Appendix A

INDOT Supporting Documentation

Excerpts

PARSONS

Interstate Access Document –

Clear Path 465

Des. 1400075

Indiana Department of Transportation

Federal Highway Administration

Prepared for the Indiana Department of Transportation

June 2018

delivering a better world

Parsons • 101 West Ohio Street, Suite 2121 • Indianapolis, Indiana 46204 • (317) 616-1000

Table of Contents

Appendices intentionally omitted.

List of Figures and List of Tables

LIST OF FIGURES

LIST OF TABLES

LIST OF ABBREVIATIONS

- AADT – Average Annual Daily Traffic
- CD – Collector-Distributor road
- CMF – Crash Modification Factor
- EA – Environmental Assessment
- EB – Eastbound
- FHWA – Federal Highway Administration
- FI – Fatal and Injury
- HCS – Highway Capacity Software
- HSM – Highway Safety Manual
- IAD – Interstate Access Document
- IAR – Interstate Access Request
- IJS - Interchange Justification Report
- IHSDM – Interactive Highway Safety Design Model
- INDOT – Indiana Department of Transportation
- LOS – Level of Service
- MPH – Miles Per Hour
- MOT – Maintenance of Traffic
- MUTCD – Manual of Uniform Traffic Control Devices
- NEPA – National Environmental Policy Act
- NB – Northbound
- PDO – Property Damage Only
- RFI – Red Flag Investigation
- RoadHAT – Road Hazard Analysis Tool
- SB - Southbound
- WB - Westbound

1.0 PROJECT OVERVIEW

This project consists of the modification of the I-465/I-69 interchange and added travel lanes on the I-465 mainline. The project has been named "Clear Path 465".

1.1 PROJECT LOCATION

The Clear Path 465 project is located in Indianapolis, Marion County, Indiana. The interchange is a system interchange located on the northeast side of Indianapolis connecting I-69 to I-465. The interchange also has a service interchange within the system interchange that connects to Binford Boulevard to the south. The I-69 corridor and the interchange is one of the most heavily traveled commuter corridors in the area.

The overall Project Limits (Project Area) are shown in Figure 1. The Project Area on I-465 begin approximately 2.4 miles west of I-69 at the east end of the I-465 bridge over the White River and continue east through the I-465/I-69 interchange and south to the north end of the I-465 bridge over Fall Creek Road which is approximately 2.15 miles south of the I-465/I-69 interchange. The Project Area on Binford Boulevard begin approximately 2,000 feet south of 75th Street and continue north to I-69. The Project Area on I-69 begin just north of I-465 and continue north to a location where the proposed lanes tie into the existing lanes between 82nd Street and 96th Street (approximately just north of 86th Street). The I-465/I-69 interchange will be modified to improve capacity and safety. The interchange ramps at I-465/Allisonville Road and I-69/82nd Street will be modified to accommodate added travel lanes on I-465 and I-69.

Figure 1: Clear Path 465 Project Area

1.2 PROJECT BACKGROUND

The I-465/69 interchange was previously studied by the Indiana Department of Transportation (INDOT) as part of the Major Moves plan. A full redesign of the interchange as well as added travel lanes on I-465 was proposed. An interchange justification study (IJS), now known as an interstate access document (IAD), was completed for the project and approved by FHWA in 2010 (Appendix 1 – 2010 Interchange Justification Report – I-465 Northeast Side). However, the I-465/69 interchange portion of the project was cancelled in 2011 and never constructed because adequate funding was not available.

This Clear Path 465 study seeks to identify a fiscally reasonable alternative to the previous proposal. The recommended alternative identified in this study will accommodate the same movements as the interchange design proposed in the 2010 IJS. **No new movements or access points are being added to the interchange.** Therefore, with these similarities it is anticipated that the major, approved conclusions of the 2010 IJS will not change. This current IAR will serve as an update to the previous 2010 IJS with updated traffic operations and safety analyses for the new design alternative.

1.3 SCOPE OF THE PROJECT (FRAMEWORK)

The scope of the Clear Path 465 project was identified in the Clear Path 465 Framework Document 2017. The following is a summary of the scope of the study as agreed-upon with INDOT and FHWA.

1.3.1 STUDY AREA

The study area (area of influence) for the I-465/69 interchange includes at least one adjacent interchange in each direction. This includes the I-465/Allisonville Road interchange to the west, the I-465/56th Street/Shadeland Avenue interchange (north ramps only) to the southeast and the I-69/106th Street interchange (south ramps only) to the north. The 56th Street/Shadeland Avenue ramps are the entrance/exit points to a CD system that includes Shadeland Avenue and 56th Street. The CD system ties back into the I-465 mainline to the south at about 48th Street. The 82nd Street interchange is the next adjacent interchange to the north, but the area of influence was increased past the 96th Street interchange to the 106th Street interchange because of possible improvements that would include the 82nd Street interchange and the interdependent traffic interactions with the 96th Street interchange. The 75th Street intersection with Binford Boulevard will be the southern limit of the area of influence. The area of influence for the project is shown in Figure 2. The 75th Street/Binford Boulevard intersection was studied in greater detail as it is the arterial intersection that serves as the ramp terminal for the service interchange within the system interchange.

It was assumed for this study that the project would tie into the existing lanes at the following locations:

- I-465 on the west: 5-mainline lanes at the White River,
- I-465 on the south: 4-mainline lanes at Fall Creek,
- I-69 on the north: 5-mainline lanes at 86th Street.

Further widening beyond these points was considered to be beyond the scope of this project.

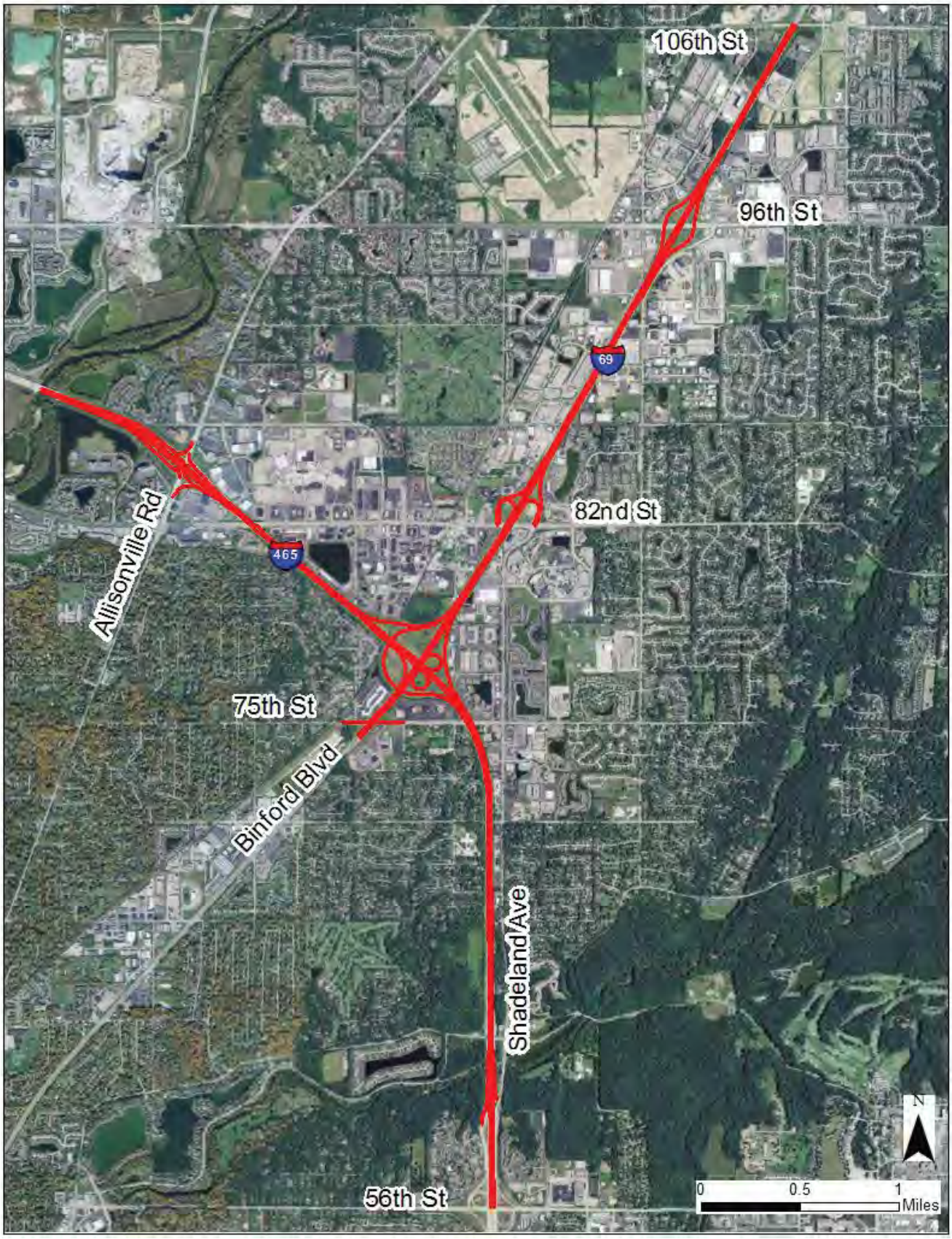


Figure 2: Clear Path 465 Influence Area

1.3.2 ANALYSIS YEARS AND TRAFFIC FORECAST

INDOT recorded hourly mainline and ramp traffic counts in the project corridor along I-465 in 2014 and I-69 in 2015. These counts formed the baseline traffic volumes for the study. The "existing" base year is considered to be 2015. The design year for the project is 2040.

- Base Year – 2015
- Open to Traffic – 2022-2024
- Design Year – 2040

AM and PM peak-hour turning movement counts were taken recently at the following intersections:

- 75th Street and Binford Boulevard
- 82nd Street and Shadeland Avenue/I-69 – Northbound Ramps
- 82nd Street and I-69 – Southbound Ramps
- 82nd Street and Bash Street

INDOT provided the design year traffic forecasts for the project. The design year traffic projections were derived by applying a growth rate to the base year volumes. Annual growth rates of 0.6% and 0.3% were applied to mainline volumes and ramp/intersection volumes respectively. These growth rates were obtained through coordination with INDOT's Asset Planning & Management Division. The growth rates are intended to capture the aggressive growth that is happening and expected to continue on the northeast side, while taking into consideration the stagnation of traffic growth that occurred during the previous decade. Base year and design year traffic volumes for the project are shown in Appendix 2 – Traffic Volumes.

1.3.3 LEVEL OF ANALYSIS

The complexity of this system interchange dictates that the IAD will be major in scale and scope. The project also requires a complex operational analysis. Therefore, a Vissim microsimulation model was developed and calibrated to analyze freeway operations during the AM and PM peak periods. The limits of the Vissim models are the same as the influence area shown in Figure 2. The Vissim models were calibrated to existing traffic conditions for the AM and PM peak hours. Synchro was used to evaluate the signalized intersections at 82nd Street and 75th Street/Binford Boulevard.

1.4 SUMMARY OF DRAFT PURPOSE AND NEED

The following summarizes the Draft Purpose and Need statement which is being developed as part of the NEPA process.

The need for the Clear Path 465 project stems from insufficient capacity that causes backups during the peak hours and safety concerns due to a high volume of crashes within the Project Area.

1. Congestion. There is insufficient existing and future capacity in critical roadway segments of the Project Area, resulting in congestion issues. The base-year and design-year peak-hour LOS for traffic congestion throughout the Project Area are summarized in Table 1. The entire Project Area is considered urban, which means the minimally acceptable LOS is D. The results show unacceptable LOS for both base-year and design-year traffic in each direction along critical roadway segments within the project corridor.

Table 1: Existing Design Speeds and LOS Summary (AM/PM)

CRITICAL ROADWAY SEGMENTS	EXISTING # OF LANES	DESIGN SPEED (MPH)	LOS	
			BASE-YEAR (2015)	DESIGN-YEAR (2040)
EB I-465 – White River to Allisonville Rd	4	70	C/D	D/E
EB I-465 - Inside Allisonville Rd Interchange	3	70	D/D	E/F
EB I-465 – Allisonville Rd to I-69 Ramps	3	70	E/F	F/F
EB I-465 – Binford Blvd Off-Ramp to Loop Ramp	3	70	E/E	F/F
EB I-465 – Loop Ramp to I-69 Ramp	3	70	C/D	D/D
SB I-465 – I-69 Ramps to 56th St. / Shadeland Ave.	4	70	E/E	F/F
NB I-465 – 56th St. / Shadeland Ave. to I-69 Ramps	4	70	E/F	F/F
WB I-465 – I-69 Ramp to Loop Ramp	3	70	D/C	E/D
WB I-465 – Loop Ramp to I-69 Ramp	3	70	C/C	F/C
WB I-465 – I-69 Ramps to Allisonville Rd (weave)	4	70	F/E	F/F
WB I-465 – Inside Allisonville Rd Interchange	3	70	F/D	F/F
WB I-465 – Allisonville Rd to White River	4	70	E/D	F/E
NB I-69 – I-465 Ramps/Binford Blvd to 82nd St. (weave)	4	55	D/F	E/F
NB I-69 – Inside 82nd St. Interchange	4	55	C/D	C/E
NB I-69 – North of 82nd St.	5	55	C/C	C/D
SB I-69 – North of 82nd St.	5	55	D/C	E/C
SB I-69 – Inside 82nd Street Interchange	4	55	D/C	F/C
SB I-69 – 82nd Street to I-465 Ramps (weave)	5	55	E/C	F/D
NB Binford – South of 75th St.	2	55	n/a	n/a
NB Binford – 75th St. to NB I-69	2	55	C/C	C/C
SB Binford – I-69 to 75th St.	3	55	n/a	n/a
SB Binford – South of 75th St.	2	55	n/a	n/a
EB I-465 to NB I-69/82nd St. (Loop)	1	25	n/a	n/a
EB I-465 to SB Binford Blvd	1	25	n/a	n/a
NB I-465 to NB I-69/82nd St.	2	50	D/E	E/F
NB Binford Blvd to WB I-465 (Loop)	1	25	n/a	n/a
SB I-69 to WB I-465	2	50	D/C	D/C
SB I-69 to SB I-465	2	50	E/E	F/E

2. **Safety**. Between 2013 and 2015, over 1,000 crashes were reported within the Project Area – an average of almost one crash per day. The crash data is summarized Table 3 in Section 1.4.3. Contributing factors include traffic congestion, configuration and weaving movements.

The **purpose** of the Clear Path 465 Project is to improve overall traffic operation by increasing capacity to meet the LOS goals stated above, and to improve safety by reducing the total number of crashes, decreasing the fatality/injury severity percentages, and reducing the crash rate (crashes/mile/year) and travel crash rate (crashes/million-vehicle-miles).

2.0 Existing Conditions

Below is a description of the existing geometry, traffic operations and safety conditions for the I-465 and I-69 interstate system within the project corridor.

2.1 EXISTING GEOMETRY

Eastbound/Southbound I-465

Even though the existing White River bridge is wide enough to accommodate five lanes, eastbound I-465 from the White River bridge to the east currently has four lanes. The right eastbound I-465 lane exits at Allisonville Road and three lanes continue under Allisonville Road. The eastbound Allisonville Road on-ramp merges onto I-465, leaving three lanes on I-465. A ramp lane is added to the outside and exits onto southbound Binford Boulevard and shortly after, another ramp lane is added to the outside and exits eastbound I-465 via a single-lane loop ramp towards northbound I-69. Three I-465 lanes continue south until the 2 lane southbound I-69 to southbound I-465 ramp merges onto I-465. The left ramp lane merges into the outside I-465 through lane and then four lanes are maintained on southbound I-465 until the Fall Creek Road bridge. The existing Fall Creek Road bridge is wide enough to accommodate five lanes, but the 5th lane exits at 56th Street/Shadeland Avenue.

There are several problems with substandard existing roadway geometry within this roadway section.

1. Eastbound I-465 traffic entering from the northbound Keystone Avenue on-ramp has two lane drops and must merge over three lanes in order to continue east past Allisonville Road. A significant volume of southbound Keystone Avenue traffic entering eastbound I-465 continues on mainline I-465 past Allisonville Road and all of this traffic must make one lane change to the left to avoid exiting at Allisonville Road.
2. The southbound I-69 to southbound I-465 ramp merges into southbound I-465 in a very abrupt manner. The right lane of mainline I-465 and the left ramp lane merge together in a manner where neither movement has its own lane. This creates an unsafe situation where traffic is forced to merge very quickly.
3. There are several locations with deficient vertical clearance including I-465 over Binford Boulevard, I-465 over 71st Street, and 75th Street over I-465.

Northbound/Westbound I-465

Northbound I-465 from Fall Creek Road has four lanes and travels over 71st Street and under 75th Street. At the I-69 interchange, two lanes head north on I-69 and three lanes travel west on I-465. Westbound I-465 crosses over Binford Boulevard and a single-lane loop ramp from northbound Binford Boulevard merges into the mainline inside the I-69 interchange. Westbound I-465 crosses over the southbound I-69 to southbound I-465 ramp and the I.T.M. railroad. The 2 lane southbound I-69 to westbound I-465 ramp merges after the loop ramp lane drop and creates four lanes heading west (the outside ramp lane drops prior to the merge). Four westbound I-465 lanes travel under the existing 82nd Street bridge. The right lane exits at Allisonville Road and three I-465 lanes continue under Allisonville Road. The Allisonville Road on-ramp to westbound I-465 creates a fourth lane that heads west and goes over the White River bridge, where the project ends. The existing White River bridge is wide enough to accommodate a fifth westbound I-465 lane as shown in the final design configuration. The existing northbound/westbound I-465 shoulder widths vary throughout the area.

There are several problems with substandard existing roadway geometry within this roadway section.

4. The I-465 median shoulders vary from 5 feet to 17 feet causing the through lanes to shift in and out and creating an unsafe situation where there is often no place to pull off towards the median in an emergency.
5. Both lanes of the northbound I-465 on-ramp at 56th Street/Shadeland Avenue drop as traffic merges onto northbound I-465. There is a large amount of traffic entering I-465 from this ramp that forces all of that traffic to merge over quickly prior to climbing the hill which causes queuing along I-465 and the ramp.
6. Northbound I-465 has a steep uphill grade from 56th Street/Shadeland Avenue to 71st Street that causes heavy vehicles to struggle to regain speed after the bottleneck which further disrupts I-465 traffic flows.

7. The current roadway signing for northbound I-465 to I-69 is inadequate and does not meet the Indiana MUTCD requirements. The overhead signs do not portray the correct lane configuration at the exit to I-69. A decision lane results in a two-lane exit. However, most drivers use only the outside lane causing a disproportionate usage of the outside lane. This causes excessive delays and traffic backups and can be attributed to the improper signage. The ground mounted regulatory sheets signs for lane geometry are difficult to see and missed by most motorists.
8. On westbound I-465, where the southbound I-69 to westbound I-465 ramp merges with westbound I-465, there is insufficient distance and time for the significant ramp traffic volume to merge onto I-465. The right ramp lane (outside) drops shortly after the gore and the left lane becomes the single-lane westbound Allisonville Road off-ramp. Therefore, almost all southbound I-69 to westbound I-465 mainline traffic uses the left ramp lane only before making a lane change to continue onto westbound I-465. All westbound I-465 traffic headed towards the Allisonville Road off-ramp must merge into the lane from the southbound I-69 ramp. This results in a heavy weave movement and long backups on westbound I-465 and southbound I-69.
9. There are several locations with deficient vertical clearance including I-465 over Binford Boulevard, I-465 over 71st Street, and 75th Street over I-465.

Northbound Binford Boulevard/I-69

Northbound Binford Boulevard from 75th Street to the north has two lanes. As Binford Boulevard travels under I-465, there is a weave section with the eastbound I-465 to northbound I-69/Binford Boulevard on-ramp (loop ramp) and the northbound Binford Boulevard to westbound I-465 exit ramp (loop ramp). Two lanes on northbound Binford Boulevard continue north carrying traffic from northbound Binford Boulevard and eastbound I-465 towards I-69 and 82nd Street. The two northbound Binford Boulevard lanes merge on the left side of I-69 with two lanes from northbound I-465. The four I-69 lanes continue north to the end of Project Area. A parallel exit ramp is introduced for the 82nd Street exit ramp.

There are several problems with substandard existing roadway geometry within this roadway section.

10. The northbound I-69 median shoulders are very narrow with a minimum width of 5 feet.
11. The eastbound I-465 to northbound I-69 loop ramp and the northbound Binford Boulevard to westbound I-465 loop ramp creates a weave section along northbound Binford Boulevard that creates congestion and queues traffic.
12. All traffic from both I-465 (both directions) and from Binford Boulevard headed north on I-69 is mixed in and has to weave across traffic heading to 82nd Street. There is no separation of I-69 mainline and 82nd Street local traffic. Eastbound I-465 to northbound I-69 traffic merges with Binford Boulevard and then merges again with the northbound I-465 to northbound I-69 ramp. A vehicle from eastbound I-465 or northbound Binford Boulevard that exits at the 82nd Street off-ramp must weave across the large volume of traffic traveling from northbound I-465 to northbound I-69. This weave movement causes backups on both exit ramps from I-465 and along northbound Binford Boulevard.
13. The vertical clearance on the I-69 bridge over 82nd Street is deficient.

Southbound I-69/Binford Boulevard

Southbound I-69 has four mainline lanes and an auxiliary lane ramp that enters from 96th Street and exits at 82nd Street. The southbound 82nd Street single-lane loop on-ramp enters southbound I-69 and creates a fifth mainline lane. Two southbound lanes exit on the left side to southbound Binford Boulevard. The second lane is an option lane so three southbound lanes continue towards I-465. The middle lane becomes an option lane and the lanes split with two lanes traveling towards westbound I-465 and two lanes heading towards southbound I-465.

As two southbound Binford Boulevard lanes travel from I-69 towards 75th Street, the single lane eastbound I-465 to southbound Binford Boulevard ramp joins in on the right as a separate free flow lane. At the 75th Street intersection, southbound Binford Boulevard has two through lanes, a right turn lane and two left turn lanes.

There are several problems with substandard existing roadway geometry within this roadway section.

14. The southbound I-69 median shoulders are very narrow with a minimum width of 5 feet.
15. Traffic entering southbound I-69 from the southbound 82nd Street on-ramp must cross over all southbound I-69 to I-465 traffic in order to access southbound Binford Boulevard.

16. The vertical clearance on the I-69 bridge over 82nd Street is deficient.

I-465/I-69 Interchange Ramps

There are several problems with substandard existing roadway geometry within the existing I-465/I-69 Interchange.

17. The eastbound I-465 to northbound I-69 single lane loop ramp creates a situation where all eastbound I-465 traffic reduces speeds and queues up because the loop ramp does not have enough capacity to accommodate the base-year peak hour traffic and the ramp lane along eastbound I-465 is too short.
18. The eastbound I-465 to southbound Binford Boulevard is a single-lane free-flow ramp that merges with high speed traffic on southbound Binford Boulevard. All ramp traffic that wants to turn left (east) onto 75th Street must weave across two lanes of high speed traffic in a short distance.
19. The vertical clearance on the southbound I-69 to southbound I-465 ramp over Binford Boulevard is deficient.
20. The roadway signs do not meet the IMUTCD requirement for a System Interchange. Motorists do not get adequate distance to be in the proper lanes at the exit to I-465. The 2 miles and 1 mile signs to I-465 do not exist and they are needed for smooth operations at this exit. The substandard signing at this exit causes backups.

2.2 TRAFFIC OPERATIONS

A traffic operations analysis was performed for the existing traffic and roadway network using Highway Capacity Software (HCS) and a Vissim microsimulation model. The Vissim model covers I-465 from 56th Street on the south to the White River on the west and I-69 from 106th Street on the north to 75th Street on the south. The existing AM and PM peak-hour volumes and resultant LOS according to the HCS analysis are shown in Figure 3. The existing AM and PM peak-period segment speed heat maps from Vissim are shown in Figure 4 and Figure 5.

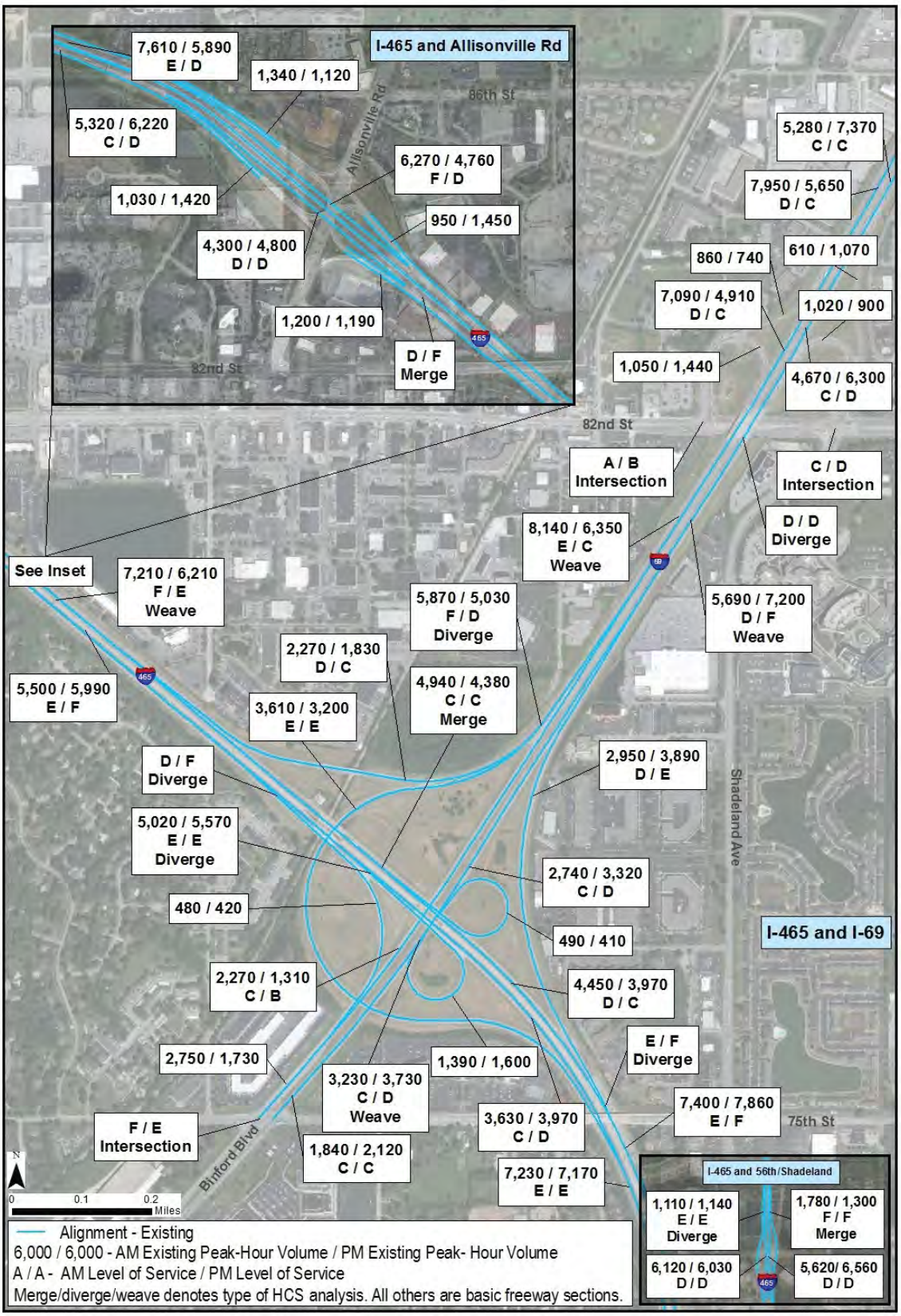


Figure 3: Existing AM and PM Peak-Hour Volumes and HCS LOS

Existing - AM

Route	Segment	6:45	7:00	7:15	7:30	7:45	8:00	8:15	8:30	Peak-Hour Average
SB I-69	106th	66	65	65	65	65	66	66	66	65
		65	65	64	64	64	65	65	65	64
	106th On to 96th Off	64	63	63	63	63	64	64	64	63
		60	58	57	56	58	60	61	61	58
	96th	64	63	62	62	63	64	64	64	63
		64	63	63	63	63	64	64	64	63
		64	63	63	63	63	64	64	64	63
	96th On to 82nd Off	64	64	63	64	64	64	65	65	64
		61	60	57	54	54	59	61	61	56
		60	59	52	45	46	55	60	60	49
	82nd St	60	58	42	33	35	51	60	60	40
	82nd On to I-465 Split	47	43	27	24	26	39	49	54	29
		52	47	44	43	43	45	53	54	44
		54	50	51	52	50	46	55	55	50
		56	53	53	52	50	46	56	56	50
NB I-69	NB Binford Blvd	58	56	56	57	56	57	57	58	56
		58	55	53	54	54	55	56	56	54
	I-465 to 82nd St Off	60	59	58	58	59	59	60	60	59
		56	54	53	53	53	53	54	56	53
	at 82nd St	63	62	61	61	61	62	62	62	61
	82nd St On to 96th St Off	64	63	62	62	62	62	63	63	62
		63	62	61	61	61	61	62	62	61
		64	63	63	63	63	63	64	64	63
		63	61	60	60	60	61	62	62	60
	at 96th St	66	65	65	64	65	65	65	65	65
		66	65	65	65	65	65	65	65	65
		66	65	65	65	65	65	65	65	65
	96th St On to 106th St Off	66	65	65	65	65	65	66	66	65
		66	65	65	65	65	65	66	66	65
	at 106th St	66	65	65	65	65	65	66	66	65
		67	66	66	66	66	66	66	66	66
NB/WB I-465	56th St On to NB to NB Ramp	57	55	47	45	49	55	58	58	49
		56	52	44	42	48	54	57	57	47
		58	56	54	54	55	57	58	58	55
		58	56	55	55	55	55	58	58	55
		57	56	55	55	54	54	57	58	55
	NB to NB thru NB to WB	60	59	58	53	42	50	58	60	51
	NB to WB Ramp to SB to WB Ramp	59	57	55	33	23	29	55	59	35
		58	55	47	27	22	25	53	58	30
	I-69 to Allisonville Rd	57	52	40	23	19	21	45	58	26
		57	52	47	46	46	46	53	56	46
	at Allisonville Rd	57	54	52	53	53	53	55	56	53
		58	55	55	54	54	55	56	57	54
		58	56	55	55	55	55	56	57	55
	Allisonville On to Keystone Off	60	59	58	58	58	58	59	60	58
		62	61	60	60	60	60	61	61	60
EB/SB I-465	Keystone On to Allisonville Off	61	60	59	59	60	61	62	62	60
		58	55	53	53	54	56	57	57	54
	at Allisonville Rd	58	57	55	55	56	57	58	58	56
		58	58	56	56	57	58	58	58	57
		58	57	56	56	56	57	58	58	56
		58	57	53	53	54	57	58	58	54
	Allisonville to I-69	59	58	53	53	54	58	59	59	55
		58	56	47	46	48	58	59	59	50
		56	52	49	48	49	53	55	56	50
	EB to SB Ramp to EB to NB Ramp	56	53	50	51	51	53	54	55	51
		55	52	49	50	50	51	53	54	50
		49	46	43	42	44	45	46	47	44
	EB to NB Ramp to SB to SB Ramp	58	56	55	54	55	55	56	56	55
	I-69 to 56th St Off	58	56	56	55	56	56	57	57	56
		59	58	57	56	57	57	58	59	57
		61	59	59	58	59	59	60	60	59

Speed (mph)
>62.5
60
58
55
53
50

Figure 4: Segment Speeds from Vissim – Existing AM

Existing - PM

Route	Segment	4:30	4:45	5:00	5:15	5:30	5:45	6:00	6:15	Peak-Hour Average
SB I-69	106th	66	66	66	66	66	66	66	67	66
		66	66	66	66	66	66	66	66	66
	106th On to 96th Off	65	65	65	65	65	65	65	65	65
		63	63	64	63	63	63	64	64	63
	96th	65	65	65	65	65	65	65	65	65
		65	65	65	65	65	65	65	65	65
		65	65	65	65	65	65	65	65	65
	96th On to 82nd Off	65	65	65	64	64	65	65	65	65
		62	62	62	62	62	62	63	63	62
		61	61	61	61	61	61	62	62	61
	82nd St	62	61	61	61	61	61	62	62	61
	82nd On to I-465 Split	51	48	48	48	45	50	52	55	48
		53	51	51	51	49	51	54	55	51
		55	55	54	53	53	54	55	56	53
		57	55	56	56	55	55	57	57	55
NB I-69	NB Binford Blvd	57	56	57	56	55	56	57	58	56
		55	52	52	52	53	52	53	54	52
	I-465 to 82nd St Off	59	57	57	58	57	57	57	58	57
		56	54	54	53	54	54	54	54	54
	at 82nd St	61	59	60	59	59	59	60	60	59
	82nd St On to 96th St Off	61	60	60	60	60	60	61	61	60
		59	58	58	58	58	58	59	59	58
		62	62	62	62	62	61	62	62	62
		62	61	59	60	60	59	61	61	60
	at 96th St	64	63	63	63	63	63	63	63	63
		64	63	63	63	63	64	64	64	63
		64	63	63	63	63	63	64	64	63
	96th St On to 106th St Off	65	64	64	64	64	64	64	64	64
		65	64	64	64	64	64	64	64	64
	at 106th St	65	64	64	64	64	64	64	64	64
		66	65	65	65	65	65	65	65	65
NB/WB I-465	56th St On to NB to NB Ramp	50	43	36	35	34	31	40	46	34
		44	39	35	34	34	33	39	43	34
		54	54	54	54	53	54	53	54	54
		56	55	55	55	55	55	55	55	55
		55	55	55	55	55	55	55	55	55
	NB to NB thru NB to WB	60	59	59	60	59	59	59	59	59
	NB to WB Ramp to SB to WB Ramp	58	58	58	59	58	58	58	58	58
		57	57	57	58	57	57	57	57	57
	I-69 to Allisonville Rd	58	56	57	57	56	56	57	57	56
		56	55	56	55	55	55	56	55	55
	at Allisonville Rd	57	56	57	56	56	56	56	57	57
		58	57	58	58	57	57	57	57	57
		58	57	58	58	57	57	57	57	57
	Allisonville On to Keystone Off	61	60	60	60	60	60	60	60	60
		62	61	61	61	61	61	61	61	61
EB/SB I-465	Keystone On to Allisonville Off	57	53	40	31	23	18	17	18	28
		49	34	28	27	28	27	29	30	27
	at Allisonville Rd	52	34	32	30	30	31	33	34	31
		52	33	33	31	31	32	33	35	32
		50	31	32	30	30	32	32	34	31
		47	29	32	30	30	31	31	34	31
	Allisonville to I-69	48	30	34	32	32	34	33	37	33
		43	23	26	25	24	27	27	30	25
		46	41	42	41	42	41	41	41	42
	EB to SB Ramp to EB to NB Ramp	49	47	48	47	48	47	47	46	48
		51	47	47	48	48	48	47	47	48
		46	41	41	43	43	42	42	40	42
	EB to NB Ramp to SB to SB Ramp	56	54	54	54	54	54	54	54	54
	I-69 to 56th St Off	57	56	56	56	56	56	56	56	56
		59	57	57	57	57	57	57	57	57
		60	59	58	58	58	59	58	59	58

Speed (mph)
>62.5
60
58
55
53
50

Figure 5: Segment Speeds from Vissim – Existing PM

Southbound I-69

There are several critical features of the southbound I-69 corridor that are especially problematic in the AM peak hour. First, there are three major movements within a short distance downstream of the 82nd Street interchange: the ramp to westbound I-465 (AM – 2,270 vehicles), the ramp to southbound I-465 (AM – 3,610 vehicles), and the ramp to southbound Binford Boulevard (AM – 2,270 vehicles). Second, there is a prominent, two-lane exit to a local street on the left side of the freeway – the southbound Binford Boulevard off-ramp. Third, the proximity (2,100 feet) of the southbound 82nd Street on-ramp to the southbound Binford Boulevard off-ramp causes a two-sided weaving section across three lanes. Maneuvering from the southbound 82nd Street on-ramp to the southbound Binford Boulevard off-ramp requires vehicles to make three lane changes across heavy southbound traffic to I-465 in the distance of 2,100 feet. Previous studies estimated that 250 vehicles make this maneuver in the AM peak hour.

The combination of these factors currently causes severe congestion and bottlenecking, especially in the AM peak hour. The AM Vissim model shows peak-hour speeds below 30 mph near the southbound 82nd Street on-ramp merge with southbound I-69. The AM heat map also indicates bottleneck queuing upstream of this point toward 96th Street during the peak hour. The analysis of existing conditions on the weaving section between the southbound 82nd Street on-ramp and the southbound Binford Boulevard off-ramp shows LOS E in the AM peak hour and LOS C in the PM peak hour. The diverge to westbound I-465 and southbound I-465 also shows a degradation of speeds in the AM heat map and operates at LOS F in the AM peak hour and LOS D in the PM peak hour. The bottlenecks in this segment regularly propagate back upstream through the 82nd Street interchange toward 96th Street in the AM peak hour.

Northbound I-69

Northbound I-69 currently suffers from delays caused by two major movements merging north of the I-465 interchange: traffic from northbound Binford Boulevard and eastbound I-465 and traffic from northbound I-465 (northbound to northbound ramp). This is complicated further by the northbound 82nd Street off-ramp being located 2,000 feet downstream. Vehicles navigating from northbound Binford Boulevard and eastbound I-465 to the northbound 82nd Street off-ramp must move three lanes to the right across a heavy volume from the northbound to northbound ramp (PM – 3,890 vehicles) in order to exit. At the same time, many of the northbound vehicles from the northbound to northbound ramp are attempting to navigate to the left lanes of northbound I-69 to avoid the friction at the 82nd Street interchange and the 96th Street interchange. This causes a weaving movement similar to the one on southbound I-69. The PM Vissim heat map shows a degradation of speed that indicates turbulence in the area of this merge. The segment of northbound Binford Boulevard just south of the merge shows an average PM peak-hour speed of 52 mph. The HCS analysis for this weave shows a LOS D in the AM peak hour and LOS F in the PM peak hour. Also, the northbound to northbound ramp is near its two-lane capacity and operates at LOS D in the AM peak hour and LOS E in the PM peak hour.

There is also a tight weaving movement on northbound Binford Boulevard between the two low-speed ramps: the loop ramp from eastbound I-465 to northbound I-69 (eastbound to northbound ramp) and the loop ramp from northbound Binford Boulevard to westbound I-465. This causes congestion and decreased speeds as traffic seeks to accelerate for its downstream mainline merge with the northbound to northbound ramp. This weave operates at LOS C in the AM peak hour and LOS D in the PM peak hour.

Northbound/Westbound I-465

Two significant problems on westbound I-465 are the weaving section between I-69 and Allisonville Road and the limited capacity under the Allisonville Road bridge. These two issues create a major bottleneck in the AM peak hour. Currently, there are three westbound mainline lanes between the westbound Allisonville Road off-ramp and the westbound Allisonville Road on-ramp. This number of lanes does not adequately serve the existing AM peak-hour traffic demands. The HCS analysis shows a LOS F in the AM peak hour and a LOS D in the PM peak hour. The weaving section between I-69 and Allisonville Road also causes congestion. Two lanes from the ramp from southbound I-69 to westbound I-465 (southbound to westbound ramp) merge with three westbound mainline I-465 lanes. The right ramp lane drops and the left ramp lane forms an auxiliary lane that exits at the westbound Allisonville Road off-ramp. The Vissim heat maps show

AM peak-hour average speeds of 26 mph and 30 mph on segments between Allisonville and I-69. These reduced speeds from the bottlenecks propagate back through the I-69 interchange. This weaving section operates at LOS F in the AM peak hour and LOS E in the PM peak hour.

A secondary bottleneck occurs on northbound I-465 at the merge of the northbound 56th Street/Shadeland Avenue on-ramp. The two lanes from the on-ramp merge into the four northbound mainline lanes of I-69. Northbound I-69 continues as a four-lane mainline section to the 82nd Street interchange. The high volume of ramp traffic (AM – 1,930 vehicles; PM 1,400 vehicles) merges into the high volume of traffic on the northbound I-465 mainline lanes (AM – 6,720 vehicles; PM 7,780 vehicles) causing congestion in both the AM and PM peak hours. The Vissim analyses indicate AM peak-hour speeds below 50 mph and PM peak-hour speeds below 35 mph. The four-lane mainline on northbound I-465 between the northbound 56th Street on-ramp and the northbound to northbound Ramp operates at LOS E in the AM peak hour and LOS F in the PM peak hour.

Eastbound/Southbound I-465

Eastbound I-465 traffic experiences a heavy bottleneck at the Allisonville Road interchange. There are five mainline lanes on eastbound I-465 between the Keystone Avenue interchange and the White River Bridge. This is where the I-465 Northeast project ended, and the eastbound mainline drops to four lanes. The right lane then drops at the eastbound Allisonville Road off-ramp leaving three mainline lanes on eastbound I-465 under the Allisonville Road bridge. These three lanes operate at LOS D for both the AM and PM peak hours. The problem worsens moving east as additional vehicles from the eastbound Allisonville Road on-ramp merges (AM – 1,200 vehicles; PM – 1,190 vehicles) onto the downstream three-lane mainline of eastbound I-465 between the Allisonville Road interchange and the I-69 interchange. This merge operates at LOS D in the AM peak hour and LOS F in the PM peak hour. The demand (AM – 5,500 vehicles; PM – 5,990 vehicles) on the downstream section of the eastbound Allisonville on-ramp and the southbound Binford Boulevard off-ramp is nearing capacity and operates at LOS E in the AM peak hour and LOS F in the PM peak hour.

There is a secondary bottleneck that is caused by vehicles decelerating as they exit to the low-speed loop ramp from eastbound I-465 to northbound I-69 (eastbound to northbound ramp). There is a high demand for the loop ramp (AM – 1,390 vehicles; PM – 1,600 vehicles) and as these vehicles slow to 25 mph or less to navigate the tight loop ramp, queueing forms and spills back onto the eastbound I-465 mainline lanes. This causes a reduction in speeds in both AM and PM peak hours. The diverge to the eastbound to northbound ramp operates at LOS E in both the AM and PM peak hours. The PM Vissim heat maps show the devastating effects that these bottlenecks have on the eastbound I-465 mainline speeds in the whole section. Nearly all of the segments throughout the PM peak period from the eastbound to northbound ramp to the end of the study area at the White River are below 50 mph, with many below 35 mph. The AM heat maps also show some segments in this area below 50 mph.

The three mainline lanes between the ramp from eastbound I-465 to northbound I-69 and the ramp from southbound I-69 to southbound I-465 operates at LOS C in the AM peak hour and LOS D in the PM peak hour. The merge of the ramp from southbound I-69 to southbound I-465 cannot be accurately assessed with the HSC Merge methodology because a lane is added. However, the Vissim model shows speeds in the mid-50s in this area. The four mainline lanes on southbound I-465 between the ramp from southbound I-69 to southbound I-465 (southbound to southbound ramp) and the southbound 56th Street/Shadeland Avenue off-ramp is near capacity and operates at LOS E in both the AM and PM peak hours. The four-lane I-465 mainline after the off-ramp operates at LOS D in both the AM and PM peak hours. This segment also has a three percent grade up from Fall Creek.

Systemwide Operations – Travel Times

Travel times were collected in the Vissim models for the six major movements through the Project Area. Table 2 below shows these travel times for the AM and PM peak hours and compares them to free-flow travel times on the same segments.

Table 2: Existing Peak-Hour Travel Times from Vissim

SEGMENT	TRAVEL TIME (MINUTES)		
	ESTIMATED FREE FLOW	AM	PM
NB to NB - 56th St to 96th St	5.2	5.6	6.5
NB to WB - 56th St to White River	5.2	6.1	6.2
SB to SB - 96th St to 56th St	5.7	6.5	6.1
SB to WB - 96th St to White River	4.6	6.1	4.9
EB to SB - White River to 56th St	5.2	5.6	7.3
EB to NB - White River to 96th St	5.5	5.9	6.9

The major movements in the AM peak hour (southbound to westbound, northbound to westbound, and southbound to southbound) experience travel time increases of 15 percent to 33 percent. This is reflective of the bottlenecks on westbound I-465 and southbound I-69. The major movements in the PM peak hour (eastbound to southbound, eastbound to northbound, northbound to northbound, and northbound to westbound) experience travel time increases of 19 percent to 42 percent. This is reflective of the bottlenecks on eastbound I-465 at Allisonville and northbound I-465.

75th Street and Binford Boulevard Intersection

The intersection of 75th Street and Binford Boulevard was analyzed using Synchro. The intersection performs at LOS E in the AM peak hour and LOS D in the PM peak hour.

2.3 HISTORICAL CRASH SAFETY ANALYSIS

The crash data for this safety analysis includes all identified incidents between 2013 and 2015, and has been provided by INDOT. The data includes specific information involved with each crash incident, including weather and surface conditions, latitude and longitude, severity, and manner of collision. The raw crash data was filtered and analyzed to better understand and consider the existing safety performance of this facility. The results are described in the two steps below.

The first step in the existing safety analysis was to examine the historical crashes to determine the safety performance of the facility. From that information, crash hot spots and manner of collision trends were identified.

The historical crash data was filtered to allow for a more accurate analysis. Only crashes that contained latitude and longitudes within the project area were used. In addition, only crashes that happened on I-465, I-69, and associated ramps were included. These filters resulted in 1,058 applicable total crashes over the three-year period, or 353 crashes per year (Table 3). Of these 1,058 crashes, 886 are property damage only (PDO) crashes, and 172 are injury crashes. There were no identified fatalities in the analysis period. These 1,058 crashes are visually represented on Collision Diagrams in Appendix 3, Exhibits 3 – 1 to 3 – 5, and detailed crash information is listed in Appendix 3, Tables 3 – 6 to 3 – 16. The data shows that there is currently an average of one crash per day within the project area of the I-465/I-69 interchange.

Table 3: Historical Crash Summary (2013 to 2015)

CRASH SEVERITY	CRASH LOCATION					
	NB I-69	SB I-69	WB/NB I-465	EB/SB I-465	UNKNOWN DIRECTION	NB/SB BINFORD
Property Damage Only	35	142	302	379	18	10
Injury	10	39	45	68	7	3
Fatality	0	0	0	0	0	0
PROPERTY DAMAGE ONLY (PDO) CRASHES [YEARLY TOTAL]:						295
FATAL/INJURY (FI) CRASHES [YEARLY TOTAL]:						57
CRASHES [YEARLY TOTAL]:						**353**
CRASHES [3-YEAR TOTAL]:						**1058**

*Note: See Appendix 3, Tables 3 – 6 to 3 – 16 for detailed historical crash information.

The second step of the analysis was to identify potential crash safety hot spots, and determine the potential causes. From the 1,058 total historical crashes, 60 percent were rear ends, and 24 percent were same direction sideswipes, as seen in Table 4. The hot spots were identified by analyzing the manner of collision distributions and spatial density distribution of crashes in the Collision Diagrams (Appendix 3, Exhibits 3-1 to 3-5), and are as follows:

21. Eastbound I-465 as it approaches the eastbound I-465 to southbound Binford Boulevard off-ramp, and the eastbound I-465 to northbound Binford Boulevard off-ramp. There was a higher-than-average density of rear end crashes recorded in that area, which can be attributed to the short distance (approximately 900 feet) between these off-ramps as shown in Appendix 3, Exhibit 3 – 3.
22. Southbound I-69 just south of the 82nd Street on-ramp. There was an above average density of rear end and sideswipe crashes recorded in that area as shown in Appendix 3, Exhibit 3 – 5. This segment is identified as a weaving section, as 82nd Street on-ramp traffic must cross southbound I-69 traffic to the southbound I-69 to westbound I-465 ramp and the southbound I-69 to southbound I-465 ramp.

These hot spot safety concerns have been addressed by the recommended alternative.

In addition, after analyzing the Collision Diagrams in Appendix 3, Exhibits 3 – 1 to 3 – 5, there were no apparent out of the ordinary trends caused by surface or lighting conditions.

Table 4: Historical Crashes Evaluated by Manner of Collision

MANNER OF COLLISION	PDO CRASHES (PROPERTY DAMAGE ONLY)	FI CRASHES (INJURY OR FATALITY)	TOTAL CRASHES
Backing Crash	4	0	4
Collision with Object in Road	18	0	18
Head on Between Two Motor Vehicles	25	10	35
Left Turn	1	1	2
Left/Right Turn	10	0	10
Non-Collision	9	1	10
Opposite Direction Sideswipe	2	0	2
Other - Explain in Narrative	9	3	12
Ran Off Road	35	25	60
Rear End	541	95	636
Rear to Rear	3	0	3
Right Angle	10	3	13
Right Turn	0	1	1
Same Direction Sideswipe	219	33	252
TOTAL CRASHES	**886**	**172**	**1,058**

*Note: See Appendix 3, Tables 3 – 6 to 3 – 16 for detailed historical crash information.

The historical crash data has also been analyzed by time of day. The peak-hour volumes for this interchange are 7:00 am to 8:00 am in the morning, and 5:00 pm to 6:00 pm in the evening. As seen in the following histogram (Figure 6), the distribution of crashes during peak-hours indicates a direct correlation between congestion and vehicular incidents.

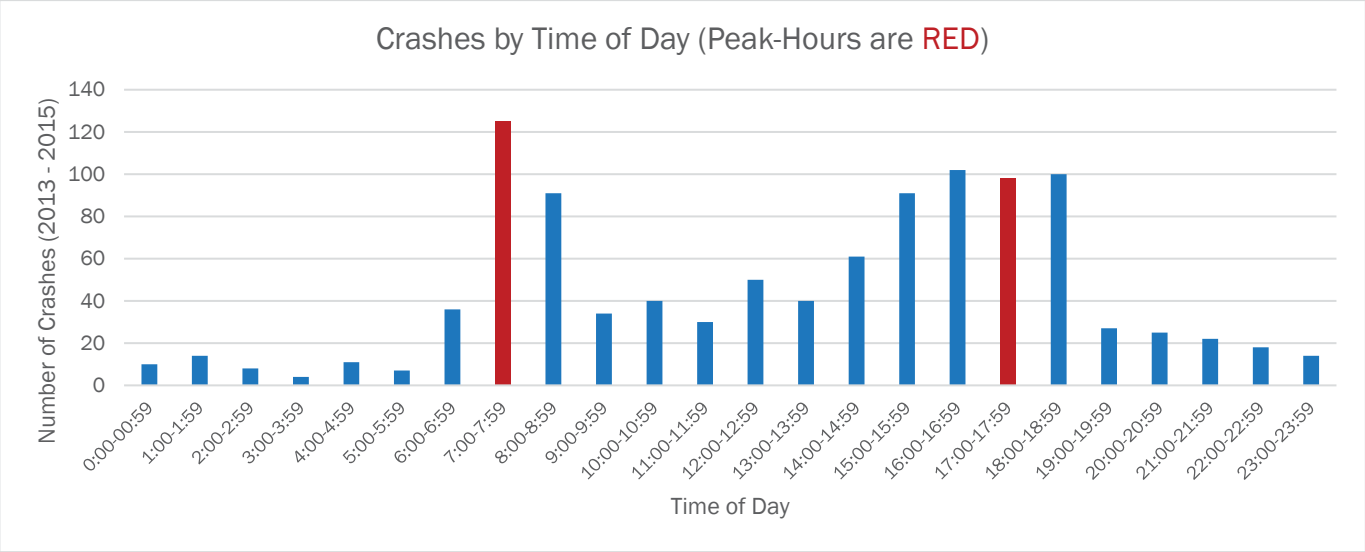


Figure 6: Crashes by Time of Day

Analyzing further, the crashes during the peak-hours were broken down by manner of collision. While 60 percent of the overall collisions were rear ends, that number jumps up to 78 percent and 76 percent for the AM and PM peak-hours, respectively. Rear end crashes can generally be attributed to stop-and-go and heavy traffic. This rear end crash percentage increase (Table 5) confirms the above conclusion that congestion plays a large role in overall vehicular incidents within the interchange.

Table 5: Manner of Collision during Peak Hours

MANNER OF COLLISION	OVERALL CRASHES	% OF OVERALL		AM CRASHES (7:00AM TO 8:00AM)	% OF AM	PM CRASHES (5:00PM TO 6:00PM)	% OF PM
BACKING CRASH	4	0%		0	0%	0	0%
COLLISION WITH OBJECT IN ROAD	18	2%		1	1%	1	1%
HEAD ON BETWEEN TWO MOTOR VEHICLES	35	3%		2	2%	1	1%
LEFT TURN	2	0%		0	0%	0	0%
LEFT/RIGHT TURN	10	1%		1	1%	0	0%
NON-COLLISION	10	1%		0	0%	1	1%
OPPOSITE DIRECTION SIDESWIPE	2	0%		0	0%	0	0%
OTHER - EXPLAIN IN NARRATIVE	12	1%		1	1%	1	1%
RAN OFF ROAD	60	6%		5	4%	2	2%
REAR END	636	60%		98	78%	74	76%
REAR TO REAR	3	0%		0	0%	0	0%
RIGHT ANGLE	13	1%		0	0%	1	1%
RIGHT TURN	1	0%		0	0%	0	0%
SAME DIRECTION SIDESWIPE	252	24%		17	14%	17	17%
TOTALS	**1058**			**125**		**98**	

The following limitations apply to the historical crash safety analysis:

Normally, the Road Hazard Analysis Tool (RoadHAT), or the Interactive Highway Safety Design Model (IHSDM) is used to predict the crash performance of an existing facility. The calculated information is then compared to the historical crash performance. This analysis helps determine how the existing facility is performing in relation to similar facilities. However, RoadHAT does not support crash predication models for complex system interchanges. In addition, Indiana has not yet finished developing the calibration factor required for comparing the IHSDM crash prediction to the historical data. Because of this, the IHSDM crash prediction numbers can only be used as a relative comparison amongst alternatives, and the existing safety performance of this facility must rely on the hot spot analysis, and raw crash data above. The historical crash data is also limited in that unlike IHSDM, specific crashes can generally not be attributed to a single alignment.

3.0 Alternatives Analysis Summary

3.1 ALTERNATIVES ANALYSIS DOCUMENT

The evaluation of alternatives began early in the project. The project team, including INDOT and FHWA staff, met bi-weekly to discuss conceptual alignment alternatives for the project. The team used high-level geometric, traffic operations, safety, and maintenance of traffic analyses to consider and dismiss many alignment alternatives. As the process progressed, three main build alternatives emerged. These three alternatives were carried forward for a detailed evaluation and comparison against the No-Build alternatives. The evaluation and findings are documented in the Alternative Analysis Report, which is shown in Appendix 4 – Alternative Analysis Report – Clear Path 465.

The recommended alternative (Build Alternative C Modified) was chosen during the Alternatives Analysis process.

4.0 Recommended Alternative Analysis

Following the submission of the Alternative Analysis Report, comments were received from INDOT and FHWA. Additional working meetings were held to discuss potential improvements to the recommended alternative. Parsons also made improvements in efficiencies and cost-savings by making minor modifications to the recommended alignment. This section contains the analyses of the Recommended Alternative.

4.1 DESCRIPTION RECOMMENDED ALTERNATIVE

The recommended alternative implements many improvements within the Project Area within the I-465/I-69 interchange, along the I-465 and I-69 mainlines, Binford Boulevard and 71st Street to allow each alternative to function properly. The design elements associated with the recommended alternative are described below. The roadway and signing plans are shown in Figure 7 - Figure 13 and Appendix 5 – Preliminary Road and Sign Plans.

