

# I-71/Big Walnut Road Interchange Feasibility Study

PID 79608

Delaware County Engineer

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## 1.0 EXECUTIVE SUMMARY

### 1.1 PURPOSE OF THE STUDY

The need for a new interchange on I-71 in southern Delaware County has been debated for more than a decade due to increased residential and commercial development in the northeast portion of the Columbus Metropolitan area. Improvements have been made to the interchange at Polaris Parkway/Gemini Place, as well as at the US 36/SR 37 interchange in Sunbury, where further improvements are planned. This study focuses on the need for an additional access point to I-71 in order to alleviate congestion at the existing interchanges, reduce travel time for motorists on county routes and provide direct access to the freeway system for local residents. A new full-access interchange on I-71 is proposed in the area of Big Walnut Road and Africa Road near mile marker 124 adjacent to Alum Creek State Park.

### 1.2 TRAFFIC ANALYSIS

Traffic analysis has been performed to evaluate the impacts of the proposed interchange on the local roadway network as well as on I-71. The Build condition analysis includes the proposed interchange with access to/from northbound I-71 on Big Walnut Road and access to/from southbound I-71 on Africa Road, along with associated improvements to local roadways and intersections. An additional northbound lane on mainline I-71 is included from Gemini Place to the exit ramp at Big Walnut Road. The No-Build condition analysis examines the existing interstate and local road geometry.

The intersection analysis was performed for the Opening Day (2020) and Design Year (2040) traffic utilizing Trafficware's Synchro 9, and it reflects the potential intersection and signal system operations. Since this is a new interchange the Build condition introduces new ramp intersections and signals where there are currently free-flow conditions on the associated roadways. Geometric and traffic control improvements are needed at some local intersections as an integral part of the interchange project, while other improvements will be pursued separately by Delaware County.

AECOM has utilized the Highway Capacity Software (HCS) to determine the levels of service (LOS) for basic freeway segments and ramp merge/diverge areas for the Design Year, No-Build, and Build conditions. Based on this analysis all basic freeway segments, as well as ramp merge/diverge segments show no degradation from No-Build to Build, or can be mitigated through various means to address negative traffic impacts.

Turn lane storage lengths to accommodate the Design Year Build condition traffic demands were also calculated per Ohio Department of Transportation (ODOT) methodology.

### 1.3 ENVIRONMENTAL OVERVIEW

Formal NEPA documentation was not conducted as part of this study, however, a review of existing conditions and prior NEPA investigations conducted in the project area did not reveal existing environmental resources that would prevent future implementation of the Build alternative. It is likely that a Categorical Exclusion document D2 will be required for the project improvements.

## 1.4 RECOMMENDED PROJECT PHASING AND COSTS

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 I-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 preliminary construction cost estimate for the proposed interchange and associated work has been developed with an assumed 2020 opening year. 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. The total estimated cost for the interchange and associated roadway construction in 2020 dollars is approximately \$68.1M and with a detailed breakdown provided in Appendix I.

## 1.5 CONCLUSIONS AND RECOMMENDATIONS

In terms of basic freeway segments and ramp merge/diverge operations on northbound I-71; there is not a significant difference between the 2040 No-Build and Build alternatives. The analysis conducted as part of this study indicates that the basic freeway segments and ramp merge/diverge segments will operate at an acceptable LOS with the addition of a fourth mainline lane from Gemini Place to Big Walnut Road. There is an existing fourth lane of pavement that is striped out from the Gemini Place overpass through the majority of the Gemini Place entrance ramp acceleration lane. The taper from the entrance ramp continues northward approximately to the Powell Road overpass, where new pavement would start and continue to become a drop

lane at Big Walnut Road. In the southbound direction basic freeway segment analysis indicates that a fourth lane would be needed from the Africa Road entrance ramp to Gemini Place to accommodate 2040 Design Year traffic without degradation of freeway traffic operations. However, it is undesired at this time to widen the southbound mainline due to the geometry and lane usage at Gemini Place/Polaris Parkway, which would necessitate carrying additional pavement almost 3 additional miles south of Polaris Parkway all the way to the I-270 interchange. Mitigation is required in order to provide adequate level of service on southbound I-71 without an additional southbound lane, which can be achieved by constraining traffic at ramp intersections and by ramp metering.

#### Constrained Traffic Analysis

The certified traffic for this project shows a Build scenario volume of 2,820 vehicles per hour (vph) in the 2040 PM peak hour traveling from eastbound I-270 to northbound I-71. That ramp has a posted advisory speed of 50 mph. Based on that volume being added to the I-71 northbound mainline volumes, an additional lane would be needed from I-270 northward through the Polaris Parkway/Gemini Place interchange to Big Walnut Road. However, 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 volume of traffic entering northbound I-71 from eastbound I-270. Freeway capacity analysis using the constrained ramp volumes from eastbound I-270 to northbound I-71 indicates that the existing lanes from I-270 through Polaris Parkway on northbound I-71 are adequate to accommodate traffic with no change in LOS from the No-Build conditions. This analysis assumes that the eastbound I-270 ramp to northbound I-71 remains as a single-lane ramp; should the eastbound I-270 ramp to northbound I-71 be upgraded to a 2-lane ramp that the traffic analysis of the study area will need to be reanalyzed separately.

Using the 2040 Design Year certified traffic for the AM peak hour, the proposed signalized intersection at Africa Road and the I-71 southbound ramps will operate at LOS F for the southbound left-turn movement, with a volume-to-capacity (v/c) ratio of 1.71. Since this movement is over-capacity, some of the forecasted peak hour volumes will be unable to access southbound I-71 from the Big Walnut interchange via Africa Road during the design hour, thus reducing the amount of traffic on the southbound I-71 mainline. Given the capacity of the signalized intersection, the volume of traffic that could potentially enter southbound I-71 from Africa Road will be reduced from the forecasted 2,200 vehicles per hour to 1,480 vehicles per hour, but additional measures will still be needed to avoid degradation of the freeway traffic operations.

#### Ramp Metering

Based on basic freeway segment analysis of the 2040 Design Year traffic, the I-71 southbound section between Africa Road and Gemini Place will require an additional lane even with volumes constrained at the proposed signalized intersection at Africa Road and the I-71 southbound ramps. However, as previously indicated, it is not desirable to widen the mainline freeway in this section at this time. In order to avoid degradation of freeway conditions, ramp metering at the Africa Road entrance ramp, and possibly upstream at the US 36/SR 37 (Sunbury) ramp, will be needed. A total of approximately 1,000 vehicles per hour need to be metered in the AM peak in order to maintain the 2040 No-Build levels of service on the southbound mainline freeway.

### Storage Length Calculations

Turn lane storage length calculations at the ramp intersections on Big Walnut Road and Africa Road have been calculated based on the certified traffic volumes and anticipated signal cycle lengths using the methodology in the Location and Design Manual<sup>1</sup> (L&D) Volume<sup>1</sup>. Additionally, the intersection of Africa Road/Big Walnut Road was evaluated to determine required turn lane storage lengths since major improvements will be needed at that intersection as part of the interchange project. Due to the constrained traffic conditions on southbound Africa Road at the I-71 entrance ramp, the maximum left-turn lane length of 600 feet is recommended.

### Conclusions

The new interchange does not improve conditions on the mainline of I-71 or at adjacent interchanges, but it does not have a substantial negative impact on freeway and interchange operations either. The purpose of the project is to provide improved and direct access to the freeway system for motorists in southern Delaware County without degrading the existing system, which the proposed new Big Walnut interchange helps to achieve. It is recommended that the proposed project be advanced into preliminary engineering, detailed design, and construction following approval of a formal Interchange Justification Study and NEPA documentation.

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<sup>1</sup> Location and Design Manual, Ohio Department of Transportation, January 2017.



## 2.0 PROJECT BACKGROUND

### 2.1 PURPOSE AND NEED

#### Purpose Statement

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. A secondary purpose of this action is to improve access to Alum Creek State Park for visitors from outside the region.

#### Need Elements

##### Improving Regional Access (Primary Need)

Creating System Linkage: The need for a new interchange on I-71 in southern Delaware County has been debated for a decade or longer, due to continuing growth in the area, particularly of residential developments. Over the last two decades, Delaware County has been the fastest-growing county in the state of Ohio. Most of that population growth has been concentrated in the southern townships. County planning activities have identified the lack of regional access as a concern for this area of high population density. Currently, motorists wishing to access the freeway system from Big Walnut Road near I-71 must travel on county and local roads to either the Gemini Place/Polaris Parkway interchange (4.95 to 5.81 miles depending on specific route) or to the US 36/SR 37 interchange (7.44 miles).

The existing regional connectivity for Delaware County is provided by I-71 access points at Polaris Parkway and US 36/SR 37. These access points were developed in the 1960s when Delaware was considered a rural county with a population of approximately 40,000 residents. Over the past two decades, Delaware County has been one of the fastest growing counties in the state. The US Census Bureau estimated the current population (July 1, 2017) at approximately 200,500 residents. The population growth has predominately occurred in the five townships along the southern border of the county. The 2010 US Census counts indicate that 61% of the county's population lives in these townships or the municipalities within them. Another 32% of the county population lives in the central five townships and municipalities. The remaining 7% of the county population lives in the eight northern townships and the one village within them. The existing east/west corridor that serves the county, US 36/SR 37, is located north of approximately 90% of the county's population.

Delaware County is in the process of creating a new east/west cross-county corridor in southern Delaware County to provide infrastructure in an underserved area. The new corridor, which follows the Home Road/Lewis Center Road/Big Walnut Road alignments, is centered in the area with the highest population density in the county. The location for this new transportation corridor was identified in the Delaware Thoroughfare Plan based on population and land development projections. System linkage of this east/west corridor to the primary north/south route in the county, Interstate 71, is needed to improve regional access for up to 90% of the Delaware County population.

County commuter patterns highlight the need for improved regional access in the southern part of Delaware County. According to US Census Commuting Flows for 2006-2010 and 2009-2013, 41% of the employed

population remains in Delaware County, while 53-54% of the employed population of Delaware County commutes to Franklin County to the south. Real-world origin-destination (i.e. travel pattern) data for the state of Ohio from the company StreetLight Data was analyzed using their InSight analytics platform, which provided annual 2017 data for origins and destinations of trips associated with the study area. In the AM Peak period (6am-10am), 44.3% of the trips originating in the study area stay in Delaware County while 52.5% are destined for Franklin County. This closely matches Commuting Flows data from the US Census Bureau. In the PM Peak period (3pm-7pm), 61.5% of the trips destined for the study area originate in Delaware County while 36.4% originate in Franklin County. The percentage of PM Peak trips originating in Franklin County is likely impacted by diverted-link trips or pass-by trips as commuters stop at intermediate locations on their way home. Appendix J provides the details of the Streetlight Data InSight data analysis as provided by ODOT.

Removing Regional Traffic from Congested Local Routes: The local roadway network in southern Delaware County is stressed due to population density and lack of connectivity to the regional access system. A planning-level overview of the roadway Level of Service, using tables in the Highway Capacity Manual: A Guide for Multimodal Analysis demonstrates the current and projected congestion issues for the roadway network serving southern Delaware County. The analyses used 2016 Average Annual Daily Traffic (AADT) volumes, and 2020/2040 No Build Certified Traffic Average Daily Traffic (ADT) volumes. Using 2016 traffic volumes, 12 (27%) of the 44 local roadway segments operated at LOS E or F, which indicates that these roadways are over capacity for at least some part of the day. An additional 15 (34%) segments operated at LOS D, which is considered nearing capacity in urban areas. Using 2020 certified projected traffic, the total number of roadway segments that are projected to operate at LOS E or F is 14 (32%), and another 17 (39%) are projected to operate at LOS D. By 2040, a total of 27 (61%) segments are projected to operate at LOS E or F and 9 (20%) are expected to operate at LOS D. The LOS analysis demonstrates that the local network providing access to the regional network is already experiencing capacity issues. By 2040, a large majority of local segments will be at or over capacity, making access to and from the regional transportation network difficult for much of the analysis area. The ability to increase capacity on local roadways is limited by the nature of the facilities. This situation will continue as the urban centers in southern Delaware County continue to develop with greater density.

#### Access to Alum Creek State Park (Secondary Need)

Alum Creek Dam is part of the flood control plan for the Ohio River Basin. The resulting 3,387-acre Alum Creek Lake and surrounding 4,630-acre State Park are operated by the Ohio Department of Natural Resources (ODNR) and support year-round outdoor activities that include camping, boating, swimming, equestrian riding, snowmobiling, and ice boating. The largest inland beach in Ohio and the marina for Alum Creek Lake are located at the southern end of Alum Creek State Park. The ODNR Division of Watercraft indicates that there are no horsepower restrictions for boats on Alum Creek Lake, meaning that it serves all sizes of boats. The campground offers year-round camping at 286 sites with electric hookup, including three full-service sites that also offer sewer and water hookups.

