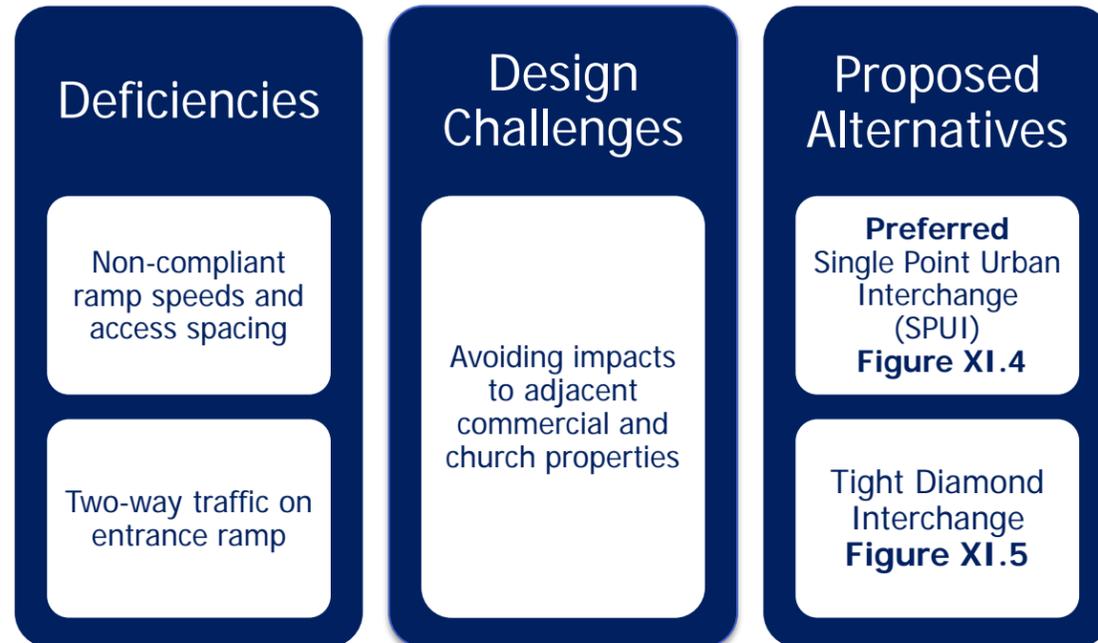


XI. First Colonial Road Interchange



XI.1 Existing Conditions

Existing conditions at the First Colonial Road interchange are described in this chapter focusing on roadway geometry, volumes, capacity analysis, and crash history.

XI.1.1 Geometry, Speeds, Lanes, Traffic Control

Figure XI.1 displays a summary of the existing roadway geometry. The First Colonial Road interchange is configured as a modified diamond, with a loop ramp providing eastbound I-264 traffic with an exit to northbound First Colonial Road. Several geometric deficiencies exist at the First Colonial Road interchange, some of the notable deficiencies include:

- Ramp speeds are non-compliant at 1 location
- Ramp speed not posted at 3 locations
- Non-compliant two-way traffic carried on entrance ramp
- Access spacing is non-compliant at 2 locations

Additional details on the existing conditions geometry at the First Colonial Road interchange can be found in the Technical Appendix.

XI.1.2 Volumes & Operations

Figure XI.2: Existing Volumes displays the existing weekday peak hour volumes for the First Colonial Road interchange for the year 2014. Traffic counts were conducted during early December 2014, with counts conducted on Tuesdays, Wednesdays and/or Thursdays. The peak hour counts document the typical commuter pattern on I-264, with heavier volumes in the westbound direction during the AM peak period and in the eastbound direction during the PM peak period. On First Colonial Road, the heavier volume is in the northbound direction in the AM peak period (both north and south of the interchange) and in PM peak period the heavier volume is in the southbound direction north of the interchange and in the northbound direction south of the interchange.

Table 11.1 displays a summary of the results of the capacity analysis of existing conditions at the interchange using the Highway Capacity Manual software (HCS) package. No major deficiencies are found, and all movements operate with service levels at no worse than B.

Movement (Type)	AM Peak Hour		PM Peak Hour	
	Density (pc/mi/ln)	LOS	Density (pc/mi/ln)	LOS
EB I-264 between Laskin Rd and First Colonial Rd (Freeway)	10.0	A	11.9	B
EB I-264 to SB First Colonial Rd (Diverge)	8.3	A	10.1	B
EB I-264 to NB First Colonial Rd (Diverge)	13.9	B	16.2	B
First Colonial Rd to EB I-264 (Merge)	10.9	B	14.0	B
EB I-264 between First Colonial Rd and Birdneck Rd (Freeway)	9.9	A	13.4	B
WB I-264 between First Colonial Rd and Birdneck Rd (Freeway)	15.4	B	12.6	B
WB I-264 to First Colonial Rd (Diverge)	15.7	B	12.9	B
First Colonial Rd to WB I-264 (Merge)	17.8	B	16.1	B
WB I-264 between Laskin Rd and First Colonial Rd (Freeway)	15.1	B	13.0	B

Capacity Analysis indicates that all movements at the First Colonial Road interchange are currently operating with adequate capacity.

