – IR 71 2040 PM Freeway Capacity Analysis

I-71 Northbound	2040 PM Peak Hour (Constraint Volumes)															
	No-Build				Build Alternative 1				Build Alternative 2				Build Alternative 3			
	LOS	v/c	d/c	Density	LOS	v/c	d/c	Density	LOS	v/c	d/c	Density	LOS	v/c	d/c	Density
btwn I-270 and Polaris/Gemini 5-lane (Basic)	E	0.95	0.95	40.2	F	1.00	1.02	45.0	F	1.00	1.02	45.0	F	1.00	1.02	45.0
btwn I-270 and Polaris/Gemini 6-lane (Basic)	D	0.79	0.79	29.6	D	0.83	0.85	32.0	D	0.83	0.85	32.0	D	0.83	0.85	32.0
at Polaris/Gemini (Diverge)*	D	0.64	-	26.4	C	0.54	-	22.2	C	0.54	-	22.2	C	0.54	-	22.2
CD at Polaris (Diverge)*	D	0.65/0.58	0.65/0.58	26.7/32.4	D	0.55/0.56	0.55/0.56	22.6/29.3	D	0.55/0.56	0.55/0.56	22.6/29.3	D	0.55/0.56	0.55/0.56	22.6/29.3
CD at Polaris (Basic)	B	0.41	0.41	17.1	B	0.29	0.29	11.8	B	0.29	0.29	11.8	B	0.29	0.29	11.8
CD at Polaris (Merge)*	B	0.31/0.14	0.31/0.14	12.0/-	A	0.26/0.25	0.26/0.25	10.0/-	A	0.26/0.25	0.26/0.25	10.0/-	A	0.26/0.25	0.26/0.25	10.0/-
at Polaris/Gemini 4 lane (Basic)	F	0.62	0.71	48.2	D	0.83	0.83	32.1	D	0.83	0.83	32.1	D	0.83	0.83	32.1
at Polaris/Gemini 3 lane (Basic)	F	0.82	0.95	70.5	-	-	-	-	-	-	-	-	-	-	-	-
at Polaris/Gemini (Merge)*	F	0.93/0.39	1.07/0.39	38.4/31.7	D	0.95/0.54	0.95/0.54	39.0/35.0	D	0.95/0.54	0.95/0.54	39.0/35.0	D	0.95/0.54	0.95/0.54	39.0/35.0
btwn Polaris/Gemini and Big Walnut (Basic)	F	0.93	1.07	38.5	E	0.95	0.96	40.3	E	0.95	0.96	40.3	E	0.95	0.96	40.3
at Big Walnut (Diverge)*	-	-	-	-	C	0.95/0.46	0.96/0.46	32.6/24.0	C	0.95/0.46	0.96/0.46	32.6/24.0	C	0.95/0.46	0.96/0.46	32.6/24.0
at Big Walnut (Basic)	-	-	-	-	D	0.74	0.74	26.4	D	0.74	0.74	26.4	D	0.74	0.74	26.4
at Big Walnut (Merge)*	-	-	-	-	C	0.76/0.18	0.79/0.18	26.9/23.6	C	0.76/0.18	0.79/0.18	26.9/23.6	C	0.76/0.18	0.79/0.18	26.9/23.6
btwn Big Walnut and Sunbury/US36/SR37 4 lane(Basic)	-	-	-	-	F	0.70	0.79	69.0	F	0.70	0.79	69.0	F	0.70	0.79	69.0
btwn Big Walnut and Sunbury/US36/SR37 3 lane (Basic)	F	0.93	1.07	38.5	F	0.93	1.05	38.5	F	0.93	1.05	38.5	F	0.93	1.05	38.5
at Sunbury/US36/SR37 (Diverge)*	F	0.93/0.77	1.08/0.77	35.1/32.8	F	0.93/0.72	1.05/0.72	34.7/31.8	F	0.93/0.72	1.05/0.72	34.7/31.8	F	0.93/0.72	1.05/0.72	34.7/31.8
CD at Sunbury (Diverge)*	C	0.78/0.94	0.78/0.94	33.5/20.4	B	0.72/0.86	0.72/0.86	30.8/18.1	B	0.72/0.86	0.72/0.86	30.8/18.1	B	0.72/0.86	0.72/0.86	30.8/18.1
CD at Sunbury (Basic)	B	0.32	0.32	13.4	B	0.31	0.31	12.7	B	0.31	0.31	12.7	B	0.31	0.31	12.7
CD at Sunbury (Merge)*	B	0.38/0.09	0.38/0.09	15.0/13.3	B	0.36/0.10	0.36/0.10	14.4/12.9	B	0.36/0.10	0.36/0.10	14.4/12.9	B	0.36/0.10	0.36/0.10	14.4/12.9
at Sunbury/US36/SR37 (Basic)	B	0.46	0.59	14.9	B	0.49	0.59	16.0	B	0.49	0.59	16.0	B	0.49	0.59	16.0
at Sunbury/US36/SR37 (Merge)*	C	0.59/0.44	0.73/0.44	21.1/22.7	C	0.63/0.45	0.73/0.45	22.6/24.0	C	0.63/0.45	0.73/0.45	22.6/24.0	C	0.63/0.45	0.73/0.45	22.6/24.0
btwn US36/SR37 and SR61 (Basic)	C	0.59	0.72	19.6	C	0.63	0.73	21.2	C	0.63	0.73	21.2	C	0.63	0.73	21.2

I-71 Southbound	2040 PM Peak Hour															
	No-Build				Build Alternative 1				Build Alternative 2				Build Alternative 3			
	LOS	v/c	d/c	Density	LOS	v/c	d/c	Density	LOS	v/c	d/c	Density	LOS	v/c	d/c	Density
btwn SR61 and US36/SR37 (Basic)	B	0.53	0.53	17.3	B	0.54	0.54	17.8	B	0.53	0.53	17.5	B	0.38	0.38	12.4
at US36/SR37 (Diverge)*	C	0.53/0.58	0.53/0.58	18.2/20.2	C	0.54/0.54	0.54/0.54	18.4/20.3	B	0.53/0.54	0.53/0.54	18.1/20.0	B	0.38/0.54	0.38/0.54	13.1/14.7
at US36/SR37 (Basic)	B	0.37	0.37	12.00	B	0.37	0.37	12.2	B	0.36	0.36	11.9	A	0.21	0.21	6.9
at US36/SR37 (Merge)*	B	0.44/0.24	0.44/0.24	15.4/16.2	B	0.45/0.27	0.45/0.27	15.8/16.8	B	0.44/0.27	0.44/0.27	15.5/16.5	B	0.29/0.27	0.29/0.27	10.2/11.4
btwn US36/SR37 and Sunbury (Basic)	B	0.44	0.44	14.4	B	0.45	0.45	15.0	B	0.45	0.45	14.7	A	0.30	0.30	9.7
at Sunbury WB (Merge)	B	0.48/0.13	0.48/0.13	16.8/16.7	B	0.48/0.09	0.48/0.09	16.9/16.6	B	0.47/0.09	0.47/0.09	16.6/16.3	B	0.32/0.09	0.32/0.09	11.2/11.2
at Sunbury (Basic)	B	0.48	0.48	15.7	B	0.48	0.48	15.8	B	0.47	0.47	15.5	A	0.32	0.32	10.6
at Sunbury EB (Merge)	C	0.61/0.43	0.61/0.43	21.7/22.9	C	0.59/0.37	0.59/0.37	21.1/22.1	C	0.58/0.37	0.58/0.37	20.8/21.9	B	0.43/0.37	0.43/0.37	15.2/16.8
btwn Sunbury and Big Walnut (Basic)	C	0.60	0.60	20.2	C	0.59	0.59	19.8	C	0.58	0.58	19.5	B	0.43	0.43	14.3
at Big Walnut (Diverge)*	-	-	-	-	B	0.60/0.19	0.60/0.19	20.8/15.4	B	0.59/0.20	0.59/0.20	20.6/15.2	A	0.44/0.15	0.44/0.15	15.3/9.8
at Big Walnut (Basic)	-	-	-	-	B	0.54	0.54	18.0	B	0.53	0.53	17.6	B	0.40	0.40	13.1
at Big Walnut (Merge)*	-	-	-	-	C	0.67/0.42	0.67/0.42	24.2/24.6	C	0.62/0.29	0.62/0.29	22.0/22.0	B	0.53/0.43	0.53/0.43	18.6/19.7
btwn Big Walnut and Gemini (Basic)	C	0.60	0.60	20.2	C	0.67	0.67	23.2	C	0.62	0.62	20.9	B	0.53	0.53	17.6
at Gemini (Diverge)*	C	0.60/0.20	0.60/0.20	21.5/23.8	C	0.67/0.23	0.67/0.23	24.0/26.1	C	0.62/0.23	0.62/0.23	22.0/24.4	C	0.53/0.23	0.53/0.23	18.8/21.4
at Gemini (Basic)	C	0.54	0.54	19.0	C	0.60	0.60	21.3	C	0.55	0.55	19.2	B	0.46	0.46	16.1
at Gemini (Merge)*	C	0.67/0.42	0.67/0.42	25.9/26.4	D	0.72/0.41	0.72/0.41	28.3/28.1	C	0.67/0.41	0.67/0.41	25.9/26.3	C	0.58/0.41	0.58/0.41	22.1/23.3
btwn Gemini and Polaris (Basic)	C	0.68	0.68	24.2	D	0.74	0.74	26.9	C	0.68	0.68	24.3	C	0.59	0.59	20.8
at Polaris WB Ramp (Basic)	D	0.54	-	30.2	C	0.46	-	26.0	C	0.46	-	26.0	C	0.46	-	26.0
at Polaris EB Ramp (Basic)	F	1.08	-	-	F	1.03	-	-	F	1.03	-	-	F	1.03	-	-
at Polaris (Merge)*	E	0.70/0.81	0.70/0.81	34.3/43.5	E	0.71/0.75	0.71/0.75	33.2/42.4	E	0.68/0.75	0.68/0.75	30.8/41.5	E	0.62/0.75	0.62/0.75	27.6/39.9
btwn Polaris and I-270 (Basic)	C	0.72	0.72	26.0	D	0.73	0.73	26.5	C	0.69	0.69	25.0	C	0.64	0.64	22.8

*Freeway/Ramp

Legend

LOS F, v/c & d/c > 1.0, Density > 45.0
LOS E, v/c & d/c = 0.9 to 1.0, Density = 35.0 to 45.0
LOS D, Density = 26.0 (28.0 for ramps) to 35.0

The 2040 IR 71 northbound No-Build condition is projected to operate at LOS F during the PM peak hour from the Polaris Parkway/Gemini Place interchange to the Sunbury Parkway/US 36/SR 37 interchange. In the Build scenarios, the 5-lane section on IR 71 NB between IR 270 and Polaris Parkway declines to LOS F during the PM peak hour. The sixth lane that is currently development midway between the two interchanges would need to be extended down to the IR 270 interchange. The addition of a 4th NB lane on IR 71 improves traffic operation from LOS F to LOS E or better until the freeway goes back down to three lanes. The proposed fourth lane will be developed from the lane reduction near Gemini Place to approximately one mile north of the proposed Big Walnut interchange. New concrete barrier will be installed with the existing guard rail and cable barrier in the section removed. North of the Jaycox Road, the median lane will taper back to the existing three northbound lanes. The segment between Big Walnut Road and US 36/SR 37 operates at LOS F in both the No-Build and the Build scenarios; however, there is no increase in traffic volumes on this segment so there is no indication that the proposed Big Walnut interchange is contributing to any degradation of the level of service. Please note, two sets of traffic analyses were completed in the northbound direction (unconstrained and constrained). Results described in this section represents the constrained traffic volumes, see constrained traffic analysis section below for additional details.

The 2040 IR 71 southbound No-Build condition is projected to operate at LOS F during the AM peak hour from Sunbury Parkway merge to Gemini Place diverge. The three build alternatives maintains the same level of traffic operations with ramp metering, with the exception of Alternative 3 which operations slightly worse than Alternatives 1 and 2. Capacity deficiencies in the Southbound direction could potentially be mitigated by adding a fourth lane with the Sunbury Parkway merge to the Polaris Parkway interchange, which ODOT determined is not feasible due to cost (estimated at roughly $35 million). Ramp metering and/or hard shoulder running in the southbound direction should be further analyzed in the IJS.

Figure 3 provides a graphic representation of the mainline and ramp analysis results for the No-Build condition, while Figures 4-6 provides the results of the Build condition for each alternative, including more detailed results within the interchanges. Appendix C includes the results of the freeway facilities analysis.

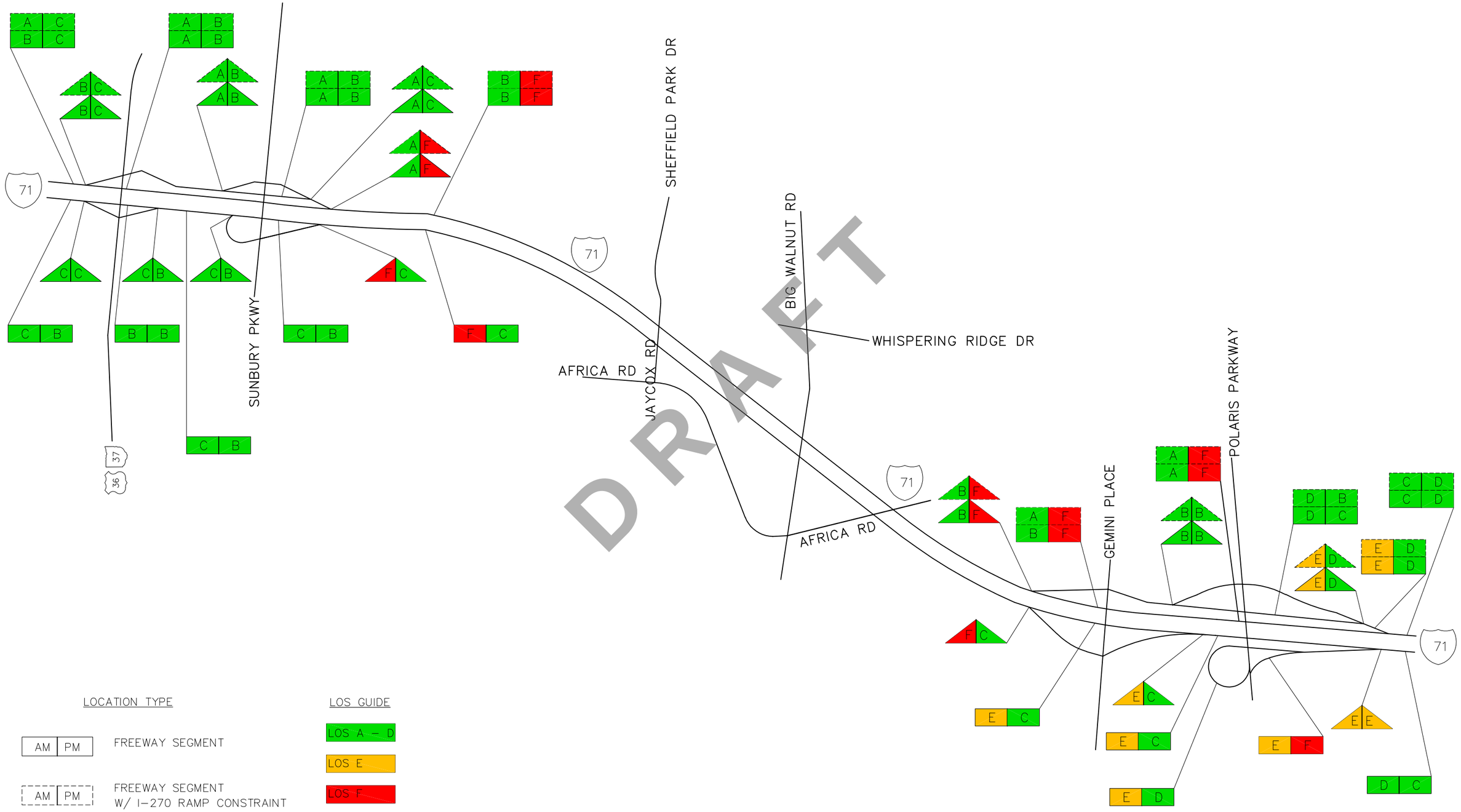
Merge ramp junction locations included in analysis:

- Polaris Parkway Entrance to C-D Road
- Gemini Place to I-71 NB Entrance Ramp
- Big Walnut Road to I-71 NB Entrance Ramp (Build only)
- US 36/SR 37 to I-71 NB Entrance Ramp
- US 36/SR 37 to I-71 SB Entrance Ramp
- Sunbury Parkway to I-71 SB Loop Entrance Ramp
- Sunbury Parkway to I-71 SB Diamond Entrance Ramp
- Big Walnut Road/Africa Road to I-71 SB Entrance Ramp (Build only)
- Polaris Parkway to C-D Road Loop Ramp
- Polaris Parkway to I-71 SB Entrance Ramp

Diverge ramp junction locations included in analysis:

- I-71 NB to Polaris Parkway/Gemini Place Exit Ramp
- Polaris Parkway Exit from C-D Road
- I-71 NB to Big Walnut Road Exit Ramp (Build only)
- I-71 NB to US 36/SR 37 Exit Ramp
- Sunbury Parkway Exit from C-D Road
- I-71 SB to US 36/SR 37 Exit Ramp
- I-71 SB to Big Walnut Road/Africa Road (Build only)
- I-71 SB to Gemini Place Exit Ramp

Due to the lane configuration at the IR 71 northbound exit to Polaris Parkway/Gemini Place and spacing that exceeds the maximum weave length, basic freeway segment analysis was performed rather than a traditional ramp diverge analysis. In addition, basic freeway segment analysis was also performed at the two Polaris Parkway entrance ramps, since merges on single lane C-D roads cannot be analyzed in HCS.