Alum Creek State Park is located in the central northern portion of the study area. It does not have direct access to I-71 or other Principal Arterial roadway facilities. Interstate access from outside the region requires exiting I-71 at either Polaris/Gemini Parkway or US 36/SR 37 and traveling on minor arterial and major collector roads to reach the beach access, marina access, and campground access points of the park. Routes to the beach access from Polaris Parkway range between 5.5 miles to 6.4 miles long, and from US 36/SR 37 range between 8.8 miles to 9.9 miles long. Routes to the marina access from Polaris Parkway & I-71 range

between 7.7 miles to 12.1 miles long, and from US 36-SR 37 range between 7.1 miles to 8.5 miles long. Providing direct access to I-71 at the southern end of the State Park is a benefit to visitors from outside the region who are bringing large boats and recreational vehicles to the area. Reducing the length of travel on local roads for these vehicles will assist in wayfinding for the visitors and will reduce the impact that the large vehicles have on the county road system.

### Summary Statement

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.

## 2.2 PREVIOUS STUDIES AND IMPROVEMENT PROJECTS

There have been several prior studies and capacity improvements in the study area over the past decade or more, which have examined the feasibility of a new interchange in the vicinity of Big Walnut Road, or have addressed capacity and other issues at existing interchanges or along mainline I-71.

A summary of prior studies and projects is listed below.

FRA/DEL-71-25.60/0.00, PID 7278 (2000)

This project included the widening of mainline I-71 in both directions from south of I-270 through the US 36/SR 37 interchange. A third lane was added northbound and southbound as one of the steps to provide a continuous six-lane freeway between Columbus and Cleveland.

I-71/Big Walnut Road Interchange Feasibility Study (URS, 2004/2008)

The Delaware County Engineer undertook a study of the feasibility of a new interchange to be located on I-71 at Big Walnut Road. The study was completed in 2004 and updated in 2008 with revised traffic volumes from MORPC's travel demand model. The Feasibility Study found that an interchange was feasible but would impact both the mainline of I-71 and some ramp junctions. Following the updated study, the project was put on hold for several years, during which time other projects were pursued in the study area.

FRA/DEL-71-28.64/0.00, PID 23977 (2005)

This improvement project extended lanes on I-71 from the I-270 system interchange to Polaris Parkway. The project also modified the interchange from a standard diamond at Polaris Parkway to a split diamond with collector-distributor roads between Polaris and Gemini Place.

DEL-36-17.64, PID 76276 (2012)

Safety improvements were undertaken at the US 36/SR 37 interchange, including implementation of access management principles and turn lanes. The bridge over I-71 was widened to provide side-by-side left-turn lanes onto the freeway. A raised median was constructed east of the interchange to control access to commercial properties and flexible delineator posts were installed west of the interchange for the same purpose.

DEL-71-9.67 (2016)

A permit project was undertaken to widen the exit ramp from northbound I-71 to US 36/SR 37 to two lanes. This was an interim measure to address ongoing congestion issues that were exacerbated by the opening of a new outlet mall in the southeast quadrant of the interchange.

## 2.3 Nearby and Related Projects

There are two significant nearby and related projects that will provide additional capacity improvements along mainline I-71, at the existing and proposed new interchanges, and along the improved regional roadway network. A summary of the nearby and related projects is listed below.

FRA/DEL-71-27.77/0.00, PID 106741 – Improvements to I-71 South between Polaris/Gemini and I-270

This project will be constructed to widen I-71 Southbound by providing an extra lane from the Gemini Place/Polaris Parkway Interchange to the I-270 Westbound ramp. An additional lane will also be constructed on the I-270 Westbound ramp from I-71 Southbound. In addition to this widening, an opening from the Gemini Place on-ramp to I-71 Southbound will be constructed. Currently a barrier wall separates this on-ramp.

The purpose of this project is to improve the safety and congestion along I-71 Southbound, the I-270 Westbound ramp, and the Gemini Place on-ramp; to improve flow of traffic and traffic delays; to provide appropriate access; and to better serve the needs of the traveling public by providing safer access to I-71 and I-270. Construction activities are anticipated to begin in late summer 2019 and continue until the summer of 2020. Traffic will be maintained throughout construction with possible nightly ramp closures.

DEL-71-7.91, PID 90200 – Improved Interchange at I-71 and Routes 36/37 and Proposed Sunbury Parkway

The project will involve construction of an interchange at I-71, south of the existing US 36/SR 37 interchange. This interchange will carry the new Sunbury Parkway over I-71 and run east and west of the interstate, operating in conjunction with the existing interchange to the north at US 36/SR37. The interchange will include a relocated I-71 northbound off-ramp which will provide access to both Sunbury Parkway and US 36/SR 37 and will occur south of the current northbound off-ramp. Access to US 36/SR 37 from northbound I-71 will be accommodated by a collector/distributor road. Access to I-71 northbound from Sunbury Parkway will also occur via the collector/distributor road. Southbound on-ramps to I-71 from Sunbury Parkway eastbound and westbound will be provided. The existing interchange at US 36/SR 37 will remain, but as stated above, the northbound exit from I-71 to access both Sunbury Parkway and US 36/SR 37 will be at the same exiting point.

## 3.0 PROJECT DESCRIPTION

### 3.1 SCOPE OF WORK

The Delaware County Engineer initiated this study to evaluate the potential of constructing a new interchange on I-71 in the vicinity of Big Walnut Road in southern Delaware County, in order to provide direct access to the freeway for local residents. This report is not a formal interstate access request and if the project is advanced it will require a formal 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 8 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.

### 3.2 ALTERNATIVES ANALYSIS

AECOM has developed conceptual alternatives for a proposed interchange in the vicinity of Big Walnut Road, with a variety of interchange configurations. The alternatives are identified as follows:

- No-Build Alternative - the "No-Build" alternative is always considered as part of planning studies. This alternative takes no further action to improve the study area beyond the improvements which are already under development by other initiatives. 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 "Build" alternatives can quantify the real benefits of Build alternatives apart from the benefits of already scheduled improvements. For the purposes of this study the No-Build alternative assumes the proposed modification of the US 36/SR 37 interchange.
- Alternative 1 - This alternative provides new access to I-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 I-71 bridge over Big Walnut Road. This alternative has a folded diamond configuration, with standard diamond ramps for access to northbound I-71, a loop ramp for exit from southbound I-71 and a diamond ramp adjacent to the loop ramp for entrance to southbound I-71. Necessary improvements to Big Walnut Road and Africa Road will be incorporated into the design.
- Alternative 2 - This alternative provides new access to I-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 I-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. Necessary improvements to Big Walnut Road and Africa Road will be incorporated into the design.

- Alternative 3 - This alternative provides new access to I-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 I-71 bridge over Big Walnut Road. Necessary improvements to Big Walnut Road and Africa Road will be 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 the freeway system. In addition, an entrance ramp in the southwest quadrant would likely have a steep profile to reach the grade of the mainline, making it difficult for large trucks to attain adequate speed to merge onto I-71.

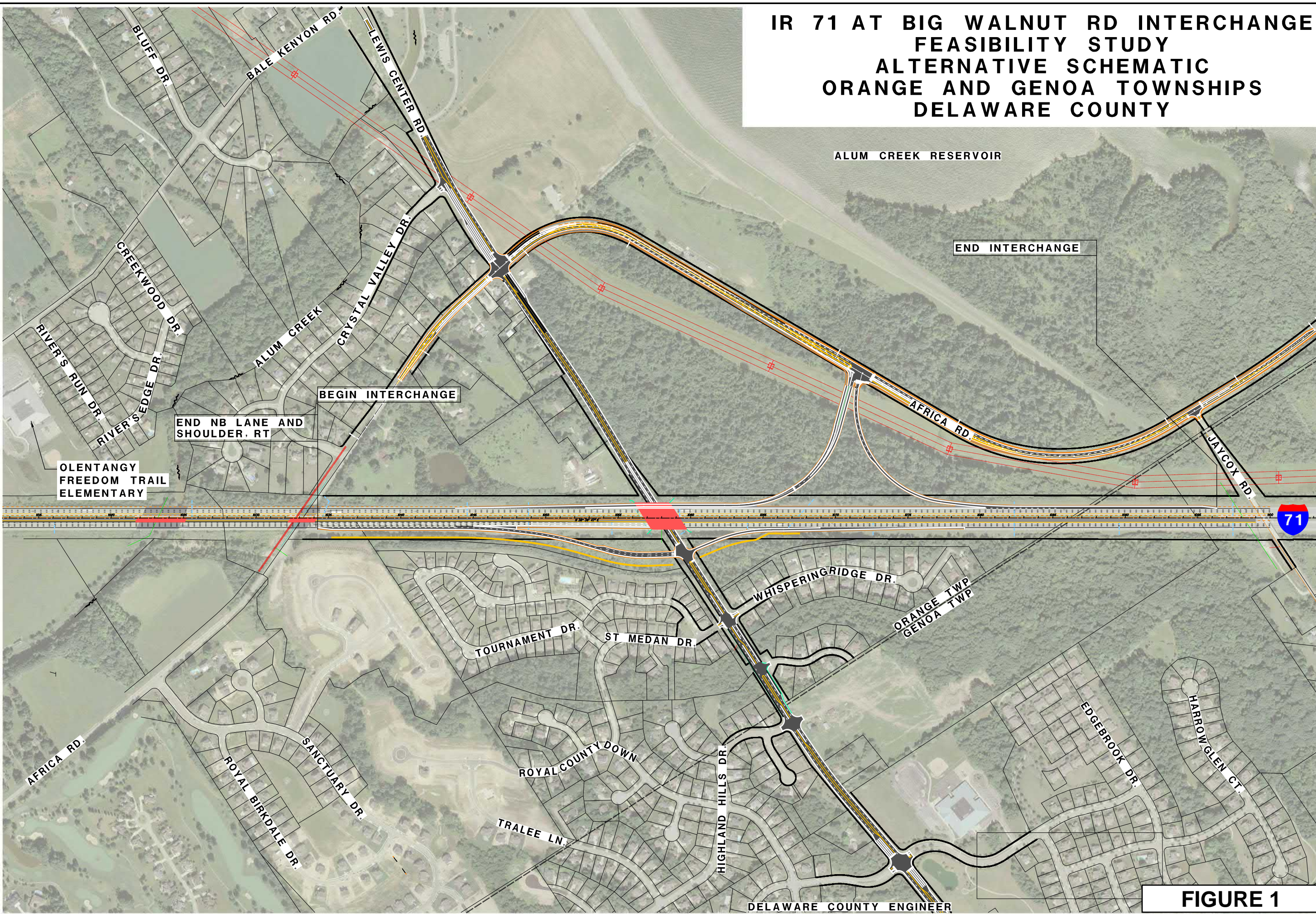
Alternative 2, locating the southbound ramps in the northwest quadrant within/adjacent to an area protected by the Army Corps of Engineers due to the adjacent Alum Creek Lake and Dam. This precludes any development adjacent to the interchange. Development of the southwest quadrant would be less attractive since there would not be direct access to the ramps. Any constraints on traffic are more easily accommodated with Alternative 2 since there is less existing congestion and more storage capacity on both the ramps themselves and on Africa Road than with either Alternative 1 or 3.

Based on capacity analysis, constructability, limitation to future development and consideration of design standards, Alternative 2 is recommended as the preferred alternative. An overview of Alternative 2 is shown on Figure 1, and conceptual layouts of all alternatives are provided in Appendix A.



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# IR 71 AT BIG WALNUT RD INTERCHANGE FEASIBILITY STUDY ALTERNATIVE SCHEMATIC ORANGE AND GENOA TOWNSHIPS DELAWARE COUNTY



CALCULATED  
BLM  
CHECKED  
PHF

IR 71 AT BIG WALNUT ROAD INTERCHANGE  
FEASIBILITY STUDY - ALTERNATE 2B

PID #: 79608

DEL-71-03.55

5  
56

**FIGURE 1**

DELAWARE COUNTY ENGINEER



### 3.3 STUDY AREA

#### Project Area Description

I-71 extends from Louisville, Kentucky, to Cleveland, Ohio, and passes through Cincinnati and Columbus, Ohio. The project study area (Figure 2) extends along I-71 from the I-270 interchange to the US 36/SR 37 interchange, encompassing the Polaris Parkway/Gemini Place interchange. Within the study area I-71 northbound provides five lanes from the I-270 ramps to Polaris Parkway, four lanes from Polaris Parkway to Gemini Place and three lanes northward through the study area. In the southbound direction, I-71 provides three lanes from US 36/SR 37 to Polaris Parkway, then four lanes from Polaris Parkway to I-270. The mainline includes 12-foot standard lanes and is gently sloping within the interstate limits. The speed limit is 65 mph from I-270 to Gemini Place and 70 mph north of Gemini Place. The free flow speed is assumed to be 70 mph throughout the study area. Figure 2 shows a map of the project study area.

Within the study area there is a system interchange with I-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. There is also an existing rest area on I-71 north of the proposed interchange, which will have adequate spacing from the proposed ramps and will not impact operations. Table 1 provides a summary of the interchange spacing, including the proposed interchange at Big Walnut Road, with distances based on the straight line mileage at the center point of the interchange or where the crossing route intersects I-71.