I-264 Corridor Evaluation Study

U.S. Department of Transportation
Federal Highway Administration

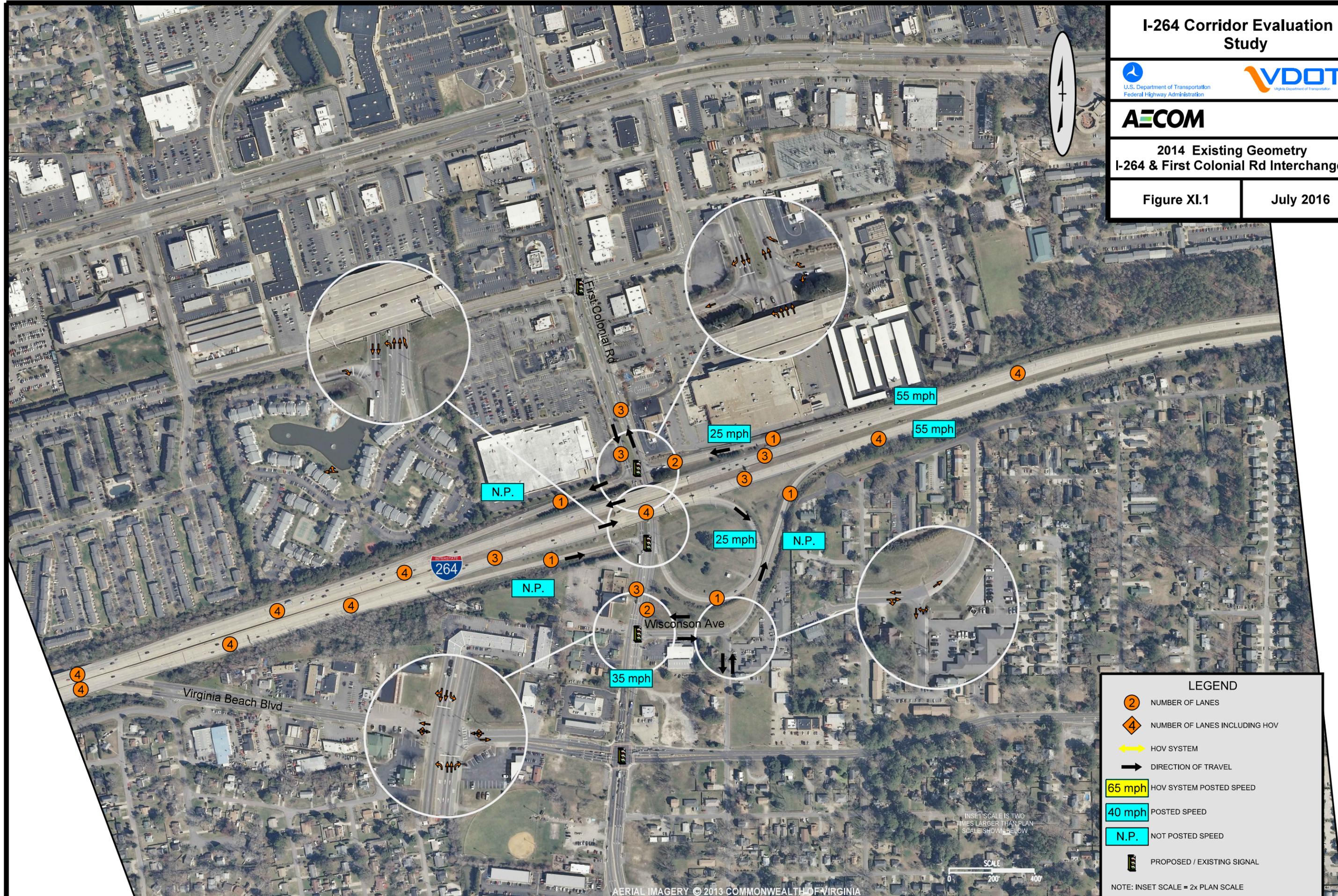


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2014 Existing Geometry I-264 & First Colonial Rd Interchange

Figure XI.1

July 2016



LEGEND

- 2 NUMBER OF LANES
- 4 NUMBER OF LANES INCLUDING HOV
- HOV SYSTEM
- DIRECTION OF TRAVEL
- 65 mph HOV SYSTEM POSTED SPEED
- 40 mph POSTED SPEED
- N.P. NOT POSTED SPEED
- PROPOSED / EXISTING SIGNAL