Eastbound/Southbound I-465 Mainline

1. Eastbound I-465 between the White River bridge and Allisonville Road will have four mainline lanes and one auxiliary lane and an option lane which exits at the eastbound Allisonville Road off-ramp as a two-lane ramp.
2. The eastbound I-465 to Allisonville Road off-ramp will be modified as needed to tie into the proposed I-465 lanes.
3. Eastbound I-465 will have four mainline lanes inside of the existing Allisonville Road interchange.
4. The eastbound I-465 to Allisonville Road on-ramp will be modified as needed to tie into the proposed I-465 lanes as a two-lane ramp.
5. Eastbound I-465 between Allisonville Road and the I-69 ramps will have four mainline lanes and one auxiliary lane. The auxiliary lane will exit to the northbound I-69 off-ramp and the next lane over (outside through lane) will be an option lane allowing vehicles to either exit towards I-69 or continue onto southbound I-465.
6. Eastbound I-465 will have four mainline lanes inside of the I-69 interchange.
7. Southbound I-465 south of I-69 will have four mainline lanes and three lanes from the southbound I-69 to southbound I-465 ramp. The outside two auxiliary lanes will drop resulting in four mainline lanes and one auxiliary lane which exits at the 56th Street/Shadeland Avenue off-ramp.
8. From 75th Street to the south end of Project Area, the existing southbound I-465 median shoulder widths are wider than required. Therefore, the median barrier and the existing shoulders will remain. Existing HMA pavement in this section will be milled and overlaid and existing concrete pavement may remain.

Northbound/Westbound I-465 Mainline

9. Northbound I-465 from the 56th Street/Shadeland Avenue on-ramp will have four mainline lanes and two auxiliary lanes. The two auxiliary lanes will exit towards northbound I-69 and the next lane over (outside through lane) will be an option lane allowing vehicles to either exit towards northbound I-69 or continue on northbound I-465.
10. Westbound I-465 will have four mainline lanes inside of the I-69 interchange.
11. Westbound I-465 will have six lanes between the I-69 ramps and Allisonville Road. The outside auxiliary lane will exit at the Allisonville Road off-ramp and the next lane over (5th lane) will be an option lane allowing vehicles to either exit at Allisonville Road or continue on westbound I-465.
12. The westbound I-465 Allisonville Road off-ramp will be modified as needed to tie into the proposed I-465 lanes.
13. Westbound I-465 from the Allisonville off-ramp to the west end of the Project Area will have five through lanes and will tie into the existing five lanes on the westbound I-465 bridge over the White River. In order to accommodate five westbound I-465 travel lanes under the existing Allisonville Road bridge, a level one design exception will be required for shoulder width on I-465.
14. The westbound I-465 Allisonville Road on-ramp will be modified from a ramp that becomes an auxiliary lane to Keystone Avenue to a parallel entrance ramp that ties into the five westbound I-465 through lanes.

15. From 75th Street to the south end of the Project Area, the existing southbound I-465 median shoulder widths are wider than required. Therefore, the median barrier and the existing shoulders will remain. Existing HMA pavement in this section will be milled and overlaid and existing concrete pavement will remain.

Northbound / Southbound Binford Boulevard

16. Northbound Binford Boulevard north of 75th Street splits from two lanes to three lanes. The left 2 lanes merge into the eastbound I-465 to northbound I-69 ramp and after they merge the outside lane drops and three lanes continue north on I-69. The right northbound Binford Boulevard lane exits to westbound I-465 and 82nd Street.
17. Southbound Binford Boulevard exits southbound I-69 on the right side as a barrier-separated CD between 96th Street and 82nd Street. Southbound Binford Boulevard then continues along the two-lane CD over 82nd Street and then along the west side of I-69 before crossing under the southbound I-69 to westbound I-465 ramp and I-465 mainline. The two-lane southbound Binford Boulevard ramp is moved to the outside of the relocated southbound I-69 to southbound I-465 ramp. Traffic arrives at a signalized intersection with the eastbound I-465 to southbound Binford Boulevard ramp before continuing south on Binford Boulevard.
18. A third lane will be added to southbound Binford Boulevard at 75th Street to increase capacity on southbound Binford Boulevard through the signal at 75th Street. The proposed third lane will be added to the outside (west side) of southbound Binford Boulevard and will extend south of 75th Street before dropping.

Northbound / Southbound I-69

19. Northbound I-69 begins where the eastbound I-465 to northbound I-69 ramp merges with the northbound I-465 to northbound I-69 ramp. At this location there are six mainline northbound I-69 lanes which continue to 82nd Street. The right lane drops after 82nd Street and before the 82nd street on-ramp and five northbound I-69 lanes continue north.
20. The northbound 82nd Street on-ramp will be reconstructed at the gore to tie into the proposed five northbound I-69 lanes.
21. Southbound I-69 has four mainline lanes and one auxiliary lane on the north end of the Project. The auxiliary lane and an option lane exits towards 82nd Street and southbound Binford Boulevard while four lanes continue south on I-69. The four southbound lanes split with the left 3 lanes heading towards southbound I-465 and the right two lanes heading towards westbound I-465. The third lane is an option lane that provides access to southbound I-465 and westbound I-465.
22. The ramp from 82nd Street to southbound I-69 will be reconstructed to tie into the proposed four southbound I-69 lanes.

I-465/I-69 System Interchange Ramps

23. A two-lane ramp that travels under I-465 and provides a direct connection from eastbound I-465 to northbound I-69.
24. Northbound I-465 to northbound I-69 is a three-lane ramp which passes over the northbound Binford Boulevard to 82nd Street ramp and merges to the right of the ramp from eastbound I-465/northbound Binford Boulevard.
25. The eastbound I-465 and northbound I-465 ramps to northbound I-69 are completely separated from local traffic heading to 82nd Street.
26. The southbound I-69 to southbound I-465 ramp will be reconstructed to the inside of its existing alignment to allow for room to construct the new southbound Binford Boulevard roadway. The southbound I-69 to southbound I-465 ramp will maintain a 45 mph design speed and will provide three lanes to accommodate design-year traffic.
27. The southbound I-69 to westbound I-465 ramp will provide two lanes and will be reconstructed to tie into the realigned I-69 and I-465.

I-465/I-69 Service Interchange Ramps and Local Roads

28. A service interchange ramp from eastbound I-465 to southbound Binford Boulevard will be provided off the right side of the proposed eastbound I-465 to northbound I-69 ramp. This ramp arrives at a signalized intersection with

the southbound I-69 to southbound Binford Boulevard CD before continuing south on Binford Boulevard. This will allow traffic to safely travel from eastbound I-465 to southbound Binford Boulevard and then turn left (east) on 75th Street.

29. The existing loop ramp from eastbound I-465 to northbound Binford Boulevard will be reconstructed to tie into the new geometry and will be used as a single-lane loop ramp for eastbound I-465 to 82nd Street traffic.
30. The northbound Binford Boulevard to westbound I-465 ramp will be a single lane loop ramp that will be barrier separated from northbound Binford Boulevard traffic heading towards northbound I-69.
31. All existing signalized I-69 ramp terminals at 82nd Street will be maintained in their existing location.
32. There is a proposed dedicated barrier-separated CD for all traffic to 82nd Street from I-465 and Binford Boulevard.
33. A single lane ramp will be added from the northbound I-465 to northbound I-69 ramp to the northbound 82nd Street off-ramp.
34. A new southbound I-69 off-ramp will be constructed north of 82nd Street to provide access from southbound I-69 to 82nd Street and southbound Binford Boulevard. The ramp will be a 2-lane ramp and will become a separated CD for access to southbound Binford Boulevard.
35. An exit ramp from the southbound CD to southbound Binford Boulevard will provide full access from southbound I-69 to 82nd Street.
36. 71st Street will be lowered under I-465 to meet the minimum vertical clearance requirements along 71st Street.

The following table lists the proposed design speeds for each ramp associated with the recommended alternative.

Table 6: Proposed Description and Design Speeds of I-465/I-69 Interchange Ramps: Recommended Alternative

RAMP MOVEMENT	RAMP DESCRIPTION	PROPOSED # OF LANES	DESIGN SPEED
EB I-465 to NB I-69	Under I-465 and Under SB Binford	2	45 mph
EB I-465 to SB Binford	Diverges from EB I-465 to SB Binford	1	40 mph
EB I-465 to 82nd St.	Proposed Loop Ramp	1	30 mph
NB I-465 to NB I-69	Over NB Binford to 82nd St Ramp	3	55 mph
NB I-465 to 82nd St.	Diverges from NB I-465 to I-69 Ramp	1	45 mph
NB Binford to WB I-465	Proposed Loop Ramp	1	25 mph
NB Binford to NB I-69	Travels under EB/NB I-465 and merges with EB I-465 to NB I-69 Ramp	2	45 mph
NB Binford to 82nd St.	Diverges off NB Binford to NB I-69 Ramp	1	45 mph
SB I-69 to SB I-465	SB I-69 become ramp movement	3	45 mph
SB I-69 to WB I-465	Exits from outside of SB I-69	2	45 mph
SB I-69 to SB Binford	Exits from outside of north of 82nd St. and travels over 82nd St. Entrance ramp, 82nd St., and SB I-69	2	40-45 mph
SB I-69 to 82nd St.	Diverges from SB I-69 to SB Binford	1	40 mph
82nd St. to SB Binford	Barrier separated CD road on outside of SB I-69 merges with SB I-69 to SB Binford	1	25 - 45 mph
82nd St. to SB I-69	Merges into I-69 SB	1	25 mph
82nd St. to SB I-465	Uses 82nd St. to SB I-69 Ramp	N/A	N/A
82nd St. to WB I-465	Uses 82nd St. to SB I-69 Ramp	N/A	N/A

Design Exceptions

A Level One Design Exception is required for 600 feet of the westbound I-465 outside shoulder width under the existing Allisonville Road bridge. Traffic operations requires a fifth westbound I-465 lane in order to mitigate the westbound I-465 weave movement between the I-69 ramps and Allisonville Road. There is not enough width under the existing Allisonville Road bridge for five westbound I-465 mainline lanes and full width median and outside shoulders. As a result, the outside shoulder must be narrowed to four feet to allow a full width median shoulder and five lanes under the bridge.

The existing vertical clearance of 14'-5" for 82nd Street under the I-69 bridges is deficient and widening the I-69 bridges will decrease the vertical clearance even further to approximately 13'-8". This would require a Level One Design Exception unless 82nd Street was lowered under I-69 or I-69 raised. The preliminary plan is to avoid a Level One Design Exception at this location for vertical clearance by either raising I-69 or lowering 82nd Street to obtain the required 14'-6" vertical clearance.

A Level Two Design Exception may be required to maintain the existing I-465 median barrier height from 75th Street to the south end of the Project Area. The existing shoulder width will be maintained with auxiliary lanes added to the outside of the existing pavement. The existing I-465 median barrier within this area may be shorter than the required 45-inch truck height barrier.

Figure 7: Recommended Alternative at I-465 and Allisonville Road

Figure 8: Recommended Alternative at I-465 and 82nd Street

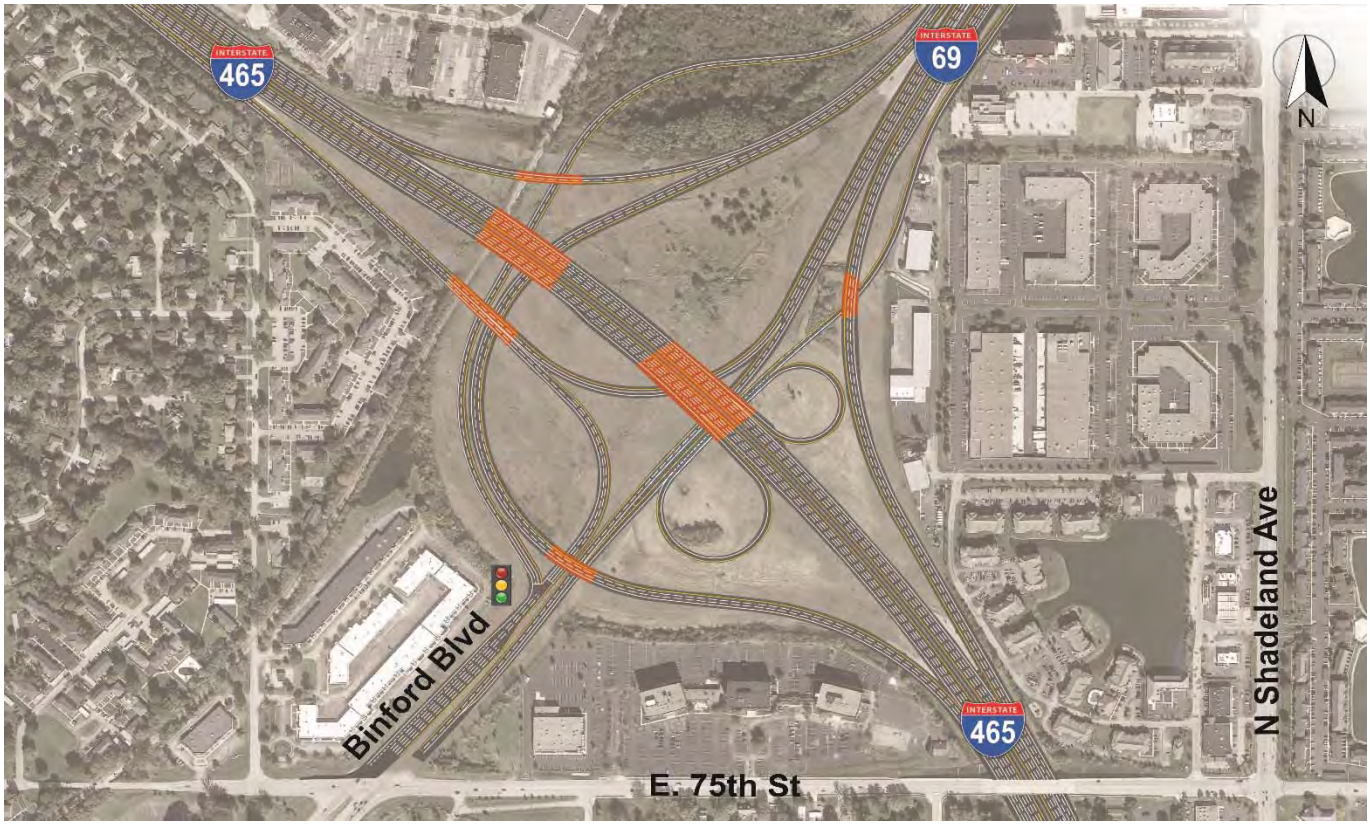


Figure 9: Recommended Alternative at I-465 and I-69

Figure 10: Recommended Alternative at I-465 and 71st Street and 75th Street

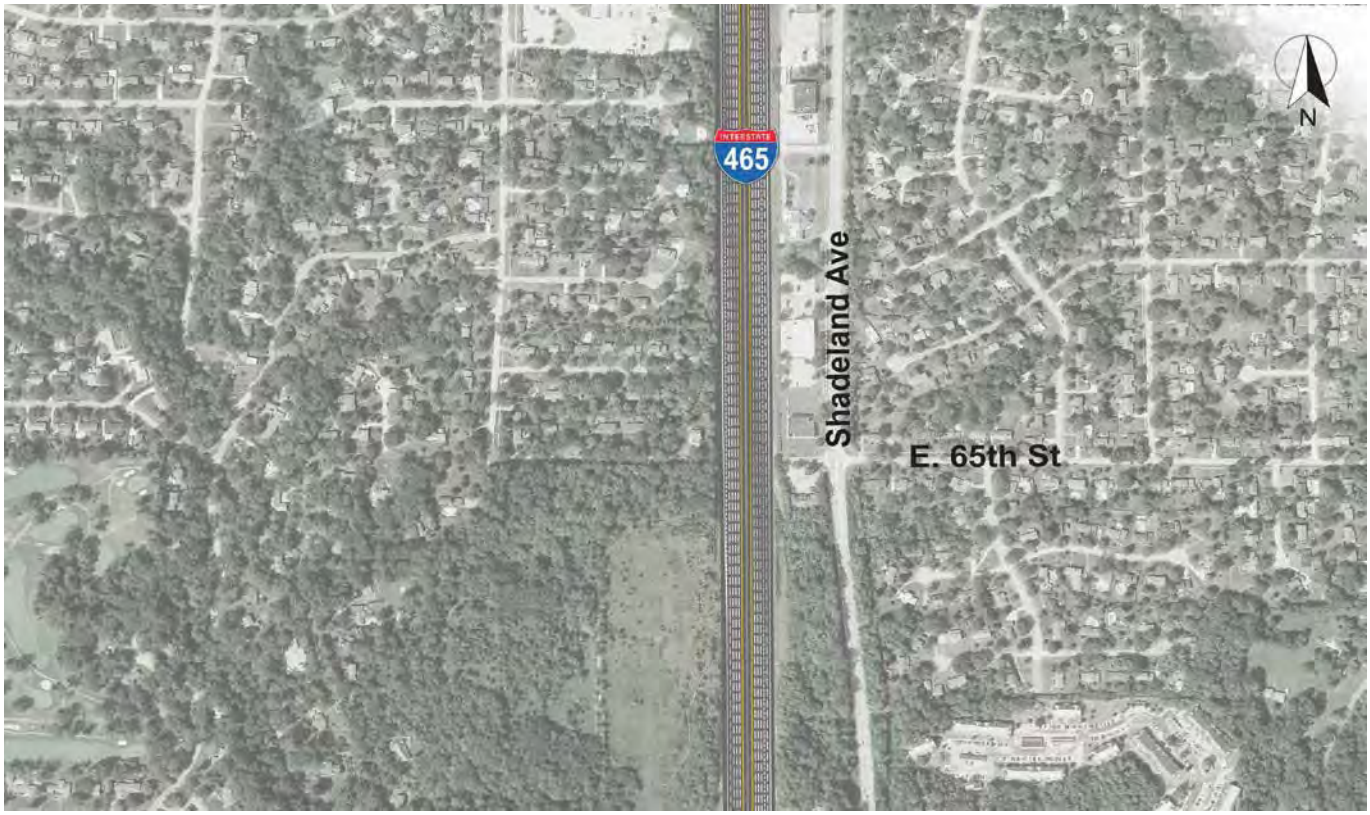


Figure 11: Recommended Alternative at I-465 and 65th Street

Figure 12: Recommended Alternative at I-465 and Fall Creek Road

Figure 13: Recommended Alternative at I-69 and 82nd Street

4.2 TRAFFIC OPERATIONS ANALYSIS

The No-Build and Recommended alternatives were analyzed with the design-year (2040) forecast peak-hour volumes. The peak hour link volumes and LOS are shown in Figure 14 for the No-Build Alternative and Figure 15 for the Recommended Alternative. Speed heat map tables for each alternative and peak period can be seen in Figure 16 (No-Build AM), Figure 17 (No-Build PM), Figure 18 (Recommended AM), Figure 19 (Recommended PM). The traffic operations are described segment by segment in the sections below.

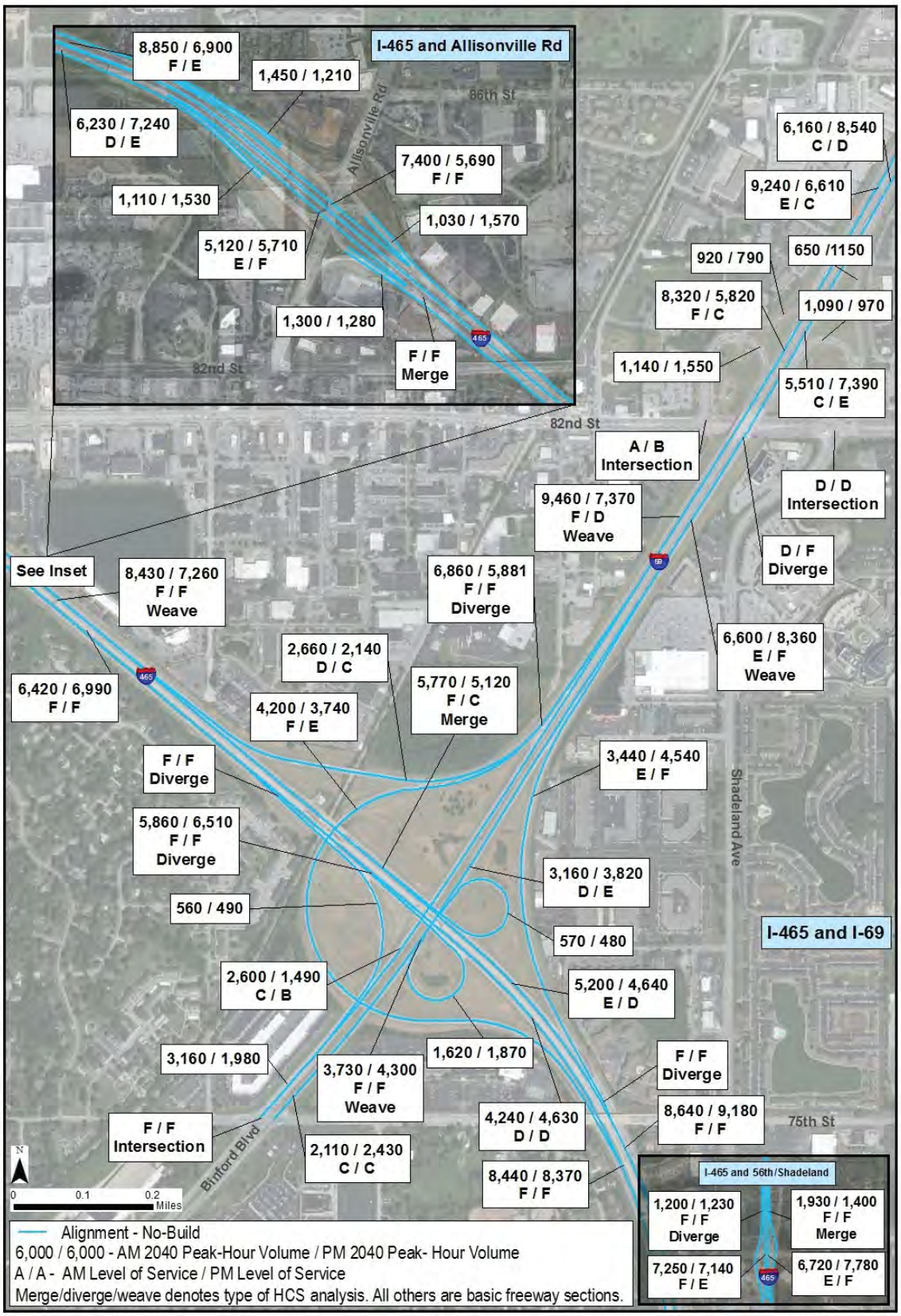


Figure 14: 2040 Peak-Hour Volumes and HCS LOS – No-Build

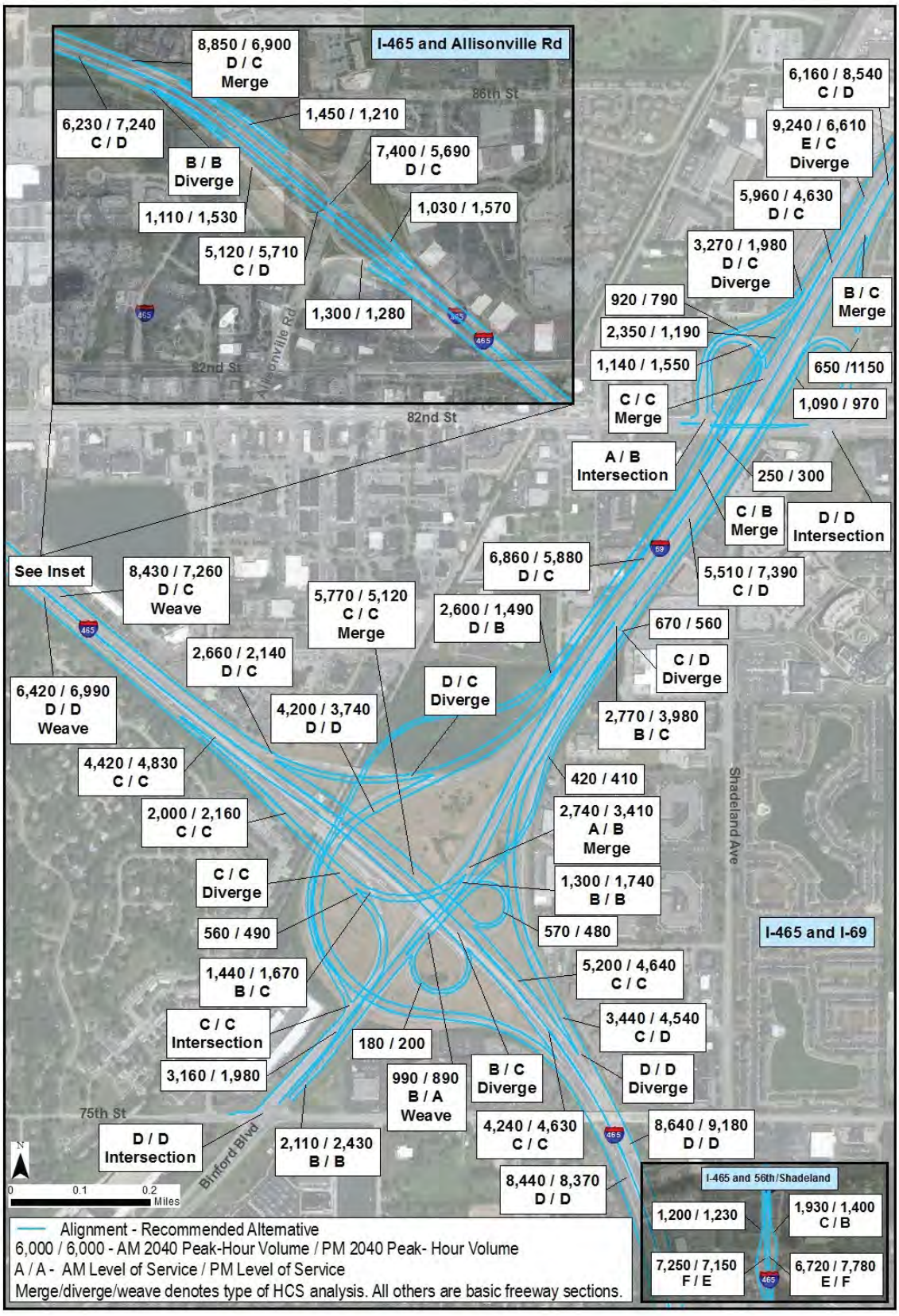


Figure 15: 2040 Peak-Hour Volumes and HCS LOS – Recommended Alternative

No-Build - AM

Route	Segment	6:45	7:00	7:15	7:30	7:45	8:00	8:15	8:30	Peak-Hour Average
SB I-69	106th	64	64	63	63	61	57	63	64	61
		63	62	61	58	30	24	40	63	43
	106th On to 96th Off	62	61	59	52	21	22	36	61	39
		63	62	61	45	21	23	30	57	37
		61	61	60	38	22	24	30	52	35
	96th	63	62	61	29	21	22	28	50	33
		63	62	61	25	21	22	28	47	32
		63	62	58	23	20	22	26	44	31
	96th On to 82nd Off	64	63	50	19	19	20	22	37	27
		59	56	35	23	23	24	25	33	26
		59	52	28	25	25	26	28	31	26
	82nd St	58	45	24	23	23	23	26	27	23
	82nd On to I-465 Split	48	30	25	24	25	24	26	26	24
		50	43	42	43	42	43	42	43	43
		51	50	50	51	51	51	51	51	51
		54	52	52	52	52	52	52	52	52
NB I-69	NB Binford Blvd	57	56	55	56	56	56	56	56	56
		61	54	53	53	54	54	53	53	53
	I-465 to 82nd St Off	64	60	59	59	59	59	59	59	59
		63	55	52	54	53	51	52	55	52
	at 82nd St	65	62	61	61	61	61	61	62	61
	82nd St On to 96th St Off	65	63	62	62	62	62	62	62	62
		65	62	61	61	61	61	61	61	61
		66	64	63	63	63	63	63	63	63
		65	63	62	63	62	63	62	62	63
	at 96th St	67	65	64	64	64	64	64	64	64
		67	65	64	64	64	64	64	64	64
		67	65	64	64	64	64	64	64	64
	96th St On to 106th St Off	67	66	65	65	65	65	65	65	65
		67	65	65	65	65	65	65	65	65
		66	65	64	64	64	64	64	64	64
	at 106th St	67	66	65	65	65	65	65	65	65
		68	67	66	66	66	66	66	66	66
NB/WB I-465	at 56th	60	55	48	39	31	26	23	22	36
	56th St On to NB to NB Ramp	60	26	11	11	11	11	11	11	11
		63	31	25	25	26	26	25	25	25
		65	54	52	52	52	52	52	52	52
		65	58	56	57	56	56	57	56	56
		65	58	57	57	56	57	57	57	57
	NB to NB thru NB to WB	67	60	59	59	59	59	60	59	59
	NB to WB Ramp to SB to WB Ramp	63	59	58	58	58	58	58	58	58
		66	58	55	55	57	56	57	56	55
	I-69 to Allisonville Rd	62	53	44	45	51	50	51	50	48
		64	54	50	50	52	52	52	52	51
	at Allisonville Rd	64	55	52	52	53	53	52	54	53
		64	57	54	54	55	55	55	55	55
		64	57	55	55	55	55	55	55	55
	Allisonville On to Keystone Off	64	60	58	58	58	58	59	59	58
		65	61	60	60	60	60	61	60	60
EB/SB I-465	Keystone On to Allisonville Off	63	61	60	57	51	47	48	56	54
		67	53	48	31	27	28	31	34	33
	at Allisonville Rd	68	55	48	32	30	31	38	39	35
		69	56	48	31	31	31	38	37	35
		69	55	44	30	31	32	36	37	34
		69	54	39	27	28	31	35	35	31
	Allisonville to I-69	63	55	39	28	29	32	37	37	32
		65	50	30	22	23	25	31	31	25
		66	51	46	44	45	43	42	42	45
	EB to SB Ramp to EB to NB Ramp	65	53	49	49	50	49	49	49	49
		63	52	48	48	49	49	49	49	48
		53	46	42	41	44	44	43	44	43
	EB to NB Ramp to SB to SB Ramp	66	57	55	54	54	54	54	54	54
	I-69 to 56th St Off	60	57	56	55	55	55	55	55	55
		63	58	56	56	56	56	56	56	56
		64	60	58	58	58	58	58	58	58
	at 56th	64	59	56	56	56	56	56	56	56

Speed (mph)
>60
60
57.5
55
52.5
50

Figure 16: Segment Speeds from Vissim – No-Build – 2040 AM

No-Build - PM

Route	Segment	4:30	4:45	5:00	5:15	5:30	5:45	6:00	6:15	Peak-Hour Average
SB I-69	106th	65	65	65	65	65	65	65	65	65
		64	64	64	64	64	64	65	65	64
	106th On to 96th Off	64	64	64	64	64	64	64	64	64
		64	64	64	64	64	64	64	64	64
		63	62	62	63	63	63	63	64	63
	96th	64	64	64	64	64	64	64	64	64
		64	64	64	64	64	64	64	64	64
		64	64	64	64	64	64	64	64	64
	96th On to 82nd Off	64	64	64	64	64	64	64	65	64
		61	61	61	61	60	60	61	62	61
		61	60	60	60	60	60	60	61	60
	82nd St	61	59	58	56	55	56	59	61	56
	82nd On to I-465 Split	44	33	30	32	27	30	33	45	30
		49	44	43	42	42	42	44	50	42
		54	50	51	49	50	50	49	53	50
		56	53	53	52	53	53	53	55	53
NB I-69	NB Binford Blvd	56	55	55	54	54	54	55	56	54
		59	52	51	51	51	52	52	52	51
	I-465 to 82nd St Off	64	59	58	58	58	58	58	58	58
		62	55	53	55	54	54	54	54	54
	at 82nd St	65	61	60	60	60	60	60	60	60
	82nd St On to 96th St Off	64	61	60	61	60	60	61	61	60
		64	60	59	59	58	58	58	59	59
		65	63	62	62	62	62	62	62	62
		65	63	62	63	61	62	63	62	62
	at 96th St	66	64	63	63	63	63	63	63	63
		66	64	63	63	63	63	63	63	63
		66	64	63	63	63	63	63	63	63
	96th St On to 106th St Off	66	64	64	63	63	63	64	64	63
		66	64	63	63	63	63	63	64	63
		65	63	62	62	61	62	61	61	61
	at 106th St	66	64	64	64	63	64	64	64	64
		67	66	65	65	65	65	65	65	65
NB/WB I-465	at 56th	57	50	37	28	22	17	14	13	26
	56th St On to NB to NB Ramp	61	26	19	19	19	18	20	21	19
		63	28	22	23	23	24	23	23	23
		65	54	53	52	53	53	52	53	53
		66	57	57	57	57	57	56	56	57
		66	57	57	57	57	57	57	57	57
	NB to NB thru NB to WB	67	61	60	61	60	60	61	60	61
	NB to WB Ramp to SB to WB Ramp	64	60	59	60	60	60	60	59	60
		67	59	59	59	59	59	59	58	59
	I-69 to Allisonville Rd	63	54	55	57	55	56	55	56	56
		64	56	55	57	55	56	56	57	56
	at Allisonville Rd	65	58	56	58	57	58	57	58	57
		65	59	58	58	58	58	58	58	58
		65	59	58	58	58	58	58	58	58
	Allisonville On to Keystone Off	64	61	60	60	60	60	60	60	60
		65	62	61	62	61	61	61	62	61
EB/SB I-465	Keystone On to Allisonville Off	60	55	45	36	30	24	20	18	34
		66	39	26	25	24	24	25	25	25
	at Allisonville Rd	67	44	29	28	27	26	28	29	27
		68	43	29	29	28	28	30	30	28
		68	41	29	28	28	28	29	30	28
		69	37	28	27	27	26	29	30	27
	Allisonville to I-69	62	38	30	29	28	29	31	31	29
		64	31	22	23	21	22	24	25	22
		65	44	42	39	40	39	40	39	40
	EB to SB Ramp to EB to NB Ramp	65	50	47	47	46	46	46	46	47
		63	49	47	46	47	47	47	47	47
		54	42	39	41	40	42	40	42	41
	EB to NB Ramp to SB to SB Ramp	65	55	54	54	54	54	53	54	54
	I-69 to 56th St Off	60	57	56	56	56	56	56	56	56
		63	58	56	56	57	56	56	57	56
		64	60	58	58	58	58	58	58	58
	at 56th	65	59	57	57	57	57	56	57	57

Speed (mph)
>60
60
57.5
55
52.5
50

Figure 17: Segment Speeds from Vissim – No-Build – 2040 PM

Recommended Alternative - AM

Route	Segment	6:45	7:00	7:15	7:30	7:45	8:00	8:15	8:30	Peak-Hour Average
SB I-69	at 106th St	65	65	64	64	65	65	65	65	65
		65	64	63	64	64	65	65	65	64
	106th St On to 96th St Off	63	62	61	61	62	63	64	64	62
		63	62	61	61	62	63	64	64	62
		62	60	60	57	60	60	63	62	59
	at 96th St	62	61	60	60	61	62	63	63	61
		63	62	62	61	62	63	63	63	62
		63	61	59	59	61	62	63	63	60
	96th St On to 82nd St Off	63	61	59	60	61	62	63	63	60
		60	59	57	57	58	60	61	61	58
		60	58	57	58	58	59	60	60	58
	at 82nd St	61	60	58	59	59	60	61	61	59
	82nd St On to I-465 Split	60	59	58	58	59	60	60	61	59
		59	57	55	56	56	58	59	60	56
		60	58	57	57	58	59	60	60	58
		60	59	58	58	59	59	60	60	59
NB I-69	EB to NB Ramp On to NB to NB Ramp On	63	62	62	62	62	62	62	63	62
		63	63	62	62	62	63	63	63	62
	at 82nd St	63	62	61	61	61	62	63	63	61
		64	63	63	63	63	63	64	64	63
		64	63	62	62	62	63	63	63	62
	82nd St On to 96th St Off	63	62	62	62	62	63	63	63	62
		63	61	60	60	60	61	62	62	60
		65	63	63	63	63	63	64	64	63
		64	63	62	62	63	63	64	64	63
	at 96th St	65	64	63	63	64	64	64	65	64
		65	64	64	64	64	64	65	65	64
		65	64	64	64	64	64	65	65	64
	96th St On to 106th St Off	66	65	64	64	64	65	65	65	64
		65	65	64	64	64	65	65	65	64
		65	64	64	64	64	64	65	64	64
	at 106th St	66	65	64	64	64	65	65	65	65
		67	66	65	65	65	66	66	66	65
NB/WB I-465	at 56th St	60	58	56	57	58	59	60	60	57
	56th/Shadeland On to NB to NB Ramp	60	59	58	59	59	60	61	61	59
		59	57	56	56	57	58	59	59	57
		60	58	57	57	58	59	60	60	58
		61	59	59	59	59	60	61	61	59
		61	59	59	59	59	60	61	61	59
	NB to NB Ramp to NB to WB Ramp	61	60	60	60	60	61	61	61	60
	NB to WB Ramp to SB to WB Ramp	61	60	59	59	59	60	61	61	59
		60	58	57	56	57	58	60	60	57
		60	58	57	57	57	59	60	60	58
	I-69 to Allisonville Rd	61	60	59	59	59	60	61	61	60
		61	60	59	59	59	60	61	61	59
	at Allisonville Rd	61	60	59	59	59	60	61	61	59
		62	60	59	59	59	60	61	61	59
		62	60	59	59	59	61	61	62	60
		62	60	59	59	59	61	61	62	60
	Allisonville Rd On to Keystone Ave Off	61	59	55	55	57	59	60	61	57
		61	59	57	57	57	59	60	60	58
EB/SB I-465	Keystone Ave On to Allisonville Rd Off	63	62	61	61	61	62	63	63	61
		61	60	59	59	59	60	61	61	60
	at Allisonville Rd	62	61	60	60	60	61	62	61	60
		62	61	60	60	60	61	62	61	60
		61	60	59	58	59	60	61	61	59
		61	60	58	58	59	59	61	60	58
	Allisonville Rd On to I-69	62	61	60	60	61	61	62	62	61
		62	61	59	59	60	61	62	61	60
		62	61	59	59	60	61	61	61	60
	EB to NB Ramp to EB to 82nd St Ramp	63	62	61	61	62	62	63	63	62
		63	62	61	61	61	62	62	62	61
		63	62	61	61	61	62	62	62	61
		62	61	60	60	61	61	61	62	61
	EB to 82nd St Ramp to SB to SB Ramp	63	62	61	61	62	62	63	63	62
	I-69 to 56th/Shadeland	62	61	60	60	60	61	62	62	60
		61	58	57	56	57	58	60	60	57
		61	58	57	56	57	58	60	60	57
		61	59	58	58	58	59	60	61	58
	at 56th St	60	57	56	55	55	57	59	59	56

Speed (mph)
>60
60
57.5
55
52.5
50

Figure 18: Segment Speeds from Vissim – Recommended Alternative – 2040 AM

Recommended Alternative - PM

Route	Segment	4:30	4:45	5:00	5:15	5:30	5:45	6:00	6:15	Peak-Hour Average
SB I-69	at 106th St	66	66	66	66	66	66	66	66	66
		66	66	66	66	66	66	66	66	66
	106th St On to 96th St Off	65	65	65	65	64	65	65	65	65
		64	64	64	64	64	64	65	65	64
		64	64	64	64	64	63	64	64	64
	at 96th St	64	64	64	64	64	64	64	65	64
		64	64	64	64	64	64	64	65	64
		64	64	64	64	64	64	64	64	64
	96th St On to 82nd St Off	64	64	64	64	64	64	64	64	64
		62	61	61	61	61	61	62	62	61
		61	61	61	60	60	60	61	61	60
	at 82nd St	61	61	61	61	61	61	62	62	61
	82nd St On to I-465 Split	60	60	60	60	60	60	61	61	60
		58	58	59	58	58	58	59	60	58
		60	60	59	59	59	59	60	61	59
		61	60	60	60	60	60	61	61	60
NB I-69	EB to NB Ramp On to NB to NB Ramp On	61	61	61	61	60	61	61	61	61
		62	61	61	61	61	61	61	61	61
	at 82nd St	59	59	58	59	58	58	59	60	58
		62	61	61	61	61	61	61	62	61
		62	61	61	61	61	60	61	61	61
	82nd St On to 96th St Off	60	59	59	59	59	58	59	60	59
		57	55	55	55	54	54	55	57	54
		61	60	59	60	59	59	60	61	59
		62	60	60	61	61	61	61	61	61
	at 96th St	63	61	61	61	61	62	62	62	61
		63	62	62	62	62	62	62	63	62
		63	62	62	62	62	62	62	63	62
	96th St On to 106th St Off	64	63	63	63	63	63	63	63	63
		64	63	63	63	63	63	63	63	63
		62	60	61	61	61	61	60	62	61
	at 106th St	64	62	63	63	63	63	63	63	63
		65	64	64	64	64	64	64	65	64
NB/WB I-465	at 56th St	55	55	55	54	51	51	55	57	53
	56th/Shadeland On to NB to NB Ramp	58	57	58	57	57	57	58	59	57
		58	57	57	57	57	57	58	58	57
		58	58	58	57	57	57	58	59	57
		59	59	59	59	59	59	59	60	59
		59	59	59	59	59	59	59	60	59
	NB to NB Ramp to NB to WB Ramp	61	60	61	60	60	60	60	61	60
	NB to WB Ramp to SB to WB Ramp	61	60	60	60	60	60	60	61	60
		60	59	59	59	58	59	59	60	59
		59	58	59	59	58	59	59	60	59
	I-69 to Allisonville Rd	60	60	60	60	59	60	60	61	60
		61	60	60	60	60	60	60	61	60
	at Allisonville Rd	61	60	61	60	60	60	60	62	60
		62	61	61	61	61	61	61	62	61
		62	61	61	61	61	61	62	62	61
		62	62	61	61	61	61	62	62	61
	Allisonville Rd On to Keystone Ave Off	61	61	61	61	60	60	61	62	61
		61	60	60	60	60	60	61	61	60
EB/SB I-465	Keystone Ave On to Allisonville Rd Off	59	59	59	59	59	59	59	60	59
		57	57	57	56	55	56	57	58	56
	at Allisonville Rd	58	58	58	57	58	58	58	59	58
		58	58	58	58	58	58	58	59	58
		57	56	57	56	56	56	57	58	56
		56	55	56	55	55	55	56	57	55
	Allisonville Rd On to I-69	59	59	59	59	59	59	59	60	59
		58	57	58	57	57	57	58	59	57
		58	57	58	57	58	58	58	58	58
	EB to NB Ramp to EB to 82nd St Ramp	61	60	60	60	60	60	60	60	60
		60	59	59	59	59	59	59	60	59
		60	59	59	59	59	59	59	60	59
		59	59	59	59	59	58	59	59	59
	EB to 82nd St Ramp to SB to SB Ramp	61	60	60	60	60	60	60	61	60
	I-69 to 56th/Shadeland	61	60	60	60	60	60	60	61	60
		58	56	56	56	56	56	57	58	56
		58	57	56	56	56	56	57	58	56
		60	58	58	58	57	57	58	59	58
	at 56th St	58	54	54	55	53	54	55	56	54

Speed (mph)
>60
60
57.5
55
52.5
50

Figure 19: Segment Speeds from Vissim – Recommended Alternative – 2040 PM

4.2.1 SOUTHBOUND I-69

No-Build Alternative

There are major operational deficiencies on southbound I-69 in the No-Build Alternative. The weaving section between the southbound 82nd on-ramp and the southbound Binford Boulevard left off-ramp operates at LOS F in the AM peak hour and LOS D in the PM peak hour (see Figure 14). The diverge to southbound I-465 and westbound I-465 operates at LOS F in both the AM and PM peak hours. The speed heat map for the AM peak period (Figure 16) shows a major bottleneck with speed degradation below 20 mph starting between 82nd Street and I-465 and propagating back all the way through the 106th Street interchange in the peak period. The PM peak hour also shows speeds below 30 mph on southbound I-69 between I-465 and 82nd Street. The southbound I-69 to southbound I-465 ramp operates at LOS F in the AM peak hour and LOS E in the PM peak hour.

Recommended Alternative

The Recommended Alternative moves the exit to southbound Binford Boulevard. Instead of keeping the exit on the left, the Recommended Alternative has Binford Boulevard exit on the right at the southbound 82nd Street off-ramp (see Figure 15). This exit becomes a two-lane off-ramp to account for the volume of the combined movements (AM – 3,270 vehicles; PM 1,980 vehicles). The vehicles to 82nd Street diverge on a one-lane slip ramp while the two-lane CD road continues south to Binford Boulevard just west of the southbound I-69 mainline. It follows the southbound to southbound ramp and ties into what is now southbound Binford Boulevard at a new signal with the eastbound to southbound ramp. As an additional benefit, this design places all local exits and entrances on the right and keeps the majority of local traffic off the I-69 mainline area between 82nd Street and I-465 and reserves it to primarily serve interstate-to-interstate movements.

The speeds on the upstream five-lane section of southbound I-69 between the 96th Street interchange and the 82nd Street interchange indicate good operations (58 mph or better in the AM peak hour) in this section as traffic to the southbound Binford Boulevard off-ramp now maneuvers to the right. The distance between the two interchanges (approximately 5,080 feet) allows adequate distance for any weaving between the interchanges to occur. The AM peak-hour HCS weaving analysis determined that the segment provides more than the maximum weaving distance required. This configuration also allows the largest downstream movement (4,200 vehicles in the AM) to stay all the way to the left and avoid interactions with the 96th Street and 82nd Street ramps.

An HCS major diverge analysis at the beginning of the project area for the diverge from southbound I-69 to the southbound Binford Boulevard CD/southbound 82nd Street off-ramp shows LOS E in the AM peak hour and LOS C in the PM peak hour. The AM major diverge analysis shows a density of 35.7 (pc/mi/ln), which is just above the top of the LOS D density threshold of 35.0. This thin margin of difference coupled with the good operating speeds shown in the Vissim output lessen the concern that the LOS E first indicates. It should also be noted that basic segment HCS analyses of the roadway upstream and downstream of the diverge all indicated LOS D in AM peak hour. The 96th street on-ramp is nearly one mile upstream of the diverge providing ample distance for vehicles to pre-position well before the 1500-foot diverging influence area.

After the diverge to the southbound Binford Boulevard/82nd Street off-ramp, four mainline lanes continue southbound. This section operates at LOS C in the AM peak hour and LOS C in the PM peak hour. The southbound 82nd Street traffic to westbound I-465 and southbound I-465 merges into the four lanes. This section shows peak-hour speeds of 56 mph or better in the AM peak hour and 58 mph or better in the PM peak hour. The four-lane section downstream of the merge operates at LOS D in the AM peak hour and LOS C in the PM peak hour.

A third lane is added to the southbound to southbound ramp in the Recommended Alternative. The additional lane not only improves the design-year LOS on the ramp, but it also helps improve the diverge to southbound I-465 and westbound I-465 to a LOS D in the AM peak hour and LOS C in the PM peak hour.

The Recommended Alternative greatly improves operations in the southbound I-69 segment.

4.2.2 NORTHBOUND I-69

No-Build Alternative

Northbound I-69 also has major operational deficiencies, especially in the PM peak hour. The northbound I-465 to northbound I-69 ramp operates at LOS F and the two-lane section of northbound Binford Boulevard operates at LOS E in the PM peak hour. The weave between the two loop ramps on northbound Binford Boulevard operate at LOS F in both the AM and PM peak hours. The weaving section on northbound I-69 between I-465 and the northbound 82nd Street off-ramp operates at LOS E in the AM peak hour and LOS F in the PM peak hour. The diverge to the northbound 82nd Street off-ramp operates at LOS F in the PM peak hour.

Recommended Alternative

The Recommended Alternative provides a two-lane CD road for vehicles exiting to northbound 82nd Street. This allows local traffic to be served separately from the mainline lanes, thus cutting down on turbulence in this section. The two-lane eastbound I-465 to northbound I-69 ramp and the two-lane northbound Binford Boulevard on-ramp merge together and drop a lane before the three-lane northbound I-465 to northbound I-69 ramp merges in on the right. The right lane is dropped downstream to get to five mainline lanes on northbound I-69 before the northbound 82nd Street on-ramp is merged in.

These changes show significant improvement over the No-Build Alternative. The Vissim analysis shows improved speeds of 61 mph or better in the AM peak hour and 58 mph or better in the PM peak hour throughout this section. The HCS analysis shows LOS C or better throughout this section of the corridor in the AM peak hour and LOS D or better in the PM peak hour.

All three build alternatives match the existing five-lane northbound mainline section between the 82nd Street interchange and the 96th Street interchange. The northbound 82nd Street on-ramp has an acceleration lane and merges into the five mainline lanes. This merge operates at LOS B in the AM peak hour and LOS C in the PM peak hour. A scenario was also tested in which the fifth northbound mainline lane would be dropped just upstream of the northbound 82nd Street on-ramp so that the northbound 82nd Street on-ramp could join as an auxiliary lane to be the fifth lane. However, this scenario did not operate as well as maintaining the five northbound mainline lanes and merging the northbound 82nd Street traffic. The upstream five-lane mainline section operates at LOS D in the PM peak hour.

4.2.3 NORTHBOUND I-465 BETWEEN 56TH STREET/SHADELAND AVENUE AND I-69

No-Build Alternative

Northbound I-465 shows operational failures between the 56th Street/Shadeland Avenue on-ramp where the project begins and the off-ramp to northbound I-69. The 56th Street/Shadeland on-ramp merge operates at LOS F in both the AM and PM peak hours. This is section is further complicated by a three percent uphill grade within the merge area. The Vissim speeds in this area in both the AM and PM peak hours show a major bottleneck with speeds below 20 mph. The four-lane mainline section of northbound I-465 operates at LOS F in both the AM and PM peak hours. The diverge to the northbound I-465 to northbound I-69 ramp operates at LOS F in both the AM and PM peak hours. Upstream of the project, the four-lane mainline section at 56th Street operates at LOS E in the AM peak hour and LOS F in the PM peak hour.

Recommended Alternative

The Recommended Alternative calls for six northbound lanes between the 56th Street/Shadeland Avenue on-ramp at the beginning of the project and the northbound I-465 to northbound I-69 ramp. This is an increase from the current alignment of four lanes. The existing four lane cross section at 56th Street is matched and the existing two-lane 56th Street/Shadeland Avenue on-ramp joins as two added lanes to make six northbound mainline lanes. Currently, these

ramp lanes both merge into the four-lane mainline section. The Recommended Alternative requires a three-lane northbound to northbound ramp because of the high PM peak-hour forecast volume of 4,540. The six-lane northbound mainline lanes split into three lanes to the northbound to northbound ramp and four lanes to westbound I-465 at the I-69 interchange. This means that the third mainline lane from the right becomes an option lane that can access either the northbound I-465 to northbound I-69 ramp or continue on westbound I-465. This option lane allows for better upstream utilization and requires fewer lane changes: zero lane changes for the northbound I-465 to northbound I-69 movement and only one lane change for the 56th Street/Shadeland Avenue on-ramp to westbound I-465 movement. With the six-lane mainline section the segment operates at 57 mph or better and LOS D in the AM peak hour and 57 mph or better and LOS D in the PM peak hour, even with the three percent uphill grade at the 56th Street on-ramp. Just upstream of the project, the four-lane mainline section at 56th Street operates at LOS E in the AM peak hour and LOS F in the PM peak hour, which could meter peak-hour flows into the study area. A fifth northbound lane outside of this project may need to be considered before the design year is reached.

A five-lane mainline cross section was also tested. However, the five-lane section provides LOS E and a degradation in speed. Furthermore, with a five-lane section and INDOT's policy to always maintain four mainline through lanes on I-465, the split at the northbound to northbound Ramp would require a parallel deceleration lane to provide three lanes on the northbound to northbound Ramp which is not acceptable for a high volume major fork.

4.2.4 WESTBOUND I-465 – I-69 TO WEST OF ALLISONVILLE ROAD INTERCHANGE

No-Build Alternative

There are major operational failures in the No-Build Alternative on westbound I-465 between I-69 and Allisonville Road. The Vissim speed heat maps show the speed degradation that propagates upstream on westbound I-465 through the I-69 interchange. The No-Build analysis shows LOS F in the AM peak hour and LOS F in the PM peak hour on westbound I-465 under the Allisonville Road bridge. The weaving section between I-69 and Allisonville Road operates at a LOS F in both the AM and PM peak hours. Westbound I-465 after the Allisonville Road on-ramp operates at LOS F in the AM peak hour.

Recommended Alternative

The Recommended Alternative has six lanes in the weaving section between the southbound I-69 to westbound I-465 ramp and the westbound Allisonville Road off-ramp. This is an increase from the existing four-lane mainline section in this segment. Westbound I-465 maintains four lanes through the I-69 interchange and merges with the two-lane southbound I-69 to westbound I-465 Ramp. The two ramp lanes are maintained through the segment to the two-lane westbound Allisonville Road off-ramp. The right lane is an exit lane drop to Allisonville Road while the second lane is an option lane. This weaving section operates at 59 mph or better and LOS D in the AM peak hour and 60 mph and LOS C in the PM peak hour. Westbound I-465 continues under the Allisonville Road bridge as a five-lane mainline section, which operates at 59 mph or better and LOS D in the AM peak hour and 60 mph or better and LOS C in the PM peak hour. The five lanes are then carried through the westbound Allisonville Road on-ramp merge and matches the current five lane section at the White River Bridge, the west end of the project. The existing alignment of three mainline lanes under the Allisonville Road bridge is the source of a major westbound AM bottleneck, so the five lanes in this section will provide a major improvement in operations. The gore for the merge point of the westbound Allisonville Road on-ramp is moved east in order to accommodate a longer acceleration lane that can end sufficiently upstream of the White River Bridge.

Upstream of this weaving section, the northbound Binford Boulevard traffic merges onto westbound I-465 via the existing one-lane loop ramp. The merge operates at LOS C in both the AM and PM peak hours. The Vissim heat maps show speeds of 57 mph and above in the AM peak hour and 59 mph and above in the PM peak hour.

4.2.5 EASTBOUND I-465 – WEST OF ALLISONVILLE ROAD INTERCHANGE TO I-69

No-Build Alternative

There are major operational failures in the No-Build Alternative on eastbound I-465 between Allisonville Road and I-69. The Vissim heat maps show a major degradation in speeds throughout this section in both the AM and PM peak hours. Eastbound I-465 operates at LOS D in the AM peak hour and LOS E in the PM upstream of the eastbound Allisonville Road off-ramp. The three-lane mainline section of eastbound I-465 under the Allisonville Road bridge operates at LOS E in the AM peak hour and LOS F in the PM peak hour. The eastbound Allisonville Road on-ramp merge operates at LOS F in both the AM and PM peak hours. The three-lane mainline section of eastbound I-465 between the Allisonville Road interchange and the I-69 interchange has a demand (AM – 6,420 vehicles; PM – 6,990 vehicles) far above capacity and operates at LOS F in both the AM and PM peak hours.

Recommended Alternative

The Recommended Alternative matches the five-lane mainline of eastbound I-465 at the beginning of the project at the White River bridge and continues five lanes to the eastbound Allisonville Road off-ramp. This is an increase from the current four-lane mainline section upstream of the Allisonville Road off-ramp. The eastbound Allisonville Road off-ramp is a two-lane exit. The right lane drops and the second lane from the right is an option lane. This allows lane balance while a fourth lane is carried under the Allisonville Road bridge. An HCS weaving analysis indicated that the distance between the Keystone on-ramp and the Allisonville Road off-ramp is just over the maximum weaving distance. Therefore, the section was analyzed as a basic freeway section (LOS C in the AM peak hour and LOS D in the PM peak hour) followed by a two-lane diverge (LOS B in both the AM and the PM peak hours). The Vissim results show speeds of 56 mph or greater in the PM peak hour.

Eastbound I-465 is four lanes under Allisonville Road and operates at 58 mph or better and LOS C in the AM peak hour and 55 mph or better and LOS D in the PM peak hour. One lane is added at the eastbound Allisonville Road on-ramp to form a five-lane mainline section between Allisonville Road and the I-69 interchange. This is an increase of two lanes from the current three-lane mainline section that causes a major bottleneck and queuing throughout the PM peak period. The additional lanes relieve this major bottleneck even with design-year traffic volumes. This weaving segment operates at LOS D in the both the AM and PM peak hours. The Vissim analysis shows that PM speeds improve to 57 mph or better throughout this section.