Table 1 – Interchange Spacing

Interchange	MP/Exit #	Distance From (miles)	Distance To (miles)
I-270	119	--	2.22
Polaris Parkway	121	2.22	0.47
Gemini Place	121	0.47	2.64
Big Walnut Road (Study Point)	124	2.64	8.72
US 36/SR 37	131	8.72	--

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. The following intersections within the proposed interchange area have been analyzed:

1. Lewis Center Road and Bale Kenyon Road (roundabout)
2. Lewis Center Road/Big Walnut Road and Africa Road (signal)
3. Big Walnut Road and I-71 NB Ramps (signal, Build only)
4. Big Walnut Road and St. Medan Drive/Whispering Ridge Drive (TWSC)
5. Big Walnut Road and Highland Hills Drive (TWSC)
6. Big Walnut Road and Willow Bend Lane/Grand Oak Boulevard (TWSC)
7. Big Walnut Road and Jeffries Court/Grandmere Boulevard (TWSC)
8. Big Walnut Road and Worthington Road (signal)
9. Big Walnut Road and Ketterington Lane/Satinwood Drive (TWSC)
10. Big Walnut Road and SR 3 (signal)
11. Africa Road and I-71 SB Ramps (signal, Build only)
12. Africa Road and Jaycox Road (TWSC)



### US 36/SR 37 Interchange Modifications

As discussed previously in Section 2.3, there is a project in development to improve the existing interchange at US 36/SR 37 by providing additional ramps at Sunbury Parkway, just south of the existing diamond interchange. The new ramps will primarily serve new commercial development in the area, as well as residents of the Village of Sunbury. The proposed improvements will provide diamond exit and entrance ramps from northbound I-71 to Sunbury Parkway, with a collector-distributor road to the existing ramps at US 36/37, a diamond entrance ramp from eastbound Sunbury Parkway to southbound I-71 and a loop entrance ramp from westbound Sunbury Parkway to southbound I-71. That project is awaiting approval of the IMS and NEPA documentation and is scheduled to begin construction in 2018, however, final plans have not been prepared yet and it is expected that construction will not begin until 2019 or later. The phased project is anticipated to be completed prior to construction of the proposed Big Walnut interchange.

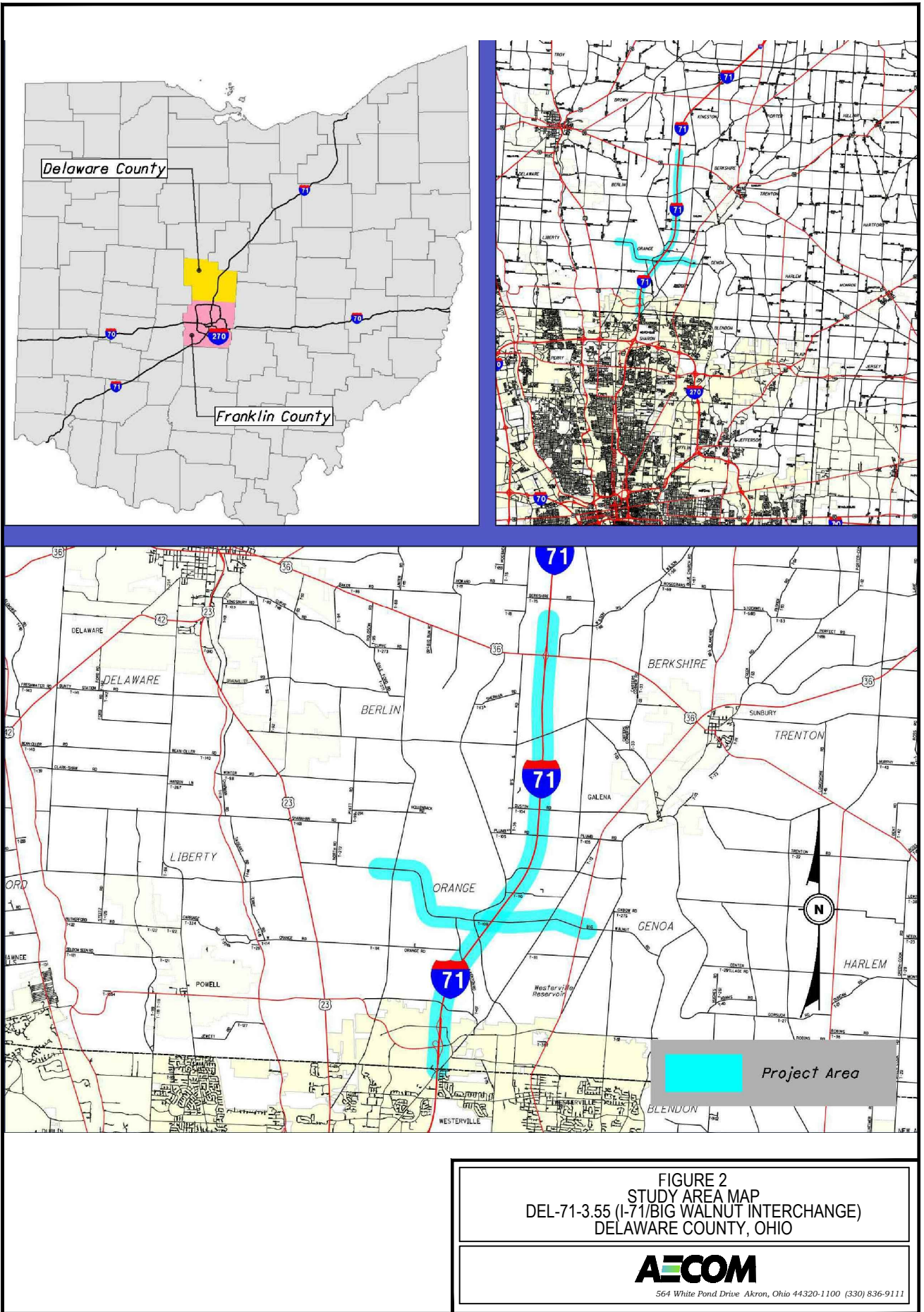


FIGURE 2  
STUDY AREA MAP  
DEL-71-3.55 (I-71/BIG WALNUT INTERCHANGE)  
DELAWARE COUNTY, OHIO



## 4.0 TRAFFIC ANALYSIS

### 4.1 ANALYSIS YEARS

The traffic analysis evaluated operations for the No-Build and Build scenarios for the Design Year (2040).

### 4.2 TRAFFIC VOLUMES

Certified traffic plates were prepared by ODOT Traffic Modeling & Forecasting for the mainline I-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. Per ODOT policy, only the 2040 Design Year traffic was analyzed for this report. Figure 3 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 and the intersection turning movement traffic counts are provided in Appendix B, along with the calculated volumes for the local intersections and modified freeway volumes due to constrained traffic.

### 4.3 METHODOLOGY AND SOFTWARE

Per ODOT methodology, Highway Capacity Software (HCS) analyses were performed for basic freeway segment and ramp merge/diverge segments within the study area for Design Year AM and PM peak periods, for both No-Build and Build alternatives. Synchro version 9 microsimulation software was used to analyze the intersections along Lewis Center Road/Big Walnut Road and Africa Road. The software allows for analysis results following HCM procedures, and for the future IJS, analysis will be conducted for the ramp intersections using HCS following ODOT methodology for balancing LOS and delay. For purposes of this study Synchro was used to determine the number of lanes, cycle lengths and signal phasing needed to provide optimized operations at the study intersections.

### 4.4 FREEWAY SEGMENT AND RAMP ANALYSIS

In order to determine any negative operational impacts of the proposed interchange on the existing interstate, the I-71 basic freeway, ramp merge and diverge segments were analyzed using HCS 2010 Release 6.70 for the Design Year (2040) No-Build and Build conditions; for the freeway segments and ramps there is no difference for the various alternatives, other than slight differences at the Big Walnut ramps themselves. The analysis included both AM and PM peak hours.

Basic Freeway Section analysis was performed for I-71 from I-270 to US 36/SR 37 and the results are shown in Table 2 for a comparison of No-Build and Build conditions.



Figure 3 - Traffic Pattern Change Map

**Legend**

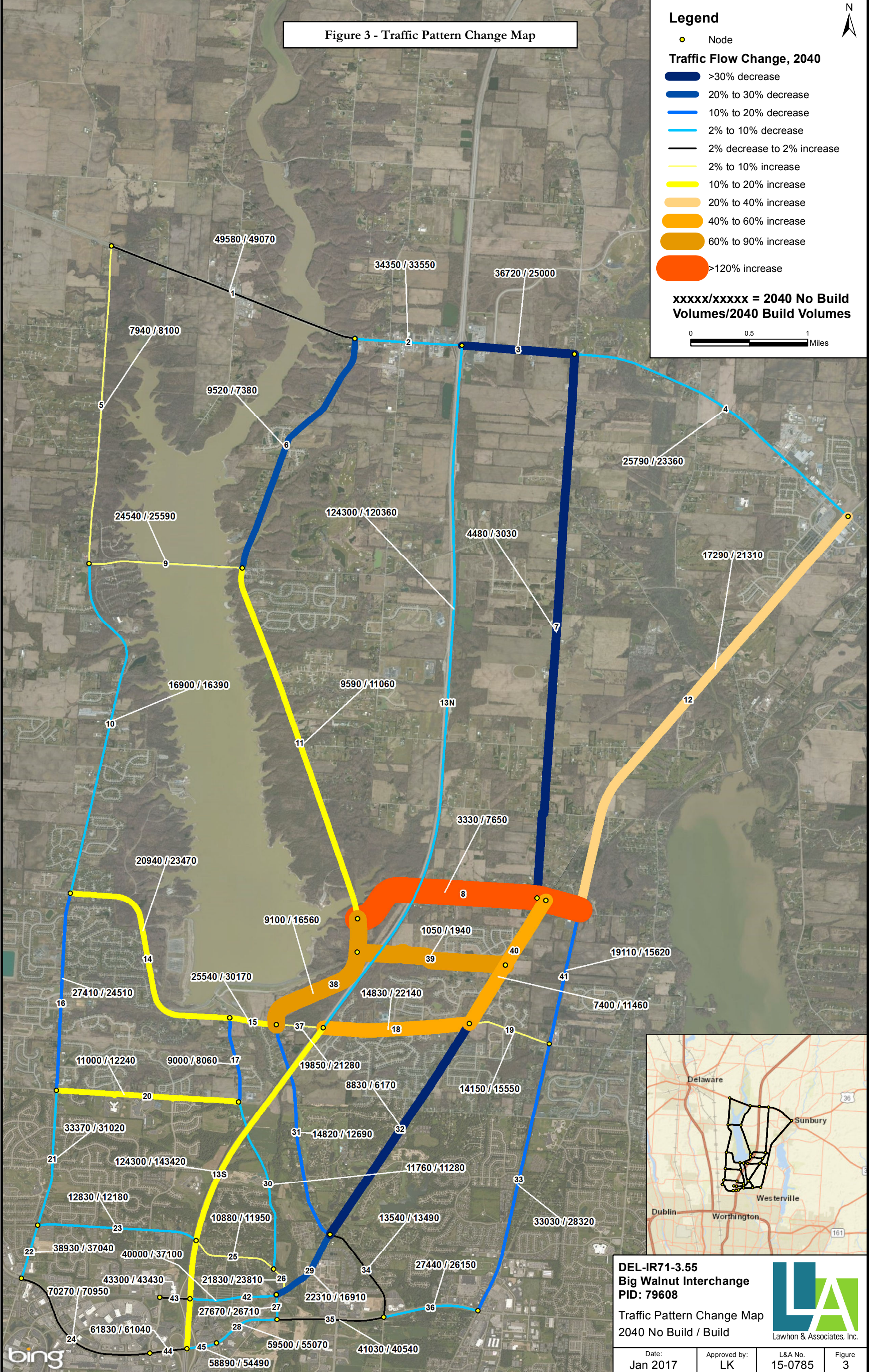
- Node

**Traffic Flow Change, 2040**

- >30% decrease
- 20% to 30% decrease
- 10% to 20% decrease
- 2% to 10% decrease
- 2% decrease to 2% increase
- 2% to 10% increase
- 10% to 20% increase
- 20% to 40% increase
- 40% to 60% increase
- 60% to 90% increase
- >120% increase

xxxxx/xxxxx = 2040 No Build Volumes/2040 Build Volumes

0 0.5 1 Miles



**DEL-IR71-3.55**  
**Big Walnut Interchange**  
**PID: 79608**

Traffic Pattern Change Map  
 2040 No Build / Build

Lawhon & Associates, Inc.