NOTE: INSET SCALE = 2x PLAN SCALE

INSET SCALE IS TWO TIMES LARGER THAN PLAN SCALE SHOWN BELOW

SCALE
0 200 400

I-264 Corridor Evaluation Study

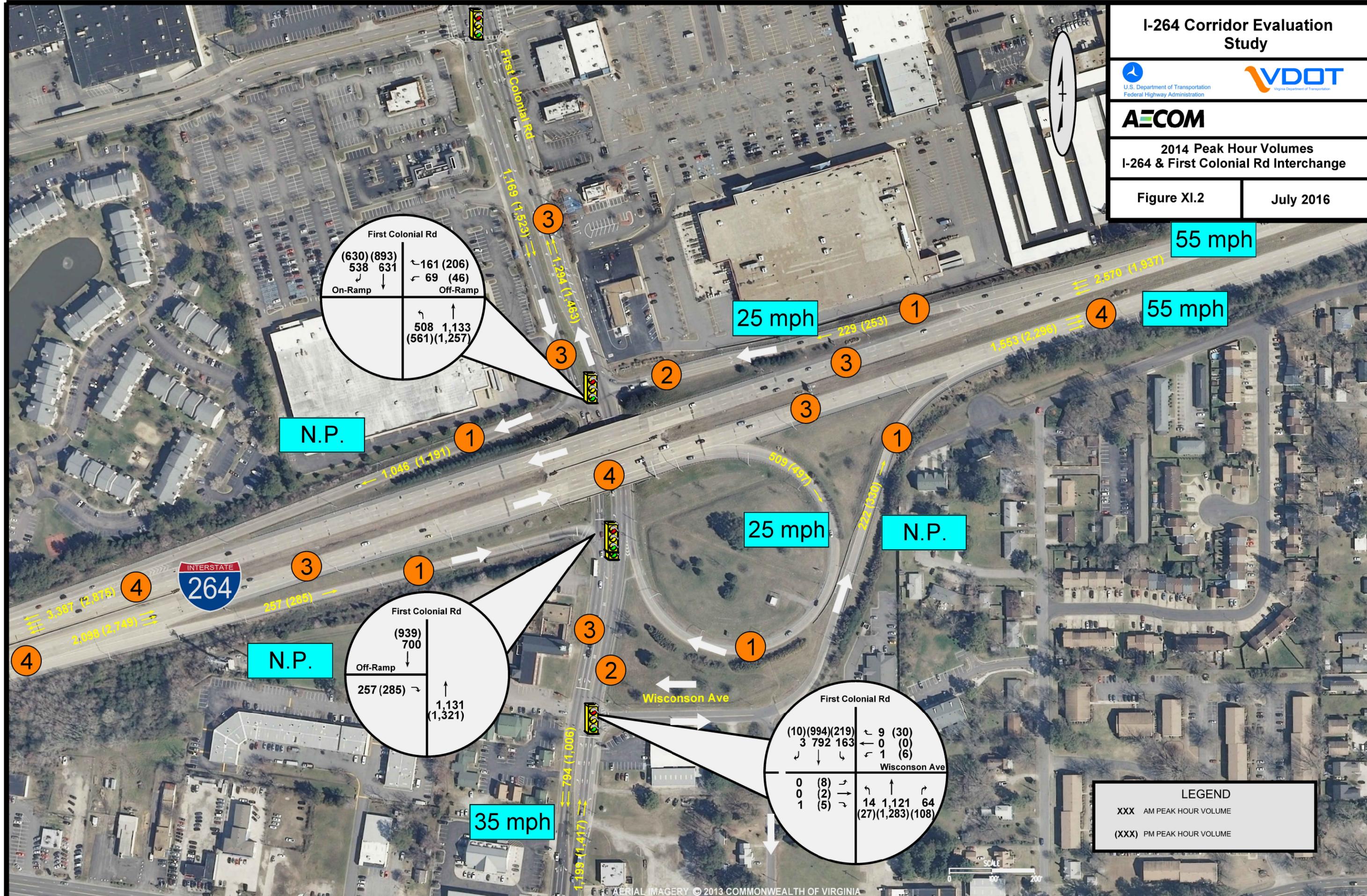


AECOM

2014 Peak Hour Volumes
I-264 & First Colonial Rd Interchange

Figure XI.2

July 2016



First Colonial Rd

(630) (893) 538 631	← 161 (206) ↖ 69 (46)
On-Ramp	Off-Ramp
	↗ 508 1,133 (561)(1,257)

First Colonial Rd

(939) 700	
Off-Ramp	
257 (285)	↗ 1,131 (1,321)

First Colonial Rd

(10)(994)(219) 3 792 163	← 9 (30) 0 (0)
	↖ 1 (6)
0 (8) 0 (2) 1 (5)	↗ 14 1,121 64 (27)(1,283)(108)
	Wisconsin Ave

N.P.

N.P.

N.P.

35 mph

25 mph

25 mph

55 mph

55 mph

LEGEND

XXX AM PEAK HOUR VOLUME

(XXX) PM PEAK HOUR VOLUME

Table 11.2 summarizes the existing conditions SimTraffic capacity analysis of the First Colonial Road corridor. The analysis shows no major deficiencies and all of the intersections operate with overall service levels of C or better.