4.2.6 EASTBOUND I-465 AT I-69

No-Build Alternative

The diverge to the low-speed eastbound I-465 to northbound I-69 loop ramp has a high demand (AM – 1,620 vehicles; PM – 1,870 vehicles) and operates at LOS F in both the AM and PM peak hours. The Vissim speed heat maps also show a major degradation in speed to 25 mph in the AM peak hour and 22 mph in the PM peak hour through this section of the corridor.

Recommended Alternative

In the Recommended Alternative, a two-lane direct-connect ramp is provided for the eastbound to northbound movement. The eastbound to northbound ramp is paired with the eastbound to southbound ramp. The downstream loop ramp remains, but only serves eastbound I-465 to 82nd Street traffic. Eastbound I-465 has five mainline lanes downstream of the eastbound Allisonville Road on-ramp. This is followed by a diverge to a two-lane off-ramp that provides movements to northbound I-69 and southbound Binford Boulevard. This off-ramp splits to a one-lane ramp to southbound Binford Boulevard and a two-lane eastbound to northbound ramp that carries all traffic going to northbound I-69 with destinations of 96th Street and north. A four-lane mainline section is provided downstream of the two-lane exit, meaning that the second lane from the right is an option lane, helping with lane balance. The next downstream ramp is a

loop off-ramp for local traffic to 82nd Street. A deceleration lane is provided for this ramp and four eastbound mainline lanes continue through the interchange. The loop ramp is low-volume (AM – 180 vehicles; PM – 200 vehicles) as it serves only local traffic to the northbound 82nd Street CD road. The downstream section of eastbound I-465 within the interchange is four lanes as per an INDOT policy to provide four continuous lanes on I-465 around the city. This section performs at LOS C in both the AM and PM peak hours. The Vissim analysis shows greatly improved speeds of 61 mph or better in the AM peak hour and 59 mph or better in the PM peak hour through this section.

4.2.7 SOUTHBOUND I-465 BETWEEN I-69 AND 56TH STREET/SHADELAND AVENUE

No-Build Alternative

The merge of the ramp from southbound I-69 to southbound I-465 cannot be accurately assessed with the HSC Merge methodology because a lane is added. However, the Vissim model shows speeds in the mid-50s in this area. The four mainline lanes between the ramp from southbound I-69 to southbound I-465 (southbound to southbound ramp) and the southbound 56th Street/Shadeland Avenue off-ramp does not provide the capacity to handle the AM and PM peak hour demands. The No-Build HCS analysis shows LOS F in both the AM and PM peak hours. Just south of the project area, the diverge to the 56th Street/Shadeland Avenue off-ramp operates at LOS F in both the AM and PM peak hours. The four-lane I-465 mainline after the off-ramp operates at LOS F in the AM peak hour and LOS E in the PM peak hour. This segment is under capacity and also has a three percent grade up from Fall Creek.

Recommended Alternative

The Recommended Alternative has five southbound lanes between the southbound to southbound ramp and the 56th Street/Shadeland Avenue off-ramp. This is an increase from the current alignment of four lanes. Eastbound I-465 carries four mainline lanes through the I-69 interchange before the three-lane southbound to southbound ramp merges. There will be a seven-lane section for 2,900 feet before the right lane drops just past the 71st Street Bridge. The seven-lane section was carried this far to try to encourage full use of the three lanes on the southbound to southbound ramp. The six-lane section continues south before dropping the right lane at about 65th Street. This five-lane section operates at LOS D in both the AM and PM peak hours. The right lane is dropped to the 56th Street/Shadeland Avenue off-ramp which leaves four lanes to match the current four-lane mainline cross section at 56th Street.

One of the negatives of this alignment is the three-lane southbound to southbound ramp dropping two consecutive lanes as it merges with the four-lane eastbound I-465. In order to accommodate this, longer distances are provided for each lane drop to accommodate the merging and lane changing. Another option considered was to make eastbound I-465 three lanes inside of the I-69 interchange upstream of the merge with the three-lane southbound to southbound ramp. This would allow a merge of three lanes from eastbound I-465 and three lanes from the southbound to southbound ramp. Then only one lane drop on the right would be necessary to get to the five mainline lanes. This option was dismissed because INDOT's policy is to maintain four continuous mainlines around the city on I-465. It should be noted that the scope of this project included the tie-in to the current lanes at the Falls Creek Road bridge. This means that only four mainline lanes are carried beyond the project and this is projected to operate at LOS F in the AM peak hour and LOS E in the PM peak hour. This segment is under capacity and may reach LOS F before the design year of 2040. It also has a three percent grade up from Fall Creek. If future work is completed to the south beyond this project and a fifth mainline lane is added, a two-lane off-ramp at 56th Street/Shadeland Avenue and maintaining six lanes on I-465 to the north should be considered.

4.2.8 SOUTHBOUND BINFORD BOULEVARD

No-Build Alternative

The eastbound to southbound ramp traffic joins southbound Binford Boulevard as an added lane that then turns right on 75th Street. Much of the traffic wishes to instead either merge with southbound flow or execute a movement across the alignment to the southbound left-turn lanes. This movement, that already is the cause of safety and congestion issues, worsens with increased traffic demands in the design year.

Recommended Alternative

The Recommended Alternative swaps the legs of the intersection of the eastbound to southbound ramp and southbound Binford Boulevard. The Southbound Boulevard CD follows southbound I-69 before swinging out to the west to wrap around the west side of the southbound to southbound ramp. It then intersects the eastbound to southbound ramp at a new traffic signal. Making this a signalized intersection provides safe gaps for traffic from either approach to reach the left turn lanes. This is especially helpful in the AM peak hour. The peak hour demand on the eastbound I-465 to southbound Binford Boulevard ramp is low enough that the southbound Binford Boulevard traffic would not need to be stopped long. The two-phased signal also serves as a means to slow traffic that has exited from a freeway facility (I-69) to a local street (Binford Boulevard). This signal operates at LOS C in both the AM and PM peak hours.

4.2.9 SIGNALIZED INTERSECTIONS

4.2.9.1 75th Street and Binford Boulevard Intersection

No-Build Alternative

The intersection of 75th Street and Binford Boulevard was analyzed using Synchro. For the No-Build Alternative, the intersection performs at LOS F in both the AM and PM peak hours.

Recommended Alternative

For the Recommended Alternative, an additional through lane was added to the southbound through movement. This allows the intersection to service the southbound traffic well enough to avoid queuing back into the new upstream signal. However, the other movements at the signal operate poorly. INDOT has begun coordination with Indianapolis Department of Public works to make additional improvements to the intersection as part of this project. Further improvements include an additional through lane for the northbound traffic. This allows less green time to be allocated to the northbound and southbound through movements and slightly more time given to the east-west movements. The northbound right turn is also turned into a channelized free right-turn lane and a right-turn lane is added to the westbound approach. These additions would allow the intersection to improve to LOS D in the AM peak hour and LOS D in the PM peak hour.

4.2.9.1 82nd Street Intersections

No-Build Alternative and Recommended Alternative

No changes to the 82nd Street intersections are proposed for this project. Therefore, the conditions will be the same under both the No-Build and Recommended alternatives. The intersection of 82nd Street and the southbound I-69 ramp and the intersection of 82nd Street and the northbound I-69 ramps/Shadeland Avenue were analyzed using Synchro. No changes are proposed at these intersections and the design year traffic is the same. The intersection with the southbound I-69 ramps operates at LOS operates at LOS A in the AM peak hour and LOS B in the PM peak hour. The

intersection with the northbound I-69 ramps/Shadeland Avenue performs at LOS C in the AM peak hour and LOS D in the PM peak hour.

4.2.10 SYSTEMWIDE OPERATIONS

The previous sections described the traffic operations for each individual section of the corridor. This section provides measures of effectiveness to describe the operations on the entire system under the Preferred Alternative. Travel time gives an indication of operations on the major corridors from one end of the network to the other. Systemwide average speed and average delay per vehicle gives an idea of the congestion and delay of the system as a whole.

4.2.10.1 Travel Time

Travel times were collected in the Vissim models for the six major movements through the Project Area. Table 7 below shows these travel times for the AM peak hour and Table 8 shows the travel times for the PM peak hour. The Preferred Alternative shows improvement over the No-Build alternative for all movements. The biggest improvement in the AM peak hour can be seen in the northbound to northbound trip which is reduced by 38 percent. The southbound to southbound trip shows a 29 percent reduction and the southbound to westbound trip shows a 33 percent reduction. These two travel time savings are both due to the elimination of the bottleneck on southbound I-69 between 82nd Street and I-465. The Recommended Alternative shows at least a 24 percent improvement in travel time for all six major movements.

Table 7: Travel Times – 2040 AM Peak Hour

SEGMENT	TRAVEL TIME (MINUTES)		
	NO-BUILD	RECOMMENDED ALTERNATIVE	PERCENT CHANGE IN TRAVEL TIME
NB to NB - 56th St to 96th St	8.7	5.4	-38%
NB to WB - 56th St to White River	7.2	5.4	-24%
SB to SB - 96th St to 56th St	8.6	6.1	-29%
SB to WB - 96th St to White River	7.4	5.0	-33%
EB to SB - White River to 56th St	7.0	5.3	-24%
EB to NB - White River to 96th St	6.7	4.9	-26%

Major improvements in the PM peak hour are seen in the eastbound to northbound and eastbound to southbound trips with a 30 percent reduction for each. This is due mostly to the elimination of the bottleneck on eastbound I-465 at Allisonville Road. Other big improvements are seen in the northbound to northbound and northbound to westbound trips with 35 percent and 23 percent reductions respectively. These reductions are due to the added travel lanes on northbound I-465, the elimination of the weaving section on NB I-69, and the added travel lanes on westbound I-465.

Table 8: Travel Times – 2040 PM Peak Hour

SEGMENT	TRAVEL TIME (MINUTES)		
	NO-BUILD	RECOMMENDED ALTERNATIVE	PERCENT CHANGE IN TRAVEL TIME
NB to NB - 56th St to 96th St	8.7	5.7	-35%
NB to WB - 56th St to White River	7.0	5.4	-23%
SB to SB - 96th St to 56th St	6.4	6.0	-6%
SB to WB - 96th St to White River	5.2	4.8	-8%
EB to SB - White River to 56th St	7.8	5.5	-30%
EB to NB - White River to 96th St	7.2	5.1	-30%

4.2.10.2 Delay

Systemwide measures of effectiveness for delay and speed were generated from the Vissim model to quantify overall changes during the peak hours between the No-Build and Recommended alternatives (see Table 9). The average delay per vehicle is a good indicator of just how congested the network is in the No-Build Alternative. This measure picks up delay that the travel time segments or near-free-flow link speeds downstream of a bottleneck do not show. This is because the model entry links were expanded so that delay is measured for vehicles even before they enter the travel time measurement segment or pass through a bottleneck. The Recommended Alternative has significantly less vehicular delay than the No-Build option.

Table 9: 2040 Systemwide Vehicular Delay and Average Speed

ALTERNATIVE	AVERAGE DELAY PER VEHICLE (S)		AVERAGE NETWORK SPEED (MPH)	
	AM	PM	AM	PM
No-Build Alternative	207	381	46	35
Recommended Alternative	35	37	57	57

The Recommended Alternative shows a 11 mph increase in the AM peak hour and a 22 mph increase in the PM peak hour in overall average network speed, which indicates major improvement in traffic operations. The No-Build Alternative shows six times as much average delay in the AM peak hour and over ten times as much average delay in the PM peak hour as compared to the Recommended Alternative.

4.3 SAFETY ANALYSIS

The second stage of the safety analysis is to quantitatively compare the safety performance of the No-Build and Recommended alternatives for the design-year (2040). To do this, the Interactive Highway Safety Design Model (IHSDM) is used. The IHSDM is a software released by the Federal Highway Administration (FHWA) to accurately model the Highway Safety Manual's (HSM) Part C – Predictive Method. The IHSDM uses the HSM's Safety Performance Functions (SPF's) to evaluate and identify the frequency and severity of crashes that would be expected on a system interchange considering its geometric design and traffic characteristics. Going forward in this Interstate Access Document, when "predicted" terminology is used, it is describing the IHSDM output, which for this project cannot be considered accurate by itself due to a lack of Indiana Calibration. However, these IHSDM "predicted" outputs are still useful in comparing the safety performance of the alternatives relative to each other. The specific IHSDM output reports can be seen in Appendix 7, Exhibits 7 – 338 to 7 – 852.

The quantitative IHSDM summary of the total predicted yearly crashes for each alternative is shown in Table 10. The predicted (non-calibrated) crash outputs are categorized by either a fatality/injury (FI), or property damage only (PDO). The Recommended Alternative has a relatively low number of total predicted (non-calibrated) yearly crashes with 308, compared to the No-Build Alternative with 360. The Recommended Alternative also has a lower percentage of predicted (non-calibrated) fatality/injury crashes with 38.7% than the No-Build Alternative with 39.2%. Further in-depth safety performance analysis for each alternative is described below.

Table 10: Total Predicted Yearly Crashes for Design Year (2040) AADT

ALTERNATIVE	CRASHES [TOTAL]	FATAL/INJURY (FI) CRASHES [TOTAL]	PROPERTY DAMAGE ONLY (PDO) CRASHES [TOTAL]	FI PERCENTAGE	PDO PERCENTAGE
No-build	360	141	219	39.2%	60.8%
Recommended	308	119	189	38.7%	61.3%

*Note: See Table 11 for detailed predicted crashes (2022 to 2040).

When compared, the Recommended Alternative performs significantly better than the No-Build Alternative in regard to safety. The biggest crash hot spot causes identified in Section 2.3 (Historical Crash Safety Analysis), which are "off-ramp proximity" at eastbound I-465 as it approaches the eastbound I-465 to southbound Binford Boulevard off-ramp with the eastbound I-465 to northbound Binford Boulevard off-ramp (as shown in Appendix 3, Exhibit 3 – 3) and "weaving" at southbound I-69 just south of the 82nd Street on-ramp (as shown in Appendix 3, Exhibit 3 – 5), have been addressed in the Recommended Alternative and contribute to the increased safety performance.

Table 11 below shows each movement for the No-Build and Recommended Alternatives, with the total number of predicted (non-calibrated) crashes for that movement. It also shows the breakdown of crash severity categorized as either Fatal/Injury (K: Fatality; A: Serious Injury; B: Minor Injury; C: Possible Injury), or Property Damage Only (O: Property Damage Only). These numbers are calculated by the IHSDM, and take into account various design aspects of each movement (see Inputs in Appendix 7, Exhibits 7-1 to 7-337).

Table 11: Total Crash Summary of Movement Safety Performance: Predicted (non-calibrated) for 2040 AADT

ALTERNATIVE	RAMP NUMBER	MOVEMENT	PREDICTED CRASHES [TOTAL: 2022-2040]	PREDICTED FI CRASHES [TOTAL: 2022-2040]	PREDICTED PDO CRASHES [TOTAL: 2022-2040]
NO-BUILD	-	I-465	3,883	1,187	2,696
	-	I-69	972	309	663
	2	82nd to SB I-69	34	13	21
	3	EB I-465 to NB BINFORD	35	14	21
	5	EB I-465 to SB BINFORD	11	5	6
	7	NB I-465 to NB I-69	382	216	166
	9	NB BINFORD to NB I-69	161	74	87
	10	NB BINFORD to WB I-465	20	9	11
	11	SB I-69 to 82nd	22	9	13
	12	SB I-69 to SB I-465	1,076	757	319
	13	SB I-69 to SB BINFORD	77	29	47
	14	SB I-69 to WB I-465	87	32	55
	17	NB I-69 to 82nd	16	6	10
	20	Allisonville – I-465 EB	12	3	8
	21	Allisonville – I-465 WB	19	7	13
	22	I-465 WB - Allisonville	14	5	9
	23	I-465 EB - Allisonville	13	5	8
NO-BUILD TOTAL (2022-2040 ANALYSIS PERIOD: 19 YEARS)			**6833**	**2680**	**4153**
NO-BUILD TOTAL [YEARLY]:			**360**	**141**	**219**
RECOMMENDED ALTERNATIVE	-	I-465 (PR-A)	3,182	1,001	2,181
	-	I-69 (PR-C)	516	168	348
	1	82nd Street - Binford SB (PR-DBS)	9	4	6
	2	82nd Street - I-69 SB (PR-DCS)	32	13	20
	3	I-465 EB - 82nd Street (PR-AED)	7	3	5
	4	I-465 EB - I-69 NB (PR-AECN)	180	67	113
	5	I-465 EB - Binford SB (PR-AEBS)	12	4	7
	6	I-465 NB - 82nd Street (PR-AND)	6	3	4
	7	I-465 NB - I-69 NB (PR-ANCN)	482	252	230
	8	Binford NB - 82nd Street (PR-BND)	60	22	37

	9	Binford NB (PR-BN)	46	17	28
	10	Binford NB - I-465 WB (PR-BNAW)	23	9	14
	11	I-69 SB - 82nd Street (PR-CSD)	20	8	12
	12	I-69 SB - I-465 SB (PR-CSAS)	732	503	229
	13	I-69 SB - Binford SB- CD (PR-CSBS)	198	73	124
	13	I-69 SB - Binford SB - Arterial (PR-CSBS)	181	59	122
	14	I-69 SB - I-465 WB (PR-CSAW)	53	20	33
	19	Binford SB (PR-BS)	61	18	43
	20	Allisonville – I-465 EB (PR-EAE)	11	3	7
	21	Allisonville – I-465 WB (PR-EAW)	17	7	10
	22	I-465 WB - Allisonville (PR-AWE)	11	4	7
	23	I-465 EB - Allisonville (PR-AEE)	15	6	9
RECOMMENDED ALTERNATIVE TOTAL (2022-2040 ANALYSIS PERIOD: 19 YEARS)			**5,853**	**2,265**	**3,588**
RECOMMENDED ALTERNATIVE TOTAL [YEARLY]:			**308**	**119**	**189**

An important conclusion taken from Table 11 is the large disparity of crashes between the alternatives for the I-465 alignment. The No-Build Alternative is predicted (non-calibrated) to have 204 crashes per year (3,883 from 2022-2040), and the Recommended Alternative is predicted (non-calibrated) to have 167 crashes per year (3,182 from 2022-2040) for I-465. This is just short of a 20% decrease. The design variables of I-465 for geometric design, shoulder/median conditions, and AADT are either identical, or very similar between the No-Build and Recommended Alternatives. Therefore, this increased safety performance can be mainly attributed to the increased number of designed mainline lanes in the Recommended Alternative. Because of the vast differences in the geometry of the ramps between the No-Build and the Recommended Alternative, a more useful output from the IHSDM is the Crash Rate (units of crashes per mile per year) and Travel Crash Rate (units of crashes per million-vehicle-miles). These numbers are broken out by ramp for each alternative, and give a more accurate weighted picture of relative safety performance (Table 12).

Table 12: Crash Rate and Travel Crash Rate Summary of Movement Safety Performance: Predicted (non-calibrated) for 2040 AADT

RAMP #	MOVEMENT	NO BUILD		RECOMMENDED ALTERNATIVE	
		CRASH RATE [CRASHES/MI/YR]	TRAVEL CRASH RATE [CRASHES/MIL VEH-MI]	CRASH RATE [CRASHES/MI/YR]	TRAVEL CRASH RATE [CRASHES/MIL VEH-MI]
1	82nd to SB BINFORD	-	-	1.73	1.59
2	82nd to SB I-69	7.56	1.34	9.24	1.85
3	EB 465 to NB BINFORD	6.04	0.88	1.60	2.22
4	EB 465 to NB I-69	-	-	10.09	1.15
5	EB 465 to SB BINFORD	1.74	0.85	3.14	1.53
6	NB 465 to 82nd	-	-	1.87	0.76
7	NB 465 to NB I-69	24.95	1.51	26.41	1.66
8	NB BINFORD to 82nd	-	-	2.70	0.96
9	NB BINFORD to NB I-69	13.15	1.02	7.15	1.01
10	NB BINFORD to WB 465	4.88	2.35	6.87	3.30
11	SB I-69 to 82nd	3.42	1.01	4.10	1.22
12	SB I-69 to SB 465	52.05	3.06	39.40	2.28
13	SB I-69 to SB BINFORD	-	-	11.55	1.24
13[1]	SB I-69 to SB BINFORD	6.26	0.65	17.10	1.80
14	SB I-69 to WB 465	10.14	1.05	9.71	1.00
15	82nd to WB 465	-	-	-	-
16	NB 465 to NB I-69 (out)	-	-	-	-
17	NB I-69 to 82nd	5.59	1.40	-	-
18	82nd to SB 465	-	-	-	-
19	Binford SB	-	-	30.46	4.05
20	Allisonville - I 465 EB	3.85	0.81	3.41	0.72
21	Allisonville - I 465 WB	3.39	0.64	2.99	0.56
22	I 465 WB - Allisonville	4.76	0.83	3.71	0.65
23	I 465 EB - Allisonville	2.54	0.46	2.98	0.53

The overall No-Build and Recommended Alternative safety performance comparison, along with ramp performances based on Crash Rate and Travel Crash Rate, are explained below. The ramps that comparatively performed better, or worse between the No-Build and Recommended Alternatives have been highlighted in yellow above, and specifically noted below:

<u>I-465 eastbound to Binford Boulevard northbound (Ramp #3; Recommended Alternative: Line "PR-AED"):</u>

The predicted (non-calibrated) crash rate for this movement is significantly less in the Recommended Alternative (1.60 crashes/mile/year) than the No-Build Alternative (6.04 crashes/mile/year). This movement is a loop ramp, and for the No-Build Alternative handles all traffic going eastbound to northbound. For the Recommended Alternative, the loop ramp only serves traffic from I-465 eastbound to 82nd Street. The large disparity in crash rate can be attributed to the decrease in AADT. In the Recommended Alternative, the additional AADT is handled with Ramp #4, which does not exist in the No-Build Alternative.

<u>I-465 eastbound to I-69 northbound (Ramp #4; Recommended Alternative: Line "PR-AECN"):</u>

This ramp exists in the Recommended Alternative, but as discussed earlier does not exist in the No-Build Alternative. This ramp was designed in the Recommended Alternative to handle all traffic from I-465 eastbound to I-69 northbound. In the No-Build Alternative, this traffic, as well as I-465 eastbound to 82nd Street traffic, is all handled on the Ramp #3

loop ramp. To provide a meaningful safety comparison, the predicted (non-calibrated) crash rates for Ramps #3 and #4 can be looked at together, and compared between the No-Build and Recommended Alternatives. With the geometry and distribution of traffic in the Recommended Alternative model in IHSDM, it performs better with predicted crash rates of 1.60 and 10.09 crashes/mile/year (averages as 5.85), as compared to the No-Build Alternative with 6.04 crashes/mile/year. But the recommended alternative geometry has 3 and 4 lanes to handle the AADT on I-465 eastbound to I-69 northbound, as opposed to 2 lanes as accounted in the IHSDM model. It is to be noted that AADT on I-465 eastbound to I-69 northbound is above the reliable levels for a 2 lane ramp configuration and the purpose of added lanes is to accommodate the high traffic and reduce congestion related delays and crashes.

Binford Boulevard northbound to 82nd Street (Ramp #8; Recommended Alternative: Line "PR-BND") and I-69 northbound to 82nd Street (Ramp #17):

For the No-Build Alternative, Binford Boulevard northbound is shared with traffic heading to 82nd Street and I-69 northbound. Because of this, Ramp #17 (I-69 northbound to 82nd Street) only exists for a short length when it splits off of I-69 northbound. In comparison, the Recommended Alternative has this movement break off of Binford Boulevard northbound earlier as a dedicated ramp with barrier, resulting in a longer length (Ramp #8). The predicted (non-calibrated) crash rate for Ramp # 8 (Recommended Alternative) is 2.70 crashes/mile/year, and the crash rate for Ramp #17 (No-Build Alternative) is 5.59 crashes/mile/year. This is somewhat misleading to compare these as the AADT carried on Ramp #8 for the longer length is accounted for in the No-Build Alternative as I-69 northbound. This contributes to the higher number of crashes on I-69 in the No-Build Alternative versus the Recommended Alternative.

Binford Boulevard northbound to I-69 northbound (Ramp #9; Recommended Alternative: Line "PR-BN"):

The predicted (non-calibrated) crash rate for this movement is significantly smaller in the Recommended Alternative (7.15 crashes/mile/year) than the No-Build Alternative (13.15 crashes/mile/year). In the No-Build Alternative, this ramp contains a weaving section with northbound through traffic, the I-465 eastbound to Binford Boulevard northbound movement (Ramp #3), and the Binford Boulevard northbound to I-465 westbound movement (Ramp #10). This weave is eliminated in the Recommended Alternative by breaking Binford Boulevard northbound off from local traffic (using Ramp #8), which results in a lower crash rate.

I-69 southbound to I-465 southbound (Ramp #12; Recommended Alternative: Line "PR-CSAS"):

The predicted (non-calibrated) crash rate for this movement is significantly less in the Recommended Alternative (39.40 crashes/mile/year) than the No-Build Alternative (52.05 crashes/mile/year). In the No-Build Alternative, the design speed of Ramp #12 is 50 miles/hour, and in the Recommended Alternative it is 45 miles/hour. This reduced speed contributes largely to the safety performance of the movement.

The No-Build and Recommended Alternative are modelled with 2 lane configuration though they are 3 lanes in No-Build and 5 and 4 lanes in Recommended Alternative. Also, the AADT in both cases exceeds the reliable range for 2 lane configuration. These factors have resulted in significantly higher crash rates for this movement.

I-69 southbound to Binford Boulevard southbound (Ramp # 13; Recommended Alternative: Line "PR-CSBS"):

In the No-Build Alternative, this movement is the continuation of I-69 southbound to Binford Boulevard southbound, and has a predicted (non-calibrated) crash rate of 6.26 crashes/mile/year. In the Recommended Alternative, this number is 11.55/17.10 crashes/mile/year (depending on the section of the ramp). This movement however, is drastically different between alternatives.

In the Recommended Alternative, this ramp diverges from I-69 southbound earlier, and is pushed out further from I-69 southbound, which increases the length of the "Freeway Ramp" classification in the IHSDM and decreases the radii of three of the curves. In addition, the shoulders are narrowed, and curb is added. At that point, the roadway classification in the IHSDM is switched from a Freeway Ramp to a one-way arterial. Even more, approximately halfway through Ramp #13, the design speed is lowered to 40 miles/hour (Ramp # 13[1] above).

Due to the many differences in these movements, it's difficult to directly compare the safety performances of these ramps. Crashes that are predicted to occur on the Recommended Alternatives' lengthier Ramp #13/13[1] are accounted

for on I-69 southbound movement in the No-Build Alternative. This contributes to the higher number of crashes on I-69 in the No-Build Alternative versus the Recommended Alternative.

Binford Boulevard southbound (Ramp #19; Recommended Alternative: Line "PR-BS"):

This movement is not shown in Table 12 above for the No-Build Alternative because for the existing condition, it is included in the Ramp #13 alignment (I-69 southbound to Binford Boulevard southbound). For the Recommended, this piece of Binford Boulevard southbound receives traffic from Ramp #5 and Ramp #13, and includes the safety analysis for an intersection of Binford Boulevard southbound and Ramp #13 (I-69 southbound to Binford Boulevard southbound). As a segment that contains an intersection, and as compared to the No-Build free flow condition, we would expect to see this relatively high crash rate, which was confirmed by the numbers in Table 12 (30.46 crashes/mile/year). The AADT in this exceeds the reliable range for 2 lane configuration and also the geometry design has 3 lanes boosting up the crash rate.

The following limitations apply to the design-year IHSDM safety analysis:

While there is definite value in the HSM Part C – Predictive Method to analyze safety performances, there are also limitations. Specifically, the HSM/IHSDM cannot model Freeway cross sections that exceed five lanes in each direction and cannot model Ramps/CD cross sections that exceed two lanes. The analysis uses the actual design year AADT (from the traffic analysis run on the entire cross section), but the IHSDM only applies it to the maximum number of lanes HSM/IHSDM allows. We feel this results in artificially high crash numbers. Generally, a limitation like this can be mitigated with the use of Crash Modification Factors (CMFs). Unfortunately, for the specific conditions in which these limitations present themselves for this project, there are no CMFs that are applicable enough to utilize.

Another HSM Part C – Predictive Method limitation is the range of "reliable" AADT's for each facility type. This situation occurred in the analysis five times for both the No-Build alternative and the Recommended alternative (Table 13 below). The HSM states that if the AADT range is outside the limits, "results may not be reliable". However, the SPF equation that computes the predicted frequency of crashes uses the actual AADT number as a variable, regardless of the reliability range. This means while it may not be as reliable, it still accounts for the overage of AADT. In addition, there are currently no Crash Modification Factors in the CMF Clearinghouse for altering AADT numbers. We felt that using the AADT numbers outside the reliability range for the few instances it occurred did not significantly affect the results. Table 13 below shows the max "reliable" AADT for each ramp that exceeds the range (based on facility type and number of lanes). It also shows the actual calculated AADT used in the analysis.

Table 13: HSM's AADT Limitations

ALTERNATIVE	RAMP #	IHSDM MAX AADT	ACTUAL 2040 AADT (MAX)
NO BUILD	I-69	110,000	132,790
	12	32,000	68,560
	3	18,000	18,730
	7	32,000	45,390
	9	32,000	43,030
RECOMMENDED	4	32,000	34,140
	7	32,000	45,390
	12	32,000	68,560
	13	32,000	32,750
	19	20,100	31,590

4.4 DRIVER EXPECTANCY AND SIGNING CONSIDERATIONS

An analysis of driver expectancy and signing considerations was completed as part of the Alternative Analysis Report (Appendix 4, Section 3.3.4). Overhead arrow-per-lane signs are utilized for the major guide signs and the signing plans have been updated for the recommended Alternative and can be found in Appendix 5.

5.0 FHWA Policy Points

5.1 FHWA POLICY POINT #1

An operational and safety analysis has concluded that the proposed change in access does not have a significant adverse impact on the safety and operation of the Interstate facility (which includes mainline lanes, existing, new, or modified ramps, and ramp intersections with crossroad) or on the local street network based on both the current and the planned future traffic projections. The analysis should, particularly in urbanized areas, include at least the first adjacent existing or proposed interchange on either side of the proposed change in access (Title 23, Code of Federal Regulations (CFR), paragraphs 625.2(a), 655.603(d) and 771.111(f)). The crossroads and the local street network, to at least the first major intersection on either side of the proposed change in access, should be included in this analysis to the extent necessary to fully evaluate the safety and operational impacts that the proposed change in access and other transportation improvements may have on the local street network (23 CFR 625.2(a) and 655.603(d)). Requests for a proposed change in access should include a description and assessment of the impacts and ability of the proposed changes to safely and efficiently collect, distribute, and accommodate traffic on the Interstate facility, ramps, intersection of ramps with crossroad, and local street network (23 CFR 625.2(a) and 655.603(d)). Each request should also include a conceptual plan of the type and location of the signs proposed to support each design alternative (23 U.S.C. 109(d) and 23 CFR 655.603(d)).

The traffic operations for the No-Build Alternative show major failures on almost every leg of the corridor. Southbound I-69 shows LOS F on the weaving section between 82nd Street and southbound Binford Boulevard left off-ramp as well as the diverge to southbound I-465 and westbound I-465. Northbound I-69 operates at LOS F in the PM peak hour in the weave section between I-465 and 82nd Street off-ramp. Eastbound I-465 operates at LOS F from the Allisonville on-ramp merge through the eastbound to northbound loop ramp in both the AM and PM peak hours. Westbound I-465 also operates at LOS F from the northbound Binford Boulevard loop on-ramp through the Allisonville Road interchange in the PM peak hour. Both northbound and southbound I-465 operate at LOS F in both the AM and PM peak hours. The No-Build Alternative is not operationally acceptable.

The traffic operations in the Recommended Alternative show major improvement over the No-Build Alternative.

Table 14below shows a comparison of LOS by segment for each of the alternatives. The Recommended Alternative meets the goal of LOS D or better on all segments, with the exception of the southbound I-69 diverge to 82nd Street/Binford Boulevard. The travel times are improved for each major movement through the corridor. Southbound I-69 is greatly improved between 82nd Street and I-465 with the southbound 82nd Street to southbound Binford Boulevard two-sided weave eliminated and the provision of the CD road for southbound Binford Boulevard. The northbound I-69 traffic flow is also improved with the provision of the two-lane direct-connect eastbound to northbound ramp, the additional lane (and 82nd Street slip ramp) on the northbound to northbound ramp, and the additional lanes provided on northbound I-69. Separating the northbound traffic to 82nd Street via a CD road also relieves congestion in this area. The bottleneck on Westbound I-465 between the southbound to westbound ramp and the westbound Allisonville Road off-ramp is improved with the increase to six lanes and the provision of an option lane that becomes the fifth mainline lane under the Allisonville Road bridge.

The Recommended Alternative provides a CD system to help organize traffic. In the southbound direction, it separates both the local 82nd Street traffic and the local Binford Boulevard traffic from the southbound freeway to freeway movements. The northbound CD system separates all traffic to 82nd Street. The Recommended Alternative also eliminates the local off-ramp on the left by exiting the southbound Binford Boulevard traffic on the right at 82nd Street.

Although the segments of northbound and southbound I-465 within 56th Street/Shadeland Avenue interchange (just outside the project limits) operate at LOS E/F and show lower speeds in the Vissim output, they are not adversely impacted by the Recommended Alternative. Capacity improvements to this section would have to be provided in a separate future project.

Table 14: 2040 LOS Comparison between No-Build and Recommended Alternatives

CRITICAL ROADWAY SEGMENTS	NO-BUILD	RECOMMENDED
EB I-465 – White River to Allisonville Rd	D/E	C/D
EB I-465 - Inside Allisonville Rd Interchange	E/F	C/D
EB I-465 – Allisonville Rd to I-69 Ramps	F/F	D/D
EB I-465 – Binford Blvd Off to Loop Ramp	F/F	C/C
EB I-465 – Loop Ramp to I-69 Ramp	D/D	C/C
SB I-465 – I-69 Ramps to 56th St. / Shadeland Ave. Ramps	F/F	D/D
* SB I-465 – Inside 56th St. / Shadeland Ave. Interchange	F/E	F/E
* NB I-465 – Inside 56th St. / Shadeland Ave. Interchange	E/F	E/F
NB I-465 – 56th St. / Shadeland Ave. Ramps to I-69 Ramps	F/F	D/D
WB I-465 – I-69 Ramp to Loop Ramp	E/D	C/C
WB I-465 – Loop Ramp to I-69 Ramp	F/C	C/C
WB I-465 – I-69 Ramps to Allisonville Rd (weave)	F/F	D/C
WB I-465 – Inside Allisonville Rd Interchange	F/F	D/C
WB I-465 – Allisonville Rd to White River	F/E	D/C
NB I-69 – I-465 Ramps/Binford Blvd to 82nd St. (weave)	E/F	C/D
NB I-69 – Inside 82nd St. Interchange	C/E	C/D
NB I-69 – North of 82nd St.	C/D	C/D
SB I-69 – North of 82nd St.	E/C	E/C
SB I-69 – Inside 82nd Street Interchange	F/C	D/C
SB I-69 – 82nd Street to I-465 Ramps (weave)	F/D	D/C
SB I-69 - CD to Binford	n/a	D/B
NB Binford – 75th St. to NB I-69	C/C	B/B
EB I-465 to NB I-69/82nd St. (Loop)	n/a	C/C
NB I-465 to NB I-69/82nd St.	E/F	C/D
SB I-69 to WB I-465	D/C	D/C
SB I-69 to SB I-465	F/E	D/D

* Segment outside of project area

The safety performance of this project is based on a quantitative comparison of the predicted (non-calibrated) number of crashes, crash severity percentages, and crash rates between the No-Build and Recommended Alternatives (2040 AADT). These numbers have been obtained from the Interactive Highway Safety Design Model (IHSDM), which models the Highway Safety Manual's (HSM) Part C – Predictive Method based on various project specific design elements. The analysis concluded that there are 360 predicted yearly crashes for the No-Build Alternative with a 39.2 fatality/injury percentage, and 308 total predicted yearly crashes for the Recommended Alternative with a 38.7 fatality/injury percentage (due to the lack of Indiana IHSDM calibration, these numbers are only accurate when comparing to each other, and do not give a clear prediction of real-world crash data). The crash rates were separated by movement and, when looked at together and in conjunction with total number of crashes, show the Recommended Alternative performs better in regard to safety than the No-Build Alternative. The safety operations are assumed to be the same for the adjacent interchanges and intersections where the geometry and traffic volumes are unchanged between the No-Build and Recommended alternatives.

The proposed modifications to the I-465/69 interchange do not have a significant adverse impact on the safety and operation of the Interstate facility or on the local street network based on both the current and the planned future traffic projections. The proposed modifications improve traffic operations and safety on the interstate facility.

5.2 FHWA POLICY POINT #2

The proposed access connects to a public road only and will provide for all traffic movements. Less than "full interchanges" may be considered on a case-by-case basis for applications requiring special access, such as managed lanes (e.g., transit or high occupancy vehicle and high occupancy toll lanes) or park and ride lots. The proposed access will be designed to meet or exceed current standards (23 CFR 625.2(a), 625.4(a)(2), and 655.603(d)). In rare instances where all basic movements are not provided by the proposed design, the report should include a full-interchange option with a comparison of the operational and safety analyses to the partial-interchange option. The report should also include the mitigation proposed to compensate for the missing movements, including wayfinding signage, impacts on local intersections, mitigation of driver expectation leading to wrong-way movements on ramps, etc. The report should describe whether future provision of a full interchange is precluded by the proposed design.

The primary purpose of the I-465/I-69 interchange is to function as a three-legged, directional system interchange between two major interstates. The existing system interchange configuration provides full access between I-465 and I-69. In addition to incorporating every movement for the three-legged system interchange, the existing configuration also accommodates several service interchange movements within the system interchange. The unique challenge at this location is that the existing system interchange, while providing all interstate-to-interstate movements, is intertwined with local road traffic due to adjacent access points for Binford Boulevard to the south and the 82nd Street service interchange to the north. The critical interstate system movements experience operational and safety problems because of the heavy weaving movements with local traffic.

The recommended alternative continues to provide all directional system interchange movements and greatly improves all system interchange movements by fully separating system interchange movements from service interchange movements and providing additional capacity as needed on the system interchange ramps. No new access points are provided to the system interchange with this project. The Recommended Alternative features the same access points proposed and approved in the 2010 IJS (Appendix 1 – 2010 Interchange Justification Report – I-465 Northeast Side) and confirmed with an FHWA response letter to Mr. Tally on February 13, 2008 (Appendix 8 – FHWA Correspondence – 2010 IJS). The recommended alternative provides several advantages to the existing system interchange:

1. Provides a direct connection between eastbound I-465 and northbound I-69 and separates this movement from the eastbound I-465 to 82nd Street movement.
2. Provides a direct connection between northbound I-465 and northbound I-69 and separates this movement from all local traffic heading towards 82nd Street from northbound Binford Boulevard or eastbound I-465.
3. Eliminates the massive weaving section created on existing northbound I-69 where traffic from northbound I-465, eastbound I-465 and northbound Binford Boulevard come together and change lanes to travel north on I-69 or towards the 82nd Street exit ramp.
4. Places diverge to the southbound I-69 to southbound I-465 ramp on the left side of southbound I-69.
5. Separates all traffic traveling from southbound I-69 to I-465 from local traffic traveling from 82nd Street to Binford Boulevard while still providing access from 82nd Street to I-465.

The recommended alternative maintains and improves all the existing access points to the local roads within the project area. No new access points are provided to the service interchanges with this project. All vehicles on Binford Boulevard and 82nd Street will still have the same access to I-465, I-69 and the local roads that exists now but the recommended alternative provides several advantages to the local road movements:

1. Vehicles traveling north on Binford Boulevard will now have direct access to 82nd Street as well as direct access to northbound I-69. Vehicles traveling north on Binford Boulevard to 82nd Street will be barrier-separated from all northbound I-69 traffic.
2. There will be direct access from northbound I-465 to 82nd Street via an exit on the right side of the northbound I-465 to northbound I-69 ramp.
3. Access to 82nd Street from eastbound I-465 will be separated from mainline northbound I-69 traffic using the reconstructed loop ramp from eastbound I-465 to northbound Binford Boulevard. This loop ramp joins with traffic traveling from northbound Binford Boulevard to 82nd Street and continues along the barrier-separated CD system towards 82nd Street. The signalized I-69 ramp terminals at 82nd Street will remain in the same location as the existing configuration.

4. Traffic traveling south on I-69 towards 82nd Street or Binford Boulevard will now exit I-69 on the right side north of 82nd Street. This ramp will split with 82nd Street traffic exiting on the right side of the ramp. Traffic traveling towards Binford Boulevard will continue south via a CD that is fully separated from southbound I-69.
5. Access from 82nd Street to southbound Binford Boulevard will continue to be in the same place along 82nd Street but traffic will no longer have to enter southbound I-69 or weave across mainline traffic headed towards I-465 to travel south on Binford Boulevard. There will be a split in the southbound 82nd Street entrance ramp that provides motorists with a choice to enter southbound I-69 towards the I-465 ramps or travel to Binford Boulevard.
6. There will be a signalized intersection at the location where southbound Binford Boulevard intersects with the eastbound I-465 to southbound Binford Boulevard ramp. Currently, the eastbound I-465 ramp joins southbound Binford Boulevard as a free-flow ramp merge. During peak hours, it is difficult for motorists traveling from I-465 to cross southbound I-69 traffic bound for southbound Binford Boulevard to reach the left-turn lanes. The proposed signal will provide gaps that will ensure that both the eastbound I-465 to southbound Binford Boulevard ramp and southbound Binford Boulevard will be able to safely make the left turn onto 75th Street.

There are two service interchange movements that are not provided within the existing I-465/I-69 system interchange configuration. Consistent with the approved 2010 IJS, these movements will not be provided in the recommended alternative. These two movements are northbound Binford Boulevard to southbound I-465 and northbound I-465 to southbound Binford Boulevard. Both movements are local road movements that are not critical to the operations of the system interchange. Adding these movements to the recommend alternative would greatly increase the construction costs (the study completed in 2009 indicated additional costs of $40-50M) and would have significant adverse right of way impacts. These movements are also redundant as motorists can currently make the movements by using local roads and without traveling out of the way. Vehicles traveling north on I-465 currently exit at Shadeland/56th Street, travel north on Shadeland and can then use 71st Street or 75th Street to travel west towards Binford Boulevard. In addition, vehicles traveling north on Binford Boulevard can turn east onto 71st Street or 75th Street and then travel south on Shadeland Ave to the service interchange on I-465. The service interchange at I-465 and 56th Street / Shadeland Avenue will not be impacted by this project. In addition, vehicles can also use the 82nd Street interchange to travel from northbound Binford Boulevard to southbound I-465 if they do not wish to use Shadeland Avenue.

Binford Boulevard was originally planned to be an extension of I-69. Had Binford Boulevard become I-69, the system interchange would be four-legged and the additional movements would be more critical to include. However, there are no plans to extend I-69 through the city on Binford Boulevard. When I-69 is completed south of the city, the signed route for I-69 will use I-465 on the east side and south side of Indianapolis. Therefore, the I-465/I-69 interchange will remain a three-legged system interchange and the two local road movements not provided by the recommended alternative will still be accommodated by the existing service interchange on I-465 and the local road network.

In conclusion, the recommended alternative provides full functionality of the system interchange, improves operations and safety without adding any new access points and separates all system interchange movements from the service interchange movements. The recommended alternative also accommodates and improves the existing local road movements. The two missing local road movements within the system interchange are already provided with the local road system. The project is being designed to meet or exceed current design standards and guidelines according to the Indiana Design Manual and AASHTO Policy on Geometric Design of Highways and Streets. The design criteria as it pertains to each alignment in the project can be found in Appendix 9.

Excerpts

PARSONS

Alternative Analysis Report

Clear Path 465

Des. 1400075

Indiana Department of Transportation

Federal Highway Administration

Prepared for INDOT Greenfield District

February 2018

delivering a better world

Parsons • 101 West Ohio Street, Suite 2121 • Indianapolis, Indiana 46204 • (317) 616-1000

Table of Contents

Appendices intentionally omitted.

List of Figures and List of Tables

LIST OF FIGURES

LIST OF TABLES

LIST OF ABBREVIATIONS

- AADT – Average Annual Daily Traffic
- AASHTO – American Association of State Highway and Transportation Officials
- CD – Collector-Distributor road
- CAC – Community Advisory Committee
- CMF – Crash Modification Factor
- EA – Environmental Assessment
- EB – Eastbound
- EOA – Engineering and Operational Acceptability
- FHWA – Federal Highway Administration
- FI – Fatal and Injury
- HCS – Highway Capacity Software
- HSM – Highway Safety Manual
- IAD – Interstate Access Document
- IAR – Interstate Access Request
- IHSDM – Interactive Highway Safety Design Model
- INDOT – Indiana Department of Transportation
- LOS – Level of Service
- MPH – Miles Per Hour
- MOT – Maintenance of Traffic
- MUTCD – Manual of Uniform Traffic Control Devices
- NEPA – National Environmental Policy Act
- NB – Northbound
- PDO – Property Damage Only
- RFI – Red Flag Investigation

- RoadHAT – Road Hazard Analysis Tool
- SB - Southbound
- WB - Westbound

1.0 Project Overview

1.1 PROJECT AREA

This operations and safety project consists of the modification to the I-465/I-69 interchange and added travel lanes on I-465 mainline within Marion County, Indianapolis, Indiana. The project has been named "Clear Path 465" and the overall Project Area is shown on Figure 1. The Project Area on I-465 begins approximately 2.4 miles west of I-69 at the east end of the I-465 bridge over the White River and continues east through the I-465/I-69 interchange and south to the north end of the I-465 bridge over Fall Creek Road which is approximately 2.15 miles south of the I-465/I-69 interchange. The Project Area on Binford Boulevard begins approximately 2,000 feet south of 75th Street and continues north to I-69. The Project Area on I-69 begins just north of I-465 and continues north to a location where the proposed lanes tie into the existing lanes between 82nd Street and 96th Street approximately just north of 86th Street. The I-465/I-69 interchange will be modified to improve capacity and safety. The interchange ramps at I-465/Allisonville Road and I-69/82nd Street will be modified to accommodate added travel lanes on I-465 and I-69.

Figure 1: Clear Path 465 Project Area

1.2 INTENT OF ALTERNATIVES ANALYSIS REPORT

This Alternatives Analysis Report is part of a series of engineering studies for the project. An Interchange Justification (IJ) Study for the I-465 Northeast Side Road Reconstruction/ Added Travel Lanes (I—465 Northeast) project was prepared for the Indiana Department of Transportation (INDOT) and approved by the Federal Highway Administration (FHWA) in 2010. This IJ study included major reconstruction and modification of the I-465/I-69 Interchange as part of the I-465 Northeast project, but the I-465/I-69 Interchange portion of the I-465 Northeast project was cancelled in 2011. A modification to the 2010 IJ is now required as part of the Clear Path 465 project. The project team is following the State of Indiana Interstate Access Request (IAR) Procedures in order to prepare an Interstate Access Document (IAD). Step 1 of the

Framework Document was completed and approved by INDOT and FHWA on March 16, 2017. The purpose of this report is to complete Step 2 of the IAR Procedures by documenting the engineering analyses used to evaluate the preliminary geometry, traffic operations and safety performance of each alternative regarding the I-465/I-69 interchange. All three build alternatives - Alternative A, Alternative B and Alternative C – and the No-Build Alternative were developed and presented to the public at a project open house on August 23, 2017. Project updates have been posted on the project website (www.clearpath465.indot.in.gov) and related social media. INDOT and FHWA have already determined that an IAD is required (IAR Procedure Step 3) to update the 2010 IJ and the continuity of the proposed movements is preserved between the 2010 IJ and the current project. This report presents the Alternative Analysis which serves as the basis for recommending an alternative to progress farther through the project development process. This report also provides much of the required content of the IAD (IAR Procedure Steps 4 and 5) which will be submitted to FHWA. FHWA approval of the IAD based on the recommended alternative will include Engineering and Operational Acceptability (EOA) which is intended to insure that the alternative in the NEPA document meets the safety, engineering and operational requirements of access to the interstate and would not negatively impact the operations of the interstate. The selection of the preferred alternative will not be finalized until the NEPA process is complete.

1.3 SUMMARY OF DRAFT PURPOSE AND NEED

The following summarizes the Draft Purpose and Need statement which is being developed as part of the NEPA process.

The need for the Clear Path 465 project stems from insufficient capacity that causes congestion during the peak hours and safety concerns due to a high volume of crashes within the Project Area.

1. Congestion. There is insufficient existing and future capacity in critical roadway segments of the Project Area, resulting in congestion issues. Peak-hour traffic volumes were collected by INDOT in 2014 and 2015. The INDOT Technical Planning and Programming section used the Indiana Statewide Travel Demand Model to assign a growth rate to the mainline (0.6%) and ramps (0.3%) in the Project Area to forecast the 2040 ("design year") peak-hour volumes. The adjusted and balanced data was then analyzed to produce a Level of Service (LOS) for key segments in the Project Area. LOS is a performance measure that represents quality of service, measured on an A – F scale, with LOS A representing the best operating conditions from a traveler's perspective and LOS F the worst. The base-year and design-year peak hour LOS for traffic congestion throughout the Project Area is summarized in Table 1. The entire Project Area is considered urban, which means the minimally acceptable LOS is D. The results show unacceptable LOS for both base-year and design-year traffic in each direction along critical roadway segments within the project corridor.

Table 1: Existing Design Speeds and LOS Summary (AM/PM)

CRITICAL ROADWAY SEGMENTS	EXISTING # OF LANES	DESIGN SPEED (MPH)	LOS	
			BASE-YEAR (2015)	DESIGN-YEAR (2040)
EB I-465 – White River to Allisonville Rd	4	70	C/D	D/E
EB I-465 - Inside Allisonville Rd Interchange	3	70	D/D	E/F
EB I-465 – Allisonville Rd to I-69 Ramps	3	70	E/F	F/F
EB I-465 – Binford Blvd Off-Ramp to Loop Ramp	3	70	E/E	F/F
EB I-465 – Loop Ramp to I-69 Ramp	3	70	C/D	D/D
SB I-465 – I-69 Ramps to 56th St. / Shadeland Ave.	4	70	E/E	F/F
NB I-465 – 56th St. / Shadeland Ave. to I-69 Ramps	4	70	E/F	F/F
WB I-465 – I-69 Ramp to Loop Ramp	3	70	D/C	E/D
WB I-465 – Loop Ramp to I-69 Ramp	3	70	C/C	F/C
WB I-465 – I-69 Ramps to Allisonville Rd (weave)	4	70	F/E	F/F
WB I-465 – Inside Allisonville Rd Interchange	3	70	F/D	F/F
WB I-465 – Allisonville Rd to White River	4	70	E/D	F/E
NB I-69 – I-465 Ramps/Binford Blvd to 82nd St. (weave)	4	55	D/F	E/F

NB I-69 – Inside 82nd St. Interchange	4	55	C/D	C/E
NB I-69 – North of 82nd St.	5	55	C/C	C/D
SB I-69 – North of 82nd St.	5	55	D/C	E/C
SB I-69 – Inside 82nd Street Interchange	4	55	D/C	F/C
SB I-69 – 82nd Street to I-465 Ramps (weave)	5	55	E/C	F/D
NB Binford – South of 75th St.	2	55	n/a	n/a
NB Binford – 75th St. to NB I-69	2	55	C/C	C/C
SB Binford – I-69 to 75th St.	3	55	n/a	n/a
SB Binford – South of 75th St.	2	55	n/a	n/a
EB I-465 to NB I-69/82nd St. (Loop)	1	25	n/a	n/a
EB I-465 to SB Binford Blvd	1	25	n/a	n/a
NB I-465 to NB I-69/82nd St.	2	50	D/E	E/F
NB Binford Blvd to WB I-465 (Loop)	1	25	n/a	n/a
SB I-69 to WB I-465	2	50	D/C	D/C
SB I-69 to SB I-465	2	50	E/E	F/E

2. **Safety**. Between 2013 and 2015, over 1,000 crashes were reported within the Project Area – an average of almost one crash per day. The crash data is summarized in Table 3 in Section 1.4.3. Contributing factors include traffic congestion, configuration and weaving movements.

The **purpose** of the Clear Path 465 Project is to improve overall traffic operation by increasing capacity to meet the LOS goals stated above, and to improve safety by reducing the total number of crashes, decreasing the fatality/injury severity percentages, and reducing the crash rate (crashes/mile/year) and travel crash rate (crashes/million-vehicle-miles).

1.4 EXISTING CONDITIONS

Below is a description of the existing geometry, traffic operations and safety conditions for the I-465 and I-69 interstate system within the project corridor.

1.4.1 EXISTING GEOMETRY

Eastbound/Southbound I-465

Even though the existing White River bridge is wide enough to accommodate five lanes, eastbound I-465 from the White River bridge to the east currently has four lanes. The right eastbound I-465 lane exits at Allisonville Road and three lanes continue under Allisonville Road. The eastbound Allisonville Road on-ramp merges onto I-465, leaving three lanes on I-465. A ramp lane is added to the outside and exits onto southbound Binford Boulevard and shortly after, another ramp lane is added to the outside and exits eastbound I-465 via a single-lane loop ramp towards northbound I-69. Three I-465 lanes continue south until the 2-lane southbound I-69 to southbound I-465 ramp merges onto I-465. The left ramp lane merges into the outside I-465 through lane and then four lanes are maintained on southbound I-465 until the Fall Creek Road bridge. The existing Fall Creek Road bridge is wide enough to accommodate five lanes.

There are several problems with substandard existing roadway geometry within this roadway section.

1. Eastbound I-465 traffic entering from the northbound Keystone Avenue on-ramp has two lane drops and must merge over three lanes in order to exit at Allisonville Road. A significant volume of southbound Keystone Avenue traffic entering eastbound I-465 continues on mainline I-465 past Allisonville Road and all of this traffic must make one lane change to the left to avoid exiting at Allisonville Road.

2. The southbound I-69 to southbound I-465 ramp merges into southbound I-465 in a very abrupt manner. The right lane of mainline I-465 and the left ramp lane merge together in a manner where neither movement has its own lane. This creates an unsafe situation where traffic is forced to merge very quickly.
3. There are several locations with deficient vertical clearance including I-465 over Binford Boulevard, I-465 over 71st Street, and 75th Street over I-465.

Northbound/Westbound I-465

Northbound I-465 from Fall Creek Road has four lanes and travels over 71st Street and under 75th Street. At the I-69 interchange, two lanes head north on I-69 and three lanes travel west on I-465. Westbound I-465 crosses over Binford Boulevard and a single-lane loop ramp from northbound Binford Boulevard merges into the mainline inside the I-69 interchange. Westbound I-465 crosses over the southbound I-69 to southbound I-465 ramp and the I.T.M. railroad. The 2-lane southbound I-69 to westbound I-465 ramp merges after the loop ramp lane drop and creates four lanes heading west (the outside ramp lane drops prior to the merge). Four westbound I-465 lanes travel under the existing 82nd Street bridge. The right lane exits at Allisonville Road and three I-465 lanes continue under Allisonville Road. The Allisonville Road on-ramp to westbound I-465 creates a fourth lane that heads west and goes over the White River bridge, where the project ends. The existing White River bridge is wide enough to accommodate a fifth westbound I-465 lane as shown in the final design configuration. The existing northbound/westbound I-465 shoulder widths vary throughout the area.

There are several problems with substandard existing roadway geometry within this roadway section.