Date: Jan 2017	Approved by: LK	L&A No. 15-0785	Figure 3
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Table 2 – Freeway Capacity Analysis LOS

Basic Freeway Segments	2040 AM		2040 PM	
	No-Build	Build	No-Build	Build
I-71 NB I-270 to Polaris Pkwy	C	C	E	F
I-71 NB Polaris Pkwy to Gemini Pl	A	A	E	F
I-71 NB Gemini Pl to US 36/SR 37	A	--	F	--
I-71 NB Gemini Pl to Big Walnut Rd	--	B	--	F
I-71 NB Big Walnut Rd to US 36/SR 37	--	A	--	F
I-71 SB US 36/SR 37 to Gemini Pl	E	--	C	--
I-71 SB US 36/SR 37 to Big Walnut Rd	--	E	--	C
I-71 SB Big Walnut Rd to Gemini Pl	--	F	--	B
I-71 SB Gemini Pl to Polaris Pkwy	D	F	B	B
I-71 SB Polaris Pkwy to I-270	F	F	D	D

There is indication that the segment of northbound I-71 between I-270 and Polaris Parkway will operate at LOS E in the Build condition, which represents a decline in performance from the LOS C in the No-Build scenario. However, the system ramp from eastbound I-270 is anticipated to operate as a constraint to demand volumes, eliminating the need for any improvements south of Polaris Parkway. The constrained traffic analysis is discussed in more detail below.

In the northbound direction between Polaris Parkway and Gemini Place the No-Build experiences LOS E and the Build scenario operates at LOS F in the PM peak, indicating some degradation in the level of service. Between Gemini Place and Big Walnut Road both scenarios operate at LOS F in the PM peak, however the Build scenario increases the volume on the mainline by 19%, which is greater than the 2% threshold used to determine degradation. Due to the apparent degradation of level of service on northbound I-71 between Polaris Parkway and Big Walnut Road for the Build scenario in the PM peak, a fourth mainline lane is recommended to help improve operating conditions. This can be accomplished by extending the fourth lane that currently merges from four lanes to three lanes beginning just south of the Gemini Place overpass. A fourth lane of pavement is currently available in the existing pavement cross section from just south of the Gemini Place overpass to approximately the Powell Road overpass, but it is striped out to facilitate the merge just south of the northbound on-ramp from Gemini Place. The proposed fourth lane will be extended to the northbound off-ramp at Big Walnut Road, where the right lane (lane #1) will become an exit-only lane to Big Walnut Road and an additional deceleration lane will be added to create a two-lane off-ramp. North of the Big Walnut Road off-ramp, the median lane will taper back to the existing three northbound lanes. Northbound I-71 will operate at LOS E between Gemini Place and Big Walnut Road in the Build scenario for the PM peak with the proposed fourth mainline lane in place. The segment between Big Walnut Road and US 36/SR 37 operates at LOS F in both the No-Build and the Build scenarios, but 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 that this analysis assumes that the eastbound I-270 ramp to northbound I-71 remains as a single-lane ramp; should the eastbound I-270 ramp to northbound I-71 be upgraded to a 2-lane ramp that the traffic analysis of the study area will need to be reanalyzed separately.

In the southbound direction I-71 the level of service on I-71 south of the proposed Big Walnut interchange I-71 decreases from LOS E in the No-Build scenario to LOS F in the Build scenario for the AM peak between Big Walnut Road and Polaris Parkway. This could potentially be mitigated by adding a fourth lane south of the

proposed southbound entrance ramp from Africa Road, but because of interchange spacing and taper length requirements, the additional fourth lane would need to extend an additional two to three miles further south of Polaris Parkway to the I-270 system interchange, which is not warranted at this time. Additionally, adding a fourth lane from the Big Walnut interchange to the I-270 interchange is not necessary at this time because the amount of traffic entering southbound I-71 from Big Walnut Road via the Africa Road on-ramp will be metered by the operation of the proposed new signalized intersection at Africa Road and the southbound I-71 ramps. I-71The volume of traffic entering the southbound I-71 entrance ramp from Africa Road will be constrained because the southbound left-turn and northbound right-turn movements of the proposed signalized intersection are expected to operate over-capacity in the AM peak. As a result, with a smaller, constrained volume of traffic entering southbound I-71 from the Big Walnut interchange, southbound I-71 between Big Walnut Road and Polaris Parkway is expected to operate at LOS E in the AM peak.

Figure 4 provides a graphic representation of the mainline and ramp analysis results for the No-Build conditions, while Figures 5A-5C provides the results of the Build condition for each alternative, including more detailed results within the interchanges. Appendix C includes the results of the mainline freeway analysis.

Ramp Junction Merge Analysis included the following locations:

- I-270 EB to I-71 NB Entrance Ramp
- 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
- 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

Ramp Junction Diverge Analysis included the following locations:

- 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 Gemini Place Exit Ramp
- I-71 SB to I-270 Exit Ramp

Due to the lane configuration at the I-71 northbound exit to Polaris Parkway/Gemini Place and at the proposed I-71 northbound exit to Big Walnut Road with the additional fourth mainline lane which becomes an exit-only drop lane to create a two-lane off-ramp, basic freeway segment analysis was performed rather than a

traditional ramp diverge analysis; these exit ramps with a drop lane cannot be analyzed using the freeway ramp analysis module in HCS. All other ramp areas have geometry that allows analysis using the freeway ramp module in HCS. The existing split diamond at Polaris Parkway/Gemini Place and the proposed configuration at US 36/SR 37 have diverge and merge areas along collector-distributor roads in addition to the junctions with I-71. Freeway Merge and Diverge Segment analysis was performed for the segments listed above and the results are provided in Table 3.

Table 3 – Ramp Merge/Diverge Capacity Analysis LOS

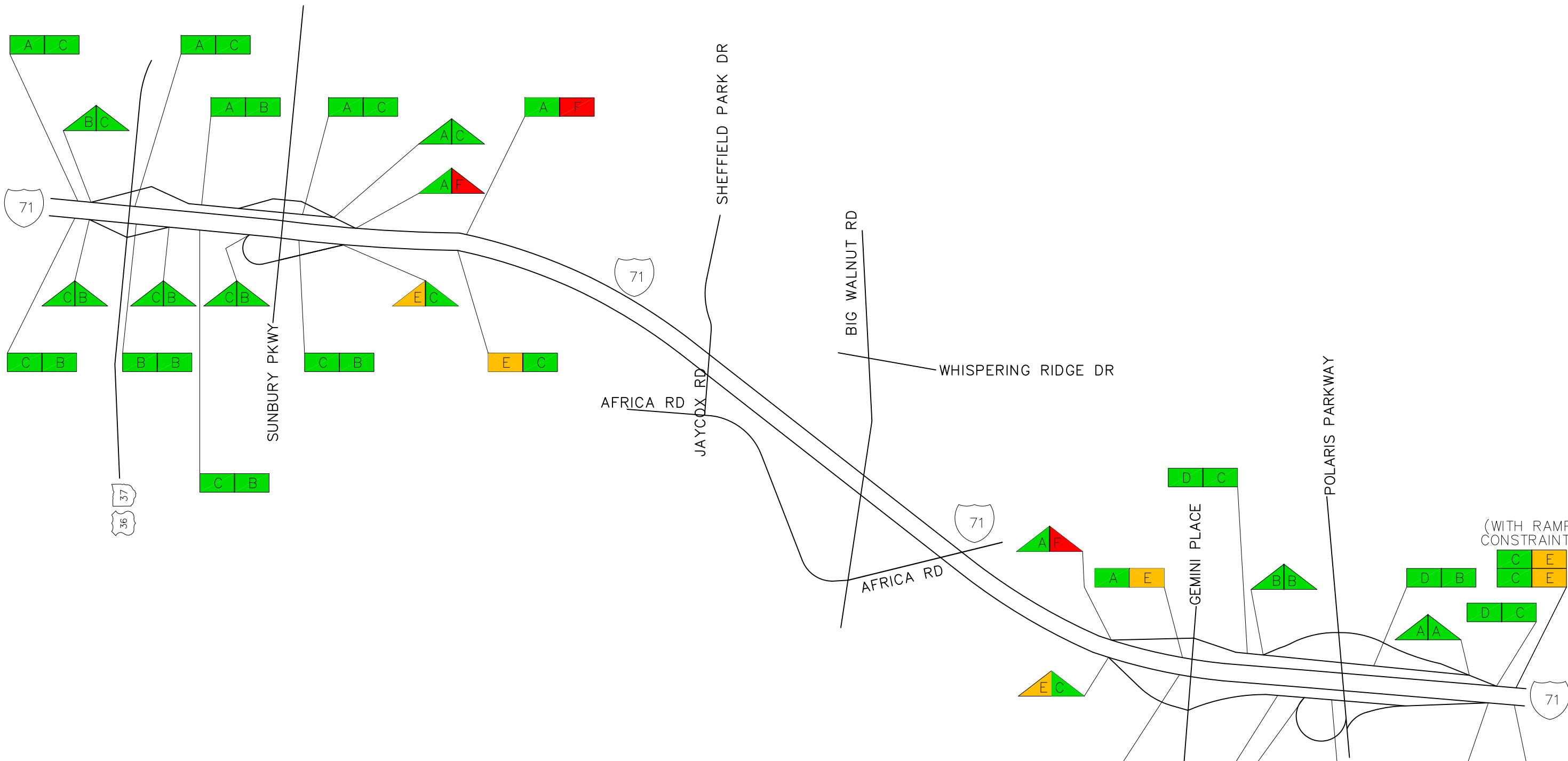
Freeway Merge and Diverge Segments	2040 AM		2040 PM	
	No-Build	Build	No-Build	Build
Ramp Merge Areas				
Polaris Parkway Entrance to NB C-D Road	B	B	B	A
Gemini Place to I-71 NB Entrance Ramp	A	B	F	D*
Big Walnut Road to I-71 NB Entrance Ramp	--	B	--	C*
US 36/SR 37 to I-71 NB Entrance Ramp	B	B	C	C
US 36/SR 37 to I-71 SB Entrance Ramp	C	C	B	B
Sunbury Parkway to I-71 SB Loop Entrance Ramp	C	C	B	B
Sunbury Parkway to I-71 SB Diamond Entrance Ramp	E	E	C	C
Africa/Big Walnut Road to I-71 SB Entrance Ramp	--	F	--	C
Polaris Parkway Loop Ramp to SB C-D Road	B	B	C	C
Polaris Parkway to I-71 SB Entrance Ramp	F	F	F	F
Ramp Diverge Areas				
I-71 NB to Polaris Park/Gemini Place Exit Ramp	D	D	C	C
Polaris Parkway Exit from C-D Road	A	A	A	A
I-71 NB to Big Walnut Road Exit Ramp	--	B	--	E*
I-71 NB to US 36/SR 37 Exit Ramp	A	A	F	F
Sunbury Parkway Exit from NB C-D Road	A	A	C	B
I-71 SB to US 36/SR 37 Exit Ramp	C	C	B	B
I-71 SB to Africa/Big Walnut Road Exit Ramp	--	E	--	C
I-71 SB to Gemini Place Exit Ramp	E	F	C	C

\*Assumes additional NB lane from Gemini Place to Big Walnut Road

As indicated in the table above, there is no apparent degradation to the existing ramp merge and diverge areas due to the proposed project, with the exception of the southbound exit to Gemini Place. That diverge area drops from LOS E in the No-Build to LOS F in the Build, but the constrained traffic and other mitigations will address the degradation. Rather, the reduction of traffic from existing interchanges to the new ramps at Big Walnut Road and Africa Road will result in a slight improvement over No-Build conditions.

The proposed entrance ramp merge from Big Walnut/Africa Road to southbound I-71 indicates LOS F in the AM peak, which would be considered unsatisfactory. However, this location will also be mitigated by traffic constraints, discussed further in the next section.

Ramp analysis results are provided in Appendix D and the results are shown graphically on Figures 4 and 5A-5C, respectively, for the No-Build and Build conditions.