Table 11.2 Summary of 2014 Existing Conditions SimTraffic Capacity Analysis I-264 at First Colonial Road Interchange				
Intersection	AM Peak Hour		PM Peak Hour	
	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
I-264 WB On-Ramp/Off-Ramp & First Colonial Road	19.0	B	27.5	C
I-264 EB Off Ramp & First Colonial Road	21.6	C	28.5	C
Wisconsin Avenue/I-264 EB On-Ramp & First Colonial Road	4.2	A	14.9	B

Table 11.3 presents a summary of the existing conditions SimTraffic queueing analysis of the I-264 off-ramps to First Colonial Road. The results show that vehicle queues are fairly long on the eastbound off-ramp but are currently accommodated by the storage available on the respective off-ramp.

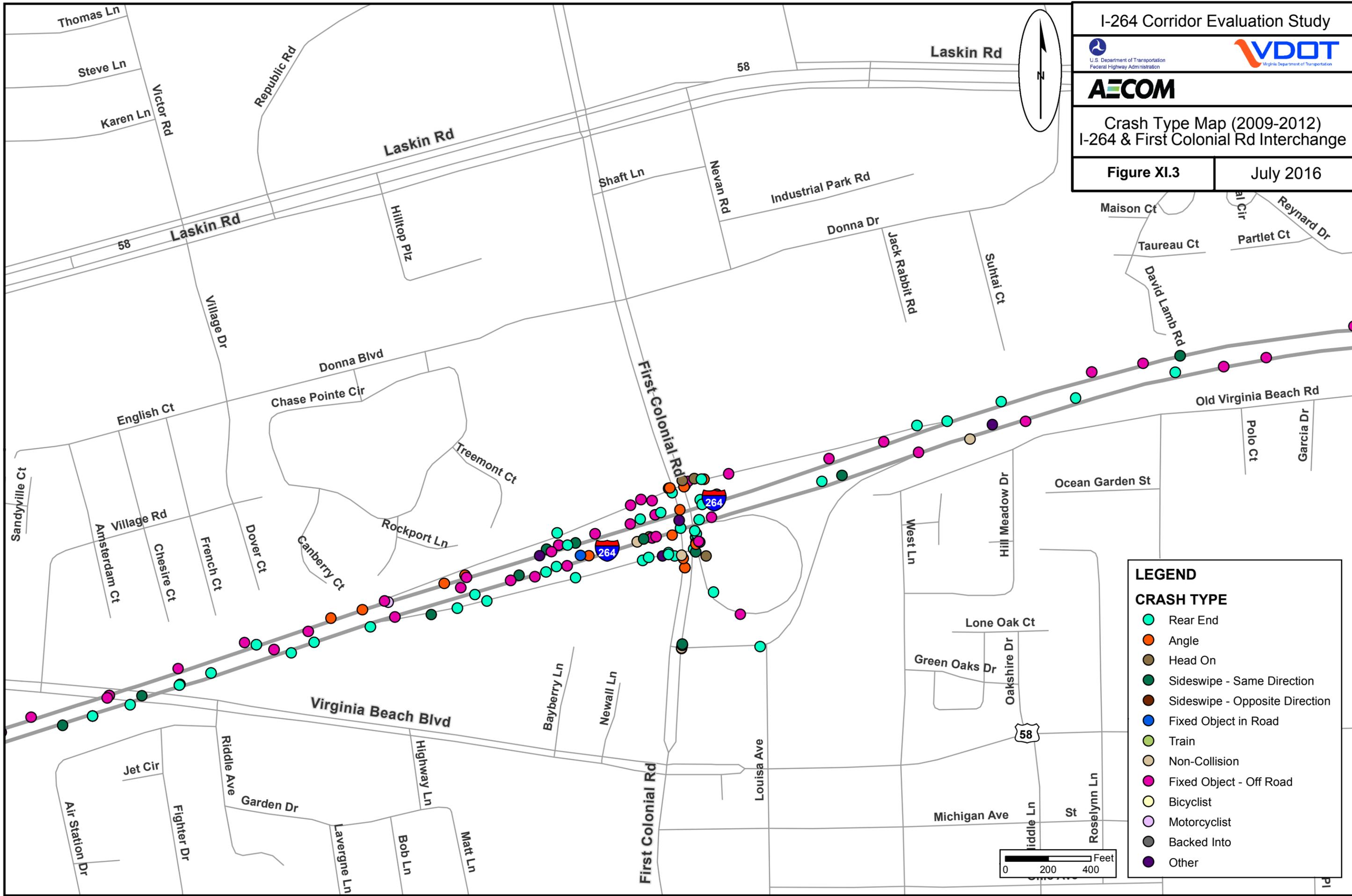
Table 11.3 Summary of 2014 Existing Conditions SimTraffic Queue Analysis I-264 at First Colonial Road Interchange					
Intersection	Ramp Length (feet)	AM Peak Hour		PM Peak Hour	
		Average (feet)	95th % (feet)	Average (feet)	95th % (feet)
WB I-264 Off-Ramp to NB/SB First Colonial Road	1,265	57	113	65	109
EB I-264 Off-Ramp to SB First Colonial Road	1,325	408	742	454	816

XI.1.3 Crashes

Figure XI.3 displays the 4-year crash history at the First Colonial Road interchange for the years 2009-2012. It illustrates a large number of crashes throughout the interchange and to the west of the interchange. Crashes in both directions of travel appear to be evenly distributed. The ramps in both directions of travel show a high density of crashes, which are likely related to a combination of moderate congestion and geometric deficiencies. The ramps show a high density of crashes nearest First Colonial Road.

Table 11.4 summarizes the crash history by direction and type of freeway facility (ramp or mainline) at the First Colonial Road interchange for the period 2009-2012. A total of 111 crashes occurred in the interchange vicinity and a majority of the crashes (42) involved rear end crashes and similar majority (68) occurred on the mainline in both directions. There were 49 injury crashes and 0 fatal crashes. 63% of the total crashes are the results of the two most frequent types of crashes, Rear End and Fixed Object Off-Road.

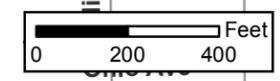
Table 11.4 Summary of Crash History at I-264 and First Colonial Road Interchange 2009-2012															
Location	Type of Crash											Severity			
	Rear End	Angle	Head On	Sideswipe - Same Dir.	Fixed Object In-Road	Non-Collision	Fixed Object Off-Road	Motorcyclist	Backed Into	Other	Misc	Total	Property Damage Only	Injury	Fatal
EB ML	12	5	1	5	1	2	10	0	0	0	1	37	18	19	0
WB ML	7	5	0	2	0	0	13	1	1	0	2	31	19	12	0
EB Ramps	19	3	0	2	0	2	2	0	0	1	0	29	17	12	0
WB Ramps	4	6	0	0	0	0	4	0	0	0	0	14	8	6	0
Total	42	19	1	9	1	4	28	1	1	1	3	111	62	49	0



LEGEND

CRASH TYPE

- Rear End
- Angle
- Head On
- Sideswipe - Same Direction
- Sideswipe - Opposite Direction
- Fixed Object in Road
- Train
- Non-Collision
- Fixed Object - Off Road
- Bicyclist
- Motorcyclist
- Backed Into
- Other



XI.2 Forecasted Conditions

The analysis of forecasted conditions includes the development and evaluation of future volumes and operations for the year 2040. The No Build Alternative and two improvement alternatives are described, followed by an explanation of the basis for the selection of the preferred alternative. Cost and impacts for the preferred alternative are listed at the end of this section as well.

XI.2.1 Forecasted Volumes & Operations

Table 11.5 displays the forecasted conditions volumes for the No Build (regular font) and Build (**bold font**) Alternatives at the First Colonial Road interchange for the year 2040. Existing volumes are also listed (*in italics*) in order to provide for comparison. In general, the volumes show moderate growth (~10 to 20%) entering and exiting the interchange area.

The roadway geometry for the No Build and Build Alternative for this interchange is different than that found in the existing conditions. Improvements are currently identified for local funding in the *Hampton Roads 2034 Long Range Transportation Plan*. These improvements include widening First Colonial Road from a 4-lane divided arterial to a 6-lane divided arterial. The project limits are from Old Donation Parkway to Virginia Beach Boulevard¹.

Table 11.8 on page XI-10 displays a summary of the results of the HCS capacity analysis of the No Build Alternative. Since traffic volume growth is forecasted to be moderate, service levels are very similar to those found under existing conditions. There were small increases in the density in comparison to the existing conditions.

Capacity Analysis indicates that all movements at the First Colonial Road interchange will continue to operate with adequate capacity through 2040.

Table 11.6 summarizes the 2040 No Build SimTraffic capacity analysis of the First Colonial Road corridor. The analysis shows most intersections operating with LOS C or better. Due to the growth of traffic along I-264 in the no-build year, the intersection of First Colonial Road with the westbound I-264 ramps increases to LOS C and E in the AM and PM peak hour.

Interstate & Direction	Movement		2014 Existing Volumes		2040 No Build Alternative		2040 Build Alternatives	
			AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour
	From	To						
I-264 EB	Mainline before First Colonial		<i>2,098</i>	<i>2,749</i>	2,337	3,068	2,294	3,033
	EB I-264	SB First Col.	<i>257</i>	<i>286</i>	291	323	280	312
	EB I-264	NB First Col.	<i>509</i>	<i>497</i>	571	557	550	538
	First Colonial	EB I-264	<i>222</i>	<i>330</i>	257	371	268	388
	Mainline after First Colonial		<i>1,553</i>	<i>2,296</i>	1,732	2,560	1,731	2,571
I-264 WB	Mainline before First Colonial		<i>2,570</i>	<i>1,937</i>	2,862	2,157	2,859	2,157
	WB I-264	First Colonial	<i>229</i>	<i>253</i>	261	294	229	253
	First Colonial	WB I-264	<i>1,046</i>	<i>1,191</i>	1,171	1,295	1,414	1,560
	Mainline after First Colonial		<i>3,387</i>	<i>2,875</i>	3,772	3,158	4,044	3,464

Intersection	AM Peak Hour		PM Peak Hour	
	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
I-264 WB On-Ramp/Off-Ramp & First Colonial Road	32.7	C	55.4	E
I-264 EB Off Ramp & First Colonial Road	13.4	B	18.6	B
Wisconsin Avenue/I-264 EB On-Ramp & First Colonial Road	7.5	A	21.3	C

¹ Hampton Roads Transportation Planning Organization. *2034 LRTP: The Regional Transportation Plan Technical Appendices*. January 2012. p. 250.