1. The I-465 median shoulders vary from 5 feet to 17 feet causing the through lanes to shift in and out and creating an unsafe situation where there is often no place to pull off towards the median in an emergency.
2. Both lanes of the northbound I-465 on-ramp at 56th Street/Shadeland Avenue drop as traffic merges onto northbound I-465. There is a large amount of traffic entering I-465 from this ramp that forces all of that traffic to merge over quickly prior to climbing the hill which causes queuing along I-465 and the ramp.
3. Northbound I-465 has a steep uphill grade from 56th Street/Shadeland Avenue to 71st Street that causes heavy vehicles to struggle to regain speed after the bottleneck which further disrupts I-465 traffic flows.
4. The current roadway signing for northbound I-465 to I-69 is inadequate and does not meet the Indiana MUTCD requirements. The overhead signs do not portray the correct lane configuration at the exit to I-69. A decision lane results in a two-lane exit. However, most drivers use only the outside lane causing a disproportionate usage of the outside lane. This causes excessive delays and traffic backups and can be attributed to the improper signage. The ground mounted regulatory sheets signs for lane geometry are difficult to see and missed by most motorists.
5. On westbound I-465, where the southbound I-69 to westbound I-465 ramp merges with westbound I-465, there is insufficient distance and time for the significant ramp traffic volume to merge onto I-465. The right ramp lane (outside) drops shortly after the gore and the left lane becomes the single-lane westbound Allisonville Road off-ramp. Therefore, almost all southbound I-69 to westbound I-465 mainline traffic uses the left ramp lane only before making a lane change to continue onto westbound I-465. All westbound I-465 traffic headed towards the Allisonville Road off-ramp must merge into the lane from the southbound I-69 ramp. This results in a heavy weave movement and long backups on westbound I-465 and southbound I-69.
6. There are several locations with deficient vertical clearance including I-465 over Binford Boulevard, I-465 over 71st Street, and 75th Street over I-465.

Northbound Binford Boulevard/I-69

Northbound Binford Boulevard from 75th Street to the north has two lanes. As Binford Boulevard travels under I-465, there is a weave section with the eastbound I-465 to northbound I-69/Binford Boulevard on-ramp (loop ramp) and the northbound Binford Boulevard to westbound I-465 exit ramp (loop ramp). Two lanes on northbound Binford Boulevard continue north carrying traffic from northbound Binford Boulevard and eastbound I-465 towards I-69 and 82nd Street. The two northbound Binford Boulevard lanes merge on the left side of I-69 with two lanes from northbound I-465. The four I-69 lanes continue north to the end of Project Area. A parallel exit ramp is introduced for the 82nd Street exit ramp.

There are several problems with substandard existing roadway geometry within this roadway section.

1. The northbound I-69 median shoulders are very narrow with a minimum width of 5 feet.
2. The eastbound I-465 to northbound I-69 loop ramp and the northbound Binford Boulevard to westbound I-465 loop ramp creates a weave section along northbound Binford Boulevard that creates congestion and queues traffic.
3. All traffic from both I-465 (both directions) and from Binford Boulevard headed north on I-69 is mixed in and has to weave across traffic heading to 82nd Street. There is no separation of I-69 mainline and 82nd Street local traffic. Eastbound I-465 to northbound I-69 traffic merges with Binford Boulevard and then merges again with the northbound I-465 to northbound I-69 ramp. A vehicle from eastbound I-465 or northbound Binford Boulevard that exits at the 82nd Street off-ramp must weave across the large volume of traffic traveling from northbound I-465 to northbound I-69. This weave movement causes backups on both exit ramps from I-465 and along northbound Binford Boulevard.
4. The vertical clearance on the I-69 bridge over 82nd Street is deficient.

Southbound I-69/Binford Boulevard

Southbound I-69 has four mainline lanes and an auxiliary lane ramp that enters from 96th Street and exits at 82nd Street. The southbound 82nd Street single-lane loop on-ramp enters southbound I-69 and creates a fifth mainline lane. Two southbound lanes exit on the left side to southbound Binford Boulevard. The second lane is an option lane so three southbound lanes continue towards I-465. The middle lane becomes an option lane and the lanes split with two lanes traveling towards westbound I-465 and two lanes heading towards southbound I-465.

As two southbound Binford Boulevard lanes travel from I-69 towards 75th Street, the single lane eastbound I-465 to southbound Binford Boulevard ramp joins in on the right as a separate free flow lane. At the 75th Street intersection, southbound Binford Boulevard has two through lanes, a right turn lane and two left turn lanes.

There are several problems with substandard existing roadway geometry within this roadway section.

1. The southbound I-69 median shoulders are very narrow with a minimum width of 5 feet.
2. Traffic entering southbound I-69 from the southbound 82nd Street on-ramp must cross over all southbound I-69 to I-465 traffic in order to access southbound Binford Boulevard.
3. The vertical clearance on the I-69 bridge over 82nd Street is deficient.

I-465/I-69 Interchange Ramps

There are several problems with substandard existing roadway geometry within the existing I-465/I-69 Interchange.

1. The eastbound I-465 to northbound I-69 single lane loop ramp creates a situation where all eastbound I-465 traffic reduces speeds and queues up because the loop ramp does not have enough capacity to accommodate the base-year peak hour traffic and the ramp lane along eastbound I-465 is too short.
2. The eastbound I-465 to southbound Binford Boulevard is a single-lane free-flow ramp that merges with high speed traffic on southbound Binford Boulevard. All ramp traffic that wants to turn left (east) onto 75th Street must weave across two lanes of high speed traffic in a short distance.
3. The vertical clearance on the southbound I-69 to southbound I-465 ramp over Binford Boulevard is deficient.
4. The roadway signs do not meet the IMUTCD requirement for a System Interchange. Motorists do not get adequate distance to be in the proper lanes at the exit to I-465. The 2 miles and 1 mile signs to I-465 do not exist and they are needed for smooth operations at this exit. The substandard signing at this exit causes backups.

1.4.2 EXISTING TRAFFIC OPERATIONS

A traffic operations analysis was performed for the existing traffic and roadway network using Highway Capacity Software (HCS) and a Vissim microsimulation model. HCS analyses are deterministic and generally consider a freeway segment in isolation. They do not adequately take into account the upstream and downstream conditions and the interaction of adjacent segments. Vissim is a stochastic microsimulation model that models each individual vehicle and considers the interaction of upstream and downstream segments. This is important in a study area such as this where closely spaced

interchanges with merges and diverges need to be considered. The two tools can provide a nice compliment to each other for a complete analysis.

The Vissim model covers I-465 from 56th Street on the south to the White River on the west and I-69 from 106th Street on the north to 75th Street on the south. The existing AM and PM peak-hour volumes and resultant LOS according to the HCS analysis are shown in Figure 2. The existing AM and PM peak-period segment speed heat maps from Vissim are shown in Figure 3 and Figure 4.

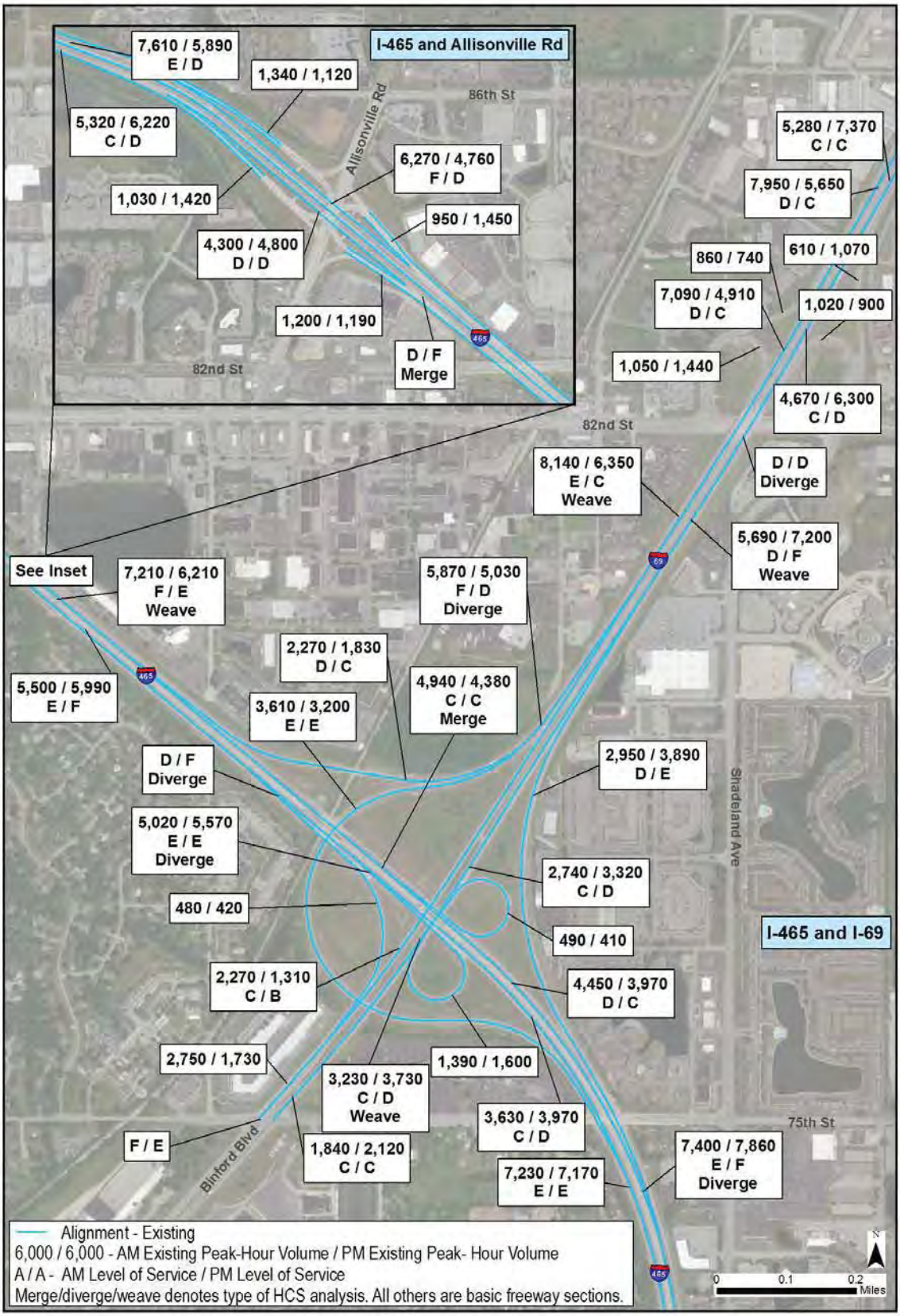


Figure 2: Existing AM and PM Peak-Hour Volumes and HCS LOS

Existing - AM

Route	Segment	6:45	7:00	7:15	7:30	7:45	8:00	8:15	8:30	Peak-Hour Average
SB I-69	106th	66	65	65	65	65	66	66	66	65
		65	65	64	64	64	65	65	65	64
	106th On to 96th Off	64	63	63	63	63	64	64	64	63
		60	58	57	56	58	60	61	61	58
	96th	64	63	62	62	63	64	64	64	63
		64	63	63	63	63	64	64	64	63
		64	63	63	63	63	64	64	64	63
	96th On to 82nd Off	64	64	63	64	64	64	65	65	64
		61	60	57	54	54	59	61	61	56
		60	59	52	45	46	55	60	60	49
	82nd St	60	58	42	33	35	51	60	60	40
	82nd On to I-465 Split	47	43	27	24	26	39	49	54	29
		52	47	44	43	43	45	53	54	44
		54	50	51	52	50	46	55	55	50
		56	53	53	52	50	46	56	56	50
NB I-69	NB Binford Blvd	58	56	56	57	56	57	57	58	56
		58	55	53	54	54	55	56	56	54
	I-465 to 82nd St Off	60	59	58	58	59	59	60	60	59
		56	54	53	53	53	53	54	56	53
	at 82nd St	63	62	61	61	61	62	62	62	61
	82nd St On to 96th St Off	64	63	62	62	62	62	63	63	62
		63	62	61	61	61	61	62	62	61
		64	63	63	63	63	63	64	64	63
		63	61	60	60	60	61	62	62	60
	at 96th St	66	65	65	64	65	65	65	65	65
		66	65	65	65	65	65	65	65	65
		66	65	65	65	65	65	65	65	65
	96th St On to 106th St Off	66	65	65	65	65	65	66	66	65
		66	65	65	65	65	65	66	66	65
	at 106th St	66	65	65	65	65	65	66	66	65
		67	66	66	66	66	66	66	66	66
NB/WB I-465	56th St On to NB to NB Ramp	57	55	47	45	49	55	58	58	49
		56	52	44	42	48	54	57	57	47
		58	56	54	54	55	57	58	58	55
		58	56	55	55	55	55	58	58	55
		57	56	55	55	54	54	57	58	55
	NB to NB thru NB to WB	60	59	58	53	42	50	58	60	51
	NB to WB Ramp to SB to WB Ramp	59	57	55	33	23	29	55	59	35
		58	55	47	27	22	25	53	58	30
	I-69 to Allisonville Rd	57	52	40	23	19	21	45	58	26
		57	52	47	46	46	46	53	56	46
	at Allisonville Rd	57	54	52	53	53	53	55	56	53
		58	55	55	54	54	55	56	57	54
		58	56	55	55	55	55	56	57	55
	Allisonville On to Keystone Off	60	59	58	58	58	58	59	60	58
		62	61	60	60	60	60	61	61	60
EB/SB I-465	Keystone On to Allisonville Off	61	60	59	59	60	61	62	62	60
		58	55	53	53	54	56	57	57	54
	at Allisonville Rd	58	57	55	55	56	57	58	58	56
		58	58	56	56	57	58	58	58	57
		58	57	56	56	56	57	58	58	56
		58	57	53	53	54	57	58	58	54
	Allisonville to I-69	59	58	53	53	54	58	59	59	55
		58	56	47	46	48	58	59	59	50
		56	52	49	48	49	53	55	56	50
	EB to SB Ramp to EB to NB Ramp	56	53	50	51	51	53	54	55	51
		55	52	49	50	50	51	53	54	50
		49	46	43	42	44	45	46	47	44
	EB to NB Ramp to SB to SB Ramp	58	56	55	54	55	55	56	56	55
	I-69 to 56th St Off	58	56	56	55	56	56	57	57	56
		59	58	57	56	57	57	58	59	57
		61	59	59	58	59	59	60	60	59

Speed (mph)
>62.5
60
58
55
53
50

Figure 3: Segment Speeds from Vissim – Existing AM

Existing - PM

Route	Segment	4:30	4:45	5:00	5:15	5:30	5:45	6:00	6:15	Peak-Hour Average
SB I-69	106th	66	66	66	66	66	66	66	67	66
		66	66	66	66	66	66	66	66	66
	106th On to 96th Off	65	65	65	65	65	65	65	65	65
		63	63	64	63	63	63	64	64	63
	96th	65	65	65	65	65	65	65	65	65
		65	65	65	65	65	65	65	65	65
		65	65	65	65	65	65	65	65	65
	96th On to 82nd Off	65	65	65	64	64	65	65	65	65
		62	62	62	62	62	62	63	63	62
		61	61	61	61	61	61	62	62	61
	82nd St	62	61	61	61	61	61	62	62	61
	82nd On to I-465 Split	51	48	48	48	45	50	52	55	48
		53	51	51	51	49	51	54	55	51
		55	55	54	53	53	54	55	56	53
		57	55	56	56	55	55	57	57	55
NB I-69	NB Binford Blvd	57	56	57	56	55	56	57	58	56
		55	52	52	52	53	52	53	54	52
	I-465 to 82nd St Off	59	57	57	58	57	57	57	58	57
		56	54	54	53	54	54	54	54	54
	at 82nd St	61	59	60	59	59	59	60	60	59
	82nd St On to 96th St Off	61	60	60	60	60	60	61	61	60
		59	58	58	58	58	58	59	59	58
		62	62	62	62	62	61	62	62	62
		62	61	59	60	60	59	61	61	60
	at 96th St	64	63	63	63	63	63	63	63	63
		64	63	63	63	63	64	64	64	63
		64	63	63	63	63	63	64	64	63
	96th St On to 106th St Off	65	64	64	64	64	64	64	64	64
		65	64	64	64	64	64	64	64	64
	at 106th St	65	64	64	64	64	64	64	64	64
		66	65	65	65	65	65	65	65	65
NB/WB I-465	56th St On to NB to NB Ramp	50	43	36	35	34	31	40	46	34
		44	39	35	34	34	33	39	43	34
		54	54	54	54	53	54	53	54	54
		56	55	55	55	55	55	55	55	55
		55	55	55	55	55	55	55	55	55
	NB to NB thru NB to WB	60	59	59	60	59	59	59	59	59
	NB to WB Ramp to SB to WB Ramp	58	58	58	59	58	58	58	58	58
		57	57	57	58	57	57	57	57	57
	I-69 to Allisonville Rd	58	56	57	57	56	56	57	57	56
		56	55	56	55	55	55	56	55	55
	at Allisonville Rd	57	56	57	56	56	56	56	57	57
		58	57	58	58	57	57	57	57	57
		58	57	58	58	57	57	57	57	57
	Allisonville On to Keystone Off	61	60	60	60	60	60	60	60	60
		62	61	61	61	61	61	61	61	61
EB/SB I-465	Keystone On to Allisonville Off	57	53	40	31	23	18	17	18	28
		49	34	28	27	28	27	29	30	27
	at Allisonville Rd	52	34	32	30	30	31	33	34	31
		52	33	33	31	31	32	33	35	32
		50	31	32	30	30	32	32	34	31
		47	29	32	30	30	31	31	34	31
	Allisonville to I-69	48	30	34	32	32	34	33	37	33
		43	23	26	25	24	27	27	30	25
		46	41	42	41	42	41	41	41	42
	EB to SB Ramp to EB to NB Ramp	49	47	48	47	48	47	47	46	48
		51	47	47	48	48	48	47	47	48
		46	41	41	43	43	42	42	40	42
	EB to NB Ramp to SB to SB Ramp	56	54	54	54	54	54	54	54	54
	I-69 to 56th St Off	57	56	56	56	56	56	56	56	56
		59	57	57	57	57	57	57	57	57
		60	59	58	58	58	59	58	59	58

Speed (mph)
>62.5
60
58
55
53
50

Figure 4: Segment Speeds from Vissim – Existing PM

Southbound I-69

There are several critical features of the southbound I-69 corridor that are especially problematic in the AM peak hour. First, there are three major movements within a short distance downstream of the 82nd Street interchange: the ramp to westbound I-465 (AM – 2,270 vehicles), the ramp to southbound I-465 (AM – 3,610 vehicles), and the ramp to southbound Binford Boulevard (AM – 2,270 vehicles). Second, there is a prominent, two-lane exit to a local street on the left side of the freeway – the southbound Binford Boulevard off-ramp. Third, the proximity (2,100 feet) of the southbound 82nd Street on-ramp to the southbound Binford Boulevard off-ramp causes a two-sided weaving section across three lanes. Maneuvering from the southbound 82nd Street on-ramp to the southbound Binford Boulevard off-ramp requires vehicles to make three lane changes across heavy southbound traffic to I-465 in the distance of 2,100 feet. Previous studies estimated that 250 vehicles make this maneuver in the AM peak hour.

The combination of these factors currently causes severe congestion and bottlenecking, especially in the AM peak hour. The AM Vissim model shows peak-hour speeds below 30 mph near the southbound 82nd Street on-ramp merge with southbound I-69. The AM heat map also indicates bottleneck queuing upstream of this point toward 96th Street during the peak hour. The analysis of existing conditions on the weaving section between the southbound 82nd Street on-ramp and the southbound Binford Boulevard off-ramp shows LOS E in the AM peak hour and LOS C in the PM peak hour. The diverge to westbound I-465 and southbound I-465 also shows a degradation of speeds in the AM heat map and operates at LOS F in the AM peak hour and LOS D in the PM peak hour. The bottlenecks in this segment regularly propagate back upstream through the 82nd Street interchange toward 96th Street in the AM peak hour.

Northbound I-69

Northbound I-69 currently suffers from delays caused by two major movements merging north of the I-465 interchange: traffic from northbound Binford Boulevard and eastbound I-465 and traffic from northbound I-465 (northbound to northbound ramp). This is complicated further by the northbound 82nd Street off-ramp being located 2,000 feet downstream. Vehicles navigating from northbound Binford Boulevard and eastbound I-465 to the northbound 82nd Street off-ramp must move three lanes to the right across a heavy volume from the northbound to northbound ramp (PM – 3,890 vehicles) in order to exit. At the same time, many of the northbound vehicles from the northbound to northbound ramp are attempting to navigate to the left lanes of northbound I-69 to avoid the friction at the 82nd Street interchange and the 96th Street interchange. This causes a weaving movement similar to the one on southbound I-69. The PM Vissim heat map shows a degradation of speed that indicates turbulence in the area of this merge. The segment of northbound Binford Boulevard just south of the merge shows an average PM peak-hour speed of 52 mph. The HCS analysis for this weave shows a LOS D in AM peak hour and LOS F in the PM peak hour. Also, the northbound to northbound ramp is near its two-lane capacity and operates at LOS D in the AM peak hour and LOS E in the PM peak hour.

There is also a tight weaving movement on northbound Binford Boulevard between the two low-speed ramps: the loop ramp from eastbound I-465 to northbound I-69 (eastbound to northbound Ramp) and the loop ramp from northbound Binford Boulevard to westbound I-465. This causes congestion and decreased speeds as traffic seeks to accelerate for its downstream mainline merge with the northbound to northbound ramp. This weave operates at LOS C in the AM peak hour and LOS D in the PM peak hour.

Northbound/Westbound I-465

Two significant problems on westbound I-465 are the weaving section between I-69 and Allisonville Road and the limited capacity under the Allisonville Road bridge. These two issues create a major bottleneck in the AM peak hour. Currently, there are three westbound mainline lanes between the westbound Allisonville Road off-ramp and the westbound Allisonville Road on-ramp. This number of lanes does not adequately serve the existing AM peak-hour traffic demands. The HCS analysis shows a LOS F in the AM peak hour and a LOS D in the PM peak hour. The weaving section between I-69 and Allisonville Road also causes congestion. Two lanes from the ramp from southbound I-69 to westbound I-465 (southbound to westbound ramp) merge with three westbound mainline I-465 lanes. The right ramp lane drops and the left ramp lane forms an auxiliary lane that exits at the westbound Allisonville Road off-ramp. The Vissim heat maps show

AM peak-hour average speeds of 26 mph and 30 mph on segments between Allisonville and I-69. These reduced speeds from the bottlenecks propagate back through the I-69 interchange. This weaving section operates at LOS F in the AM peak hour and LOS E in the PM peak hour.

A secondary bottleneck occurs on northbound I-465 at the merge of the northbound 56th Street/Shadeland Avenue on-ramp. The two lanes from the on-ramp merge into the four northbound mainline lanes of I-69. Northbound I-69 continues as a four-lane mainline section to the 82nd Street interchange. The high volume of ramp traffic (AM – 1,930 vehicles; PM 1,400 vehicles) merges into the high volume of traffic on the northbound I-465 mainline lanes (AM – 6,720 vehicles; PM 7,780 vehicles) causing congestion in both the AM and PM peak hours. The Vissim analyses indicate AM peak-hour speeds below 50 mph and PM peak-hour speeds below 35 mph. The four-lane mainline on northbound I-465 between the northbound 56th Street on-ramp and the northbound to northbound Ramp operates at LOS E in the AM peak hour and LOS F in the PM peak hour.

Eastbound/Southbound I-465

Eastbound I-465 traffic experiences a heavy bottleneck at the Allisonville Road interchange. There are five mainline lanes on eastbound I-465 between the Keystone Avenue interchange and the White River Bridge. This is where the I-465 Northeast project ended, and the eastbound mainline drops to four lanes. The right lane then drops at the eastbound Allisonville Road off-ramp leaving three mainline lanes on eastbound I-465 under the Allisonville Road bridge. These three lanes operate at LOS D for both the AM and PM peak hours. The problem worsens moving east as additional vehicles from the eastbound Allisonville Road on-ramp merges (AM – 1,200 vehicles; PM – 1,190 vehicles) onto the downstream three-lane mainline of eastbound I-465 between the Allisonville Road interchange and the I-69 interchange. This merge operates at LOS D in the AM peak hour and LOS F in the PM peak hour. The demand (AM – 5,500 vehicles; PM – 5,990 vehicles) on the downstream section of the eastbound Allisonville on-ramp and the southbound Binford Boulevard off-ramp is nearing capacity and operates at LOS E in the AM peak hour and LOS F in the PM peak hour.

There is a secondary bottleneck that is caused by vehicles decelerating as they exit to the low-speed loop ramp from eastbound I-465 to northbound I-69 (eastbound to northbound Ramp). There is a high demand for the loop ramp (AM – 1,390 vehicles; PM – 1,600 vehicles) and as these vehicles slow to 25 mph or less to navigate the tight loop ramp, queueing forms and spills back onto the eastbound I-465 mainline lanes. This causes a reduction in speeds in both AM and PM peak hours. The diverge to the eastbound to northbound Ramp operates at LOS E in both the AM and PM peak hours. The PM Vissim heat maps show the devastating effects that these bottlenecks have on the eastbound I-465 mainline speeds in the whole section. Nearly all of the segments throughout the PM peak period from the eastbound to northbound ramp to the end of the study area at the White River are below 50 mph, with many below 35 mph. The AM heat maps also show some segments in this area below 50 mph.

Finally, the four mainline lanes on southbound I-465 between the ramp from southbound I-69 to southbound I-465 (southbound to southbound Ramp) and the southbound 56th Street/Shadeland Avenue off-ramp is near capacity and operates at LOS E in both the AM and PM peak hours.

Systemwide Operations – Travel Times

Travel times were collected in the Vissim models for the six major movements through the Project Area. Table 2 below shows these travel times for the AM and PM peak hours and compares them to free-flow travel times on the same segments.

Table 2: Existing Peak-Hour Travel Times from Vissim

SEGMENT	TRAVEL TIME (MINUTES)		
	ESTIMATED FREE FLOW	AM	PM
NB to NB - 56th St to 96th St	5.2	5.6	6.5
NB to WB - 56th St to White River	5.2	6.1	6.2
SB to SB - 96th St to 56th St	5.7	6.5	6.1
SB to WB - 96th St to White River	4.6	6.1	4.9
EB to SB - White River to 56th St	5.2	5.6	7.3
EB to NB - White River to 96th St	5.5	5.9	6.9

The major movements in the AM peak hour (southbound to westbound, northbound to westbound, and southbound to southbound) experience travel time increases of 15 percent to 33 percent. This is reflective of the bottlenecks on westbound I-465 and southbound I-69. The major movements in the PM peak hour (eastbound to southbound, eastbound to northbound, northbound to northbound, and northbound to westbound) experience travel time increases of 19 percent to 42 percent. This is reflective of the bottlenecks on eastbound I-465 at Allisonville and northbound I-465.

75th Street and Binford Boulevard Intersection

The intersection of 75th Street and Binford Boulevard was analyzed using Synchro. The intersection performs at LOS E in the AM peak hour and LOS D in the PM peak hour.

1.4.3 HISTORICAL CRASH SAFETY ANALYSIS

The crash data for this safety analysis includes all identified incidents between 2013 and 2015, and has been provided by INDOT. The data includes specific information involved with each crash incident, including weather and surface conditions, latitude and longitude, severity, and manner of collision. The raw crash data was filtered and analyzed to better understand and consider safety performance in the alternative selection process. The results are described in the two steps below.

The first step in the existing safety analysis was to examine the historical crashes to determine the safety performance of the facility. From that information, crash hot spots and manner of collision trends were determined.

The historical crash data was filtered to allow for a more accurate analysis. Only crashes that contained latitude and longitudes within the Project Area were used. In addition, only crashes that happened on I-465, I-69, and associated ramps were included. These filters resulted in 1,058 applicable total crashes over the three-year period, or 353 crashes per year (Table 3). Of these 1,058 crashes, 886 are property damage only (PDO) crashes, and 172 are injury crashes. There were no identified fatalities in the analysis period. These 1,058 crashes are visually represented on Collision Diagrams in Appendix E, Exhibits E – 1 to E – 5, and detailed crash information is listed in Appendix E, Tables E – 6 to E – 16. The data shows that there is currently an average of one crash per day within the project area of the I-465/I-69 interchange.

Table 3: Historical Crash Summary (2013 to 2015)

CRASH SEVERITY	CRASH LOCATION					
	NB I-69	SB I-69	WB/NB I-465	EB/SB I-465	UNKNOWN DIRECTION	NB/SB BINFORD
Property Damage Only	35	142	302	379	18	10
Injury	10	39	45	68	7	3
Fatality	0	0	0	0	0	0
PROPERTY DAMAGE ONLY (PDO) CRASHES [YEARLY TOTAL]:						295
FATAL/INJURY (FI) CRASHES [YEARLY TOTAL]:						57
CRASHES [YEARLY TOTAL]:						353
CRASHES [3-YEAR TOTAL]:						1058

*Note: See Appendix E, Tables E – 6 to E – 16 for detailed historical crash information.

The second step of the analysis was to identify potential crash safety hot spots, and determine the causes. From the 1,058 total historical crashes, 60 percent were rear ends, and 24 percent were same direction sideswipes as seen in Table 4. The hot spots identified by analyzing the manner of collision distributions and spatial density distribution of crashes in the Collision Diagrams are as follows:

1. Eastbound I-465 as it approaches the eastbound I-465 to southbound Binford Boulevard off-ramp and the eastbound I-465 to northbound Binford Boulevard off-ramp. There was a higher-than-average density of rear end crashes recorded in that area, which can be attributed to the short distance (approximately 900 feet) between these off-ramps as shown in Appendix E, Exhibit E – 3.
2. Southbound I-69 just south of the 82nd Street on-ramp. There were above average densities of rear end and sideswipe crashes recorded in that area as shown in Appendix E, Exhibit E – 5. This segment is identified as a weaving section, as 82nd Street on-ramp traffic must cross southbound I-69 traffic to the southbound I-69 to westbound I-465 ramp and the southbound I-69 to southbound I-465 ramp.

These hot spot safety concerns will be addressed by the recommended alternative. In addition, after analyzing the Collision Diagrams in Appendix E, Exhibits E – 1 to E – 5, there were no apparent out of the ordinary trends caused by surface or lighting conditions.

Table 4: Historical Crashes Evaluated by Manner of Collision

MANNER OF COLLISION	PDO CRASHES (PROPERTY DAMAGE ONLY)	FI CRASHES (INJURY OR FATALITY)	TOTAL CRASHES
Backing Crash	4	0	4
Collision with Object in Road	18	0	18
Head on Between Two Motor Vehicles	25	10	35
Left Turn	1	1	2
Left/Right Turn	10	0	10
Non-Collision	9	1	10
Opposite Direction Sideswipe	2	0	2
Other - Explain in Narrative	9	3	12
Ran Off Road	35	25	60
Rear End	541	95	636
Rear to Rear	3	0	3
Right Angle	10	3	13
Right Turn	0	1	1
Same Direction Sideswipe	219	33	252
TOTAL CRASHES	886	172	1,058

*Note: See Appendix E, Tables E – 6 to E – 16 for detailed historical crash information.

The historical crash data has also been analyzed by time of day. The peak-hour volumes for this interchange are 7:00am to 8:00am in the morning, and 5:00pm to 6:00pm in the evening. As seen in the following histogram (Figure 5), the distribution of crashes during peak-hours indicates a direct correlation between congestion and vehicular incidents.

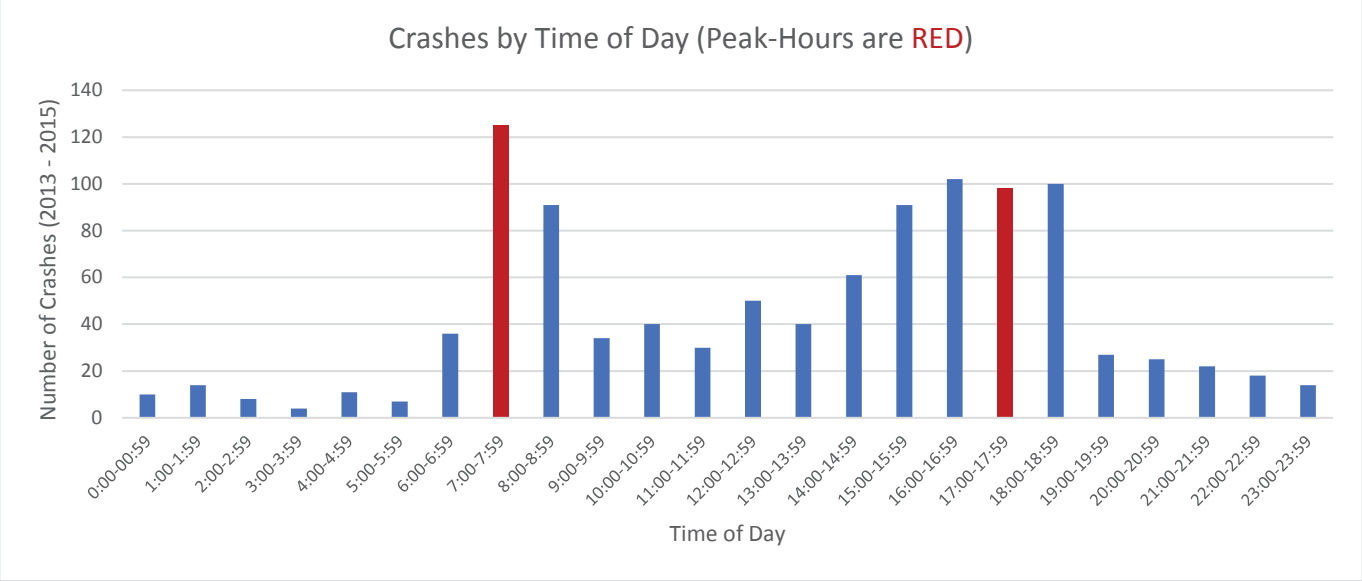


Figure 5: Crashes by Time of Day

Analyzing further, the crashes during the peak-hours were broken down by manner of collision. While 60 percent of the overall collisions were rear ends, that number jumps up to 78 percent and 76 percent for the AM and PM peak-hours, respectively. Rear end crashes can generally be attributed to stop-and-go and heavy traffic. This rear end crash percentage increase (Table 5) confirms the above conclusion that congestion plays a large role in overall vehicular incidents within the interchange.

Table 5: Manner of Collision during Peak Hours

MANNER OF COLLISION	OVERALL CRASHES	% OF OVERALL		AM CRASHES (7:00AM TO 8:00AM)	% OF AM	PM CRASHES (5:00PM TO 6:00PM)	% OF PM
BACKING CRASH	4	0%		0	0%	0	0%
COLLISION WITH OBJECT IN ROAD	18	2%		1	1%	1	1%
HEAD ON BETWEEN TWO MOTOR VEHICLES	35	3%		2	2%	1	1%
LEFT TURN	2	0%		0	0%	0	0%
LEFT/RIGHT TURN	10	1%		1	1%	0	0%
NON-COLLISION	10	1%		0	0%	1	1%
OPPOSITE DIRECTION SIDESWIPE	2	0%		0	0%	0	0%
OTHER - EXPLAIN IN NARRATIVE	12	1%		1	1%	1	1%
RAN OFF ROAD	60	6%		5	4%	2	2%
REAR END	636	60%		98	78%	74	76%
REAR TO REAR	3	0%		0	0%	0	0%
RIGHT ANGLE	13	1%		0	0%	1	1%
RIGHT TURN	1	0%		0	0%	0	0%
SAME DIRECTION SIDESWIPE	252	24%		17	14%	17	17%
TOTALS	**1058**			**125**		**98**	

The following limitations apply to the historical crash safety analysis:

Normally, the Road Hazard Analysis Tool (RoadHAT), or the Interactive Highway Safety Design Model (IHSDM) is used to predict the crash performance of an existing facility. The calculated information is then compared to the historical crash performance. This analysis helps determine how the existing facility is performing in relation to similar facilities. However, RoadHAT does not support crash predication models for complex system interchanges. In addition, Indiana has not yet finished developing the calibration factor required for comparing the IHSDM crash prediction to the historical data. Because of this, the IHSDM crash prediction numbers can only be used as a relative comparison amongst alternatives, and the existing safety performance of this facility must rely on the hot spot analysis, and raw crash data above. While IHSDM could technically be run on the no-build alternative with current AADT, we determined that for the scope of this Alternative Analysis Report, the IHSDM results were most valuable when comparing proposed geometry and configurations with each other and the No-Build alternative using the design year AADT. The historical crash data is also limited in that unlike IHSDM, specific crashes can generally not be attributed to a single alignment.

2.0 Overview of Alternatives

2.1 DESIGN CRITERIA

The following design criteria were used to develop and analyze each build alternative.

Table 6: Design Criteria

CRITERIA	I-465 MAINLINE	I-69 MAINLINE	I-465/I-69 NON-LOOP RAMPS	I-465/I-69 LOOP RAMPS	BINFORD BLVD.	71ST ST.
Design Speed (mph)	70	55	45	25	55	40
Minimum Acceptable LOS	D	D	D	D	D	Existing
Lane Width (ft)	12	12	12	16	12	12
Inside Shoulder Width (ft)	12	12	4 (1-2 Lane) 10 (3-Lane)	4	4	N/A
Inside Shoulder Barrier Offset (ft)	2	2	2	2	2	N/A
Outside Shoulder Width (ft)	12	12	8 (1-Lane) 10 (2-3 Lane)	8	10	Curb and Gutter
Outside Shoulder Barrier Offset (ft)	2	2	2	2	2	N/A
Bridge Clear-Roadway Width (ft)	Full Paved Approach Width					N/A
Structural Capacity	HL-93 (New) HS-20 (Existing)					N/A
Horizontal Curvature, Min. Radius (ft)	1,810	960	587	150	587	444
Maximum Superelevation Rates (emax)	8	8	8	8	8	4
Horizontal Stopping Sight Distance (ft)	730	495	360	155	360	305
Vertical Stopping Sight Distance (ft)	730	495	360	155	360	305
Maximum Vertical Grades (%)	3	3.5	5	5	5	10
Travel Lane Cross Slope	2% 3% (3 or more lanes sloping in same direction)	2% 3% (3 or more lanes sloping in same direction)	2% 3% (3 or more lanes sloping in same direction)	2%	2%	2%
Vertical Clearance (ft)	16' – 6"	16' – 6"	16' – 6"	16' – 6"	16' – 6"	14' – 0"
Bridge-Railing Safety Performance Criteria (TL-2 vs. TL-4 vs. TL-5)	TL-5					N/A
Assumed minimum distance between retaining walls and Right-of-Way (ft)	10	10	10	N/A	10	N/A

2.2 ALTERNATIVE EVALUTATION CRITERIA

There are many quantitative and qualitative advantages and disadvantages to each alternative within the evaluation criteria. The following guidelines are used to provide a qualitative rating for each category.

- Three Adjective Ratings
  - Low, Medium, High
  - Comparison to accepted criterion level and other build alternatives.
  - Relative comparison to other build alternatives and within the project intent.
  - Rating for entire alternative not just one element.

- Traffic Operations
  - Low – Does not meet LOS requirements for most movements.
  - Medium – Achieves minimum LOS for all movements. Non-analyzed elements (ex. separating freeway-to-freeway and local movements, exits/entrances on right) pose a potential concern.
  - High – Achieves desirable LOS for majority of movements. Non-analyzed elements (ex. separating freeway-to-freeway and local movements, exits/entrances on right) do not pose a concern.
- Safety
  - Low – Large overall crash rate/travel crash rate in relation to the other ramps or roadways.
  - Medium – Above-average overall crash rate/travel crash rate in relation to the other ramps or roadways.
  - High – Small overall crash rate/travel crash rate in relation to the other ramps or roadways.
- Driver Expectancy and Signing
  - Low – Non-conventional movements that cannot be mitigated through signing and marking. Signing does not meet MUTCD requirements. Less desirable geometric features.
  - Medium – Non-conventional movements or signing required that do present a safety concern. MUTCD minimum values met. Geometric features meet driver expectations.
  - High – Movements are consistent with AASHTO. Signage within desirable values of MUTCD. Highly desirable geometric features.
- Constructability
  - Low – Complex sub phases required to construct. Many conflicts with existing traffic. Detriment to construction projected construction time. Proposed geometry creates difficult elements to construct.
  - Medium – Unconventional construction present. Conflicts with existing traffic and phases.
  - High – Conventional construction techniques. Few conflicts with existing traffic. Potential for accelerated construction. Proposed geometry creates simple elements to construct.
- Long-Term Maintenance
  - Low – High square feet of bridge, long spans, high square feet of retaining walls, use of steel instead of concrete, existing bridges and pavement rehabilitated rather than reconstructed.
  - Medium – Average amount of roadway, retaining walls and bridges which requires common maintenance and inspection activities. There are no overly complex elements requiring special access or preventative maintenance cycles.
  - High – Minimal retaining walls, relatively low square feet of bridge, no unique elements that may require special inspection or treatment. Contains more reconstructed elements than rehabilitation.
- Environmental Impact
  - Low – Substantial impacts to resources such as wetlands and forested habitat. Several relocations required. Possible Section 4(f) and 6(f) impacts. Mitigation required for multiple impacts. Likely disproportionate impacts to environmental justice populations.
  - Medium – Minor impacts to resources, such as wetlands and forested habitat. Few to no relocations. Potential noise impacts. No Section 4(f) or Section 6(f) impacts.
  - High – Low likelihood of impacting resources, or requires no mitigation or *de minimus* impact. No relocations. No disproportionate impacts to environmental justice populations anticipated.
- Utility Impact
  - Low – Major utility or many minor utilities relocations. Relocations schedule drives ability to construct significant portions of the project.
  - Medium – Relocations required for distribution, services lines. Coordination required to minimize schedule impact.
  - High – Avoidance or minor relocations that will not impact schedule.

2.3 PREVIOUSLY DISMISSED ALTERNATIVES

Many design concepts were considered during the alternative analysis but they were dismissed for a variety of reasons. A summary of the dismissed alternatives and the reasons they were dismissed are listed below.

I-465/69 Interchange:

- Lower the design speed on eastbound I-465 to northbound I-69 ramp to 40 mph providing for tighter geometry and more optimal bridge design (dismissed for safety).
- Restricted access from any northbound movement to 82nd Street (dismissed due to traffic volumes).
- A loop ramp to southbound Binford Boulevard with a left-hand exit from the eastbound I-465 to northbound I-69 ramp (dismissed due to added travel time and driver expectations).
- A single lane northbound on Binford Boulevard which reduces the overall width of I-69 while providing additional distance for lane drops (dismissed due to traffic volumes).
- A sweeping loop for eastbound I-465 to northbound I-69 that goes over Binford Boulevard and back over I-465 east of the existing interchange (dismissed due to cost and complexity).
- Adding a signal for northbound Binford with southbound Binford (dismissed due to traffic and driver expectations).
- Adding a service interchange with an eastbound I-465 to northbound I-69 direct connection (dismissed due to cost, complexity and traffic).
- Options that incorporate the missing movements (northbound Binford Boulevard to southbound I-465 and northbound I-465 to southbound Binford Boulevard) were reviewed but these movements are not included in any of the build alternatives. The completion of these movements was studied in detail in the Connections EIS and subsequent Interchange Justification (IJ) report. That study found that completion of the missing movements was costly to construct, had high right of way and environmental impacts and required more extensive reconstruction of the I-465/I-69 interchange to accommodate the missing ramps. The 2010 IJ was approved by INDOT and FHWA without the missing movements and they will not be added as part of this project (dismissed due to cost, traffic impacts, redundancy of movements, they are not required movements). This Alternative Analysis Report builds on the prior study which dismissed completion of the missing movements. The primary function of the I-465/I-69 interchange is as a system interchange between two major interstates: I-465 and I-69. The system interchange has full functionality and incorporates every system interchange movement in addition to several service interchange movements within the system interchange. The two missing movements are both service interchange movements from I-465 to local roads that represent redundant movements. Motorists can still make, without traveling very far out of the way, the northbound Binford Boulevard to southbound I-465 movement by traveling east to Shadeland Avenue and then south to I-465. In the same way, the northbound I-465 to southbound Binford Boulevard movement can be made by exiting on northbound I-465 at Shadeland/56th Street, traveling north on Shadeland Avenue and then heading west on 71st Street or 75th Street.

I-69/82nd Street interchange:

- Fully reconstructing the interchange with multiple configurations for the 82nd Street ramps (dismissed due to cost and impacts on 82nd Street).
- Creating a ramp lane in between northbound and southbound I-69. (dismissed due to cost, complexity and traffic)
- Single lane exits on the right-hand side for Binford Boulevard (dismissed due to traffic).
- Using Bash Street and Castleton Road to accommodate travel between Binford Boulevard and 82nd Street in lieu of I-69 (even though this option would greatly improve traffic operations on southbound I-69, it was dismissed due to traffic concerns on 82nd Street, costs associated with upgrading 82nd Street for a new major intersection and impacts to local businesses).
- Adding a ramp on the southwest corner of 82nd Street and I-69 as an on-ramp (dismissed due to traffic and complexity with the 82nd Street signal).

The No-Build Alternative and three Build Alternatives, described in the following sections, were carried forward for further analysis.

2.4 NO-BUILD ALTERNATIVE

The No-Build Alternative is based on the existing roadway geometry which is described in Section 1.4.1.

2.5 BUILD ALTERNATIVE COMMON DESIGN ELEMENTS

The three build alternatives show different configurations for the I-465/I-69 interchange. However, similar improvements are required within the Project Area along I-465, I-69, Binford Boulevard and 71st Street to allow each alternative to function properly. All of these common design elements are shown on Figure 6 and listed below for each roadway segment.

Design Exceptions

A Level One Design Exception is required for 600 feet of the westbound I-465 outside shoulder width under the existing Allisonville Road bridge. Traffic operations requires a fifth westbound I-465 lane in order to mitigate the westbound I-465 weave movement between the I-69 ramps and Allisonville Road. There is not enough width under the existing Allisonville Road bridge for five westbound I-465 mainline lanes and full width median and outside shoulders. As a result, the outside shoulder must be narrowed to four feet to allow a full width median shoulder and five lanes under the bridge. This is required for all build alternatives.

The existing vertical clearance of 14'-5" for 82nd Street under the I-69 bridges is deficient and widening the I-69 bridges will decrease the vertical clearance even further to approximately 13'-8". This would require a Level One Design Exception unless 82nd Street was lowered under I-69 or I-69 raised. The preliminary plan is to avoid a Level One Design Exception at this location for vertical clearance by lowering 82nd Street to obtain the required 14'-6" vertical clearance.

A Level Two Design Exception may be required to maintain the existing I-465 median barrier height from 75th Street to the south end of the Project Area. The existing shoulder width will be maintained with auxiliary lanes added to the outside of the existing pavement. The existing I-465 median barrier within this area may be shorter than the required 45-inch truck height barrier.

Eastbound/Southbound I-465

1. Eastbound I-465 between the White River bridge and Allisonville Road will have four mainline lanes and one auxiliary lane and an option lane which exits at the eastbound Allisonville Road off-ramp as a two-lane ramp (see Figure 6).
2. The eastbound I-465 Allisonville Road off-ramp will be modified as needed to tie into the proposed I-465 lanes (see Figure 6).
3. Eastbound I-465 will have four mainline lanes inside of the existing Allisonville Road interchange (see Figure 6).
4. The eastbound I-465 Allisonville Road on-ramp will be modified as needed to tie into the proposed I-465 lanes (see Figure 6).
5. Eastbound I-465 between Allisonville Road and the I-69 ramps will have four mainline lanes and one auxiliary lane. The auxiliary lane will exit to the northbound I-69 off-ramp and the next lane over (outside through lane) will be an option lane allowing vehicles to either exit towards I-69 or continue onto southbound I-465 (see Figure 6).
6. Eastbound I-465 will have four mainline lanes inside of the I-69 interchange.
7. Southbound I-465 south of I-69 will have four mainline lanes and three lanes from the southbound I-69 to southbound I-465 ramp. The outside two auxiliary lanes will drop resulting in four mainline lanes and one auxiliary lane which exits at the 56th Street/Shadeland Avenue off-ramp.
8. From 75th Street to the south end of Project Area, the existing southbound I-465 median shoulder widths are wider than required. Therefore, the median barrier and the existing shoulders will remain. Existing HMA pavement in this section will be milled and overlaid and existing concrete pavement will remain.

Northbound/Westbound I-465

9. Northbound I-465 from the 56th Street/Shadeland Avenue on-ramp will have four mainline lanes and two auxiliary lanes. The two auxiliary lanes will exit towards northbound I-69 and the next lane over (outside through lane) will be an option lane allowing vehicles to either exit towards northbound I-69 or continue on northbound I-465 (see Figure 6).
10. Westbound I-465 will have four mainline lanes inside of the I-69 interchange.
11. Westbound I-465 will have six lanes between the I-69 ramps and Allisonville Road. The outside auxiliary lane will exit at the Allisonville Road off-ramp and the next lane over (5th lane) will be an option lane allowing vehicles to either exit at Allisonville Road or continue on westbound I-465 (see Figure 6).
12. The westbound I-465 Allisonville Road off-ramp will be modified as needed to tie into the proposed I-465 lanes (see Figure 6).
13. Westbound I-465 from the Allisonville off-ramp to the west end of Project Area will have five through lanes and will tie into the existing five lanes on the westbound I-465 bridge over the White River. In order to accommodate five westbound I-465 travel lanes under the existing Allisonville Road bridge, a level one design exception will be required for shoulder width on I-465 (see Figure 6).
14. The westbound I-465 Allisonville Road on-ramp will be modified from a ramp that becomes an auxiliary lane to Keystone Avenue to a parallel entrance ramp that ties into the five westbound I-465 through lanes (see Figure 6).
15. From 75th Street to the south end of Project Area, the existing southbound I-465 median shoulder widths are wider than required. Therefore, the median barrier and the existing shoulders will remain. Existing HMA pavement in this section will be milled and overlaid and existing concrete pavement will remain.

Northbound Binford Boulevard/I-69

16. The northbound 82nd Street on-ramp will be reconstructed at the gore to tie into the proposed five northbound I-69 lanes (see Figure 6).
17. Northbound I-69 will have five mainline lanes at the north end of the Project Area (see Figure 6).
18. The northbound Binford Boulevard to westbound I-465 ramp will be a single lane loop ramp that will be barrier separated from northbound Binford Boulevard traffic heading towards northbound I-69.

Southbound I-69/Binford Boulevard

19. The southbound 82nd Street off-ramp will be modified as needed to tie into the proposed I-69 lanes (see Figure 6).
20. A third lane will be added to southbound Binford Boulevard at 75th Street to increase capacity on southbound Binford Boulevard through the signal at 75th Street. The proposed third lane will be added to the outside (west side) of southbound Binford Boulevard and will extend approximately 1,000 feet south of 75th Street before dropping (see Figure 6).

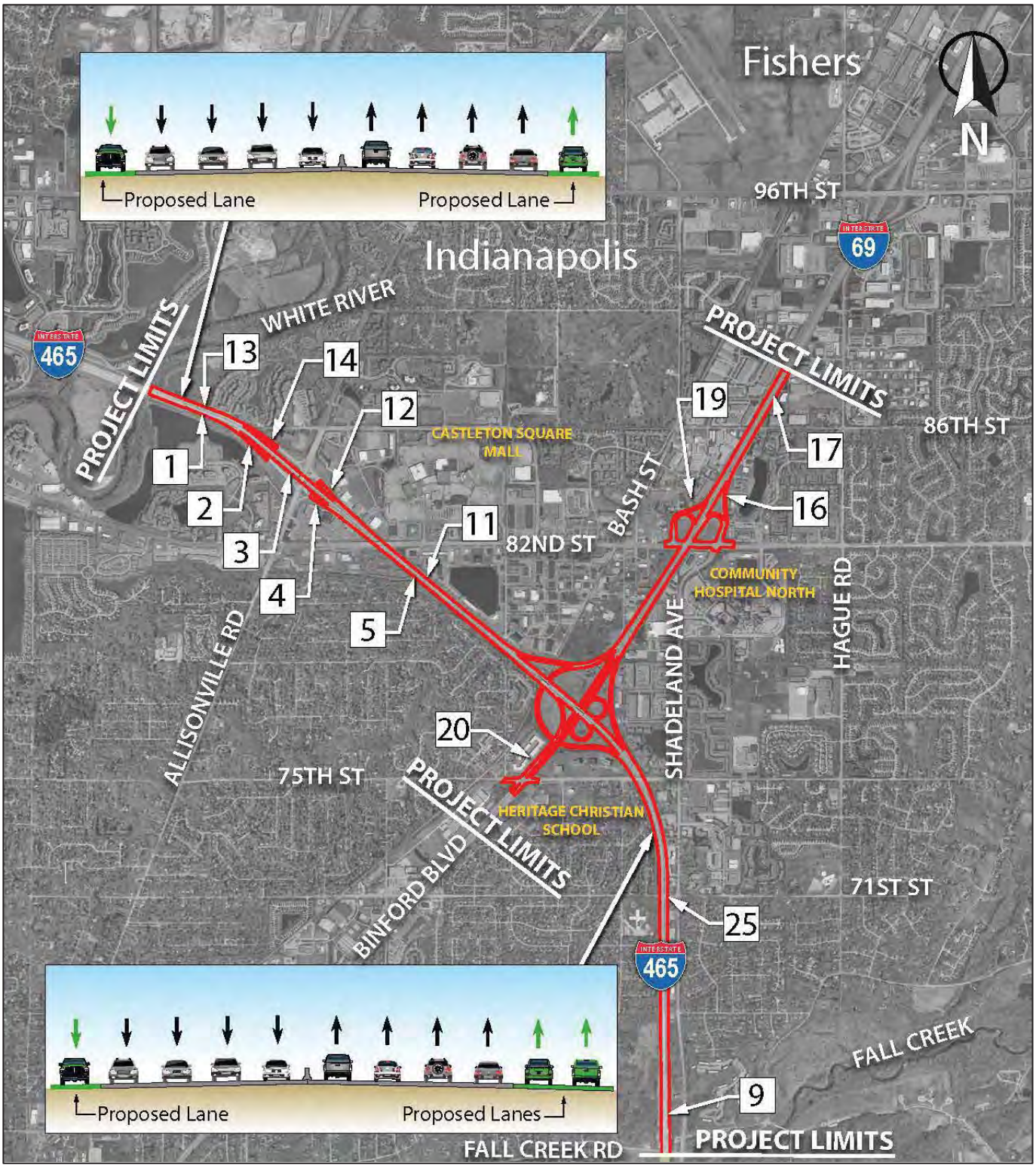
I-465/I-69 Interchange Ramps

21. The southbound I-69 to southbound I-465 ramp will need three lanes to accommodate design-year traffic.
22. The southbound I-69 to westbound I-465 ramp will have two lanes.
23. A single lane ramp will be added from the northbound I-465 to northbound I-69 ramp to the northbound 82nd Street off-ramp.
24. The eastbound I-465 to southbound Binford Boulevard ramp terminal will have a traffic signal at the intersection. This will allow traffic to safely travel from eastbound I-465 to southbound Binford Boulevard and then turn left (east) on 75th Street.

Local Roads

25. 71st Street will be lowered under I-465 to meet the minimum vertical clearance requirements along 71st Street (see Figure 6).

All other movements not listed above will be described in subsequent sections as part of Alternative A, Alternative B and Alternative C.



Note: The numbers correspond to the specified movements outlined in Section 2.4

Figure 6: Clear Path 465 Common Design Elements

2.6 BUILD ALTERNATIVE A

Refer to Figure 7, Figure 8 and Preliminary Plans in Appendix A, Plans A – 1 to A – 11 for the plan view layout of Build Alternative A. The primary features of this alternative include:

- Two-lane "fly-over" direct connection for eastbound I-465 to northbound I-69.
- Additional dedicated off-ramp from eastbound I-465 to southbound Binford Boulevard and 82nd St.
- Dedicated CD roadway for traffic to 82nd St from I-465 and Binford Boulevard.
- Westbound I-465 to northbound I-69 remains at-grade and merges to the right of northbound Binford Boulevard and eastbound I-465 traffic.
- Southbound I-69 to southbound Binford Boulevard off-ramp is a left-hand exit and passes under I-465.
- Alternative A consists of 10 bridges (refer to Figure 7 and Figure 8 for bridge numbers for this alternative). Included in this option are two I-465 mainline bridges (Bridges 1 and 4), one I-69 mainline bridge (Bridge 10), six 2nd level flyover ramps (Bridges 2, 3, 5, 6, 7, and 8), and one 3rd level flyover ramp (Bridge 9) which spans over I-465. Bridges 5, 6, and 8 are ramp bridges.