LOCATION TYPE

- AM | PM FREEWAY SEGMENT
- AM | PM FREEWAY SEGMENT WITH ADD LANE
- AM | PM MERGE/DIVERGE
- AM | PM MERGE/DIVERGE WITH ADD LANE

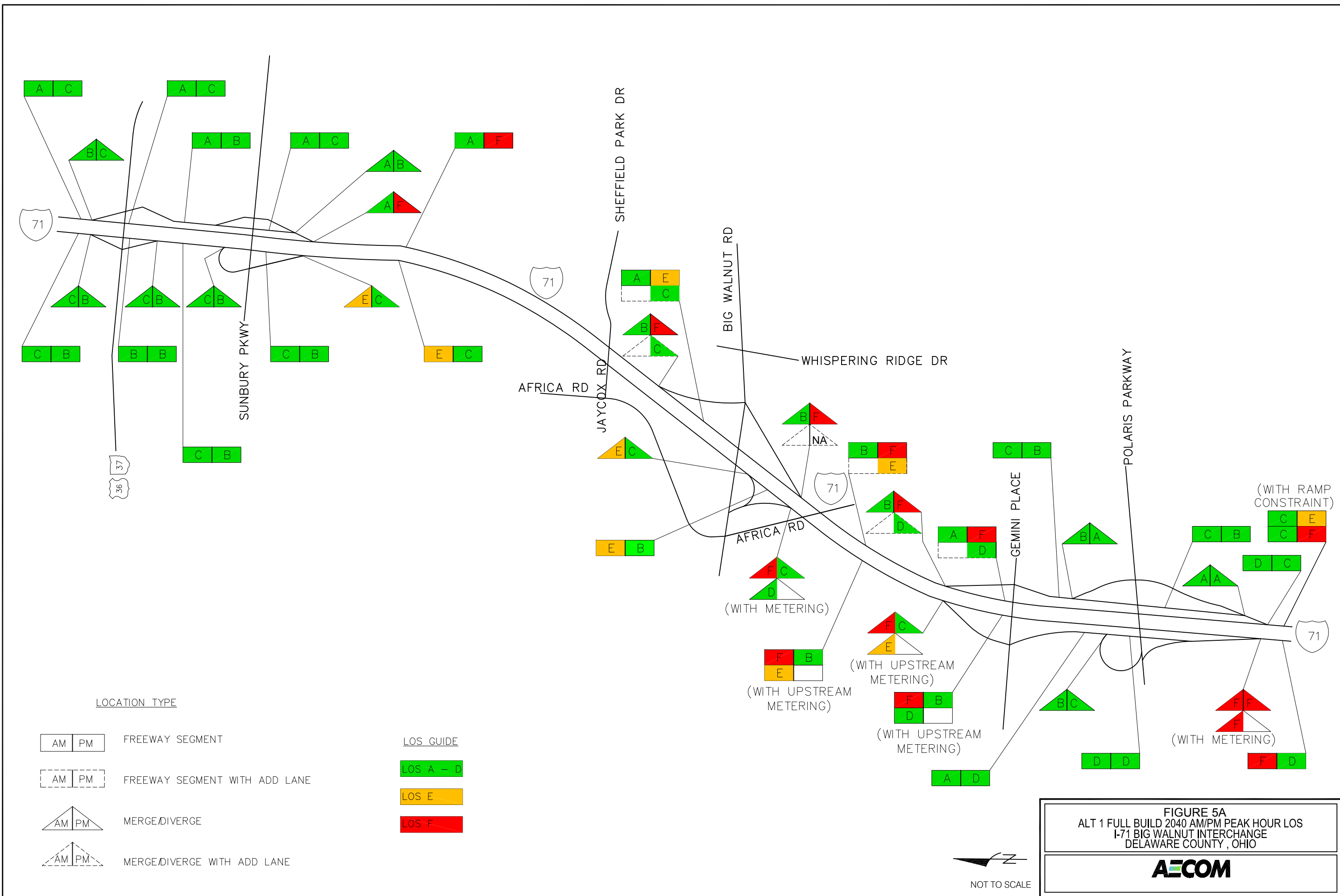
LOS GUIDE

- LOS A - D
- LOS E
- LOS F

NOT TO SCALE

**FIGURE 4**  
 NO BUILD 2040 AM/PM PEAK HOUR LOS  
 I-71 BIG WALNUT INTERCHANGE  
 DELAWARE COUNTY, OHIO





LOCATION TYPE

- |    |    |
|----|----|
| AM | PM |
|----|----|

 FREEWAY SEGMENT
- |    |    |
|----|----|
| AM | PM |
|----|----|

 FREEWAY SEGMENT WITH ADD LANE
- |    |    |
|----|----|
| AM | PM |
|----|----|

 MERGE/DIVERGE
- |    |    |
|----|----|
| AM | PM |
|----|----|

 MERGE/DIVERGE WITH ADD LANE

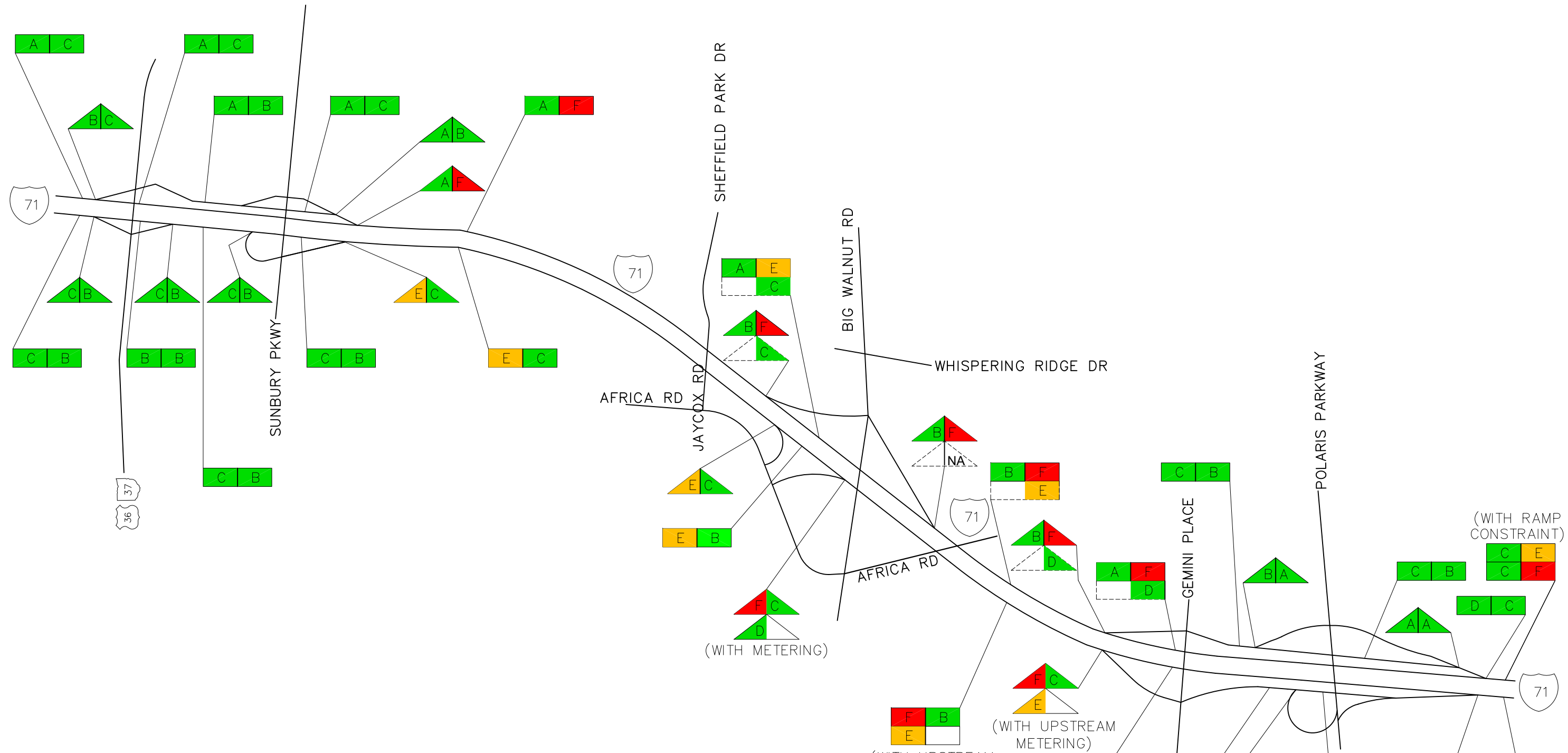
LOS GUIDE

- LOS A - D
- LOS E
- LOS F

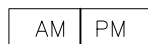
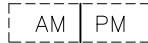


FIGURE 5A  
 ALT 1 FULL BUILD 2040 AM/PM PEAK HOUR LOS  
 I-71 BIG WALNUT INTERCHANGE  
 DELAWARE COUNTY, OHIO

**AECOM**

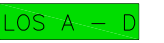


NOT TO SCALE



LOCATION TYPE

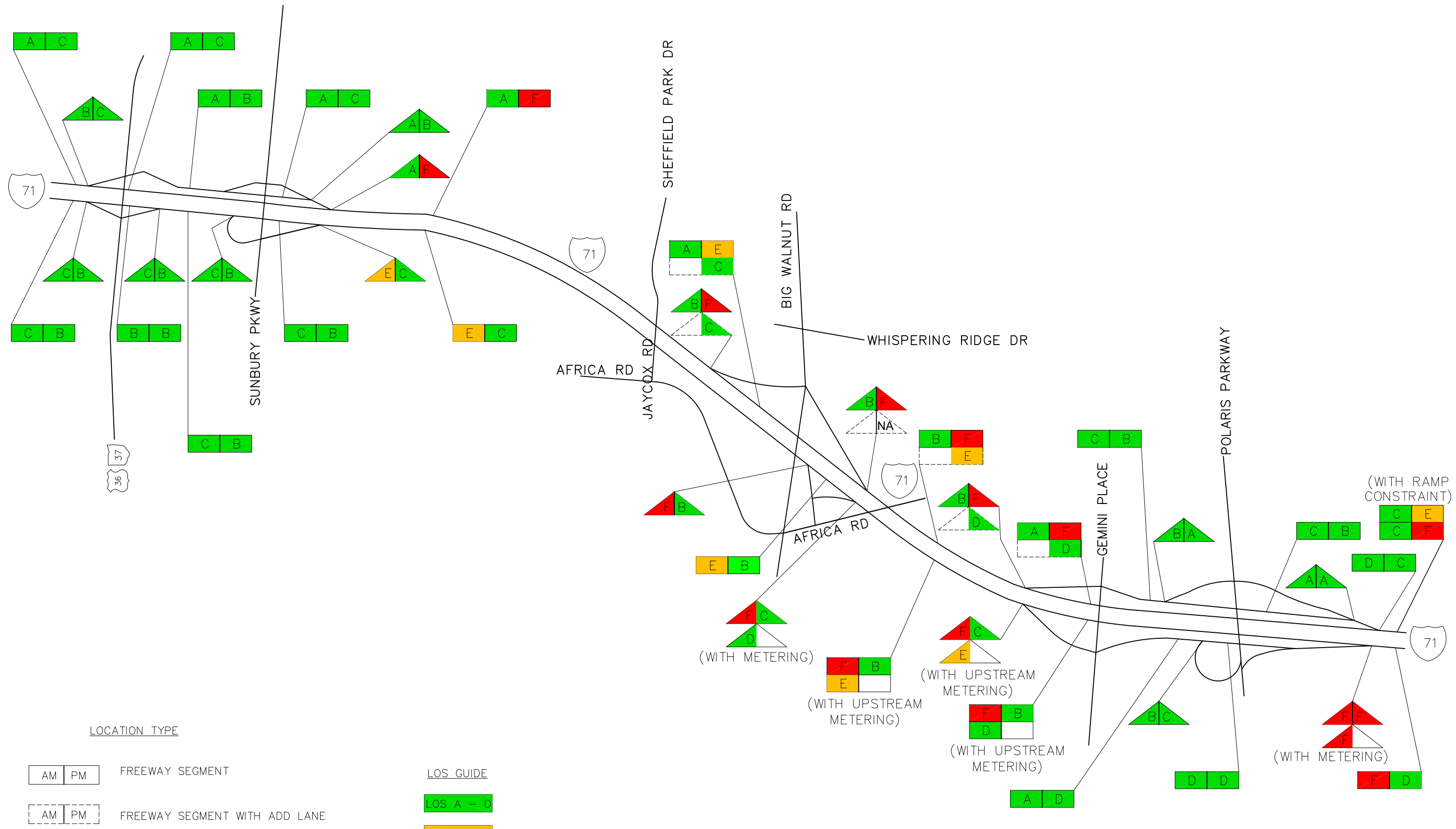
-  FREEWAY SEGMENT
-  FREEWAY SEGMENT WITH ADD LANE
-  MERGE/DIVERGE
-  MERGE/DIVERGE WITH ADD LANE

LOS GUIDE

-  LOS A - D
-  LOS E
-  LOS F

  
NOT TO SCALE

FIGURE 5B  
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 WITH ADD LANE
- |    |    |
|----|----|
| AM | PM |
|----|----|

 MERGE/DIVERGE
- |    |    |
|----|----|
| AM | PM |
|----|----|

 MERGE/DIVERGE WITH ADD LANE

LOS GUIDE

- LOS A - D
- LOS E
- LOS F

NOT TO SCALE

**FIGURE 5C**  
 ALT 3 FULL BUILD 2040 AM/PM PEAK HOUR LOS  
 I-71 BIG WALNUT INTERCHANGE  
 DELAWARE COUNTY, OHIO  
**AECOM**

## 4.5 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, as identified previously in Section 3.3, Study Area. 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 Trafficware's Synchro traffic analysis, optimization, and simulation software except for the Lewis Center Road/Bale Kenyon Road intersection. This intersection was analyzed as a roundabout using a spreadsheet analysis developed by the Georgia Department of Transportation. The intersection analysis will be completed in HCS to satisfy ODOT requirements for balancing LOS and delays in a future IJS. Synchro was used to determine the lane requirements and the traffic signal phasing and timing needed to accommodate the AM and PM 2040 Design Year traffic volumes at the various intersections.

The overall intersection analysis results are presented on Table 4 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 high volumes on the main road, which are free-flow, ensure that the intersection as a whole has a good overall LOS even where the side streets may experience substantial delays. Copies of the analysis results are provided in Appendix E.