DRAFT

LOCATION TYPE

AM | PM — FREEWAY SEGMENT

AM | PM — FREEWAY SEGMENT W/ I-270 RAMP CONSTRAINT

AM | PM — MERGE/DIVERGE

AM | PM — MERGE/DIVERGE W/ I-270 RAMP CONSTRAINT

LOS GUIDE

LOS A – D

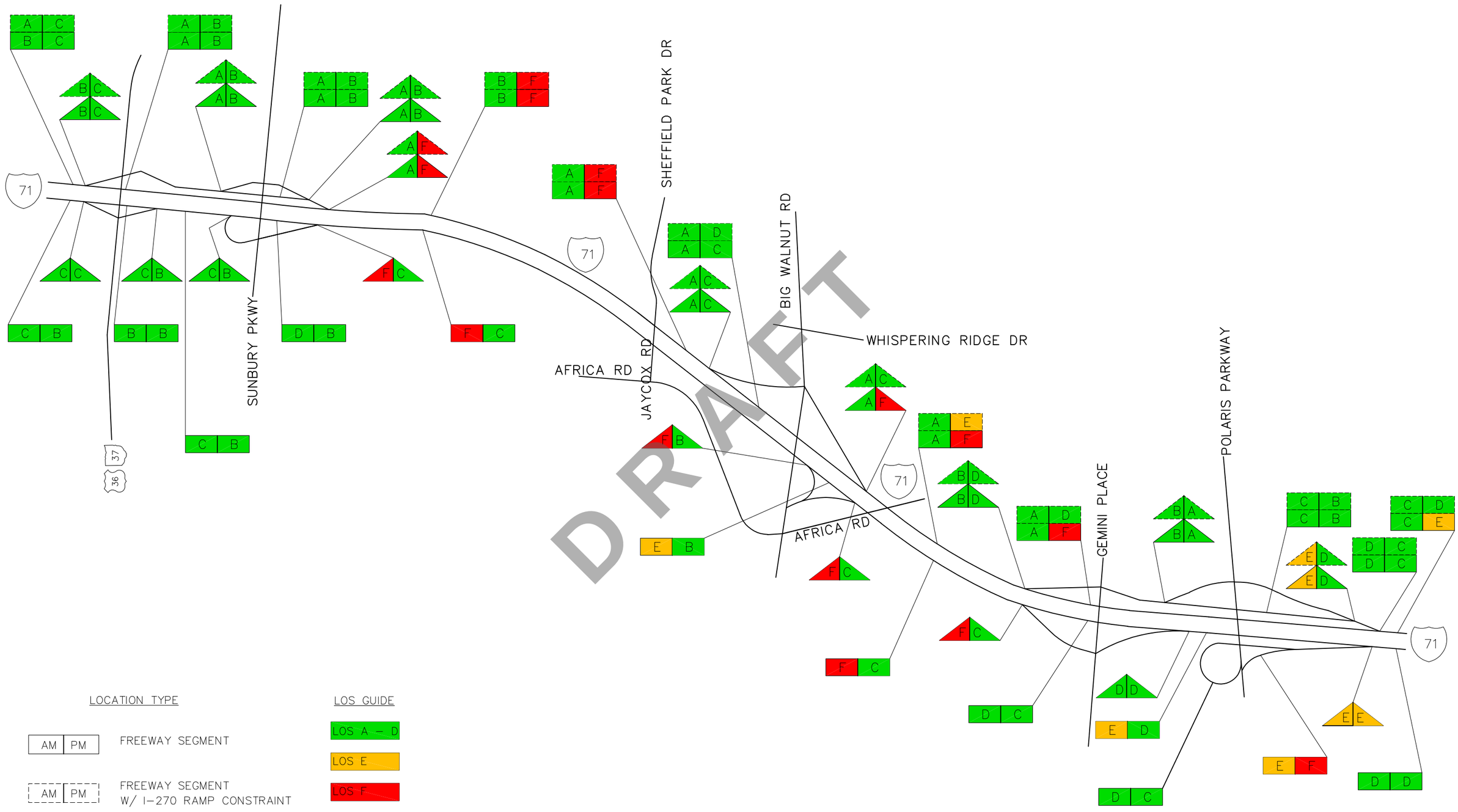
LOS E

LOS F

NOT TO SCALE

FIGURE 3
NO BUILD 2040 AM/PM PEAK HOUR LOS
I-71 BIG WALNUT INTERCHANGE
DELAWARE COUNTY , OHIO

AECOM



LOCATION TYPE

AM | PM — FREEWAY SEGMENT

AM | PM — FREEWAY SEGMENT W/ I-270 RAMP CONSTRAINT

AM | PM — MERGE/DIVERGE

AM | PM — MERGE/DIVERGE W/ I-270 RAMP CONSTRAINT

LOS GUIDE

LOS A – D

LOS E

LOS F

NOT TO SCALE

FIGURE 4
ALT 1 FULL BUILD 2040 AM/PM PEAK HOUR LOS
I-71 BIG WALNUT INTERCHANGE
DELAWARE COUNTY , OHIO

AECOM

SUNBURY PKWY

SHEFFIELD PARK DR

JAYCOX RD

BIG WALNUT RD

AFRICA RD

WHISPERING RIDGE DR

GEMINI PLACE

POLARIS PARKWAY

71

37

36

DRAFT

LOCATION TYPE

AM | PM	FREEWAY SEGMENT
AM | PM	FREEWAY SEGMENT W/ I-270 RAMP CONSTRAINT
AM | PM	MERGE/DIVERGE
AM | PM	MERGE/DIVERGE W/ I-270 RAMP CONSTRAINT

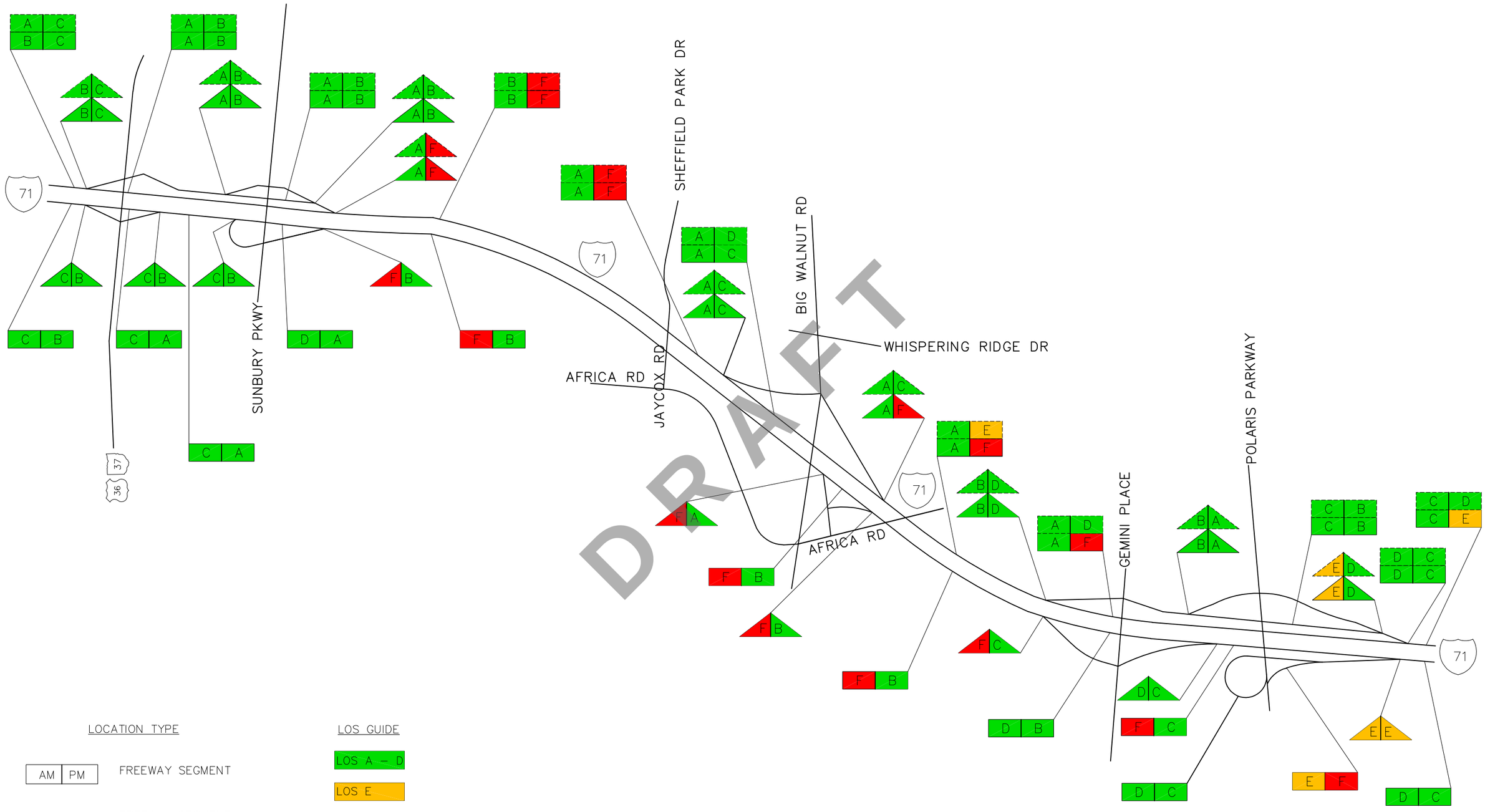
LOS GUIDE

- LOS A – D
- LOS E
- LOS F

NOT TO SCALE

FIGURE 5
ALT 2 FULL BUILD 2040 AM/PM PEAK HOUR LOS
I-71 BIG WALNUT INTERCHANGE
DELAWARE COUNTY , OHIO

AECOM



LOCATION TYPE

AM | PM — FREEWAY SEGMENT

AM | PM — FREEWAY SEGMENT W/ I-270 RAMP CONSTRAINT

AM | PM — MERGE/DIVERGE

AM | PM — MERGE/DIVERGE W/ I-270 RAMP CONSTRAINT

LOS GUIDE

LOS A – D

LOS E

LOS F

NOT TO SCALE

FIGURE 6
ALT 3 FULL BUILD 2040 AM/PM PEAK HOUR LOS
I-71 BIG WALNUT INTERCHANGE
DELAWARE COUNTY , OHIO

AECOM

Intersection Analysis

The intersection analysis for the No-Build and Build alternatives was limited to the twelve intersections along Lewis Center/Big Walnut Road and Africa Road. Intersection analysis was not conducted at the adjacent interchanges. Several of the studied intersections are outside the immediate interchange area but are anticipated to be impacted by traffic utilizing the interchange and were evaluated at the request of Delaware County, including several unsignalized intersections serving residential developments.

All intersection analysis for this study was completed using HCS7, with a 120-second cycle length for both the No-Build and Build conditions. Intersection LOS grade of "D" or better is defined by the LDM as an acceptable LOS for future build conditions. In addition, the delay of the worst of the east/west approaches was balanced, within 3 seconds, with the worst delay of the north/south approaches and no right-turns on red were permitted. Intersection analysis was used to determined lane use requirements, traffic signal phasing, and signal timings needed to accommodate the AM and PM 2040 Design Year Traffic Volumes.

The approach and overall intersection analysis results are presented on Table 3 and Table 4 below, comparing the No-Build scenario to the three Build alternatives. Note that for the intersections along Big Walnut Road where the side streets are stop-controlled the amount of traffic on the major street results in poor levels of service on the side streets with excessive delays, several delays exceeded the maximum time and could not be computed by HCS, noted as "-" in the tables below. Potential improvements including signalization will be investigated in a future study. Copies of the analysis results are provided in Appendix E.

Table 3 – Intersection LOS 2040 AM Peak Hour

	No Build AM		Alternative 1 - AM		Alternative 2 - AM		Alternative 3 - AM	
	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay
Intersection 1 (Big Walnut & Bale Kenyon)								
NB	D	27.5	D	27.4	F	145.4	F	51.4
EB	F	263.8	F	273.8	F	564.5	F	393.3
WB	F	137.5	F	68.9	F	93.6	F	68.9
Overall Int.	F	168.4	F	147.9	F	324.8	F	212.0
Intersection 2 (Big Walnut & Africa)								
NB	F	128.5	D	39.7	C	29.3	D	46.1
SB	F	99.5	D	37.4	D	35.2	D	42.2
EB	C	25.0	C	34.0	C	32.5	D	44.4
WB	F	127.4	D	37.2	C	32.1	D	26.6
Overall Int.	F	87.6	D	36.5	C	32.5	D	38.8
Intersection 3 (Africa & Jaycox)								
SB	A	0.9	A	0.9	A	0.9	A	0.9
WB	C	15.9	C	22.4	C	16.8	C	20.9
Intersection 4 (Big Walnut & St. Medan)								
			Alt 1A		Alt 1B		Alt 2A	
NB	F	245.1	F	111.4	F	179.3	F	166.9
SB	F	110.1	F	69.5	F	81.2	F	96.9
EB	A	0.2	A	0.1	A	0.1	A	0.1
WB	A	0.1	A	0.2	A	0.1	A	0.2
			Alt 2B		Alt 3A		Alt 3B	
NB	F	285.1	F	146.3	F	247.5		
SB	F	116.2	F	85.8	F	101.6		
EB	A	0.1	A	0.1	A	0.1		
WB	A	0.1	A	0.2	A	0.1		
Intersection 5 (Big Walnut & Highland Hills)								
NB	F	1129.8	F	682.6	F	890.0	F	778.4
SB	F	116.5	F	98.4	F	125.2	F	109.4
EB	A	0.2	A	0.1	A	0.1	A	0.1
WB	A	0.2	A	0.1	A	0.1	A	0.1
Intersection 6 (Big Walnut & Willow Bend)								
NB	F	177.7	F	145.2	F	221.1	F	193.1
SB	F	538.5	F	322.3	F	587.1	F	460.1
EB	A	1.2	A	0.5	A	0.5	A	0.5
WB	A	0.1	A	0.1	A	0.1	A	0.1
Intersection 7 (Big Walnut & Jeffries Court)								
NB	E	36.7	D	31.6	E	37.1	E	35.9
SB	F	328.3	F	110.1	F	159.5	F	135.7
EB	A	0.1	A	0.1	A	0.1	A	0
WB	A	0.1	A	0.1	A	0.1	A	0.1
Intersection 8 (Big Walnut & Worthington)								
NB	C	34.5	C	28.0	C	28.1	C	26.5
SB	F	146.7	D	52.4	D	51.8	D	44.7
EB	D	36.6	D	49.4	D	52.6	D	46.7
WB	F	143.8	C	32.3	C	33.7	C	32.2
Overall Int.	F	110.7	D	47.2	D	48.2	D	42.7
Intersction 9 (Big Walnut & Ketterington)								
NB	F	105.6	C	22.2	D	25.5	D	25.1
SB	F	301.8	C	17.3	C	19.7	C	18.9
EB	A	0.2	A	0.2	A	0.2	A	0.2
WB	A	0.1	A	0.6	A	0.5	A	0.6
Intersection 10 (Big Walnut & SR 3)								
NB	F	399.8	C	23.2	C	25.3	C	24.9
SB	F	166.6	D	39.6	D	44.7	D	42.2
EB	F	142.8	D	40.0	D	42.7	D	43.7
WB	F	390.1	D	38.1	C	32.5	C	34.0
Overall Int.	F	257.7	D	37.4	D	39.8	D	39.3
Intersection 11 (I-71 SB Ramp Terminal)								
NB	-	-	C	25.0	C	24.4	B	19.4
SB	-	-	-	-	B	19.8	C	25.6
EB	-	-	C	27.8	-	-	-	-
WB	-	-	C	20.3	C	25.6	C	26.7
Overall Int.	-	-	C	24.2	C	22.6	C	23.8
Intersection 12 (I-71 NB Ramp Terminal)								
			Alt 1A		Alt 1B		Alt 2A	
NB	-	-	A	7.1	C	29.0	A	8.5
EB	-	-	A	6.3	B	16.4	A	6.7
WB	-	-	B	12.3	C	28.6	B	13.5
Overall Int.	-	-	A	8.7	C	24.2	A	9.6
			Alt 2B		Alt 3A		Alt 3B	
NB	C	29.0	A	8.3	C	28.2		
EB	B	17.1	A	6.6	B	17.5		
WB	C	30.2	B	12.8	C	30.3		
Overall Int.	C	25.0	A	9.3	C	24.9		