Table 7: Proposed Description and Design Speeds of I-465/I-69 Interchange Ramps: Alternative A

RAMP MOVEMENT	RAMP DESCRIPTION	PROPOSED # OF LANES	DESIGN SPEED
EB I-465 to NB I-69	Over I-465 and over SB Binford	2	45 mph
EB I-465 to SB Binford	Diverges from EB I-465 to 82nd St ramp	1	45 - 30 mph
EB I-465 to 82nd St.	Proposed Loop Ramp	1	25 mph
NB I-465 to NB I-69	Over NB Binford to 82nd St Ramp	3	45 mph
NB I-465 to 82nd St.	Diverges from NB I-465 to NB I-69 Ramp	1	45 mph
NB Binford to WB I-465	Proposed Loop Ramp	1	25 mph
NB Binford to NB I-69	Diverges from NB Binford to WB I-465 / 82nd Street	2	45 mph
NB Binford to 82nd St.	Diverges from NB Binford and travels under NB I-465 to NB I-69 Ramp	1	45 mph
SB I-69 to SB I-465	Exits from middle of SB I-69	3	45 mph
SB I-69 to WB I-465	Exits from outside of SB I-69	2	45 mph
SB I-69 to SB Binford	Exits from inside of SB I-69	2	45 mph
SB I-69 to 82nd St	Exits SB I-69	1	45 – 25 mph
82nd St. to SB Binford	Barrier separated CD road on outside of SB I-69	1	25 – 45 mph
82nd St. to SB I-69	Merges into I-69 SB	1	25 mph
82nd St. to SB I-465	Uses 82nd St. to SB I-69 Ramp	N/A	N/A
82nd St. to WB I-465	Uses 82nd St. to SB I-69 Ramp	N/A	N/A

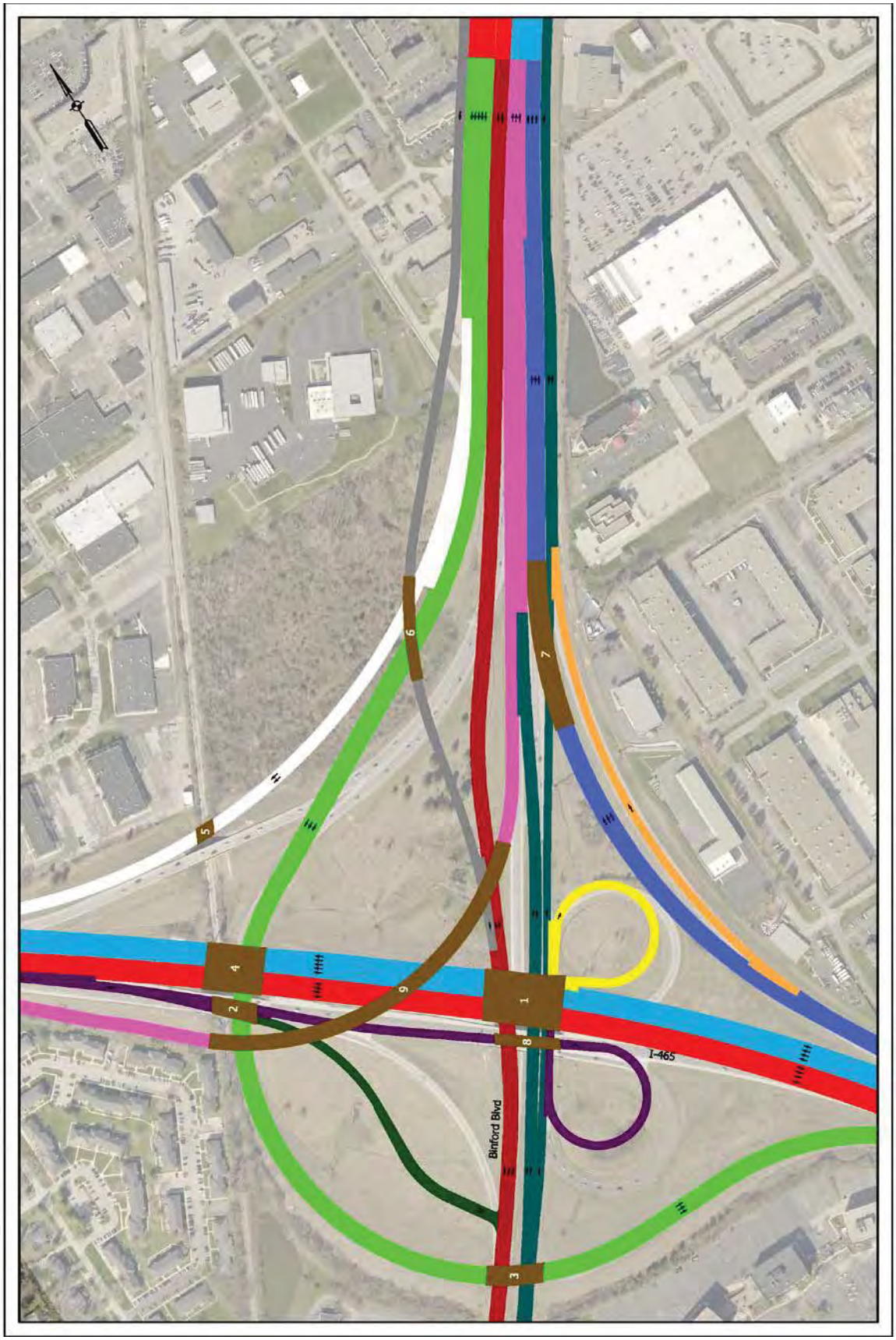


Figure 7: Alternative A Overview (I-465/I-69 Interchange)

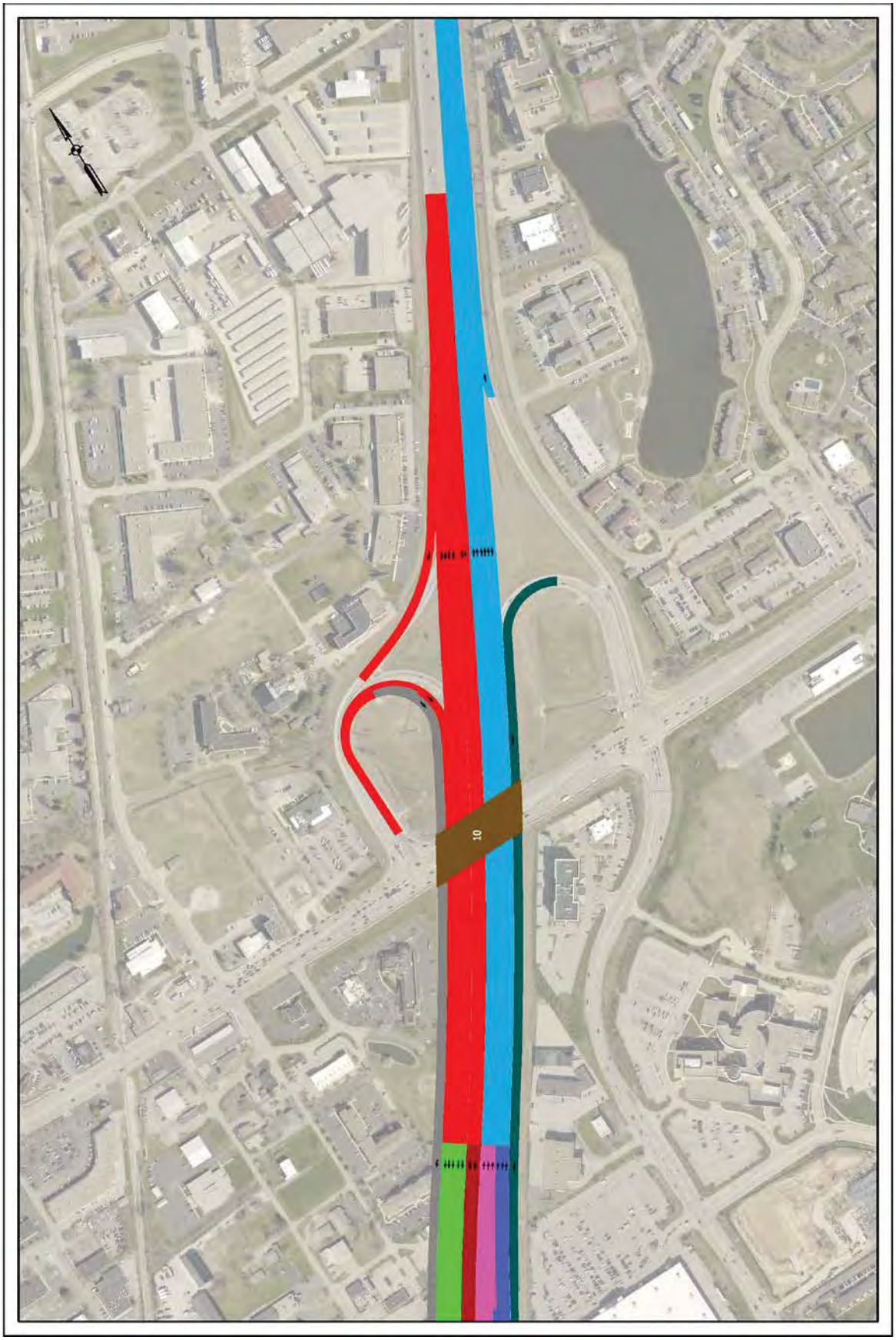


Figure 8: Alternative A Overview (I-69/82nd Street Interchange)

2.7 BUILD ALTERNATIVE B

Refer to Figure 9, Figure 10 and Preliminary Plans in Appendix A, Plans A – 12 to A – 22 for the plan view layout of Build Alternative B. The primary features of this alternative include:

- Two-lane underpass direct connection for eastbound I-465 to northbound I-69/82nd Street and southbound Binford Boulevard.
- Two-lane exit to 82nd Street from I-69 north.
- Westbound I-465 to northbound I-69 passes over the northbound Binford Boulevard and the eastbound I-465 ramps and merges to the left of these movements.
- Southbound I-69 to southbound Binford Boulevard off-ramp is a left-hand exit and passes over I-465.
- Dedicated CD Road for 82nd Street on-ramp.
- Alternative B consists of 9 bridges (refer to Figure 9 and Figure 10 for bridge numbers for this alternative). Included in this option are two I-465 mainline bridges (Bridges 1 and 4), one I-69 mainline bridge (Bridge 9), five 2nd level flyover ramps (Bridges 2, 3, 5, 6, and 7), and one 3rd level flyover ramp (Bridge 8) which spans over I-465 and tapers down to fly under Bridge 3. Bridges 2, 5, and 6 are ramp bridges.

Table 8: Proposed Description and Design Speeds of I-465/I-69 Interchange Ramps: Alternative B

RAMP MOVEMENT	RAMP DESCRIPTION	PROPOSED # OF LANES	DESIGN SPEED
EB I-465 to NB I-69	Under I-465 and Under SB Binford	2	45 mph
EB I-465 to SB Binford	Diverges from EB I-465 to SB Binford	1	45 - 30 mph
EB I-465 to 82nd St.	N/A	N/A	N/A
NB I-465 to NB I-69	Over NB Binford to NB I-69 and over EB I-465 to NB I-69	3	45 mph
NB I-465 to 82nd St.	Diverges from NB I-465 to NB I-69 Ramp	1	45 mph
NB Binford to WB I-465	Proposed Loop Ramp	1	25 mph
NB Binford to NB I-69	Diverges from NB Binford and travels under NB I-465 to NB I-69 Ramp	2	45 mph
NB Binford to 82nd St.	Uses NB I-69 to 82nd St. Ramp	2	25 mph
SB I-69 to SB I-465	Diverges on outside from SB I-69	3	45 mph
SB I-69 to SB Binford	Exits SB I-69 from the left side of SB I-69	2	45 mph
SB I-69 to WB I-465	Diverges on outside from SB I-69 to SB I-465	2	45 mph
SB I-69 to 82nd St.	Exits SB I-69	1	45 – 25 mph
82nd St. to SB Binford	Merges with SB I-69 to SB Binford from CD road	1	45 mph
82nd St. to SB I-69	N/A	N/A	N/A
82nd St. to SB I-465	Merges with SB I-69 to SB I-465 from CD road	1	45 mph
82nd St. to WB I-465	Merges with SB I-69 to WB I-465 from CD road	1	45 mph

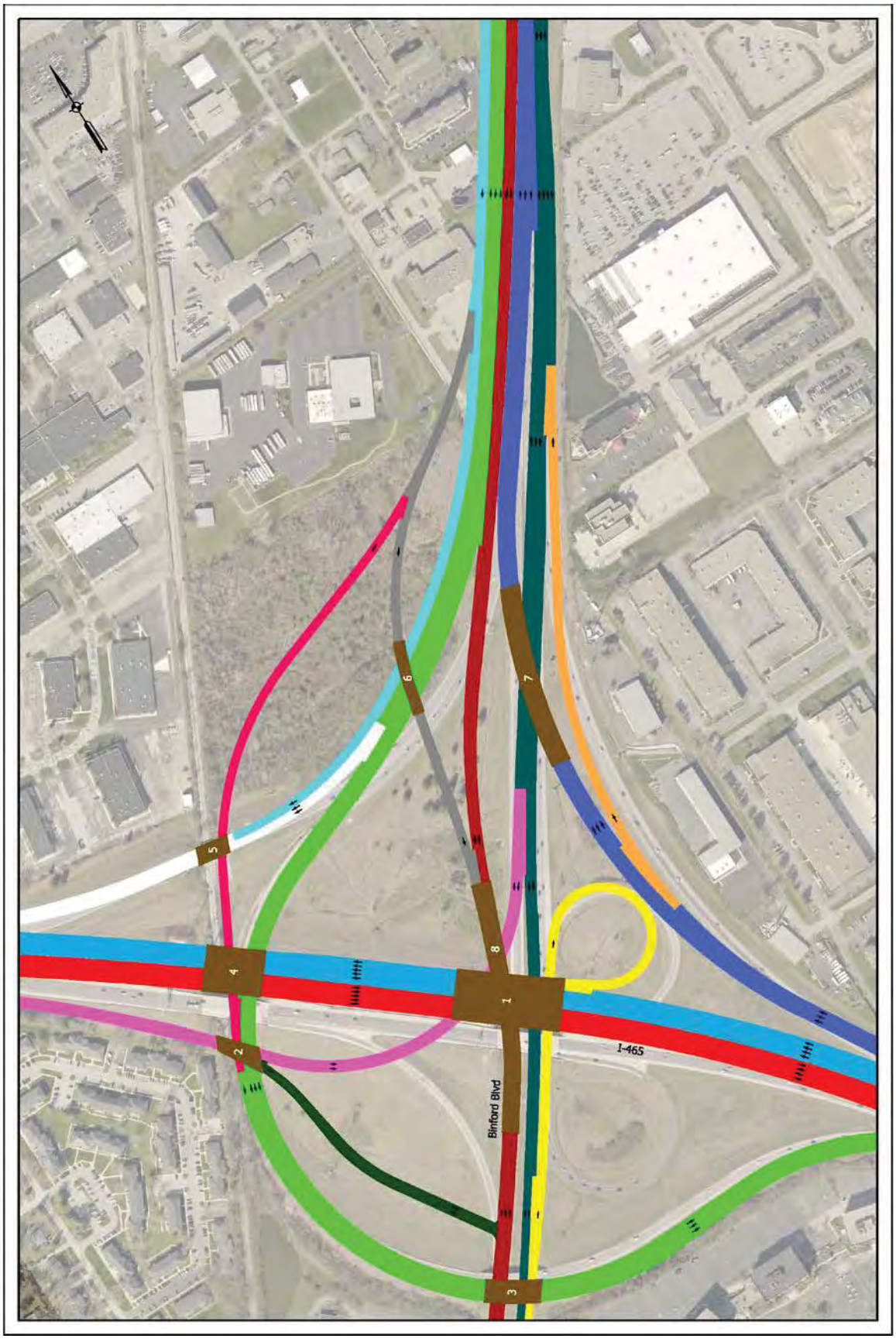


Figure 9: Alternative B Overview (I-465/I-69 Interchange)

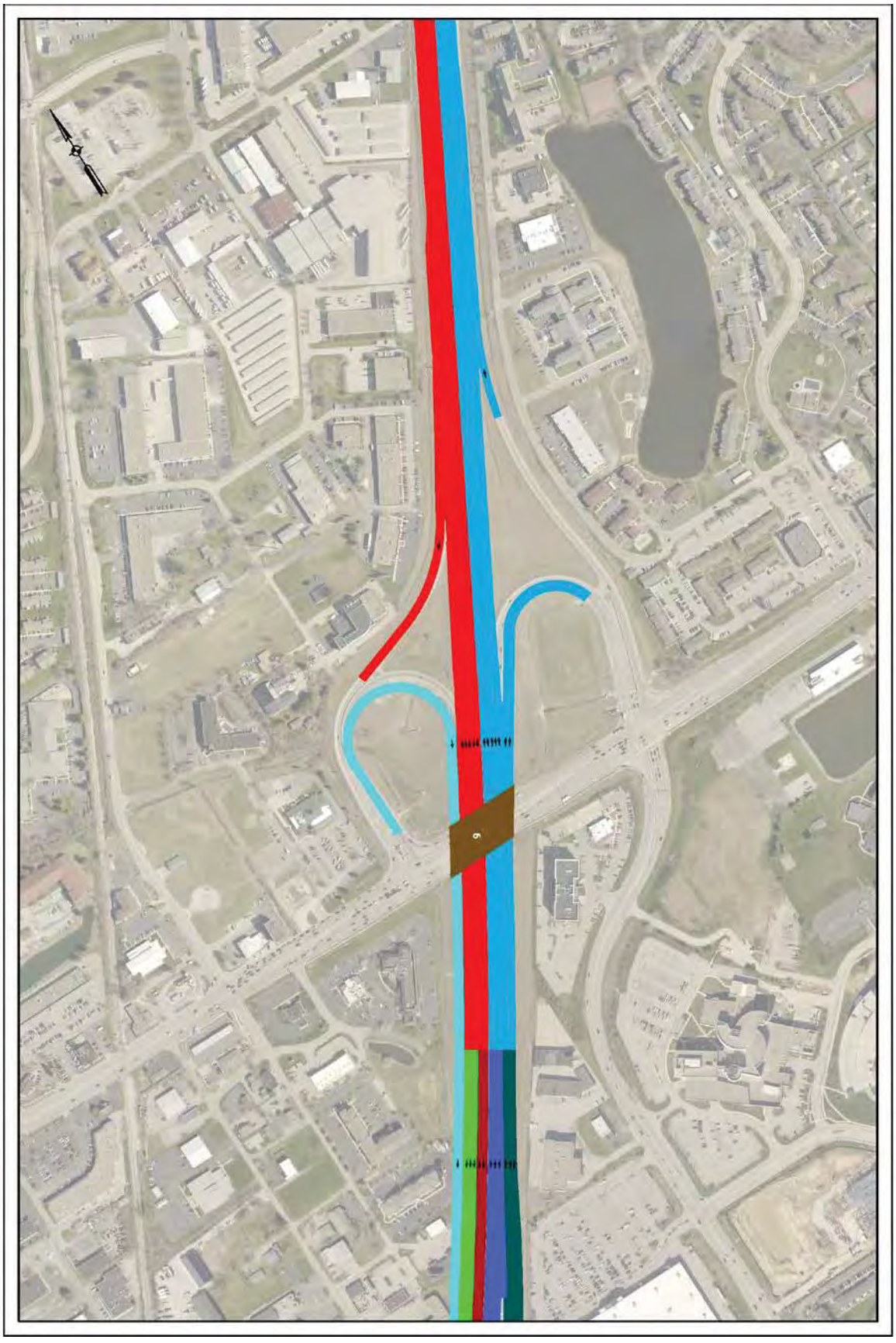


Figure 10: Alternative B Overview (I-69/82nd Street Interchange)

2.8 BUILD ALTERNATIVE C

Refer to Figure 11, Figure 12 and Preliminary Plans in Appendix A, Plans A – 23 to A – 33 for the plan view layout of Build Alternative C. The primary features of this alternative include:

- Two-lane underpass direct connection for eastbound I-465 to northbound I-69 and southbound Binford Boulevard.
- Additional dedicated off-ramp from eastbound I-465 to 82nd St.
- Dedicated CD roadway for traffic to 82nd St from I-465 and Binford Boulevard.
- Westbound I-465 to northbound I-69 passes over the northbound Binford Boulevard to 82nd Street ramp and merges to the right of I-465 east and Binford Boulevard ramp traffic.
- Southbound I-69 to southbound Binford Boulevard off-ramp is a right-hand exit that diverges north of 82nd Street passing over 82nd Street and under I-465.
- Alternative C consists of 11 bridges (refer to Figure 11 and Figure 12 for bridge numbers for this alternative). Included in this option are two I-465 mainline bridges (Bridges 1 and 4), one I-69 mainline bridge (Bridge 11), eight 2nd level flyover ramps (Bridges 2, 3, 5, 6, 7, 8, 9, and 10). Bridges 2, 5, 6, 8, 9, and 10 are ramp bridges.

Table 9: Proposed Description and Design Speeds of I-465/I-69 Interchange Ramps: Alternative C

RAMP MOVEMENT	RAMP DESCRIPTION	PROPOSED # OF LANES	DESIGN SPEED
EB I-465 to NB I-69	Under I-465 and Under SB Binford	2	45 mph
EB I-465 to SB Binford	Diverges from EB I-465 to SB Binford	1	45 – 30 mph
EB I-465 to 82nd St.	Proposed Loop Ramp	1	25 mph
NB I-465 to NB I-69	Over NB Binford to 82nd St Ramp	3	55 mph
NB I-465 to 82nd St.	Diverges from NB I-465 to I-69 Ramp	1	45 mph
NB Binford to WB I-465	Proposed Loop Ramp	1	25 mph
NB Binford to NB I-69	Travels under EB/NB I-465 and merges with EB I-465 to NB I-69 Ramp	2	45 mph
NB Binford to 82nd St.	Diverges off NB Binford to NB I-69 Ramp	1	45 mph
SB I-69 to SB I-465	SB I-69 become ramp movement	3	45 mph
SB I-69 to WB I-465	Exits from outside of SB I-69	2	45 mph
SB I-69 to SB Binford	Exits from outside of north of 82nd St. and travels over 82nd St. Entrance ramp, 82nd St., and SB I-69	2	45 mph
SB I-69 to 82nd St.	Diverges from SB I-69 to SB Binford	1	45 mph
82nd St. to SB Binford	Barrier separated CD road on outside of SB I-69 merges with SB I-69 to SB Binford	1	25 - 45 mph
82nd St. to SB I-69	Merges into I-69 SB	1	25 mph
82nd St. to SB I-465	Uses 82nd St. to SB I-69 Ramp	N/A	N/A
82nd St. to WB I-465	Uses 82nd St. to SB I-69 Ramp	N/A	N/A

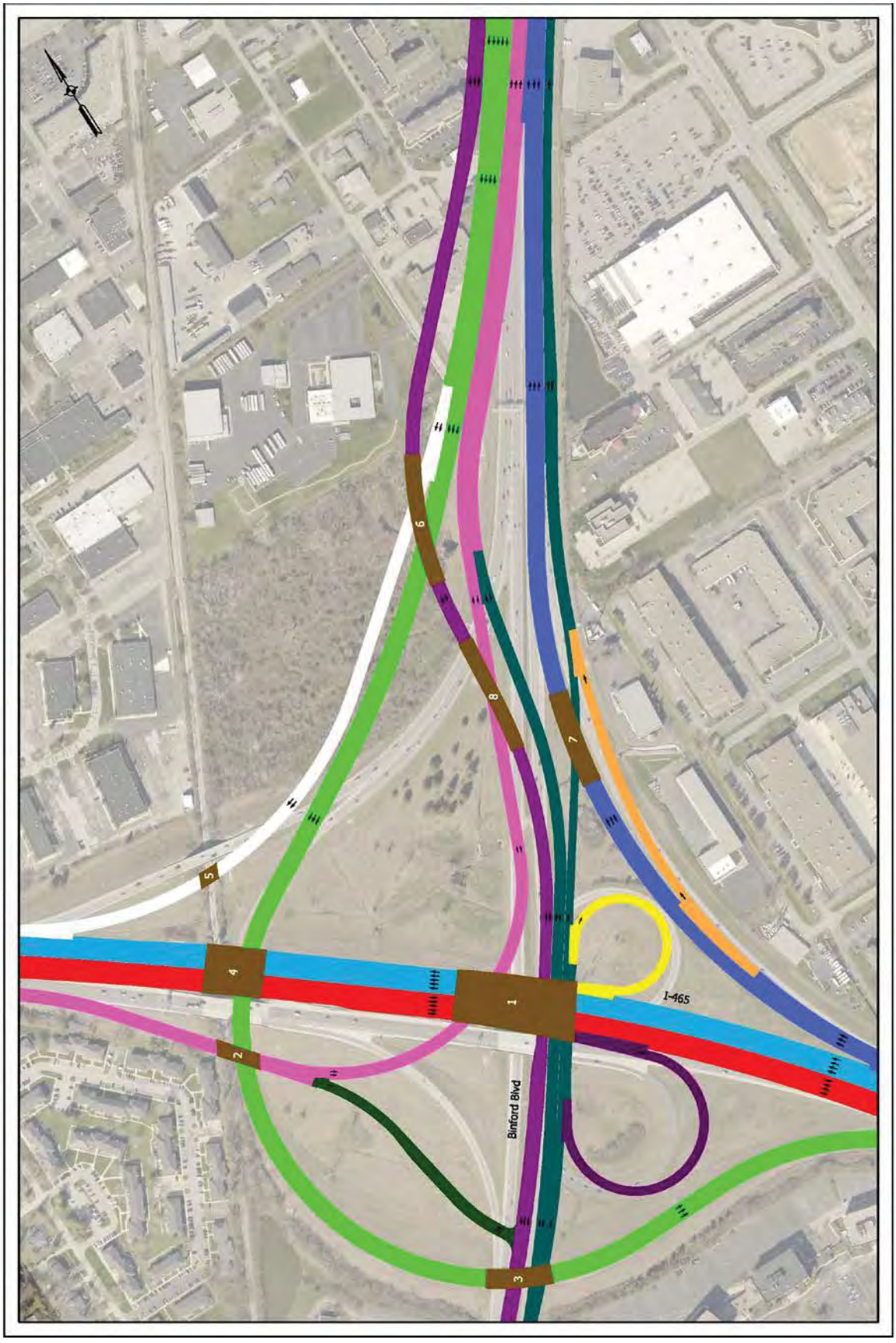


Figure 11: Alternative C Overview (I-465/I-69 Interchange)

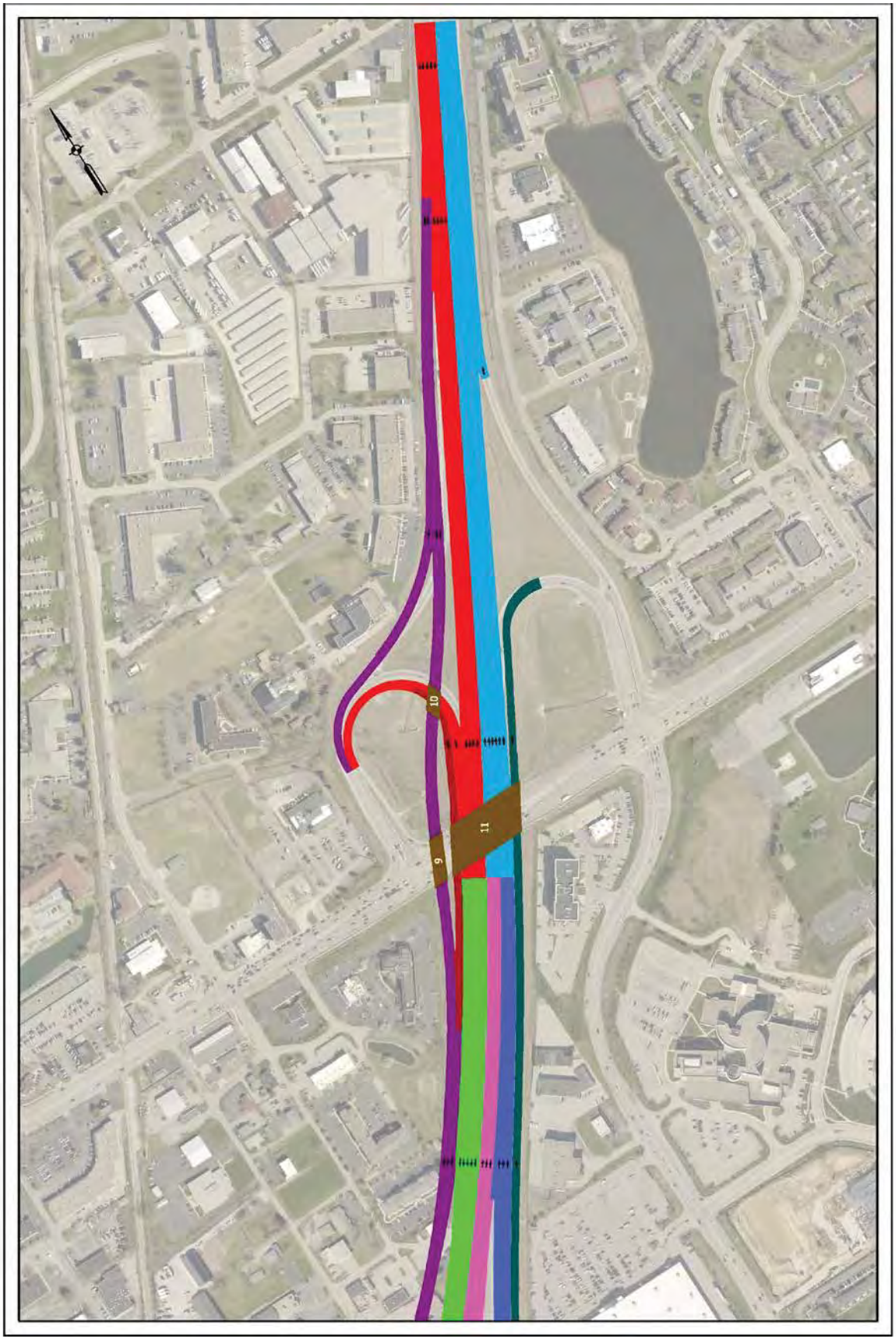


Figure 12: Alternative C Overview (I-69/82nd Street Interchange)

3.0 Alternatives Analysis

3.1 DESIGN-YEAR TRAFFIC OPERATIONS ANALYSIS

Each of the alternatives was analyzed with design-year (2040) forecast peak-hour volumes. The peak hour link volumes and LOS are shown in Figure 13 (No-Build), Figure 14 (Alternative A), Figure 15 (Alternative B), and Figure 16 (Alternative C). Speed heat map tables for each alternative and peak period can be seen in Figure 17 through Figure 24. The four alternatives are compared segment by segment in the sections below.

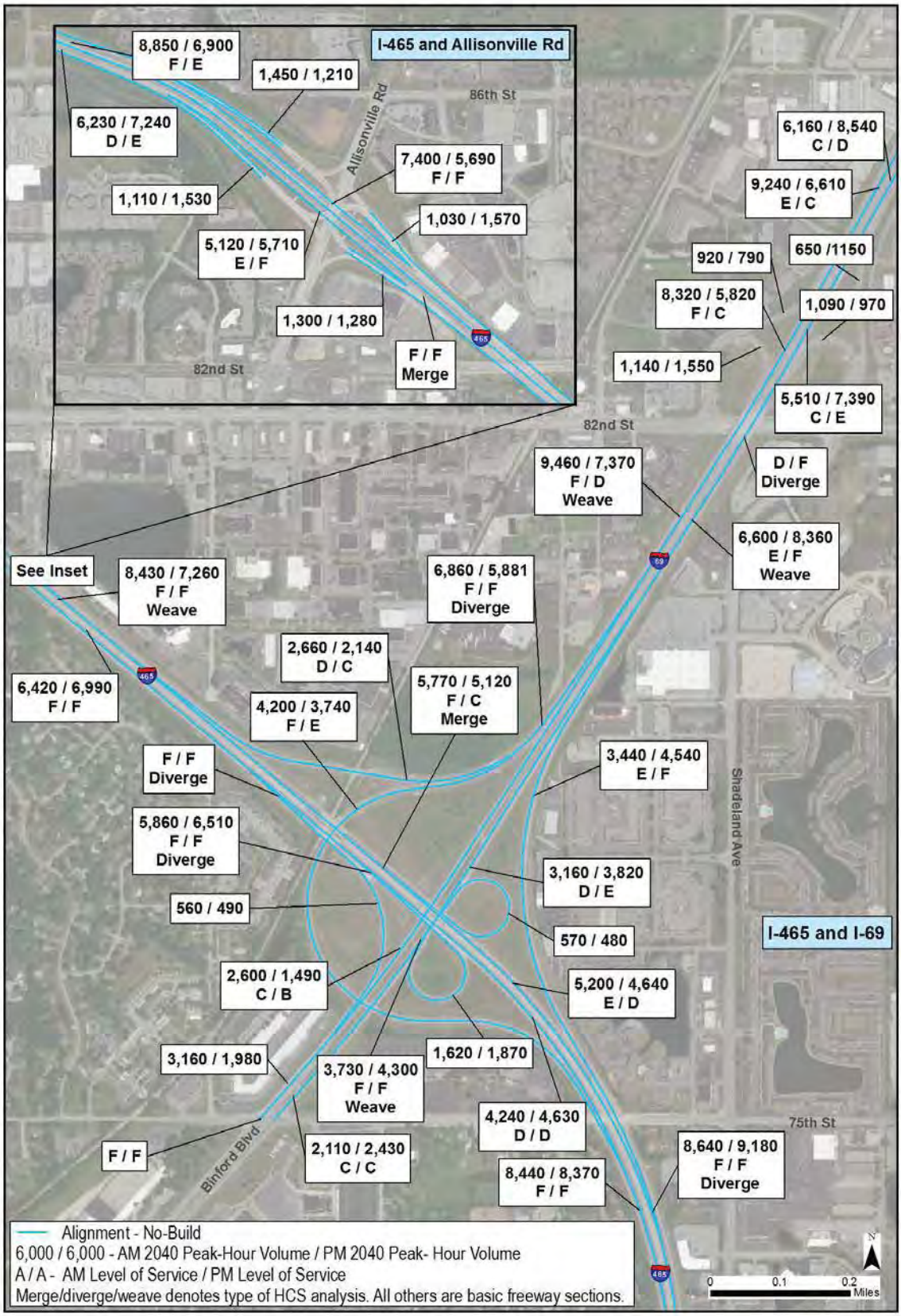


Figure 13: 2040 Peak-Hour Volumes and HCS LOS – No-Build

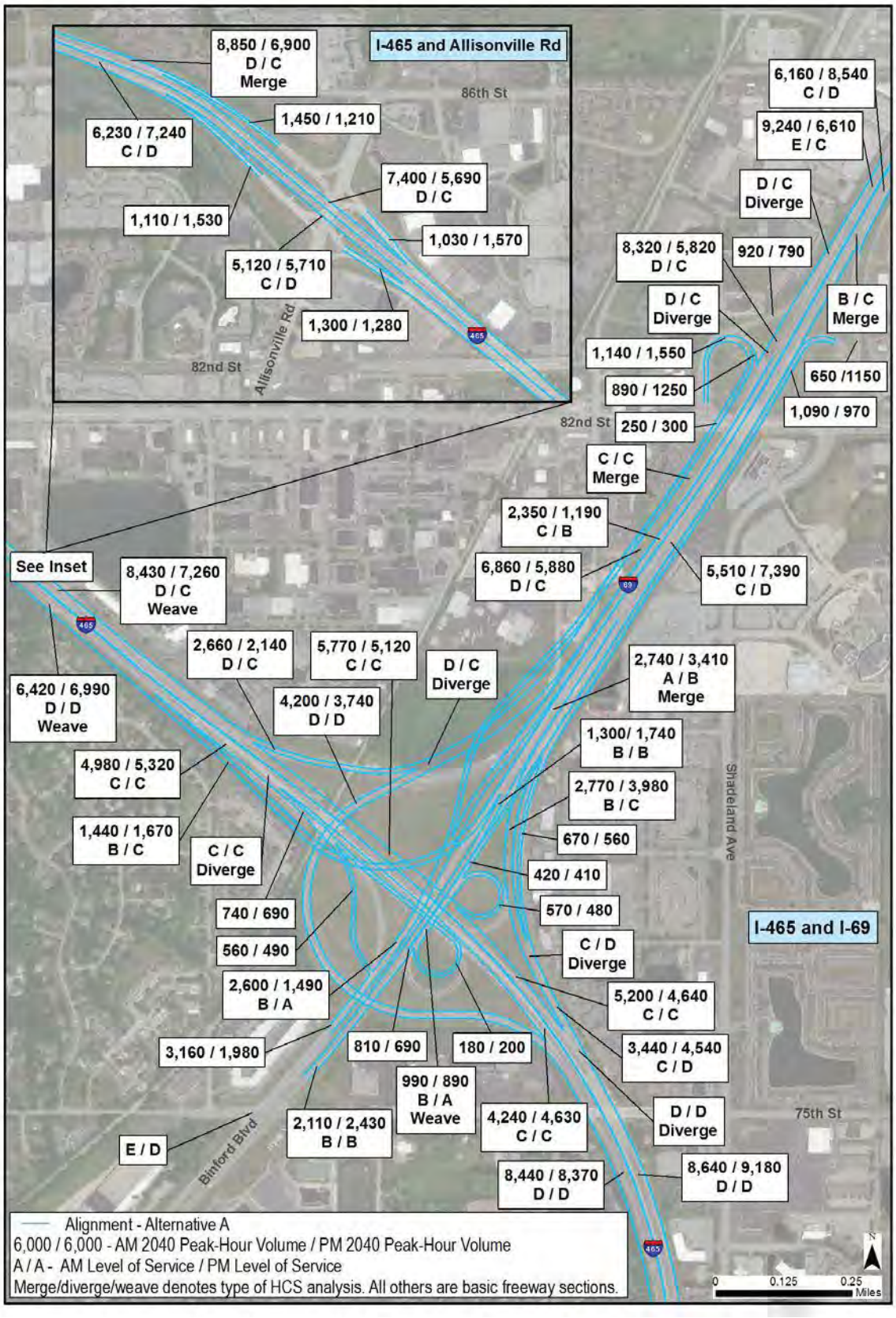


Figure 14: 2040 Peak-Hour Volumes and HCS LOS – Alternative A

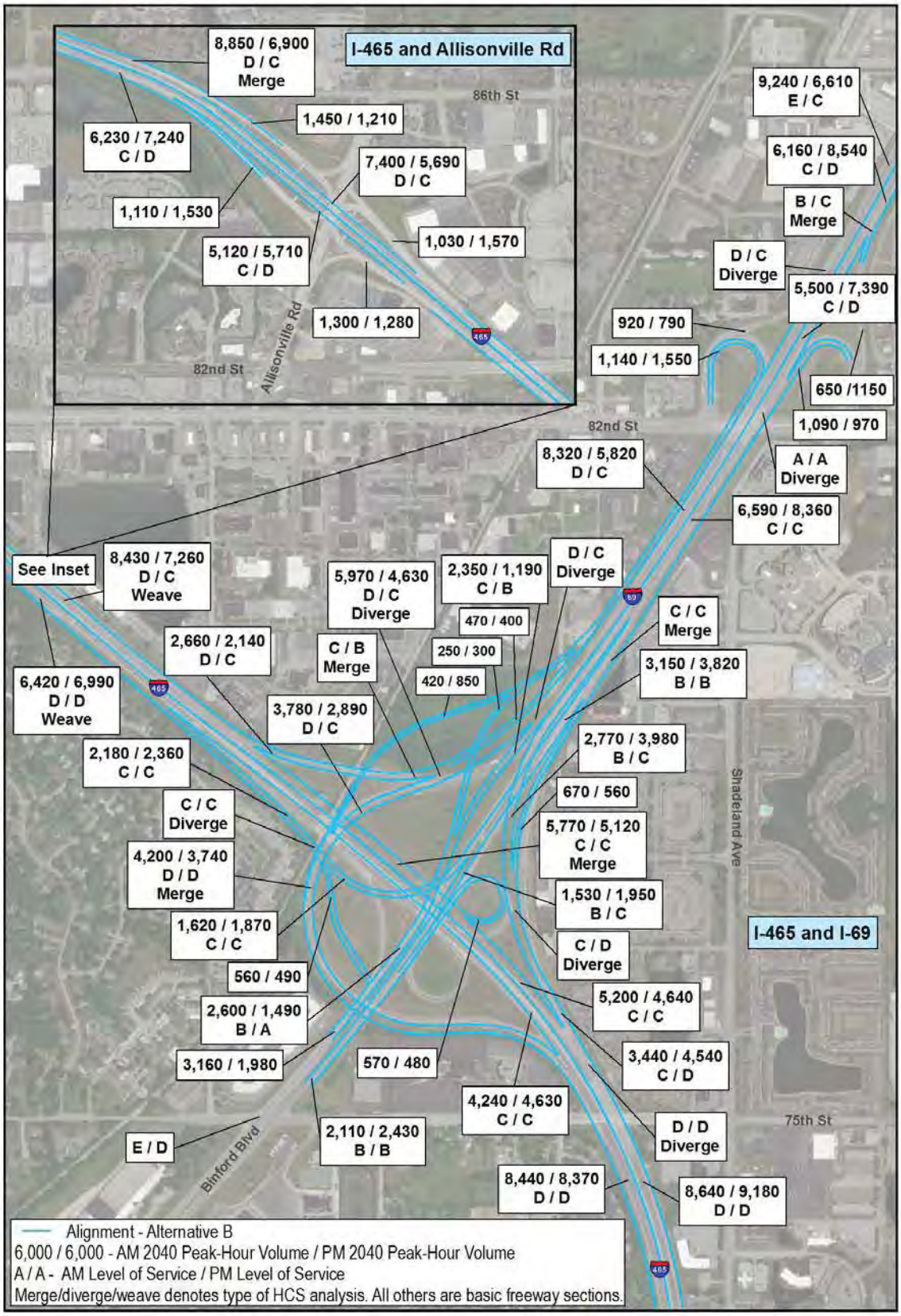


Figure 15: 2040 Peak-Hour Volumes and HCS LOS – Alternative B

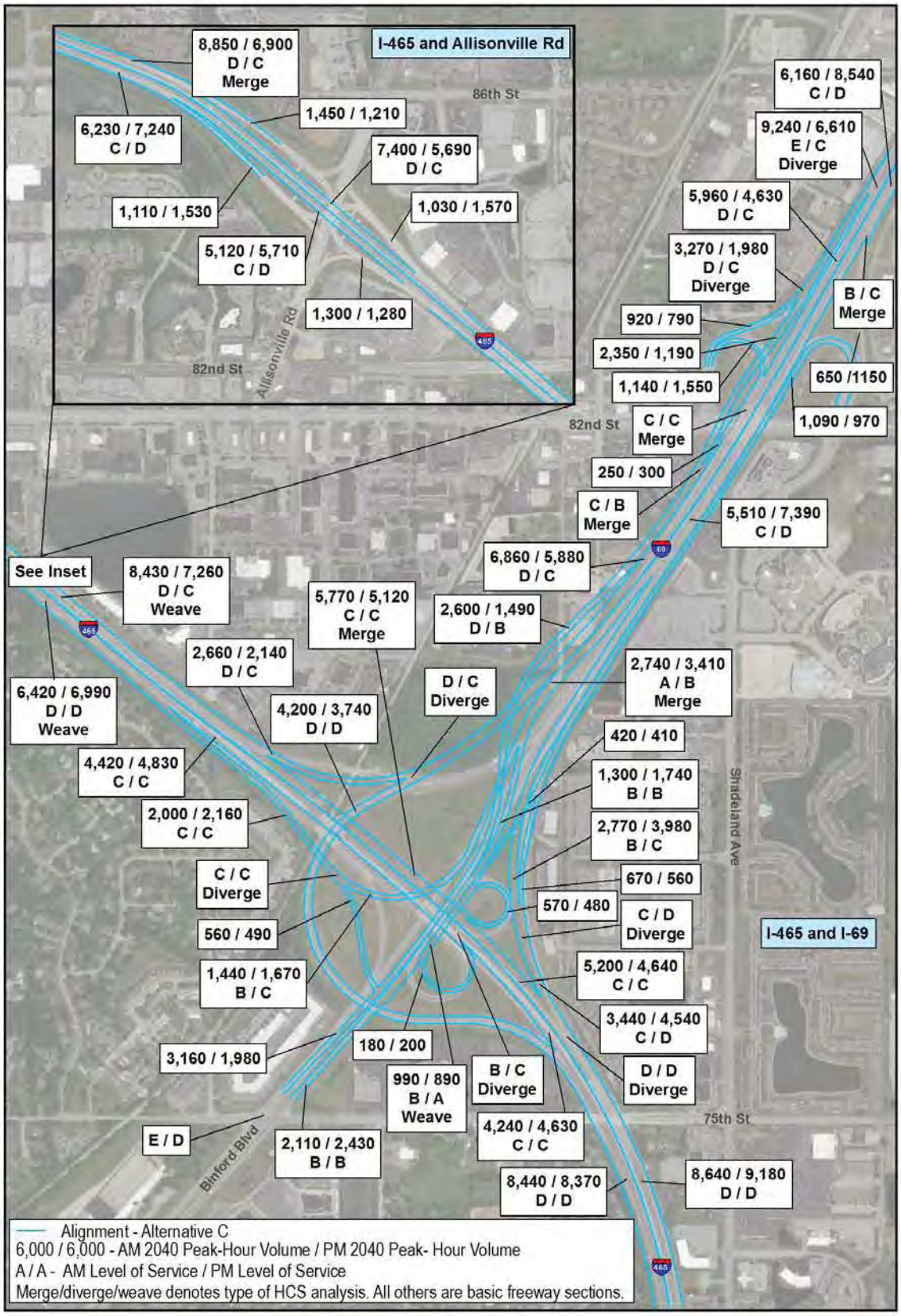


Figure 16: 2040 Peak-Hour Volumes and HCS LOS – Alternative C

No-Build - AM

Route	Segment	6:45	7:00	7:15	7:30	7:45	8:00	8:15	8:30	Peak-Hour Average
SB I-69	106th	64	64	63	63	60	43	36	36	57
		63	62	61	58	24	13	12	13	39
	106th On to 96th Off	62	61	59	51	19	14	15	16	36
		63	62	61	43	19	15	16	17	34
		61	61	60	35	20	16	17	19	33
	96th	63	62	61	28	18	15	16	18	30
		63	62	61	24	18	16	16	18	29
		63	62	58	22	17	16	16	18	28
	96th On to 82nd Off	64	63	50	19	16	15	14	16	25
		59	56	35	22	19	17	17	19	23
		59	52	28	24	20	18	19	20	22
	82nd St	58	45	24	22	18	17	18	19	20
	82nd On to I-465 Split	46	30	26	23	19	18	18	19	21
		50	43	42	39	28	26	25	25	34
		51	50	50	45	30	28	28	31	38
		54	52	51	42	24	24	24	26	35
NB I-69	NB Binford Blvd	57	56	55	56	56	56	56	56	56
		61	54	53	53	54	53	53	53	53
	I-465 to 82nd St Off	64	59	58	58	58	58	58	58	58
		62	54	51	53	52	51	52	52	52
	at 82nd St	65	62	60	61	61	61	61	61	61
	82nd St On to 96th St Off	65	63	62	62	62	62	62	62	62
		65	62	61	61	61	61	61	61	61
		66	64	63	63	63	63	63	63	63
		66	63	63	62	62	63	62	62	63
	at 96th St	67	65	64	64	64	64	64	64	64
		67	65	64	64	64	64	64	64	64
		67	65	64	64	64	64	64	64	64
	96th St On to 106th St Off	67	65	65	65	64	65	65	65	65
		67	65	64	64	64	65	65	65	64
		66	65	64	64	64	64	64	64	64
	at 106th St	67	66	65	65	65	65	65	65	65
		68	66	66	66	65	66	66	66	66
NB/WB I-465	56th St On to NB to NB Ramp	60	38	22	16	16	16	22	26	17
		64	40	34	34	34	34	32	31	34
		65	55	53	54	54	54	53	52	54
		65	56	55	55	55	55	55	52	55
		65	56	54	55	54	53	54	50	54
	NB to NB thru NB to WB	67	59	58	53	40	40	45	39	48
	NB to WB Ramp to SB to WB Ramp	63	57	49	34	31	31	32	26	36
		66	54	36	26	28	28	29	23	30
	I-69 to Allisonville Rd	62	46	29	20	22	23	23	20	23
		64	51	46	45	46	46	45	45	45
	at Allisonville Rd	64	55	52	52	52	52	52	53	52
		64	57	54	54	54	54	54	55	54
		64	57	55	55	55	55	55	55	55
	Allisonville On to Keystone Off	64	60	58	58	58	58	58	58	58
		65	61	60	60	60	60	60	60	60
EB/SB I-465	Keystone On to Allisonville Off	63	61	60	57	51	47	48	56	54
		67	53	48	31	27	28	31	34	33
	at Allisonville Rd	68	55	46	32	30	31	38	39	35
		69	56	46	31	31	31	38	37	36
		69	55	44	30	31	32	36	37	34
		69	54	39	27	28	31	35	35	31
	Allisonville to I-69	63	55	39	28	29	32	37	37	32
		65	50	30	22	23	25	31	31	25
		66	51	46	44	45	43	42	42	45
	EB to SB Ramp to EB to NB Ramp	65	53	49	49	50	48	49	49	49
		63	52	48	48	49	48	48	49	48
		53	46	42	41	44	42	43	45	42
	EB to NB Ramp to SB to SB Ramp	66	57	55	54	54	54	54	54	54
	I-69 to 56th St Off	60	57	56	55	56	56	56	55	56
		63	58	56	56	57	57	57	57	57
		64	60	58	58	58	58	58	58	58

Speed (mph)
>60
60
58
55
53
50

Figure 17: Segment Speeds from Vissim – No-Build – 2040 AM

No-Build - PM

Route	Segment	4:30	4:45	5:00	5:15	5:30	5:45	6:00	6:15	Peak-Hour Average
SB I-69	106th	65	65	65	65	65	65	65	65	65
		64	64	64	64	64	64	65	65	64
	106th On to 96th Off	64	64	64	64	64	64	64	64	64
		64	64	64	64	64	64	64	64	64
		63	62	62	63	62	63	63	64	63
	96th	64	64	64	64	64	64	64	64	64
		64	64	64	64	64	64	64	64	64
		64	64	64	64	64	64	64	64	64
	96th On to 82nd Off	64	64	64	64	64	64	64	65	64
		61	61	61	61	61	60	61	62	61
		61	60	60	60	60	60	60	61	60
	82nd St	61	59	58	56	55	55	59	61	56
	82nd On to I-465 Split	43	33	32	32	27	29	33	45	30
		48	44	43	42	42	41	44	50	42
		54	50	51	48	50	49	49	52	49
		56	53	53	52	53	52	53	55	53
NB I-69	NB Binford Blvd	57	55	54	54	54	54	55	56	54
		59	53	51	51	51	51	52	52	51
	I-465 to 82nd St Off	64	58	57	57	57	57	57	57	57
		62	54	55	53	54	54	55	56	54
	at 82nd St	65	60	59	59	59	59	59	60	59
	82nd St On to 96th St Off	64	61	60	60	60	60	60	60	60
		64	59	58	57	57	58	58	58	57
		65	62	62	61	61	61	62	62	61
		65	62	62	61	61	61	62	61	61
	at 96th St	66	63	63	62	62	63	63	63	62
		66	64	63	63	63	63	63	63	63
		66	64	63	63	63	63	63	63	63
	96th St On to 106th St Off	66	64	63	63	63	63	63	63	63
		66	64	63	63	63	63	63	63	63
		65	62	61	61	61	61	61	61	61
	at 106th St	66	64	63	63	63	63	63	63	63
		67	65	65	65	65	65	65	65	65
NB/WB I-465	56th St On to NB to NB Ramp	61	35	29	28	28	27	28	31	26
		64	36	31	31	31	30	31	32	31
		66	54	53	54	54	53	53	53	53
		66	55	55	55	55	55	55	55	55
		66	56	55	55	55	55	55	55	55
	NB to NB thru NB to WB	67	60	59	59	59	59	59	60	59
	NB to WB Ramp to SB to WB Ramp	64	59	58	58	59	58	58	59	58
		67	57	57	57	56	57	57	58	57
	I-69 to Allisonville Rd	63	54	53	55	52	53	52	56	53
		64	55	53	53	53	53	54	55	53
	at Allisonville Rd	65	57	56	55	56	55	56	57	55
		65	58	57	57	57	57	57	57	57
		65	58	57	57	57	57	57	57	57
	Allisonville On to Keystone Off	64	60	59	59	59	59	59	60	59
		65	62	61	61	61	61	61	61	61
EB/SB I-465	Keystone On to Allisonville Off	60	55	45	36	30	24	20	18	34
		65	39	26	25	24	24	25	25	25
	at Allisonville Rd	67	44	29	28	27	26	29	29	27
		68	43	29	29	28	28	30	30	28
		68	41	29	28	28	28	29	30	28
		69	38	28	27	27	26	29	30	27
	Allisonville to I-69	62	38	30	28	28	28	31	32	29
		64	31	22	23	22	22	24	26	22
		65	44	42	40	41	39	40	39	40
	EB to SB Ramp to EB to NB Ramp	65	50	47	48	47	46	46	46	47
		62	49	47	46	47	47	47	48	47
		54	42	39	40	40	42	41	43	40
	EB to NB Ramp to SB to SB Ramp	65	55	54	54	54	54	54	54	54
	I-69 to 56th St Off	60	57	56	56	56	56	56	56	56
		63	58	56	56	56	56	56	57	56
		64	60	58	58	58	58	58	59	58

Speed (mph)
>60
60
58
55
53
50

Figure 18: Segment Speeds from Vissim – No-Build – 2040 PM

Alternative A - AM

Route	Segment	6:45	7:00	7:15	7:30	7:45	8:00	8:15	8:30	Peak-Hour Average
SB I-69	at 106th St	65	65	64	64	64	65	65	65	64
		65	64	63	64	64	65	65	65	64
	106th St On to 96th St Off	63	62	61	62	62	63	64	64	62
		63	62	60	61	62	63	63	63	61
		60	59	56	57	57	61	62	62	58
	at 96th St	63	62	61	61	61	62	63	63	61
		63	61	61	61	61	62	63	63	61
		63	62	61	61	62	62	63	63	62
	96th St On to 82nd St Off	64	64	63	63	64	64	64	64	63
		60	58	56	56	58	59	60	60	57
		60	59	58	58	59	60	60	60	59
	at 82nd St	61	60	59	60	60	61	61	61	60
	82nd St On to I-465 Split	59	57	54	55	57	58	59	59	56
		59	57	55	55	56	58	59	59	56
		60	59	58	58	59	60	60	61	59
NB I-69	EB to NB Ramp On to NB to NB Ramp On	60	59	58	58	58	59	59	59	59
		63	63	62	62	62	63	63	63	62
	at 82nd St	62	61	60	61	61	61	62	62	61
		63	62	62	62	62	62	63	63	62
		64	63	62	63	62	63	63	64	62
	82nd St to 96th St	63	62	61	61	61	62	63	63	62
		62	60	59	59	60	61	62	62	60
		64	63	62	62	62	63	64	64	62
		64	63	62	62	62	63	64	64	62
	at 96th St	65	64	63	63	63	64	64	64	63
		65	64	64	64	64	64	65	65	64
		65	64	64	64	64	64	65	65	64
	96th St to 106th St	66	65	65	64	65	65	65	65	65
		65	64	64	64	64	64	65	65	64
		64	63	62	63	62	63	64	64	63
	at 106th St	66	65	64	64	64	65	65	65	64
		66	66	65	65	65	66	66	66	65
NB/WB I-465	56th/Shadeland On to NB to NB Ramp	60	59	58	58	58	59	60	60	58
		61	59	59	59	59	60	61	61	59
		60	59	58	58	58	59	60	60	58
		60	59	59	59	59	60	61	61	59
		61	60	60	60	60	60	61	61	60
	NB to NB Ramp to NB to WB Ramp	62	61	60	60	60	61	62	62	60
	NB to WB Ramp to SB to WB Ramp	60	59	58	58	58	59	60	60	58
		61	60	59	59	59	60	61	62	59
		61	60	58	59	58	60	61	61	59
	I-69 to Allisonville Rd	60	59	58	58	58	59	59	60	58
		62	61	60	59	60	60	61	62	60
	at Allisonville Rd	62	60	59	59	59	60	61	62	59
		62	61	60	60	60	61	62	62	60
		62	61	60	60	60	61	62	62	60
		62	61	60	60	60	61	62	62	60
	Allisonville Rd On to Keystone Ave Off	62	61	59	59	60	60	61	62	60
		63	61	60	60	60	61	62	62	61
EB/SB I-465	Keystone Ave On to Allisonville Rd Off	63	62	61	61	61	62	63	63	61
		61	60	59	58	60	60	61	61	59
	at Allisonville Rd	62	61	60	60	60	61	62	62	60
		62	61	60	60	60	61	62	61	60
		62	61	59	59	59	60	62	61	60
		61	60	59	59	59	60	61	61	59
	Allisonville Rd On to I-69	61	61	60	60	60	61	62	61	60
		62	61	60	60	60	61	62	62	60
		61	59	58	58	59	60	61	61	58
	EB to NB Ramp to EB to 82nd St Ramp	62	61	60	59	60	60	61	61	60
		61	60	59	58	59	60	61	60	59
	EB to 82nd St Ramp to SB to SB Ramp	63	62	61	61	61	62	62	62	61
		63	62	62	62	62	62	63	63	62
		63	62	62	62	62	63	63	63	62
		64	63	62	61	62	62	63	63	62
	I-69 to 56th/Shadeland	62	61	60	60	60	61	62	62	60
		61	59	57	57	58	59	60	61	58
		60	58	55	54	56	58	59	60	56
		61	59	58	57	58	59	60	60	58