Table 4 – Intersection Analysis LOS and Delay (seconds)

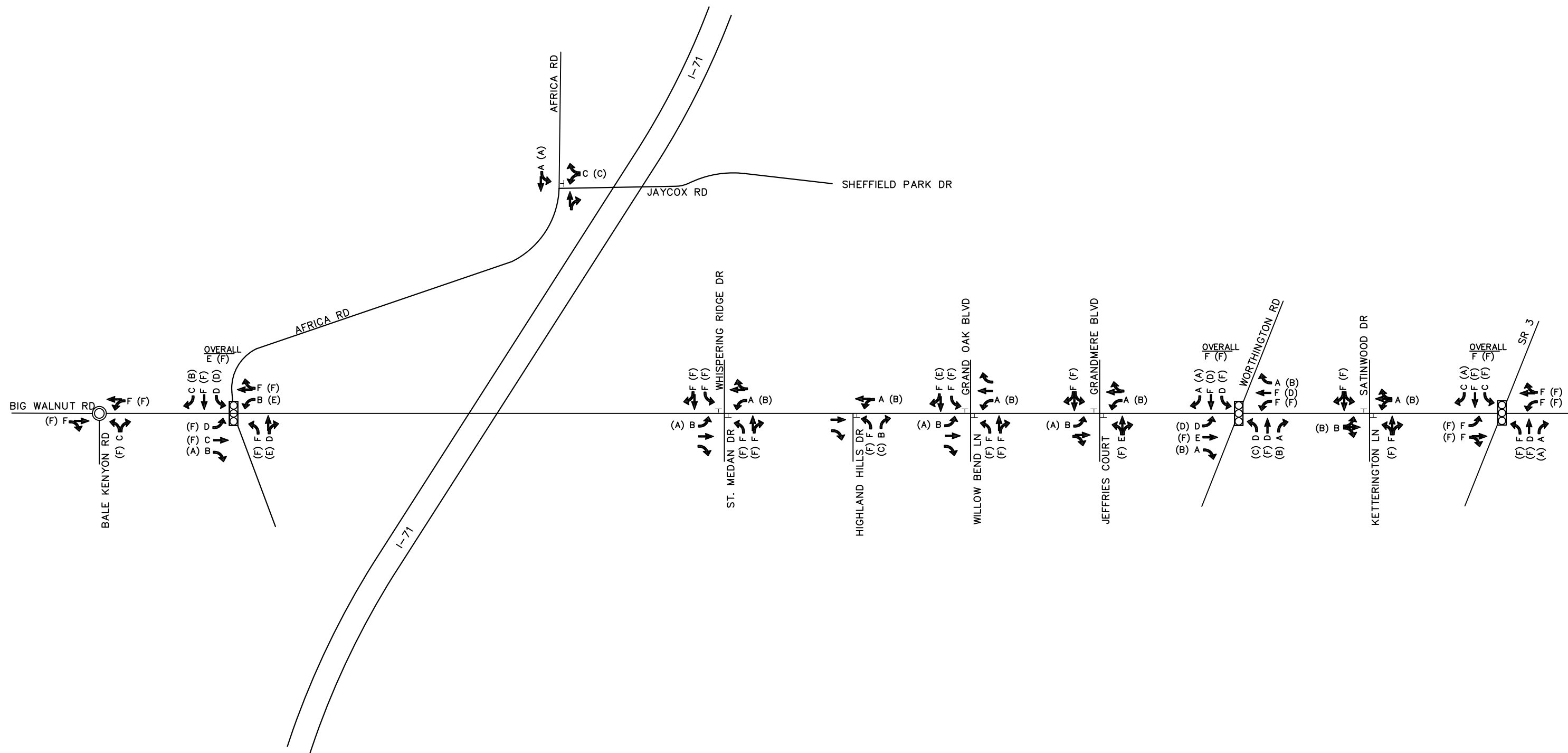
Intersection	2040 AM				2040 PM			
	No-Build	Alt. 1	Alt. 2	Alt. 3	No-Build	Alt. 1	Alt. 2	Alt. 3
Lewis Center Rd & Bale Kenyon Rd	F	F	F	F	F	F	F	F
Lewis Center Rd/Big Walnut Rd & Africa Rd	E	D	D	E	F	D	D	D
Big Walnut Rd & I-71 NB Ramps	--	C	B	C	--	D	D	E
Big Walnut Rd & St. Medan Dr/Whispering Ridge Dr	A	B	B	B	A	C	A	B
Big Walnut Rd & Highland Hills Dr	A	B	B	B	A	A	A	A
Big Walnut Rd & Willow Bend Ln/Grand Oak Blvd	A	B	B	B	A	C	A	B
Big Walnut Rd & Jeffries Ct/Grandmere Blvd	A	B	B	B	A	C	A	B
Big Walnut Rd & Worthington Rd	F	D	D	D	F	D	D	D
Big Walnut Rd & Ketterington Ln/Satinwood Dr	A	B	B	B	B	B	A	A
Big Walnut Rd & SR 3	F	D	D	E	F	D	C	D
Big Walnut/Africa Rd & I-71 SB Ramps	--	D	F	F	--	C	D	C
Africa Rd & Jaycox Rd	A	A	B	A	A	A	B	A

It should be noted that some of the studied intersections are part of separate improvement projects being undertaken by Delaware County or other agencies. For example, the Lewis Center Road/Bale Kenyon Road intersection will be reconstructed as a roundabout prior to any implementation of the Big Walnut Road interchange. The intersection of Big Walnut Road and Worthington Road was recently upgraded with turn

lanes and a traffic signal. Other intersections will be improved as part of the interchange project, including Lewis Center Road/Big Walnut Road and Africa Road. The LOS results in Table 4 include all completed and planned intersection improvements, whether part of the interchange project or stand-alone projects.

As indicated above, the proposed interchange is not expected to have a significant impact on traffic operations at the study area intersections. There are several stop-controlled residential streets that will operate at LOS F, but this is an existing condition that is not affected by the proposed interchange. The proposed interchange improves operations at several of the signalized intersections in the study area due to changes in travel patterns. The intersections of Big Walnut Road at Africa Road, Worthington Road and SR 3 all improve from LOS E or F in the No-Build to LOS D or better under Build Alternative 2 conditions.

There are intersections in the immediate vicinity of the interchange that are anticipated to operate over-capacity, namely the intersection of Africa Road and the I-71 southbound ramps under Alternatives 2 and 3. This condition will actually serve as a means of mitigating the impacts to the mainline of I-71 south of the new interchange since the signal will act as a constraint on traffic entering the freeway system; this is discussed in more detail in the following section of the report. The intersection capacity results are shown graphically on Figure 6 for the No-Build scenario and on Figures 7A-7C for the Build scenarios.



**LEGEND**

→ TRAFFIC LANE

ⓧ TRAFFIC SIGNAL

XX (XX) AM (PM) PEAK HOUR LOS

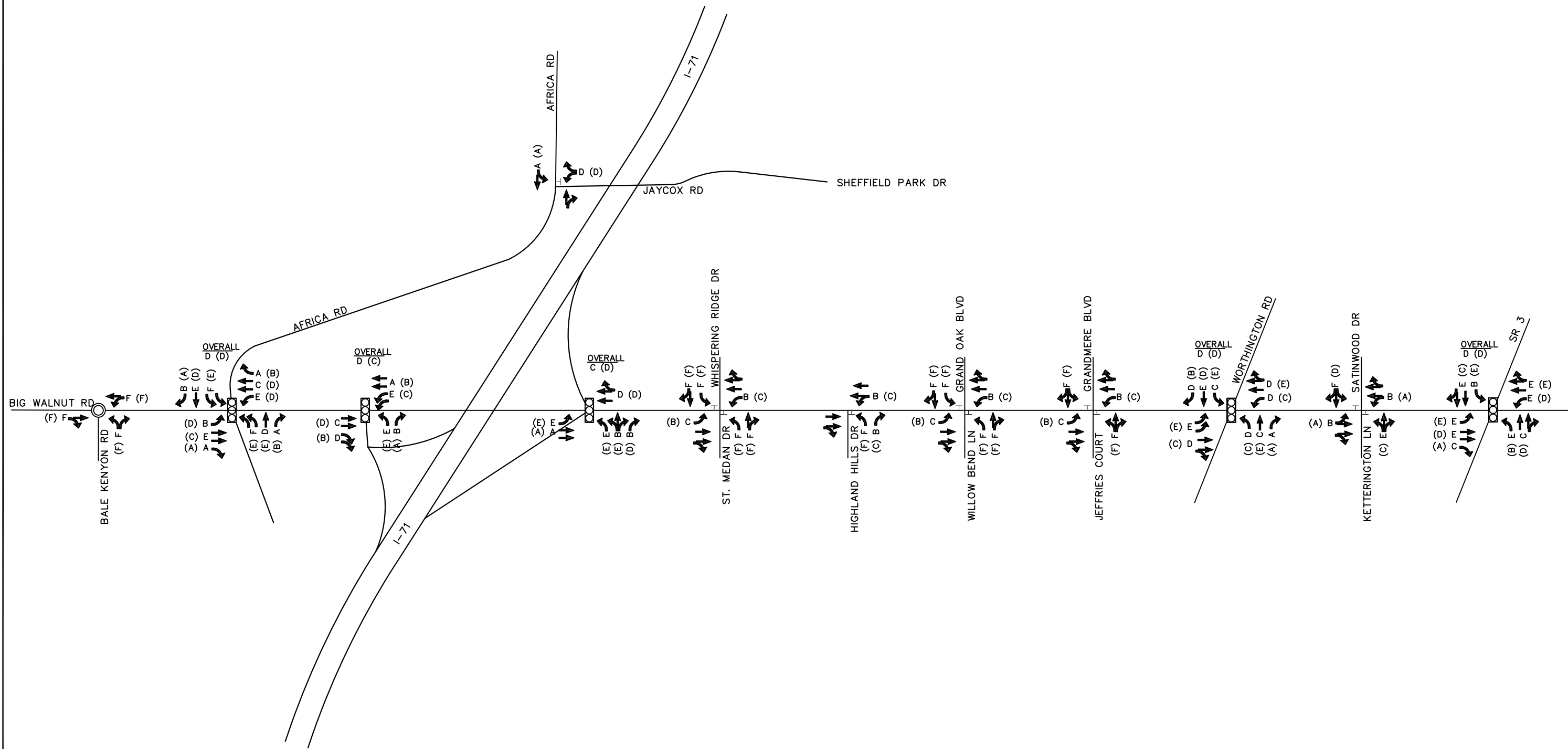


NOT TO SCALE

**FIGURE 6**  
 NO BUILD DESIGN YEAR 2040 PEAK HOUR LOS  
 I-71 BIG WALNUT INTERCHANGE  
 DELAWARE COUNTY, OHIO



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

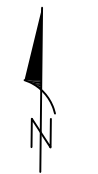


**LEGEND**

→ TRAFFIC LANE

☐ TRAFFIC SIGNAL

XX (XX) AM (PM) PEAK HOUR LOS

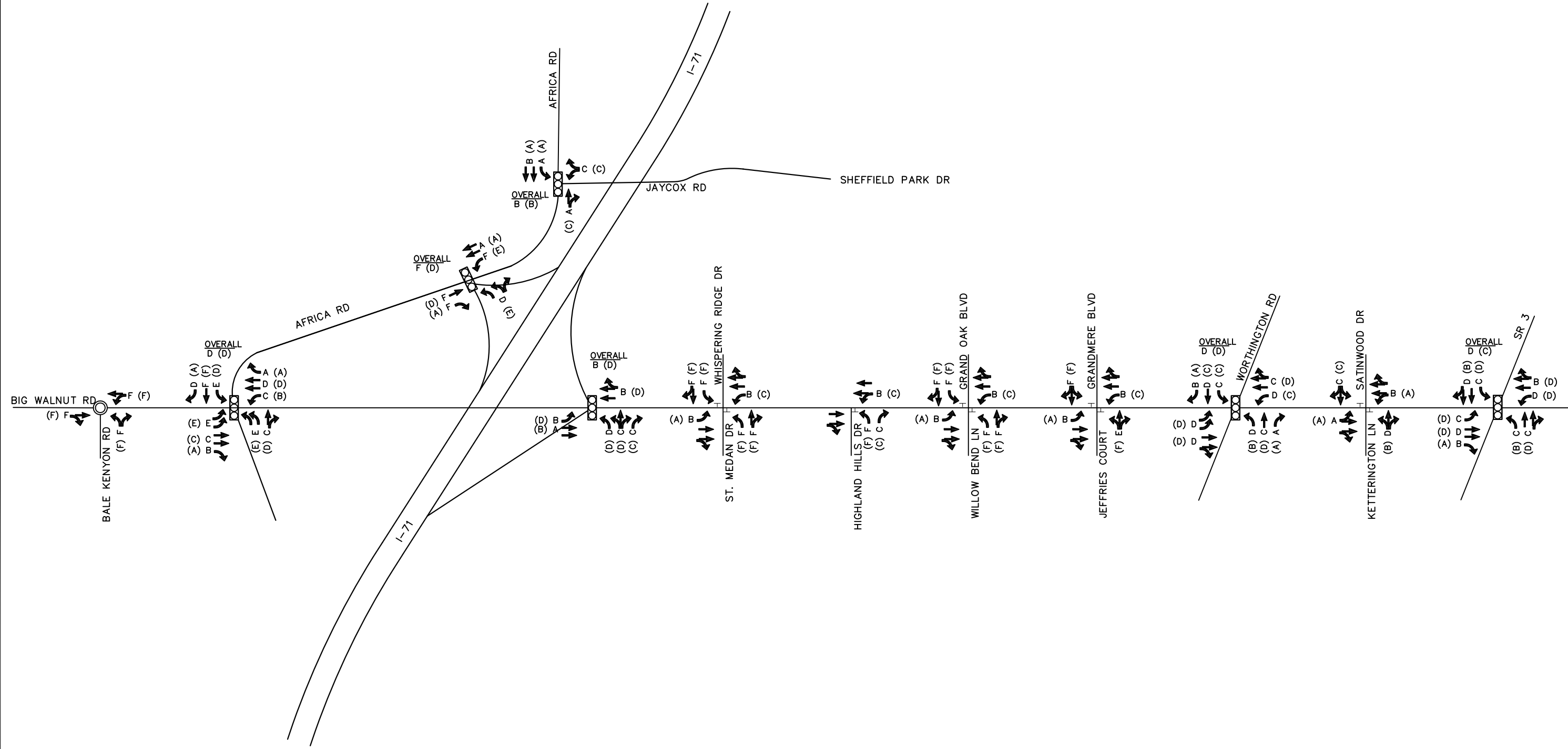


NOT TO SCALE

**FIGURE 7A**  
 ALT 1 DESIGN YEAR 2040 PEAK HOUR LOS  
 I-71 BIG WALNUT INTERCHANGE  
 DELAWARE COUNTY, OHIO



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



**LEGEND**

→ TRAFFIC LANE

☐ TRAFFIC SIGNAL

XX (XX) AM (PM) PEAK HOUR LOS



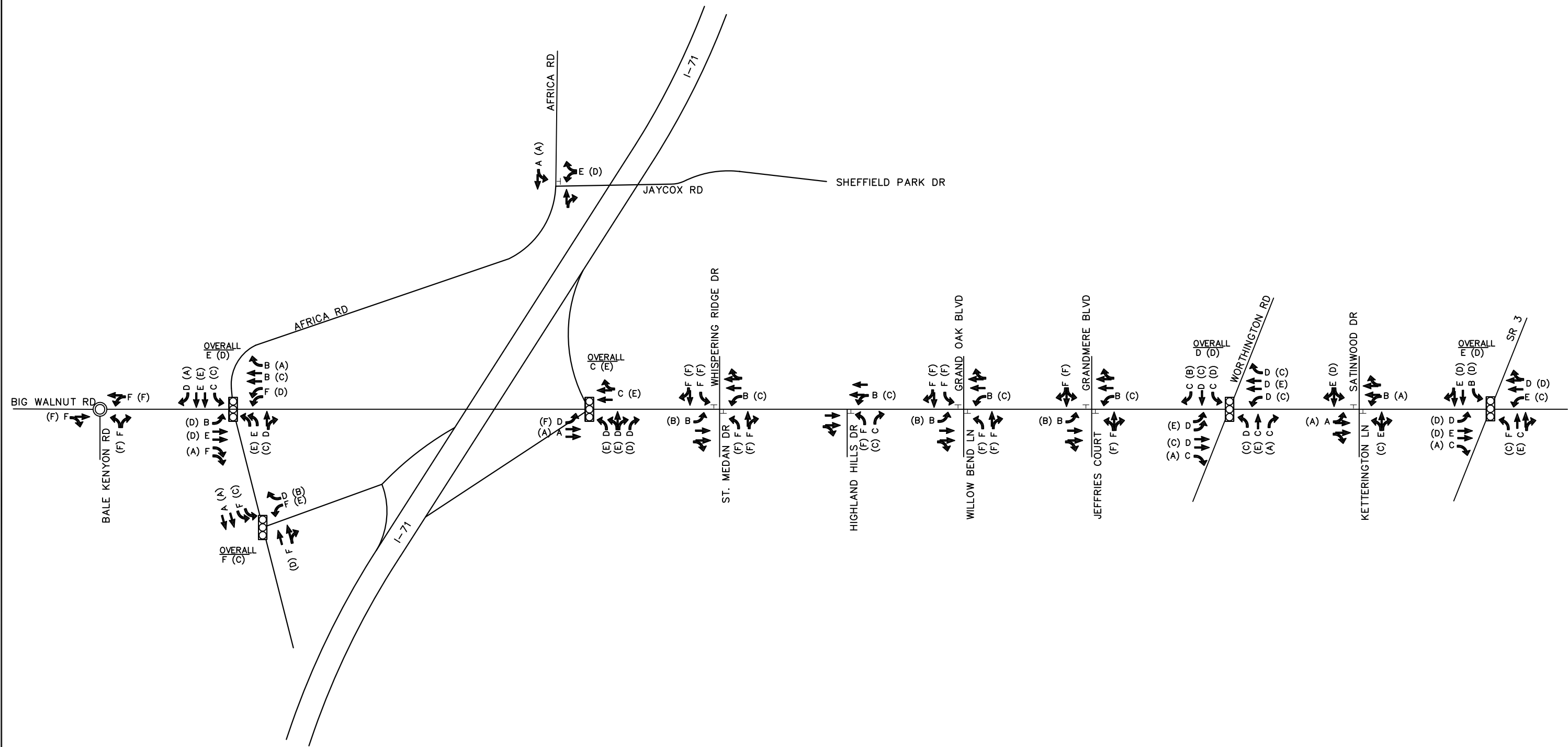
NOT TO SCALE

**FIGURE 7B**  
 ALT 2 DESIGN YEAR 2040 PEAK HOUR LOS  
 I-71 BIG WALNUT INTERCHANGE  
 DELAWARE COUNTY, OHIO



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



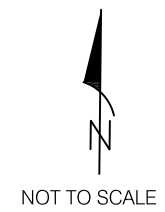


**LEGEND**

→ TRAFFIC LANE

☐ TRAFFIC SIGNAL

XX (XX) AM (PM) PEAK HOUR LOS



NOT TO SCALE

<p><b>FIGURE 7C</b>          ALT 3 DESIGN YEAR 2040 PEAK HOUR LOS          I-71 BIG WALNUT INTERCHANGE          DELAWARE COUNTY, OHIO</p>
<p><b>AECOM</b>  <small>564 White Pond Drive Akron, Ohio 44320-1100 (330) 836-9111</small></p>

## 4.6 CONSTRAINED TRAFFIC ANALYSIS

Typically constrained traffic analysis applies when there is an existing condition in which the freeway is operating in oversaturated conditions and the flow of traffic entering the freeway is constrained in the No-Build scenario but the constraint will be eliminated in the Build condition. By removing the constraint more traffic can enter the freeway, requiring a check that the mainline will not be negatively impacted.

The situation evaluated in this report is actually the opposite; under No-Build conditions the mainline operates at acceptable levels, but the Build condition increases traffic entering certain segments of the freeway system that would result in oversaturated conditions. However, there are constraints that will limit the flow of the demand volume, thus reducing the amount of traffic actually reaching the freeway.

The first constrained location is the ramp from eastbound I-270 to northbound I-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 hours, respectively, and 2,720 vehicles per hour and 2,820 vehicles per hour in the No-Build and Build PM peak hours, respectively. As shown in Table 2, the section of I-71 between the I-270 entrance ramp and the Polaris Parkway exit ramp will operate at LOS E in the PM No-Build and at LOS F in the PM Build with these demand volumes. However, according to Exhibit 13-10 of the Highway Capacity Manual<sup>2</sup>, 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 I-71 volumes. Analysis conducted using a volume of 2,100 vehicles on the ramp indicates that the existing lanes from I-270 through Polaris Parkway on northbound I-71 are adequate to process traffic with LOS E in the PM peak under both the No-Build and Build conditions. The reduced volumes were carried through to other mainline and ramp segments through the study area, and all other analysis assumed the constrained volumes. Again, it should be noted that this analysis assumes that the eastbound I-270 ramp to northbound I-71 remains as a single-lane ramp; should the eastbound I-270 ramp to northbound I-71 be upgraded to a 2-lane ramp that the traffic analysis of the study area will need to be reanalyzed separately. The volumes used for constrained analysis are provided in Appendix B with other traffic volume data.

The other location with constrained traffic conditions is the intersection of Africa Road and the I-71 southbound ramps under Alternative 2. This T-intersection will be signalized, with two lanes on the I-71 exit ramp (one left-turn lane and one shared left-right lane), a left-turn lane and two thru lanes on southbound Africa Road, and a thru lane plus one right-turn lane on northbound Africa Road. The entrance ramp will have two lanes, separated by a raised median to facilitate the flow of traffic from both directions of Africa Road. The Synchro analysis indicates that the southbound left-turn movement will have a v/c ratio of 1.71 during the AM peak of the design year; the northbound right-turn movement will have a v/c of 1.16 during the same period. Due to the oversaturation of the intersection, the volume reaching the freeway will be reduced from a demand volume of 2,200 vehicles to 1,480 vehicles. This will result in substantial queuing on Africa Road, but will help maintain flow on southbound I-71. The constraints from this intersection are not sufficient to maintain No-Build levels of service on southbound I-71 however, and additional mitigation measures will need to be taken to I-71 ensure that the level of service on southbound I-71 in the Build scenario is equal to or better than the level of service in the No Build scenario.

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<sup>2</sup> Highway Capacity Manual (HCM) 2010, Transportation Research Board, Washington, DC, 2010.

Although constrained traffic conditions may occur under Alternatives 1 and 3, they have not been evaluated for purposes of this report. The LOS results of the constrained traffic volumes are shown on Figures 5A through 5C for the freeway conditions. The constrained traffic volumes themselves are shown in Appendix B (Certified Traffic & Intersection Traffic Volumes) and are indicated with a \* or \*\* to indicate where volumes were reduced. As the figures indicate, Alternative 2 actually allows the most traffic to enter I-71 southbound at the proposed interchange over Alternative 1 and 3. This is due to the location of the proposed ramps under the different scenarios, which impacts how motorists approach the interchange and, in fact, whether they use the new interchange or continue to use existing interchanges.

## 4.7 ITS CONSIDERATIONS

Adaptive ramp metering and the use of dynamic shoulder lanes (i.e. hard shoulder running) are among two key Active Traffic Management (ATM) strategies that warrant further consideration, as they can be effective and cost-conscious solutions 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 entrance ramp from Africa Road to southbound I-71. The forecasted demand volume on the ramp is 2,200 vehicles in the AM peak hour of the 2040 Design Year, but in order to maintain the same level of service in the Build scenario as was calculated for the No Build scenario on southbound I-71, a maximum of only 480 additional vehicles can be added to the segment of southbound I-71 between Africa Road and Gemini Place without a degradation in the level of service. As described previously in the report, the volume of traffic entering the southbound I-71 entrance ramp from Africa Road will be constrained because the southbound left-turn and northbound right-turn movements of the proposed signalized intersection are expected to operate over-capacity in the AM peak. The constraints of the signalized ramp intersection operations will reduce the volume of vehicles that could enter southbound I-71 from the Africa Road on-ramp to approximately 1,480 vehicles in the AM peak hour, indicating that an additional 1,000 vehicles will need to be controlled through ramp metering or find another route.

The two-lane southbound I-71 on-ramp at Africa Road can be metered; overflow traffic, primarily southbound Africa Road left-turning vehicles, will queue on the on-ramp and onto Africa Road. However, due to the large amount of traffic that needs to be metered, it is anticipated that ramp metering will also be required on the on-

ramps at US 36/SR 37 and Sunbury Parkway. It is not realistic to expect that the additional 1,000 vehicles that need to be controlled through ramp metering at the Africa Road on-ramp to southbound I-71 will wait in the inevitably long queues that would form on the on-ramp and along Africa Road. Metering 1,000 vehicles at the Africa Road on-ramp would result in queues of over 4.5 miles long; drivers will change their route or otherwise modify their travel patterns before waiting in several miles of queuing to enter the freeway.

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. 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 I-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. At this point it is assumed that metering at one or both interchanges will be required to maintain operations on I-71 southbound, but the details will be addressed further in the IJS for Big Walnut Road.

Additionally, ramp metering could also be used to potentially address the LOS F conditions on northbound I-71 north of Gemini Place in the 2040 No-Build scenario in the PM peak period. 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.

#### Hard Shoulder Running

Hard Shoulder Running (HSR), also known as part-time shoulder use, is a strategy for addressing congestion and travel time reliability issues within the transportation system. Hard shoulder running involves the use of the left or right shoulders of an existing roadway for temporary travel during certain hours of the day. The shoulder is used for travel only during those times of day when the adjoining lanes are likely to be heavily congested (e.g., during peak hours, when congestion is detected, or when general purpose lanes are closed for construction or incidents). When not needed as an additional travel lane, the shoulder is restored to its original purpose as a "shoulder," and the basic physical characteristics of the shoulder are retained and recognizable.

Hard shoulder running has primarily been used in locations where there is recurring congestion due to lack of peak period capacity through the corridor, particularly where other alternatives to peak period operations are infeasible or cost-prohibitive. In such situations, hard shoulder running may be a cost-effective way of reducing delays and improving travel-time reliability. Hard shoulder running is a form of Active Traffic Management and modifies roadway conditions and controls – in this case the number of lanes – in response to forecast or observed traffic conditions. It may be used in combination with other ATM strategies, such as ramp metering, overhead lane control signs, dynamic speed limits, and queue warning as part of a comprehensive freeway management system.

ODOT has established the precedent for part-time shoulder use with the planned I-670 SmartLANE project in Columbus, which will begin just east of I-71 in downtown Columbus and extend to I-270 on the East Side. The left shoulder adjacent to the median will be used as a 45 mph part-time shoulder use lane with a 3 to 4-foot buffer from the median barrier. Although part-time shoulder use can be a very cost-effective solution, it may not be an appropriate strategy where minimum geometric clearances, visibility, and pavement requirements cannot be met, or it may have an adverse impact on safety. While a detailed feasibility study of hard shoulder running in the left shoulder of northbound I-71 is beyond the scope of this feasibility study, the concept may warrant further study as an alternative to addressing the recurring congestion on northbound I-71 north of Gemini Place in the 2040 No Build and Build scenarios.

## 4.8 TURN LANE STORAGE CALCULATIONS

To identify and address the required turn lane storage length at the four core signalized intersections in the interchange area, turn lane storage calculations were performed per ODOT L&D Manual methodology.

The Build Alternative 2 2040 Design Year traffic volumes were used for the turn lane calculations. Table 5 shows the recommended turn lane lengths for the following intersections:

- Lewis Center Road/Big Walnut Road and Africa Road
- Big Walnut Road and I-71 NB Ramps
- Africa Road and I-71 SB Ramps
- Africa Road and Jaycox Road

A copy of the spreadsheet used to calculate the turn lane lengths is provided in Appendix F. There are some turn lanes that indicate a calculated turn lane length greater than the maximum recommended by ODOT, in which case the maximum is recommended (600 feet for left-turn lanes, 800 feet for right-turn lanes). For cases where thru vehicle blocking would prevent turning vehicles from reaching the turn lane, the thru blocking length is recommended in cases where it is not prohibitive based on cost or right of way, or would be excessively long compared to the required storage for the turn itself.

Table 5 – 2040 Build Turn Lane Calculations

Intersection	Movement	Calculated	Existing	Recommended	Comments
Lewis Center Rd/Big Walnut Rd and Africa Rd	EBL	800'	335'	600'	Max per ODOT
	EBR	725'	335'	800'	Max per ODOT
	WBL	1175'	185'	185'	Does not incl thru blocking
	WBR	1175'	NA	375'	Does not incl thru blocking
	SBL	350'	175'	350'	Includes thru blocking
	SBR	350'	225'	350'	Includes thru blocking
Big Walnut Rd and I-71 NB Ramps	EBL	945'	NA	275'	Does not incl thru blocking
	NBL	1065'	NA	600'	Max per ODOT
Africa Rd and I-71 SB Ramps	NBR	775'	NA	800'	Max per ODOT
	SBL	1580'	NA	600'	Max per ODOT
	WBL	275'	NA	275'	Two-lane Ramp Approach
Africa Rd and Jaycox Rd	SBL	855'	NA	100'	Does not incl thru blocking

Per ODOT methodology, turn lane storage length at intersections is determined based on the average vehicles per cycle and is calculated based on the highest design hour volume and intersection cycle length. Table 5 includes only the values and results for the worst-case scenario of the Build condition, but both the AM and PM calculations are shown in the referenced spreadsheet.

## 5.0 ROADWAY ASSESSMENT

Interstate 71 runs northeast-southwest through Ohio for nearly 250 miles, connecting Cincinnati, Columbus and Cleveland. There are nearly 100 interchanges providing access to local communities. Franklin County alone has 31 interchanges that provide access to and from I-71. Delaware County has a total of 2 interchanges with I-71; the US 36/SR 37 interchange and the northern portion of the Polaris Parkway/Gemini Place interchange. There is a current study being conducted by MS Consultants that will determine the feasibility of modifying the US 36/SR 37 interchange with new ramps at the proposed location of Sunbury Parkway. Construction of the proposed Big Walnut interchange approximately 2 miles north of the Gemini Place ramps would give Delaware County a much needed additional access to I-71. Whereas the Sunbury Parkway ramps will provide access to the newly constructed Tanger Outlet Mall and surrounding businesses, the proposed Big Walnut interchange will improve the mobility of local residents by providing an alternative route other than the heavily congested Polaris Parkway corridor.

I-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 and Bale Kenyon Road to the intersection of Big Walnut Road and Africa Road where both right- and left-turn lanes are developed in the eastbound direction and a left-turn lane is developed in the westbound direction. From this point, Big Walnut Road tapers back down to a one-lane road in each direction, with auxiliary turn lanes provided at most intersections throughout the study area. The additional intersections primarily serve residential developments located north and south of Big Walnut Road.

Africa Road is a one-lane road in each direction from the intersection of Africa Road and Sanctuary Drive to the intersection of Africa Road and Big Walnut Road. At this intersection, a left-turn lane is developed in the

northbound direction and both and left- and right-turn lanes are developed in the southbound direction. From this point, Africa Road tapers back down to a one-lane road in each direction up to the intersection of Africa Road and the entrance to Alum Creek State Park.

Existing utility companies were contacted thru OUPS in regards to 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 6 presents a list of utilities in the project limits.

Table 6 – 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

## 6.0 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. See Appendix G for the full preliminary geotechnical report.

### 6.1 GEOLOGY OF THE SITE

The I-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 (see Plate 4 of Appendix A) 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.

## 6.2 GEOTECHNICAL CONSIDERATIONS

Based on review of the regional geology and the historic borings performed for the I-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 the majority 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 I-71.

Although plans of the existing I-71 bridge were not located, the 1957 Subsurface Investigation report included recommendations for supporting the I-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 I-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.

## 7.0 STRUCTURAL ASSESSMENT

### 7.1 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 I-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 H for a conceptual plan and profile of the proposed bridge.



## 7.2 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

## 7.3 PROPOSED I-71 STRUCTURES

The proposed superstructure and substructure units for the new I-71 bridges will be independent from the existing I-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 I-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 I-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 I-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 I-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 Appendix G 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.

## 8.0 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.

## 9.0 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 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 can be constructed within the existing limited access right of way and that existing land owned by Delaware County in the NE quadrant of I-71 and Big Walnut Road would provide for the needed ROW for the northbound entrance ramp; new right of way will need to be acquired for the southbound ramps.

## 10.0 ENVIRONMENTAL OVERVIEW

Pursuant to 23 U.S.C. 327 and a Memorandum of Agreement dated December 11, 2015 executed by FHWA and ODOT, ODOT has been assigned responsibility for compliance with all applicable federal environmental laws. It is now ODOT's responsibility to determine all classes of action and approve all environmental documents with the exception of projects that cross state lines. Projects without significant environmental impacts are considered "Categorically Excluded" in accordance with 23 CFR 771.117. Based on available information and the anticipated impacts of the proposed Build alternative it is likely that the NEPA Document will be processed as a "D2" Categorical Exclusion during future phases of project development.

During the Feasibility Study, limited environmental studies have been completed for several disciplines in order to determine whether resources are present that would influence the comparison of alternatives. Based upon the data collected to date, there are no substantial differences among the alternatives based upon environmental issues. The primary differences relate to the impacts to USACE-owned property (Alum Creek reservoir and surrounding area). Information collected to date regarding environmental issues is summarized below.

### 10.1 ECOLOGICAL RESOURCES

Ecological fieldwork was conducted and a draft ecological resources map was prepared during the summer of 2016. The fieldwork identified the presence of suitable wooded habitat for the Indiana bat (*Myotis sodalis*) and Northern long-eared bat (*Myotis septentrionalis*). One potential maternity roost tree (PMRT) for these species was observed within the study area. Twenty-eight wetlands were identified and delineated in throughout the study area. These wetlands range from small (<0.01 acre) provisional Category 1 Wetlands up to medium sized (>0.50 acre) provisional Category 2 Wetlands. Twenty-four streams were documented within the study area. The vast majority of these streams are small headwater streams with ephemeral or intermittent flow. Alum Creek flows through the study area under CR 106 (Lewis Center Road) just south if the Alum Creek Dam Spillway. Alum Creek also flows through the study area again under I-71 in the southern leg of the study area. Live mussels were observed within Alum Creek at this location. Information on the location of resources will be

provided to the design team to evaluate avoidance and minimization of impacts. Once a preferred alternative has been identified, the impacts will be quantified and a Level 1 Ecological Survey Report will be prepared for OES review and coordination with ODNR and USFWS.

## 10.2 ENVIRONMENTAL SITE ASSESSMENT

Lawhon & Associates (L&A) completed an Environmental Site Assessment (ESA) Screening for the DEL-IR 71-3.55 (Big Walnut Interchange) project in September 2016. ODOT's Office of Environmental Services (OES) concluded, based upon the screening, that there are no parcels which warrant a Phase I ESA within the study area. Once a preferred alternative is identified, the project limits will be compared against the Screening to confirm that this finding remains valid.

## 10.3 CULTURAL RESOURCES

The Ohio State Historic Preservation Office (SHPO) electronic mapping data was reviewed in May 2016 to identify known historic resources within or immediately adjacent to the study area. The review of SHPO data identified 39 historic-age (50 years and older) properties in the study area. No historic properties were identified in the database. At this time, no building impacts are anticipated.

The SHPO database indicates several archeological sites in and adjacent to the project study area. Once a preferred alternative is identified, a Section 106 Scoping Request Form will be submitted for OES determination of whether additional cultural resources studies are required.

## 10.4 SECTION 4(F) AND 6(F) RESOURCES

Title 49 USC 303 (generally known as Section 4(f) of the Department of Transportation Act) provides protection from conversion to a transportation use for publicly owned parks and recreation areas, wildlife or waterfowl refuges, or historic sites (regardless of ownership) of national, state or local significance.

Likely, the most sensitive environmental issue with regard to schedule will be impacts to the USACE property. Section 4(f) coordination has not been initiated yet for this project. Lawhon & Associates prepared the Section 4(f) Determination for a nearby project at the intersection of CR106 and TR107. As part of that work, coordination was conducted with USACE to obtain concurrence that the impacts would be de minimis. During that work, it was found that Section 6(f) Land and Water Conservation Funds were used to improve Alum Creek Beach. It was determined that 6(f) did not apply to the CR 106/TR 107 intersection area. A similar approach will be used to complete the 4(f) and 6(f) documentation for the interchange's impacts on the Alum Creek State Park property.

## 11.0 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 I-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).

## 12.0 COST ESTIMATE

A preliminary construction cost estimate for the proposed interchange 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 and with a detailed breakdown provided in Appendix I.

## 13.0 CONCLUSIONS AND RECOMMENDATIONS

As discussed within this report, the scope of this study is to evaluate the feasibility of a new interchange along I-71 in the vicinity of Big Walnut Road. Three conceptual alternatives were developed with various configurations of ramps intersecting either Big Walnut Road or Africa Road.

There are no anticipated geometric, geologic or environmental constraints to constructing a new interchange to provide direct freeway access for residents of southern Delaware County, as well as visitors to Alum Creek State Park. A new interchange will reduce travel times and vehicle-miles for those who live in Delaware County but travel into Franklin County and the City of Columbus for work or leisure purposes. Drivers currently must travel a circuitous route along congested local roadways to access I-71. The proposed new interchange will reduce travel by several miles, whether motorists currently use the Polaris Parkway/Gemini Place interchange or the US 36/SR 37 interchange.

Analysis of the certified traffic volumes indicates that the new interchange will have a negative impact on southbound I-71 between Africa Road and Gemini Place in the PM peak. However, the intersection at the ramp will constrain some traffic from reaching the freeway and ramp metering can be implemented to further mitigate the degradation in operations. It is anticipated that both the Big Walnut Road interchange and the new ramps on Sunbury Parkway at US 36/SR 37 will need to be metered. This will be evaluated in further detail during the next steps of project development.

Based on results of the traffic capacity analysis, constructability, design standards and limitations of future development, Alternative 2 is the recommended preferred alternative. The location of the ramps for southbound I-71 adjacent to Alum Creek State Park, near lands controlled by the Army Corps of Engineers, precludes further development which could degrade the freeway. Alternatives 1 and 3 include ramps in the southwest quadrant that would likely attract further development, thus increasing freeway volumes more. Additionally, there are grade issues that would result in steep ramps, impacting the ability of large trucks to achieve adequate speeds before reaching the freeway in Alternatives 1 and 3.

Based on the analysis summarized in this document, it can be concluded that the proposed I-71 interchange at Big Walnut Road will improve travel conditions for motorists in Delaware County without having any serious impacts on the existing freeway network. Therefore, it is recommended that the proposed interchange be advanced to submit a formal IMS access request to ODOT and FHWA and advanced to detailed design, NEPA documentation and construction.