Table 11.7 presents a summary of the 2040 No Build SimTraffic queueing analysis, and the results show that vehicle queues extending from the traffic signals will be accommodated by the ramp storage lengths.

Intersection	Ramp Length (feet)	AM Peak Hour		PM Peak Hour	
		Average (feet)	95th % (feet)	Average (feet)	95th % (feet)
WB I-264 Off-Ramp to NB/SB First Colonial Road	1,265	70	131	95	164
EB I-264 Off-Ramp to SB First Colonial Road	1,325	193	297	238	378

XI.2.2 Improvement Alternatives

Although capacity analysis of the First Colonial Road interchange indicates that no ramp deficiencies are forecasted to occur, the interchange still exhibits geometric deficiencies. Consequently, any major construction activities (such as bridge replacement to accommodate a widened First Colonial Road) should be designed to bring the existing interchange into compliance with design guidelines for interstate freeways. To that end, two improvement alternatives have been developed and analyzed. These are shown in **Figure XI.4** and **Figure XI.5**. Geometric compliance has been intentionally provided with all proposed improvements.

The first improvement alternative in **Figure XI.4 – Single Point Urban Interchange** - consists of converting the First Colonial Road interchange into a single point intersection configuration. This improvement alternative removes the existing eastbound I-264 off-ramp to northbound First Colonial Road and the on-ramp to eastbound I-264 from Wisconsin Avenue. This on-ramp configuration does not comply with design guidelines since it currently allows two-way traffic to access businesses along Wisconsin Avenue.

The second improvement alternative in **Figure XI.5 – Tight Diamond Interchange**- consists of converting the First Colonial interchange into two intersections: one for eastbound I-264 traffic and one for westbound I-264 traffic. This improvement alternative also removes the existing eastbound I-264 off-ramp to northbound First Colonial Road and the on-ramp to eastbound I-264 from Wisconsin Avenue.

The improvement alternatives have been analyzed using HCS - used in the analysis of existing conditions and No Build Alternative. The results of the capacity analysis for all the forecasted year 2040 alternatives (including the No Build Alternative) are shown in **Table 11.8**. In addition,

SimTraffic simulation software capacity and queue analysis was conducted for each improvement alternative at signalized intersections and the results for all the year 2040 improvement alternatives are shown in **Table 11.9** and **Table 11.10**.

Single Point Urban Interchange

The Single Point Urban Interchange (SPUI) removes two existing ramps in the eastbound direction and reconstructs one ramp in order to allow for a single intersection to serve I-264. The results in **Table 11.8** show that all of the movements associated with the interchange exhibit adequate service levels of C or better.

For the two signalized intersections, the SimTraffic capacity analysis summarized in **Table 11.9** indicates all services levels will be C or better.

Table 11.10 presents a summary of the SimTraffic queueing analysis, and the results show that vehicle queues extending from the traffic signals will be easily accommodated by the storage available on the respective off-ramps. The eastbound I-264 off-ramp queues extend longer than the westbound I-264 off-ramp queues.

Tight Diamond Interchange

The second improvement alternative provides similar reconstruction for the First Colonial Road interchange as to the Single Point Urban Interchange; however, two intersections are provided to serve I-264 movements. One intersection will serve the ramps for eastbound I-264 and one intersection will serve the westbound I-264 ramps. The capacity analysis results in **Table 11.8** are the same as for the first improvement alternative (SPUI) since the freeway geometry will be the same, only the arterial network will be different.

For the three signalized intersections, **Table 11.9** indicates all services levels will be D or better along First Colonial Road. The intersection of First Colonial Road and the eastbound I-264 ramps operates with the lowest service levels found in the build alternatives with LOS D in both peak hours.

Table 11.10 presents a summary of the SimTraffic queueing analysis, and the results show that vehicle queues extending from the traffic signals will be accommodated by the storage available on the respective off-ramps. Again, the eastbound I-264 off-ramp queues extend longer than the westbound I-264 off-ramp queues and are larger in comparison to the first improvement alternative.

I-264 Corridor Evaluation Study

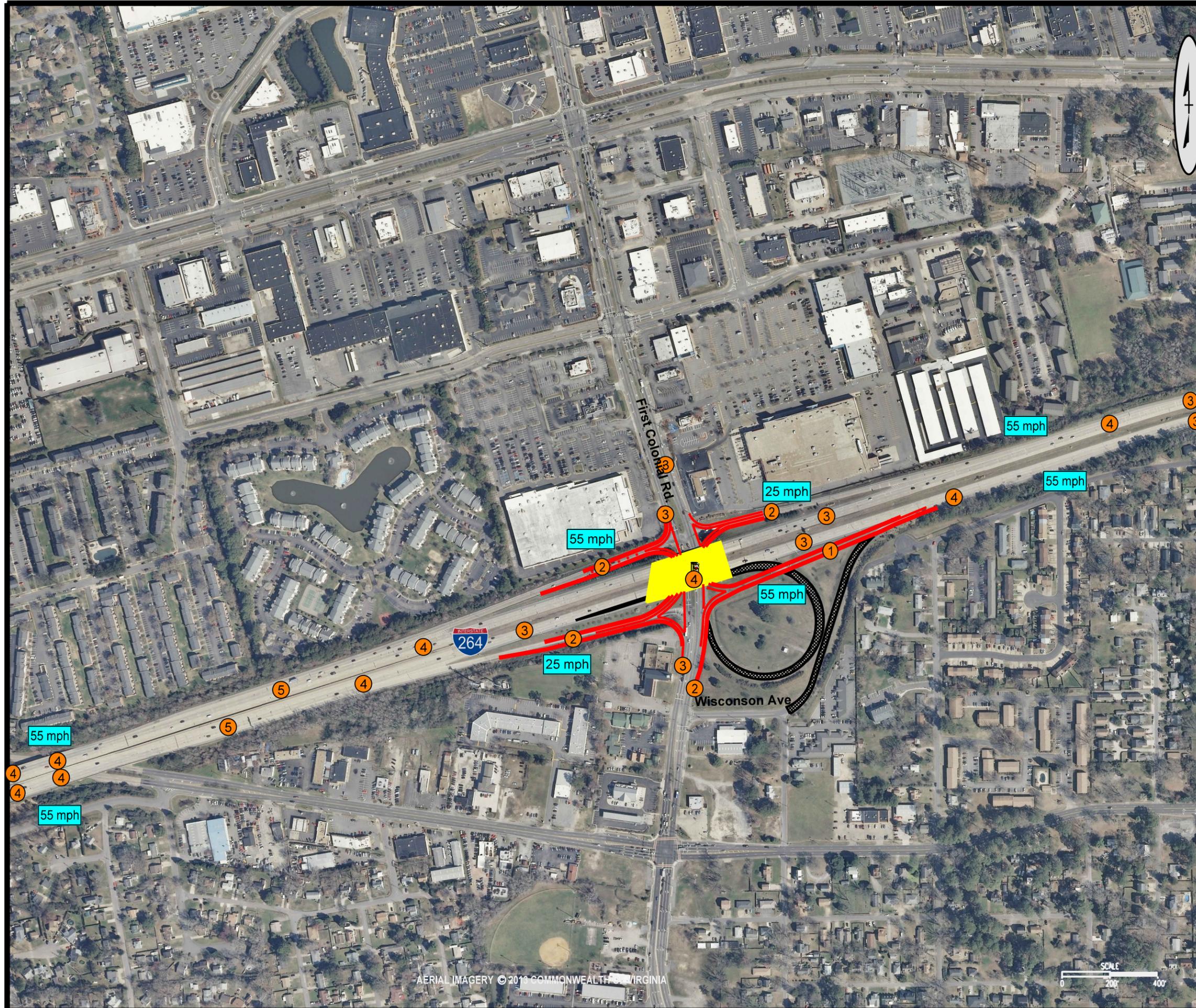


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2040 Build Preferred Alternative
I-264 & First Colonial Interchange
Single Point Urban Interchange

Figure XI.4

July 2016



LEGEND

- NUMBER OF LANES
- NUMBER OF LANES INCLUDING HOV
- HOV SYSTEM
- DIRECTION OF TRAVEL
- HOV SYSTEM POSTED SPEED
- POSTED SPEED
- NOT POSTED SPEED
- PROPOSED / EXISTING SIGNAL

NOTE: INSET SCALE = 2x PLAN SCALE

I-264 Corridor Evaluation Study

U.S. Department of Transportation
Federal Highway Administration

VDOT
Virginia Department of Transportation

AECOM

2040 Build Alternative
I-264 & First Colonial Interchange
Tight Diamond

Figure XI.5

July 2016



AERIAL IMAGERY © 2013 COMMONWEALTH OF VIRGINIA

LEGEND

- 2 NUMBER OF LANES
- 4 NUMBER OF LANES INCLUDING HOV
- HOV SYSTEM
- DIRECTION OF TRAVEL
- 65 mph HOV SYSTEM POSTED SPEED
- 40 mph POSTED SPEED
- N.P. NOT POSTED SPEED
- PROPOSED / EXISTING SIGNAL

NOTE: INSET SCALE = 2x PLAN SCALE

Table 11.8
Summary of Capacity Analysis Results
Year 2040 Alternatives: First Colonial Road & I-264

Year 2040 Alternative		No Build Alternative				Single Point Urban Interchange				Tight Diamond Interchange			
Time of Day		AM Peak Hour		PM Peak Hour		AM Peak Hour		PM Peak Hour		AM Peak Hour		PM Peak Hour	
Dir	Movement (Type)	Density	LOS	Density	LOS	Density	LOS	Density	LOS	Density	LOS	Density	LOS
HCS Analysis Results													
East-bound I-264	EB I-264 between Laskin Rd and First Colonial Rd (Freeway)	10.8	A	13.3	B	10.6	A	13.1	B	10.6	A	13.1	B
	EB I-264 to SB First Colonial Rd (Diverge)	9.2	A	11.5	B	11.9	B	14.9	B	11.9	B	14.9	B
	EB I-264 to NB First Colonial Rd (Diverge)	14.8	B	17.9	B	-	-	-	-	-	-	-	-
	First Colonial Rd to EB I-264 (Merge)	11.6	B	15.4	B	11.6	B	16.2	B	11.6	B	16.2	B
	EB I-264 between First Colonial Rd and Birdneck Rd (Freeway)	10.6	A	14.9	B	10.6	A	14.9	B	10.6	A	14.9	B
West-bound I-264	WB I-264 between First Colonial Rd and Birdneck Rd (Freeway)	17.2	B	13.1	B	17.2	B	13.1	B	17.2	B	13.1	B
	WB I-264 to First Colonial Rd (Diverge)	17.4	B	13.5	B	17.3	B	13.4	B	17.3	B	13.4	B
	First Colonial Rd to WB I-264 (Merge)	19.3	B	17.5	B	21.4	C	19.4	B	21.4	C	19.4	B
	WB I-264 between Laskin Rd and First Colonial Rd (Freeway)	16.8	B	14.3	B	18.0	C	15.7	B	18.0	C	15.7	B

Table 11.9 Summary of 2040 Build SimTraffic Capacity Analysis I-264 at First Colonial Road Improvement Alternatives				
Intersection	AM Peak Hour		PM Peak Hour	
	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
Single Point Urban Interchange (Figure XI.4)				
I-264 Ramps & First Colonial Road	24.1	C	34.1	C
Wisconsin Avenue & First Colonial Road	3.9	A	6.5	A
Tight Diamond Interchange (Figure XI.5)				
I-264 WB Ramps & First Colonial Road	28.8	C	30.1	C
I-264 EB Ramps & First Colonial Road	35.6	D	38.3	D
Wisconsin Avenue & First Colonial Road	2.8	A	9.0	A

Table 11.10 Summary of 2040 Build SimTraffic Queue Analysis I-264 at First Colonial Road Improvement Alternatives					
Intersection	Ramp Length (feet)	AM Peak Hour		PM Peak Hour	
		Average (feet)	95th % (feet)	Average (feet)	95th % (feet)
Single Point Urban Interchange (Figure XI.4)					
WB I-264 Off-Ramp to First Colonial Road	1,265	24	60	24	66
EB I-264 Off-Ramp to First Colonial Road	1,325	171	244	230	325
Tight Diamond Interchange (Figure XI.5)					
WB I-264 Off-Ramp to First Colonial Road	1,265	48	99	54	97
EB I-264 Off-Ramp to First Colonial Road	1,325	306	599	344	665

XI.2.3 Alternative: Cost

Planning level cost estimates were developed for the two improvement alternatives for the First Colonial Road interchange. Detailed calculations have been included in the Technical Appendix. It should be noted that the estimates do not include costs associated with complete removal of existing I-264 through lanes and inflation/escalation. A 4" overlay was assumed over portions of I-264 that are not being completely removed. The cost estimates in year 2015 dollars are:

Alternative	Cost (in \$million)
Single Point Urban Interchange	\$75.2
Tight Diamond Interchange	\$66.3

XI.2.4 Stakeholder Coordination

Coordination meetings were held with staff from the City of Virginia Beach. In general, representatives from the City were supportive of the evaluation process and the selection of the Single Point Urban Interchange as the preferred alternative.

XI.2.5 Impacts

Identification of potential impacts on key resources from construction of the two improvement alternatives was evaluated using desktop GIS mapping analysis. Detailed exhibits are included in the Technical Appendix. Summarized in **Table 11.11**, the results show that both alternatives would not impact water resources (wetlands, for example) or Section 4(f) properties (public parks, for example). Neither alternative would impact adjacent buildings or residences surrounding the interchange.

Table 11.11 First Colonial Road Interchange Improvement Alternative Impacts				
Improvement Alternative	WATER	BUILDINGS	RESIDENTIAL	POTENTIAL SECTION 4F
Single Point Urban Interchange	N	0	0	N
Tight Diamond Interchange	N	0	0	N

XI.3 Recommendation

Although on the basis of cost alone, the Tight Diamond Interchange would be the most likely candidate for the preferred alternative, adding two closely spaced traffic signals on a corridor that is already signalized would likely be counterproductive to maintaining progression along the First Colonial Road corridor. With the installation of the SPUI, the spacing between the single interchange traffic signal would be approximately 1,100 feet to both the adjacent signal at Virginia Beach Boulevard to the south and to Donna Drive to the north. Adequate traffic signal spacing would also provide adequate turn lane storage, particularly on the northbound left turn to the westbound I-264 on-ramp.

In consideration of providing optimal capacity through the interchange and enhancing the ability to provide for progression on the First Colonial Road arterial corridor, the Single Point Urban Interchange is recommended as the Preferred Alternative.