Speed (mph)
>62.5
60
58
55
53
50

Figure 19: Segment Speeds from Vissim – Alternative A – 2040 AM

Alternative A - PM

Route	Segment	4:30	4:45	5:00	5:15	5:30	5:45	6:00	6:15	Peak-Hour Average
SB I-69	at 106th St	66	66	66	66	66	66	66	66	66
		66	66	66	66	65	66	66	66	66
	106th St On to 96th St Off	64	64	64	64	64	64	64	65	64
		64	64	64	64	64	64	64	65	64
		63	63	63	63	63	62	63	63	63
	at 96th St	64	64	64	64	64	64	64	64	64
		64	64	64	64	64	64	64	64	64
		64	64	64	64	64	64	64	64	64
	96th St On to 82nd St Off	64	64	64	64	64	64	65	65	64
		61	61	61	61	61	61	62	62	61
		61	60	61	61	60	60	61	61	61
	at 82nd St	62	61	62	62	61	61	62	62	61
	82nd St On to I-465 Split	58	58	59	58	58	57	59	60	58
		59	58	58	58	58	57	59	60	58
		61	60	60	60	60	60	60	61	60
NB I-69	EB to NB Ramp On to NB to NB Ramp On	59	58	57	57	58	58	58	58	57
		61	61	60	60	60	61	61	61	60
	at 82nd St	59	59	58	58	58	58	59	60	58
		61	60	60	60	60	60	61	61	60
		62	61	61	61	61	61	61	62	61
	82nd St to 96th St	60	59	59	58	58	59	59	60	58
		57	54	54	53	53	53	55	56	54
		61	59	60	59	59	59	60	61	59
		62	61	60	61	61	60	61	61	61
	at 96th St	63	62	61	62	61	61	62	62	62
		63	62	62	62	62	62	62	62	62
		63	62	62	62	62	62	62	63	62
	96th St to 106th St	64	64	63	63	63	63	64	64	63
		64	63	63	62	62	62	63	63	62
		61	60	59	59	58	57	60	61	59
	at 106th St	64	63	63	63	63	62	63	63	63
		65	64	64	64	64	64	64	65	64
NB/WB I-465	56th/Shadeland On to NB to NB Ramp	57	57	57	57	57	57	57	58	57
		59	59	59	59	59	59	59	60	59
		59	58	59	59	58	58	59	59	59
		59	59	59	59	59	59	59	60	59
		60	60	60	60	60	60	60	60	60
	NB to NB Ramp to NB to WB Ramp	61	60	60	60	60	60	60	61	60
	NB to WB Ramp to SB to WB Ramp	59	59	59	59	59	59	59	60	59
		60	60	60	60	59	59	59	60	60
		60	59	59	59	59	59	59	60	59
	I-69 to Allisonville Rd	59	58	58	58	58	58	58	59	58
		61	60	60	60	60	60	60	61	60
	at Allisonville Rd	61	61	61	60	61	60	61	61	61
		62	62	61	61	61	61	61	62	61
		62	62	61	61	61	61	61	62	61
		62	62	61	61	61	61	62	62	61
	Allisonville Rd On to Keystone Ave Off	62	61	61	61	61	61	61	62	61
		63	62	62	62	62	61	62	62	62
EB/SB I-465	Keystone Ave On to Allisonville Rd Off	59	59	59	59	59	59	59	60	59
		57	57	55	56	56	57	57	57	56
	at Allisonville Rd	59	58	58	58	58	58	58	59	58
		58	58	58	57	58	58	58	58	58
		58	57	57	57	57	57	58	58	57
		57	57	57	56	57	57	57	58	57
	Allisonville Rd On to I-69	59	58	58	58	58	58	59	59	58
		59	58	58	58	58	58	59	59	58
		57	56	56	56	55	56	56	57	56
	EB to NB Ramp to EB to 82nd St Ramp	59	58	58	58	58	58	58	59	58
		58	56	58	56	57	58	58	59	57
	EB to 82nd St Ramp to SB to SB Ramp	60	59	59	59	59	59	59	60	59
		61	60	60	60	60	60	60	61	60
		61	60	61	60	60	60	60	61	60
		61	61	61	60	60	60	60	61	60
	I-69 to 56th/Shadeland	61	61	60	60	60	60	61	61	60
		58	56	55	56	55	55	56	59	56
		57	54	53	53	53	53	54	57	53
		58	57	57	57	57	56	57	58	57

Speed (mph)
>62.5
60
58
55
53
50

Figure 20: Segment Speeds from Vissim – Alternative A – 2040 PM

Alternative B - AM

Route	Segment	6:45	7:00	7:15	7:30	7:45	8:00	8:15	8:30	Peak-Hour Average
SB I-69	at 106th St	65	65	64	64	65	65	65	65	64
		65	64	63	64	64	65	65	65	64
	106th St On to 96th St Off	63	62	61	61	62	63	64	64	62
		63	62	61	61	62	63	64	64	62
		63	61	61	59	61	61	63	62	61
	at 96th St	63	62	62	62	62	63	63	63	62
		63	62	62	62	62	63	63	63	62
		63	62	62	62	62	63	63	63	62
	96th St On to 82nd St Off	64	63	63	63	63	63	64	64	63
		61	59	58	58	59	60	61	61	59
		60	59	58	58	59	60	60	60	59
	at 82nd St	60	59	58	58	59	60	60	60	59
	82nd St On to I-465 Split	60	59	58	58	59	60	60	60	59
		59	58	56	56	57	58	60	60	57
		59	58	56	56	57	58	59	60	57
		60	59	57	57	58	59	60	60	58
NB I-69	EB to NB Ramp On to NB Slip Ramp On	62	61	60	60	60	61	61	61	60
		62	60	59	59	59	60	61	61	59
	NB Slip Ramp On to NB to NB Ramp Merge	61	59	59	59	59	60	61	61	59
		61	58	57	57	58	58	60	60	58
	NB to NB Ramp Merge to 82nd St Off	63	61	61	61	61	61	62	62	61
		63	62	62	62	62	62	63	63	62
	at 82nd St	64	63	62	62	62	63	63	63	62
	82nd St On to 96th St Off	63	62	61	61	61	62	63	63	61
		62	60	59	59	60	61	61	62	60
		64	63	63	63	63	63	64	64	63
		65	64	64	64	64	64	65	64	64
	at 96th St	65	64	64	64	64	64	65	65	64
		65	64	64	64	64	64	65	65	64
		65	64	64	64	64	64	65	65	64
	96th St On to 106th St Off	65	65	64	64	64	65	65	65	64
		65	65	64	64	64	65	65	65	64
		65	64	63	63	63	64	65	64	63
	at 106th St	66	65	64	64	64	65	65	65	64
NB/WB I-465	56th/Shadeland On to NB to NB Ramp	60	59	58	58	58	60	60	60	58
		61	59	59	59	59	60	61	61	59
		60	59	58	58	58	59	60	61	58
		61	59	59	59	59	60	61	61	59
		61	59	59	58	59	60	61	61	59
	NB to NB Ramp to NB to WB Ramp	61	60	60	59	60	60	61	62	60
	NB to WB Ramp to SB to WB Ramp	60	59	58	58	58	59	60	60	58
		60	59	58	57	57	59	60	61	58
		60	59	57	57	57	59	60	60	58
	I-69 to Allisonville Rd	61	60	59	59	59	60	61	61	59
		61	60	59	59	59	60	61	61	59
	at Allisonville Rd	61	60	59	59	59	60	61	62	59
		61	60	59	59	59	60	61	62	59
		62	61	59	59	59	60	61	62	60
		62	61	60	59	60	60	61	62	60
	Allisonville Rd On to Keystone Ave Off	62	61	60	60	60	61	62	62	60
		62	60	59	59	59	60	61	62	59
EB/SB I-465	Keystone Ave On to Allisonville Rd Off	63	62	61	61	61	62	63	63	61
		61	60	59	59	59	60	61	61	59
	at Allisonville Rd	62	61	60	60	60	61	62	61	60
		61	61	59	59	60	60	61	61	60
		61	60	59	59	59	60	61	61	59
		61	59	58	58	58	59	60	60	58
	Allisonville Rd On to I-69	61	60	59	59	59	60	61	61	59
		61	60	59	59	59	60	61	61	59
		60	59	58	57	58	59	61	60	58
	EB to NB Ramp to EB to 82nd St Ramp	63	62	61	61	61	62	63	63	62
		63	63	62	62	62	62	63	63	62
		63	63	62	62	62	62	63	63	62
		64	63	62	62	62	63	64	63	63
	EB to 82nd St Ramp to SB to SB Ramp	63	63	62	61	62	62	63	63	62
	I-69 to 56th/Shadeland	62	61	60	60	60	61	62	62	60
		61	59	57	56	58	59	61	61	58
		61	58	56	55	56	58	60	60	56
		61	59	58	58	58	59	60	60	58

Speed (mph)
>62.5
60
57.5
55
52.5
<50

Figure 21: Segment Speeds from Vissim – Alternative B – 2040 AM

Alternative B - PM

Route	Segment	4:30	4:45	5:00	5:15	5:30	5:45	6:00	6:15	Peak-Hour Average
SB I-69	at 106th St	66	66	66	66	66	66	66	66	66
		66	66	66	65	65	65	66	66	66
	106th St On to 96th St Off	65	65	65	64	64	65	65	65	65
		64	64	64	64	64	64	65	65	64
		64	63	64	63	63	64	64	64	63
	at 96th St	64	64	64	64	64	64	64	65	64
		64	64	64	64	64	64	64	65	64
		64	64	64	64	64	64	64	64	64
	96th St On to 82nd St Off	64	64	64	64	64	64	64	65	64
		62	62	62	62	61	61	62	62	62
		62	61	61	61	61	61	62	62	61
	at 82nd St	62	62	62	62	61	61	62	62	62
	82nd St On to I-465 Split	61	61	61	61	61	61	61	62	61
		61	60	60	60	60	60	61	61	60
		60	60	60	60	60	60	60	61	60
		61	61	60	60	60	60	61	61	60
NB I-69	EB to NB Ramp On to NB Slip Ramp On	59	58	58	58	58	59	59	59	58
		58	56	57	56	56	57	57	58	56
	NB Slip Ramp On to NB to NB Ramp Merge	58	56	57	57	56	57	57	58	56
		57	54	54	54	54	55	55	56	54
	NB to NB Ramp Merge to 82nd St Off	60	59	59	59	59	59	59	60	59
		61	60	60	60	60	60	61	61	60
	at 82nd St	61	61	61	61	60	61	61	61	61
	82nd St On to 96th St Off	58	56	55	57	56	56	57	58	56
		56	54	53	54	53	53	55	56	54
		62	61	60	60	60	60	61	62	60
		63	62	62	62	62	62	62	63	62
	at 96th St	63	62	62	62	62	62	62	63	62
		63	62	62	62	62	62	62	63	62
		63	62	62	62	62	62	62	63	62
	96th St On to 106th St Off	64	63	63	63	63	63	63	63	63
		64	63	63	63	63	62	63	63	63
		62	60	60	60	58	55	59	60	59
	at 106th St	64	63	62	62	62	62	63	63	62
NB/WB I-465	56th/Shadeland On to NB to NB Ramp	57	57	57	57	57	57	57	59	57
		60	59	59	59	59	59	59	60	59
		59	58	59	59	59	59	59	60	59
		59	59	59	59	59	59	59	60	59
		59	59	59	59	59	59	59	60	59
	NB to NB Ramp to NB to WB Ramp	61	60	61	60	60	60	60	61	60
	NB to WB Ramp to SB to WB Ramp	60	59	60	59	59	59	59	60	59
		60	59	60	59	59	59	59	61	59
		59	58	59	58	58	58	59	60	58
	I-69 to Allisonville Rd	60	59	59	59	59	59	59	60	59
		61	60	60	60	60	60	60	61	60
	at Allisonville Rd	62	61	61	61	61	60	60	61	61
		62	61	61	61	61	61	61	62	61
		62	62	62	61	61	61	61	62	61
		62	62	62	61	61	61	61	62	62
	Allisonville Rd On to Keystone Ave Off	63	62	62	62	62	62	62	62	62
		62	62	61	61	61	61	61	62	61
EB/SB I-465	Keystone Ave On to Allisonville Rd Off	59	59	59	59	59	59	60	60	59
		56	57	56	57	56	56	56	58	56
	at Allisonville Rd	58	58	58	58	57	58	58	59	58
		58	57	58	57	57	57	58	58	57
		56	55	56	56	55	56	57	57	56
		55	55	55	54	55	55	56	56	55
	Allisonville Rd On to I-69	58	57	57	57	57	57	58	58	57
		58	57	57	57	57	57	58	58	57
		56	56	56	56	55	56	56	58	56
	EB to NB Ramp to EB to 82nd St Ramp	60	60	60	60	59	60	60	60	60
		61	61	60	60	60	60	61	61	60
		61	61	60	60	60	60	61	61	60
		62	61	61	61	61	61	61	62	61
	EB to 82nd St Ramp to SB to SB Ramp	61	60	60	60	60	60	60	61	60
	I-69 to 56th/Shadeland	61	61	60	60	60	60	61	61	60
		58	55	56	56	56	55	57	59	56
		56	54	54	54	53	52	54	57	54
		60	57	57	58	56	56	57	58	57

Speed (mph)
>62.5
60
57.5
55
52.5
50

Figure 22: Segment Speeds from Vissim – Alternative B – 2040 PM

Alternative C - AM

Route	Segment	6:45	7:00	7:15	7:30	7:45	8:00	8:15	8:30	Peak-Hour Average
SB I-69	at 106th St	65	65	64	64	65	65	65	65	65
		65	64	63	64	64	65	65	65	64
	106th St On to 96th St Off	63	62	61	61	62	63	64	64	62
		63	62	61	61	62	63	64	64	62
		62	59	58	57	59	60	62	62	58
	at 96th St	62	61	60	60	61	62	63	63	61
		63	62	61	62	62	63	63	63	62
		62	61	58	60	60	62	63	63	60
	96th St On to 82nd St Off	63	62	59	61	61	63	63	63	61
		60	58	55	57	58	59	60	61	57
		59	58	57	57	58	59	60	59	58
	at 82nd St	60	59	58	58	59	60	61	61	59
	82nd St On to I-465 Split	60	59	58	58	59	60	61	61	59
		59	57	55	56	56	58	59	60	56
		59	58	56	56	57	58	59	60	57
		60	59	57	57	58	59	60	60	58
NB I-69	EB to NB Ramp On to NB to NB Ramp On	64	63	63	62	63	63	63	63	63
		64	63	62	62	62	63	63	64	62
	at 82nd St	63	62	61	61	61	62	62	63	61
		64	63	63	63	63	63	63	64	63
		64	63	62	62	62	63	63	64	63
	82nd St On to 96th St Off	64	62	62	62	62	63	63	63	62
		63	61	60	60	60	61	62	62	60
		65	63	63	63	63	63	64	64	63
		65	63	63	63	63	63	64	64	63
	at 96th St	65	64	64	63	64	64	65	65	64
		65	64	64	64	64	64	65	65	64
		65	64	64	64	64	64	65	65	64
	96th St On to 106th St Off	66	65	64	64	64	65	65	65	64
		66	65	64	64	64	65	65	65	64
		65	64	63	64	64	64	64	65	64
	at 106th St	66	65	64	64	64	65	65	65	64
		67	66	65	65	65	66	66	66	65
NB/WB I-465	56th/Shadeland On to NB to NB Ramp	60	59	58	59	59	60	61	61	59
		60	59	59	59	59	60	61	61	59
		60	59	58	58	58	59	60	60	59
		61	59	59	59	59	60	61	61	59
		61	59	59	59	59	60	61	60	59
	NB to NB Ramp to NB to WB Ramp	61	60	60	60	60	60	61	61	60
	NB to WB Ramp to SB to WB Ramp	60	59	58	58	58	59	60	60	58
		60	59	57	58	58	59	60	61	58
		60	59	57	57	58	59	60	61	58
	I-69 to Allisonville Rd	61	60	59	59	59	60	61	61	59
		61	60	59	59	59	60	61	61	59
	at Allisonville Rd	61	61	59	59	59	60	61	62	59
		62	60	59	59	59	60	61	61	59
		62	61	59	59	60	60	61	62	60
		62	61	59	59	60	61	61	62	60
	Allisonville Rd On to Keystone Ave Off	61	59	55	56	56	59	60	61	56
		61	59	57	57	58	59	60	61	58
EB/SB I-465	Keystone Ave On to Allisonville Rd Off	63	62	61	61	61	62	63	63	61
		61	59	59	59	59	60	61	61	59
	at Allisonville Rd	62	61	60	60	60	61	62	61	60
		62	61	60	59	60	60	62	61	60
		61	60	59	59	59	60	61	61	59
		61	60	58	58	59	60	61	60	59
	Allisonville Rd On to I-69	61	60	59	59	59	60	61	61	60
		62	61	59	59	60	61	61	61	60
		61	60	58	58	59	59	60	61	59
	EB to NB Ramp to EB to 82nd St Ramp	63	62	61	61	62	62	63	63	62
		63	62	61	61	61	62	63	63	61
		63	62	61	61	61	62	63	63	62
		63	62	61	61	61	62	63	63	61
	EB to 82nd St Ramp to SB to SB Ramp	63	62	62	61	62	62	63	63	62
	I-69 to 56th/Shadeland	62	61	60	60	60	61	62	62	60
		61	59	58	56	57	59	61	61	58
		60	58	55	54	56	58	60	60	56
		61	59	58	57	58	59	60	60	58

Speed (mph)
>60
60
57.5
55
52.5
<50

Figure 23: Segment Speeds from Vissim – Alternative C – 2040 AM

Alternative C - PM

Route	Segment	4:30	4:45	5:00	5:15	5:30	5:45	6:00	6:15	Peak-Hour Average
SB I-69	at 106th St	66	66	66	66	66	66	66	66	66
		66	66	66	66	66	66	66	66	66
	106th St On to 96th St Off	65	65	65	65	64	65	65	65	65
		64	64	64	64	64	64	65	65	64
		64	64	64	63	64	63	64	64	64
	at 96th St	64	64	64	64	64	64	64	65	64
		64	64	64	64	64	64	64	65	64
		64	64	64	64	64	64	64	64	64
	96th St On to 82nd St Off	64	64	64	64	64	64	64	65	64
		61	61	61	61	61	61	62	62	61
		61	60	60	61	60	60	61	61	60
	at 82nd St	61	61	61	61	61	61	61	62	61
	82nd St On to I-465 Split	60	60	60	60	60	60	61	61	60
		59	59	59	58	58	58	59	60	58
		59	59	59	59	59	58	60	60	59
		60	60	60	60	59	59	60	61	59
NB I-69	EB to NB Ramp On to NB to NB Ramp On	62	61	61	61	61	61	61	61	61
		62	61	61	60	61	61	61	61	61
	at 82nd St	59	58	58	58	57	58	58	59	58
		62	61	61	61	61	61	61	62	61
		62	61	61	61	61	61	61	61	61
	82nd St On to 96th St Off	60	59	59	59	59	59	59	60	59
		57	55	55	54	55	54	55	57	55
		61	60	60	60	59	59	60	61	59
		62	61	61	61	61	60	61	62	61
	at 96th St	63	62	62	61	61	61	62	62	61
		63	62	62	62	62	62	62	63	62
		63	62	62	62	62	62	62	63	62
	96th St On to 106th St Off	64	63	63	63	63	63	63	63	63
		64	63	63	63	63	63	63	63	63
		63	60	61	61	60	59	62	62	61
	at 106th St	64	63	63	63	62	63	63	63	63
		65	64	64	64	64	64	64	65	64
NB/WB I-465	56th/Shadeland On to NB to NB Ramp	58	57	58	57	57	57	58	59	57
		60	59	59	59	59	59	59	60	59
		59	59	59	59	58	58	59	59	58
		59	59	59	59	59	59	59	60	59
		59	59	59	59	59	59	59	60	59
	NB to NB Ramp to NB to WB Ramp	61	60	61	60	60	60	60	61	60
	NB to WB Ramp to SB to WB Ramp	60	59	60	59	59	59	59	60	59
		60	59	60	59	59	59	59	60	59
		59	58	59	58	58	58	59	60	58
	I-69 to Allisonville Rd	60	59	59	59	59	59	59	60	59
		61	60	60	60	60	60	60	61	60
	at Allisonville Rd	61	61	61	61	61	60	61	61	61
		62	61	61	61	61	61	61	62	61
		62	62	62	61	61	61	61	62	61
		62	62	62	62	61	61	62	62	61
	Allisonville Rd On to Keystone Ave Off	61	61	61	61	61	60	61	62	61
		61	61	60	60	60	60	61	61	60
EB/SB I-465	Keystone Ave On to Allisonville Rd Off	59	59	59	59	59	59	59	60	59
		57	56	56	56	55	56	57	57	56
	at Allisonville Rd	59	58	58	58	58	58	59	59	58
		58	57	58	57	58	57	58	58	57
		57	56	57	55	56	56	57	58	56
		56	55	56	55	55	55	56	57	55
	Allisonville Rd On to I-69	58	57	57	57	57	58	58	58	57
		58	57	58	57	58	58	58	59	58
		57	56	57	56	56	56	57	58	56
	EB to NB Ramp to EB to 82nd St Ramp	61	60	60	60	60	59	60	61	60
		61	60	60	60	60	60	60	60	60
		61	60	60	60	60	60	60	60	60
		59	59	59	59	58	59	59	60	59
	EB to 82nd St Ramp to SB to SB Ramp	61	60	60	60	60	60	60	61	60
	I-69 to 56th/Shadeland	61	61	60	60	60	60	61	61	60
		58	56	56	56	56	56	57	59	56
		57	54	54	54	54	53	54	57	53
		59	58	57	56	56	57	57	58	57

Speed (mph)
>60
60
57.5
55
52.5
50

Figure 24: Segment Speeds from Vissim – Alternative C – 2040 PM

3.1.1 SOUTHBOUND I-69

No-Build Alternative

There are major operational deficiencies on southbound I-69 in the No-Build Alternative. The weaving section between the southbound 82nd on-ramp and the southbound Binford Boulevard left off-ramp operates at LOS F in the AM peak hour and LOS D in the PM peak hour (see Figure 13). The diverge to southbound I-465 and westbound I-465 operates at LOS F in both the AM and PM peak hours. The speed heat map for the AM peak period (Figure 17) shows a major bottleneck with speed degradation below 20 mph starting between 82nd Street and I-465 and propagating back all the way through the 106th Street interchange in the peak period. The PM peak hour also shows speeds below 30 mph on southbound I-69 between I-465 and 82nd Street. The southbound I-69 to southbound I-465 ramp operates at LOS F in the AM peak hour and LOS E in the PM peak hour.

Alternative A

Alternative A keeps the exit to southbound Binford Boulevard on the left, but moves the diverge point north of the southbound 82nd Street on-ramp. This serves to physically prevent vehicles entering from the southbound 82nd Street on-ramp to maneuver across multiple lanes to the left off-ramp to southbound Binford Boulevard. Instead, these vehicles are accommodated by a single-lane collector/distributor roadway (CD) that connects directly to southbound Binford Boulevard to the south near I-465. The diverge to the southbound Binford Boulevard off-ramp is accomplished by splitting the five southbound mainline lanes of I-465 to two lanes to the southbound Binford Boulevard off-ramp and four lanes continuing south to the I-465 diverge. This creates an option lane in the second lane from the left which allows for more uniform lane utilization upstream between the 96th Street interchange and the 82nd Street interchange. The diverge to westbound I-465 and southbound I-465 is accomplished by splitting the four mainline lanes of southbound I-69 for two lanes to the southbound I-69 to westbound I-465 ramp and three lanes to the southbound I-69 to southbound I-465 ramp. This creates an option lane in the second lane from the right, which allows more uniform lane utilization in this area.

These changes show significant improvement over the No-Build Alternative. The HCS analysis shows LOS D or better throughout this section of the corridor in the AM peak hour and LOS C or better in the PM peak hour (see Figure 14). The one exception is the LOS E in the AM peak hour on the mainline section of southbound I-69 north of 82nd Street that is outside the project area. The Vissim analysis shows improved speeds throughout this section.

Alternative B

Alternative B keeps the exit to southbound Binford Boulevard on the left, and unlike Alternative A, the diverge point stays at roughly the same place as the existing location south of 82nd Street. To prevent the southbound 82nd Street on-ramp traffic from making the three-lane cross movement to get to the southbound Binford Boulevard off-ramp, a separate one-lane CD road is provided parallel to southbound I-69. The southbound 82nd Street on-ramp traffic uses the CD road and three separate direct-connect ramps to access southbound Binford Boulevard, the southbound I-69 to westbound I-465 ramp, and the southbound I-69 to southbound I-465 ramp. These ramps and the projected peak-hour design-year volumes can be seen in Figure 15. This configuration keeps the local 82nd Street movements out of the mainline between the southbound 82nd Street off-ramp and the southbound Binford Boulevard off-ramp. This section operates at LOS D in the AM peak hour and LOS C in the PM peak hour, with peak hour speeds of 57 mph or better in the AM peak hour and 60 mph or better in the PM peak hour (see Figure 15).

The diverge to the left-hand southbound Binford Boulevard off-ramp is two lanes with four lanes continuing south as the southbound I-465 mainline. This makes the second lane from the left an option lane which provides better lane balance for the upstream mainline section. The four-lane section continues to the south before splitting to two lanes to the southbound I-69 to westbound I-465 ramp and three lanes to the southbound I-69 to southbound I-465 ramp. This makes the second lane from the right an option lane. The four-lane upstream section operates at LOS D in the AM peak hour and LOS C in the PM peak hour.

Alternative C

Alternative C is unique in its handling of the exit to southbound Binford Boulevard. Instead of keeping the exit on the left, the exit to southbound Binford Boulevard is moved to the right and shares the exit with the southbound 82nd Street off-ramp (see Figure 16). It is a two-lane off-ramp to account for the volume of the combined movements (AM – 3,270 vehicles; PM 1,980 vehicles). The vehicles to 82nd Street diverge on a one-lane slip ramp while the two-lane CD road continues south to Binford Boulevard just west of the southbound I-69 mainline. As an additional benefit, this design places all local exits and entrances on the right and keeps the majority of local traffic off the I-69 mainline area between 82nd Street and I-465 and reserves it to primarily serve interstate-to-interstate movements.

The speeds on the upstream five-lane section of southbound I-69 between the 96th Street interchange and the 82nd Street interchange indicate good operations in this section as traffic to the southbound Binford Boulevard off-ramp now maneuvers to the right. The distance between the two interchanges (approximately 6,000 feet) allows adequate distance for any weaving between the interchanges to occur. The AM peak-hour HCS weaving analysis determined that the segment provides more than the maximum weaving distance required. This configuration also allows the largest downstream movement (4,200 vehicles in the AM) to stay all the way to the left and avoid interactions with the 96th Street and 82nd Street ramps.

An HCS major diverge analysis for the diverge from southbound I-69 to the southbound Binford Boulevard CD/southbound 82nd Street off-ramp shows LOS E in the AM peak hour and LOS C in the PM peak hour. The AM major diverge analysis shows a density of 35.7 (pc/mi/ln), which is just above the top of the LOS D threshold of 35.0. This thin margin of difference coupled with the good operating speeds shown in the Vissim output lessen the concern that the LOS E first indicates. It should also be noted that basic segment HCS analyses of the roadway upstream and downstream of the diverge all indicated LOS D in AM peak hour. The 96th street on-ramp is over 1 mile upstream of the diverge providing ample distance for vehicles to pre-position well before the 1500-foot diverging influence area.

After the diverge to the southbound Binford Boulevard/82nd Street off-ramp, four mainline lanes continue southbound. This section operates at LOS C in the AM peak hour and LOS C in the PM peak hour. The southbound 82nd Street traffic to westbound I-465 and southbound I-465 merges into the four lanes. This section shows peak-hour speeds of 56 mph or better in the AM peak hour and 58 mph or better in the PM peak hour. The four-lane section downstream of the merge operates at LOS D in the AM peak hour and LOS C in the PM peak hour.

All three Build Alternatives add a third lane to the southbound to southbound ramp. The additional lane not only improves the design-year LOS on the ramp, but it also helps improve the diverge to southbound I-465 and westbound I-465 to a LOS D in the AM peak hour and LOS C in the PM peak hour.

3.1.2 NORTHBOUND I-69

No-Build Alternative

Northbound I-69 also has major operational deficiencies. The northbound I-465 to northbound I-69 ramp operates at LOS F and the two-lane section of northbound Binford Boulevard operates at LOS E in the PM peak hour. The weave between the two loop ramps on northbound Binford Boulevard operate at LOS F in both the AM and PM peak hours. The weaving section on northbound I-69 between I-465 and the northbound 82nd Street off-ramp operates at LOS E in the AM peak hour and LOS F in the PM peak hour. The diverge to the northbound 82nd Street off-ramp operates at LOS F in the PM peak hour.

Alternative A

Alternative A provides a one-lane CD road for vehicles exiting to northbound 82nd Street. This allows local traffic to be served separately from the mainline lanes thus cutting down on turbulence in this section. The two-lane eastbound I-465 to northbound I-69 ramp and the two-lane northbound Binford Boulevard on-ramp merge together and drop a lane before

the three-lane northbound I-465 to northbound I-69 ramp merges in on the right. The right lane is dropped downstream to get to five mainline lanes on northbound I-69 before the northbound 82nd Street on-ramp is merged in.

These changes show significant improvement over the No-Build Alternative. The Vissim analysis shows improved speeds throughout this section, with a slight dip in speed at the northbound 82nd Street on-ramp merge during the PM peak hour. The HCS analysis shows LOS C or better throughout this section of the corridor in both the AM and PM peak hours. The lone exception is the LOS D on the northbound I-69 section between I-465 and 82nd Street.

Alternative B

Alternative B does not provide a northbound CD road to 82nd Street. Instead, all of the traffic to 82nd Street is handled in the mainline. In Alternative B, the northbound I-465 to northbound I-69 ramp is brought into northbound I-69 to the left of the eastbound I-465 to northbound I-69 ramp and the northbound Binford Boulevard on-ramp movements. The northbound I-465 to northbound I-69 ramp does have a slip ramp for northbound 82nd Street off-ramp traffic to get to the right side of the I-69 mainline making the access to the off-ramp easier. There is a succession of lane drops on the right side of the alignment. There is a lane drop after the two-lane eastbound I-465 to northbound I-69 ramp merges with the two-lane northbound Binford Boulevard on-ramp to make three lanes going northbound. Then the northbound I-465 to northbound slip ramp to 82nd Street merges with this three-lane section. This section then merges with the three-lane northbound I-465 to northbound I-69 ramp to form a six-lane northbound I-69 mainline. A two-lane off-ramp to 82nd Street is provided in Alternative B with the second lane from the right being an option lane. By making this a two-lane off-ramp with an option lane, fewer upstream lane changes are required and more uniform lane utilization can be achieved. This section shows peak-hour speeds of 58 mph or better in the AM peak hour and 54 mph or better in the PM peak hour.

Alternative C

Alternative C is very similar to the Alternative A in the northbound I-69 corridor. Alternative C provides a one-lane CD road for vehicles exiting to northbound 82nd Street. This allows local traffic to be served separately from the mainline lanes, thus cutting down on turbulence in this section. The two-lane eastbound I-465 to northbound I-69 ramp and the two-lane northbound Binford Boulevard on-ramp merge together and drop a lane before the three-lane northbound I-465 to northbound I-69 ramp merges in on the right. The right lane is dropped downstream to get to five mainline lanes on northbound I-69 before the northbound 82nd Street on-ramp is merged in.

These changes show significant improvement over the No-Build Alternative. The Vissim analysis shows improved speeds of 60 mph or better in the AM peak hour and 58 mph or better in the PM peak hour throughout this section. The HCS analysis shows LOS C or better throughout this section of the corridor in the AM peak hour and LOS D or better in the PM peak hour.

All three build alternatives match the existing five-lane northbound mainline section between the 82nd Street interchange and the 96th Street interchange. The northbound 82nd Street on-ramp has an acceleration lane and merges into the five mainline lanes. This merge operates at LOS B in the AM peak hour and LOS C in the PM peak hour. A scenario was also tested in which the fifth northbound mainline lane would be dropped just upstream of the northbound 82nd Street on-ramp so that the northbound 82nd Street on-ramp could join as an auxiliary lane to be the fifth lane. However, this scenario did not operate as well as maintaining the five northbound mainline lanes and merging the northbound 82nd Street traffic. The upstream five-lane mainline section operates at LOS D in the PM peak hour.

3.1.3 NORTHBOUND I-465 BETWEEN 56TH STREET/SHADELAND AVENUE AND I-69

No-Build Alternative

Northbound I-465 shows operational failures between the 56th Street/Shadeland Avenue on-ramp and the off-ramp to northbound I-69. The four-lane mainline section of northbound I-465 operates at LOS F in both the AM and PM peak

hours. The speed heat maps show the speed degradation in the area of this merge in both the AM and PM peak hours. The diverge to the northbound I-465 to northbound I-69 ramp operates at LOS F in both the AM and PM peak hours.

Alternative A, Alternative B, and Alternative C

All three Build Alternatives call for six northbound lanes between the 56th Street/Shadeland Avenue on-ramp and the northbound I-465 to northbound I-69 ramp. This is an increase from the current alignment of four lanes. The existing four lane cross section at 56th Street is matched and the existing two-lane 56th Street/Shadeland Avenue on-ramp joins as two added lanes to make six northbound mainline lanes. Currently, these ramp lanes both merge into the four-lane mainline section. All three build alternatives require a three-lane northbound to northbound ramp because of the high PM peak-hour forecast volume of 4,540. The six-lane northbound mainline lanes split into three lanes to the northbound to northbound Ramp and four lanes to westbound I-465 at the I-69 interchange. This means that the third mainline lane from the right becomes an option lane that can access either the northbound I-465 to northbound I-69 ramp or continue on westbound I-465. This option lane allows for better upstream utilization and requires fewer lane changes: zero lane changes for northbound I-465 and only one lane change for the 56th Street/Shadeland Avenue on-ramp traffic to westbound I-465. With the six-lane mainline section the segment operates at 57 mph or better and at LOS D in the AM peak hour and LOS D in the PM peak hour.

A five-lane mainline cross section was also tested. However, the five-lane section provides LOS E and a degradation in speed. Furthermore, with a five-lane section and INDOT's request to always maintain four mainline through lanes on I-465, the split at the northbound to northbound Ramp would require a parallel deceleration lane to provide three lanes on the northbound to northbound Ramp which is not acceptable for a high volume major fork.

3.1.4 WESTBOUND I-465 BETWEEN I-69 AND ALLISONVILLE ROAD

No-Build Alternative

There are major operational failures in the No-Build Alternative on westbound I-465 between I-69 and Allisonville Road. The Vissim speed heat maps show the speed degradation that propagates upstream on westbound I-465 through the I-69 interchange. The No-Build analysis shows LOS F in the AM peak hour and LOS F in the PM peak hour on westbound I-465 under the Allisonville Road bridge. The weaving section between I-69 and Allisonville Road operates at a LOS F in both the AM and PM peak hours. Westbound I-465 after the Allisonville Road on-ramp operates at LOS F in the AM peak hour.

Alternative A, Alternative B, and Alternative C

All three build alternatives have six lanes in the weaving section between the southbound I-69 to westbound I-465 ramp and the westbound Allisonville Road off-ramp. This is an increase from the existing four-lane mainline section in this segment. Westbound I-465 maintains four lanes through the I-69 interchange and merges with the two-lane southbound I-69 to westbound I-465 Ramp. The two ramp lanes are maintained through the segment to the two-lane westbound Allisonville Road off-ramp. The right lane is an exit lane drop to Allisonville Road while the second lane is an option lane. This weaving section operates at LOS D in the AM peak hour and LOS C in the PM peak hour. Westbound I-465 continues under the Allisonville Road bridge as a five-lane mainline section, which operates at LOS D in the AM peak hour and LOS C in the PM peak hour. The five lanes are then carried through the westbound Allisonville Road on-ramp merge and matches the current five lane section at the White River Bridge. The existing alignment of three mainline lanes under the Allisonville Road bridge is the source of a major westbound AM bottleneck, so the five lanes in this section will provide a major improvement in operations. The gore for the merge point of the westbound Allisonville Road on-ramp is moved east in order to accommodate a longer acceleration lane that can end sufficiently upstream of the White River Bridge.

Other configurations were tested in the weaving area on westbound I-465 between I-69 and Allisonville Road. One configuration provided the six-lane mainline section through the weaving section and four lanes under the Allisonville

Road bridge. A 1,200' option lane would be extended through the Allisonville Road off-ramp diverge to provide a fifth through-lane that would be dropped just upstream of the Allisonville Road bridge. This alignment did not perform as well with design-year volumes, so it was dropped in favor of carrying five lanes under the Allisonville Road bridge.

3.1.5 EASTBOUND I-465 BETWEEN ALLISONVILLE ROAD AND I-69

No-Build Alternative

There are major operational failures in the No-Build Alternative on eastbound I-465 between Allisonville Road and I-69. Eastbound I-465 operates at LOS D in the AM peak hour and LOS E in the PM upstream of the eastbound Allisonville Road off-ramp. The three-lane mainline section of eastbound I-465 under the Allisonville Road bridge operates at LOS E in the AM peak hour and LOS F in the PM peak hour. The eastbound Allisonville Road on-ramp merge operates at LOS F in both the AM and PM peak hours. The three-lane mainline section of eastbound I-465 between the Allisonville Road interchange and the I-69 interchange has a demand (AM – 6,420 vehicles; PM – 6,990 vehicles) far above capacity and operates at LOS F in both the AM and PM peak hours.

Alternative A, Alternative B, and Alternative C

All three build alternatives match the five-lane mainline of eastbound I-465 at the White River bridge and continue five lanes to the eastbound Allisonville Road off-ramp. This is an increase from the current four-lane mainline section upstream of the Allisonville Road off-ramp. The right lane drops at the eastbound Allisonville Road off-ramp and a fourth lane is added under the Allisonville Road bridge. This section operates at LOS C in the AM peak hour and LOS D in the PM peak hour. One lane is added at the eastbound Allisonville Road on-ramp to form a five-lane mainline section between Allisonville Road and the I-69 interchange. This is an increase of two lanes from the current three-lane mainline section that causes a major bottleneck and queuing throughout the PM peak period. The additional lanes are common to all three alternatives and relieves this major bottleneck even with design-year traffic volumes. This segment operates at LOS D in the both the AM and PM peak hours. The Vissim analysis shows that PM speeds improve to 55 mph or better throughout this section.

3.1.6 EASTBOUND I-465 AT I-69

No-Build Alternative

The diverge to the low-speed eastbound I-465 to northbound I-69 loop ramp has a high demand (AM – 1,620 vehicles; PM – 1,870 vehicles) and operates at LOS F in both the AM and PM peak hours. The Vissim speed heat maps also show a major degradation in speed to 25 mph in the AM peak hour and 22 mph in the PM peak hour through this section of the corridor.

Alternative A

Alternative A provides a two-lane eastbound to NB Ramp that carries all traffic going to northbound I-69 with destinations of 96th Street and north. A four-lane mainline section is provided downstream of the eastbound I-465 to northbound I-69 ramp. The next ramp is an off-ramp that combines the eastbound I-465 to southbound Binford Boulevard ramp and the loop ramp to 82nd Street. A deceleration lane is provided for this ramp and four eastbound mainline lanes continue through the interchange. The loop ramp is a low-volume ramp (AM – 180 vehicles; PM – 200 vehicles) that serves only local traffic to the northbound 82nd Street CD road. The downstream four-lane section performs at LOS C in both the AM and PM peak hours.

Alternative B

Alternative B combines the eastbound to northbound ramp and the eastbound to southbound ramp into one exit from eastbound I-465. In this alternative, the eastbound to northbound loop to 82nd Street is not provided because there is no northbound CD road to 82nd Street. All traffic from eastbound I-465 to 82nd Street uses the eastbound to northbound ramp. Therefore, all traffic from eastbound I-465 to southbound Binford Boulevard, 82nd Street, and northbound I-69 uses the same off-ramp. Traffic from eastbound I-465 to 82nd Street can use the right lane of the eastbound to northbound ramp and does not have to change lanes to exit because of the option lane provided on northbound I-69 at the 82nd Street off-ramp.

The eastbound to southbound ramp exit from eastbound I-465 is a two-lane diverge with the second lane from the right being an option lane. Even with the combined traffic exiting at the eastbound to northbound ramp, the upstream weaving section on eastbound I-465 operates at LOS D in the AM peak hour and LOS D in the PM peak hour with design-year traffic volumes. Eastbound I-465 continues as a four-lane mainline section through the intersection before merging with the southbound to southbound ramp. This mainline section operates at LOS C in both the AM and PM peak hours.

Alternative C

Alternative C is similar to Alternative A in the eastbound I-465 area except that the eastbound to northbound Ramp is paired with the eastbound to southbound ramp and the eastbound to 82nd Street loop ramp is a separate ramp. Eastbound I-465 has five mainline lanes downstream of the eastbound Allisonville Road on-ramp. This is followed by a diverge to a two-lane off-ramp that provides movements to northbound I-69 and southbound Binford Boulevard. This off-ramp splits to a one-lane ramp to southbound Binford Boulevard and a two-lane eastbound to northbound ramp that carries all traffic going to northbound I-69 with destinations of 96th Street and north. A four-lane mainline section is provided downstream of the two-lane exit, meaning that the second lane from the right is an option lane. The next downstream ramp is a loop off-ramp for local traffic to 82nd Street. A deceleration lane is provided for this ramp and four eastbound mainline lanes continue through the interchange. The loop ramp is low-volume (AM – 180 vehicles; PM – 200 vehicles) that serves only local traffic to the northbound 82nd Street CD road. The downstream four-lane section performs at LOS C in both the AM and PM peak hours.

3.1.7 SOUTHBOUND I-465 BETWEEN I-69 AND 56TH STREET/SHADELAND AVENUE

No-Build Alternative

The four mainline lanes between the ramp from southbound I-69 to southbound I-465 (southbound to southbound Ramp) and the southbound 56th Street/Shadeland Avenue off-ramp does not provide the capacity to handle the AM and PM peak hour demands. The No-Build HCS analysis shows LOS F in both the AM and PM peak hours.

Alternative A, Alternative B, and Alternative C

All three build alternatives have five southbound lanes between the southbound to southbound ramp and the 56th Street/Shadeland Avenue off-ramp. This is an increase from the current alignment of four lanes. Eastbound I-465 carries four mainline lanes through the I-69 interchange before the three-lane southbound to southbound ramp merges. There will be a seven-lane section for 1,500 feet before the right lane drops for a six-lane section. The six-lane section, which operates at LOS D in both the AM and PM peak hours, continues south before dropping the right lane at about 65th Street. The right lane is dropped to the 56th Street/Shadeland Avenue off-ramp which leaves four lanes to match the current four-lane mainline cross section at 56th Street.

One of the negatives of this alignment is the three-lane southbound to southbound ramp dropping two consecutive lanes as it merges with the four-lane eastbound I-465. However, enough distance is provided with each lane drop to accommodate the merging and lane changing. Another option considered was to make eastbound I-465 three lanes inside of the I-69 interchange upstream of the merge with the three-lane southbound to southbound ramp. This would allow a merge of three lanes from eastbound I-465 and three lanes from the southbound to southbound ramp. Then only

one lane drop on the right would be necessary to get to the five mainline lanes. This option was dismissed because INDOT's policy is to maintain four continuous mainlines around the city on I-465.

3.1.8 SOUTHBOUND BINFORD BOULEVARD

No-Build Alternative

The eastbound to southbound ramp traffic merging into the two-lane southbound Binford Boulevard as an added lane and the movement across the alignment to the southbound left-turn lanes only worsens with increased traffic demands in the design-year.

Alternative A, Alternative B, and Alternative C

All three build alternatives add a signal on southbound Binford Boulevard at its intersection with the ramp from eastbound I-465 to southbound Binford Boulevard (eastbound to southbound ramp). Making this an intersection and adding a traffic signal provides safe gaps for the eastbound I-465 to southbound Binford Boulevard ramp traffic to maneuver across to the left turn lanes. The peak hour demand on the eastbound I-465 to southbound Binford Boulevard ramp is low enough that the southbound Binford Boulevard traffic would not need to be stopped long. The signal also serves as a means to slow traffic that has exited from a freeway facility (I-69) to a local street (Binford Boulevard).

3.1.9 75TH STREET AND BINFORD BOULEVARD INTERSECTION

No-Build Alternative

The intersection of 75th Street and Binford Boulevard was analyzed using Synchro. For the No-Build Alternative, the intersection performs at LOS F in both the AM and PM peak hours.

Alternative A, Alternative B, and Alternative C

For each of the Build Alternatives, an additional through lane was added on both the northbound and southbound approaches. This allows less green time to be allocated to the northbound and southbound through movements and slightly more time given to the east-west movements. The northbound right turn is also turned into a channelized free right-turn lane and a right-turn lane is added to the westbound approach. These additions would allow the intersection to improve to LOS E in the AM peak hour and LOS D in the PM peak hour.

3.1.10 SYSTEMWIDE OPERATIONS

The previous sections described the traffic operations for each individual section of the corridor. This section provides measures of effectiveness to describe the operations on the entire system under each alternative. Travel time gives an indication of operations on the major corridors from one end of the network to the other. Systemwide average speed and average delay per vehicle gives an idea of the congestion and delay of the system as a whole.

3.1.10.1 Travel Time

Travel times were collected in the Vissim models for the six major movements through the Project Area. Table 10 below shows these travel times for the AM peak hour and Table 11 shows the travel times for the PM peak hour. All three build alternatives have very similar travel times. All three alternatives show improvement over the No-Build alternative by between 23 percent and 51 percent. The biggest improvement can be seen in the southbound to westbound trip which is reduced by over half.

Table 10: Travel Times – 2040 AM Peak Hour

SEGMENT	TRAVEL TIME (MINUTES)			
	NO-BUILD	ALTERNATIVE A	ALTERNATIVE B	ALTERNATIVE C
NB to NB - 56th St to 96th St	7.2	5.5	5.3	5.4
NB to WB - 56th St to White River	7.3	5.5	5.4	5.4
SB to SB - 96th St to 56th St	9.2	6.3	6.1	6.2
SB to WB - 96th St to White River	10.1	5.0	4.9	5.0
EB to SB - White River to 56th St	6.8	5.3	5.3	5.3
EB to NB - White River to 96th St	6.7	4.9	5.0	4.9

All three build alternatives have very similar travel times in the PM peak hour. All three alternatives show improvement in travel times over the No-Build alternative ranging from six percent to 32%. The biggest improvement is seen in the movement from the White River to 56th Street.

Table 11: Travel Times – 2040 PM Peak Hour

SEGMENT	TRAVEL TIME (MINUTES)			
	NO-BUILD	ALTERNATIVE A	ALTERNATIVE B	ALTERNATIVE C
NB to NB - 56th St to 96th St	7.5	5.7	5.5	5.6
NB to WB - 56th St to White River	6.5	5.6	5.4	5.4
SB to SB - 96th St to 56th St	6.5	6.2	6.1	6.1
SB to WB - 96th St to White River	5.4	4.8	4.8	4.8
EB to SB - White River to 56th St	8.0	5.5	5.5	5.5
EB to NB - White River to 96th St	7.4	5.1	5.2	5.1

3.1.10.2 Delay

Systemwide measures of effectiveness for delay and speed were generated from the Vissim model to quantify overall changes during the peak hours between the alternatives (see Table 12). The average delay per vehicle is a good indicator of just how congested the network is in the No-Build Alternative. This measure picks up delay that the travel time segments or near-free-flow link speeds downstream of a bottleneck do not show. This is because the model entry links were expanded so that delay is measured for vehicles even before they enter the travel time measurement segment or pass through a bottleneck. All three Build Alternatives have significantly less vehicular delay than the No-Build option.

Table 12: 2040 Systemwide Vehicular Delay and Average Speed

ALTERNATIVE	AVERAGE DELAY PER VEHICLE (S)		AVERAGE NETWORK SPEED (MPH)	
	AM	PM	AM	PM
No-Build Alternative	185	289	47	40
Alternative A	33	37	57	57
Alternative B	33	37	58	57
Alternative C	34	37	57	57

All three of the Build Alternatives show at least a 10 mph AM peak hour increase and a 17 mph PM peak hour increase in overall average network speed, which indicates major improvement in traffic operations.

The three Build Alternatives are virtually the same in terms of average delay per vehicle and average network speed.

3.1.11 TRAFFIC OPERATIONS SUMMARY

This section summarizes the traffic operations for each of the alternatives. Table 13 below shows a comparison of LOS by segment for each of the alternatives.

No-Build Alternative

The traffic operations for the No-Build Alternative show major failures on almost every leg of the corridor. Southbound I-69 shows LOS F on the weaving section between 82nd Street and southbound Binford Boulevard left off-ramp as well as the diverge to southbound I-465 and westbound I-465. Northbound I-69 operates at LOS F in the PM peak hour in the weave section between I-465 and 82nd Street off-ramp. Eastbound I-465 operates at LOS F from the Allisonville on-ramp merge through the eastbound to northbound loop ramp in both the AM and PM peak hours. Westbound I-465 also operates at LOS F from the northbound Binford Boulevard loop on-ramp through the Allisonville Road interchange in the PM peak hour. Both northbound and southbound I-465 operate at LOS F in both the AM and PM peak hours. The No-Build Alternative is not operationally acceptable.

Alternative A

The traffic operations in Alternative A show major improvement over the No-Build Alternative. Alternative A meets the goal of LOS D or better on all segments[1]. The travel times are improved for each major movement through the corridor. Southbound I-69 is greatly improved with the southbound 82nd Street to southbound Binford Boulevard two-sided weave eliminated and the provision of the CD for 82nd Street traffic to southbound Binford Boulevard. The northbound I-69 traffic flow is also improved with the provision of the two-lane direct-connect eastbound to northbound ramp, the additional lane (and 82nd Street slip ramp) on the northbound to northbound Ramp, and the additional lanes provided on northbound I-69. Separating the northbound traffic to 82nd Street via a CD road also relieves congestion in this area. The bottleneck on westbound I-465 between the southbound to westbound Ramp and the westbound Allisonville Road off-ramp is improved with the increase to six lanes and the provision of an option lane that becomes the fifth mainline lane under the Allisonville Road bridge.

Alternative A does provide a limited CD system that separates some of the local 82nd Street traffic from the freeway to freeway movements, which is desirable. However, Alternative A still has an off-ramp on the left side to a local street (southbound Binford Boulevard), which is less desirable.

Alternative B

The traffic operations in Alternative B show major improvement over the No-Build Alternative. Alternative B meets the goal of LOS D or better on all segments[1]. The travel times are improved for each of the major movements through the corridor. Southbound I-69 is greatly improved with the southbound 82nd Street to southbound Binford Boulevard two-sided weave eliminated. The separate CD road for southbound movements from 82nd Street also helps improve operations on the southbound mainline between 82nd Street and I-465. The northbound I-69 traffic flow is also improved with the provision of the two-lane direct-connect eastbound to northbound ramp, the additional lane (and 82nd Street slip ramp) on the northbound to northbound ramp, and the additional lanes provided on northbound I-69. The bottleneck on westbound I-465 between the southbound to westbound ramp and the westbound Allisonville Road off-ramp is improved with the increase to six lanes and the provision of an option lane that becomes the fifth mainline lane under the Allisonville Road bridge.

Alternative B does provide a limited CD system that separates the local 82nd Street traffic from the freeway to freeway movements in the southbound direction. However, Alternative B mixes all local 82nd Street traffic with the mainline freeway to freeway traffic, which is less desirable. Alternative B (like the other two Build Alternatives) provides a slip-

[1] The one exception is the LOS E in the AM peak hour on the mainline section of southbound I-69 north of 82nd Street that is outside the project area where the project is matching the existing five-lane section.

ramp from the northbound to northbound ramp for traffic going to 82nd Street to merge on the right in anticipation of the northbound 82nd Street off-ramp. However, there is nothing physically preventing vehicles destined for 82nd Street staying on the northbound to northbound ramp and then cutting across the northbound traffic from the eastbound to northbound ramp and northbound Binford Boulevard in order to exit at 82nd Street. This operationally detrimental weaving movement is not likely, but it is not physically prevented.

Alternative C

The traffic operations in Alternative C show major improvement over the No-Build Alternative. Alternative C meets the goal of LOS D or better on all segments[1]. The travel times are improved for each major movement through the corridor. Southbound I-69 is greatly improved between 82nd Street and I-465 with the southbound 82nd Street to southbound Binford Boulevard two-sided weave eliminated and the provision of the CD road for southbound Binford Boulevard. The northbound I-69 traffic flow is also improved with the provision of the two-lane direct-connect eastbound to northbound ramp, the additional lane (and 82nd Street slip ramp) on the northbound to northbound ramp, and the additional lanes provided on northbound I-69. Separating the northbound traffic to 82nd Street via a CD road also relieves congestion in this area. The bottleneck on Westbound I-465 between the southbound to westbound ramp and the westbound Allisonville Road off-ramp is improved with the increase to six lanes and the provision of an option lane that becomes the fifth mainline lane under the Allisonville Road bridge.

Alternative C provides the most comprehensive CD system of the alternatives. In the southbound direction, it separates both the local 82nd Street traffic and the local Binford Boulevard traffic from the southbound freeway to freeway movements. The HCS analysis of the diverge to the southbound CD indicates a density of 35.7 pc/mi/ln, which is LOS E (the 35 pc/mi/ln is threshold for LOS D). However, microsimulation output shows good average speeds in the area. Alternative C also provides a northbound CD system that separates all traffic to 82nd Street. Alternative C also eliminates the local off-ramp on the left by exiting the southbound Binford Boulevard traffic on the right at 82nd Street.