Table 4 – Intersection LOS 2040 PM Peak Hour

	No Build PM		Alternative 1 - PM		Alternative 2 - PM		Alternative 3 - PM	
	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay
Intersection 1 (Big Walnut & Bale Kenyon)								
NB	F	189.8	F	136.0	F	136.0	F	136.0
EB	F	84.3	F	77.8	F	77.8	F	77.8
WB	F	89.8	F	210.2	F	331.1	F	322.8
Overall Int.	F	152.2	F	211.5	F	224.3	F	219.1
Intersection 2 (Big Walnut & Africa)								
NB	F	141.1	D	46.9	D	46.6	D	47.5
SB	F	95.6	D	46.4	D	37.4	D	43.6
EB	F	141.5	C	33.5	C	29.0	D	46.1
WB	E	69.1	D	46.0	D	45.1	D	41.4
Overall Int.	F	120.6	D	42.2	D	39.4	D	44.2
Intersection 3 (Africa & Jaycox)								
SB	A	2.2	A	2.4	A	1.5	A	2.0
WB	C	19.2	D	26.8	E	49.8	D	25.4
Intersection 4 (Big Walnut & St. Medan)								
			Alt 1A		Alt 1B		Alt 2A	
NB	F	210.0	F	-	F	-	F	-
SB	F	125.5	F	-	F	-	F	-
EB	A	0.2	A	0.2	A	0.1	A	0.2
WB	A	0.1	A	0.3	A	0.2	A	0.4
			Alt 2B		Alt 3A		Alt 3B	
NB	F	-	F	-	F	-		
SB	F	-	F	-	F	-		
EB	A	0.1	A	0.2	A	0.1		
WB	A	0.2	A	0.3	A	0.1		
Intersection 5 (Big Walnut & Highland Hills)								
NB	F	501.8	F	-	F	-	F	-
SB	F	115.8	F	-	F	-	F	-
EB	A	0.1	A	0.1	A	0.1	A	0.1
WB	A	0.1	A	0.3	A	0.5	A	0.3
Intersection 6 (Big Walnut & Willow Bend)								
NB	F	168.7	F	3107.2	F	605.3	F	-
SB	F	231.9	F	2277.5	F	294.8	F	-
EB	A	0.3	A	0.3	A	0.2	A	0.3
WB	A	0.5	A	0.5	A	0.7	A	0.4
Intersection 7 (Big Walnut & Jeffries Court)								
NB	F	145.3	F	399.0	F	262.6	F	466.1
SB	F	118.7	F	153.1	F	60.9	F	234.3
EB	A	0.1	A	0.1	A	0.1	A	0.1
WB	A	0.1	A	0.1	A	0.2	A	0.1
Intersection 8 (Big Walnut & Worthington)								
NB	F	114.0	E	79.1	E	63.1	E	63.1
SB	F	108.8	C	22.8	C	20.6	C	20.9
EB	F	111.9	E	65.9	E	57.6	E	56.6
WB	F	85.2	F	81.9	E	63.9	E	65.6
Overall Int.	F	106.1	E	62.7	D	51.4	D	52.7
Intersction 9 (Big Walnut & Ketterington)								
NB	F	85.1	C	15.8	B	14.2	C	16.4
SB	F	206.0	D	25.1	C	15.3	D	30.4
EB	A	0.1	A	0.2	A	0.2	A	0.2
WB	A	0.1	A	0.3	A	0.4	A	0.2
Intersection 10 (Big Walnut & SR 3)								
NB	F	324.1	D	38.5	D	43.5	D	46.4
SB	F	201.1	C	29.7	C	24.8	C	30.1
EB	F	310.1	D	37.8	D	43.9	D	35.8
WB	E	78.2	D	40.2	C	34.3	D	44.7
Overall Int.	F	258.5	D	36.9	D	38.5	D	40.7
Intersection 11 (I-71 SB Ramp Terminal)								
NB	-	-	D	35.2	D	37.2	D	36.1
SB	-	-	-	-	D	37.9	C	26.4
EB	-	-	D	37.6	-	-	-	-
WB	-	-	B	18.3	D	36.3	D	35.7
Overall Int.	-	-	C	27.1	D	37.2	C	31.5
Intersection 12 (I-71 NB Ramp Terminal)								
			Alt 1A		Alt 1B		Alt 2A	
NB	-	-	F	205.6	D	41.3	F	205.6
EB	-	-	A	6.2	C	23.7	A	6.2
WB	-	-	F	159.8	D	43.7	F	53.3
Overall Int.	-	-	F	144.7	D	37.7	F	120.3
			Alt 2B		Alt 3A		Alt 3B	
NB	C	34.7	F	201.5	D	48.0		
EB	C	22.2	A	6.1	C	25.2		
WB	C	32.9	F	217.6	D	48.6		
Overall Int.	C	31.0	F	160.8	D	42.9		

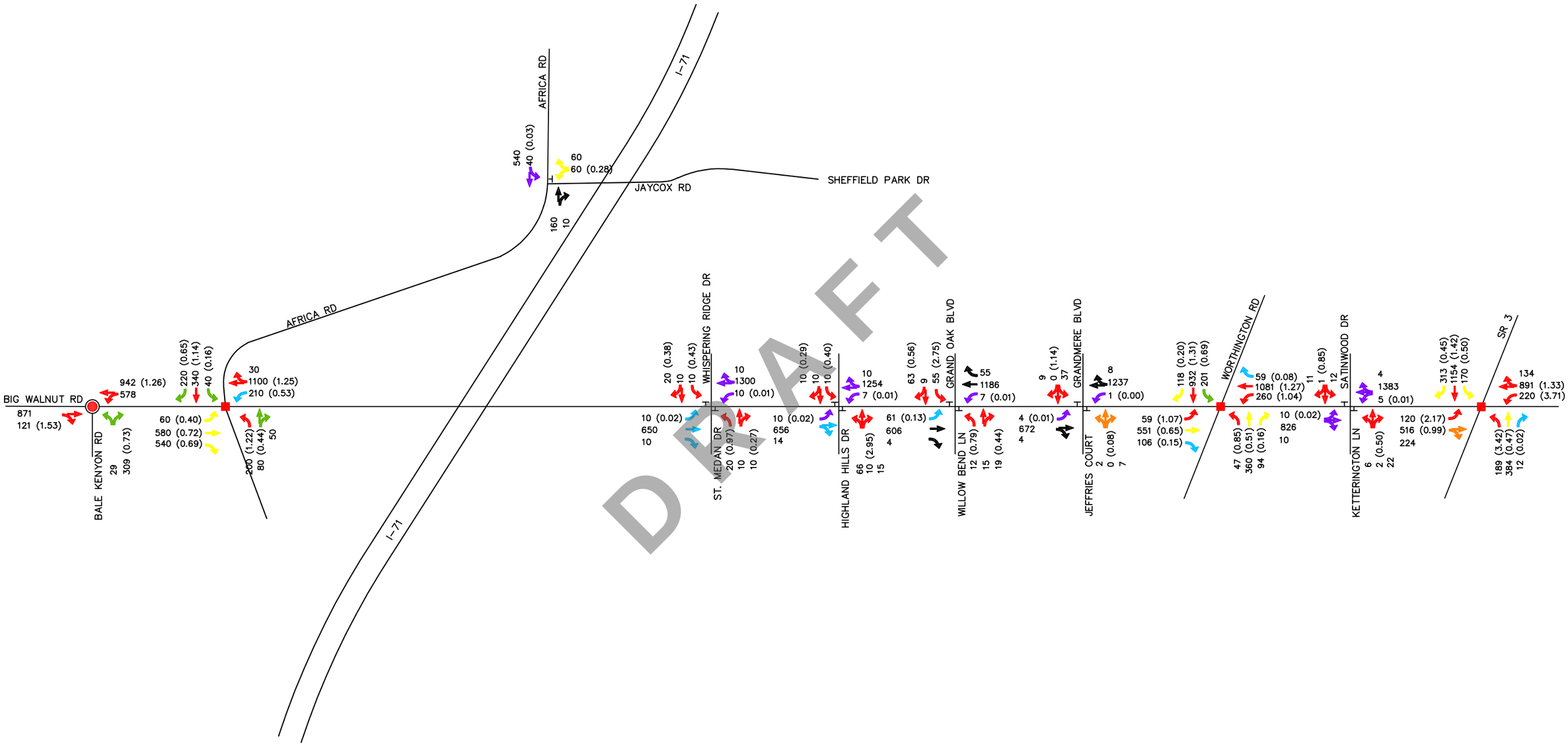
Intersection capacity analysis indicates that the proposed ramp terminal intersections for the IR 71/Big Walnut interchange operate at LOS D or better except for the roundabout option at the NB ramp terminal. Proposed improvements at the other signalized intersections analyzed (Big Walnut Road/Africa Road, Big Walnut/Worthington Road, Big Walnut/SR 3) increases the LOS from F in the No-Build to LOS D or better in all three build alternatives, except for the Big Walnut/Worthington intersection in Alternative 1 (overall intersection LOS E in the PM peak hour). As mentioned previously, the minor street approaches for the stop-controlled intersection experience excessive delays. Mitigation including signalization will be studied in as part of a future traffic study. Lewis Center Road/Big Walnut Road/ Bale Kenyon Road roundabout is over capacity in the No-Build and all three Build scenarios. Although this roundabout has been recently upgraded from a stop-controlled intersection, added capacity will be needed as the proposed interchange will attract more traffic through the intersection. The intersection capacity results are shown graphically on Figure 7 for the No-Build scenario and on Figures 8-10 for the Build scenarios.

Synchro/SimTraffic Analysis

The signal analysis revealed several movements with Queue Storage Ratios greater than 1.0. Since HCM procedures do not account for queue spillover from turn lanes or spillback into upstream intersections, a simulation tool (Synchro/SimTraffic version 10.3) was employed. The Synchro software program is similar to HCS, with the ability to optimize a coordinated network, in an effort to predict the "true" operations of the corridor. Synchro computer modeling was applied to the Big Walnut Road corridor to refine operational analysis of signal timing/phasing and account for the benefits of coordination of the signal network in the Study Area. Lane geometry and signal cycle lengths were similar in both applications. Traffic simulations for all three alternatives indicates that the single lane roundabout at Lewis Center Road/Bale Kenyon Road causes queuing on Big Walnut Road through the interchange ramps and on Africa Road approaching Big Walnut Road. Adequate capacity at the roundabout would improve traffic progression through the Big Walnut corridor. SimTraffic queuing reports are provided in Appendix F.

Traffic volumes used in the analysis does not capture the total demand of the IR 71/Big Walnut Road southbound demand. The metered traffic volumes were used for analysis. Queuing along the southbound on ramp and Africa Road is expected; however, the length of these queues depends on driver patience and other factors. For purposes of this study, the available SB on ramp storage is provided for each alternative, which includes storage available on the on-ramp and along Africa Road between the ramp terminal and Big Walnut Road.

- Alternative 1: 1,840 feet
- Alternative 2: 4,080 feet
- Alternative 3: 3,360 feet



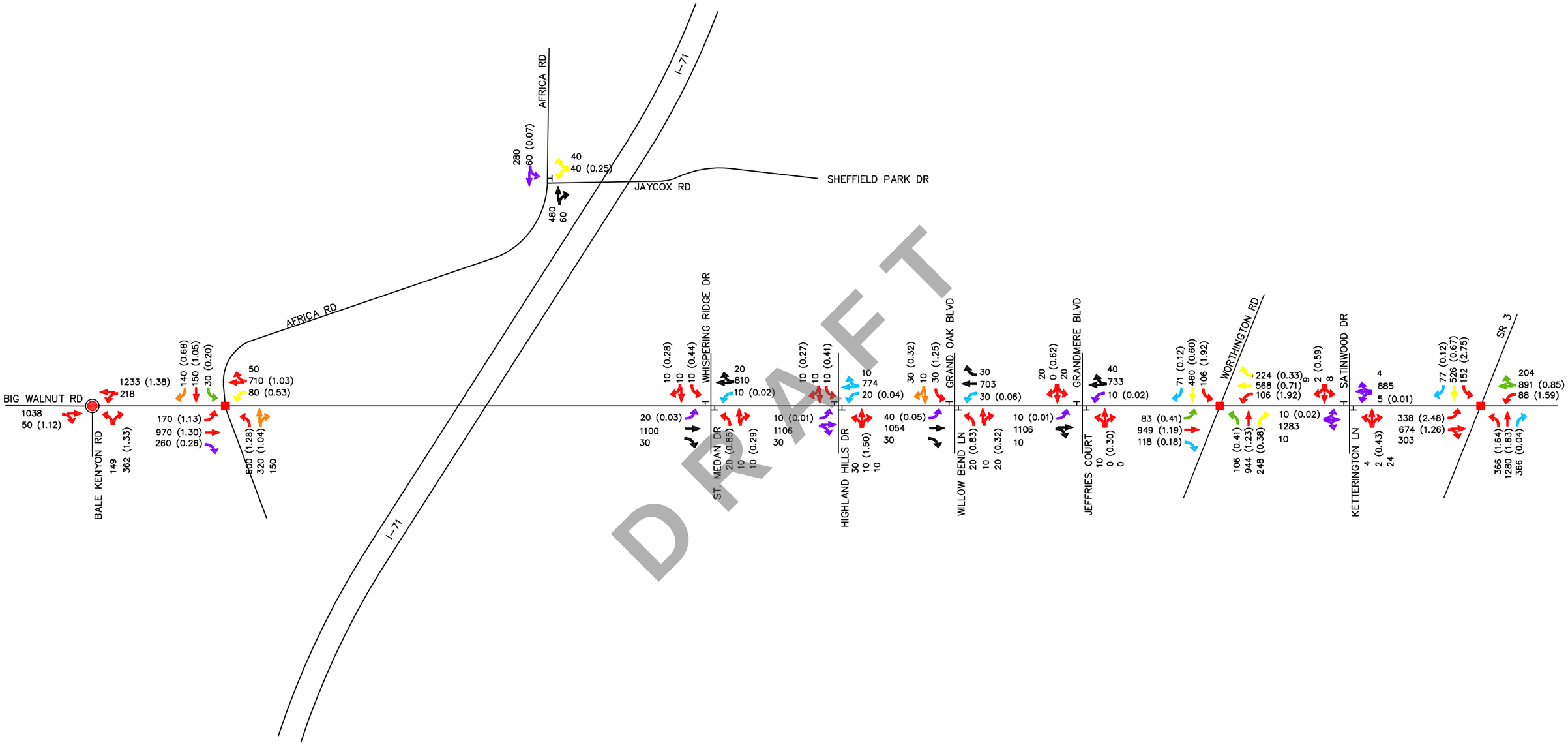
LEGEND

- TRAFFIC MOVEMENT
- XX (XX) VOLUME (V/C RATIO)
- APPROACH LOS
- A B C D E F INTERSECTION LOS

NOT TO SCALE

FIGURE 7 (AM PEAK HOUR)
2040 NO BUILD INTERSECTION TRAFFIC VOLUMES & LOS
I-71 BIG WALNUT INTERCHANGE
DELAWARE COUNTY , OHIO

AECOM
564 White Pond Drive Akron, Ohio 44320-1100 (330) 836-9111



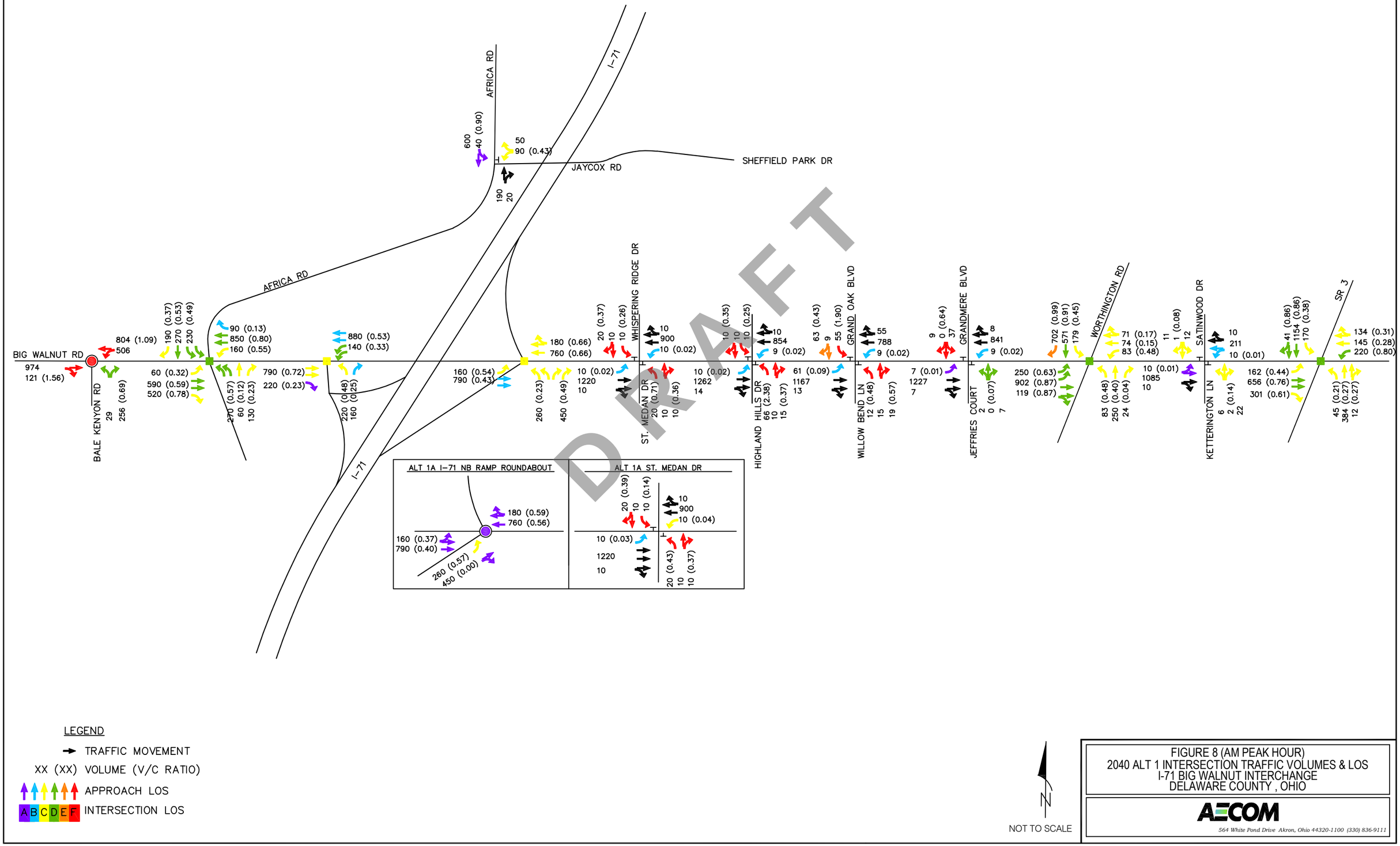
LEGEND

- TRAFFIC MOVEMENT
- XX (XX) VOLUME (V/C RATIO)
- APPROACH LOS
- A B C D E F INTERSECTION LOS

NOT TO SCALE

FIGURE 7 (PM PEAK HOUR)
2040 NO BUILD INTERSECTION TRAFFIC VOLUMES & LOS
I-71 BIG WALNUT INTERCHANGE
DELAWARE COUNTY , OHIO

AECOM
564 White Pond Drive Akron, Ohio 44320-1100 (330) 836-9111



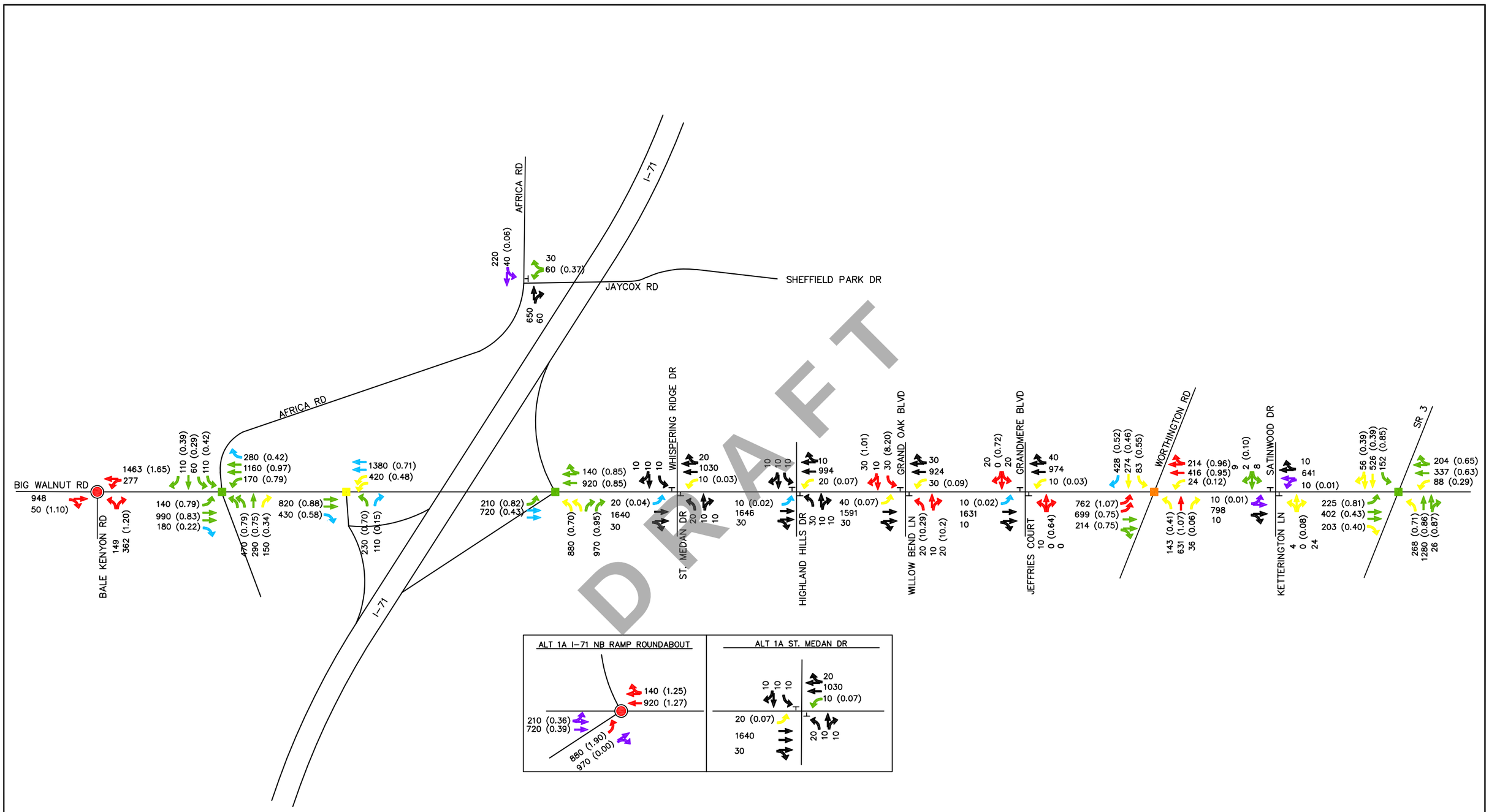
LEGEND

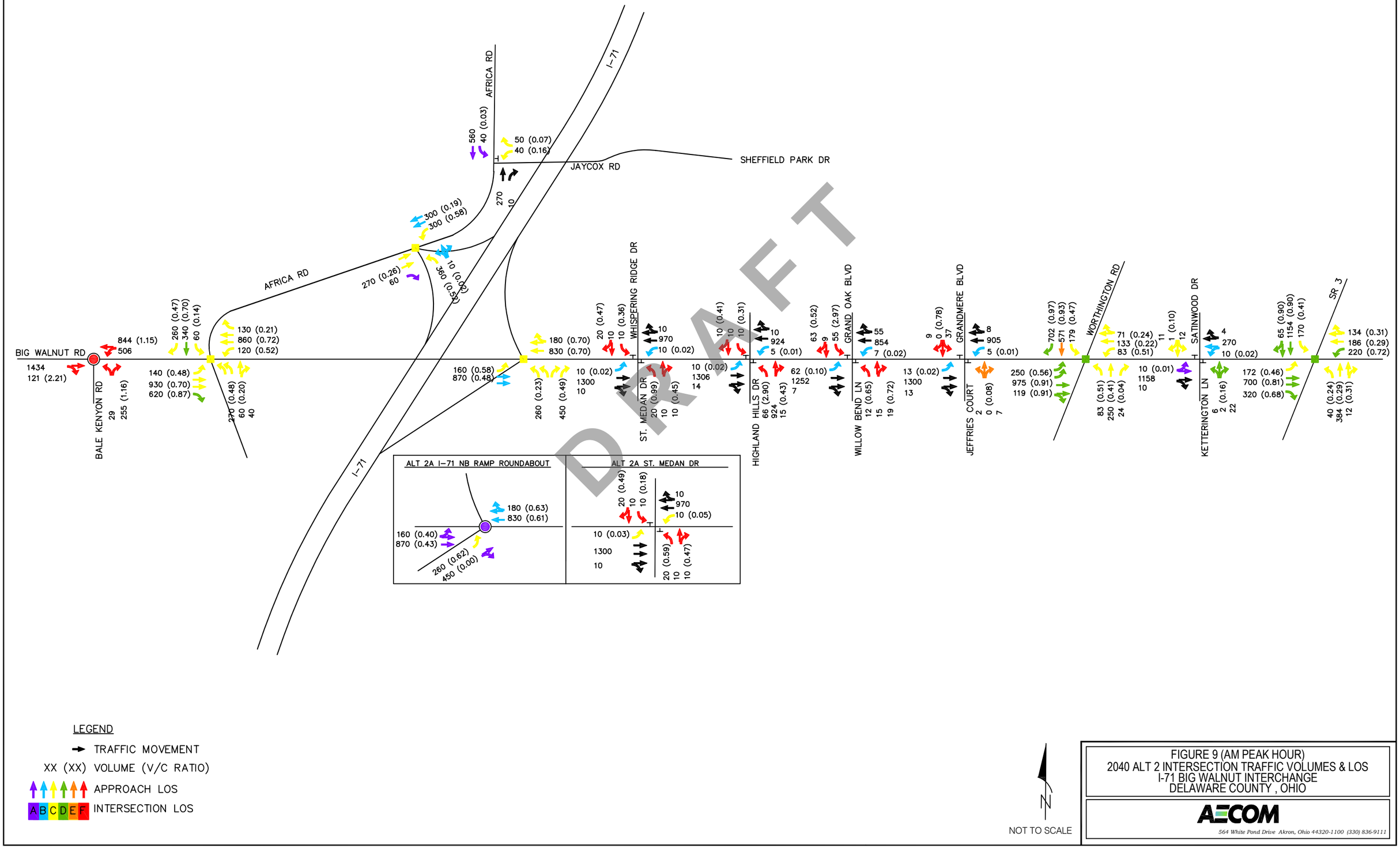
- TRAFFIC MOVEMENT
- XX (XX) VOLUME (V/C RATIO)
- APPROACH LOS
- A B C D E F INTERSECTION LOS

NOT TO SCALE

FIGURE 8 (AM PEAK HOUR)
2040 ALT 1 INTERSECTION TRAFFIC VOLUMES & LOS
I-71 BIG WALNUT INTERCHANGE
DELAWARE COUNTY , OHIO

AECOM
564 White Pond Drive Akron, Ohio 44320-1100 (330) 836-9111


AFRICA RD
I-71
JAYCOX RD
SHEFFIELD PARK DR
BIG WALNUT RD
BALE KENYON RD
AFRICA RD
WHISPERING RIDGE DR
ST. MEDAN DR
HIGHLAND HILLS DR
GRAND OAK BLVD
WILLOW BEND LN
GRANDMERE BLVD
JEFFRIES COURT
WORTHINGTON RD
SATINWOOD DR
KETTERINGTON LN
SR 3
I-71
ALT 1A I-71 NB RAMP ROUNDABOUT
140 (1.25)
920 (1.27)
210 (0.36)
720 (0.39)
880 (1.90)
970 (0.00)
ALT 1A ST. MEDAN DR
20 (0.07)
1640
30
DRAFT
LEGEND
TRAFFIC MOVEMENT
XX (XX) VOLUME (V/C RATIO)
APPROACH LOS
A B C D E F INTERSECTION LOS
NOT TO SCALE
FIGURE 8 (PM PEAK HOUR)
2040 ALT 1 INTERSECTION TRAFFIC VOLUMES & LOS
I-71 BIG WALNUT INTERCHANGE
DELAWARE COUNTY , OHIO
AECOM
564 White Pond Drive Akron, Ohio 44320-1100 (330) 836-9111



LEGEND

→ TRAFFIC MOVEMENT

XX (XX) VOLUME (V/C RATIO)

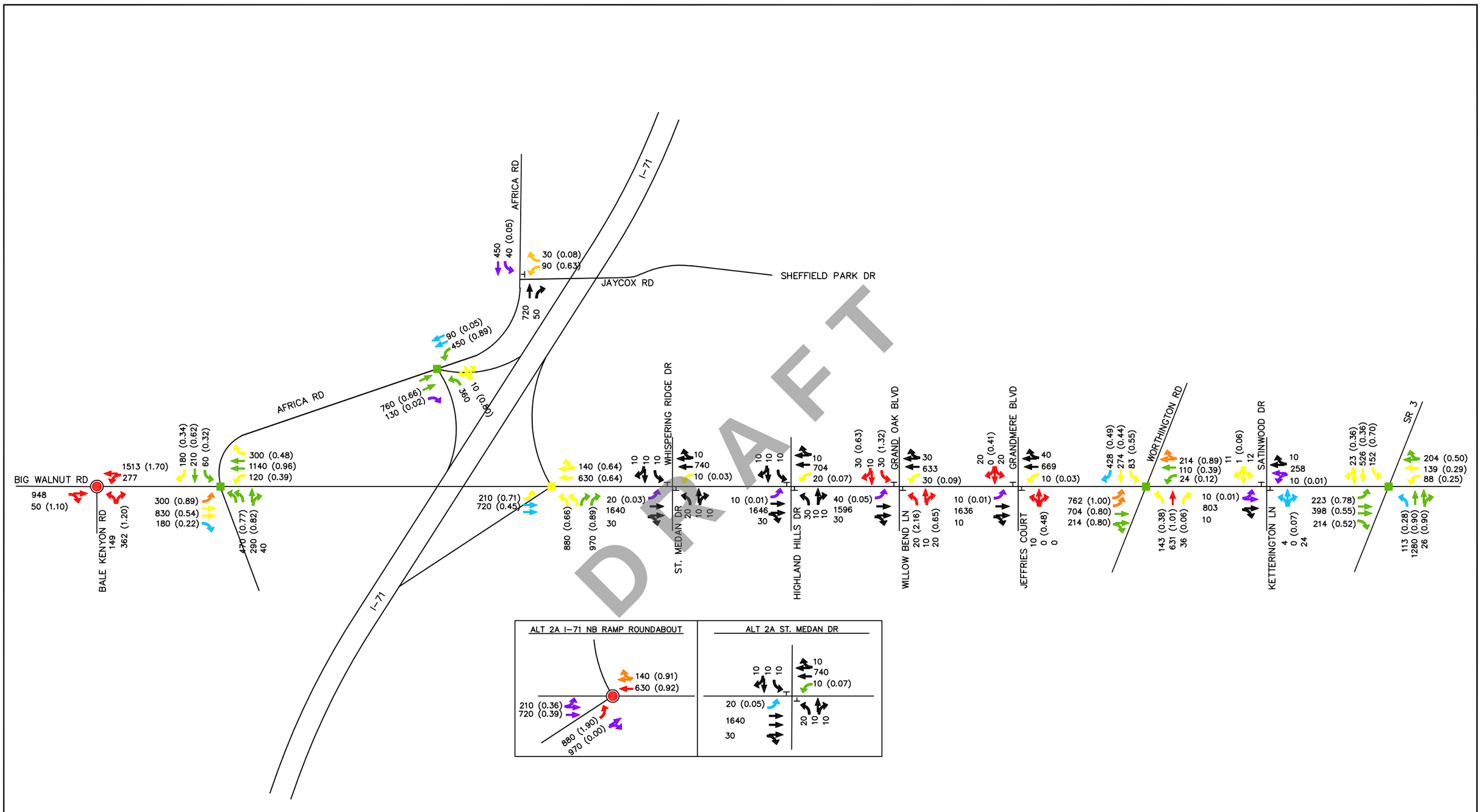
APPROACH LOS

A B C D E F INTERSECTION LOS

NOT TO SCALE

FIGURE 9 (AM PEAK HOUR)
2040 ALT 2 INTERSECTION TRAFFIC VOLUMES & LOS
I-71 BIG WALNUT INTERCHANGE
DELAWARE COUNTY , OHIO

AECOM
564 White Pond Drive Akron, Ohio 44320-1100 (330) 836-9111



LEGEND

→ TRAFFIC MOVEMENT

XX (XX) VOLUME (V/C RATIO)

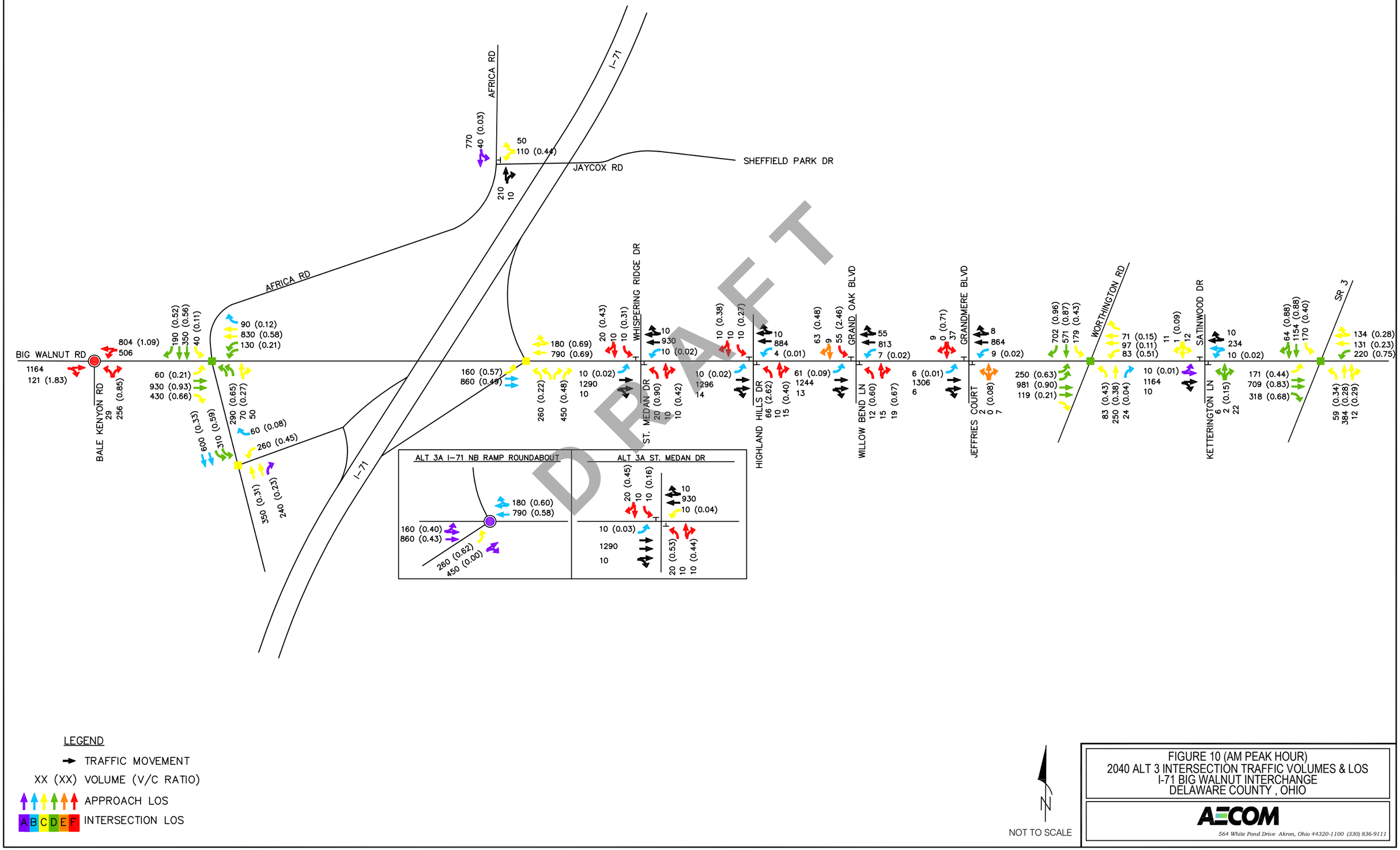
APPROACH LOS

A B C D E F INTERSECTION LOS

NOT TO SCALE

FIGURE 9 (PM PEAK HOUR)
2040 ALT 2 INTERSECTION TRAFFIC VOLUMES & LOS
I-71 BIG WALNUT INTERCHANGE
DELAWARE COUNTY , OHIO

AECOM
564 White Pond Drive Akron, Ohio 44320-1100 (330) 836-9111



LEGEND

- TRAFFIC MOVEMENT
- XX (XX) VOLUME (V/C RATIO)
- APPROACH LOS
- A B C D E F INTERSECTION LOS

NOT TO SCALE

FIGURE 10 (AM PEAK HOUR)
2040 ALT 3 INTERSECTION TRAFFIC VOLUMES & LOS
I-71 BIG WALNUT INTERCHANGE
DELAWARE COUNTY , OHIO

AECOM
564 White Pond Drive Akron, Ohio 44320-1100 (330) 836-9111

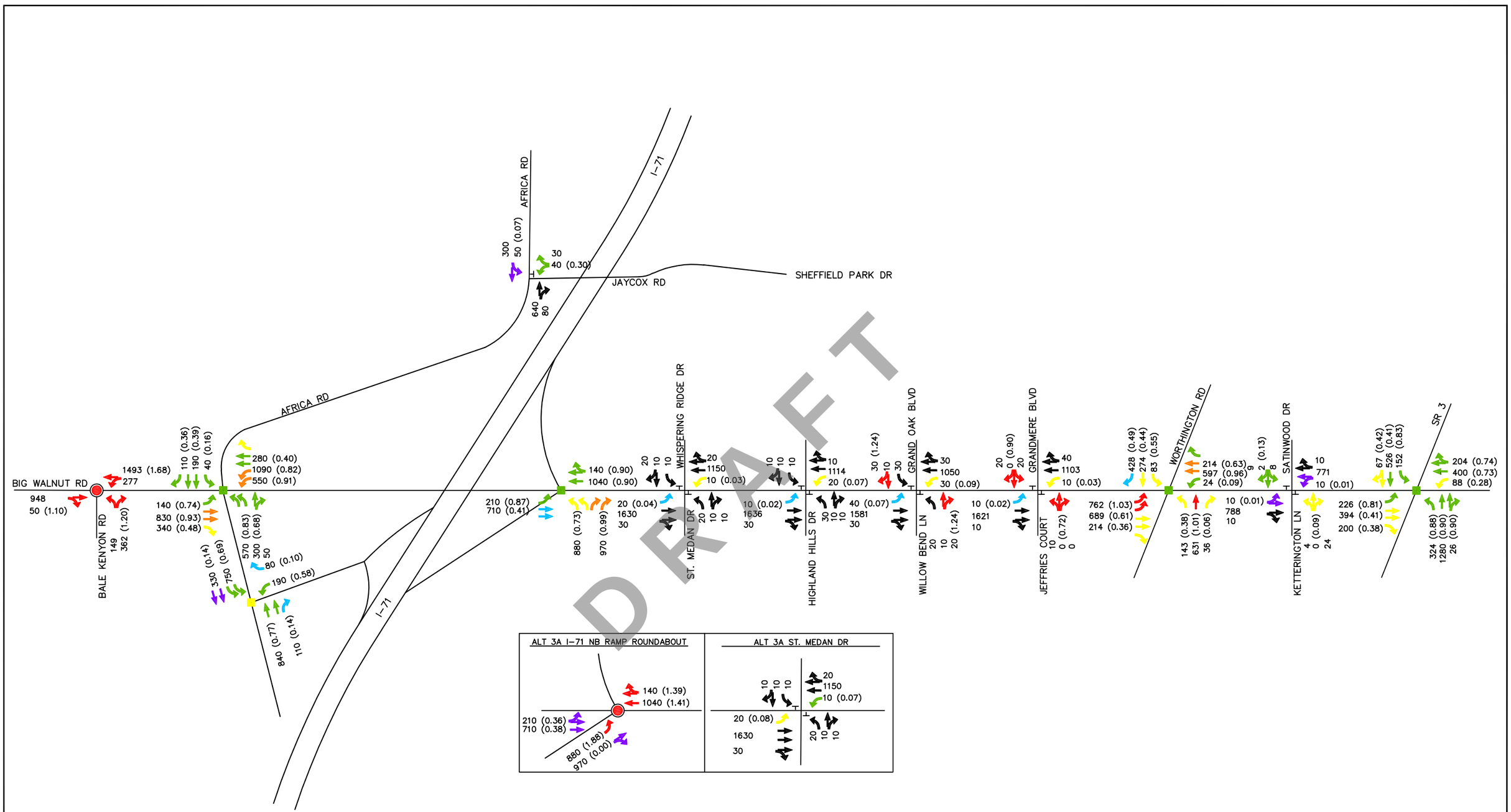


FIGURE 10 (PM PEAK HOUR)
2040 ALT 3 INTERSECTION TRAFFIC VOLUMES & LOS
I-71 BIG WALNUT INTERCHANGE
DELAWARE COUNTY , OHIO

AECOM
564 White Pond Drive Akron, Ohio 44320-1100 (330) 836-9111

Constrained Traffic Analysis

Typically, constrained analyses are required when improvements at an interchange along an arterial are made that reduce or eliminate the constrained volume of traffic entering a downstream section (merge/basic/weave segment) that meets the thresholds per LDM Section 550.3.2. Although this project is unusual since a new interchange is introduced, the requirements of constrained analyses and possible mitigation remains the same.

The situation evaluated in this report is the opposite, as the Build condition increases traffic entering certain segments of the freeway system that would further degrade the freeway. However, there are existing constraints that will limit the flow of the demand volume, thus reducing the amount of traffic actually reaching the freeway.

Constrained traffic occurs on the ramp from eastbound IR 270 to northbound IR 71. This ramp has a posted advisory speed of 50 mph and 2040 Design Year volumes of 2,370 vehicles per hour and 2,460 vehicles per hour in the No-Build and Build AM peak hour respectively, and 2,720 vehicles per hour and 2,820 vehicles per hour in the No-Build and Build PM peak hours respectively. According to Exhibit 14-12 of the Highway Capacity Manual, 6th Edition (HCM6), a single-lane ramp with a design speed of 40-50 mph can only accommodate 2,100 vehicles per hour, meaning the ramp itself will act as a constraint to the IR 71 volumes. Analysis conducted using a volume of 2,100 vehicles on the IR 270 EB to IR 71 NB ramp indicates that the proposed interchange at Big Walnut Road would have adequate capacity to accommodate the demand volumes. The reduced volumes were carried through to other mainline and ramp segments through the study area, and all other analysis assumed the constrained volumes. LOS results of the constrained traffic volumes are shown on Figures 3 through 6 for the freeway conditions. The volumes used for constrained analysis are provided in Appendix B.

Turn Lane Storage Calculations

Turn lane lengths were calculated for all existing and proposed turn lanes in the study area based on LDM criteria applied to the 2040 Design Year traffic volumes (higher of the AM or PM) for Alternatives 1-3. Turn lane length computations were based on 120-second cycle lengths at the signalized intersections. Tables 5 - 7 provides a summary of the design speed, existing turn lane storage, required turn lane storage and proposed storage length. Figures 11-14 illustrate the lane use and storage lengths for the No-Build and Build conditions. Copies of the spreadsheets used to calculate the turn lane storage are provided in Appendix G. There are some turn lanes that indicate a calculated turn lane length greater than the maximum recommended by ODOT, in which case the maximum recommended was used (600 feet for left-turns and 800 feet for right-turns). For cases where through vehicle blocking would prevent turning vehicles from reaching the turn lane, the through blocking length is recommended so long as the length is not prohibitive based on cost of right-of-way or would be excessively long compared to the required storage turning demand volume.

Table 5 – 2040 Alternative 1 Turn Lane Calculations

Turn Lane	Design Speed (mph)	Turn Lane Length (ft)*			Comments
		Existing	Required	Proposed	
Big Walnut Road/Africa Road					
Eastbound Left Turn Lane	45	400	650	600	Maximum left turn storage is 600 ft per LDM
Eastbound Right Turn Lane	45	400	725	725	
Westbound Left Turn Lane	45	250	700	600	Maximum left turn storage is 600 ft per LDM
Westbound Right Turn Lane	45	N/A	700	700	
Northbound Left Turn Lanes	45	450	450/500	450/500	
Northbound Right Turn Lane	45	N/A	425	425	
Southbound Left Turn Lanes	45	250	400/450	400/450	
Southbound Right Turn Lane	45	275	375	375	
I-71 SB Ramps/Big Walnut Road					
Eastbound Right Turn Lane	45	N/A	625	625	
Westbound Left Turn Lanes	45	N/A	775/825	550/600	Maximum left turn storage is 600 ft per LDM
Northbound Left Turn Lane	45	N/A	450	450	
I-71 NB Ramps/Big Walnut Road					
Eastbound Left Turn Lane	45	N/A	525	525	
Northbound Left Turn Lanes	45	N/A	650/700	550/600	Maximum left turn storage is 600 ft per LDM
Northbound Right Turn Lane	45	N/A	675	675	
Big Walnut Road/Medan Drive/Whispering Ridge Drive					
Eastbound Left Turn Lane	45	220	175	175	
Westbound Left Turn Lane	45	120	175	175	
Northbound Left Turn Lane	25	60	100	60	Limited by existing median island
Southbound Left Turn Lane	25	50	100	100	
Big Walnut Road/Highland Hills Drive/Sedgewick Lane					
Eastbound Left Turn Lane	45	175	175	175	
Westbound Left Turn Lane	45	175	175	175	
Northbound Left Turn Lane	25	N/A	100	100	
Southbound Left Turn Lane	25	150	100	150	
Big Walnut Road/Willow Bend Lane/Grand Oak Boulevard					
Eastbound Left Turn Lane	45	175	175	175	
Westbound Left Turn Lane	45	190	175	175	
Northbound Left Turn Lane	25	175	100	175	
Southbound Left Turn Lane	25	100	100	100	
Big Walnut Road/Jeffries Court/Grandmere Boulevard					
Eastbound Left Turn Lane	45	175	175	175	
Westbound Left Turn Lane	45	125	175	175	
Big Walnut Road/Worthington Road					
Eastbound Left Turn Lanes	45	235	600/650	550/600	Maximum left turn storage is 600 ft per LDM
Westbound Left Turn Lane	45	400	450	450	
Northbound Left Turn Lane	45	385	775	600	Maximum left turn storage is 600 ft per LDM
Northbound Right Turn Lane	45	385	775	175	Low right turn volume
Southbound Left Turn Lane	45	350	700	600	Maximum left turn storage is 600 ft per LDM
Southbound Right Turn Lane	45	350	900	800	Maximum right turn storage is 800 ft per LDM
Big Walnut Road/SR 3					
Eastbound Left Turn Lane	45	270	450	450	
Eastbound Right Turn Lane	45	N/A	500	500	
Westbound Left Turn Lane	45	200	400	400	
Northbound Left Turn Lane	55	600	800	600	Maximum left turn storage is 600 ft per LDM
Southbound Left Turn Lane	55	540	725	540	Proposed length is based on turn lane storage not through-block

* Includes 50-foot taper

Table 6 – 2040 Alternative 2 Turn Lane Calculations

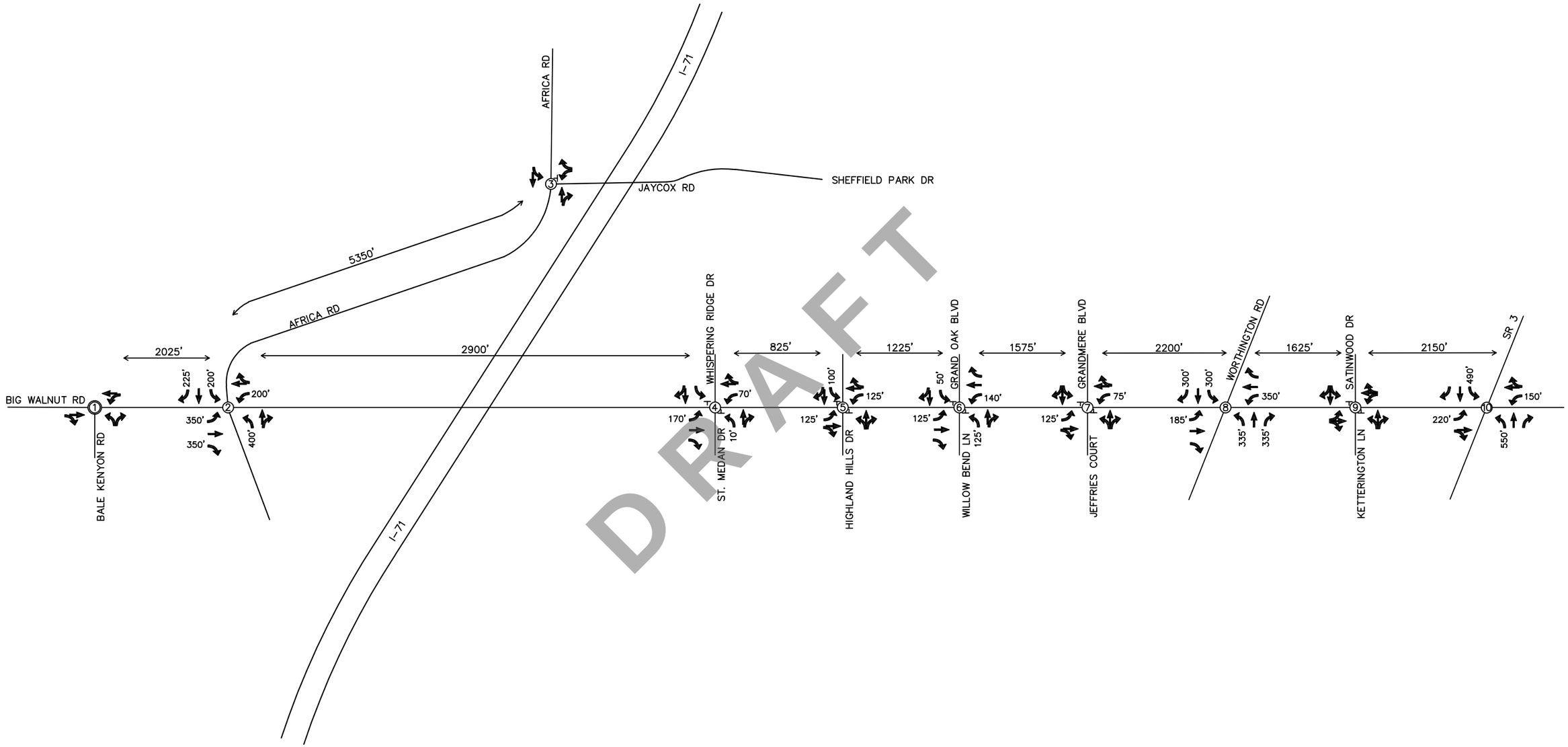
Turn Lane	Design Speed (mph)	Turn Lane Length (ft)*			Comments
		Existing	Required	Proposed	
Big Walnut Road/Africa Road					
Eastbound Left Turn Lane	45	400	600	600	Maximum left turn storage is 600 ft per LDM
Eastbound Right Turn Lane	45	400	850	800	Maximum right turn storage is 800 ft per LDM
Westbound Left Turn Lane	45	250	700	600	Maximum left turn storage is 600 ft per LDM
Westbound Right Turn Lane	45	N/A	700	700	
Northbound Left Turn Lanes	45	450	450/500	450/500	
Southbound Left Turn Lane	45	250	450	450	
Southbound Right Turn Lane	45	275	475	475	
I-71 SB Ramps/Africa Road					
Westbound Left Turn Lane	45	N/A	375	375	
Northbound Right Turn Lane	55	N/A	525	525	
Southbound Left Turn Lane	55	N/A	690	600	Maximum left turn storage is 600 ft per LDM
Africa Road/Jaycox Road					
Westbound Left Turn Lane	45	N/A	150	150	
Southbound Left Turn Lane	55	N/A	285	285	
I-71 NB Ramps/Big Walnut Road					
Eastbound Left Turn Lane	45	N/A	575	575	
Northbound Left Turn Lanes	45	N/A	650/700	550/600	Maximum left turn storage is 600 ft per LDM
Northbound Right Turn Lane	45	N/A	675	675	
Big Walnut Road/Medan Drive/Whispering Ridge Drive					
Eastbound Left Turn Lane	45	220	175	175	
Westbound Left Turn Lane	45	120	175	175	
Northbound Left Turn Lane	25	60	100	60	Limited by existing median island
Southbound Left Turn Lane	25	50	100	100	
Big Walnut Road/Highland Hills Drive/Sedgewick Lane					
Eastbound Left Turn Lane	45	175	175	175	
Westbound Left Turn Lane	45	175	175	175	
Northbound Left Turn Lane	25	N/A	100	100	
Southbound Left Turn Lane	25	150	100	150	
Big Walnut Road/Willow Bend Lane/Grand Oak Boulevard					
Eastbound Left Turn Lane	45	175	175	175	
Westbound Left Turn Lane	45	190	175	175	
Northbound Left Turn Lane	25	175	100	175	
Southbound Left Turn Lane	25	100	100	100	
Big Walnut Road/Jeffries Court/Grandmere Boulevard					
Eastbound Left Turn Lane	45	175	175	175	
Westbound Left Turn Lane	45	125	175	175	
Big Walnut Road/Worthington Road					
Eastbound Left Turn Lanes	45	235	600/650	550/600	Maximum left turn storage is 600 ft per LDM
Westbound Left Turn Lane	45	400	275	275	
Northbound Left Turn Lane	45	385	775	600	Maximum left turn storage is 600 ft per LDM
Northbound Right Turn Lane	45	385	775	175	Low right turn volume
Southbound Left Turn Lane	45	350	700	600	Maximum left turn storage is 600 ft per LDM
Southbound Right Turn Lane	45	350	900	800	Maximum right turn storage is 800 ft per LDM
Big Walnut Road/SR 3					
Eastbound Left Turn Lane	45	270	500	500	
Eastbound Right Turn Lane	45	N/A	525	525	
Westbound Left Turn Lane	45	200	400	400	
Northbound Left Turn Lane	55	600	800	600	Maximum left turn storage is 600 ft per LDM
Southbound Left Turn Lane	55	540	725	540	Proposed length is based on turn lane storage not through-block

* Includes 50-foot taper

Table 7 – 2040 Alternative 3 Turn Lane Calculations

Turn Lane	Design Speed (mph)	Turn Lane Length (ft)*			Comments
		Existing	Required	Proposed	
Big Walnut Road/Africa Road					
Eastbound Left Turn Lane	45	400	600	600	
Eastbound Right Turn Lane	45	400	625	625	
Westbound Left Turn Lanes	45	250	625/675	550/600	Maximum left turn storage is 600 ft per LDM
Westbound Right Turn Lane	45	N/A	675	675	
Northbound Left Turn Lanes	45	450	500/550	500/550	
Southbound Left Turn Lane	45	250	300	300	
Southbound Right Turn Lane	45	275	375	375	
I-71 SB Ramps/Africa Road					
Westbound Left Turn Lane	45	N/A	475	475	
Westbound Right Turn Lane	45	N/A	275	275	
Northbound Right Turn Lane	45	N/A	550	550	
Southbound Left Turn Lanes	45	N/A	600/650	550/600	Maximum left turn storage is 600 ft per LDM
I-71 NB Ramps/Big Walnut Road					
Eastbound Left Turn Lane	45	N/A	550	550	
Northbound Left Turn Lanes	45	N/A	650/700	550/600	Maximum left turn storage is 600 ft per LDM
Northbound Right Turn Lane	45	N/A	675	675	
Big Walnut Road/Medan Drive/Whispering Ridge Drive					
Eastbound Left Turn Lane	45	220	175	175	
Westbound Left Turn Lane	45	120	175	175	
Northbound Left Turn Lane	25	60	100	60	Limited by existing median island
Southbound Left Turn Lane	25	50	100	100	
Big Walnut Road/Highland Hills Drive/Sedgewick Lane					
Eastbound Left Turn Lane	45	175	175	175	
Westbound Left Turn Lane	45	175	175	175	
Northbound Left Turn Lane	25	N/A	100	100	
Southbound Left Turn Lane	25	150	100	150	
Big Walnut Road/Willow Bend Lane/Grand Oak Boulevard					
Eastbound Left Turn Lane	45	175	175	175	
Westbound Left Turn Lane	45	190	175	175	
Northbound Left Turn Lane	25	175	100	175	
Southbound Left Turn Lane	25	100	100	100	
Big Walnut Road/Jeffries Court/Grandmere Boulevard					
Eastbound Left Turn Lane	45	175	175	175	
Westbound Left Turn Lane	45	125	175	175	
Big Walnut Road/Worthington Road					
Eastbound Left Turn Lanes	45	235	600/650	550/600	Maximum left turn storage is 600 ft per LDM
Eastbound Right Turn Lane	45	250	450	450	
Westbound Left Turn Lane	45	400	400	400	
Westbound Right Turn Lane	45	410	400	400	
Northbound Left Turn Lane	45	385	775	600	Maximum left turn storage is 600 ft per LDM
Northbound Right Turn Lane	45	385	775	175	Low right turn volume
Southbound Left Turn Lane	45	350	700	600	Maximum left turn storage is 600 ft per LDM
Southbound Right Turn Lane	45	350	900	800	Maximum right turn storage is 800 ft per LDM
Big Walnut Road/SR 3					
Eastbound Left Turn Lane	45	270	500	500	
Eastbound Right Turn Lane	45	N/A	525	525	
Westbound Left Turn Lane	45	200	400	400	
Northbound Left Turn Lane	55	600	800	600	Maximum left turn storage is 600 ft per LDM
Southbound Left Turn Lane	55	540	725	540	Proposed length is based on turn lane storage not through-block

* Includes 50-foot taper



NOTE: TURN LANE LENGTHS INCLUDE STORAGE LENGTH ONLY (NO DIVERGING TAPER)

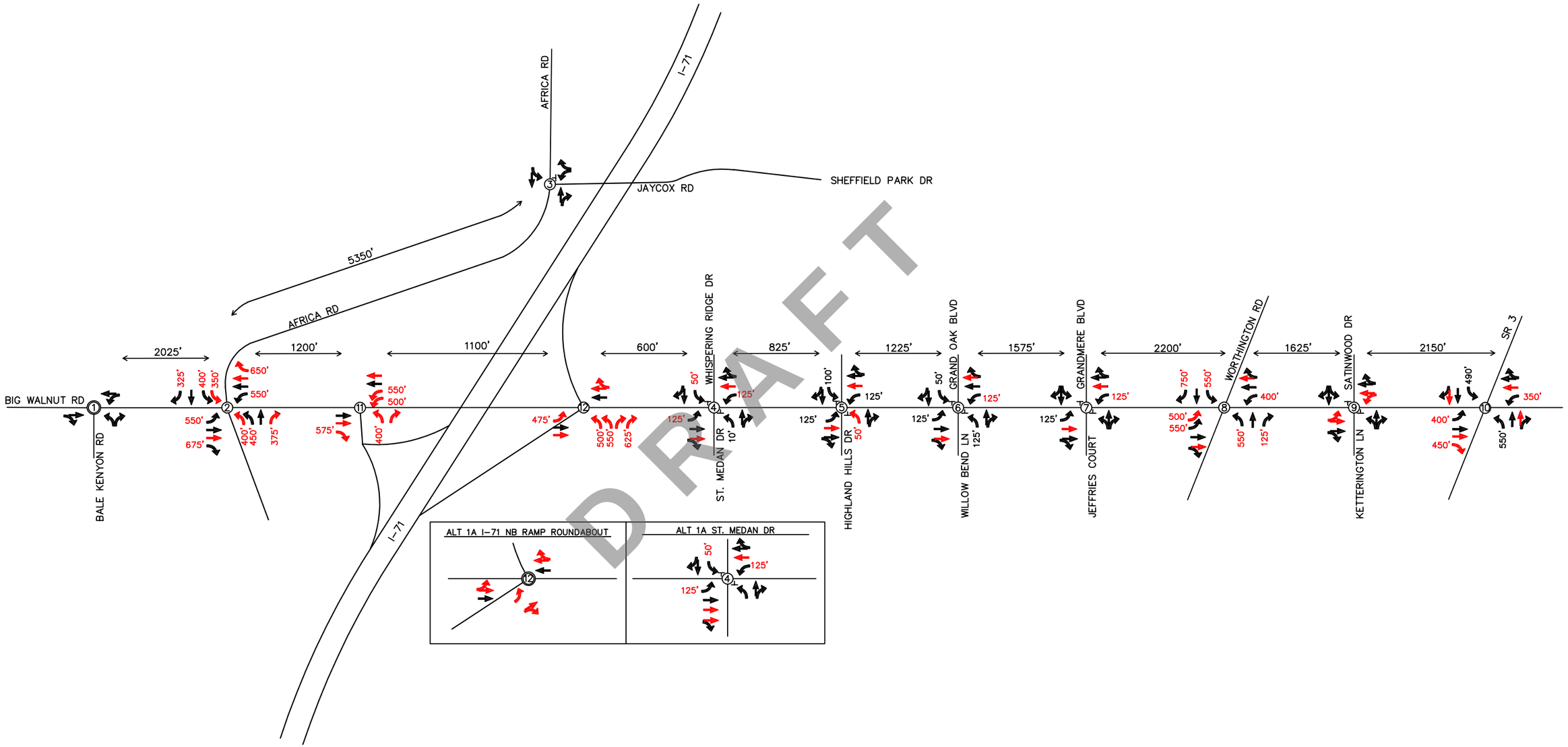
LEGEND

- TRAFFIC MOVEMENT
- PROPOSED IMPROVEMENT

NOT TO SCALE

FIGURE 11
2040 NO BUILD INTERSECTION LANE USE
I-71 BIG WALNUT INTERCHANGE
DELAWARE COUNTY , OHIO

AECOM
564 White Pond Drive Akron, Ohio 44320-1100 (330) 836-9111



NOTE: TURN LANE LENGTHS INCLUDE STORAGE LENGTH ONLY (NO DIVERGING TAPER)

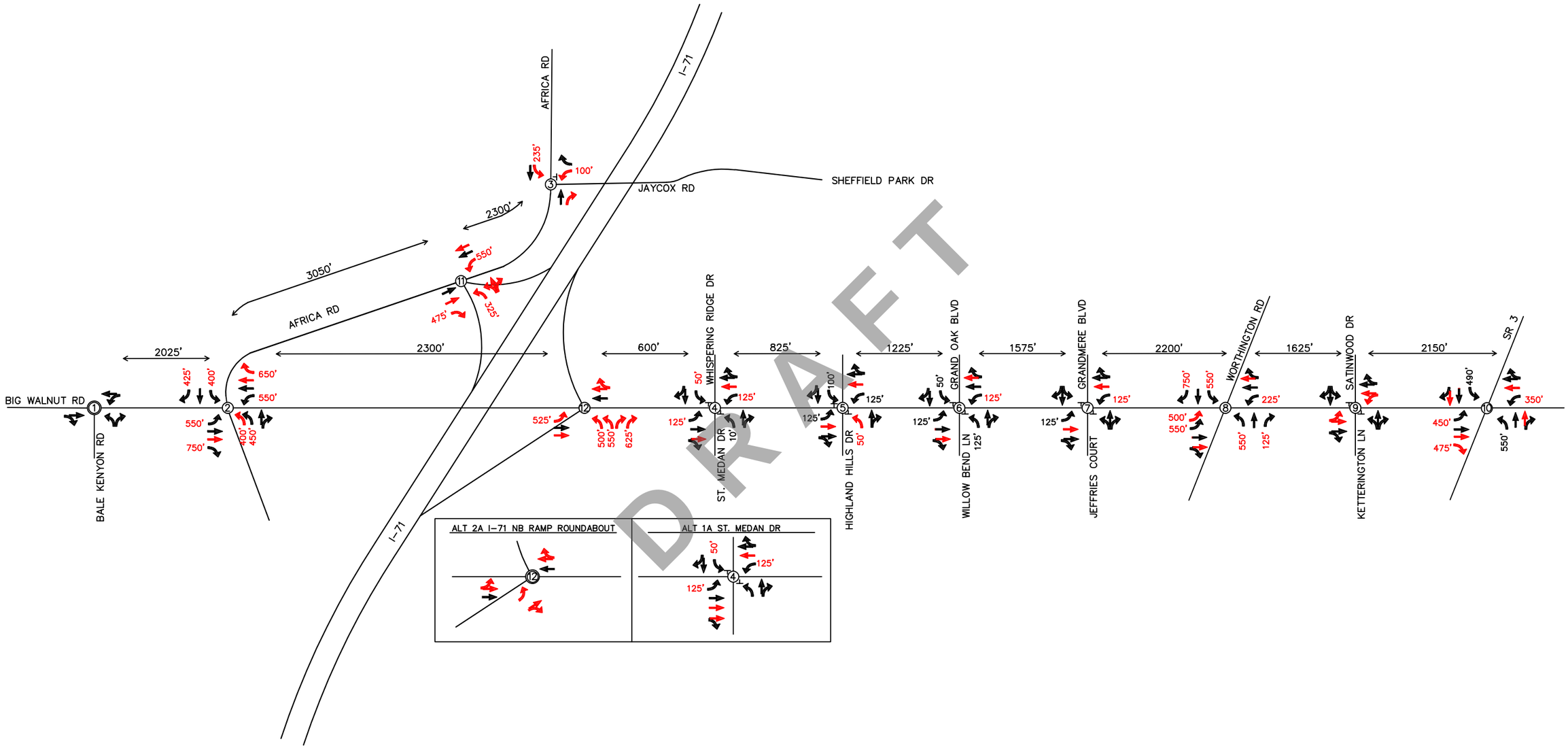
LEGEND

- TRAFFIC MOVEMENT
- PROPOSED IMPROVEMENT

NOT TO SCALE

FIGURE 12
2040 ALT 1 INTERSECTION LANE USE
I-71 BIG WALNUT INTERCHANGE
DELAWARE COUNTY , OHIO

AECOM
564 White Pond Drive Akron, Ohio 44320-1100 (330) 836-9111



NOTE: TURN LANE LENGTHS INCLUDE STORAGE LENGTH ONLY (NO DIVERGING TAPER)

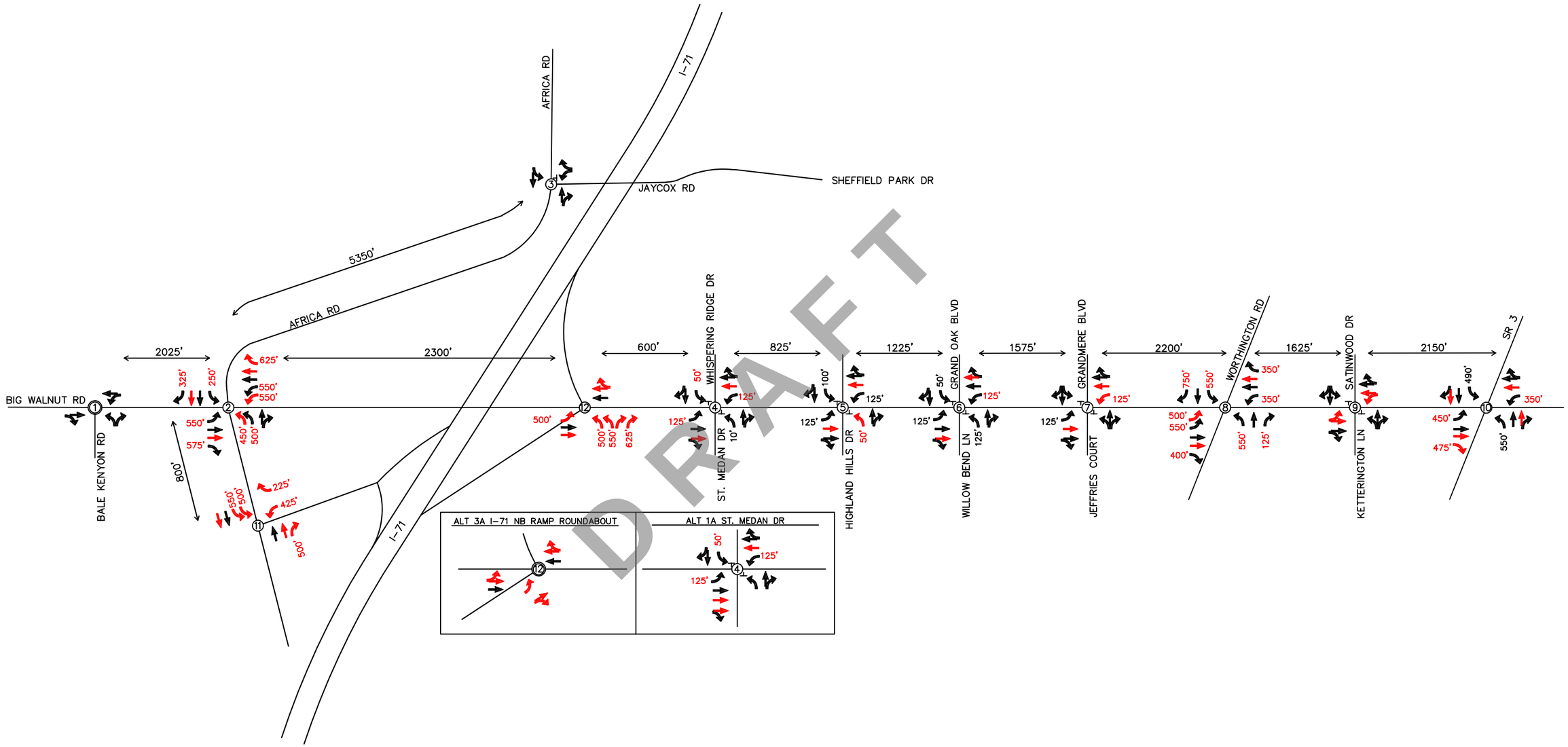
LEGEND

- TRAFFIC MOVEMENT
- PROPOSED IMPROVEMENT

NOT TO SCALE

FIGURE 13
2040 ALT 2 INTERSECTION LANE USE
I-71 BIG WALNUT INTERCHANGE
DELAWARE COUNTY , OHIO

AECOM
564 White Pond Drive Akron, Ohio 44320-1100 (330) 836-9111



NOTE: TURN LANE LENGTHS INCLUDE STORAGE LENGTH ONLY (NO DIVERGING TAPER)

LEGEND

- TRAFFIC MOVEMENT
- PROPOSED IMPROVEMENT

NOT TO SCALE

FIGURE 14
2040 ALT 3 INTERSECTION LANE USE
I-71 BIG WALNUT INTERCHANGE
DELAWARE COUNTY , OHIO

AECOM
564 White Pond Drive Akron, Ohio 44320-1100 (330) 836-9111

4.2 CRASH ANALYSIS

The Economic Crash Analysis Tool (ECAT) which utilizes Highway Safety Manual (HSM) methodology to calculate predicted crashes was used as a way to compare safety of each alternative. Predicted crash rates for the proposed ramps at the IR 71/Big Walnut interchange were calculated based on roadway geometry and traffic volumes. Table 8 compares the predicted crash rate for each alternative. Results of the ECAT predicted crash rates are included in Appendix H.

Table 8 – Crash Frequency Predictions

Alternative	Crash Rate (Crashes Per Year)
Alternative 1	9.11
Alternative 2	5.93
Alternative 3	6.51

4.3 ITS CONSIDERATIONS

Adaptive ramp metering is a key Active Traffic Management (ATM) strategy that warrant further consideration, as it can be an effective and cost-conscious solution when deployed as part of a comprehensive freeway management initiative.

Adaptive Ramp Metering

Ramp meters are traffic signals installed on freeway on-ramps to control the frequency at which vehicles enter the flow of traffic on the freeway. Ramp metering reduces overall freeway congestion by managing the amount of traffic entering the freeway and by breaking up platoons that make it difficult to merge onto the freeway. Without ramp meters in operation, multiple vehicles merge in tightly packed platoons, causing drivers on the mainline to slow down or even stop in order to allow vehicles to enter. The cascading slower speeds, both on the mainline and on the ramp, quickly lead to congestion and sometimes stop-and-go conditions. Ramp meters can break up the platoons by controlling the rate at which vehicles enter the mainline from the ramp. This allows vehicles to merge smoothly onto the mainline and reduces the need for vehicles on the mainline to reduce speed. In addition to breaking up platoons, ramp meters help manage entrance demand at a level that is near the capacity of the freeway, which prevents traffic flow breakdowns. Ramp meters are shown to reduce peak hour lane occupancies (i.e., freeway density) and quicken recovery from mainline breakdown back to or below the critical occupancy threshold.

As previously discussed, it is anticipated that this project will include ramp metering on the proposed southbound entrance ramp. The 2040 AM peak hour is over capacity. In order to maintain the same d/c ratio in the Build scenario as was calculated for the No Build scenario on IR 71 SB, the amount of traffic entering southbound IR 71 will be limited to the amount of traffic exiting at Big Walnut Road, a maximum of 360 vehicles. The excess demand will utilize the available storage on the ramp and Africa Road or find another route to avoid degradation on IR 71 SB in the AM peak hour.

Ramp metering has not been included in the IMS for US 36/SR 37 interchange improvement project

and is not required specifically for that project; however, due to the large amount of traffic anticipated at the Big Walnut interchange, ramp metering at the adjacent interchange should also be considered. Any ramp metering would be implemented as part of the Big Walnut Road Interchange project. Based on discussions with staff from ODOT District 6, it is believed that the interchange is being designed with the capacity to accommodate metering. A second westbound left-turn lane may be needed on US 36/SR 37, along with a two-lane entrance ramp, in order to maximize metering possibilities. Ideally, the ramp metering system would be designed with in-pavement (conductive loops or wireless sensors) or roadside-mounted non-pavement invasive (video cameras or microwave radar) vehicle detection system equipment at both interchanges and include provisions to include remote communications with the ramp metering system so that the ramp metering system can be operated as efficiently and intelligently as possible. The ramp metering system could be configured to operate only when mainline volume and density reach a certain threshold on southbound IR 71; ramp metering would initiate at the Africa Road on-ramp first, and ramp metering at the US 36/SR 37 and Sunbury Parkway on-ramps would only be initiated as needed. It is assumed that metering at one or both interchanges will be required to maintain operations on IR 71 southbound. Details for ramp metering at the adjacent interchanges will be further evaluated in the IJS for Big Walnut Road.

Additionally, ramp metering could also be used to potentially address the LOS F conditions on northbound IR 71 north of Gemini Place in the 2040 No-Build scenario during the PM peak hour. Ramp metering could be implemented at on-ramps to the south of Gemini Place in Columbus at times of peak congestion as part of a regional comprehensive freeway management initiative. While this was not analyzed and is beyond the scope of this feasibility study, this is another consideration that may warrant further study.

4.4 UTILITIES

Existing utility companies were contacted thru OUPS regarding the project. Record plans were requested for any utilities that might be critical to the progression of the project. Further investigation and research (subsurface utility evaluation Level B & C) will need to be done before detailed design begins. Table 9 presents a list of utilities within the project limits.

Table 9 – Identified Utility Companies in Project Limits

Wide Open West
AT&T
Columbia Gas
AEP
DELCO Water
Delaware City Regional Sewer District
Frontier
Consolidated Electric Coop
Columbus Department of Utilities
Suburban Natural Gas
Charter Communications

4.5 GEOTECHNICAL ASSESSMENT

A preliminary geotechnical assessment of existing and proposed conditions was conducted for this project. This assessment was based on readily available information and did not include site specific soil borings or sampling. A field reconnaissance was performed by a geotechnical engineer. Refer to the Preliminary Geotechnical Study, dated June 14, 2016 for the full report.

Geology of the Site

The IR 71 and Big Walnut Road project site is located just north of the transition between two physiographic regions in Ohio; the Central Ohio Clayey Till Plain, and the Columbus Lowland portion of the Southern Ohio Loamy Till Plain. This site is also located on the northern (rear) portion of the Powell end moraine, a hummocky “ridge” which is slightly higher than the surrounding terrain.

The soil overburden in this area typically consists of loamy Wisconsin-aged cohesive glacial till containing discontinuous granular deposits. A few deeper glacial outwash deposits of granular soil are also present near larger watercourses, particularly in the Columbus Lowland region. Shallow alluvial deposits are also present near the Alum Creek valley south of the reservoir and slightly west of IR 71. The approximate ground surface elevations for IR 71 and Big Walnut Road at the existing bridge overpass are approximate Elevations 894 and 876, respectively.

The uppermost bedrock in the vicinity of this site consists of Devonian-aged Ohio Formation shale. ODNR bedrock topography mapping indicates the uppermost bedrock is located near approximate

El. 850. Two (2) of the borings drilled in 1957 for the existing IR 71 bridge over TR 109 did encounter bedrock at Elevations 823.4 and 840.4; however, the remaining four (4) structure borings drilled during 1957 did not encounter bedrock, with the borings being terminated between Elevation 838.9 and 861.5.

The “Ohio Karst Areas” map published by ODNR does not show any probable karst features in the immediate vicinity of the site, and the “Abandoned Underground Mine Maps” published by ODNR do not indicate the presence of underground mines near this site. A cursory review of ODNR’s “Landslides in Ohio” maps indicates this site is not located within an area of Ohio that is subject to severe slope failures.

Geotechnical Considerations

Based on review of the regional geology and the historic borings performed for the IR 71 overpass structure, we anticipate the presence of subsurface conditions that will be generally capable of supporting the construction of a new interchange at this location. Large deposits of unsuitable or weak soils are not anticipated, and most of the overburden soils are likely to be able to support lightly to moderately loaded structures using shallow spread foundations. Bedrock is anticipated to be present at depths more than 20 feet below the level of Big Walnut Road at IR 71.

The 1957 Subsurface Investigation report included recommendations for supporting the IR 71 bridge structure on spread foundations. At the time of this preliminary study, it was not known whether the proposed interchange would require modification or replacement of any of the existing bridge structure. It should be anticipated, however, that any modifications to or widening of the existing structure may require extended foundations to minimize differential settlement between the old and new portions of the structure. Updated requirements for lateral loading may also dictate the need for extended foundations to support the new structure configuration.

North and west of IR 71 and south and east of Africa Road, the potential Alternative 2 ramp configuration would pass through a wooded area that is relatively flat and which is crossed by high tension electric wires. During the site reconnaissance, several wet areas of previous standing water were noted, along with shallow runoff swales. These types of areas may contain zones of near surface soil which is not suitable for roadway subgrades or embankment foundations, but we would anticipate that these areas of unsuitable soil will be discontinuous and not indicative of the overall site conditions. These areas may also require stabilization or moisture conditioning during construction. Markers for an existing gas line were noted southeast of Africa Road near the high-tension wires. The approximate alignment of this utility was not observed.

4.6 STRUCTURAL ASSESSMENT

General

An assessment was performed to determine the potential structure needs to accommodate the proposed widening of Big Walnut Road in the vicinity of the two existing IR 71 mainline bridges over existing Big Walnut Road. The proposed widening will require reconstruction of both existing bridges DEL-71-0355R (SFN: 2102226 and DEL-71-0355L (SFN: 2102196). The reconstruction is required as the existing bridges have approximately a 45-foot lateral clearance between the faces of the existing piers along the existing roadway. As the proposed roadway preferred alternative is 64 feet face to face of curb a reconstruction including removal of the existing piers to below grade will be required. Please see Appendix I for a conceptual plan and profile of the proposed bridge.

Design Criteria

The proposed bridge structure has been developed in accordance with the following criteria assuming a complete replacement:

- AASHTO LRFD Bridge Design Specifications Seventh edition including all Interims and ODOT exceptions
- ODOT Bridge Design Manual, 2007
- ODOT Standard Bridge Drawings
- ODOT Location and Design Manual, Volumes, I, II &III

Proposed IR 71 Structures

The proposed superstructure and substructure units for the new IR 71 bridges will be independent from the existing IR 71 bridges. As the existing piers and abutments are founded on spread footings, they can be removed completely in order to maximize efficiency for the proposed structure without interfering with any existing deep foundations.

The new bridge will be configured to match the existing skew and replace the existing using phased construction. The proposed clear span over Big Walnut Road would require a minimum span of approximately 130'-0" given the 64'-0" curb to curb roadway width plus 15'-0" each side for clear zone requirements and an additional 6'-6"' beyond each side to the centerline of bearing. Given the existing grading condition and the requirements to cut for even the proposed single span option, multiple span options were not considered as they would increase future maintenance and initial construction costs. During detailed design the costs for steel versus concrete superstructure types will be compared to verify the most cost-effective option.

The proposed roadway width of the IR 71 Northbound (R) bridge will be 64'-0" toe-to-toe of barrier to match the existing width, consisting of three 12'-0" travel lanes with 16'-0" and 14'-0" shoulders on the west and east side, respectively. The proposed roadway width of the IR 71 Southbound (L) bridge will be approximately 76'-0" toe- to-toe of barrier to match the existing width and accommodate the new entrance ramp lane, consisting of one 16'-0" entrance ramp lane along with

three 12'-0" travel lanes with 8'-0" and 16'-0" shoulders on the west and east side, respectively. The bridge width will be reduced as feasible during final design dependent on the tapering width of the entrance ramp. In order to provide adequate clearance, the horizontal and vertical clearance will match that of the existing IR 71 bridges. The increased structure depth due to the longer span lengths will be accommodated by lowering the profile of the Proposed Big Walnut Road. Similar to the existing IR 71 bridges, it is expected that storm water drainage will be discharged off the bridges at both ends.

The proposed alignment is on a tangent for the length of the bridge. The superstructure will be composed of either painted steel plate girders or pre-stressed concrete beams both with a composite reinforced concrete deck. The substructures will consist of semi-integral stub type abutments founded on piling behind new Mechanically Stabilized Earth (MSE) walls. New approach slabs will also be constructed. Based on the project geotechnical assessment (see Geotechnical Report for additional information), it is assumed that the abutments will be founded on piling.

At this time, it is assumed that no significant retaining walls other than those at the abutments will be required for the project. The need for noise walls remains to be determined.

4.7 DRAINAGE ASSESSMENT

At this point in the project development process no formal drainage studies or evaluations have been completed. The proposed interchange is adjacent to Alum Creek State Park, and the Alum Creek Dam is located approximately 2800 feet northwest of intersection of Big Walnut Road and Africa Road. As the project moves into detailed design the drainage areas and hydraulic information will be identified in detail.

4.8 RIGHT OF WAY ASSESSMENT

Existing right of way limits were established from existing as completed plans and GIS records from Delaware County. Existing right-of-way (ROW) limits are shown on the alternatives' figures. Further investigation and research (field survey) will need to be done before detailed design begins. It is anticipated that the northbound exit ramp and entrance ramp can be constructed within the existing limited access ROW and existing land owned by Delaware County. New ROW will need to be acquired for the southbound ramps. The SB ramps for Alternatives 1 and 3 will both require new right of way from several private properties in the SW quadrant of the interchange. The SB ramps for Alternative 2 will require new right of way from the park property in the NW quadrant of the interchange.

4.9 ENVIRONMENTAL OVERVIEW

Existing environmental data sources have been consulted for Section 4(f), Regulated Materials, Ecological Resources and Cultural Resources to determine whether environmental resources are present that would influence the comparison of alternatives. A summary of the findings for each resource area is provided below. Other topic areas (such as Underserved Populations) would be similar among all the alternatives and are not included below.

Parks, Recreation Areas, and Wildlife/Waterfowl Refuges – Section 4(f)

One known Section 4(f) property is located within the study area. Alum Creek Reservoir is owned by the U.S. Army Corps of Engineers (USACE). Management of recreational areas for Alum Creek State Park is under the jurisdiction of the Ohio Department of Natural Resources (ODNR). Park maps do not indicate any park facilities, services or marked trails within the property east of Africa Road. Preliminary coordination with ODNR indicates that no programmed activities occur within this area. Alternatives 1 and 3 would not impact the park property. Alternative 2 would impact approximately 10.3 acres of the park property. Based upon the minimal impact to recreational uses and the small acreage compared to the overall size of Alum Creek State Park, it is possible that this impact would be considered *de minimis*. Formal coordination will be required to confirm the appropriate determination and resolve proposed mitigation if Alternative 2 moves forward. Alternatives 1, 2 and 3 are anticipated to have strip takes of R/W from the park property along Big Walnut Road and Africa Road near the intersection. (approximately 0.5 acres)

Ecological Resources

USGS StreamStats, included in Appendix J indicates three streams within the area. Alternative 1 appears likely to have one crossing and possibly a lateral encroachment of the stream along I-71. Alternative 2 appears to have one stream crossing adjacent to Africa Road. Alternative 3 appears likely to have a lateral encroachment. According to the ODOT TIMS database, there are no National Wetland Inventory (NWI) wetlands within the limits of the alternatives.

All three alternatives contain Suitable Wooded Habitat (SWH) for the Indiana bat and Northern long-eared bat. Based upon the current level of detail, Alternative 1 would impact 3.9 acres, Alternative 2 12.1 acres, and Alternative 3 3.5 acres.

Cultural Resources

Per the State Historic Preservation Office (SHPO) database, included in Appendix J, there are no known historic properties within the limits of any of the alternatives. The database indicates several previously recorded archaeological sites, described as “isolated finds,” from a c.1988 survey. None of these would be expected to influence the comparison of alternatives. The SHPO database also indicates a cemetery on the east side of Africa Road, south of Lewis Center Road, that is mapped in the vicinity of Alternative 3. The database does not indicate high confidence in the mapping and the exact location of the cemetery has not been verified.

Regulated Materials

A review of the Ohio Regulated Properties Search (ORPS) Tool indicates that there are no recorded regulated materials concerns. The only item shown are two locations in the OEPA Spills Database of diesel fuel spills along IR 71 near the project area.

Environmental Summary

Based upon the above information, impacts to Section 4(f) property, streams and suitable wooded habitat are the factors that differ among the alternatives. These topics are included in the comparison matrix on Figure 16.

4.10 RECOMMENDED PROJECT PHASING

It will be important to construct this project in logical phases, and three main phases have currently been identified with each subsequent phase coming online as increasing traffic demand necessitates further expansion and the project funding becomes available. This section provides a brief summary of the three main phases of the project.

Phase 1

- Construction is expected to begin in 2023
- Constructing the Big Walnut Interchange including freeway ramps
- Widening I-71 bridges over Big Walnut Road
- Widening Big Walnut Road from Africa Road to Grand Oak
- Widening Africa Road from Big Walnut Road to Jaycox Road

Phase 2

- Construction is expected to begin in 2028
- Widening IR 71 from Gemini Place to Jaycox Road with median barrier section
- Widen or restripe the northbound exit ramp lane to Big Walnut Road

Phase 3

- Construction is expected to begin in 2037
- Widening Big Walnut Road to Worthington Road or to SR 3 (as needed based on future analysis of the capacity of the Big Walnut Road and Worthington Road intersection.

A schematic map of the proposed project phasing is shown for reference Figure 15.

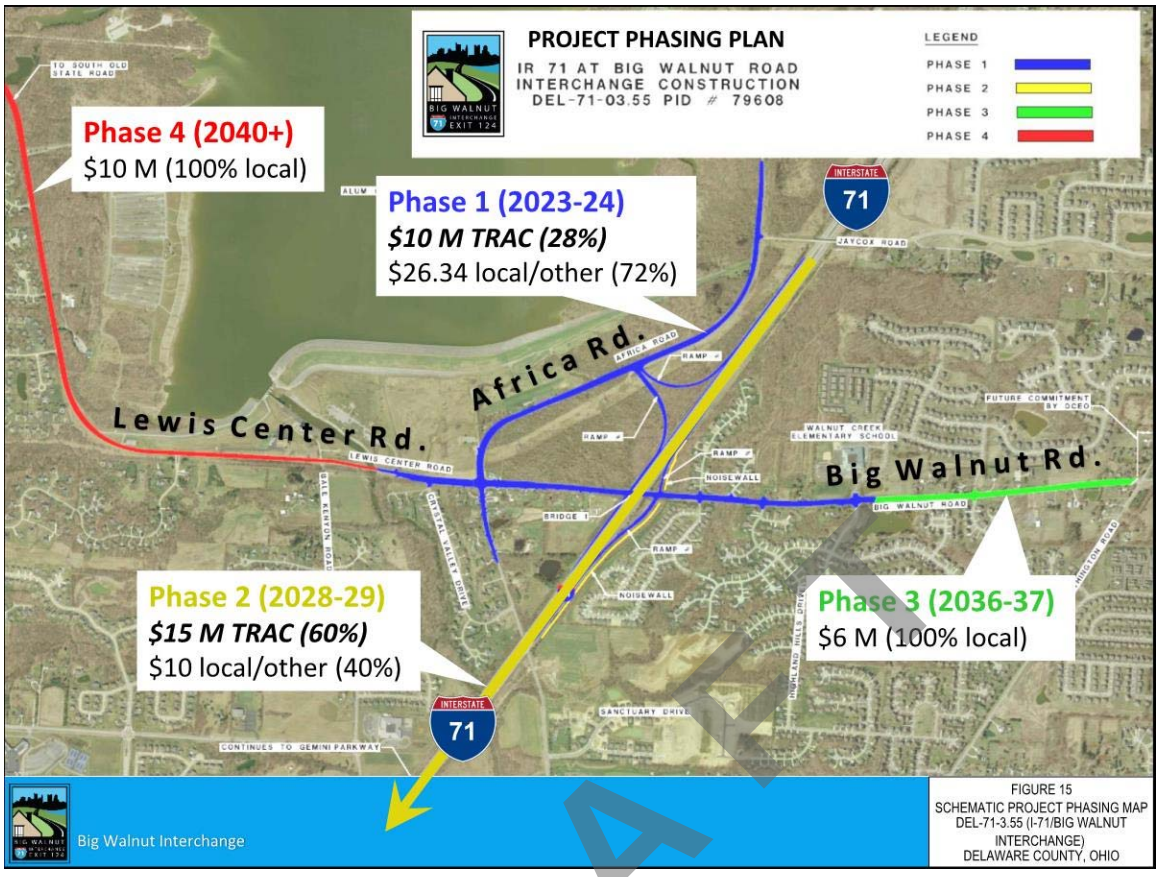


FIGURE 15
SCHEMATIC PROJECT PHASING MAP
DEL-71-3.55 (I-71/BIG WALNUT INTERCHANGE)
DELAWARE COUNTY, OHIO

4.11 CONSTRUCTABILITY

All three alternatives contain many of the same improvements which may affect the constructability of the project. Replacement of the two bridges over Big Walnut Road is required in all three alternatives and may involve temporary closures. The NB widening of IR 71 will also require widening of the NB bridges over Alum Creek and Africa Road in all the alternatives. Additionally, the widening and improvements for Big Walnut Road extend through the same corridor limits from West of Africa Road to east of Willow Bend Lane. The primary difference between the alternatives is the location of the SB ramps. The SB ramps for Alternate 1 are located in the SW quadrant of the interchange and connect with Big Walnut Road between Africa Road and IR 71. The ramps for Alternative 1 will require the additional widening of the SB bridge over Africa Road. The SB ramps for Alternative 2 are located in the NW quadrant of the interchange and connect with Africa Road north of Big Walnut Road. The ramps for Alternative 2 will not require the widening of any additional bridges on IR 71; however, additional widening of Africa Road will be required (approximately 0.7 miles) between Big Walnut Road and Jaycox Road. The SB ramps for Alternative 3 are located in the SW quadrant of the interchange and connect with Africa Road south of Big Walnut Road. The ramps for Alternative 3 will require the additional widening of the bridge over Africa Road and the bridge over Alum Creek. Alternative 3 will also require the widening of Africa Road between IR 71 and Big Walnut Road (approximately 0.25 miles).

4.12 CONSTRUCTION COST ESTIMATE

A preliminary construction cost estimate for the proposed interchange (Alternative 2) and associated work has been developed with an assumed 2023 construction year for Phase 1 and 2028 for Phase 2. The methodology for estimating follows general procedures for this level of design and follows ODOT's Office of Estimation procedures for conceptual construction costs. Items that could be quantified were calculated, and unit prices were applied. A 25% contingency was included, and costs will be updated as plans are developed further.

Right of way costs have not been included since there is not enough detail at this point to determine the number of parcels affected or the amount of land that will be required. The total estimated cost for the interchange and associated roadway construction is:

	Construction Year	Construction Cost
Phase 1 - Big Walnut Road & Africa Road & I-71 Bridge Over Big Walnut Road	2023	$43,415,240
Phase 2 - I-71 Widening & Median Barrier	2028	$24,684,298
	Grand Total	**$68,099,538**

The Grand Total construction cost is approximately $68.1M (Alternative 2) with a detailed breakdown provided in Appendix K. Estimates for Alternatives 1 and 3 were developed by evaluating the major differentiating features of the interchange layouts with respect to Alternative 2 including the length of Africa Road improvements and the widening of structures on I-71 SB due to the impact of the proposed ramps. A relative adjustment value was developed and applied to the Alternative 2 estimate amount to determine the estimated costs for Alternatives 1 and 3. The construction cost for Alternative 1 is estimated to be $64.6 M and the cost for Alternative 3 is estimated to be $66.1 M.

5.0 COMPARISON OF ALTERNATIVES

	Right-of-Way	Environmental Issues	Traffic Operations	Safety	Future Development	Constructability	Cost Estimate (in million dollars)
No Build	□	□	□	□	□	□	$0
Alternative 1	▲	▲	●	▲	▲	▲	$64.6
Alternative 2	▲	▲	●	●	□	▲	$68.1
Alternative 3	▲	▲	●	●	▲	▲	$66.1

Legend *(Impacts Compared to the No Build Alternative)*
● High positive impact ▲ High negative impact □ Similar impact
● Moderate positive impact ▲ Moderate negative impact

Figure 16 – Alternative Comparison Matrix

All of the build alternatives meet the project purpose. The evaluation matrix shown in Figure 16 compares the alternative benefits, impacts and costs. Notable differences between the alternatives are summarized below:

Right-of-way – Alternatives 1 and 3 require ROW takes from several private properties in the SW quadrant of the interchange. Alternative 2 requires new ROW from the park property in the NW quadrant of the interchange.

Environmental Issues – Alternative 2 would impact approximately 10.3 acers of the park property, which is considered to de minims. All three alternatives contain Suitable Wooded Habitat for the Indiana bat and Northern long-eared bat (Alternative 1 – 3.9 acers, Alternative 2 – 12.1 acers, Alternative 3 – 3.5 acers).

Traffic Operations – Level of service is similar between the three alternatives. Alternative 2 provides the most storage for the SB on ramp which is needed with ramp metering (Alternative 1 – 1,840 feet, Alternative 2 – 4,080 feet, Alternative 3 – 3,360 feet).

Safety – Alternative 2 has the lowest predicted crash rates and available queue storage on the interchange ramps resulting in a higher rating (Alternative 1 – 9.11 crashes per year, Alternative 2 – 5.93 crashes per year, Alternative 3 – 6.51 crashes per year). Queuing on Big Walnut Road for Alternative 1 is also a safety concern.

Future Development – Alternative 2 does not provide direct access to the interchange for developable land, while Alternatives 1 and 3 would encourage development in the area due to freeway access. Given the current congestion on the freeway, potential future development is considered a negative impact.

Constructability – All of the alternatives required widening of IR 71 and the NB bridges over Alum Creek and Africa Road. Alternative 1 requires additional widening of the SB bridge over Africa Road. Alternative 2 will not require widening of any additional bridges on IR 71; however, additional widening of Africa Road will be required between Big Walnut Road and Jaycox Road. Alternative 3 requires additional widening of the SB bridge over Africa Road and Alum Creek. Alternative 3 will also require widening of Africa Road between IR 71 and Big Walnut Road.

6.0 CONCLUSIONS AND RECOMMENDATIONS

Alternative 2 meets the project purpose and need and is supported by Delaware County. However, none of the alternatives have been eliminated until input from public involvement is considered. A preferred alternative will be identified after the public involvement phase.

7.0 NEXT STEPS

Public involvement is expected to occur within the next 6 months. Following the public involvement and acceptance by ODOT, an Interchange Justification Study (IJS) and detailed design will be completed. Construction is anticipated to begin in 2023. Delaware County is currently pursuing Transportation Review Advisory Council (TRAC) funding for this project.