Table 13: 2040 LOS Comparison between Alternatives

CRITICAL ROADWAY SEGMENTS	NO-BUILD	ALTERNATIVE A	ALTERNATIVE B	ALTERNATIVE C
EB I-465 – White River to Allisonville Rd	D/E	C/D	C/D	C/D
EB I-465 - Inside Allisonville Rd Interchange	E/F	C/D	C/D	C/D
EB I-465 – Allisonville Rd to I-69 Ramps	F/F	D/D	D/D	D/D
EB I-465 – Binford Blvd Off to Loop Ramp	F/F	C/C	C/C	C/C
EB I-465 – Loop Ramp to I-69 Ramp	D/D	C/C	C/C	C/C
SB I-465 – I-69 Ramps to 56th St. / Shadeland Ave.	F/F	D/D	D/D	D/D
NB I-465 – 56th St. / Shadeland Ave. to I-69 Ramps	F/F	D/D	D/D	D/D
WB I-465 – I-69 Ramp to Loop Ramp	E/D	C/C	C/C	C/C
WB I-465 – Loop Ramp to I-69 Ramp	F/C	C/C	C/C	C/C
WB I-465 – I-69 Ramps to Allisonville Rd (weave)	F/F	D/C	D/C	D/C
WB I-465 – Inside Allisonville Rd Interchange	F/F	D/C	D/C	D/C
WB I-465 – Allisonville Rd to White River	F/E	D/C	D/C	D/C
NB I-69 – I-465 Ramps/Binford Blvd to 82nd St. (weave)	E/F	C/D	C/C	C/D
NB I-69 – Inside 82nd St. Interchange	C/E	C/D	C/D	C/D
NB I-69 – North of 82nd St.	C/D	C/D	C/D	C/D
SB I-69 – North of 82nd St.	E/C	E/C	E/C	E/C
SB I-69 – Inside 82nd Street Interchange	F/C	D/C	D/C	D/C
SB I-69 – 82nd Street to I-465 Ramps (weave)	F/D	D/C	D/C	D/C
SB I-69 - CD to Binford	n/a	n/a	n/a	D/B

NB Binford – 75th St. to NB I-69	C/C	B/B	B/B	B/B
EB I-465 to NB I-69/82nd St. (Loop)	n/a	B/C	C/C	C/C
NB I-465 to NB I-69/82nd St.	E/F	C/D	C/D	C/D
SB I-69 to WB I-465	D/C	D/C	D/C	D/C
SB I-69 to SB I-465	F/E	D/D	D/D	D/D

3.2 DESIGN-YEAR SAFETY ANALYSIS

The second stage of the safety analysis is to quantitatively compare the safety performance of each proposed alternative for the design-year (2040). To do this, the Interactive Highway Safety Design Model (IHSDM) is used. The IHSDM is a software released by Federal Highway Administration (FHWA) to accurately model the Highway Safety Manual's (HSM) Part C – Predictive Method. The IHSDM uses the HSM's Safety Performance Functions (SPF's) to evaluate and identify the frequency and severity of crashes that would be expected on a system interchange considering its geometric design and traffic characteristics. Going forward in this Alternative Analysis Report, when "predicted" terminology is used, it is describing the IHSDM output, which for this project cannot be considered accurate by itself due to a lack of Indiana calibration. However, these IHSDM "predicted" outputs are still useful in comparing the safety performance of the build alternatives relative to each other. The specific IHSDM output reports can be seen in Appendix F, Outputs F – 500 to F – 1436.

The quantitative IHSDM summary of total yearly crashes for each alternative is shown in Table 14. The predicted (non-calibrated) crash outputs are categorized by either a fatality/injury (FI), or property damage only (PDO). Alternative B has the lowest number of total predicted (non-calibrated) yearly crashes with 216, followed by Alternative A with 231, Alternative C with 232, and the No-Build Alternative with 305. Alternative B has the lowest percentage of predicted (non-calibrated) fatality/injury crashes with 29.6%. Additional safety performance analysis for each alternative is described in Sections 3.2.1 through 3.2.4 below.

Table 14: Total Predicted (non-calibrated) Yearly Crashes for 2040 AADT by Alternative (for comparison only)

ALTERNATIVE	CRASHES [TOTAL]	FATAL/INJURY (FI) CRASHES [TOTAL]	PROPERTY DAMAGE ONLY (PDO) CRASHES [TOTAL]	FI PERCENTAGE	PDO PERCENTAGE
No-build	**305**	99	206	32.5%	67.5%
Alternative A	**231**	72	159	31.2%	68.8%
Alternative B	**216**	64	152	29.6%	70.4%
Alternative C	**232**	72	160	31.0%	69.0%

*Note: See Appendix E, Table E-17 for detailed predicted crashes for comparison (2022 to 2040).

When compared, all three proposed alternatives perform significantly better than the No-Build Alternative in regard to safety. The biggest crash hot spot causes identified in Section 1.4.3 (Historical Crash Safety Analysis), which are "off-ramp proximity" at eastbound I-465 as it approaches the eastbound I-465 to southbound Binford Boulevard off-ramp with the eastbound I-465 to northbound Binford Boulevard off-ramp (as shown in Appendix E, Exhibit E – 3) and "weaving" at southbound I-69 just south of the 82nd Street on-ramp (as shown in Appendix E, Exhibit E – 5), have been addressed in each of the build alternatives and contribute to the increased safety performance.

Another useful output from the IHSDM is the Crash Rate (units of crashes per mile per year), and Travel Crash Rate (units of crashes per million-vehicle-miles). These numbers are broken out by ramp for each alternative, and can give a more accurate weighted picture of relative safety performance (Table 15).

Table 15: Summary of Relative Safety Performance for Each Movement

RAMP #	MOVEMENT	NO BUILD		ALTERNATIVE A		ALTERNATIVE B		ALTERNATIVE C	
		CRASH RATE [CRASHES/MI/YR]	TRAVEL CRASH RATE [CRASHES/MIL VEH-MI]	CRASH RATE [CRASHES/MI/YR]	TRAVEL CRASH RATE [CRASHES/MIL VEH-MI]	CRASH RATE [CRASHES/MI/YR]	TRAVEL CRASH RATE [CRASHES/MIL VEH-MI]	CRASH RATE [CRASHES/MI/YR]	TRAVEL CRASH RATE [CRASHES/MIL VEH-MI]
1	82nd to SB Binford	-	-	0.80	0.74	1.35	0.69	8.43*	1.07*
2	82nd to SB I-69	7.56	1.34	7.36	1.44	-	-	8.03	1.58
3	EB I-465 to NB Binford	8.69	1.27	1.71	1.39	-	-	1.30	1.80
4	EB I-465 to NB I-69	-	-	7.44*	1.00*	5.41*	0.50	6.52*	0.86*
5	EB I-465 to SB Binford	1.74	0.85	2.68	1.31	2.15	1.05	1.63	0.80
6	NB I-465 to 82nd	-	-	1.82	0.74	-	-	1.73	0.70
7	NB I- 465 to NB I-69	10.92	0.66	11.21*	0.75*	8.54*	0.57*	13.19*	0.89*
8	NB Binford to 82nd	-	-	2.75	0.84	-	-	2.85	0.83
9	NB Binford to NB I-69	12.04*	0.93*	5.90	0.89	6.04*	0.84*	6.95	1.05
10	NB Binford to WB I-465	4.88	2.35	4.63	2.23	3.02	1.45	5.35	2.57
11	SB I-69 to 82nd	3.42	1.01	3.20	0.95	2.92	0.87	3.43	1.02
12	SB I-69 to SB I-465	33.16*	1.95*	20.18*	1.02*	6.11*	0.38*	10.00*	0.56*
13	SB I-69 to SB BINFORD	6.06*	0.63*	4.83*	0.52	11.13*	0.65*	12.99	1.38
14	SB I-69 to WB I-465	7.28	0.75	7.89	0.81	6.21*	0.68*	7.17	0.74
15	82nd to WB I-465	-	-	-	-	2.91	0.70	-	-
16	NB I-465 to NB I-69 (out)	-	-	-	-	1.57	0.64	-	-
17	NB I-69 to 82nd	5.59	1.40	-	-	6.44	1.61	-	-
18	82nd to SB I-465	-	-	-	-	2.12	0.69	-	-

*Note: For HSM lane limitations, lane addition CMF is used and Crash Rate is recalculated. See applicable CMF in Appendix E, Table E – 19.

The highlighted color-coded safety categories in Table 15 above range from green (relatively most safe) to red (relatively least safe), and are as follows:

- Crash Rate [crashes/mi/yr]: Green (0 to 6), Orange (6 to 12), Red (12+)
- Travel Crash Rate [crashes/mil veh-mi]: Green (0 to 1.1), Orange (1.1 to 1.8), Red (1.8+)

The overall alternative safety performance comparison, along with ramp performances based on Crash Rate and Travel Crash Rate, are explained in Sections 3.2.1 through 3.2.4 below. The ramps that had specific elements with relatively deficient safety performances have been specifically noted. The ramps whose ranking in the middle 1/3 of Crash Rates and Travel Crash Rates are categorized as having a "mediocre" relative safety performance. Those ranking in the highest 1/3 of Crash Rates and Ravel Crash Rates are categorized as having a "poor" relative safety performance. The ramps that had specific elements with relatively deficient safety performances have been specifically noted, and highlighted in yellow.

The following limitations apply to the design-year IHSDM safety analysis:

While there is definite value in the HSM Part C – Predictive Method to analyze safety performances, there are also limitations. The HSM only has safety performance models for freeway ramps with one or two lanes and freeways with up to five lanes in each direction. This project frequently exceeds those limits, therefore we used additional Crash Modification Factors for segments that needed additional lanes. The CMFs used for the additional lanes have a 3-star rating on the CMF Clearinghouse and have been obtained from the study "*Identifying Crash Distributions and Prone Locations by Lane Groups at Freeway Diverge Areas, Chen et al., 2011*" based on data from 2004-2006 in Florida.

These were the most relevant published CMFs available. The summary of these CMFs can be seen in Appendix E, Table E – 19. The numbers above reflect the additionally factored raw numbers. Appendix E, Table E – 18 details which CMF ID and factors are used for the above roadway segments for additional lanes.

Another HSM Part C – Predictive Method limitation is the range of "reliable" AADT's for each facility type. This situation occurred in the analysis four or five times per alternative (Table 16 below). The HSM states that if the AADT range is outside the limits, "results may not be reliable". However, the SPF equation that computes the predicted frequency of crashes uses the actual AADT number as a variable, regardless of the reliability range. This means while it may not be as reliable, it still accounts for the overage of AADT. In addition, there are currently no Crash Modification Factors in the CMF Clearinghouse for altering AADT numbers. For this alternative analysis, we felt that using the AADT numbers outside the reliability range for the few instances it occurred did not significantly affect the results. Table 16 below shows the max "reliable" AADT for each ramp that exceeds the range (based on facility type and number of lanes). It also shows the actual calculated AADT used in the analysis.

Table 16: HSM's AADT Limitations

ALTERNATIVE	RAMP #	IHSDM MAX AADT	ACTUAL 2040 AADT (MAX)
No Build	I-69	110,000	132,790
	12	32,000	68,560
	3	18,000	18,730
	7	32,000	45,390
	9	32,000	43,030
A	I-69	110,000	160,340
	4	32,000	34,140
	7	32,000	45,390
	12	32,000	68,560
	13	18,000	23,520
B	4	32,000	44,990
	7	32,000	45,390
	12	32,000	59,680
	13	32,000	83,200
C	4	32,000	34,140
	7	32,000	45,390
	12	32,000	68,560
	13	32,000	32,750

Additional safety considerations outside the scope of this report:

The countermeasures below (Table 17) have been identified as potential methods in increasing the safety performance of the selected alternative going forward. These countermeasures were not quantified in this alternative analysis report, and exist outside the scope of basic geometric layout and cross-section design which provided safety solutions for each alternative. The countermeasures below have been identified as being comparatively negligible when applied equally to all alternatives, and the level of design for this report was insufficient to allow for a meaningful result. These design elements may have a positive effect on safety and will be considered as the design progresses for the selected alternative.

Table 17: Potential Countermeasure Considerations

POTENTIAL COUNTERMEASURE	CMF	PERCENT REDUCTION IN CRASHES	SEVERITY	CMF ID
Install curb and gutter	0.89	11%	All	2375
Flatten sideslope from 1V:3H to 1V:4H	0.58	42%	A, B, C	26
Flatten sideslope from 1V:3H to 1V:4H	0.71	29%	O	27
Flatten sideslope from 1V:4H to 1V:6H	0.78	22%	A, B, C	29
Flatten sideslope from 1V:4H to 1V:6H	0.76	24%	O	30
Upgrade existing markings to wet-reflective pavement markings	0.977	2%	All	8133
Upgrade existing markings to wet-reflective pavement markings	0.881	12%	K, A, B, C	8134
Implement automated speed enforcement cameras	0.942	6%	All	7266
Install chevron signs on horizontal curves	0.721	28%	All	7268
Install w-beam guardrail	1.06	-6%	All	8391
Install w-beam guardrail	0.99	1%	K, A, B, C	8392
Install w-beam guardrail	0.84	16%	K, A	8393
Install changeable crash ahead warning signs	0.56	44%	A, B, C	75
Install lighting at interchanges	0.74	26%	K, A, B, C	1284

*Note: K: Fatality, A: Serious Injury, B: Minor Injury, C: Possible Injury, O: Property Damage Only

3.2.1 NO-BUILD ALTERNATIVE

The No-Build Alternative is included in the comparison to represent the predicted performance in the design-year (2040) assuming there are no changes made to the interchange. Since the IHSDM predicted (non-calibrated) data for proposed alternatives cannot be compared with the historical crash data (as stated earlier), comparing them back to the No-Build Alternative gives the best baseline for potential improvements. All of the No-Build Alternative's IHSDM inputs can be seen in Appendix F, Images F – 1 to F – 104 and posted speed and AADT broken out by ramp can be seen in Appendix E, Table E – 29.

As seen in Table 18 below, the No-Build Alternative is predicted (non-calibrated) to have 305 total crashes per year. This is the highest among alternatives.

Table 18: Predictive (non-calibrated) Crashes Summary Table: Alternative No-build

RAMP #	MOVEMENT	CRASHES [TOTAL]	FI CRASHES [TOTAL]	PDO CRASHES [TOTAL]
-	I-465	3,614	998	2,616
-	I-69	890	261	629
2	82nd to SB I-69	34	13	21
3	EB I-465 to NB BINFORD	50	20	29
5	EB I-465 to SB BINFORD	11	5	6
7	NB I-465 to NB I-69	167	71	96

9	NB BINFORD to NB I-69	148*	64*	84*
10	NB BINFORD to WB I-465	20	9	11
11	SB I-69 to 82nd	22	9	13
12	SB I-69 to SB I-465	685*	383*	302*
13	SB I-69 to SB BINFORD	74*	28*	46*
14	SB I-69 to WB I-465	62	23	39
17	NB I-69 to 82nd	16	6	10
ALTERNATIVE NO-BUILD TOTAL (2022 TO 2040 ANALYSIS PERIOD: 19 YEARS)		**5,794**	**1,890**	**3,904**
ALTERNATIVE NO-BUILD TOTAL [YEARLY]:		**305**	**99**	**206**

*Note: For HSM lane limitations, lane addition CMF is used and Crash Rate is recalculated. See applicable CMF in Appendix E, Table E – 19.

Notable No-Build Alternative ramp safety performance issues are as follows:

- 82nd Street to southbound I-69 (Ramp #2) is predicted (non-calibrated) to have a relatively mediocre crash rate for this alternative, as well as Alternative A and C (In Alternative B this movement does not have a separate alignment but is combined with 82nd Street to southbound I-465 (Ramp #18)). This movement is a loop ramp, and performs poorly due to the combination of high traffic, tight radii, and design speed.
- Eastbound I-465 to northbound Binford Boulevard (Ramp # 3) is predicted (non-calibrated) to have a relatively mediocre crash rate for this alternative. This movement is a loop ramp, and handles all traffic going eastbound to northbound. While this loop ramp still exists in Alternative A and C, in those alternatives it only serves traffic from eastbound I-465 eastbound to 82nd Street, as opposed to eastbound I-465 eastbound to 82nd Street and to eastbound I-465 to northbound I-69 AADT. This large AADT movement in the No-Build Alternative is addressed with additional ramps in Alternatives A, B, and C.
- Northbound Binford Boulevard to westbound I-465 (Ramp #10) is common among all alternatives. This movement is a loop ramp, and performs poorly due to the combination of high traffic, tight radii, and design speed.
- Southbound I-69 to southbound I-465 (Ramp #12) is predicated to have the highest Crash Rate out of all ramps in all alternatives. The No-Build posted speed of this movement is 50 mph. Alternatives A, B, and C all have 45 mph posted speeds, which significantly reduces the number of predicted (non-calibrated) crashes.

3.2.2 ALTERNATIVE A

All the Alternative A IHSDM inputs can be seen in Appendix F, Images F – 105 to F – 240. Posted speed and AADT broken out by ramp can be seen in Appendix E, Table E–29.

As seen in Table 19 below, Alternative A is predicted (non-calibrated) to have 231 total crashes per year. This is the second lowest among alternatives.

Table 19: Predictive (non-calibrated) Crashes Summary Table: Alternative A

RAMP #	MOVEMENT	CRASHES [TOTAL]	FI CRASHES [TOTAL]	PDO CRASHES [TOTAL]
-	I-465	2771*	772*	1999*
-	I-69	229*	68*	160*
1	82nd to SB BINFORD	14	6	8
2	82nd to SB I-69	32	13	19
3	EB I-465 to NB BINFORD	18	7	10
4	EB I-465 to NB I-69	164*	51*	113*
5	EB I-465 to SB BINFORD	12	5	7
6	NB I-465 to 82nd	12	6	6
7	NB I-465 to NB I-69	176*	66*	110*

8	NB BINFORD to 82nd	63	21	42
9	NB BINFORD to NB I-69	55	20	35
10	NB BINFORD to WB I-465	23	9	13
11	SB I-69 to 82nd	16	7	9
12	SB I-69 to SB I-465	677*	275*	402*
13	SB I-69 to SB BINFORD	67*	24*	43*
14	SB I-69 to WB I-465	51	19	32
ALTERNATIVE A TOTAL (2022 TO 2040 ANALYSIS PERIOD: 19 YEARS)		**4,380**	**1,370**	**3,010**
ALTERNATIVE A TOTAL [YEARLY]:		**231**	**72**	**159**

*Note: For HSM lane limitations, lane addition CMF is used and Crash Rate is recalculated. See applicable CMF in Appendix E, Table E – 19.

Notable Alternative A ramp safety performance issues are as follows:

- 82nd Street to southbound I-69 (Ramp #2) is predicted (non-calibrated) to have a relatively mediocre crash rate for this alternative, as well as Alternative C and the No-Build Alternative (Alternative B eliminates this movement). This movement is a loop ramp, and performs poorly due to the combination of high traffic, tight radii, and design speed.
- Northbound Binford Boulevard to westbound I-465 (Ramp #10) is common among all alternatives. This movement is a loop ramp, and performs poorly due to the combination of high traffic, tight radii, and design speed.
- I-69 southbound to I-465 southbound (Ramp #12) is shown as having a relatively poor safety performance compared to the other alternatives. This number is artificially high, however, due to another limitation with the IHSDM predictive modeling. This movement for Alternative A splits off from the main I-69 southbound alignment significantly earlier than the other alternatives, and due to the IHSDM's limitations for multiple classifications per alignment, the entirely of it must be classified as a "Freeway Ramp". This classification, in conjunction with design data intended for an interstate for the first part of the alignment, explain the relatively high number.

3.2.3 ALTERNATIVE B

All of Alternative B's IHSDM inputs can be seen in Appendix F, Images F – 241 to F – 365. Posted speed and AADT broken out by ramp can be seen in Appendix E, Table E – 29.

As seen in Table 20 below, Alternative B is predicted (non-calibrated) to have 216 total crashes per year. This option has the lowest total number of crashes as well as the lowest FI crashes among alternatives.

Table 20: Predictive (non-calibrated) Crashes Summary Table: Alternative B

RAMP NUMBER	MOVEMENT	CRASHES [TOTAL]	FI CRASHES [TOTAL]	PDO CRASHES [TOTAL]
-	I-465	2811*	787*	2024*
-	I-69	466	141	326
1	82nd to SB BINFORD	11	4	7
4	EB I-465 to NB I-69	133*	45*	88*
5	EB I-465 to SB BINFORD	8	3	5
7	NB I-465 to NB I-69 (in)	146*	47*	99*
9	NB BINFORD to NB I-69	46*	16*	30*
10	NB BINFORD to WB I-465	28	11	16
11	SB I-69 to 82nd	15	6	9
12	SB I-69 to SB I-465	114*	33*	81*
13	SB I-69 to SB BINFORD	182*	72*	110*
14	SB I-69 to WB I-465	40*	15*	25*

15	82nd to WB I-465	57	21	36
16	NB I-465 to NB I-69 (out)	11	4	7
17	NB I-69 to 82nd	22	8	14
18	82nd to SB I-465	16	6	10
ALTERNATIVE B TOTAL (2022 TO 2040 ANALYSIS PERIOD: 19 YEARS)		**4,105**	**1,220**	**2,886**
ALTERNATIVE B TOTAL [YEARLY]:		**216**	**64**	**152**

*Note: For HSM lane limitations, lane addition CMF is used and Crash Rate is recalculated. See applicable CMF in Appendix E, Table E – 19.

A notable Alternative B ramp safety performance issue is as follows:

- Southbound I-69 to southbound Binford Boulevard (Ramp #13) has very different geometric configurations for each alternative. For Alternative B, the raw predicted (non-calibrated) numbers show that this is a relatively unsafe movement. Even more, due to its configuration, this movement has a relatively steep downgrade with a relatively small radius, and contains traffic coming directly from I-69 southbound. These conditions exist while it approaches a signalized intersection with I-465 eastbound to Binford Boulevard southbound. We believe these combined conditions create a situation where rear end crashes are more likely to occur. Due to the HSM's lack of safety performance functions for profile grades for this facility, these additional safety concerns are not reflected in the above numbers. To mitigate this additional safety concern, this roadway profile grade should be flattened as much as possible heading into the intersection.
- Northbound I-69 to 82nd Street (Ramp #17) is the off-ramp movement for traffic going from northbound I-69 to 82nd Street. This movement is a loop ramp with a tight radius, and a 25 mph posted speed. Alternative B and the No-Build Alternative do not have this as a barrier separated off-ramp. Alternatives A and C barrier separate this movement, but still contain the tight radius and 25 mph posted speed. This safety concern is common among all alternatives, but appear in different movement summaries.

3.2.4 ALTERNATIVE C

All of Alternative C's IHSDM inputs can be seen in Appendix F, Images F – 366 to F – 499. Posted speed and AADT broken out by ramp can be seen in Appendix E, Table E – 29.

As seen in Table 21 below, Alternative C is predicted (non-calibrated) to have 232 total crashes per year. This is the second highest just after the No-Build Alternative. In this alternative, the SB I-69 to SB Binford movement has a relatively poor crash rate and travel crash rate in relation to other movements. It also has two other movements that have mediocre safety performance, as seen in Table 21, increasing the predicted (non-calibrated) number of crashes in this option.

Table 21: Predictive (non-calibrated) Crashes Summary Table: Alternative C

RAMP NUMBER	MOVEMENT	CRASHES [TOTAL]	FI CRASHES [TOTAL]	PDO CRASHES [TOTAL]
-	I-465	2,772*	808*	1,964*
-	I-69	513	147	366
1	82nd to SB BINFORD	191*	69*	122*
2	82nd to SB I-69	31	13	18
3	EB I-465 to NB BINFORD	7	3	5
4	EB I-465 to NB I-69	125*	40*	85*
5	EB I-465 to SB BINFORD	5	2	3
6	NB I-465 to 82nd	8	3	5
7	NB I-465 to NB I-69	243*	93*	150*
8	NB BINFORD to 82nd	65	24	41

9	NB BINFORD to NB I-69	72	26	46
10	NB BINFORD to WB I-465	23	9	13
11	SB I-69 to 82nd	14	6	8
12	SB I-69 to SB I-465	190*	66*	124*
13	SB I-69 to SB Binford	116	46	70
14	SB I-69 to WB I-465	35	13	23
ALTERNATIVE C TOTAL (2022 TO 2040 ANALYSIS PERIOD: 19 YEARS)		**4,411**	**1,367**	**3,044**
ALTERNATIVE C TOTAL [YEARLY]:		**232**	**72**	**160**

*Note: For HSM lane limitations, lane addition CMF is used and Crash Rate is recalculated. See applicable CMF in Appendix E, Table E – 19.

Notable Alternative C ramp safety performance issues are as follows:

- 82nd to southbound I-69 (Ramp #2) is predicted (non-calibrated) to have a relatively mediocre crash rate among this alternative, as well as Alternative A and the No-Build Alternative (Alternative B eliminates this movement). This movement is a loop ramp, and performs poorly due to the combination of high traffic, tight radii, and design speed.
- Northbound Binford Boulevard to westbound I-465 (Ramp #10) is common among all alternatives. This movement is a loop ramp, and performs poorly due to the combination of high traffic, tight radii, and design speed.
- Southbound I-69 to southbound Binford Boulevard (Ramp #13) is the same movement for each alternative, but the ramp geometry differs. In Alternative C, this ramp diverges from I-69 southbound earlier, and is pushed out further, which increases the length of the "ramp" classification in IHSDM, and decreases the radii of three of the curves. This lesser radius is captured in the IHSDM analysis, which leads to relatively less safe numbers overall. However, this movement fixes the additional safety concern described with Alternative B with flatter profile grades, which is not captured in the IHSDM numbers due to the HSM's lack of safety performance functions for profile grades for this facility.

3.3 DRIVER EXPECTANCY AND SIGNING CONSIDERATIONS

Driver expectancy relates to a driver's readiness to respond to situations, features, and information in predictable and successful ways. Driver expectancy influences driver speed and accuracy. The more predictable the feature, the less chance of errors. As drivers, the public has come to expect certain things while driving. A lot of the design in the state and national manuals have taken this into account. Each of the options have advantages and disadvantages relating to driver expectancy.

3.3.1 NO-BUILD ALTERNATIVE

There are disadvantages related to driver expectancy and signing considerations associated with the No-Build Alternative:

- The exit for Binford Boulevard is on the left side on southbound I-69. Left side exits are relatively uncommon and cause delays.
- The traffic entering from the 82nd Street ramp must cross three lanes on I-69 if they have to go on Binford Boulevard. This is a safety issue for this movement.
- The signing on northbound I-465 to northbound I-69 is inadequate. A decision lane results in a two-lane exit. However, most drivers use only the outside lane causing a disproportionate usage of the outside lane. This causes excessive delays and traffic backups and can be attributed to the improper signage.
- The eastbound I-465 to northbound I-69 movement is currently a loop ramp. For a system interchange, drivers expect a higher speed ramp.
- The weave distance between the eastbound I-465 to northbound I-69 loop ramp and northbound I-69 to westbound I-465 loop ramp is too short and creates a major safety issue. Moreover, the northbound Binford Boulevard traffic merges onto I-69 and is not expected by all motorists.

3.3.2 ALTERNATIVE A

Alternative A features advantages related to driver expectancy and signing considerations:

- This alternative provides good separation of traffic and keeps the local traffic headed to 82nd Street away from northbound I-69 traffic.
- The eastbound I-465 off-ramps for Binford Boulevard and 82nd Street are combined into a single eastbound I-465 off-ramp which reduces the number of exits on eastbound I-465 and improves driver expectancy and safety. Overhead arrow-per-lane signs will be provided at this location.
- This alternative provides acceptable distance between the exits on eastbound I-465.
- Barrier separation will be provided to separate mainline traffic and ramp traffic from 82nd St to Binford Boulevard.

Alternative A has disadvantages related to driver expectancy and signing considerations:

- Southbound I-69 to southbound Binford Boulevard remains on the left side of southbound I-69. However, the movement will be barrier separated so that no traffic entering from 82nd Street can cross over and weave with southbound I-69 traffic.
- Southbound I-69 to Binford Boulevard lanes will be barrier separated from southbound I-69. This gore occurs on the left side of southbound I-69 close to the same location where the southbound 82nd Street off-ramp gore is located on the right side.
- The heavy northbound I-465 to northbound I-69 movement is on the right side and features more lane drops than the smaller eastbound I-465 to northbound I-69 movement. Typically, higher traffic movements get fewer lane drops.

3.3.3 ALTERNATIVE B

Alternative B features advantages related to driver expectancy and signing considerations:

- There is only one exit along eastbound I-465 throughout the entire I-465/I-69 interchange. This improves driver expectancy and safety. Overhead arrow-per-lane signs will be provided at this location.
- Since the eastbound I-465 to northbound I-69 ramp is aligned on the right side of northbound I-69, eastbound I-465 traffic heading towards 82nd Street can also use the same ramp as the eastbound I-465 to northbound I-69 traffic while staying to the right. This configuration allows the existing eastbound I-465 to northbound I-69/82nd Street loop ramp to be removed. Providing a separate ramp for the northbound I-465 to 82nd Street traffic in this overall configuration eliminates the weaving with the northbound Binford Boulevard to westbound I-465 loop ramp.
- The southbound 82nd Street on-ramp does not split into two movements.

Alternative B has disadvantages related to driver expectancy and signing considerations:

- The two-lane eastbound I-465 to northbound I-69/82nd Street ramp travels under I-465 with a slight downgrade heading into a horizontal curve. Similar to Alternative C, several mitigation factors outlined have been introduced to increase the safety of this movement and prevent rollover crashes.
  - Introduce spiral transitions at the beginning and end of the horizontal curve.
  - Minimize the downgrade as much as possible (maximum downgrade of 4% and ideally closer to 3%).
  - Design full-width shoulders on both sides of the ramp where both shoulders are full width shoulders that are completely in plane with the roadway without any shoulder breaks or rollover.
  - Increase the ramp radius and design the superelevation transition to meet NCHRP Report 774 which specifies the correct superelevation transition at the PC. The design follows the guidance from the British Columbia Ministry of Transportation supplement to the Transportation Association of Canada Geometric Design Guide which increases the radius by 10% for each 1% increase in grade over 3%.
  - Per NCHRP Report 774, downgrades of more than 4% should require “Stay in Lane” signs. Those will be posted on this alignment as well.
- Southbound I-69 to southbound Binford Boulevard remains on the left side of southbound I-69.

- The ramp from the CD road to southbound I-465 travels under the southbound I-69 to westbound I-465 ramp and I-465, creates a fourth lane on the outside of the southbound I-69 to southbound I-465 ramp and drops on the outside of the curve prior to merging with southbound I-465.
- Motorists on northbound I-465 to northbound I-69 may try to cross over the eastbound I-465 to northbound I-69 movement and exit at 82nd Street. This may potentially create an unsafe situation.
- There is a steep downgrade on southbound Binford Boulevard over I-465. This may make stopping at the signal unsafe during wet and snowy conditions.

3.3.4 ALTERNATIVE C

Alternative C features advantages related to driver expectancy and signing considerations:

- The eastbound I-465 to northbound I-69 ramp travels under I-465 and then has a straight tangent (approximately 1,000 feet long) before northbound Binford Boulevard merges in on the right side of the ramp. This layout provides desirable distance between the individual ramp merges and lane drops.
- There are only two exits along eastbound I-465 throughout the entire I-465/I-69 Interchange.
- The northbound I-465 to northbound I-69 ramp crosses over the northbound Binford Boulevard to 82nd Street ramp and merges into the right side of northbound I-69 before continuing north with the outside mainline lane dropping inside the 82nd Street interchange. This creates a safe merging situation and improves driver expectancy.
- Southbound I-69 to southbound I-465 is the heaviest southbound movement and is a system interchange movement. Alternative C places this heaviest movement on the left side. This is a major advantage and tremendously improves driver expectancy and reduces weave movement impacts.
- I-69 traffic heading for Binford Boulevard will now exit on the right side of I-69 north of the 82nd Street bridge. This exit is combined with the 82nd Street off-ramp which improves driver expectancy. Southbound Binford Boulevard traffic then cross over the southbound 82nd Street on-ramp and 82nd Street via a new bridge and becomes a CD road running parallel to southbound I-69.

Alternative C has disadvantages related to driver expectancy and signing considerations:

- The two-lane eastbound I-465 to northbound I-69/82nd Street ramp travels under I-465 with a slight downgrade heading into a horizontal curve. Similar to Alternative B, several mitigation factors outlined have been introduced to increase the safety of this movement and prevent rollover crashes.
  - Introduce spiral transitions at the beginning and end of the horizontal curve.
  - Minimize the downgrade as much as possible (maximum downgrade of 4% and ideally closer to 3%).
  - Design full-width shoulders on both sides of the ramp where both shoulders are full width shoulders that are completely in plane with the roadway without any shoulder breaks or rollover.
  - Increase the ramp radius and design the superelevation transition to meet NCHRP Report 774 which specifies the correct superelevation transition at the PC. The design follows the guidance from the British Columbia Ministry of Transportation supplement to the Transportation Association of Canada Geometric Design Guide which increases the radius by 10% for each 1% increase in grade over 3%.
  - Per NCHRP Report 774, downgrades of more than 4% should require “Stay in Lane” signs. Those will be posted on this alignment as well.
- The 82nd Street on-ramp to southbound I-69 remains a loop ramp, but it will be barrier separated. Traffic must decide on the ramp to either enter southbound Binford Boulevard on the right or southbound I-69 on the left.
- Eastbound I-465 to 82nd Street causes difficulty with the signing on eastbound I-465. Instead of having the ability to use arrow signs for the eastbound I-465 to northbound I-69 ramp and the through movement on I-465, minor interchange signing must be used.
- Overhead lane-per-arrow signs cannot be provided for eastbound I-465. However, the signage will still meet the MUTCD requirement for the shared lane situation on eastbound I-465.

3.4 CONSTRUCTABILITY

The overall complexity of the maintenance of traffic for the I-465/I-69 interchange construction is high but very comparable between the three build alternatives. There will be multiple construction phases, complicated bridges, long retaining walls and multiple merge/diverge tapers to maintain. The preliminary cost estimates reflect the differences in complexity between the various bridges and the amount of temporary pavement, shoring and the location of construction access points should be similar between all three alternatives. The existing northbound Binford Boulevard to westbound I-465 ramp will be closed for the duration of construction. The following sections present the primary constructability advantages and disadvantages for each alternative.

3.4.1 NO-BUILD ALTERNATIVE

There are some reduced constructability impacts associated with the No-Build Alternative. Eventually rehabilitation work will be required on the existing pavement and bridges. There will be lane closures and challenges to maintain traffic through the congested work zones as rehabilitation work progresses. Several bridges are reaching the end of their service life and in the case of the I-465 bridges over 71st Street, a deck replacement is required since those bridges have already received three overlays. The I-465 bridges over the railroad and over existing Binford Boulevard will also require routine and regular maintenance. Heavy congestion and operational deficiencies will reduce the ability of contractors to make repairs and upgrades to the facility, especially on I-69 north of I-465. The existing I-465 and I-69 mainlines feature narrow shoulders, inadequate capacity and significant weave movements that cause heavy queuing during any construction that occurs during the day and especially during AM or PM peak-hours.

3.4.2 ALTERNATIVE A

There are primary constructability advantages for Alternative A:

- The proposed eastbound I-465 bridge over Binford Boulevard does not have a fifth lane which provides more space to construct the proposed eastbound I-465 bridge over Binford Boulevard off-line. This also reduces the probability of needing an eastbound I-465 counterflow lane on the proposed westbound I-465 bridge.
- The I-465 bridges are easier to construct because the ramps are separate bridges not directly connected to the mainline bridges.

The primary constructability disadvantages for Alternative A include:

- The eastbound I-465 to northbound I-69 ramp over I-465 can be constructed off-line but cannot be used until the end of construction since the grade differences inside the I-465/I-69 interchange north of I-465 prohibit tying in that ramp. This forces the northbound Binford Boulevard movement to remain in a temporary configuration for multiple construction seasons while the grade is raised and the northbound I-465 to northbound I-69 elevated ramp is completed. Options for temporary movements are limited based on the preliminary retaining wall layout.
- The eastbound I-465 to northbound I-69 ramp is a three-level bridge over I-465 that must be constructed over live traffic.
- The eastbound I-465 to northbound I-69 ramp and the northbound I-465 to northbound I-69 ramp are both elevated and run down the middle of the existing I-69 alignment requiring high walls on both sides.
- The northbound I-465 to northbound I-69 bridge crosses over the ramp from northbound Binford Boulevard to 82nd Street at a very tight skew.
- Northbound Binford Boulevard has to be raised by approximately 15 feet just north of I-465 in order to merge with the eastbound I-465 to northbound I-69 ramp that is descending from over I-465.

3.4.3 ALTERNATIVE B

There are primary constructability advantages for Alternative B:

- The proposed eastbound I-465 bridge over Binford Boulevard does not have a fifth lane which provides more space to construct the proposed eastbound I-465 bridge over Binford Boulevard off-line. This also reduces the probability of needing an eastbound I-465 counterflow lane on the proposed westbound I-465 bridge.
- The ramp from 82nd Street to southbound I-465 can be constructed off-line and used to maintain southbound Binford Boulevard traffic away from the middle of the interchange.
- The eastbound I-465 to northbound I-69 ramp is at-grade and can be entirely constructed once southbound Binford Boulevard traffic is moved away from the middle of the interchange.
- There is no northbound barrier-separated CD road to 82nd Street allowing more pavement to be used for MOT.

The primary constructability disadvantages for Alternative B include:

- The southbound Binford Boulevard three-level bridge over I-465 is the most complicated bridge in any alternative to construct and must be constructed over live traffic. The construction of this bridge is also tied to the demolition of the existing eastbound I-465 bridge. Southbound Binford Boulevard traffic will probably remain in a temporary configuration for multiple construction seasons.
- The skew on the northbound I-465 to northbound I-69 bridge over the eastbound I-465 to northbound I-69 ramp forces the northbound I-465 to northbound I-69 ramp alignment to be much closer to the proposed northbound Binford Boulevard to westbound I-465 loop ramp than in the other two alternatives.
- Constructing the northbound I-465 to northbound I-69 ramp over the eastbound I-465 to northbound I-69 ramp will require some temporary pavement and traffic shifts.
- Retaining walls are required between northbound Binford Boulevard and southbound Binford Boulevard south of I-465 as southbound Binford Boulevard comes down to existing ground.
- Southbound Binford Boulevard, the ramp from 82nd Street to southbound Binford Boulevard and the northbound I-465 to northbound I-69 ramps are all elevated well above existing ground creating a more difficult scenario for access to these ramps for construction traffic and material deliveries.

3.4.4 ALTERNATIVE C

There are primary constructability advantages for Alternative C:

- There are more opportunities to construct proposed pavement off-line because more of the proposed ramps can be constructed at existing grade through the middle of the I-465/I-69 interchange.
- Retaining wall is greatly minimized within the north side of the interchange since the eastbound I-465 to northbound I-69 and the northbound Binford Boulevard to northbound I-69 ramps are at-grade. The northbound I-465 to northbound I-69 ramp is elevated but merges in on the right side of I-69 with more room on the left side of the ramp for side slopes than in the other two alternatives.
- There is enough space between proposed southbound Binford Boulevard and the proposed northbound I-465 to northbound I-69 ramp to construct a temporary ramp for northbound I-465 to northbound I-69 traffic.
- There are no three-level bridges and no bridges over I-465 inside the I-465/I-69 interchange.
- This alternative provides the most cost-effective solution for handling the traffic traveling from 82nd Street to southbound Binford Boulevard through the use of a slip lane from the southbound 82nd Street on-ramp.

The primary constructability disadvantages for Alternative C include:

- Bridge 6 and Bridge 8 are difficult to construct.
- Southbound Binford Boulevard is squeezed in between the two northbound ramps with retaining walls on both sides of the 2-lane ramp.

3.4.5 SUMMARY OF BRIDGE CONSTRUCTABILITY FOR BUILD ALTERNATIVES

Constructability of the proposed bridges is a key component for each alternative. Below is a table outlining the major constructability features for each bridge shown in each build alternative. All of the information shown below is *preliminary* and based on the conceptual roadway alignments as developed for the alternatives analysis.

Table 22: Summary of Bridge Constructability

ALTERNATIVE A	ALTERNATIVE B	ALTERNATIVE C
BRIDGE 1 (I-465 OVER BINFORD BOULEVARD)		
• Approx. Length=275 ft • Max. Span approx. 140 ft • Concrete or steel superstructure options • Replacement bridges do not encroach on exist EB bridge providing clearance during construction • Multiple MOT Phases (WB 1st) • No 3rd Level Bridge above this bridge	• Approx. Length=410 ft • Max. Span approx. 200 ft • Steel superstructure • Spans EB I-465 to NB I-69 fly-under which complicates span arrangement ➔ lengthens spans, variable girder lengths / staggered substructure • Extensive shoring during MOT due to difference in length between existing and proposed bridges • Multiple MOT Phases (WB 1st) • 3rd Level Bridge (#8) above this bridge	• Approx. Length=410 ft • Max. Span approx. 200 ft • Steel superstructure • Same complexity as Alternative B regarding span arrangements and shoring requirements • More complicated phasing than Alternative A due to encroachment of proposed bridge on the exist EB bridge • Multiple MOT Phases (WB 1st) • No 3rd Level Bridge above this bridge
BRIDGE 2 (EB I-465 TO NB I-69 / SB BINFORD BOULEVARD RAMP OVER RR / SB I-69 TO SB I-465 RAMP)		
• Approx. Length=165 ft • Single Span • Tapered width for gore: more complex to construct than constant width • Possible superelevation transition	• Approx. Length=165 ft • Single Span • Gore is on bridge making it most complex bridge of 3 Alternatives • Possible superelevation transition	• Approx. Length=160 ft • Single Span • Constant width on tangent • Least complex bridge of 3 Alternatives • Possible super transition
BRIDGE 3 (SB I-69 TO SB I-465 RAMP OVER BINFORD BOULEVARD)		
• Approx. Length=180 ft • Max. Span approx. 100 ft • Multiple MOT Phases • Same Complexity	• Approx. Length=195 ft • Max. Span approx. 100 ft • Multiple MOT Phases • Same Complexity	• Approx. Length=225 ft • Max. Span approx. 110 ft • Multiple MOT Phases • Same Complexity
BRIDGE 4 (I-465 OVER SB I-69 TO SB I-465 RAMP / RR)		
• Approx. Length=205 ft • Max. Span approx. 100 ft • Multiple MOT Phases (WB 1st) • Same Complexity	• Approx. Length=205 ft • Max. Span approx. 100 ft • Multiple MOT Phases (WB 1st) • Same Complexity	• Approx. Length=205 ft • Max. Span approx. 100 ft • Multiple MOT Phases (WB 1st) • Same Complexity
BRIDGE 5 (SB I-69 TO SB I-465 RAMP OVER RR)		
• Approx. Length=70 ft • Single Span • Multiple MOT Phases • Same Complexity	• Approx. Length=170 ft • Max. Span approx. 70 ft • Multiple MOT Phases • Same Complexity	• Approx. Length=75 ft • Single Span • Single MOT Phase Off-Line • Same Complexity
BRIDGE 6 (SB BINFORD BOULEVARD RAMP OVER SB I-69 TO I-465 RAMPS)		
• Approx. Length=355 ft • Max. Span approx. 175 ft • Curved bridge for 1 lane of traffic • Pier placed in gore with cap expected to overhang roadway potentially raising bridge profile or requiring an integral pier cap to meet vertical clearance requirement • Less complicated than Alternative C)	• Approx. Length=310 ft • Max. Span approx. 150 ft • Similar complexity and design features as Alternative A	• Approx. Length=445 ft • Max. Span approx. 220 ft • Curved bridge for 2 lanes of traffic • Similar complexity and design features as other alternatives with the exception that the pier cap will be wider and more heavily loaded making this most complex of 3 Alternatives

BRIDGE 7 (NB I-465 TO NB I-69 RAMP OVER NB RAMPS)		
• Approx. Length=570 ft • Max. Span approx. 225 ft • Curved bridge for 3 lanes of traffic • Straddle bents required • Tight skew requires extra length • Probably need at least 1 integral cap	• Approx. Length=630 ft • Max. Span approx. 160 ft • Curved bridge for 3 lanes of traffic • Long Straddle bents to cross NB traffic • Probably needs integral pier caps due to skew and vertical requirements • Most complicated of Alternatives	• Approx. Length=330 ft • Max. Span approx. 160 ft • Curved bridge for 3 lanes of traffic • Straddle bents required • Least complicated of Alternatives
BRIDGE 8 (UNIQUE LOCATION TO EACH ALTERNATIVE)		
• EB I-465 to 82nd St. Ramp over Binford Blvd. • Approx. Length=230 ft • Max. Span approx. 115 ft • Unique structure but relatively simple	• SB Binford Blvd over I-465 • Approx. Length=850 ft • Max. Span approx. 225 ft • Curved 3rd Level Bridge • Complex geometry with curve on bridge • Ramp gore on north end of bridge • Final design will be adjusted to accommodate center pier location in I-465 median • Potentially tall MSE walls • Most complex bridge in any location on any alternative to construct	• SB Binford Blvd over EB I-465 to NB I-69 Ramp • Approx. Length=410 ft • Max. Span approx. 200 ft • Skew requires a straddle bent to achieve reasonable span lengths • Complex geometry with superelevation transition, tapered width and curves • MSE walls on both sides of SB Binford south of bridge creates undesirable situation
BRIDGE 9 (UNIQUE LOCATION TO EACH ALTERNATIVE)		
• EB I-465 to NB I-69 Ramp over I-465 • Approx. Length=1,315 ft • Max. Span approx. 235 ft • 3rd Level Bridge • Pier cap overhangs on I-465 with adequate vertical clearance to avoid integral caps • Constant curvature and superelevation • Conventional hammerhead piers • Complex girder erection over live traffic	• I-69 / 82nd St. Ramps over 82nd St. • Approx. Length=185 ft • Max. Span approx. 90 ft • Bridge widening • Possible conflict with AT&T utility • Similar to Alt A (Bridge 10) & Alt C (Bridge 11)	• New SB Binford Ramp over 82nd St. • Approx. Length=180 ft • Max. Span approx. 90 ft • New bridge • Possible conflict with AT&T utility
BRIDGE 10 (UNIQUE LOCATION TO EACH ALTERNATIVE)		
• I-69 / 82nd St. Ramps over 82nd St. • Approx. Length=190 ft • Max. Span approx. 95 ft • Bridge widening • Possible conflict with AT&T utility • Similar to Alt B (Bridge 9) & Alt C (Bridge 11)	• N/A	• New SB Binford Blvd Ramp over 82nd St Loop Ramp • Approx. Length=105 ft • Single Span • New bridge • Possible conflict with AT&T utility
BRIDGE 11 (UNIQUE LOCATION TO EACH ALTERNATIVE)		
• N/A	• N/A	• I-69 / 82nd St. Ramps over 82nd St. • Approx. Length=190 ft • Max. Span approx. 95 ft • Bridge widening • Possible conflict with AT&T utility • Similar to Alt A (Bridge 10) & Alt B (Bridge 9)

Overall bridge construction on Alternative A is similar in complexity to Alternative C and less complex to construct than Alternative B. Alternative A features a long flyover structure (Bridge 9) but its construction is more conventional due to constant geometrics though the girder erection will be complex. Alternative C avoids a flyover bridge but introduces an additional structure (Bridge 8) with a straddle bent with very complex geometry and span lengths pushing practical limits for straddle bent structures. Alternative A has a simpler Bridge 1 than Alternative C and there are other nuances between these options that when considered make the overall bridge constructability between Alternative A and Alternative C similar. Alternative B is more complex than Alternatives A and C because Bridge 8 is the most complex bridge to construct of any alternative and the other bridges are not significantly less complex than comparable bridges in other alternatives.

3.5 LONG-TERM MAINTENANCE CONSIDERATIONS

There are a number of elements that should be reviewed for long-term maintenance considerations. Three major items were chosen to be evaluated and discussed because of potential future cost as well as impact to existing traffic flow patterns while being maintained. These items are pavement buildup, bridges, and drainage structures.

3.5.1 NO-BUILD ALTERNATIVE

The No-Build Alternative would include long-term costs of maintaining the existing I-465 and I-69 corridor including but not limited to pavement resurfacing or replacement, bridge rehabilitation or replacement and culvert replacement or lining. This would result in a commitment of resources associated with maintenance and potential rehabilitation activities that could be taken over the short-term or long-term to address safety and level of service deficiencies of the existing facilities. It will be more cost effective to implement one of the Build Alternatives.

3.5.2 ALTERNATIVE A

Below is discussion of the preliminary pavement, bridge, and drainage features in Alternative A compared to those in other alternatives (refer to Figure 7 and Figure 8 for bridge numbers for each alternative):

- Overall new pavement area is roughly 2,770,000 square feet, the most of all alternatives
- Alternative A has 16,000 linear feet of concrete median barrier and 3,200 linear feet of single faced concrete barrier for a total of 19,200 linear feet.
- Alternative A has 10 total bridges to inspect and maintain, higher than Alternative B (9 bridges) but less than Alternative C (11 bridges).
- Alternative A has 275,000 square feet of bridge deck to maintain.
- The I-465 mainline bridges on Alternative A (Bridges 1 & 4) have a combined deck area of approximately 80,000 square feet compared to approximately 100,000 square feet on other alternatives. While Alternative A has more overall bridge, there is less bridge maintenance impact to I-465 traffic on this alternative than Alternatives B and C.
- The southbound Binford Boulevard through movement between I-465 and 82nd Street does not require a bridge on Alternative A. The maintenance of Bridge 8 on Alternative B and Bridges 6 and 8 on Alternative C will impact Binford Boulevard traffic.
- Bridge 9 will be the highest cost bridge to maintain of all alternatives due to its length.
- Alternative A requires 1 less straddle bent to maintain than Alternative C. Structures on integral straddle bents are more complicated to rehabilitate as superstructure replacements and re-decking is complicated by the integral pier cap. Inspection of the straddle bent cap will also be complicated as utilizing a steel cap would introduce a fracture critical member and post tensioning cannot be inspected visually except at the anchorages.

Alternative A includes the largest amount of new pavement which in turn will have the most future cost as well as the largest potential of traffic disruption during these future maintenance periods. Alternative A also has the most concrete barrier out of all of three alternatives. The length of concrete barrier is directly proportional to the number of drainage inlets warranted. Continued future maintenance of these inlets will be needed to ensure proper drainage and minimize the risk of ponding in the traveled way. Alternative A has the most bridge area and the most complex bridges to maintain, the benefit of less long-term impact to the I-465 mainline combined with having one less straddle bent makes it comparable to Alternative C in terms of long-term maintenance since the difference in total deck area is not high (<10%).

3.5.3 ALTERNATIVE B

Below is discussion of preliminary bridge features in Alternative B compared to those in other alternatives (refer to Figure 9 and Figure 10 for bridge numbers for each alternative):

- Overall new pavement area is roughly 2,490,000 square feet, the least of any alternatives.
- Alternative B has 10,000 linear feet of concrete median barrier and 2,500 linear feet of single faced concrete barrier for a total of 12,500 linear feet.
- Alternative B has 9 total bridges to inspect and maintain, the least of any alternatives.
- Alternative B has 259,200 square feet of deck to maintain, slightly higher than Alternative C and less than Alternative A.
- There are more I-465 mainline bridges (Bridges 1 & 4) to maintain on Alternative B than on Alternative A and a similar amount as on Alternative C.
- The southbound Binford Boulevard through movement between I-465 and 82nd Street requires a complex fly over bridge (Bridge 8) on Alternative B. Inspection and maintenance of this bridge will impact southbound Binford Boulevard traffic and the routes below. Alternative A does not require a structure for the southbound Binford Boulevard movement while Alternative C requires 2 bridges.
- Bridge 8 will be the second highest cost bridge to maintain of all alternatives.
- Alternative B requires 1 less straddle bent to maintain than Alternative C. See discussion in Alternative A regarding long-term considerations for straddle bents.

Alternative B has the least amount of pavement as well as concrete barrier so future maintenance of pavement cost will be less than the other two alternatives. However, the Alternative B Bridge 8 features have the most long-term maintenance complications of any alternative due to the complex flyover for the through movement on southbound Binford Boulevard at I-465. The maintenance of the complex flyover on Alternative B directly impacts traffic on southbound Binford Boulevard as well as I-465 and the eastbound I-465 to northbound I-69 ramp below making Alternative A and Alternative C more favorable than Alternative B since the total deck area is also not significant.

3.5.4 ALTERNATIVE C

Below is discussion of preliminary bridge features in Alternative C compared to those in other alternatives (refer to Figure 11 and Figure 12 for bridge numbers for each alternative):

- Overall new pavement area is roughly 2,560,000 square feet
- Alternative C has 13,000 linear feet of concrete median barrier and 1,000 linear feet of single faced concrete barrier for a total of 14,000 linear feet.
- Alternative C has 11 total bridges to inspect and maintain, the most of any alternatives.
- Alternative C has 257,600 square feet of deck to maintain, lowest of all alternatives.
- There are no 3rd level structures on this alternative to maintain.
- There are more I-465 mainline bridges (Bridges 1 & 4) to maintain on Alternative C than on Alternative A and a similar amount as on Alternative B.
- The southbound Binford Boulevard through movement between I-465 and 82nd Street requires 2 structures (Bridges 6 & 8). Bridge 8 requires a straddle bent while bridge 6 may require integral pier caps. Inspection and maintenance of these bridges will impact Binford Boulevard. traffic. Alternative A does not require a structure for the Binford movement while Alternative B has a single bridge though more complex (Bridge 8).
- Alternative C requires 1 more straddle bent to maintain than Alternatives A and B. See discussion in Alternative A regarding long-term considerations for straddle bents.

Alternative C has the least bridge area and does not have a 3rd level flyover structure which simplifies future inspection and maintenance operations. However, this alternative has more I-465 mainline bridge length and an additional straddle bent compared to Alternative A making both alternatives comparable overall (see additional discussion in Alternative A).

3.6 ENVIRONMENTAL IMPACTS

The potential for significant environmental differences between the build alternatives was evaluated. All four alternatives will be carried forward for additional environmental analyses within the Environmental Assessment (EA), scheduled to be completed in the summer of 2019. Initial environmental screening included the following activities:

- A preliminary Red Flag Investigation (RFI) per standard INDOT guidance, dated April 25, 2017 was conditionally approved by INDOT Environmental Services on May 18, 2017. The RFI identifies potential environmental concerns using data from geographic information system (GIS) databases, searched within a half-mile radius (or greater) of the Project Area.
- Field investigations were conducted by qualified personnel in September 2016 to identify terrestrial habitat and water resources (wetlands, streams, ponds, etc.) within the areas shown on draft Water Resources figures in Appendix C, Exhibits C - 1 to C - 12. The data collected during these investigations will be used for a Waters of the United States (US) report and any subsequent permitting. The preliminary draft data was used for this screening.
- A preliminary environmental justice (EJ) memorandum was prepared on July 19, 2017 for INDOT and FHWA to identify the potential for low-income and minority populations within or near the Project Area, and to assess the potential for disproportionate impacts to those populations.
- A preliminary record check and an above-ground survey were conducted in February 2017 by qualified historians/archaeologists to determine potential impacts to cultural resources, such as historic landmarks, historic districts, and known archaeological sites.
- A community advisory committee (CAC) meeting was held on August 16, 2017 followed by a public open house on August 23, 2017. Stakeholder and public feedback regarding the build alternatives and potential environmental impacts was requested.

Data obtained from the activities listed above was used to estimate the potential environmental impact of each alternative. Approximate construction limits were developed to determine the resource impacts to forests, streams, wetlands, Section 6(f) resources, etc. In order to assess cultural resources, noise impacts and hazardous material sites (dry cleaners, industrial releases, gasoline stations, etc.), appropriate buffers were used depending on the resource analyzed. Potential Section 4(f) resources were identified within 1,000 feet of the construction limits. Hazardous material sites were searched for adjacent and nearby parcels, within 150 feet of construction. Potential noise impacts were assessed for areas within 500 feet of the edge of the proposed outside travel lanes.

3.6.1 COMPARISON OF ALTERNATIVES

A majority of the environmental field work (see locations of resources in Appendix C, Exhibits C – 1 to C – 13) is complete and Table 23 summarizes potential environmental impacts. A narrative description of each category is provided further below.

Table 23: Summary of Potential Environmental Impacts

CATEGORY	NO-BUILD	ALTERNATIVE A	ALTERNATIVE B	ALTERNATIVE C
Wetlands (acres)	0	8.3	8.3	8.3
Rivers and Streams (linear feet)	0	14,000	14,000	14,000
Floodplains (acres)	0	10.9	10.9	10.9
Forested Habitat (acres)	0	16.3	16.3	16.3
Potential to impact threatened or endangered species	None	Low to Moderate	Low to Moderate	Low to Moderate
Potential Section 4(f) Public Parks, Recreation Areas and Wildlife/Waterfowl Refuges (number)	0	1[1]	1[1]	1[1]
Potential Section 4(f) Historic Properties/Districts (number)	0	1	1	1
Known Archaeological Sites (number)	0	0	0	0
Cemeteries (number)	0	0[2]	0[2]	0[2]
Potential to negatively impact Cultural Resources	None	Low to Moderate	Low to Moderate	Low to Moderate
Section 6(f) Properties (numbers/acres)	0	0	0	0
Farmland (acres)	0	0	0	0
Residential Relocations (number)	0	0	0	0
Business Relocations (number)	0	4[3]	4[3]	4[3]
Public Facilities and Services Relocations (number)	0	0	0	0
Potential for disproportionate impacts to EJ populations	None	Low	Low	Low
Potential Noise Impacts	None	High	High	High
Potential Hazardous Materials Sites (number)	0	11	11	11

Notes:

1 – Temporary impacts may occur to the 71st Street Multi-Use Trail, located underneath the I-465 bridge over 71st Street. See below.

2 – The former Wright Cemetery is believed to have been properly relocated. Additional coordination/investigation is pending.

3 – The Suburban Extended Stay Hotel is counted as a business for the purpose of this screening. Additional investigation is needed to fully assess the socio-economic impact of potentially relocating this facility.

The No-Build Alternative would have very minimal environmental impacts in the absence of reconstruction. This statement assumes that no widening would occur and the existing infrastructure would continue to be maintained and rehabilitated as needed on an on-going basis. This on-going maintenance includes pavement resurfacing or replacement, bridge rehabilitation or replacement and culvert replacement or lining. All of the maintenance work could be completed within the existing previously disturbed right of way and a significant amount of rehabilitation work could occur without leaving the existing roadway. Outside of future widening, there is only a slight change of minimal environmental impacts associated with the No-Build Alternative. However, this alternative would not address the congestion and safety issues discussed in the Summary of Draft Purpose and Need (Section 1.3). Impacts to environmental resources from Alternatives A, B, and C are discussed below.

Wetlands

No National Wetlands Inventory (NWI) wetland polygons were identified within the Project Area during the RFI. Field investigations identified approximately 110 wetlands, covering 8.3 acres and all three build alternatives equally impact these wetlands. The majority of the delineated wetlands are low-quality, emergent wetlands contained within a roadside ditch and dominated by invasive species.

Rivers and Streams

Six rivers and streams were identified within a half-mile of the Project Area during the RFI. Field investigations found an estimated 20 likely jurisdictional streams totaling approximately 14,000 linear feet. These streams include the White River, Dry Run, Hillsdale Run, Blue Creek, and unnamed tributaries (UNTs), some of which are entirely located within roadside ditches. The I-465 bridge over the White River was already widened and upgraded, so no impact to the White River is anticipated. There is no significant difference in the estimated stream impacts between the three build alternatives.

Floodplains

Federal Emergency Management Agency (FEMA) GIS data was used to identify mapped floodplains. The floodplains that cross the study area are associated with the White River and Dry Run. There is no significant difference in the estimated floodplain impacts between the three build alternatives.

Forested Habitat

The 16.3 acre block of forested area located north of the I-465/I-69 interchange will likely be used for ramps, roadway side slopes and drainage requirements. Additionally, there are strips of wooded land within existing right-of-way along the White River floodplain and I-465 (riparian habitat) that will be impacted by common design elements.

Threatened or Endangered Species

The project is within the range of the federally endangered Indiana Bat (IBat), *Myotis sodalis*, and the federally threatened northern long-eared bat (NLEB), *Myotis septentrionalis*. The RFI did not identify known hibernacula or capture records within the Project Area but riparian corridors along the rivers, streams and forested area potentially contain bat habitat. Therefore, due to likely impacts to this forested habitat, all three build alternatives have a low to moderate potential to negatively impact the IBat and NLEB. Given the urban nature of the project area, it is assumed there is a low potential for any of the build alternatives to negatively impact other threatened or endangered species.

Potential Section 4(f) Resources

Public Parks, Recreation Areas and Wildlife/Waterfowl Refuges. The RFI identified multiple potential Section 4(f) resources within a half-mile of the Project Area, including public parks, recreational areas (including public schools), and nature preserves as shown in Appendix C, C – 13. Public recreational resources near the project area include Skiles Test Elementary School, Lawrence North High School, Town Run Trail Park, Skiles Test Nature Park, Fort Harrison State Park, the Town Run Trail, the 71st Street Multi-Use Trail, the Fall Creek Greenway Trail, Sahm Park, and Sahm Golf Course. Additionally, there are several nature preserves: Oliver Woods Nature Preserve along the White River (part of which is also used for Town Run Trail), Woolen Gardens Nature Preserve (south of Fall Creek), and two preserves within the Fort Harrison State Park: Bluffs of Fall Creek Nature Preserve and Lawrence Creek Nature Preserve.

The only potential Section 4(f) resource within the three build alternatives is the 71st Street Multi-Use Trail, which crosses under the I-465 bridge over 71st Street. All three build alternatives will result in a Temporary Occupancy or *de minimis* impact to this trail. No conversion of land to a transportation purpose, or other "constructive Section 4(f) use" is proposed. The other potential Section 4(f) resources should not be impacted by the proposed project. There is no significant difference in the likely Section 4(f) Public Parks, Recreation Areas and Wildlife/Waterfowl Refuges resource impacts between the three build alternatives.

Historic Properties/Districts. No above-ground resources listed in the National Register of Historic Places (NRHP) were identified within the Project Area. Historians did identify one resource that may be eligible for listing in the NRHP: the parcel at 6930 East 71st Street. This parcel contains an early stone-clad Styled Ranch (circa 1945) that historians identified in the field to be "Notable" per the Indiana Historic Sites and Structures Inventory rating system. This parcel is adjacent to existing I-465 right-of-way, the 71st Street Multi-Use Trail, and the I-465 bridge over 71st Street as shown in Appendix C, C – 13. Although no new right-of-way is currently proposed in this area, there is a potential each build

alternatives could impact this parcel. However, there is no significant difference in the likely Section 4(f) Historic Properties/Districts resource impacts between the three build alternatives.

Known Archaeological Sites or Cemeteries

The only known archaeological site or cemetery within the Project Area is the former Wright Cemetery, located within the forested parcel. This cemetery is believed to have been properly exhumed and relocated by INDOT contractors between 2006 and 2010. Even though additional investigation and coordination may be required, it is assumed no known archaeological sites or cemeteries will be impacted by the alternatives.

Cultural Resources

Initial screening activities indicate the three build alternatives each have a low to moderate potential to impact cultural resources. The area of potential effect (APE) cannot be established until the elevations are more defined and coordination with consulting parties has been initiated.

Section 6(f) Properties

There are no known properties within the project area that utilized the National Park Service's Land and Water Conservation Fund (LWCF). The nearest property that used LWCF funding include portions of the Fall Creek Greenway Trail. Based on the initial screening, no potential Section 6(f) resources will be impacted by the project.

Farmland

The project area is urban and environmental screening activities did not identify any farmland within the Project Area.

Residential Relocations

The Project Area is adjacent to many single family and multi-family residential areas. However, none of the alternatives include residential relocations.

Business Relocations

The three build alternatives may directly impact several businesses including Wheaton Van Lines (impacts to drives and parking), a vacant office building that previously contained two tenants, an automotive repair shop, and the Suburban Extended Stay Hotel (8055 Bash Street). At this time, there is no significant difference in proposed business relocations between the three build alternatives.

Public Facilities and Services Relocations

The RFI identified Community North and Fairbanks hospitals within a half-mile of the project. Preliminary screening did not identify potential relocations of public facilities or services, such as post offices or hospitals. Likewise, no transit facilities (e.g., bus stations) were identified.

Environmental Justice Populations

Initial screening activities identified potential low-income and/or minority populations adjacent to the Project Area, east of I-69 and north of I-465. However, no residential or business relocations are proposed in that area. Therefore, per the current, preliminary information, there is a low potential for any of the three build alternatives to have a disproportionate impact to environmental justice populations.

Noise

Due to the presence of multiple sensitive noise receptors, including many residences, there is a high potential for noise impacts for all three of the build alternatives. Noise analysis is required for all three of the build alternatives and will be conducted as design progresses. It is reasonable to expect some noise mitigation measures, such as sound barriers, will be needed for the build alternatives. At this time, there is not sufficient information to analyze the difference in noise impacts from the three build alternatives.

Hazardous Material Sites

The RFI identified 66 hazardous materials sites within a half-mile radius of the Project Area, of which 11 are estimated to be adjacent to the three build alternatives. These sites include existing and former gasoline stations, industrial sites including Best Access System (6161 E. 75th Street), and several dry cleaners. The three build alternatives require further evaluation of these facilities to ensure they do not negatively impact right-of-way acquisition or construction.

3.6.2 PUBLIC COMMENTS

The comments received from the CAC, public open house, and social media primarily deal with general comments, right-of-way questions, drainage/hydraulics, business impacts, current/proposed signals on Binford Boulevard, and noise impacts. Of the 48 comments received as of September 8, 2017,

- Four generally support the project and agree with the needs for the project.
- Four comments indicated a preference for Alternative A.
- Five comments indicated a preference for Alternative B.
- Six comments indicated a preference for Alternative C.
- Three comments did not like the proposed signal at the eastbound I-465 to southbound Binford Boulevard ramp.
- Eight comments requested adding missing movements to the I-465/I-69 interchange. These missing movements include the northbound Binford Boulevard to eastbound I-465 movement, and the westbound I-465 to southbound Binford Boulevard movement.

The results of initial stakeholder and public involvement activities have not identified a strong preference for any of the three build alternatives.

3.6.3 CONCLUSION

The results of the initial environmental screening did not identify any substantial differences in impacts to known environmental resources between the three build alternatives. The No-Build Alternative does not impact environmental resources but it also does not meet the project Purpose and Need. Additional agency coordination and environmental analyses are needed to fully assess impacts. As the project progresses, every effort will be taken to avoid and minimize impacts to identified resources. If impacts will occur, appropriate minimization measures will be employed, and certain impacts would require mitigation. Impacts must be minimized before mitigation can be considered.

3.7 UTILITY IMPACTS

The project team has identified two major utility impacts that must be considered during the Alternative Analysis. It is anticipated that additional utility impacts will be identified as final design progresses and a detailed conflict analysis is performed.

The INDOT Communications Distribution Point (CDP) located at the I-465/I-69 interchange is in conflict with the realignment of I-465. A new CDP will need to be installed and brought online prior to the current CDP being disturbed. It is estimated that this impact will be similar for all three build alternatives.

AT&T Indiana's Fishers Central Office is located northwest of the I-69/82nd Street interchange and has a 24-duct run which heads south from the office through the northwest infield of the interchange. It is anticipated that the bridge widening and/or construction over 82nd Street for each build alternative will be in conflict with the existing AT&T duct. Reconstruction of this duct and the facilities within is estimated to include 6-9 months of work.

3.8 PRELIMINARY COST ESTIMATES

Preliminary cost estimates have been developed for each build alternative. The major items affecting the cost of the structure were computed for the three alternates. Items not influencing the overall cost of the project are assumed to be equal for each alternate, and have not been included in the comparative costs listed below. A summary of the preliminary cost estimates for each build alternative are found in the following sections and a more comprehensive breakdown of costs are found in Appendix D.

The cost estimates include the following assumptions:

- Pavement unit prices are based on composite square foot prices including 14 inches (HMA) and subgrade for reconstruction sections.
- Mainline milling and overlay are both 2 inches.
- Retaining wall unit prices are based on square foot prices which includes the wall, leveling pad, structure backfill and B borrow. The retaining walls were built as far down the slope as possible to minimize retaining wall height, moment slab and concrete barrier.
- All retaining walls are assumed to be MSE walls.
- Underdrains on I-465 are assumed to be on the outside and at the median (3 runs) and on the outside of the other alignments (2 runs).
- Earthwork was calculated at $20/cys for cut and $15/cys for borrow.
- Unit prices are based on current INDOT bid tabs.

The following items are excluded from the preliminary cost estimates:

- Right-of-Way Costs
- Utility Relocations (preliminary costs for the ITS tower and AT&T relocation are included)
- Proposed Noise Barriers
- Aesthetics of structures
- Landscaping
- I-465 mainline costs outside of the I-465/I-69 interchange
- Temporary shoring for bridge construction
- Complex bridge demolition
- Premium MOT bridge costs for constructing complex bridges adjacent to traffic
- Right-of-Way
- Mobilization and Demobilization
- Clearing Right-of-Way
- Staking and Engineering
- Maintenance-of-Traffic
- Erosion and Sediment Control
- Contingency
- Temporary pavement, pavement markings and temporary barrier
- Utility Relocation
- ITS
- Noise barrier
- Signing and Lighting
- Drainage

Construction is planned to begin in the Spring 2020 but all preliminary construction costs are shown in base-year dollars and no escalation factors have been applied.

3.8.1 NO-BUILD ALTERNATIVE

Since the analysis of the No-Build Alternative is based on existing geometry, there were no construction costs included with this alternative. Regular maintenance and rehabilitation costs would be required to maintain the existing infrastructure. Several of the existing bridges were built in 1969 (i.e. I-69 over 82nd Street, I-465 over 71st Street) and would require significant rehabilitation in upcoming years. The existing I-465 and I-69 mainline and ramp pavement would require multiple interventions over the next several decades. While this cost can add up, it is unknown at this time what the actual costs are for the No-Build Alternative.

3.8.2 ALTERNATIVE A

A breakdown of the Alternative A bridge costs is shown in Table 24.

Table 24: Summary of Bridge Costs: Alternative A

BRIDGE #	COST (PER SFT)	AREA (SFT)	TOTAL COST (M)
1	$ 175	48,125	$ 8.42
2	$ 195	9,570	$ 1.87
3	$ 195	11,102	$ 2.16
4	$ 175	31,878	$ 5.58
5	$ 195	2,924	$ 0.57
6	$ 225	12,460	$ 2.80
7	$ 225	30,263	$ 6.81
8	$ 195	7,557	$ 1.47
9	$ 195	61,758	$ 12.04
10	$ 95	58,905	$ 5.60
		Total Bridge Cost	$ 47.33
		Overall Cost / SFT	$ 194

The preliminary construction cost for Alternative A is shown in Table 25.

Table 25: Cost Summary Table: Alternative A

PAY ITEM	I-465/I-69 INTERCHANGE & 82ND ST. RAMPS	I-465 MAINLINE INSIDE INTERCHANGE
Full Depth Pavement	$18,020,000.00	$4,570,000.00
Mill & Overlay	$0.00	$0.00
Bridges	$47,330,000.00	$0.00
Moment Slab	$710,000.00	$0.00
Concrete Barrier	$210,000.00	$0.00
Median Barrier	$1,180,000.00	$340,000.00
Retaining Wall	$7,450,000.00	$0.00
Underdrain	$1,380,000.00	$180,000.00
Earthwork	$11,200,000.00	$4,280,000.00
SUBTOTAL	**$87,480,000.00**	**$9,370,000.00**
ALTERNATIVE A COST	**$96,850,000.00**	

3.8.3 ALTERNATIVE B

A breakdown of the Alternative B bridge costs is shown in Table 26

Table 26: Summary of Bridge Costs: Alternative B

BRIDGE #	COST (PER SFT)	AREA (SFT)	TOTAL COST (M)
1	$ 195	69,905	$ 13.63
2	$ 195	10,692	$ 2.08
3	$ 195	12,285	$ 2.40
4	$ 175	29,391	$ 5.14
5	$ 195	7,138	$ 1.39
6	$ 225	11,322	$ 2.55
7	$ 225	40,950	$ 9.21
8	$ 225	46,750	$ 10.52
9	$ 95	30,728	$ 2.92
		Total Bridge Cost	$ 49.85
		Overall Cost / SFT	$ 205

The preliminary construction cost for Alternative B is shown in Table 27.

Table 27: Cost Summary Table: Alternative B

PAY ITEM	I-465/I-69 INTERCHANGE & 82ND ST. RAMPS	I-465 MAINLINE INSIDE INTERCHANGE
Full Depth Pavement	$16,160,000.00	$4,570,000.00
Mill & Overlay	$0.00	$0.00
Bridges	$49,850,000.00	$0.00
Moment Slab	$370,000.00	$0.00
Concrete Barrier	$160,000.00	$0.00
Median Barrier	$760,000.00	$340,000.00
Retaining Wall	$3,120,000.00	$0.00
Underdrain	$1,100,000.00	$180,000.00
Earthwork	$13,740,000.00	$4,280,000.00
SUBTOTAL	**$85,260,000.00**	**$9,370,000.00**
ALTERNATIVE B COST	**$94,630,000.00**	

3.8.4 ALTERNATIVE C

A breakdown of the Alternative C bridge costs is shown in Table 28.

Table 28: Summary of Bridge Costs: Alternative C

BRIDGE #	COST (PER SFT)	AREA (SFT)	TOTAL COST (M)
1	$ 195	77,025	$ 15.02
2	$ 195	7,426	$ 1.45
3	$ 195	13,725	$ 2.68
4	$ 175	33,108	$ 5.79
5	$ 195	3,367	$ 0.66
6	$ 225	21,854	$ 4.92
7	$ 225	19,886	$ 4.47
8	$ 225	19,894	$ 4.48
9	$ 195	8,010	$ 1.56
10	$ 195	4,635	$ 0.90
11	$ 95	48,620	$ 4.62
		Total Bridge Cost	$ 46.55
		Overall Cost / SFT	$ 204

The preliminary construction cost for Alternative C is shown in Table 29.

Table 29: Cost Summary Table: Alternative C

PAY ITEM	I-465/I-69 INTERCHANGE & 82ND ST. RAMPS	I-465 MAINLINE INSIDE INTERCHANGE
Full Depth Pavement	$16,650,000.00	$4,570,000.00
Mill & Overlay	$0.00	$0.00
Bridges	$46,550,000.00	$0.00
Moment Slab	$170,000.00	$0.00
Concrete Barrier	$60,000.00	$0.00
Median Barrier	$960,000.00	$340,000.00
Retaining Wall	$6,430,000.00	$0.00
Underdrain	$1,210,000.00	$180,000.00
Earthwork	$11,300,000.00	$4,280,000.00
SUBTOTAL	**$83,330,000.00**	**$9,370,000.00**
ALTERNATIVE C COST	**$92,700,000.00**	

3.9 ALTERNATIVE ANALYSIS RESULTS

Table 30 summarizes the results of the alternative analysis. There are slight differences in traffic operations and safety but the results of the qualitative and quantitative analysis reveal that all three build alternatives perform very well.

Table 30: Alternative Analysis Summary

CRITERIA	BUILD ALTERNATIVES			NO BUILD
	A	B	C	
MEETS PURPOSE AND NEED				
	Yes	Yes	Yes	No
TRAFFIC OPERATIONS				
AM Vehiclular Delay (s)	33	33	34	185
PM Vehiclular Delay (s)	37	37	37	289
AM Network Speed (mph)	57	58	57	47
PM Network Speed (mph)	57	57	57	40
Qualitative Operations Analysis				
Overall Traffic Operations (Vissim)	High	High	High	Low
NB I-69 Segment from Binford to 82nd Street	High (Barrier Separated)	Medium (EB I-465 to NB I-69 freeway traffic weaves with 82nd Street local traffic)	High (Barrier Separated)	Low
Overall CD System Operations	Medium (Limited CD System)	Medium (Limited C-D System)	High (Full C-D System)	N/A
SB I-69 Split to I-465 / Binford	Medium (SB Binford on left)	Medium (SB Binford on left)	High (SB I-465 on left)	Medium
SAFETY				
Quantitative Analysis				
Predicated Yearly Crashes	231	216	232	305
Fatal/Injury Percentage	31.20%	29.60%	31.00%	32.50%
Qualitative Analysis (Ramp Performance)				
82nd Street to SB I-69 (Alt A/C) 82nd Street to WB I-465 (Alt B)	Medium	High (Barrier Separated)	Medium	Medium
EB I-465 to NB Binford	High	High	High	Medium
NB I-465 to NB I-69	High	High	Medium (Very Long Ramp Classification)	High
NB Binford to NB I-69	High	High	High	Medium
NB Binford to WB I-465	Medium	High (No Weave with EB I-465 to NB Binford Loop Ramp)	Medium	Medium

SB I-69 to SB I-465	Medium (Long Barrier Separated Ramp Classification)	High	High	Low
SB I-69 to SB Binford	High	Low (5% downgrade to signal creates risk of rear-end crashes)	Medium	High
NB I-69 to 82nd	High (Barrier Separated)	Medium	High (Barrier Separated)	Medium
DRIVER EXPECTANCY				
Overall Geometric Layout	Medium	Medium	High	Low
EB I-465 to NB I-69 Ramp Profile	High	Medium	Medium	Medium
NB I-465 to NB I-69 Ramp	Medium	High (Heavy movement enters I-69 on left side)	Medium	Low
NB I-69 Lane Drop Spacing	Medium	Medium	High	N/A
NB I-69 Separation for 82nd Street	High	Medium	High	Medium
EB I-465 Exit Ramps	Medium	High (Single Exit)	Medium	Low
SB 82nd Street to SB Binford Blvd	High	High	High	Low
SB I-69 to SB Binford Blvd	Medium	Medium	High (Exits on Right)	Medium
EB I-465 to NB Binford / 82nd Street Loop Ramp	Medium	High (Loop is removed)	Medium	Low
SB I-69 to SB I-465	High	Low (Ramp enters on right side and drops on curve)	High	Low
SB Binford Blvd Profile at Signal	High	Low (Steep profile from 3rd level bridge to existing ground)	High	N/A
Signing	High	High	Medium	Medium
CONSTRUCTABILITY				
Bridge 1	High	Medium	Medium	N/A
Bridge 2	Medium	Medium	High	N/A
Bridge 3	Medium	Medium	Medium	N/A
Bridge 4	High	Medium	High	N/A
Bridge 5	High	Medium	High	N/A
Bridge 6	Low	Low	Low	N/A
Bridge 7	Low	Low	Low	N/A
Bridge 8	High	Low	Low	N/A
Bridge 9	Low	High	High	N/A
Bridge 10	High	N/A	High	N/A

Bridge 11	N/A	N/A	Medium	N/A
Retaining Walls	Medium (Higher Walls)	Medium (Higher Walls)	High	N/A
LONG-TERM MAINTENANCE				
Overall Long-Term Maintenance	Medium (large 3rd-level bridge)	Medium (large 3rd-level bridge)	High (no 3rd-level bridges)	N/A
Number of Bridges:	10	9	11	8
Total Bridge Area (sf)	274,550	259,170	257,550	96,000
No. of 3rd Level Structures	1	1	0	0
No. of Straddle Bents	1	1	2	0
Qualitative Evaluation	High	Medium	Medium	
Retaining Walls:				
Retaining Wall Area (sf)	149,000	62,320	128,600	N/A
Qualitative Evaluation	Medium	High	Medium	N/A
ENVIRONMENTAL IMPACTS				
Wetlands (ac)	8.3	8.3	8.3	0
Rivers and Streams (ft)	14,000	14,000	14,000	0
Floodplains (ac)	10.9	10.9	10.9	0
Forested Habitat (ac)	16.3	16.3	16.3	0
Potential Impact to Endangered Species	High	High	High	N/A
UTILITY				
Overall Utility Impacts	Medium	Medium	Medium	N/A
COST				
Construction	$96,850,000.00	$94,630,000.00	$92,700,000.00	Regular Maintenance Required
OVERALL QUALITATIVE SUMMARY				
High	20	15	23	
Medium	17	18	15	
Low	3	6	3	

In conclusion, all three build alternatives satisfy the purpose and need and ranked very close to each other once the final analysis was completed. All three build alternatives realize significant improvements to the traffic operations and safety over the No-Build Alternative. The Alternative Analysis Summary shows traffic operations are very similar between the

three build alternatives with almost no distinguishable difference in AM/PM peak-hour delay or AM/PM peak-hour network speeds. The primary differentiators related to traffic operations are qualitative in nature as Alternative C offers the best benefit by featuring a full C-D system and allowing southbound I-465 traffic to exit SB I-69 on the left side. A full C-D system separates mainline freeway and local traffic thus preventing any unintended weaving between mainline I-69 and local traffic (82nd Street). From a quantitative and qualitative perspective regarding traffic operations, Alternative C is the most desirable.

The safety analysis shows that each build alternative is much safer compared to the No-Build Alternative. Quantitatively, Alternative B has a slight advantage due to the lower number of crashes and a lower percentage of fatal/injury crashes compared to Alternative A and Alternative C. However, as stated early in the report, HSM/IHSDM does not support safety performance functions for profile grades. Alternative B places the southbound I-69 to southbound Binford ramp through the middle of the I-465/I-69 interchange in a configuration that requires the southbound I-69 to southbound Binford ramp to travel over I-465 on a third-level bridge (Bridge #8). Southbound Binford then travels down at a 5 percent grade towards the signalized intersection at the eastbound I-465 to southbound Binford ramp terminal. This is very undesirable because this situation produces prime conditions for rear-end crashes. This situation worsens in the winter when icy conditions exist. One of the other primary differences that impacts safety is the existing eastbound I-465 to northbound Binford loop ramp is no longer needed in Alternative B whereas Alternative A and Alternative C continue to use both loop ramps. The advantage that Alternative B has over the other two alternatives is minimized because Alternative A and Alternative C keep the existing eastbound I-465 to northbound Binford loop ramp for traffic exiting I-465 towards 82nd Street. Since all northbound I-69 mainline traffic is separated from local traffic, the volumes are greatly reduced on this loop ramp and the weave problem, while still there in Alternative A and Alternative C, is greatly improved. From a quantitative perspective regarding safety, Alternative B is the most desirable but from a qualitative perspective, both Alternative A and Alternative C are safer.

Alternative B offers both some strong advantages and strong disadvantages related to driver expectancy, geometric design and constructability. Alternative B allows the northbound I-465 to northbound I-69 traffic (the heaviest movement) to enter northbound I-69 on the left side without dropping any of the lanes. There is also only a single exit on eastbound I-465 through the I-465/I-69 interchange creating a desirable configuration for signing. However, Alternative B also features a ramp from 82nd Street which enters on the right side of the southbound I-69 to southbound I-465 ramp creating a fourth lane which drops on the outside of the ramp through a horizontal curve. All three build alternatives have three bridges which are difficult to construct and have received low ratings due to their complex geometry and constructability. However, as the report explains, the third-level bridge (Bridge #8) in Alternative B over I-465 is the most complex, difficult and most expensive to construct and maintain. As a result of these qualitative factors, Alternative A and Alternative C are relatively equal and both are more desirable than Alternative B.

Alternative B requires the least amount of retaining walls but both Alternative A and Alternative B require long-term maintenance on a third-level bridge over I-465. As a result of this, Alternative C, which is a two-level interchange with no bridges over I-465, has the advantage related to long-term maintenance.

There are no distinguishable separators between the build alternatives related to environmental or utility impacts.

Alternative A is the most expensive at $96.9M, Alternative B is second most expensive at $94.6M and Alternative C is the most cost-effective alternative at $92.7M. As a result, of this analysis of the three build alternatives, **Alternative C provides the best value for this interchange**.

A modification (referred to below as Alternative C Modified) was developed that mitigates the low qualitative scores for and significantly improves Alternative C. As shown below, the 2-lane southbound Binford Boulevard ramp is moved to the outside of the southbound I-69 to southbound I-465 ramp. The southbound I-69 to southbound I-465 ramp will be relocated to the inside of its existing location while maintaining a 45-mph design speed. This modification to Alternative C will be designed so the signal shown below is coordinated with the signal at Binford Boulevard / 75th Street to efficiently serve southbound traffic even if the traffic volumes spike and actual future demand is much greater than forecasted. Final design details will be worked out to ensure the signal functions well where southbound Binford Boulevard and the eastbound I-465 to southbound Binford Boulevard ramp intersect. There are several significant advantages to Alternative C Modified:

- The difficult bridges to construct (Bridge #6 and Bridge #8) are eliminated. This mitigates two of the three low ratings associated with Alternative C by removing these bridges all-together.
- There is the potential for cost savings since moving southbound Binford to the outside reduces the need for retaining wall on both sides of the southbound Binford.
- Geometric improvements can be made to the proposed eastbound I-465 to northbound I-69 ramp since the skew of Bridge #8 is no longer a constraint.
- Since the proposed eastbound I-465 to northbound I-69 ramp can be straightened out and moved to the west, there is more room to design the northbound I-465 to northbound I-69 bridge over northbound Binford (Bridge #7) with a reduced skew. This, in conjunction with moving the ramp from northbound I-465 to 82nd Street to the north (not shown in the following figure), eliminates the need for a straddle bent bridge.
- As a result of eliminating Bridge #6 and Bridge #8 and reducing the skew on Bridge #7, there are no straddle bent bridges required for Alternative C Modified.
- The maintenance of traffic plan can have a more efficient phasing sequence since southbound Binford can be constructed early and off-line. This reduces the amount of traffic that is in conflict with construction as the middle of the interchange is constructed.

As a result of all of this analysis, ***the final conclusion is that Alternative C Modified (shown below) is the recommended alternative***. Alternative C Modified will be the alternative that is presented in the IAD. The IAD will compare Alternative C Modified to the No-Build Alternative and the geometric/traffic/signing plans, the Vissim traffic model and the IHSDM safety model will be updated to reflect Alternative C Modified.

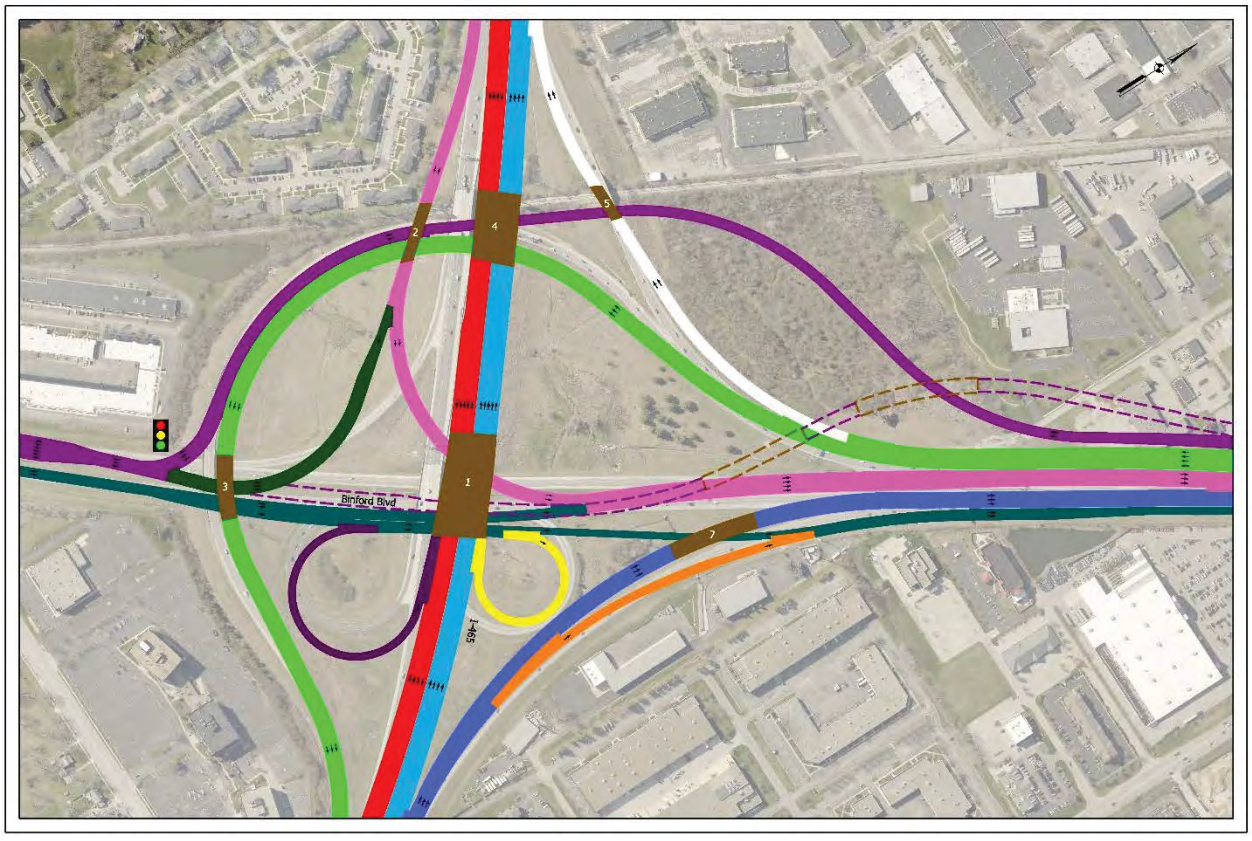


Figure 25: Alternative C Modified

ENVIRONMENTAL SCREENING MEMORANDUM

Clear Path 465 (I-465 / I-69 Interchange Improvement Project with Added Travel Lanes)
Des. No. 1400075
Indianapolis, Marion County
November 7, 2017

INTRODUCTION

The purpose of this memorandum is to summarize the potential environmental impacts of the current alternatives under consideration for recommendation; the "Do Nothing/No Build" Alternative and Alternatives A, B, and C, using the current preliminary information gathered for the project. To-date, preliminary environmental screening activities have focused on the project study area shown on Figure E-1. All four alternatives will be carried forward for additional environmental analyses within the Environmental Assessment (EA), scheduled to be completed in the summer of 2019. Initial environmental screening and public involvement activities have included:

- A preliminary Red Flag Investigation (RFI) per standard Indiana Department of Transportation (INDOT) guidance, dated April 25, 2017 and conditionally approved by INDOT Environmental Services on May 18, 2017. The RFI identifies potential environmental concerns using data from geographic information system (GIS) databases, searched within a half-mile radius (or greater) of the project area.
- Field investigations were conducted by qualified personnel in September 2016 to identify terrestrial habitat and water resources (wetlands, streams, ponds, etc.) within the study area. The data collected during these investigations will be used for a Waters of the United States (US) report and any subsequent permitting. The preliminary, draft data was used for this screening.
- Preliminary environmental justice (EJ) memorandum, dated July 19, 2017, and associated INDOT and Federal Highway Administration (FHWA) feedback and meetings. This information was used to identify the potential for low-income and minority populations within the study area, and to assess the potential for disproportionate impacts to those populations.
- A preliminary records check and an above-ground survey conducted in February 2017 by qualified individuals (Weintraut & Associates) for potential cultural resources, such as historic landmarks, historic districts, and known archaeological sites.
- A community advisory committee (CAC) meeting held on August 16, 2017 and an initial public open house held on August 23, 2017. Stakeholder feedback regarding alternative preference and potential environmental impacts was requested.

Using the screening data described above and initial construction limit estimates, the potential environmental impact of each alternative was assessed. This included using appropriate boundaries for different categories of environmental impacts. Specifically:

- To assess the amount of impacts to resources, such as acres of forest, linear feet of streams, acres of wetlands, Section 6(f) resources, etc., the assumed construction limits of each build alternative were used.
- To assess right-of-way impacts, such as potential relocations, the assumed right-of-way limits of each build alternative were used.
- To assess cultural resources, hazardous materials sites (dry cleaners, industrial releases, gasoline stations, etc.), and noise impacts, appropriate buffers were used depending on the resource analyzed. Potential Section 4(f) resources were identified within a 1,000-foot radius of construction limits. Hazardous material sites were searched for adjacent and nearby parcels, within 150 feet of construction. Potential noise impacts were assessed for areas within 500 feet of the edge of the proposed outside travel lanes.

COMPARISON OF ALTERNATIVES

This memorandum provides a summary of the preliminary environmental screening activities performed to date. The following table summarizes the potential environmental impacts of each of the four alternatives. A narrative description of each category is provided further below.

Table E-1 Summary of Potential Environmental Impacts

CATEGORY	NO-BUILD	ALTERNATIVE A	ALTERNATIVE B	ALTERNATIVE C
Wetlands (acres)	0	8.3	8.3	8.3
Rivers and Streams (linear feet)	0	14,000	14,000	14,000
Floodplains (acres)	0	10.9	10.9	10.9
Forested Habitat (acres)	0	16.3	16.3	16.3
Potential to impact threatened or endangered species	None	Low to Moderate	Low to Moderate	Low to Moderate
Potential Section 4(f) Public Parks, Recreation Areas and Wildlife/Waterfowl Refuges (number)	0	1[1]	1[1]	1[1]
Potential Section 4(f) Historic Properties/Districts (number)	0	1	1	1
Known Archaeological Sites (number)	0	0	0	0
Cemeteries (number)	0	0[2]	0[2]	0[2]
Potential to negatively impact Cultural Resources	None	Low to Moderate	Low to Moderate	Low to Moderate
Section 6(f) Properties (numbers/acres)	0	0	0	0
Farmland (acres)	0	0	0	0
Residential Relocations (number)	0	0	0	0
Business Relocations (number)	0	4[3]	4[3]	4[3]
Public Facilities and Services Relocations (number)	0	0	0	0
Potential for disproportionate impacts to EJ populations	None	Low	Low	Low
Potential Noise Impacts	None	High	High	High
Potential Hazardous Materials Sites (number)	0	11	11	11

Notes:

1 – Temporary impacts may occur to the 71st Street Multi-Use Trail, located underneath the I-465 bridge over 71st Street. See below.

2 – The former Wright Cemetery is believed to have been properly relocated. Additional coordination/investigation is pending.

3 – The Suburban Extended Stay Hotel is counted as a business for the purpose of this screening memorandum. Additional investigation is needed to fully assess the socio-economic impact of potentially relocating this facility.

The "Do Nothing" or "No Build" alternative would have no project cost and no environmental impacts. However, this alternative would not address the congestion and safety issues discussed in Section 1.3 Summary of Draft Purpose and Need of the Recommended Alternatives Report. Impacts to environmental resources from Alternatives A, B, and C are discussed below.

Wetlands. No National Wetlands Inventory (NWI) wetland polygons were identified within the study area during the RFI. During the field investigations, an estimated 110 wetlands consisting of approximately 8.3 acres were identified. Alternatives A, B and C (the "build alternatives") were assumed to impact all of the wetlands located within existing right-of-way and the forested parcel. These areas are shown on the draft Water Resources Maps (Figures E-2 to E-13). A forested area located north of the I-465/I-69 interchange was the only area studied outside of the existing right-of-way. Additional field work is pending in several areas, as noted on Figures E-7 and E-10. The majority of the delineated

wetlands are low-quality, emergent wetlands contained within a roadside ditch and dominated by invasive species. There is no significant difference in the estimated wetland impacts between the three build alternatives.

Rivers and Streams. Six rivers and streams were identified within a half-mile of the study area during the RFI. During the field investigations, an estimated 20 likely jurisdictional streams totaling approximately 14,000 linear feet were found within and adjacent to the project area. These streams include the White River, Dry Run, Hillsdale Run, Blue Creek, and unnamed tributaries (UNTs), some of which are entirely located within roadside ditches. These resources are shown on the draft Water Resources Maps (Figures E-2 to E-13). The I-465 bridge over the White River was already widened and upgraded, so no impact to the White River is anticipated. The remaining streams would be impacted by all three of the build alternatives, as shown in Table E-1. Therefore, there is no significant difference in the estimated stream impacts between the three build alternatives.

Floodplains. Federal Emergency Management Agency (FEMA) GIS data was used to identify mapped floodplains within the study area, which are shown on the draft Water Resources Maps (Figures E-2 to E-13). The floodplains that cross the study area are associated with the White River and Dry Run. The three build alternatives are estimated to impact approximately 10.9 acres of floodplain. There is no significant difference in the estimated floodplain impacts between the three build alternatives.

Forested Habitat. The forested area located north of the I-465/I-69 interchange is the only block of forested habitat within the study area. This 16.3-acre block of forested area is shown on the Water Resources Map, Figure E-11. All three build alternatives would likely use this entire area for roadway and drainage. Additionally, there are strips of wooded land within existing right-of-way along the White River floodplain and I-465 (riparian habitat), which can be seen on Figure E-2. This riparian habitat may be impacted. There is no significant difference in the estimated forested habitat impacts between the three build alternatives.

Threatened or Endangered Species. The study area is within the range of the federally endangered Indiana Bat (IBat), *Myotis sodalis*, and the federally threatened northern long-eared bat (NLEB), *Myotis septentrionalis*. The results of the RFI did not identify any known hibernacula or capture records within the study area. Although the study area is urban, it contains potential bat habitat including the riparian corridors along the above-discussed rivers and streams, and the 16.3-acre forested area (Figure E-11). Therefore, due to the likely impacts to this forested habitat, all three build alternatives have a low to moderate potential to negatively impact the IBat and NLEB. Given the urban nature of the project area, it is assumed there is a low potential for any of the build alternatives to negatively impact other threatened or endangered species. Thus, there is no significant difference in the likely endangered species impacts associated with the three build alternatives.

Potential Section 4(f) Resources: Public Parks, Recreation Areas and Wildlife/Waterfowl Refuges. The RFI identified multiple potential Section 4(f) resources within a half-mile of the project area, including public parks, recreational areas (including public schools), and nature preserves, which are shown on the Potential Section 4(f) Resources Map (Figure E-14). Public recreational resources near the project area include Skiles Test Elementary School, Lawrence North High School, Town Run Trail Park, Skiles Test Nature Park, Fort Harrison State Park, the Town Run Trail, the 71st Street Multi-Use Trail, the Fall Creek Greenway Trail, Sahm Park, and Sahm Golf Course. Additionally, there are several nature preserves: Oliver Woods Nature Preserve along the White River (part of which is also used for Town Run Trail), Woolen Gardens Nature Preserve (south of Fall Creek), and two preserves within the Fort Harrison State Park: Bluffs of Fall Creek Nature Preserve and Lawrence Creek Nature Preserve.

The only potential Section 4(f) resource within the three build alternatives is the 71st Street Multi-Use Trail, which crosses underneath the I-465 bridge over 71st Street. There will likely be a temporary impact to this trail during construction of the three build alternatives. At this time, it is assumed that all three build alternatives will result in a Temporary Occupancy or *de minimis* impact to this trail. No conversion of land to a transportation purpose, or other "constructive Section 4(f) use" is proposed. The other potential 4(f) resources should not be impacted by the proposed project. Thus, there is no significant difference in the likely Section 4(f) Public Parks, Recreation Areas and Wildlife/Waterfowl Refuges resource impacts between the three build alternatives.

Potential Section 4(f) Resources: Historic Properties/Districts. No above-ground resources listed in the National Register of Historic Places (NRHP) were identified within the study area footprint. Historians did identify one resource that may be

eligible for listing in the NRHP: the parcel at 6930 East 71st Street. This parcel contains an early stone-clad Styled Ranch (circa 1945) that historians believed in the field to be "Notable" per the Indiana Historic Sites and Structures Inventory rating system. This parcel is adjacent to existing I-465 right-of-way, the 71st Street Multi-Use Trail, and the I-465 bridge over 71st Street. Although no new right-of-way is currently proposed in this area, there is a potential the build alternatives could impact this parcel. However, there is no significant difference in the likely Section 4(f) Historic Properties/Districts resource impacts between the three build alternatives.

Known Archaeological Sites or Cemeteries. The only known archaeological site or cemetery within the study area is the former Wright Cemetery, which was located within the forested parcel as shown on Figure E-14. This cemetery is believed to have been properly exhumed and relocated by INDOT contractors sometime between 2006 and 2010. However, additional investigation and coordination is needed. Therefore, it is assumed no known archaeological sites or cemeteries will be impacted by the 3 alternatives.

Cultural Resources. Initial screening activities indicate the three build alternatives have a low to moderate potential to impact cultural resources. The area of potential effect (APE) cannot be established until the elevations are more defined and coordination with consulting parties has been initiated.

Section 6(f) Properties. There are no known properties within the project area that utilized the National Park Service's Land and Water Conservation Fund (LWCF). The nearest property that used LWCF funding include portions of the Fall Creek Greenway Trail. Based on the initial screening, no potential Section 6(f) resources will be impacted by the project.

Farmland. The project area is relatively urban. Environmental screening activities did not identify any farmland with the study area. Therefore, no farmland is expected to be impacted by the project.

Residential Relocations. Much of the project area is adjacent to single family and multi-family residential areas. However, none of the four alternatives include residential relocations.

Business Relocations. The three build alternatives may directly impact several businesses including Wheaton Van lines, a vacant office building that previously contained two tenants, an automotive repair shop, and the Suburban Extended Stay Hotel (8055 Bash Street). Wheaton Van Lines should not be relocated; however, there may be impacts to its parking lot and driveways. At this time, there is no significant difference in proposed business relocations between the three build alternatives.

Public Facilities and Services Relocations. The results of the RFI identified Community North and Fairbanks hospitals within a half-mile of the study area. However, the preliminary screening did not identify potential relocations of public facilities or services, such as post offices or hospitals. Likewise, no transit facilities (e.g., bus stations) were identified.

EJ Populations. Initial screening activities identified potential low-income and/or minority populations adjacent to the project area, east of I-69 and north of I-465. However, no residential or business relocations are proposed in that area. Therefore, per the current, preliminary information, there is a low potential for any of the three build alternatives to have a disproportionate impact to EJ populations.

Noise. Due to the presence of multiple sensitive noise receptors, including many residences, there is a high potential for noise impacts for all three of the build alternatives. Noise analyses will be required for all three of the build alternatives, and will be conducted when needed details such as elevations, right-of-way, etc., are established for the project. It is reasonable to expect some noise mitigation measures, such as sound barriers, will be needed for the build alternatives. At this time, there is not sufficient information to analyze the difference in noise impacts from the three build alternatives.

Hazardous Material Sites. The results of the RFI identified 66 hazardous materials sites within a half-mile radius of the study area. Of these, 11 are estimated to be adjacent or nearly adjacent to the three build alternatives. These sites include existing and former gasoline stations, industrial sites including Best Access System (6161 E. 75th Street), and several dry cleaners. The three build alternatives would require further evaluation of these facilities to ensure they do not negatively impact construction or right-of-way acquisition. At this time, there is not sufficient information to analyze the difference in hazardous materials impacts from the three build alternatives.

CAC and Public Comments

The comments received from the CAC, public open house, and social media primarily deal with general comments, right-of-way questions, drainage/hydraulics, business impacts, current/proposed signals on Binford Boulevard, and noise impacts. Of the 48 comments received to-date,

- Four generally support the project and agree with the needs for the project.
- Four comments had a preference for Alternative A.
- Five comments had a preference for Alternative B.
- Six comments had a preference for Alternative C.
- Three comments did not like the proposed signal/stop light at the I-465 eastbound ramps to southbound Binford Boulevard.
- Eight comments requested adding missing movements to the I-465/I-69 interchange. These included the northbound Binford Boulevard to southbound I-465 movement, and the westbound I-465 to southbound Binford Boulevard movement.

Conclusion

The results of the initial environmental screening did not identify any substantial differences in impacts to known environmental resources between the three build alternatives. The "Do Nothing" or "No-Build" Alternative would not impact environmental resources. However, the "Do Nothing" alternative would not address the Purpose and Need of the project. Additional agency coordination and environmental analyses are needed to fully assess impacts. As the project progresses, every effort will be taken to avoid impacts to identified resources. If impacts will occur, appropriate minimization measures will be employed and certain impacts may require mitigation. Impacts must be minimized before mitigation can be considered

The results of initial stakeholder and public involvement activities have not identified a strong preference for any of the three build alternatives.

Attached figures intentionally omitted to avoid duplication. Refer to Appendix B.

Table A.1 Clear Path 465 Des. Nos.

Work Description	Des. No.	Structure*
Northbound I-69, from I-465 to 1.4 miles north of I-465	1400075	N/A
I-465, from 2.25 mile west of I-69 (White River Bridge / Allisonville Rd) to I-69	1400076	N/A
Southbound I-69, at I-465, from I-465 to 1.55 mile sorth of I-465	1500125	N/A
Northbound I-465, from I-69 to bridge over Fall Creek Road to 2.00 miles south of I-69	1500126	N/A
Southbound I-465, from I-69 to 2.15 miles south of I-69 (bridge over Fall Creek Road)	1700140	N/A
General number for all minor culverts	1901991	N/A
General number for all traffic, Intelligent Traffic System (ITS), and lighting elements	1901992	N/A
Signal modification at 82nd Street and southbound I-69 ramp terminals	1901993	N/A
Signal modification at 82nd Street and northbound I-69 ramp terminals	1901994	N/A
Signal modification at Binford Boulevard and 75th Street	1901995	N/A
New traffic signal at the southbound I-69 to Binford Boulevard ramp and eastbound I-465 to southbound Binford Boulevard ramp intersection	1901996	N/A
Sanitary sewer replacement, off-line	1901997	N/A
Demolish existing bridge, new bridge moved off-line to the north	1801667	Bridge #1
Demolish existing bridge, new bridge moved off-line to the north	1801668	Bridge #2
Demolish existing bridge, new bridge moved off-line to the north	1801669	Bridge #3
Demolish existing bridge, new bridge moved off-line to the north	1801670	Bridge #4
Demolish existing bridge, new bridge moved off-line to the north	1801671	Bridge #5
New bridge	1801672	Bridge #6
New bridge	1801673	Bridge #7
New bridge	1801674	Bridge #8
New bridge	1801675	Bridge #9
Bridge deck replacement and widening with semi-integral end bents	1801662	Bridge #10
Bridge deck replacement and widening with semi-integral end bents	1801663	Bridge #11
New bridge	1801676	Bridge #12
New bridge	1801677	Bridge #13
New bridge	1801678	Bridge #14
Bridge deck replacement and widening with semi-integral end bents	1801664	Bridge #15
Bridge deck replacement and widening with semi-integral end bents	1801665	Bridge #16
Culvert repair - line pipe	1801636	CV I-465-049-34.78
Existing structure remains in place	1801637	CV I-465-049-34.96

Work Description	Des. No.	Structure*
Existing structure remains in place	1801638	CV I-465-049-35.31 L
Existing structure remains in place	1801640	CV I-465-049-35.31 R
Existing structure remains in place	1801641	CV I-465-049-35.76 R
Culvert repair - extend pipe	1801642	CV I-465-049-35.77
Culvert repair - extend pipe	1801643	CV I-465-049-35.85
Existing structure remains in place	1801644	CV I-465-049-36.15
Culvert replacement	1801639	Str. 465-77
Culvert replacement	1801645	(No asset tag)
Culvert repair - line pipe	1801646	CV I-465-049-36.72 R
Culvert replacement	1801647	CV I-465-049-36.75
Culvert replacement	1801648	CV I-465-049-36.86 R
Culvert replacement	1801649	CV I-465-049-37.41
Culvert replacement	1801650	CV I-465-049-37.50
Culvert replacement	1801651	CV I-465-049-37.88
Culvert replacement	1801652	CV I-465--049-37.76
Culvert replacement	1801653	CV I-465-049-38.22
Structure will be removed	1801654	CV I-465--049-38.39
Structure will be removed	1801655	CV I-69-049-200.11
Culvert replacement	1801656	CV I-69-049-200.15
Culvert replacement	1801657	CV I-69-049-200.18 R
Culvert repair or replace	1801658	CV I-69-049-200.71
Culvert repair or replace	1801659	CV I-69-049-200.90 L
Culvert repair or replace	1801660	CV I-69-049-200.92
Culvert replacement	1801661	CV I-69-049-200.93 R

*Refer to Table 5 for associated existing and proposed INDOT bridge numbers.

Excerpts

Bridge Inspection Report

I465-124-05268 CSBL
I-465 SB
over
EAST 71ST STREET

Inspection Date: 06/25/2018

Inspected By: Brian D. Harvey

Inspection Type(s): Routine
Special

GENERAL NOTES:

Access: noise abatement walls along SB shoulder - drive around or access bottom from the NB bridge.

Bent #1 is NORTH.

Clearance Posted 13'-8"

Special Detail - tapered coverplates (only on original beams, ends at abutments)

The bridge was built in 1968, under contract R-7841.
'A' Rehab (Overlaid) in 1981, B-12988 (8.5"x11" plans).
'B' Rehab (Re-overlaid & Added concrete barrier) in 1992, R-19482.
'C' Rehab (Widened & Re-overlaid) in 2002, R-26266.

Excerpts

Bridge Inspection Report

I465-124-05268 CNBL
I-465 NB
over
EAST 71ST STREET

Inspection Date: 06/25/2018

Inspected By: Brian D. Harvey

Inspection Type(s): Routine
Special

GENERAL NOTES:

Bent #1 is NORTH.

Posted 13'-8"

Access: noise abatement walls along right shoulder of SB structure - access SB structure from NB.

Special Detail - tapered coverplates (only on original beams, ends at abutments)

The bridge was built in 1968, under contract R-7841.
'A' Rehab (Overlaid) in 1981, B-12988 (8.5"x11" plans).
'B' Rehab (Re-overlaid, Added concrete barrier) in 1992, R-19482.
'C' Rehab (Widened & Re-overlaid) in 2002, R-26266.

NE drain is plugged - water ponding along barrier - 4' wide x length of span A.
SW drain pipe is disconnected.

Bridge Inspection Report

(59) SUPERSTRUCTURE: **7 - Good Condition (some minor problems)**

Comments:
12 Steel Beams: tapered coverplates on original beams; 2002 rehab added 2 new beamlines at each coping - new beams are not as deep as the existing beams; downspout brackets are field-welded to beam webs; original diaphragm brackets welded to original coping beams on top of bottom flange have been torched off.

Collision damage: original East coping beam (beam #3) has minor deflection of ~1"; minor scrapes & gouges to bottom flanges of several beams; hydraulic fluid on all 12 beams over WB lanes.

(60) SUBSTRUCTURE: **7 - Good Condition (some minor problems)**

Comments:
Concrete columns: minor cracks in repairs at West end of bent #2; minor delaminations at base - West side of column #2; some repointed areas.

(61) CHANNEL/CHANNEL PROTECTION **N - Not Applicable**

Comments:

(62) CULVERTS: **N - Not Applicable**

Comments:

LOAD RATING AND POSTING

(31) DESIGN LOAD:	**6 - HS 20+Mod**	(66) INVENTORY RATING:	**38**
(70) BRIDGE POSTING	**5 - Equal to or above legal loads**	(65) INVENTORY RATING METHOD:	**1 - Load Factor (LF)**
		(66B) INVENTORY RATING (H):	**27**
(41) STRUCTURE OPEN/POSTED/CLOSED:	**A - Open**	(66C) TONS POSTED :	
		(66D) DATE POSTED/CLOSED:	
(64) OPERATING RATING:	**64**		
(63) OPERATING RATING METHOD:	**1 - Load Factor (LF)**		

APPRAISAL

SUFFICIENCY RATING:	**81.0**	(36) TRAFFIC SAFETY FEATURE:	
STATUS:	**2**	36A) BRIDGE RAILINGS:	**1**
(67) STRUCTURAL EVALUATION:	**7**	36B) TRANSITIONS:	**1**
(68) DECK GEOMETRY:	**9**	36C) APPROACH GUARDRAIL:	**1**
(69) UNDERCLEARANCES, VERTICAL & HORIZONTAL:	**3**	36D) APPROACH GUARDRAIL ENDS:	**1**

(71) WATERWAY ADEQUACY: **N - Not Applicable**
Comments:

(72) APPROACH ROADWAY ALIGNMENT: **8 - Equal to present desirable criteria**
Comments:

(113) SCOUR CRITICAL BRIDGES: **N - Not over waterway**
Comments: