OCTOBER 2012

1401 EAST BROAD STREET
RICHMOND, VA 23219

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

ACRONYMS

CSXT	CSX Transportation
EBL	Express Bus Lane
EIS	Environmental Impact Statement
ETL	Express Toll Lane
FHWA	Federal Highway Administration
FRA	Federal Railroad Administration
GIS	Geographic Information Systems
HOT	High Occupancy Toll
HOV	High Occupancy Vehicle
I-64	Interstate 64
I-664	Interstate 664
I-95	Interstate 95
LOS	Level of Service
MPO	Metropolitan Planning Organization
NHS	National Highway System
NS	Norfolk Southern
ROD	Record of Decision
STRAHNET	Strategic Highway Network
SYIP	Six-Year Improvement Program
TDM	Travel Demand Management
TPO	Transportation Planning Organization
TSM	Transportation Systems Management
USDOT	United States Department of Transportation
VDOT	Virginia Department of Transportation
VRDPT	Virginia Department of Rail and Public Transportation
VRE	Virginia Railway Express

I. Introduction

The following report describes the alternatives development process along with detailed descriptions of the range of Alternatives which have been investigated for the Interstate 64 (I-64) Peninsula Study. The purpose of this report is to summarize the foundation data and the methodologies that were utilized in preparing the different alternatives for this project.

A. Project Description

The Virginia Department of Transportation (VDOT), in cooperation with the Federal Highway Administration (FHWA), is evaluating options to improve the 75 mile long I-64 corridor from the Interstate 95 (I-95) (Exit 190) interchange in the City of Richmond to the Interstate 664 (I-664) (Exit 264) interchange in the City of Hampton. This study is known as the Interstate 64 Peninsula Study (hereinafter referred to as the I-64 Study in this document). As shown in **Figure 1**, the study area is located within seven localities, including the City of Richmond, Henrico County, New Kent County, James City County, York County, the City of Newport News, and the City of Hampton.

The number of lanes on existing I-64 varies through the study area. In the vicinity of the City of Richmond, from Exit 190 to Exit 197, there are generally three travel lanes in each direction. Between Exit 197 and mile marker 254, there are generally two travel lanes in each direction. Beginning at mile marker 254 and continuing east to the City of Hampton area, I-64 widens to four lanes in each direction with three general purpose lanes and one 2+ person High Occupancy Vehicle (HOV 2+) lane during the AM and PM peak periods. There are some additional lanes between closely spaced interchanges at the eastern end of the corridor to provide for easier merging of traffic on and off of the I-64 mainline.

B. Purpose and Need

Interstate 64 runs east to west through the middle of the state from West Virginia to the Hampton Roads region, for a total of 298 miles. Within the project study area, I-64 connects the Norfolk/Hampton Roads and the City of Richmond metropolitan areas and is an important link in the interstate system. I-64 is part of the National Highway System (NHS) and the Strategic Highway Network (STRAHNET) and was designated by VDOT as a Corridor of Statewide Significance in VTrans 2035 (Virginia's Statewide multimodal transportation policy plan). In addition to being a connecting corridor between urban areas, the corridor serves numerous purposes, including:

- Daily commuting for residents and business trips.
- Providing access to tourist attractions throughout the region.
- Providing access to, from and between military facilities.
- Transporting freight in and out of the Port of Virginia.
- Acting as an emergency evacuation route, particularly during hurricane events affecting the Hampton Roads region.

Within the 75-mile long study area, the I-64 corridor includes 25 interchanges and 109 major bridge structures on or over the interstate. There are several park and ride lots near interchanges along the corridor, along with two rest stops (one in each direction) which includes a Welcome Center in New Kent County. Additionally there are weigh stations in each direction between Exits 200 and 205. The corridor is also paralleled by a CSX Transportation (CSXT) railroad, which also supports Amtrak passenger rail operations between the Cities of Richmond and Newport News.

After reviewing the many elements and conditions throughout the I-64 study area corridor, it was determined that multiple conditions exist creating numerous needs for improvements within the I-64 corridor. These identified needs have been grouped into three categories and include:

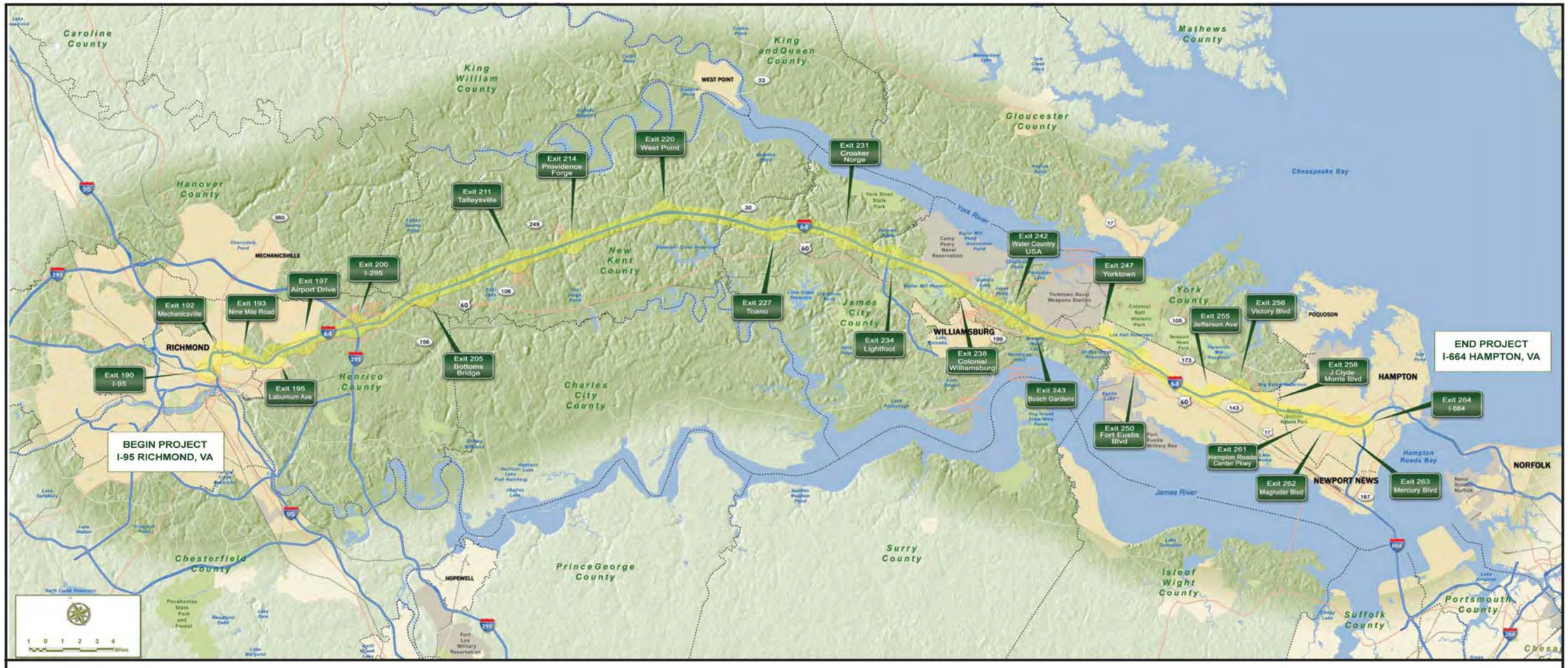


Figure 1
Project Location Map

I-64 PENINSULA STUDY ENVIRONMENTAL IMPACT STATEMENT

Capacity

- Provide for increased capacity in order to reduce travel delays.
- Improve access to tourist attractions throughout the region.
- Improve connectivity to, from and between military installations.
- Provide for increased demand from the freight industry.
- Provide for the efficient transporting of freight in and out of the Port of Virginia.
- Support the current economic development needs along the corridor and in the region.

Roadway Deficiencies

- Minimize roadway geometric and structure deficiencies on the I-64 mainline and at the interchanges.

Safety

- Improve safety by reducing the congestion and improving roadway design geometrics to meet current standards for interstate highways.

Further descriptions of each of these identified needs are presented in the *Purpose and Need Technical Memorandum,* as well as, other sections of the Draft Environmental Impact Statement (EIS).

II. Alternatives Considered

The alternatives development process began with the identification of the purpose and need of the study and the establishment of design criteria, which were utilized in developing a reasonable range of Alternatives. These alternatives were then evaluated to determine whether they would address the purpose and need established for this study. As a result of this analysis, alternatives were either not carried forward for further study, or retained for detailed study. Agency coordination and public involvement played key roles throughout the alternatives development process.

A. Alternatives Development Process

The following describe the process followed to develop the various alternatives for this study.

1. Purpose and Need

Before any alternative was developed, the study purpose and need was clearly defined. This effort included analyzing both the base year (2011) and future year (2040) conditions along the I-64 corridor. The project Purpose and Need was described in detail in the ***Purpose and Need Technical Memorandum.*** The current and future needs identified include increasing capacity, eliminating roadway deficiencies and improving safety along the 75 mile long section of I-64 from I-95 in the City of Richmond to I-664 in the City of Hampton.

2. Establishment of Design Criteria

Engineering design criteria for the Build Alternatives are based on VDOT's standards and guidelines, as published in the VDOT *Road Design Manual* (2005, revised January 2012), and meet the standard for the NHS. All alternatives assume project termini of I-95 in the City of Richmond and I-664 in the City of Hampton. Detailed tables showing the mainline I-64 design criteria and the interchange and ramp design criteria that were used for this study are found in **Appendix A**. Overall, the design criteria are based on the functional classification for each section of the roadway as shown in **Figure 2.** In addition, each of the main bridge structures where I-64 goes over an existing facility along with the structures that go over I-64 were reviewed from existing VDOT data sources. A table showing these structures can be found in **Appendix B**.

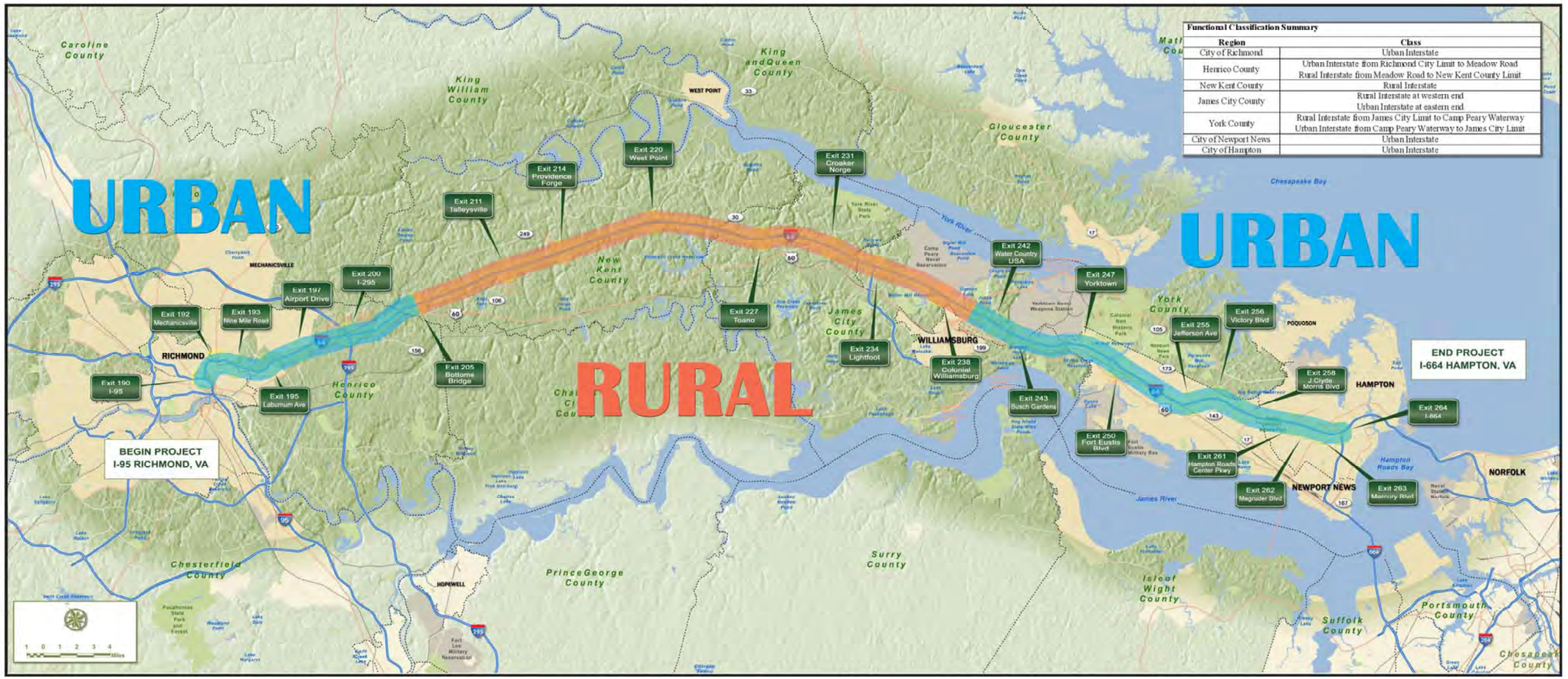


Figure 2
Functional Classification

I-64 PENINSULA STUDY
ENVIRONMENTAL IMPACT STATEMENT

3. Alternatives Development

After defining the study purpose and need along with establishing the design criteria, a reasonable range of study alternatives was developed. The goals in developing alternatives were to develop solutions that meet the needs and criteria while avoiding and minimizing impacts to the human and natural environments. The alternatives developed or investigated included a No-Build Alternative, Transportation Systems Management (TSM)/Travel Demand Management (TDM) strategies, an investigation of future passenger/freight rail, and the development of a range of highway Build Alternatives which focused on:

- The number of lanes required to achieve a Level of Service (LOS) "C" or better in the future year 2040. The LOS is a letter grade rating the traffic operations of a freeway, ramp, weaving section, or intersection, as described further in the ***Traffic and Transportation Technical Memorandum***. LOS C has been identified as the required minimum LOS for the I-64 mainline for this study.
- The type of lanes including general purpose travel lanes, tolled lanes, and/or managed lanes, such as High Occupancy Toll (HOT) lanes, High Occupancy Vehicle (HOV) lanes, Express Toll Lanes (ETL) and Express Bus Lanes (EBL).
- The locations of lanes, specifically widening to the inside within the median, widening to the outside of the existing lanes, and combinations of the two, making an effort to stay within the existing right of way to the greatest extent practicable.
- Preserving and improving pedestrian/bicyclist accommodations for roads crossing over or under I-64.
- Preserving and expanding location and size of "park and rides" and rest areas within the corridor.
- Promoting rail and barge freight service as an alternative to truck freight.

B. Alternatives Considered and Not Carried Forward for Further Study

The following summarizes the alternatives which were considered, but not carried forward for further study:

1. Transportation Systems Management/Travel Demand Management

TSM/TDM strategies would involve only minor work to the existing I-64 corridor. TSM strategies improve traffic flow, improve signalization, convert existing general purpose lanes to managed lanes, improve intersections, and implement traveler information programs. TDM encourages new driving habits through staggered commuting hours, telecommuting, car and vanpooling, ridesharing, and the creation of park and ride facilities. Possible TSM/TDM opportunities for the I-64 corridor include:

- Optimizing traffic signal timing and pursuing strategies to better coordinate traffic signals such as adaptive signal control.
- Encouraging commuters to carpool/vanpool to work by expanding park and ride lots, using educational campaigns to promote carpooling, and working with major regional employers (e.g. the Navy in Hampton Roads area and state government in the City of Richmond area) to promote staggered work hours and/or telecommuting.
- Making minor geometric improvements to improve safety and capacity, such as correcting existing geometric deficiencies and providing weaving lanes between closely-spaced interchanges where none currently exist.
- Encouraging transit as an alternative to driving, by enhancing existing transit options within the corridor, particular in the urban areas at either end of the corridor.
- Preserving and improving pedestrian/bicyclist accommodations for roads crossing over or under I-64.

While some TSM/TDM strategies have the potential to result in slight reductions in peak hour traffic volumes or slight shifts in traffic away from peak hours and towards off-peak hours, they could not reasonably be expected to impact mainline traffic volumes on I-64 to the extent needed to preclude the

need for mainline capacity improvements. It should also be noted that the improvements described in utilizing TSM/TDM strategies (telecommuting, vanpooling, etc.) are generally geared towards typical weekday commuters. However, a major component of the need for capacity improvements to I-64 is the summer weekend traffic. Based on summer travel patterns this type of traffic is less likely to change their travel patterns due to TSM/TDM improvements. In addition, the TSM/TDM strategies have limited opportunity to reduce single-occupancy driving since there are already park-and-ride lots with ample capacity located throughout the corridor. In addition, the existing pavement width that provides for the general purpose lanes could not be restriped or reconfigured to provide for HOV/HOT operations without adversely impacting capacity or safety. Lastly, it should be noted that TSM/TDM strategies typically work best when applied to commuters within highly congested urban areas, however as shown in **Figure 2**, approximately half of the 75 mile long I-64 corridor is classified as rural and primarily serves intercity (as opposed to intracity) travelers.

In evaluating the 25 interchanges areas TSM/TDM strategies could provide some improvements to existing geometric deficiencies such as capacity at the ramps, weaves, and intersections and thus address some of the safety issues that arise from those deficiencies. However, TSM/TDM would not include any major work needed for interchange configurations such as reconstructing ramps and structures and therefore these elements that contribute to the safety issues would continue. Overall, the TSM/TDM strategies would not provide any substantial improvement to the capacity nor remove enough vehicle trips required to obtain an acceptable levels of service needed to meet either the existing or future 2040 capacity needs for traffic on I-64. Therefore, the TSM/TDM strategies alone would not meet the purpose and need of the I-64 project and were not carried forward for further study as an individual, stand alone alternative. However, TSM/TDM improvements can be pursued independently or as part of one of the Build Alternatives to provide for additional low-cost options for improving the transportation conditions within the I-64 study area.

2. Passenger/Freight Rail

In Virginia, railroads are owned and operated by private entities focused on the transport of freight. The railroad corporations allow passenger rail service to operate on their infrastructure through agreements with various organizations, including the Virginia Department of Rail and Public Transportation (VDRPT), Amtrak, and the Virginia Railway Express (VRE). As part of the Intermodal Study conducted for this EIS, both existing and planned passenger and freight railroad services were examined. These efforts included a review of recently completed studies along with those currently underway in the Hampton to Richmond corridor by both public and private organizations. Further information from the Intermodal Study is included in the ***Traffic and Transportation Technical Memorandum.***

Within the I-64 Peninsula Study area, there are two principal rail transportation facilities: (1) the existing CSXT/Amtrak route from Richmond to Newport News, north of the James River on the Virginia Peninsula (Peninsula/CSXT) and (2) the Norfolk Southern (NS) Corporation rail route, south of the James River between Petersburg and Norfolk (Southside/NS). The Peninsula/CSXT Route is parallel to I-64 while the Southside/NS Route is parallel to Route 460. Improvements are currently planned and underway for both corridors.

The VDRPT has been investigating improved passenger rail service between Richmond and Hampton Roads for a number of years. This service would ultimately connect to the Southeast, Northeast and Mid-Atlantic regions as an extension of the Southeast High Speed Rail Corridor. The VDRPT prepared the *Richmond/Hampton Roads Passenger Rail Tier I Final Environmental Impact Statement (EIS)* which evaluated multiple options for passenger rail in the Richmond to Hampton Roads region, including the I-64 Peninsula Study area. The Tier I Final EIS, approved in August 2012, identifies Build Alternative 1 (Higher-speed Southside/Conventional speed Peninsula at maximum authorized speeds of up to 90 mph)

as the Preferred Alternative. The Record of Decision (ROD) is expected to be approved by the Federal Railroad Administration (FRA) in fall 2012.

As stated in the Tier I Final EIS, high-speed intercity passenger rail service attracts different types of ridership and therefore it is unlikely that the additional rail trips generated by the Preferred Alternative would cause a measurable reduction in automobile traffic on major highways such as I-64 and I-95. In specifically examining the potential effects on traffic on I-64, the Tier I Final EIS states that a reduction of vehicles caused by diversion to rail would amount to only approximately 0.7 percent to 2.3 percent reductions in traffic on I-64 when using 2025 traffic volumes. This fraction is small enough that the resultant decrease in traffic would not be measurable, given the normal daily and seasonal fluctuations in traffic volume. If a travel time savings did occur on the I-64 or I-95 routes, the savings likely would be immediately offset by the induced demand of additional vehicles that would divert to the affected routes.

The route along the Route 460 corridor between Norfolk and Petersburg is part of NS's Heartland Corridor, the primary rail route serving the Port of Hampton Roads. The Heartland Corridor began handling double-stacked container trains in August 2010, providing a more direct route between Norfolk and the Midwest.

The VDRPT has issued an $87 million Rail Enhancement Fund grant designed to restart rail passenger service in the corridor between Norfolk, Richmond and the Northeast by upgrading the NS tracks so that they are suitable for use by passenger trains. Projects include upgraded signaling, track extensions and connections, passenger train turning and servicing facilities, and a track and platform near Norfolk's Harbor Park for the passenger train. Also included is construction of a new connection between NS and CSXT tracks near Petersburg. These improvements would enable passenger trains to run on NS's busy Heartland Corridor route. Slated to begin service in December 2012, the trains would be part of Amtrak Virginia's regional service, and would operate at speeds up to 79 mph between Norfolk and Petersburg. The service would begin with one departure in each direction per day with additional departures introduced as funding allows.

CSXT and NS transport large amounts of freight shipments on their railroads within Virginia. A published report by some of the railroads, *Freight Rail Investing In Virginia* (CSXT and NS, 2005) provides details on freight transportation by the two entities within the Hampton Roads and Norfolk region. One of their main cargo shipments is export coal. According to FHWA's Freight Analysis Framework 3rd Version, 2011, (FAF3), in 2007, 99.9% of export coal was shipped to the region by rail. CSXT and NS do not anticipate the proportion of shipment methods to change by 2040.

CSXT and NS projections estimate that the total tonnage of export coal would increase from 36.9 million tons to 62.7 million tons. With this projection, CSXT's freight trains on the Peninsula/CSXT Route would increase by 70% between 2007 and 2040, from 12-15 trains per day to 21-26 trains per day to account for the increased tonnage. Even though tonnage is increasing by approximately 50% and the number of trains are increasing approximately 70%, each train set varies in length and tonnage carried. With these increases, CSXT recognizes that it needs to improve their freight service along the Peninsula/CSXT Line and is evaluating projects to add passing siding and/or a second track throughout the corridor. The current railroad right of way could accommodate an additional track, however, there is currently no funded capital improvement program for this action. Since most of the of CSXT Peninsula trains currently carry export coal, and export coal would not likely be carried by trucks in the future, the freight rail improvements on the Peninsula/CSXT Route would have little to no impact on the I-64 truck traffic.

Overall, the passenger and freight rail improvements that have been identified are not expected to remove enough general purpose vehicle trips from I-64 to obtain acceptable LOS needed to meet either the existing or future 2040 capacity needs for traffic on I-64. New or improved rail lines and/or facilities

within the I-64 corridor would not address the roadway deficiencies and safety needs identified for the I-64 project. Therefore, rail improvements would not meet the purpose and need of the I-64 project and were not carried forward for further study.

3. Highway Build Alternatives

Throughout the development of the Build Alternatives, an emphasis was placed on designing alternatives which would meet the study purpose and need along with the established design criteria. Specific to meeting the study needs for capacity, the future (2040) traffic volumes were projected and analyzed. As described in **Chapter I - Purpose and Need** and in the ***Traffic and Transportation Technical Memorandum***, a LOS criteria of C or better was established for the I-64 mainline and for all merges/diverges/weaves while a LOS criteria of D or better was established for signalized and unsignalized cross street intersections. **Figures I.4** and **I.10** in the Purpose and Need Chapter of the Draft EIS shows the 2011 Base Conditions LOS and projected 2040 No-Build LOS for the corridor which was used to determine the number of lanes needed to address the capacity needs. All of the Build Alternatives developed were then specifically designed to include the number of lanes needed to achieve or exceed these LOS goals. The alternatives that did not meet the LOS needs were not carried forward for further study. The Build Alternatives that were determined to meet these criteria were retained for detailed study and are described as follows.

C. Alternatives Retained for Detailed Study

The alternatives retained for detailed analysis in the Draft EIS include a No-Build Alternative and five separate highway Build Alternatives including:

- Alternative 1A – adding additional general purpose lanes to the outside of the existing general purpose lanes.
- Alternative 1B – adding additional general purpose lanes in the median.
- Alternatives 2A – adding additional lanes to the outside and tolling all lanes.
- Alternatives 2B – adding additional lanes to the median and tolling all lanes.
- Alternative 3 – adding managed lanes to the median.

These five Build Alternatives were specifically designed to meet the identified purpose and need and thus were retained for detailed study. Lane diagrams showing the number of proposed lanes for each of the Build Alternatives are found in **Appendix C. Table 1** presents a comparison of the alternatives retained for detailed study with regard to their ability to meet the purpose and need of the study.

Table 1: Alternatives Retained for Detailed Study – Ability to Meet Purpose and Need

Category	Purpose and Need	No-Build Alternative	General Purpose Lanes Alternatives		Full Toll Lanes Alternatives		Managed Lanes with General Purpose Lanes Alternative
			1A	1B	2A	2B	3
Capacity	Provide increased capacity to reduce travel delays	No	Yes	Yes	Yes	Yes	Yes
	Improve access to tourist attractions	No	Yes	Yes	Yes	Yes	Yes
	Provide efficient connectivity for military installations	No	Yes	Yes	Yes	Yes	Yes

Category	Purpose and Need	No-Build Alternative	General Purpose Lanes Alternatives		Full Toll Lanes Alternatives		Managed Lanes with General Purpose Lanes Alternative
			1A	1B	2A	2B	3
	Provide capacity for increased freight demand	No	Yes	Yes	Yes	Yes	Yes
	Provide for efficient freight movement in and out of the Port of Virginia	No	Yes	Yes	Yes	Yes	Yes
	Support current economic development needs along the corridor and in the region	No	Yes	Yes	Yes	Yes	Yes
Roadway Deficiencies	Eliminate roadway and bridge deficiencies on the I-64 mainline and at the interchanges	No	Yes	Yes	Yes	Yes	Yes
Safety	Improve safety by reducing congestion and improving roadway design to meet current standards for interstates	No	Yes	Yes	Yes	Yes	Yes

1. No-Build Alternative

The No-Build Alternative serves as a baseline for the comparison of future conditions and impacts.

As shown in **Figure 3,** within the 75 mile corridor, there are three areas along I-64 with different lane configurations for the mainline. Typical sections showing the existing lane configurations within each of the three areas are shown in this figure and in **Appendix D**.

This alternative also assumes that the projects currently programmed and funded in VDOT's FY2013-2018 Six-Year Improvement Program (SYIP) would be implemented. These projects are shown in **Table 2**.

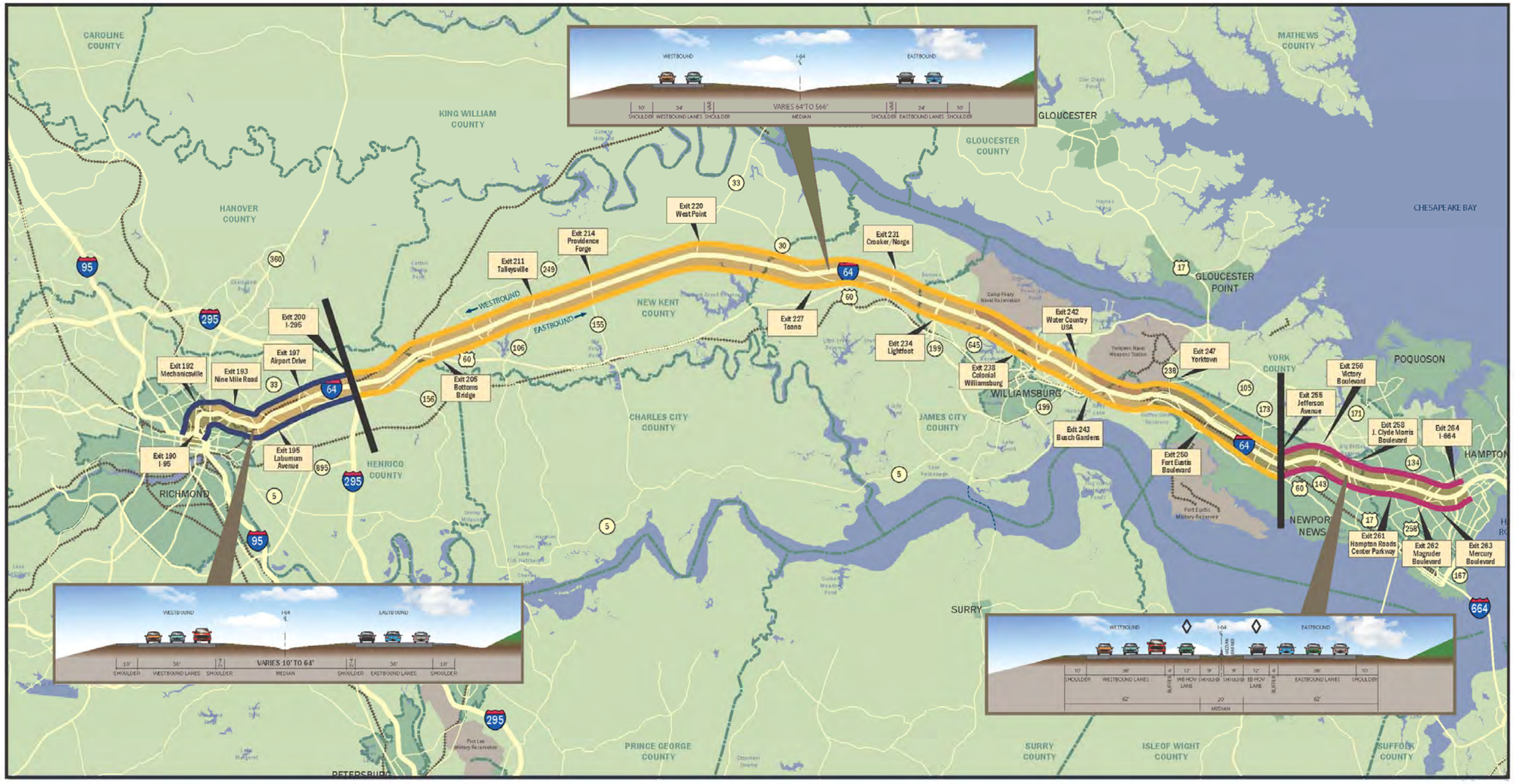


Figure 3
Existing Number of Lanes/No-Build Alternative

I-64 PENINSULA STUDY ENVIRONMENTAL IMPACT STATEMENT

Table 2: I-64 Projects on VDOT's Fiscal Year 2013-18 Six-Year Improvement Program

Locality	UPC	Description
City of Richmond	N/A	N/A
Henrico County	97565	Rehabilitate or replace I-64 EB bridge over Route 156
	97566	Rehabilitate or replace I-64 WB bridge over Route 156
New Kent County	11800	Pavement rehabilitation and widening from Henrico line to James City County line
James City County	N/A	N/A
York County	98098	Install VMS, and lengthen ramp/weave area on I-64 WB near milepost 242
City of Newport News	93077	Replace Denbigh Boulevard bridge over I-64 and CSXT Railroad
City of Hampton	12834	Hampton Roads Third Crossing (PE Funding Only)
Hampton Roads District	71598	I-64 lighting and electrical upgrades

In addition to the programmed VDOT projects, the Tidewater Super-Regional Model developed by VDOT and used for this study includes other projects within the corridor that are part of the Richmond Area Metropolitan Planning Organization (MPO) or Hampton Roads Transportation Planning Organization's (TPO) Constrained Long Range Plans, as well as the Rural Long Range Transportation Plans (which are not fiscally constrained) for the Richmond and Hampton Roads Planning District Commissions. These projects form a part of the base conditions, and the effects of these projects on I-64 traffic are accounted for in all 2040 No-Build analyses. Some of the projects included on these Long-Range Plans include the following:

- The US 460 Corridor Improvements Project, a proposed toll road paralleling existing US 460 between Petersburg and Chesapeake.
- The proposed Richmond-Hampton Roads passenger rail improvements, including the new rail service from Richmond through Petersburg to Norfolk.

The following projects are Fully Funded Committed Projects in the Hampton Roads TPO Constrained Long Range Plan (2034 Long Range Plan):

- Fort Eustis Boulevard bridge replacement at Lee Hall Reservoir.
- I-64 Interchange at LaSalle Avenue (east of this Draft EIS's study area).
- VA 150 Fort Eustis Boulevard widening from a 2-lane undivided to a 4-lane divided arterial from east of Jefferson Avenue to west of George Washington Memorial Highway.

The following projects are listed as Regional Funding Identified in the Hampton Roads TPO Constrained Long Range Plan (2034 Long Range Plan):

- I-64 Peninsula widening, from Jefferson Avenue (Exit 255) to Fort Eustis Boulevard (Exit 250).
- Atkinson Boulevard extension project including a new 4-lane divided arterial with a new bridge over I-64 in the area between Fort Eustis Boulevard (Exit 250) and Jefferson Avenue (Exit 255).
- Denbigh Boulevard Bridge Replacement, which includes building a replacement 4-lane undivided arterial bridge over I-64 and the CSXT Railroad.

The details of all of the input parameters used to analyze the No-Build Alternative are shown in the ***Traffic and Transportation Technical Memorandum.***

2. Alternatives 1A/1B General Purpose Lanes

These alternatives involve adding additional general purpose travel lanes to the I-64 mainline. The result is that Alternative 1A/1B is projected to result in a LOS C or better for all sections of mainline I-64, thus

meeting the criteria established in The ***Purpose and Need Technical Memorandum***. This is true even after using the travel demand model to estimate the increase in traffic on I-64 due to the improvements in I-64 capacity. The modeling of Alternative 1A/1B and the capacity analysis calculations for this alternative are further described in the ***Traffic and Transportation Technical Memorandum***.

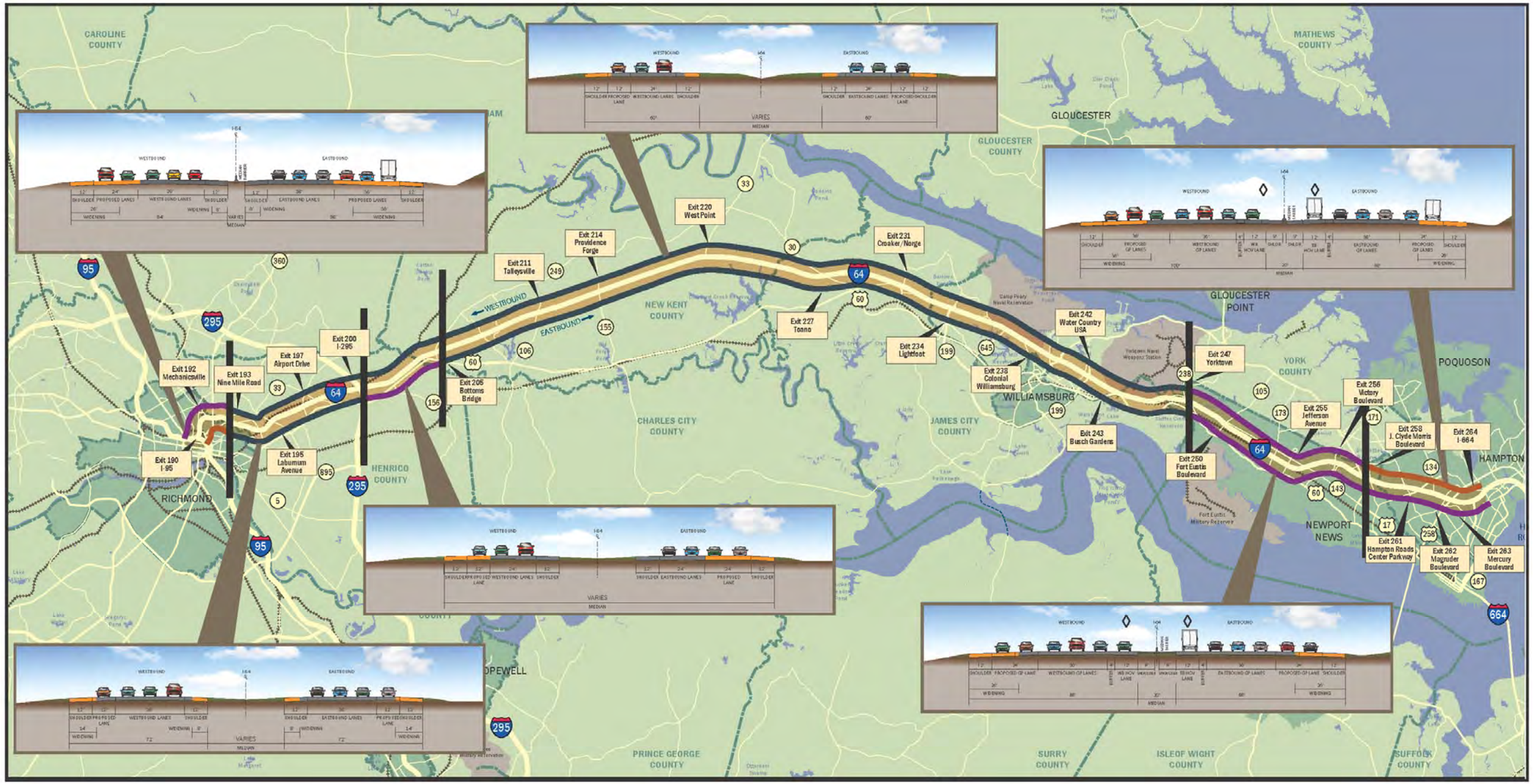
The numbers of lanes that are proposed to be added to I-64 mainline along with typical sections showing the lane configurations are shown in **Figure 4** for Alternative 1A and in **Figure 5** for Alternative 1B. Lane diagrams for Alternatives 1A/1B are found in **Appendix C** and typical sections for Alternatives 1A/1B are found in **Appendix D.**

Although there are numerous possible combinations for adding these lanes, Alternative 1A involves widening exclusively to the outside of the existing general purpose lanes, while Alternative 1B involves widening into the median to the greatest extent practicable. Both alternatives were designed to stay within the existing right of way as much as possible. **Figure 6** shows a representation of the possible disturbance footprints for Alternatives 1A and 1B. Not all sections of the corridor have sufficient median area to accommodate the needed additional lanes so in these areas the additional lanes are proposed to the outside of the existing general purpose lanes. These areas include the sections of the I-64 corridor from Exits 190 to 192 in Richmond/Henrico County and from Exits 255 to 264 in Newport News/Hampton. These sections currently have a narrow median with concrete median barrier, meaning that Alternative 1B is identical to Alternative 1A in these sections.

The proposed typical sections show 12-foot wide travel lanes along with 12-foot wide shoulders on both the outside and median side for Alternatives 1A/1B respectively. Based on the conceptual engineering performed for Alternatives 1A/1B less than 10% or 13 miles of the 150 mile I-64 corridor (75 miles in each direction) may require additional right of way for the mainline widening improvements. The areas which may require additional right of way are located in the most urban areas of the corridor located at the western end in the City of Richmond and at the eastern end in the Cities of Newport News and Hampton. The areas which may require additional right of way include both eastbound and westbound between Exits 190 (I-95) and Exit 192 (Mechanicsville Turnpike), eastbound from mile post 257 to mile post 259.5 and westbound from Exits 264 (I- 664) to Exit 258 (J. Clyde Morris Blvd.).

For the 25 existing interchanges within the study corridor, geometric deficiencies were examined along with future year 2040 traffic volumes and resulting LOS at each interchange location. Conceptual designs were investigated that would accommodate the future traffic and assumptions were made and applied to each interchange to establish a study footprint that would allow for flexibility during final design. Note that the study footprints shown are starting points for design and are not approved design concepts. While the final designs are expected to lie within these footprints, the footprints do not serve as limits to what can be examined during the design phase. In order to be moved forward, any design concept will need to be shown to provide safe traffic operation commensurate with the design speed in the Design Year. **Table 3** provides a summary of the improvements proposed for each of the interchanges while **Figures 7A** and 7**B** show the proposed study area footprints for each of the 25 interchanges. The concept designs that were investigated to form the proposed study area footprint for each of the 25 interchanges are found in **Appendix E**.

At 15 of the 25 interchanges, the footprint increases considerably from the current footprint in order to provide for ramps that meet the horizontal and vertical curvature design standards established for this project, as well as providing adequate weave areas and acceleration/deceleration lane lengths. For the 10 interchanges that do not show any additional study area improvements outside of the existing right of way, there are improvements that would be needed to these interchange areas however it is anticipated that these improvements could be done within the existing right of way.



N

1 0 4 Miles

LEGEND

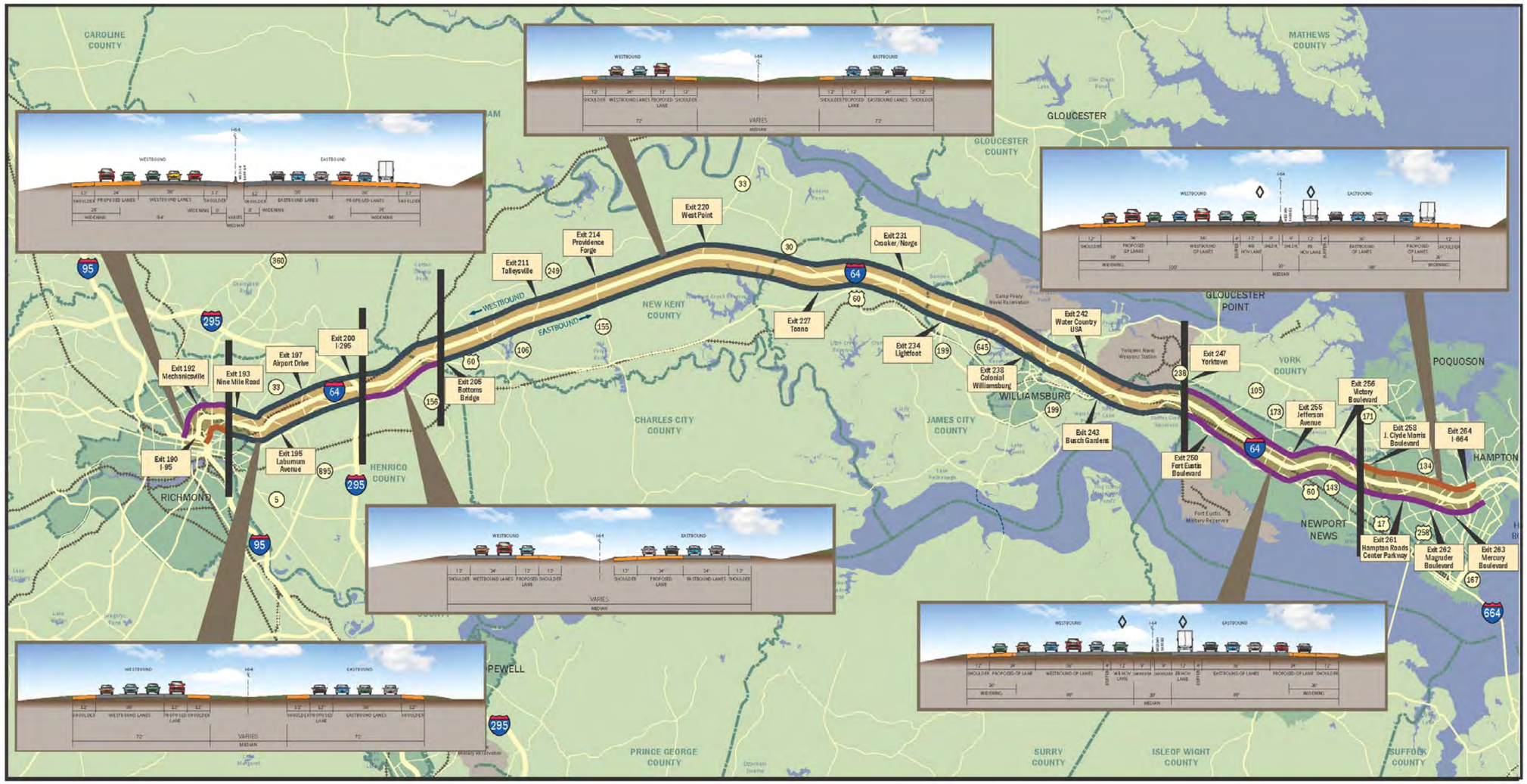
= One Additional Lane

= Two Additional Lanes

= Three Additional Lanes

Figure 4
Proposed Number of Additional Lanes for Build Alternatives 1A and 2A

I-64 PENINSULA STUDY ENVIRONMENTAL IMPACT STATEMENT



N

0 4 Miles

LEGEND

= One Additional Lane

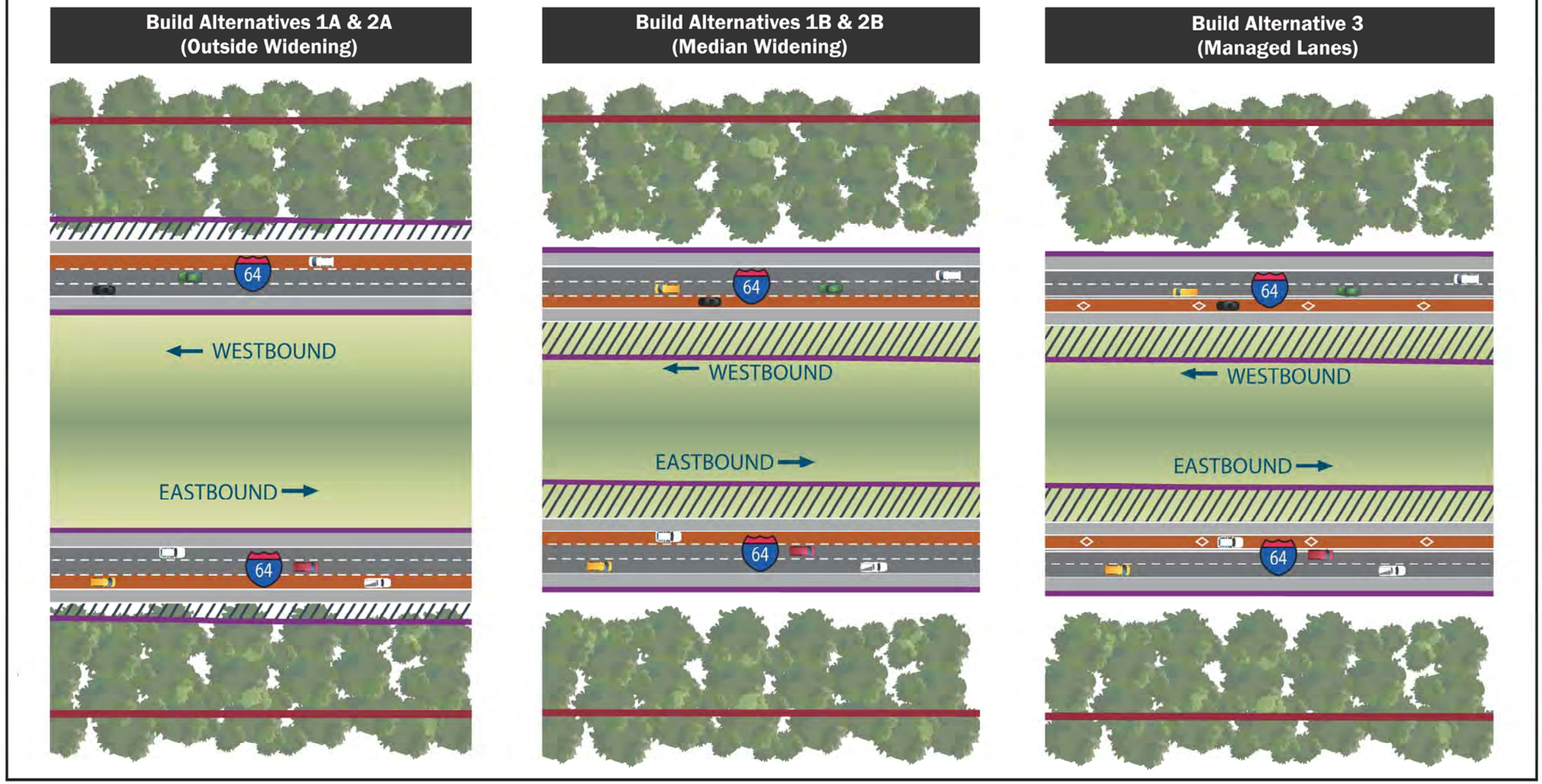
= Two Additional Lanes

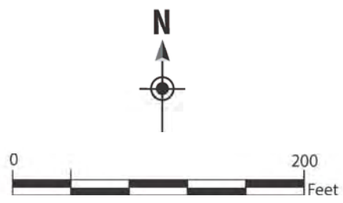
= Three Additional Lanes

* Not all sections of the I-64 corridor have sufficient median area to accommodate the addition of any lanes. In these areas, the facility is proposed to be widened to the outside in order to accommodate the managed lanes in between the eastbound and westbound general purpose travel lanes.

Figure 5
Proposed Number of Additional Lanes for Build Alternatives 1B and 2B

I-64 PENINSULA STUDY ENVIRONMENTAL IMPACT STATEMENT





LEGEND

- = Existing Right of Way
- = Existing Lane
- = Alternative Footprint
- = Conceptual Lane
- = Conceptual Shoulder
- = Potential Disturbance Area

* Note: The representative section shown is located in New Kent County.

Figure 6
Representative Alternative Footprints

LEGEND

= Study Area Inside Existing Right of Way

= Study Area Outside Existing Right of Way

Figure 7A
Proposed Interchange Study Area Footprint

I-64 PENINSULA STUDY ENVIRONMENTAL IMPACT STATEMENT

LEGEND

= Study Area Inside Existing Right of Way

= Study Area Outside Existing Right of Way

Figure 7B
Proposed Interchange Study Area Footprint

I-64 PENINSULA STUDY ENVIRONMENTAL IMPACT STATEMENT

The designs for the I-64/I-95 Interchange (Exit 190) utilize the conceptual designs being prepared as part of VDOT's *I-95/I-64 Overlap Planning Study*. The conceptual design for I-64/I-664 Interchange (Exit 264) has been coordinated with and uses the same conceptual design as the *Hampton Roads Bridge-Tunnel (HRBT) EIS* that begins at this same interchange location. Further engineering and traffic analyses should be performed at each interchange as the project progresses. During the *Interchange Modification Report* process that will follow completion and approval of the Final EIS, each of these interchange configurations will serve as a starting point to be further studied and refined in a more in-depth examination of the needs at each location.

Table 3: Interchange Improvement Summary

Exit	Interchange	Locality	Improvement Description	Additional Right of Way Required
190	I-95 (Shockoe Valley)	Richmond	Revise Westbound to Southbound ramp	Yes
192	US 360 (Mechanicsville Turnpike)	Richmond / Henrico line	Full reconfiguration of all ramps in all quadrants	Yes
193	VA 33 (Nine Mile Road)	Henrico	Full reconfiguration of all ramps in all quadrants	Yes
195	Laburnum Avenue	Henrico	Reconfiguration of ramps in Northeast quadrant	Yes
197	VA 156 (Airport Drive)	Henrico	Full reconfiguration of all ramps in all quadrants	Yes
200	I-295	Henrico	None	No
205	VA 249 (Bottoms Bridge)	New Kent	Reconfiguration of ramps in Northeast and Southeast quadrants	Yes
211	VA 106 (Talleysville)	New Kent	None	No
214	VA 155 (Providence Forge)	New Kent	None	No
220	VA 33 (West Point)	New Kent	None	No
227	VA 30 (Toano)	James City	Reconfiguration of ramps in Southwest quadrant	Yes
231	Route 607 (Croaker)	James City	Full reconfiguration of all ramps in all quadrants	Yes
234	VA 199 (Lightfoot)	York	Reconfiguration of ramps	Yes

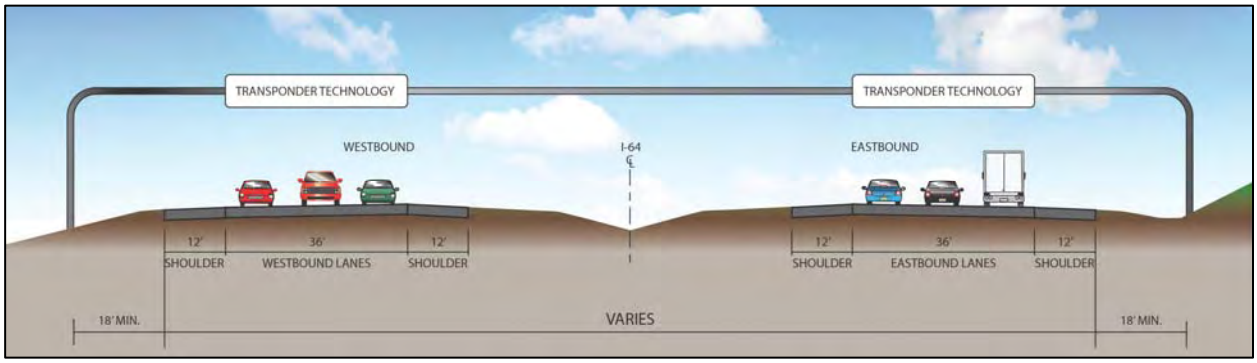
Exit	Interchange	Locality	Improvement Description	Additional Right of Way Required
			in Northwest, Southwest, and Northeast quadrants	
238	VA 143 (Colonial Williamsburg)	York	Reconfiguration of ramps in Northwest, Southwest, and Northeast quadrants	Yes
242	VA 199 (Water Country USA)	York	Full reconfiguration of all ramps in all quadrants	Yes
243	Busch Gardens	York/ James City	Construction of Collector-Distributor roads to join with Exit 242 based on proximity	Yes
247	VA 238 (Yorktown)	Newport News	None	No
250	VA 105 (Ft Eustis Blvd)	Newport News	Full reconfiguration of all ramps in all quadrants	Yes
255	VA 143 (Jefferson Ave)	Newport News	Full reconfiguration of all ramps in all quadrants	Yes
256	VA 171 (Victory Blvd)	Newport News	Full reconfiguration of all ramps in all quadrants	Yes
258	US 17 (J Clyde Morris Blvd)	Newport News	Full reconfiguration of all ramps in all quadrants	Yes
261	Hampton Roads Center Pkwy	Hampton	Reconfiguration of ramps in Northwest, Northeast quadrants	Yes
262	VA 134 (Magruder Blvd)	Hampton	None	No
263	US 258 (Mercury Blvd)	Hampton	None	No
264	I-664	Hampton	Full reconstruction of flyover ramps, connect direction slip ramps	Yes

3. Alternatives 2A/2B Full Toll Lanes

These alternatives evaluate the impacts of tolling the entire facility. However, as of the time of this study, there is no federal or state agreement in place that would allow for tolling I-64 from I-95 in the City of Richmond to I-664 in the City of Hampton. Therefore, these alternatives that involve tolling may or may not ultimately be possible. Notwithstanding, because tolling could be an option in the future, alternatives that involve tolling were considered in the range of possible alternatives evaluated. For the purposes of this study, it was assumed that if the facility is tolled, the tolling would be for all vehicles, in both directions, and for the entire length of the corridor from I-95 in Richmond to I-664 in Hampton. It was

also assumed that there would be toll collection stations, using overhead gantries and all-electronic tolling (i.e. all tolls would be collected at highway speeds), for every interchange-to-interchange segment of I-64. **Figure 8** provides a typical section showing an overhead gantry. However, it is expected that if Alternative 2A or 2B is identified as the Preferred Alternative, subsequent design and financial studies would refine the specifics for tolling operations.

Figure 8: Typical Section of a Toll Collection Station Using Overhead Gantries and All-Electronic Tolling



In order to determine the number of lanes needed for Alternatives 2A/2B, the traffic studies included a toll diversion analysis. This toll diversion analysis is included in the ***Traffic and Transportation Technical Memorandum***. As a result of this analysis, the tolling of I-64 is expected to have either a neutral effect or result in a decrease in traffic volumes on the I-64 mainline due to people choosing to avoid a tolled I-64 and using other parallel routes instead. The main parallel route which is projected to see the largest increase in traffic volumes is US Route 60, which parallels I-64 for most of the corridor. This road is projected to see traffic volumes increasing anywhere from 0-33%, depending on the section of US Route 60 and whether a lower or higher toll rate is used, with the largest increases projected to occur on the section of US Route 60 between Route 155 and Route 30 in eastern New Kent/western James City Counties. Note that this tolling analysis also included the proposed US 460 tolled freeway between Petersburg and Suffolk, as that project is already included on the Tri-Cities MPO and Hampton Roads TPO Constrained Long-Range Plans. The tolls diversion analysis showed that tolling I-64 would not increase traffic volumes at any location along the I-64 mainline. This analysis indicated possible reductions to traffic on the I-64 corridor, however these reductions are not projected to change the number of lanes needed to achieve a LOS C or better in the future year 2040 from those indicated for the General Purpose Lanes Alternatives (Alternatives 1A and 1B). Therefore, the proposed disturbance limits for Alternatives 2A/2B would be the same as Alternatives 1A/1B, respectively.

The number of lanes that are proposed to be added to the I-64 mainline along with typical sections showing the lane configurations are shown in **Figure 4** for Alternative 2A and in **Figure 5** for Alternative 2B. Lane diagrams for Alternatives 2A/2B are found in **Appendix C** and typical sections for Alternatives 2A/2B are found in **Appendix D.**

Although there are numerous possible combinations for adding these lanes, the analysis focused on adding all that is needed to either the outside of the existing general purpose lanes, with an effort to keep all proposed improvements within the existing right of way to the greatest extent practicable. These areas include the sections of the I-64 corridor from Exits 190 to 192 in Richmond/Henrico County and from Exits 255 to 264 in Newport News/Hampton. These sections currently have a narrow median with concrete median barrier, meaning that Alternative 2B is identical to Alternative 2A in these sections. **Figure 6** shows a representation of the possible disturbance footprints for Alternatives 2A and 2B. Not all

sections of the corridor have sufficient median area to accommodate the needed additional lanes so in these areas the additional lanes are proposed to the outside.

The proposed typical sections show 12-foot wide travel lanes along with 12-foot wide shoulders on both the outside and median side for Alternatives 2A/2B respectively. Based on the conceptual engineering performed for Alternatives 2A/2B less than 10% or 13 miles of the 150 mile I-64 corridor (75 miles in each direction) may require additional right of way for the mainline widening improvements. The areas which may require additional right of way are located in the most urban areas of the corridor located at the western end in the City of Richmond and at the eastern end in the Cities of Newport News and Hampton. The areas which may require additional right of way include both eastbound and westbound between Exits 190 (I-95) and Exit 192 (Mechanicsville Turnpike), eastbound from mile post 257 to mile post 259.5 and westbound from Exits 264 (I- 664) to Exit 258 (J. Clyde Morris Blvd.).

In addition to the mainline improvements, due to only modest changes in traffic volumes, as determined in the toll diversion analysis, Alternatives 2A/2B also includes the same improvements to the 25 interchanges as described in Alternatives 1A/1B. **Table 3** provides a summary of the improvements proposed for each of the interchanges while **Figures 7A** and **7B** show the proposed study area footprints for each of the 25 interchanges**.** The concept designs that were investigated to form the proposed study area footprint for each of the 25 interchanges are found in **Appendix E**.

4. Alternative 3 Managed Lanes

This alternative involves the addition of separated, managed lanes located in the median. These managed lanes were examined for the entire length of the I-64 study area from I-95 in Richmond to I-664 in Hampton. As previously described, not all sections of the I-64 corridor have sufficient median area to accommodate the addition of any lanes. In these areas, the facility is proposed to be widened to the outside of the existing general purpose lanes in order to accommodate the managed lanes in between the eastbound and westbound general purpose travel lanes.

Managed lanes can refer to many different strategies, including:

- High Occupancy Vehicle (HOV) lanes - lanes that are open only to vehicles with multiple occupants. Typically HOV lanes allow buses but exclude trucks. Variables include:
  - Extent of HOV lanes (i.e. where do they start and end).
  - Number of HOV lanes.
  - Occupancy restrictions (2+ occupants or 3+ occupants).
  - Time of day/day of week restrictions, if any.
  - Locations of access points to and from the HOV lanes, at intermediate locations as well as the end points.
  - Separation between the HOV lanes and the general purpose lanes (barrier/ bollards/pylons, painted buffer area, double white line).

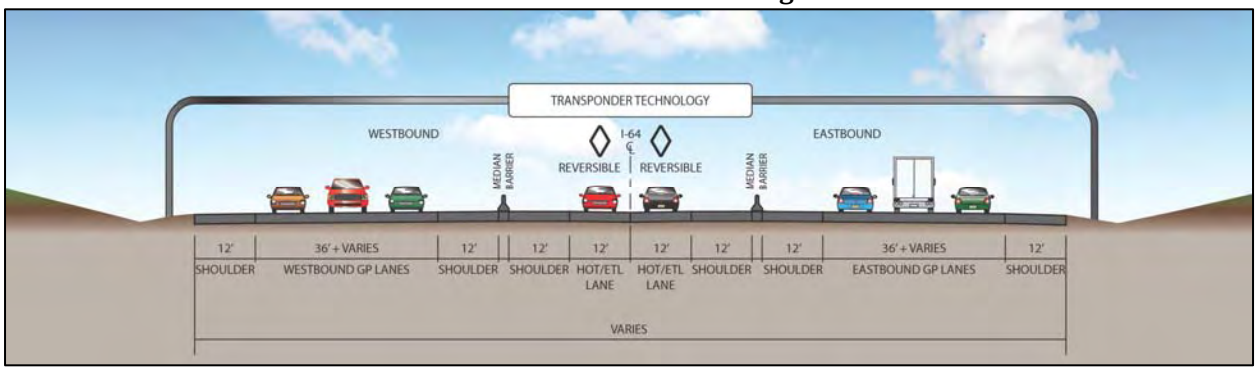
- High Occupancy Toll (HOT) lanes - very similar to HOV lanes except that single-occupant vehicles can also drive in the HOT lanes if they pay a fee. Variables include:
  - Extent of HOT lanes (i.e. where do they start and end).
  - Number of HOT lanes.
  - Occupancy restrictions (2+ occupants or 3+ occupants).
  - Toll rate (variable or fixed) for single-occupant vehicles.
  - Locations of access points to and from the HOT lanes, at intermediate locations as well as the end points.
  - Separation between the HOT lanes and the general purpose lanes (barrier/ bollards/pylons, painted buffer area, double white line).

- Express Toll Lanes (ETL) - very similar to HOT lanes except there are no discounts for multiple-occupancy vehicles. Variables include:
  - Extent of ETL lanes (i.e. where do they start and end).
  - Number of ETL lanes.
  - Toll rate (variable or fixed).
  - Locations of access points to and from the ETL lanes, at intermediate locations as well as the end points.
  - Separation between the ETL lanes and the general purpose lanes (barrier/ bollards/pylons, painted buffer area, double white line).

- Express Bus Lanes (EBL) – lanes for the exclusive use of public transit buses. These could potentially include bus transit stations within the highway right of way. Variables include:
  - Extent of EBL lanes (i.e. where do they start and end).
  - Locations of access points to and from the EBL lanes, at intermediate locations as well as the end points.
  - Location of express bus transit stations, if any.
  - Separation between the EBL lanes and the general purpose lanes (barrier/ bollards/pylons, painted buffer area, double white line).

For any of the managed lanes that involve toll collection (HOT or ETL lanes), traditional toll plazas were not included. All toll collection would be done by overhead gantries with all-electronic tolling used to collect all tolls at highway speeds. **Figure 9** shows a typical section showing an overhead gantry.

Figure 9: Typical Section of a Toll Collection Station for Managed Lanes, using Overhead Gantries and All-Electronic Tolling



The EIS study does not identify what type of managed lanes would be constructed. Moreover, if Alternative 3 is identified as the Preferred Alternative, subsequent studies would refine the specifics of the managed lanes throughout the I-64 corridor.

A methodology for projecting traffic volumes and analyzing capacity for Alternative 3 has been developed as outlined in the ***Traffic and Transportation Technical Memorandum***. It was determined that the LOS goal for Alternative 3 was to provide a LOS B or better for the managed lanes and a LOS D or better for the general purpose lanes. The rationale for providing a lower LOS threshold for the general purpose lanes is that, if the general purpose lanes are free of congestion, there is no incentive to use the managed lanes.

As a part of this analysis, reversible managed lanes (similar to the existing HOV lanes on I-95 in northern Virginia) were also considered.

Reversible lanes may be appropriate when there is a distinct directionality in the projected traffic flow, e.g., predominant inbound flow during the AM peak, and predominant outbound flow during the PM peak. If the difference in inbound and outbound volumes exceeds the capacity of one or more lanes, a reversible lane can reduce the necessary footprint of disturbance. In the Richmond area, projected traffic volumes exhibit this characteristic and therefore reversible lanes may be possible. In the Hampton Roads area and throughout the center of the study area, the preliminary analysis shows that there is no distinctive directional traffic flow and that the placement of managed lanes for use in each direction may be the best option. Note that reversible lanes require considerable infrastructure in terms of gates, signing, etc. to eliminate any possibility of wrong-way entry into the managed lanes. There are also considerable operating costs associated with performing the daily switchovers from eastbound to westbound operations or vice versa.

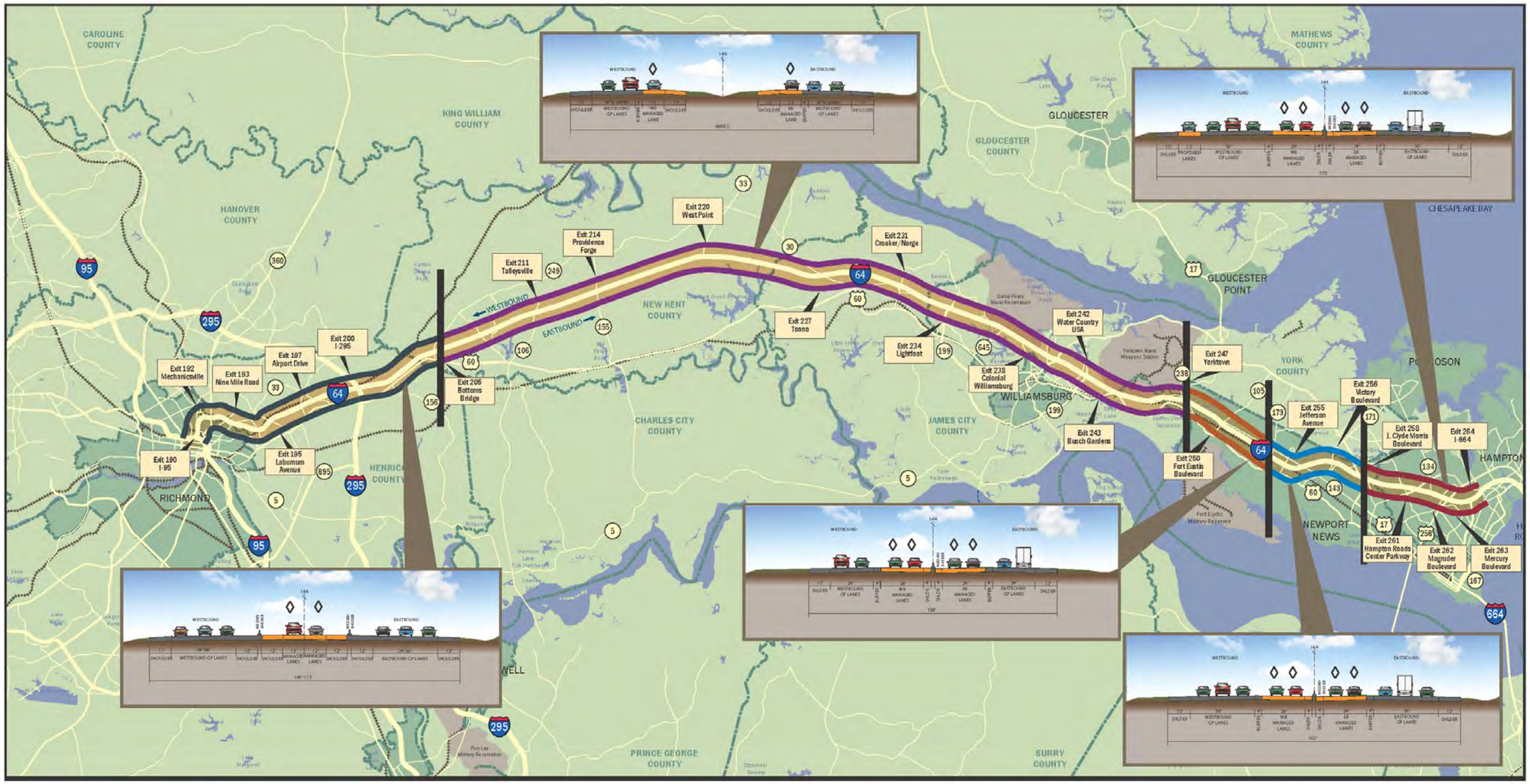
The following assumptions were made for Alternative 3 for the purposes of the EIS:

- The managed lanes would stretch the entire length of the I-64 Peninsula Corridor.
- Reversible managed lanes must be separated from the adjacent general purpose lanes by a barrier. For locations with nonreversible managed lanes, it was assumed that a four-foot buffer area would be used to separate the managed lanes from the general purpose lanes. **Figure 10** shows a nonreversible managed lane section from the SR 91 HOT lanes in Orange County, California.
- Although there are numerous possible combinations for adding managed lanes, the analysis focused on the conditions which would result in the widest area of proposed disturbance. Therefore, any additional general purpose lanes required were added to the outside of the existing general purpose lanes.

Figure 10: Nonreversible Managed Lane
(SR 91 HOT Lanes (Orange County, California)

Based on the results of this capacity analysis, the lane configurations developed for Alternative 3 along the I-64 corridor are described in **Table 4.** The numbers of lanes that are proposed to be added to the I-64 mainline along with typical sections showing the lane configurations are shown in **Figure 11** for Alternative 3. **Figure 6** shows a representation of the possible disturbance footprint for Alternative 3. A lane diagram for Alternatives 3 is found in **Appendix C,** and typical sections for Alternative 3 are found in **Appendix D.**

Based on the conceptual engineering performed for Alternative 3, approximately 2%, or 3 miles of the 150 mile I-64 corridor (75 miles in each direction), may require additional right of way for the mainline widening improvements. The areas which may require additional right of way are located in the most urban areas of the corridor located at the western end in the City of Richmond including both eastbound and westbound between Exits 190 (I-95) and Exit 192 (Mechanicsville Turnpike).



LEGEND

- = Two Reversible Managed Lanes in the Median
- = One Managed Lanes in Each Direction in the Median
- = Two Managed Lanes in Each Direction in the Median
- = Two Managed Lanes in Each Direction in the Median
- = Two Managed Lanes in Each Direction in the Median Plus One Additional Westbound Lane

* If Alternative 3 is selected, subsequent studies will define the specific type of managed lanes, lane needs and locations, access to and from the managed lanes, along with end points and transition zones for the managed lanes along with the needed general purpose lanes.

** Not all sections of the I-64 corridor have sufficient median area to accommodate the addition of any lanes. In these areas, the facility is proposed to be widened to the outside in order to accommodate the managed lanes in between the eastbound and westbound general purpose travel lanes.

Figure 11
Proposed Number of Additional Lanes for Build Alternative 3

I-64 PENINSULA STUDY ENVIRONMENTAL IMPACT STATEMENT

In addition to these mainline improvements, due to only modest changes in traffic volumes, Alternative 3 also includes the same improvements to the 25 interchanges as described in Alternatives 1A/1B. **Table 3** provides a summary of the improvements proposed for each of the interchanges, while **Figures 7A** and **7B** show the proposed study area footprints for each of the 25 interchanges. The concept designs that were investigated to form the proposed study area footprint for each of the 25 interchanges are found in **Appendix E**.

Table 4: Alternative 3 Characteristics*

From	To	Number of Managed Lanes located in the Median Area**	Number of Additional General Purpose Lanes added to the Outside
I-95 (Exit 190)	Bottoms Bridge (Exit 205)	2 (Reversible 2 in each direction)	0
Bottoms Bridge (Exit 205)	Yorktown (Exit 247)	2 (1 in each direction)	0
Yorktown (Exit 247)	I-664 (Exit 264)	4 (2 in each direction)	One additional Westbound lane from I-664 (Exit 264) to J. Clyde Morris Blvd (Exit 258)

* If Alternative 3 is identified as the Preferred Alternative, subsequent studies would define the specific type of managed lanes, lane needs and locations, access to and from the managed lanes, and end points and transition zones for the managed lanes along with the needed general purpose lanes.

** Not all sections of the I-64 corridor have sufficient median area to accommodate the addition of any lanes. In these areas, the facility is proposed to be widened to the outside in order to accommodate the managed lanes in between the eastbound and westbound general purpose travel lanes.

D. Cost Estimates

Cost estimates for each of the alternatives studied in detail were calculated including both construction costs and anticipated right of way costs.

1. Construction Costs

Construction costs were calculated using the VDOT 2009 Planning Level Cost Spreadsheet and are found in **Appendix F**. The following is a list of key assumptions used in developing these costs:

- The VDOT 2009 Planning Level Cost Spreadsheet uses different equations for rural and urban classifications. As shown in **Figure 2** the functional classes used for the study area section of I-64 are urban from mile posts 190 to 202.5, rural from 202.5 to 241.5 and urban from 241.5 to 264.
- Final costs were developed for “Low” and “High” scenarios.
- Build Year used was 2017.
- Inflation Rate used was 2% per year.
- For calculating right of way costs Zone 1 and Zone 2 were split at mile marker 224 which is the boundary between the VDOT Richmond and Hampton Roads Districts.
- For interchanges, the degree of anticipated impact was used to determine the cost selected. 4-quadrant reconfiguration = high cost, 2-quadrant reconfiguration = low cost, tie in @ ramps = improvement cost.
- Bridges were calculated separately if they are not part of interchange.

- Interchange bridges were included in the interchange costs.
- It is assumed that all mainline and overhead bridges would be replaced.
- 1% was added to the cost of Alternative 3 Managed Lanes to account for additional pavement width for the buffer area.
- For Alternatives 2A/2B Full Toll Lanes there were 24 tolling gantries assumed at a per gantry cost of $220,000 per gantry and toll shelter. The TTMS which includes tolling equipment, software, back office work, and testing was estimated at approximately $2,000,000 per location and the ITS duct bank of conduit and fiber was included at approximately $25 per linear foot for the 75 mile long corridor.
- Alternative 3 Managed Lanes costs do not include any tolling gantries. If High Occupancy Toll (HOT) lanes or Express Toll Lanes (ETL) are selected additional costs would be needed for gantries and tolling equipment.

2. Right of Way Costs

In addition to construction, costs were estimated for the anticipated right of way needed along the I-64 mainline and at the interchanges for each of the alternatives studied in detail. A detailed description of the methodology used to calculate the estimated right of way costs along with descriptions of the specific parcels anticipated to be acquired are found in the ***Right of Way Technical Memorandum***. In summary, the estimated acreage of additional right of way to be acquired was obtained by overlaying each alternative footprint onto VDOT Geographic Information Systems (GIS) right of way boundary and parcel data provided by each locality along the corridor. Parcels were separated by VDOT District (Richmond and Hampton Roads) and then categorized into four types, in accordance with the VDOT Planning Level Costs Estimation Process:

- Rural.
- Residential/Suburban Low Density.
- Outlying Business/Suburban High Density.
- Central Business District.

Along the mainline, the acreage between the existing right of way and the proposed right of way was determined for each District, resulting in small fractions of parcels to be acquired, which totaled up to an overall acreage of mainline right of way to be acquired for each parcel type for each Build Alternative. It was assumed that since the right of way would be from the back portion of each parcel along the mainline and access would not be affected, right of way negotiations would be limited to partial acquisitions and therefore no mainline impacts were considered complete acquisitions.

At the interchanges, there are areas where right of way would be needed, as well. However, there is the potential for access issues to businesses and commercial properties at the interchanges; and therefore, in order to assess a worst case scenario at this planning stage, it was initially determined that for those properties that are impacted, the entire property would be considered acquired, which is also referred to as a relocation or take. However, there were a number of fairly large parcels that created outliers and skewed the results, therefore it was decided that any parcel impacted by 25% or more would be considered a complete acquisition while those impacted by less than 25% would be a partial acquisitions, similar to the mainline. This methodology was used in order to develop more accurate right of way and cost estimates. It should be noted that all of the interchange footprints are the same across all proposed Build Alternatives and therefore the impacts are also the same.

The right of way estimates are conservative estimates and the actual number of acquisitions or relocations is expected to decrease as the project design is advanced and roadway right of way requirements are determined using more detailed information. The acreage of each type of parcel impacted within each District was added to the mainline right of way acreage for each type to yield a total acreage of

anticipated right of way for each parcel category for each Build Alternative.

In order to develop costs, a planning level construction estimate for the entire project was developed using the VDOT Planning Level Costs Estimation Process. Right of way and utility costs are shown as a percentage of construction costs and were determined for each alternative using the figures from the VDOT Planning Level Costs Estimation Process. Using the total right of way estimates obtained for each alternative along the corridor, per District and per category, percentages of the overall total were then determined. This percentage was then multiplied by the low and high right of way and utility cost percentages of the overall construction cost and totaled for each alternative.

3. Estimated Total Costs

A summary of the estimated construction and right of way costs is provided in **Table 5**. These estimates were calculated using Low and High variables according to VDOT's 2009 Planning Level Cost Spreadsheet, which can be found in **Appendix F**.

Table 5: Total Cost Estimates for Alternatives Studied in Detail

Alternative	Estimate	Low	High
1A General Purpose – Outside	Construction	$2,611,084,360	$4,206,122,750
	Right of Way and Utilities	$2,129,305,238	$3,076,433,676
	Total Cost Estimates	**$4,740,389,598**	**$7,282,556,426**
1B General Purpose – Median	Construction	$2,605,894,220	$4,198,710,630
	Right of Way and Utilities	$2,104,139,703	$3,037,316,247
	Total Cost Estimates	**$4,710,033,923**	**$7,236,026,877**
2A Full Toll – Outside	Construction	$2,611,084,360	$4,206,122,750
	Right of Way and Utilities	$2,168,619,006	$3,133,281,617
	Total Cost Estimates	**$4,779,703,366**	**$7,339,404,367**
2B Full Toll – Median	Construction	$2,605,894,220	$4,198,710,630
	Right of Way and Utilities	$2,143,106,256	$3,093,604,859
	Total Cost Estimates	**$4,749,000,476**	**$7,292,315,489**
3 Managed Lanes	Construction	$2,570,629,712	$4,141,681,426
	Right of Way and Utilities	$2,158,069,074	$3,123,754,479
	Total Cost Estimates	**$4,728,698,786**	**$7,265,435,905**

REFERENCES

A Policy on Geometric Design of Highways and Streets, Fifth Edition, AASHTO, Washington DC, 2004
Roadside Design Guide, Third Edition, AASHTO, Washington DC, 2006

VDOT Road Design Manual, 2005, revised January 2012

Various Mapping of the Study Area, http://maps.google.com

VDOT I-64 As-Built Plans, provided by the Department over a 4 month period in 2011

VDOT Structure Inspection Reports, provided by the Department over a 4 month period in 2011

VDOT FY 2013-18 Six Year Improvement Program

2009 VDOT Planning Level Cost Estimate Spreadsheet

City of Richmond GIS, furnished February 2011

Henrico County GIS, furnished March 2011

New Kent County GIS, furnished March 2011

York County GIS, furnished February 2011

James City County GIS, furnished February 2011

City of Newport News GIS, furnished February 2011

City of Hampton GIS, furnished March 2011

INTERSTATE 64 PENINSULA STUDY

APPENDIX A

Engineering Design Criteria

Design Guidelines for the Widening of I-64

Approved: June 29, 2011

Below are the design guidelines that will be used for the I-64 Environmental Impact Statement Alternatives Development.

- Design Speed shall be 75 mph for Rural Interstate and 70 mph for Urban Interstate.
  - A review will be performed for portions of the corridor which do not meet the current standards for 75 mph.
- The Functional Classifications used to determine the design standards are listed below:

Functional Classification	
Region	***Class***
Richmond	Urban Interstate
Henrico	Urban Interstate from Richmond City Limit to Meadow Road
	Rural Interstate from Meadow Road to New Kent County Limit
New Kent	Rural Interstate
James City	Rural Interstate at Western End
	Urban Interstate at Eastern End
York	Rural Interstate from James City Limit to Camp Peary Waterway
	Urban Interstate from Camp Peary Waterway to James City Limit
Newport News	Urban Interstate
Hampton	Urban Interstate

- Travel lane widths are to be 12 feet wide.
- Two 12 feet wide travel lanes in each direction shall be maintained on the mainline at all times with a minimum of 1 foot offset to the Barrier Service during construction unless otherwise approved by VDOT.
- At least one travel lane in each direction shall be maintained on the crossroads at all times. The width of the travel lane is to be approved by VDOT.
- All interchanges are to remain functional during mainline construction activities unless otherwise determined by VDOT.
- 12 feet full depth paved shoulders are to be provided on each side of the roadway; graded at a 5% cross slope.
- Outside shoulder widths, cut and fill, shall be 17 feet. The graded portion (5 feet) beyond the edge of the paved shoulder shall be 5/8":1' governed by the GS-11 Standard.
- Median shoulder widths, cut and fill, shall be 17 feet. The graded portion (5 feet) beyond the edge of the paved shoulder shall be 5/8":1' governed by the GS-11 Standard.
- All interchanges will have a minimum of 1200 feet acceleration lanes for on-ramps and 800 feet deceleration lanes for off-ramps. Lengths of acceleration

lanes and deceleration lanes are to be in accordance with the latest standards except for minimum lengths as noted. Longer than standard lengths may be needed in special situations.

- Any median 60 feet or less in width is to have Concrete Median Barrier (Tall Wall) as conditions dictate.
- Concrete Median Barrier (Tall Wall) is to be considered for median widths ranging from 60 – 68 feet.
- Side slopes shall be in accordance with CS-4E Standards.
- Mainline Bridges shall be designed so they can be widened economically in the future.
- Mainline Bridges will be designed with 14 feet shoulders on both sides of the roadway.
- All Bridge Clearances over Mainline I-64 are to be 16’-6” for the total paved cross section, including paved shoulders.
- Roadways under Mainline I-64 shall have 14’ vertical clearance.

Mainline Design Criteria

Approved: June 29, 2011

	LIMITED ACCESS FREEWAY	RURAL INTERSTATE	URBAN INTERSTATE
ROADWAY	**LANE WIDTHS** [1]	4 or More 12'-0" Travel Lanes	4 or More 12'-0" Travel Lanes
	SHOULDER WIDTHS [2,3]	Outside Shoulder 12'-0" Width, 10'-0" Paved Inside Shoulder 8'-0" (Graded) or 4'-0" Paved with 4'-0" Graded	Outside Shoulder 12'-0" Width, 10'-0" Paved Inside Shoulder 8'-0" (Graded) or 4'-0" Paved with 4'-0" Graded
	MEDIAN WIDTHS [4]	Minimum 36'-0"	Minimum 10'-0"
	TRAVEL WAY CROSS SLOPES (NORMAL CROWN OR SUPERELEVATED)	Minimum 2.0% Maximum 8.0%	Minimum 2.0% Maximum 8.0%
	SHOULDER CROSS SLOPES [5]	Minimum Pavement / Concrete: 2.0% Gravel / Crushed Rock: 4.0% Maximum Pavement / Concrete: 6.0% Gravel / Crushed Rock: 6.0%	Minimum Pavement / Concrete: 2.0% Gravel / Crushed Rock: 4.0% Maximum Pavement / Concrete: 6.0% Gravel / Crushed Rock: 6.0%
	BRIDGE WIDTHS [6]	Cross Section Shall Match Approach Roadway (Lesser for Long (200'+) Bridges)	Cross Section Shall Match Approach Roadway (Lesser for Long (200'+) Bridges)
	VERTICAL GRADES (Minimum)	Minimum 0.5%	Minimum 0.5%
	VERTICAL CLEARANCE	Desired: 16'-6" Minimum: 16'-0"	Desired: 16'-6" Minimum: 16'-0"
	HORIZONTAL CURVATURE	AASHTO Exhibit 3-15, pg. 147 Minimum Radius = $V^2 / (15(0.01e_{max}+f_{max}))$	AASHTO Exhibit 3-15, pg. 147 Minimum Radius = $V^2 / (15(0.01e_{max}+f_{max}))$
	VERTICAL CURVATURE [7]	AASHTO Green Book, Exhibit 3-72 and 3-73, pg. 272	AASHTO Green Book, Exhibit 3-72 and 3-73, pg. 272
	EMERGENCY VEHICLE ACCESS [8]	Spaced @ 3-4 Miles On Center	NA
ROADSIDE	**CLEAR ZONE WIDTHS** [9, 10]	30 - 34'	30 - 34'
	ROADSIDE BARRIER [11]	NCHRP approved Guiderail, Concrete Barriers, End Treatment, and Impact Attenuating Devices	NCHRP approved Guiderail, Concrete Barriers, End Treatment, and Impact Attenuating Devices
	MEDIAN BARRIER [11]	NCHRP approved Guiderail, Concrete Barriers, End Treatment, and Impact Attenuating Devices	NCHRP approved Guiderail, Concrete Barriers, End Treatment, and Impact Attenuating Devices
	SIDE SLOPES [12]	Desired 1V:6H or Flatter Minimum 1V:4H 1V:2H with Barrier	Desired 1V:6H or Flatter Minimum 1V:4H 1V:2H with Barrier
DESIGN	**DESIGN SPEED**	75 mph	Desired 75 mph Minimum 60 mph
	SIGHT DISTANCES	Vertical Sight Distance Dependent on Design Speed See 2004 AASHTO Green Book, Exhibit 3-72, pg. 272 Horizontal Sight Distance Dependent on Curve Radius, Design Speed See 2004 AASHTO Green Book, Exhibit 3-54, pg. 227	Vertical Sight Distance Dependent on Design Speed See 2004 AASHTO Green Book, Exhibit 3-72, pg. 272 Horizontal Sight Distance Dependent on Curve Radius, Design Speed See 2004 AASHTO Green Book, Exhibit 3-54, pg. 227
	VERTICAL GRADES (Maximum)	Dependent on Design Speed and Type of Terrain See 2004 AASHTO Green Book, Exhibit 8-1, pg. 506	Dependent on Design Speed and Type of Terrain See 2004 AASHTO Green Book, Exhibit 8-1, pg. 506

1. Number of lanes determined by lane capacity design for selected Level of Service.
2. Both shoulders shall be 12'-0" paved where truck traffic exceeds 250 DDHV.
   AASHTO pg. 505, AASHTO Policy on Design Standards Interstate System
3. If section has six or more lanes, inside shoulder shall be 10'-0" paved, or 12'-0" paved if truck traffic exceeds 250 DDHV. PENNDOT DM-2,
   AASHTO pg. 505, AASHTO Policy on Design Standards Interstate System
4. Minimum for a four-lane facility. For six or more lanes, or where DDHV is greater than 250 trucks, minimum median width
   is 22'-0" and desired median width is 26'-0". AASHTO pg. 513
5. Algebraic difference between pavement and shoulder cross slope not to exceed 8.0%. AASHTO pg. 316
6. See AASHTO Policy on Design Standards Interstate System pg. 5
7. Dependent on Design Speed, Algebraic Difference in Grade, Required Sight Distance, and K Values.
8. Required if typical interchange spacing is greater than five miles. AASHTO pg. 510 - 511
9. Dependent on design speed, horizontal curvature, traffic volume, and roadside terrain. AASHTO Roadside Design Guide, Chapter 3
10. For center piers, ensure that proper barriers and clearances are present. See Publication 15M, Design Manual, Part 4, Structures.
11. Dependent on embankment, roadside obstacles, clear zone, and roadside terrain. AASHTO Roadside Design Guide, Chapters 5 and 6
12. Dependent on cut or fill, normal crown or superelevation, on tangent or on curve, traffic type, soil type, etc. See AASHTO Roadside Design Guide, Chapter 3

Interchange & Ramp Design Criteria

Approved: June 29, 2011

	ELEMENT	AASHTO STANDARDS	AASHTO SOURCE
ROADWAY	PAVEMENT WIDTHS (TRAVEL-WAY AND SHOULDER)	Governed by Type of Operation, Curvature, and Volume and Type of Traffic.	Exhibit 10-67, pg. 839
	HORIZONTAL CURVATURE	Corresponds to Ramp Design Speed and Superelevation.	Exhibit 3-15, pg. 147
	VERTICAL CURVATURE	Dependent on Required Vertical Alignment, and Ramp and/or Highway Design Speed and their Relative K Values.	Crest: Exhibit 3-72, pg. 272 Sag: Exhibit 3-75, pg. 277
	VERTICAL CLEARANCES	**UNDERPASS / OVERPASS ROADWAY** Desirable: 16'-6" Minimum: 16'-0" **OVERHEAD SIGN STRUCTURES** Desirable: 17'-0" Minimum: 16'-0"	AASHTO Pg. 506 to 507
	LATERAL CLEARANCES	**DESIRED** 14'-0" from Edge of Travel Way to Face of Protective Barrier. **MINIMUM** Typical Section Shoulder Width from Edge of Pavement to Face of Protective Barrier.	Exhibit 10-6, pg. 761 to 762
TERMINALS	ACCEL / DECEL LANES	Accel / Decel Lane and Taper Lengths are Governed by Grade, Curvature, Number of Lanes, Highway Design Speed, Ramp Design Speed, Parallel or Taper Type, and Stopping Conditions.	**SINGLE ACCELERATION LANE** Exhibits 10-70 and 10-71, pg. 847 to 848 **SINGLE DECELERATION LANE** Exhibits 10-72 and 10-73, pg. 850 to 851 **DUAL ACCELERATION LANE** Exhibit 10-76, pg. 858 **DUAL DECELERATION LANE** Exhibit 10-88, pg. 859
	GORE AREAS	**WIDTH AT NOSE** Typically Between 20'-0" and 30'-0". See MUTCD for Striping Requirements. **LENGTH OF NOSE TAPER** See Exhibits 10-59, 10-60, 10-61, and 10-62, pg. 832 to 837	AASHTO Pg. 832 - 835
	WEAVING SECTIONS	Design Level of Service is Dependent on Length, Number of Lanes, Acceptable Congestion, and Volumes of Individual Movements.	Exhibit 2-32, Pg. 85
	INTERCHANGE SPACING	**URBAN FREEWAY** 1 Mile **RURAL FREEWAY** 3 Miles	AASHTO Policy on Design Standards Interstate System Pg. 5
ROADSIDE	GUIDE RAIL / BARRIER	Dependent on Side Slope, Clear Zone Requirements, Embankment Height, and Roadside Obstacles	AASHTO Road Design Manual Figure 5.1b, pg. 5-4 Table 5.1, pg. 5-5
	SIDE SLOPES	**DESIRED** 1V:6H or Flatter **MINIMUM** 1V:4H 1V:2H with Barrier	AASHTO Pg. 512
	CLEAR ZONE	Dependent on Design Speed, Side Slope, and Traffic Volumes	Roadside Design Guide Table 3.1, pg. 3-6
DESIGN	DESIGN SPEED	Dependent on Highway Design Speed and Desired Range.	Exhibit 10-56, pg. 826
	SIGHT DISTANCE	Dependent on Ramp Design Speed, Curvature, and Stopping Conditions. Passing sight distance is not required.	**DECISION SIGHT DISTANCE (DESIRED)** Exhibit 3-3, pg. 116 **STOPPING SIGHT DISTANCE (MINIMUM)** Crest: Exhibit 3-72, pg. 272 Sag: Exhibit 3-75, pg. 277

INTERSTATE 64 PENINSULA STUDY

Interstate 64 Structures - Data from VDOT Inventory

APPENDIX B

Interstate 64 Structure Inventory

Locality	Structure Type	Feature Intersected	Description	VA Structure #	Structure Rating	EB Minimum Vertical Clearance	WB Minimum Vertical Clearance
City of Richmond	On Ramp Bridge	I-95	Route I-64 over I-95, 4th st., 5th st.	127-2812	Fair	-	-
	Off Ramp Bridge		Exit 190 Ramp to I-95 NB	127-2808	Fair	-	-
	64 Bridges	Rail	I-64 over tracks just east of City	127-2806	Poor	-	-
				127-2807	Poor	-	-
	64 Bridges	Rail	I-64 over tracks just west of 360	127-2810 (EB)	Poor	-	-
				127-2811 (WB)	Poor	-	-
	Overhead Bridge	Route 360 Mechanicsville Tpk	360 over I-64	127-1803	Poor	16'-6"	17'
	64 Bridges	Route 615 Fairfield Ave	I-64 over 615	127-2813 (WB)	Fair	-	-
				127-2814 (EB)	Fair	-	-
Henrico County	Overhead Bridge	Route 33 Nine Mile Rd	33 over I-64	043-1083	Poor	16'-6"	16'-10"
	Overhead Bridge	Stoney Run Pkwy	Stoney Run Pkwy over I-64	043-5002	Good	17'-1"	16'-9"
	64 Bridges	Masonic Lane	I-64 over Masonic Lane	043-2079 (EB)	Fair	-	-
				043-2080 (WB)	Fair	-	-
	64 Bridges	Norfolk Southern Railway	I-64 over Norfolk Southern Railway	043-2083 (EB)	Fair	-	-
				043-2084 (WB)	Fair	-	-
	Overhead Bridges	S Laburnum Ave	S Laburnum Ave over I-64	043-5011 (NB)	unknown	17'	17'
				043-5010 (SB)	unknown	17'	17'
	Overhead Bridge	Oakleys Lane	Oakleys Lane over I-64	043-5012	Fair	17'-1"	16'-8"
	64 Bridges	Route 156 Airport Dr.	I-64 over 156	043-2015 (EB)	Poor	-	-
				043-2016 (WB)	Poor	-	-
	64 Bridges	Route 33 Nine Mile Rd	I-64 over 33	043-2013 (EB)	Poor	-	-
				043-2014 (WB)	Poor	-	-
	Overhead Bridge	Drybridge Rd	Drybridge Road over I-64	043-5008	Fair	16'-7"	20'-9"
	Overhead Bridges	I-295	I-295 over I-64 (5 bridges)	043-2094	Fair	18'-1"	19'-2"
				043-2095	Fair	17'-7"	18'-10"
				043-2096	Fair	18'-1"	19'-2"
				043-2097	Fair	18'-1"	19'-4"
				043-2105	Good	33'-1"	32'-4"
	Overhead Bridge	Meadow Road	Meadow Road over I-64	043-5014	Fair	16'11"	17'-6"
New Kent County	64 Bridges	Chickahominy River	I-64 over Chickahominy River	063-2900 (EB)	Fair	-	-
				063-2901 (WB)	Fair	-	-
	Overhead Bridge	Route 33 / 249 New Kent Hwy	33 / 249 over I-64	063-1031	Poor	16'-3" **	17'9"
	Overhead Bridge	Route 665 N Henpeck Road	665 over I-64	063-6035	unknown	16'-10"	16'10"
	Overhead Bridge	Route 640 Old Roxbury Road	640 over I-64	063-6036	unknown	16'-10"	16'-10"
	Overhead Bridges	Route 612 Airport Road	612 over I-64	063-6037 (EB)	Fair	16'-9"	-
				063-6038 (WB)	Fair	-	16'-10"
	Overhead Bridge	Route 106/609 Emmaus Church Road	609 over I-64	063-6039	Fair	16'8"	16'-8"
	Overhead Bridges	Route 618 Olivet Church Road	618 over I-64	063-6040 (EB)	Good-Fair	17'-7"	-
				063-6041 (WB)	Good-Fair	-	17'-8"
	64 Bridges	Route 155 Courthouse Road	I-64 over 155	063-2008 (EB)	Fair	-	-
				063-2009 (WB)	Fair	-	-
	64 Bridges	Route 627 Good Hope Road	I-64 over Good Hope Road	063-2006 (EB)	Fair	-	-
				063-2007 (WB)	Fair	-	-
	Overhead Bridges	Route 33 Eltham Road	33 over I-64	063-2004 (WB)	Fair	-	16'-7"
				063-2005 (EB)	Fair	16'-7"	-
				063-1034 (WB)	Good	-	16'-4" **
				063-1035 (EB)	Satisfactory	16' **	-
	64 Bridges	Beaverdam Creek	I-64 over Beaverdam Creek	063-2010 (EB)	Fair	-	-
				063-2011 (WB)	Fair	-	-
	Overhead Bridge	Route 620 Homestead Road	620 over I-64	063-6044 (EB)	unknown	16'-9"	-
				063-6045 (WB)	unknown	-	16'-7"
	64 Bridges	Wahrani Swamp	I-64 over Wahrani Swamp	063-2012 (EB)	Fair	-	-
				063-2013 (WB)	Fair	-	-
	Overhead Bridges	Route 621 Ropers Church Road	621 over I-64	063-6042 (EB)	Good	16'-7"	-
				063-6043 (WB)	Good	-	16'-6"
James City County	Overhead Bridges	Route 601 Barnes Road	601 over I-64	047-6026	unknown	16'-2" **	16'-2" **
	Overhead Bridges	Route 30 Old Stage Road	30 over I-64	047-1030	Fair	16'-3" **	16'-7"
				047-1031	Fair	16'-5" **	16'-2" **
	64 Bridges	Route 600 La Grange Pkwy	I-64 over 600	047-2006 (EB)	Fair	-	-
				047-2007 (WB)	Fair	-	-
	Overhead Bridges	Route 607 Croaker Road	607 over I-64	047-6006 EB	Satisfactory	18'-2"	-
				047-6007 WB	unknown	-	17'
York County	Overhead Bridges	Route 646 Newman Road	646 over I-64	099-6003	Fair	16'-6"	17'-4"
				099-6004	Satisfactory	16'-2" **	17'-3"
	Overhead Bridge	Route 604 Barlow Road	604 over I-64	099-6002	Satisfactory	16'-4" **	16'-9"
	Overhead Bridge	Route 143 Merrimac Trail (Camp Peary)	143 over I-64	099-1027	Fair	16'-6"	16'-5" **
	64 Bridges	Wetlands	I-64 over waterway adjacent to Camp Peary	099-2007 (EB)	Fair	-	-
				099-2008 (WB)	Fair	-	-
	Overhead Bridge	Route 716 W Queens Drive	716 over I-64	099-6013	Satisfactory	17'	17'-3"
	64 Bridges	Lakeshead Drive	I-64 over Lakeshead Dr	099-2003	Satisfactory	-	-
				099-2004	Satisfactory	-	-
	64 Bridges	Colonial National Historic Parkway	I-64 over CNHP	099-2005 (EB)	Satisfactory	-	-
				099-2006 (WB)	Satisfactory	-	-
	64 Bridges	Route 641 Penniman Road	I-64 over 641 (to naval weapons station)	099-2000 (EB)	Fair	-	-
				099-2001 (WB)	Fair	-	-
	Overhead Bridges	Route 199	199 over I-64	099-1034 (EB)	Good	18'-3"	17'-2"
				099-1035 (WB)	unknown	17'-9"	16'-10"
	Overhead Bridge	Entrance to Busch Gardens	Ramp over I-64	099-2017/2018	Satisfactory/Good	28'-6"	17'-4"
	64 Bridge	Route 143 Ramp	Exit 243 ramp from I-64 WB	099-2002	Good	-	-
City of Newport News	64 Bridges	Route 143 Jefferson Avenue	I-64 over 143	121-2206 (EB)	Fair	-	-
				121-2207 (WB)	Fair	-	-
	64 Bridges	Route 238 Yorktown Road	I-64 over 238	121-2208 (EB)	Fair	-	-
				121-2209 (WB)	Fair	-	-
	64 Bridges	Newport News Reservoir	I-64 over City Reservoir	121-2204 (EB)	Fair	-	-
				121-2205 (WB)	Fair	-	-
	64 Bridges	Route 105 Fort Eustis Blvd	I-64 over 105	121-2212 (EB)	Fair	-	-
				121-2213 (WB)	Fair	-	-
	64 Bridges	Industrial Park Drive	I-64 over Industrial Park Drive	121-2210 (EB)	Fair	-	-
				121-2211 (WB)	Fair	-	-
	Overhead Bridge	Route 173 Denbigh Blvd	173 over I-64	121-2222	Fair	20'-4"	17'-10"
	Overhead Bridge	Bland Blvd	Bland Blvd over I-64	121-8017	unknown	19'-4"	19'-4"
	Overhead Bridge	Route 143 Jefferson Avenue	143 over I-64	121-2221	Good	19'-2"	18'-6"
	Overhead Bridge	Route 171 Victory Blvd	171 over I-64	121-2216	unknown	16'-10"	16'-10"
	Overhead Bridge	Old Oyster PoInterchange Road	Old Oyster PoInterchange over I-64	121-2203	unknown	18'-2"	18'-2"
	64 Bridge	Route 17 J Clyde Morris Blvd	I-64 over 17	121-2245	Satisfactory	-	-
	Overhead Bridge	Harpersville Road	Harpersville Road over I-64	121-2202	Fair	16'-11"	16'-5" **
City of Hampton	Overhead Bridge	Route 600 Big Bethel Road	600 over I-64	114-8001	Fair	17'-5"	16'-8"
	Overhead Bridges	Hampton Roads Center Parkway	HRCP over I-64	114-2815	unknown	19'-2"	19'-2"
				114-2813	unknown	17'-1"	17'-1"
	Overhead Bridge	Route 134 Magruder Blvd	134 over I-64	114-1818	unknown	16'-10"	16'-10"
	Overhead Bridges	Route 152 Cunningham Drive	152 over I-64	114-8004	Good	16'-6"	16'-6"
				114-8003	unknown	16'-6"	16'-6"
	64 Bridge	Route 258 Mercury Blvd	I-64 over 258	114-2819	Good	-	-
	Overhead Bridge	Route 258 Mercury Blvd	258 on ramp to I-64 WB	114-2845	Good	17'-2"	21'-7"
	Overhead Bridge	Pine Chapel Road	Pine Chapel Road over I-64	114-8000	Fair	16'-5" **	16'-8"
	Overhead Bridge	I-664	I-664 WB ramp to I-64 WB	114-2830	unknown	17'-3"	17'-3"
	Overhead Bridge	I-664	I-64 WB ramp to I-664 EB	114-2816	unknown	16'-5" **	16'-5" **
	64 Bridges	I-664	I-64 over Newmarket Creek	114-2817	unknown	-	-
				114-2818	unknown	-	-

** Indicates substandard vertical clearance

This information was gathered from As-Built Plans and Structure Inspection Reports provided over a four month period from May to September of 2011.

Culverts and similar drainage structures were not evaluated as part of this exercise.

INTERSTATE 64 PENINSULA STUDY

APPENDIX C

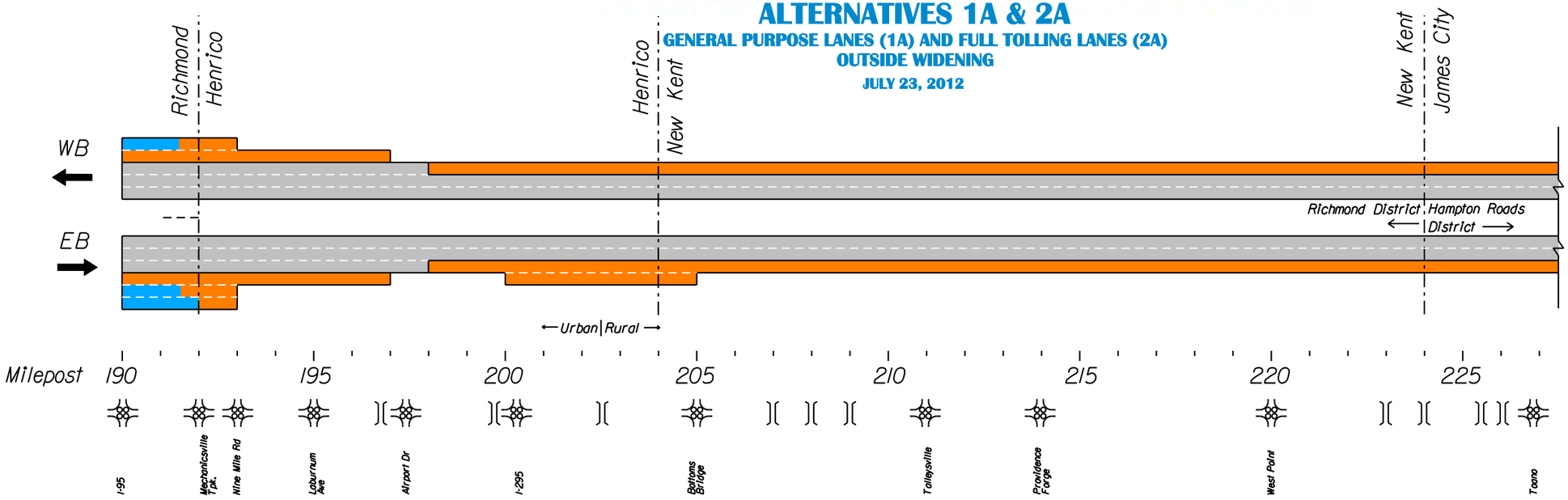
Lane Diagrams

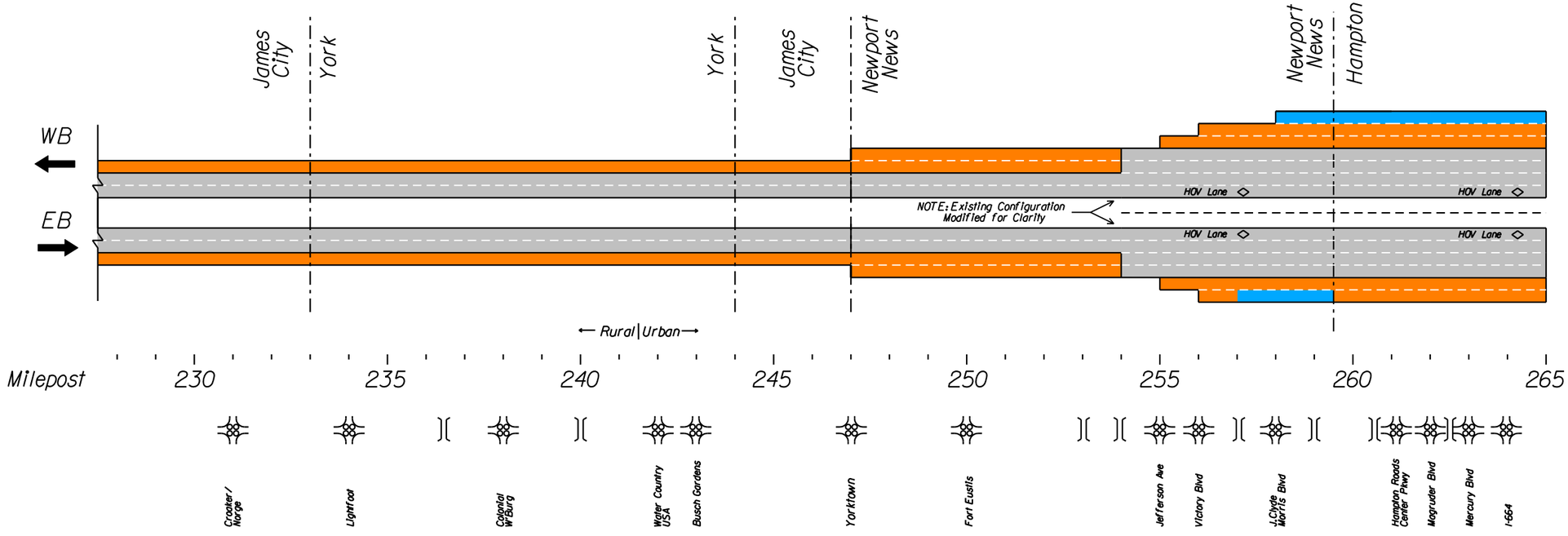
INTERSTATE 64 PENINSULA STUDY ENVIRONMENTAL IMPACT STATEMENT

ALTERNATIVES 1A & 2A

GENERAL PURPOSE LANES (1A) AND FULL TOLLING LANES (2A) OUTSIDE WIDENING

JULY 23, 2012





LEGEND

- Existing Lanes
- Required Lanes (No ROW Needed)
- Required Lanes (ROW Needed)
- Existing Interchange
- Existing Overhead Bridge
- Existing Median Barrier

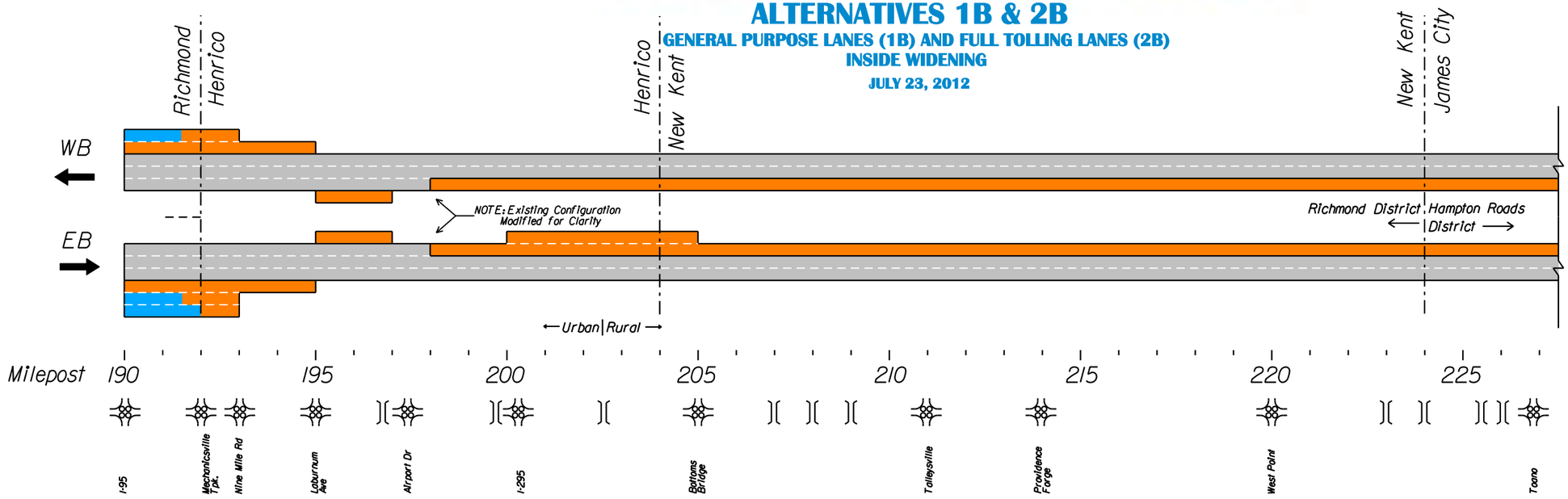
NOTE: This graphic is solely intended to display the number of lanes required to achieve a level of service "C" along the I-64 mainline. Furthermore, this graphic does not depict any required right-of-way needed for interchange improvements.

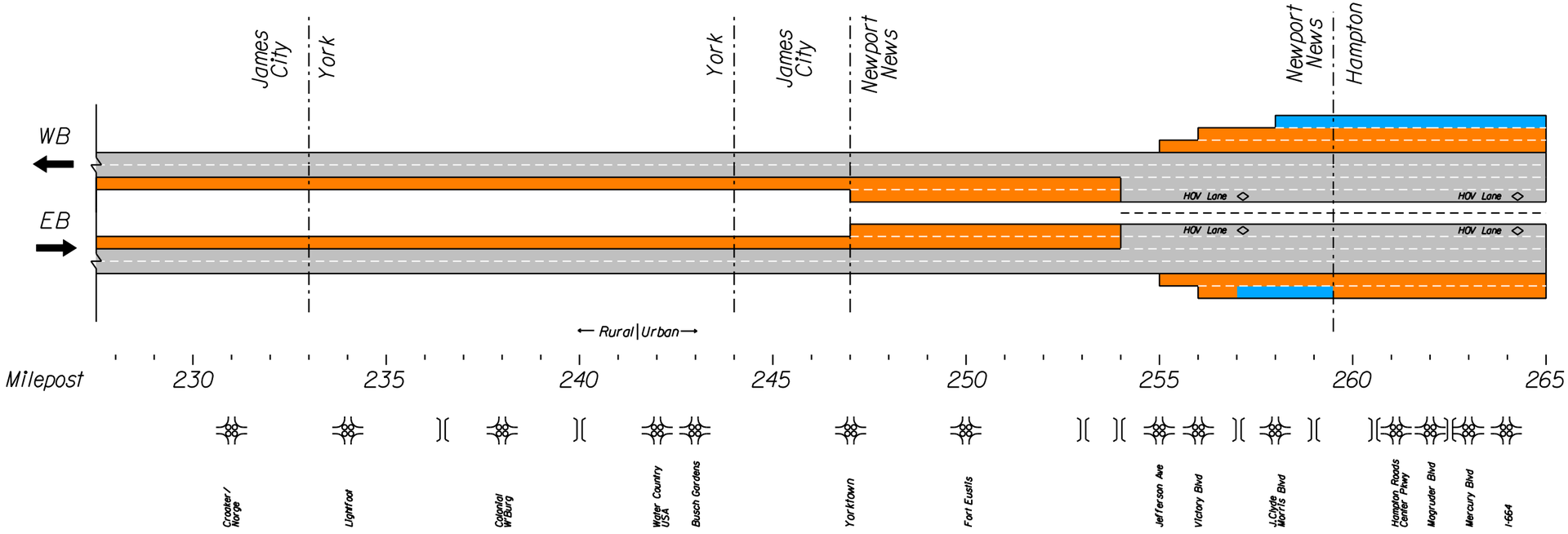
INTERSTATE 64 PENINSULA STUDY ENVIRONMENTAL IMPACT STATEMENT

ALTERNATIVES 1B & 2B

GENERAL PURPOSE LANES (1B) AND FULL TOLLING LANES (2B) INSIDE WIDENING

JULY 23, 2012





LEGEND

- Existing Lanes
- Required Lanes (No ROW Needed)
- Required Lanes (ROW Needed)
- Existing Interchange
- Existing Overhead Bridge
- Existing Median Barrier

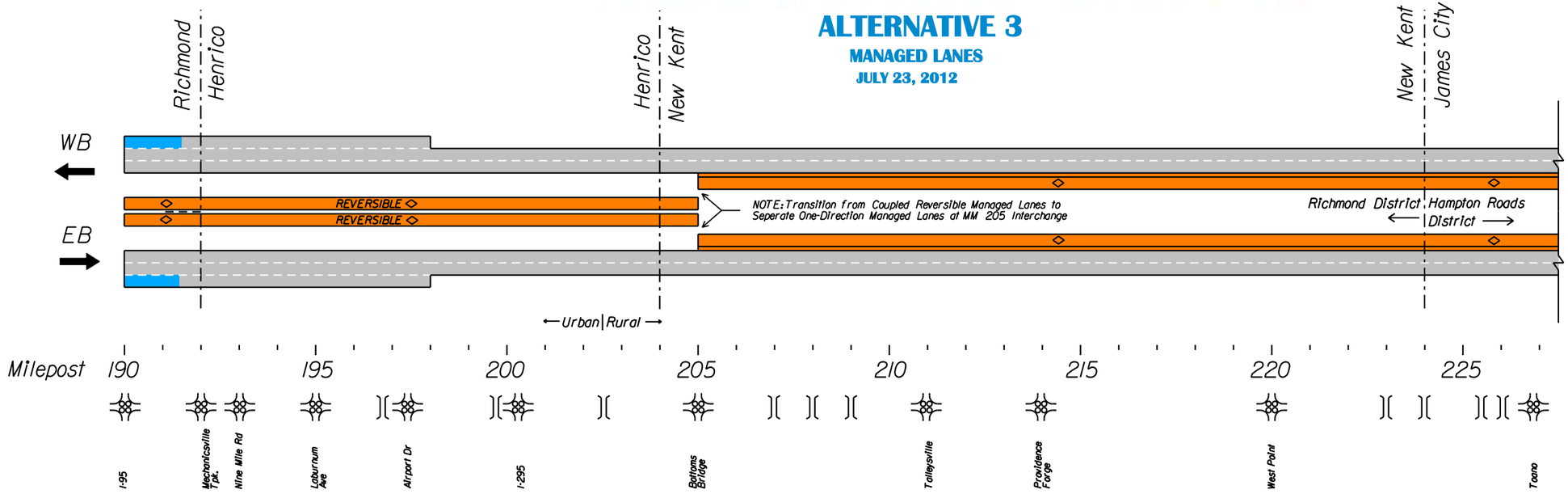
NOTE: This graphic is solely intended to display the number of lanes required to achieve a level of service "C" along the I-64 mainline. Furthermore, this graphic does not depict any required right-of-way needed for interchange improvements.

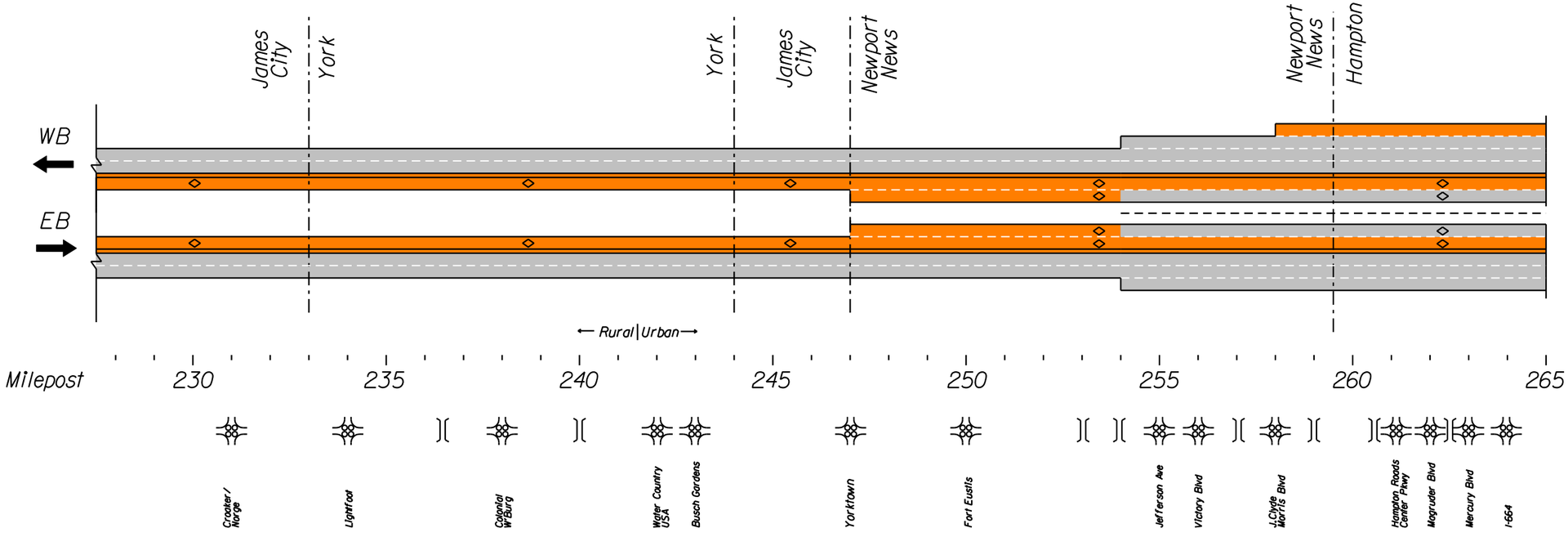
INTERSTATE 64 PENINSULA STUDY ENVIRONMENTAL IMPACT STATEMENT

ALTERNATIVE 3

MANAGED LANES

JULY 23, 2012





LEGEND

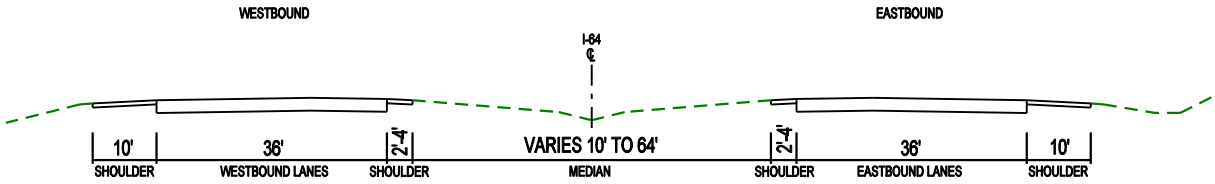
- Existing Lanes
- Required Lanes (No ROW Needed)
- Required Lanes (ROW Needed)
- Existing Interchange
- Existing Overhead Bridge
- Existing Median Barrier

NOTE: This graphic is solely intended to display the number of lanes required to satisfy the requirements for managed lanes along the I-64 mainline. Furthermore, this graphic does not depict any required right-of-way needed for interchange improvements.

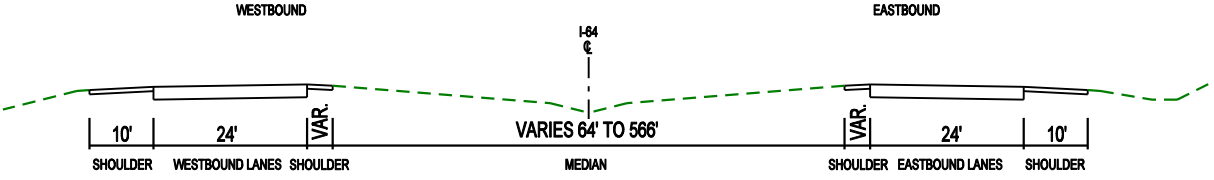
INTERSTATE 64 PENINSULA STUDY

APPENDIX D

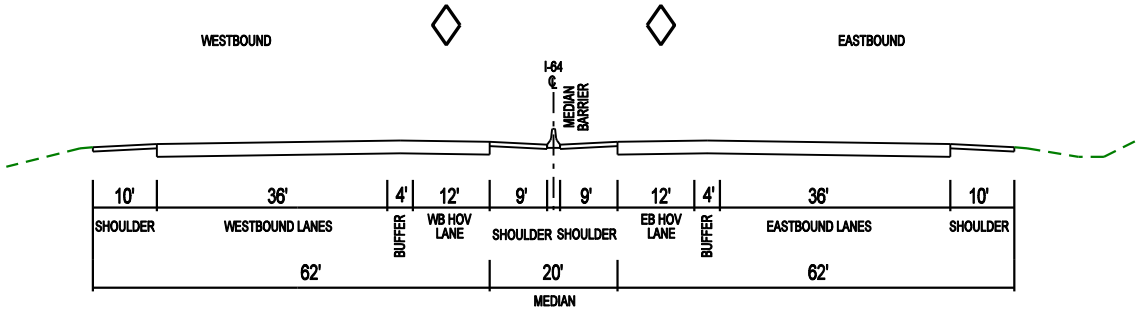
Typical Sections



NO BUILD: EXISTING CONDITIONS
(6 - LANE SECTION)



NO BUILD: EXISTING CONDITIONS
(4 - LANE SECTION)

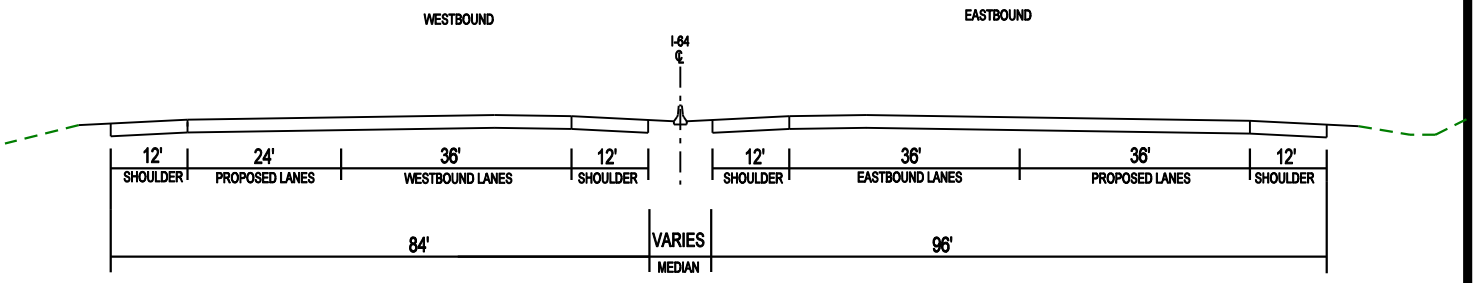


NO BUILD: EXISTING CONDITIONS
(8 - LANE SECTION WITH HOV)

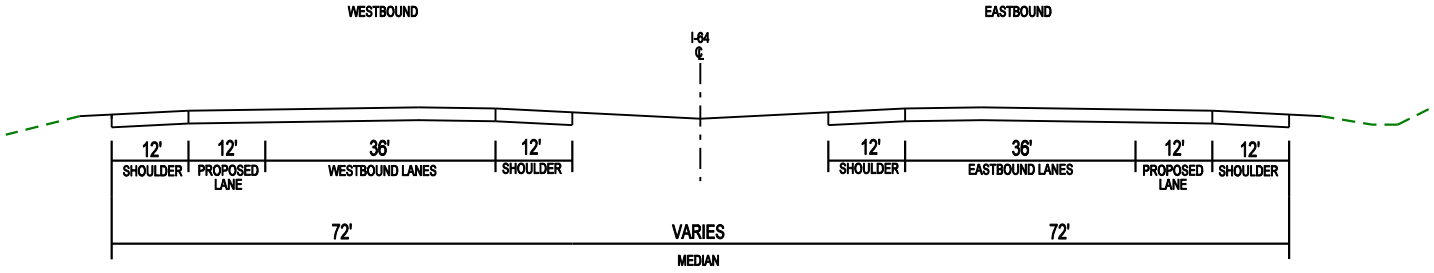
INTERSTATE 64 PENINSULA STUDY ENVIRONMENTAL IMPACT STATEMENT

TYPICAL SECTIONS
EXISTING CONDITIONS

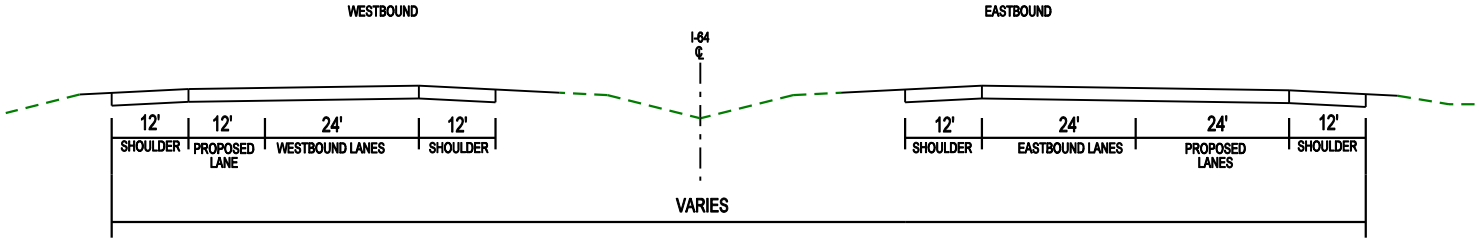
JULY 2012



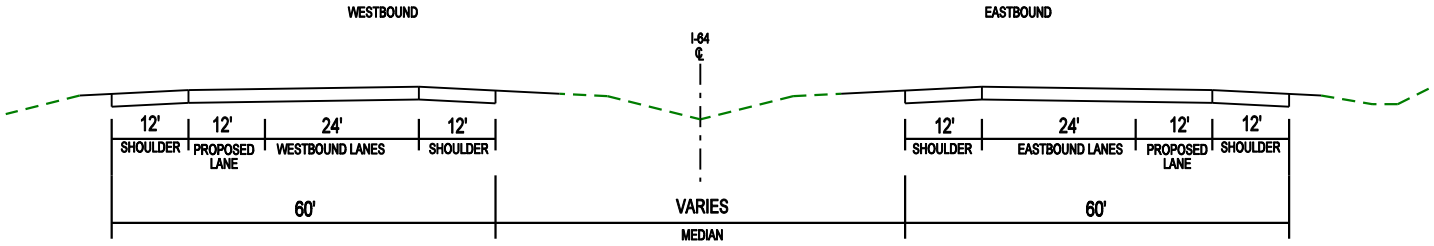
BUILD: ADD TWO OUTSIDE LANES WB, THREE OUTSIDE LANES EB
(11 - LANE SECTION)



BUILD: ADD ONE OUTSIDE LANE
(8 - LANE SECTION)



BUILD: ADD ONE OUTSIDE LANE WB, TWO OUTSIDE LANES EB
(7 - LANE SECTION)

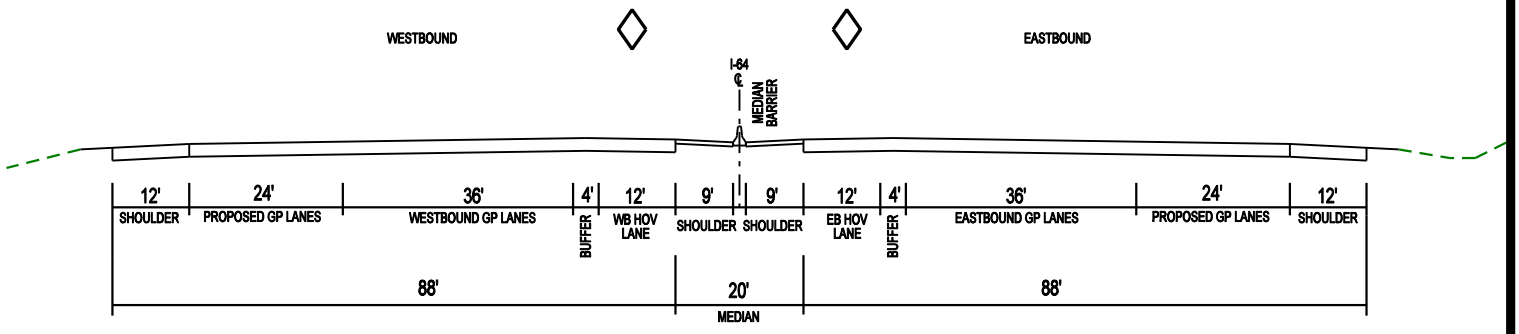


BUILD: ADD ONE OUTSIDE LANE
(6 - LANE SECTION)

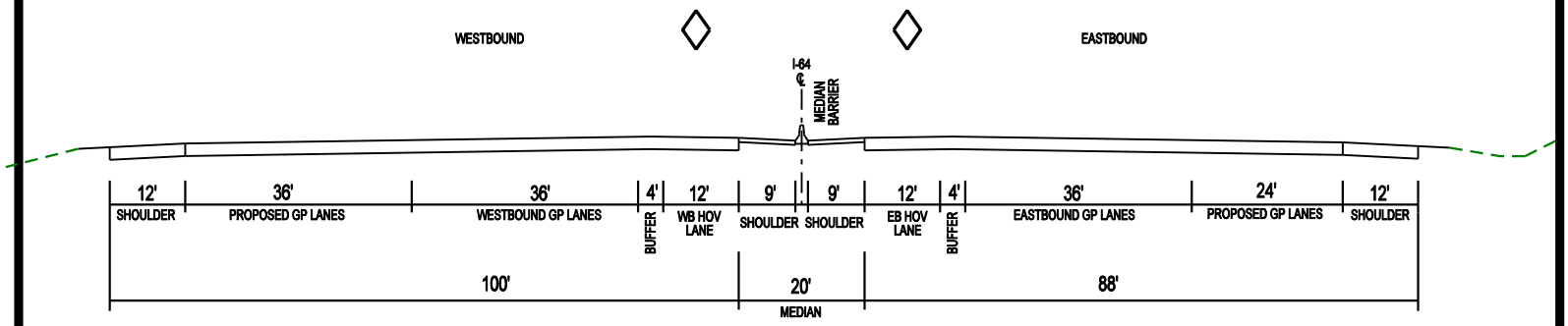
INTERSTATE 64 PENINSULA STUDY ENVIRONMENTAL IMPACT STATEMENT

TYPICAL SECTIONS
ALTERNATIVE 1A / 2A

JULY 2012



BUILD: ADD TWO GENERAL PURPOSE LANES OUTSIDE
MAINTAIN EXISTING HOV-2 LANES
(12 - LANE SECTION)

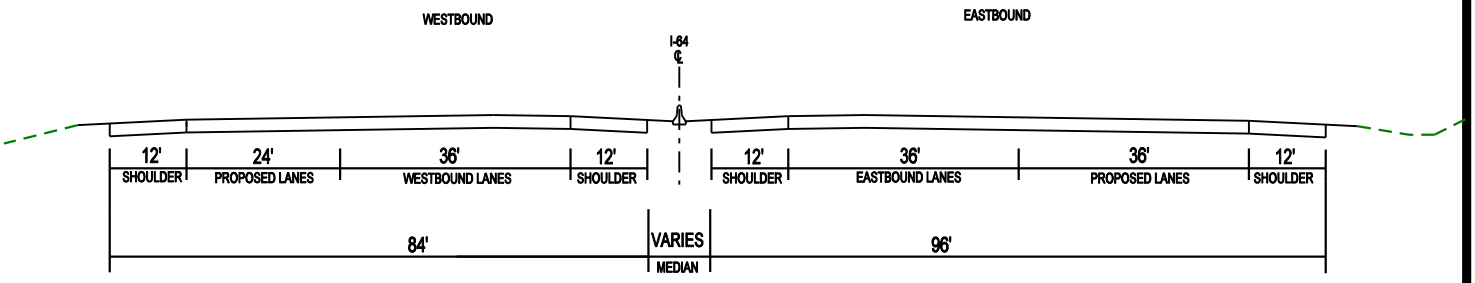


BUILD: ADD THREE GENERAL PURPOSE LANES WB, TWO GENERAL PURPOSE LANES EB
MAINTAIN EXISTING HOV-2 LANES
(13 - LANE SECTION)

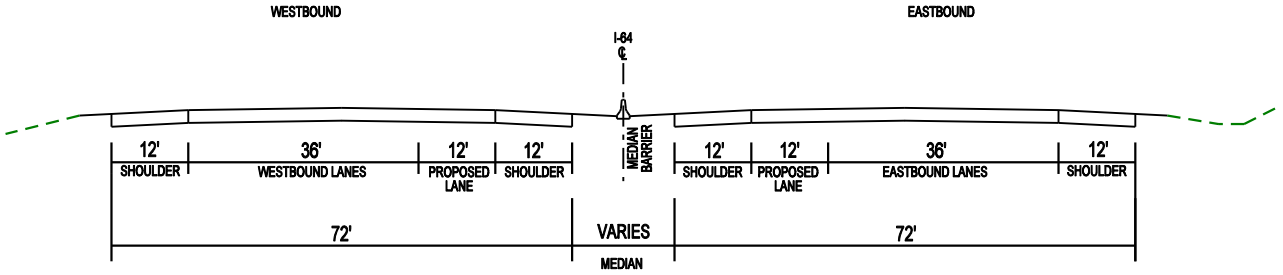
INTERSTATE 64 PENINSULA STUDY ENVIRONMENTAL IMPACT STATEMENT

TYPICAL SECTIONS
ALTERNATIVE 1A / 2A

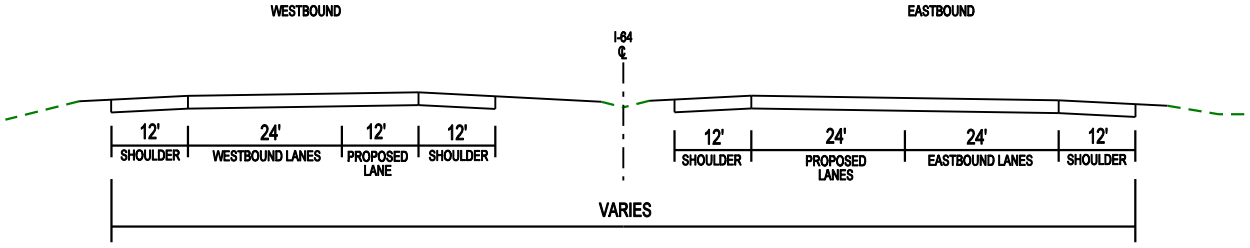
JULY 2012



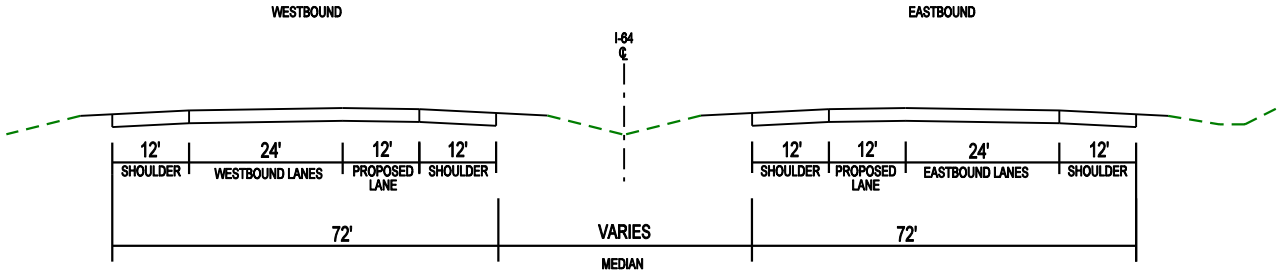
BUILD: ADD TWO OUTSIDE LANES WB, THREE OUTSIDE LANES EB
(11 - LANE SECTION)



BUILD: ADD ONE INSIDE LANE
(8 - LANE SECTION)



BUILD: ADD ONE INSIDE LANE WB, TWO INSIDE LANES EB
(7 - LANE SECTION)

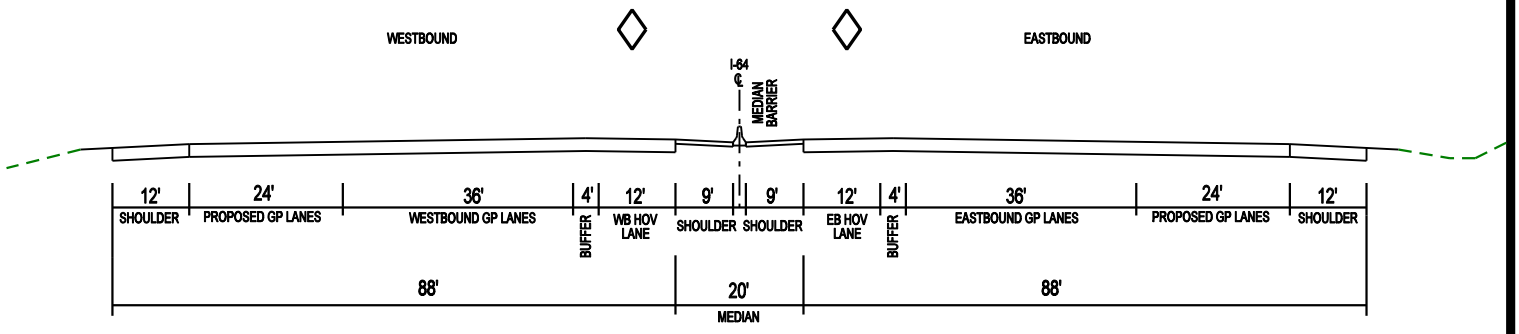


BUILD: ADD ONE INSIDE LANE
(6 - LANE SECTION)

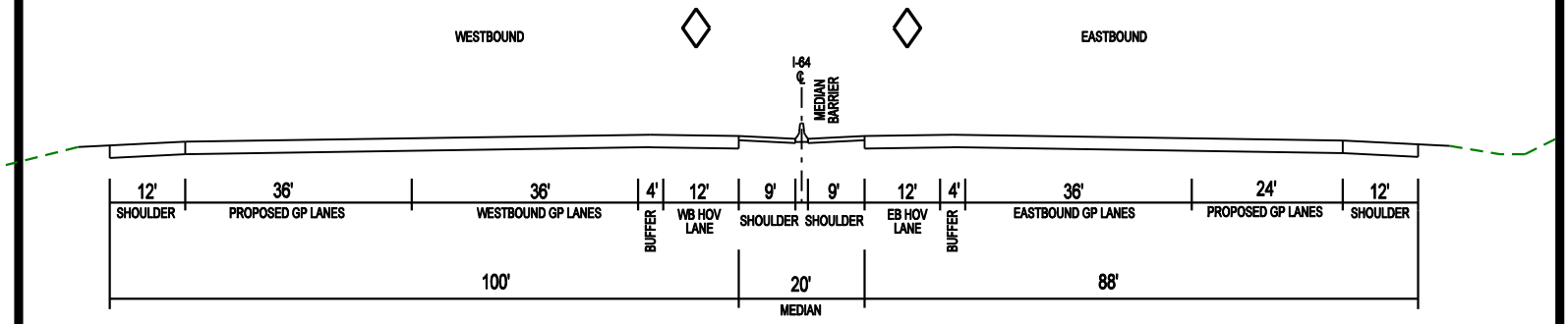
INTERSTATE 64 PENINSULA STUDY ENVIRONMENTAL IMPACT STATEMENT

TYPICAL SECTIONS
ALTERNATIVE 1B / 2B

JULY 2012



BUILD: ADD TWO GENERAL PURPOSE LANES OUTSIDE
MAINTAIN EXISTING HOV-2 LANES
(12 - LANE SECTION)

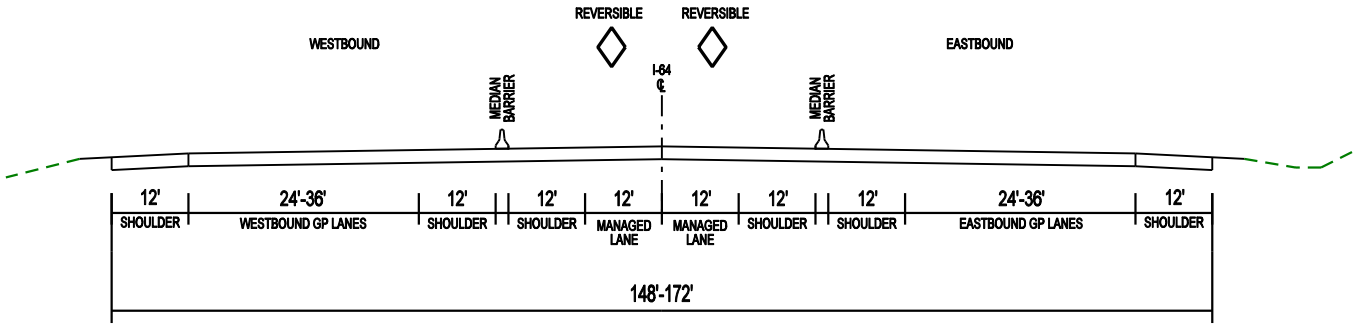


BUILD: ADD THREE GENERAL PURPOSE LANES WB, TWO GENERAL PURPOSE LANES EB
MAINTAIN EXISTING HOV-2 LANES
(13 - LANE SECTION)

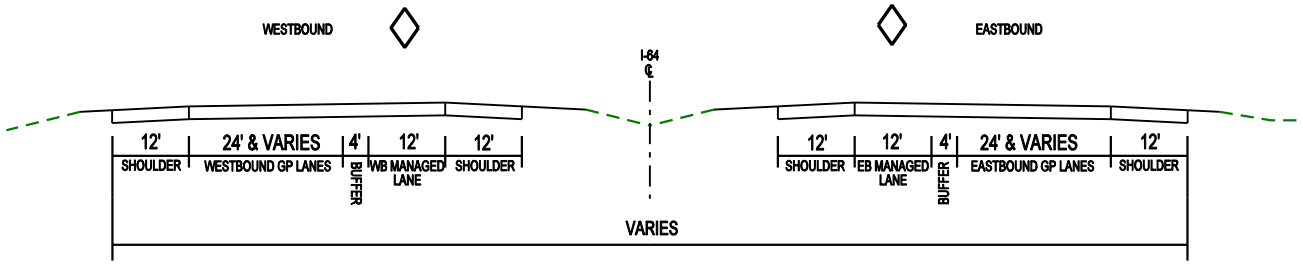
INTERSTATE 64 PENINSULA STUDY ENVIRONMENTAL IMPACT STATEMENT

TYPICAL SECTIONS
ALTERNATIVE 1B / 2B

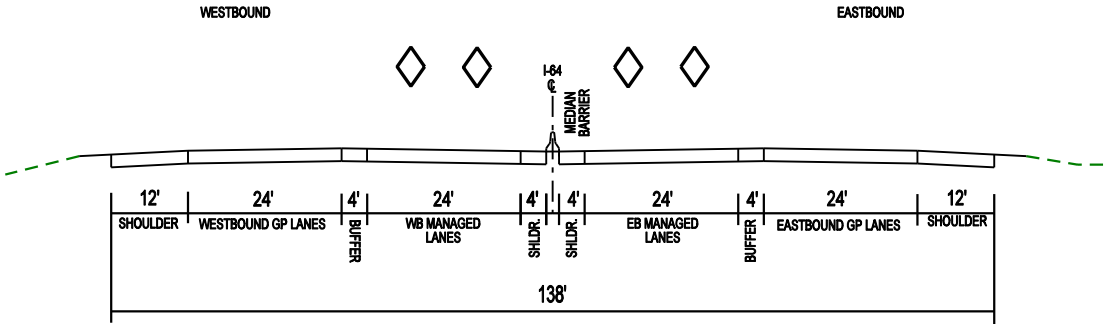
JULY 2012



BUILD: SEPERATED REVERSIBLE HOT / HOV LANES IN MEDIAN
(6 TO 8 - LANE SECTION)
MM 190 - 205



BUILD: ADD ONE MANAGED INSIDE LANE
(6-LANE SECTION)
MM 205 - 247

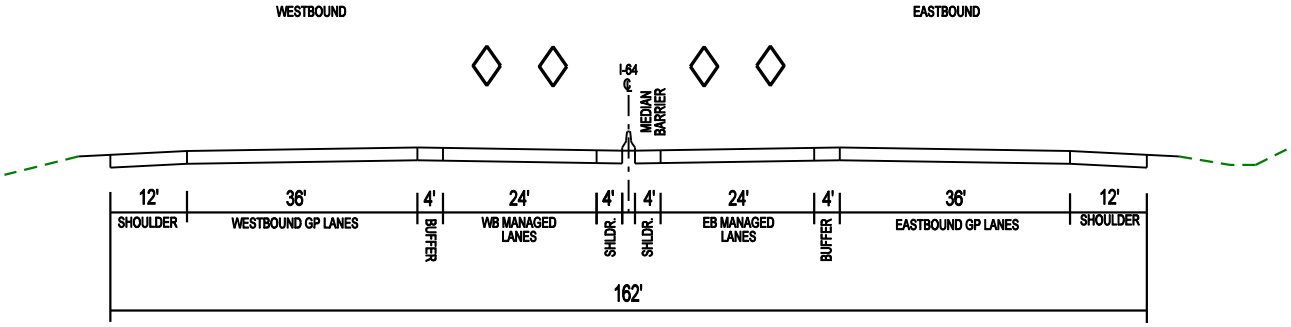


BUILD: ADD TWO MANAGED INSIDE LANES
(8- LANE SECTION)
MM 247 - 254

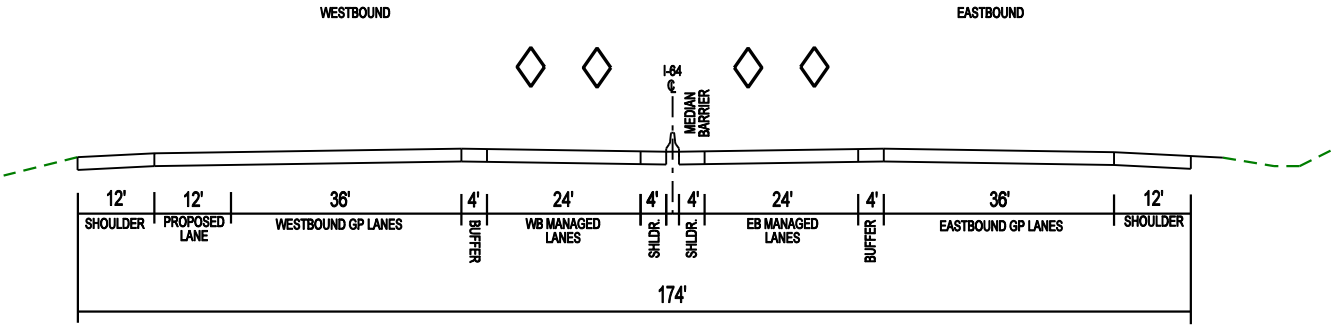
INTERSTATE 64 PENINSULA STUDY ENVIRONMENTAL IMPACT STATEMENT

TYPICAL SECTIONS
ALTERNATIVE 3

JULY 2012



BUILD: ADD ONE MANAGED INSIDE LANE TO EXISTING CONFIGURATION
(10- LANE SECTION)
MM 254-258



BUILD: ADD ONE MANAGED INSIDE LANE TO EXISTING CONFIGURATION &
ADD ONE WESTBOUND LANE
(11- LANE SECTION)
MM 258-265

INTERSTATE 64 PENINSULA STUDY ENVIRONMENTAL IMPACT STATEMENT

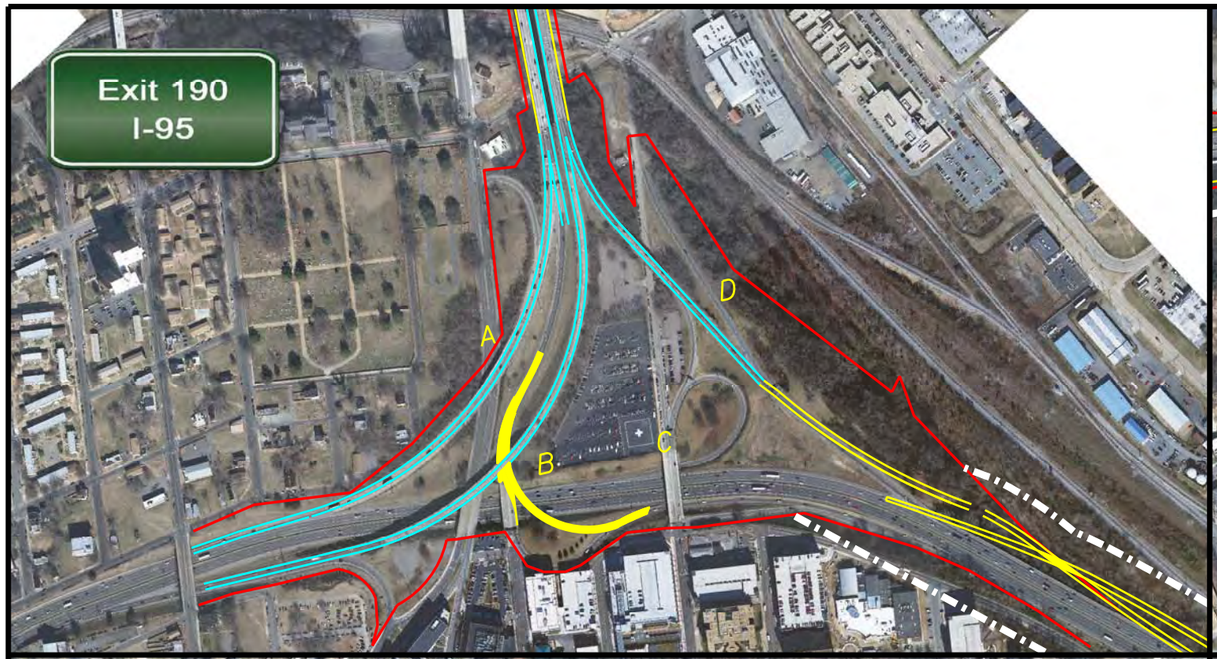
TYPICAL SECTIONS
ALTERNATIVE 3

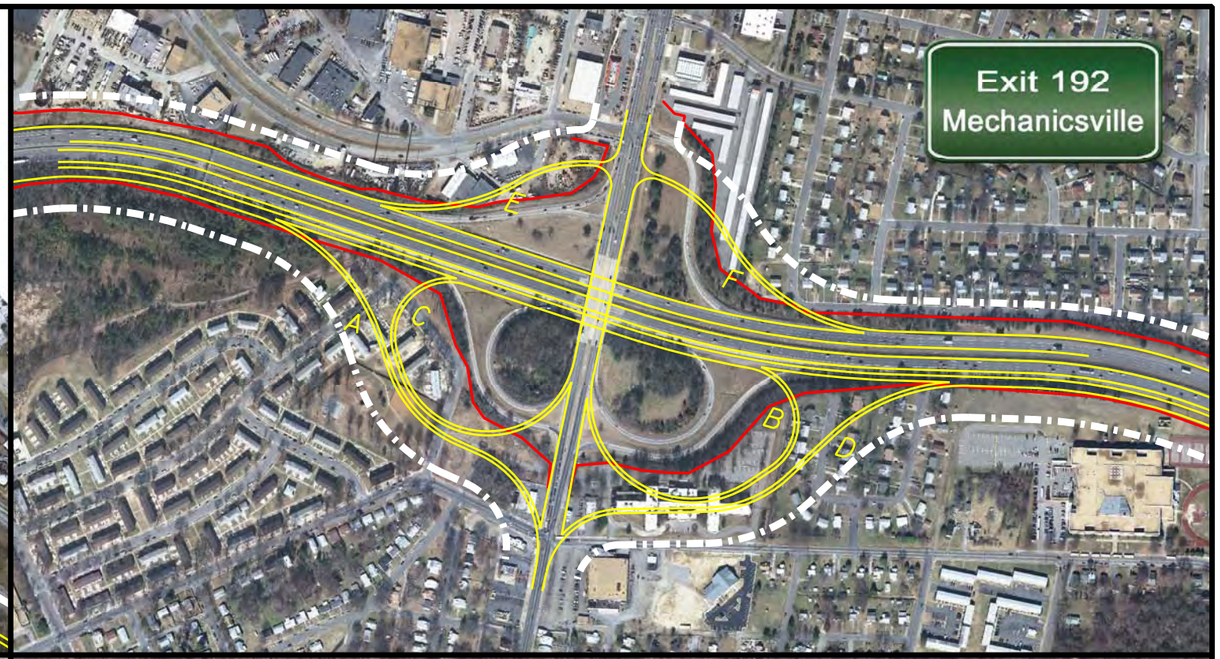
JULY 2012

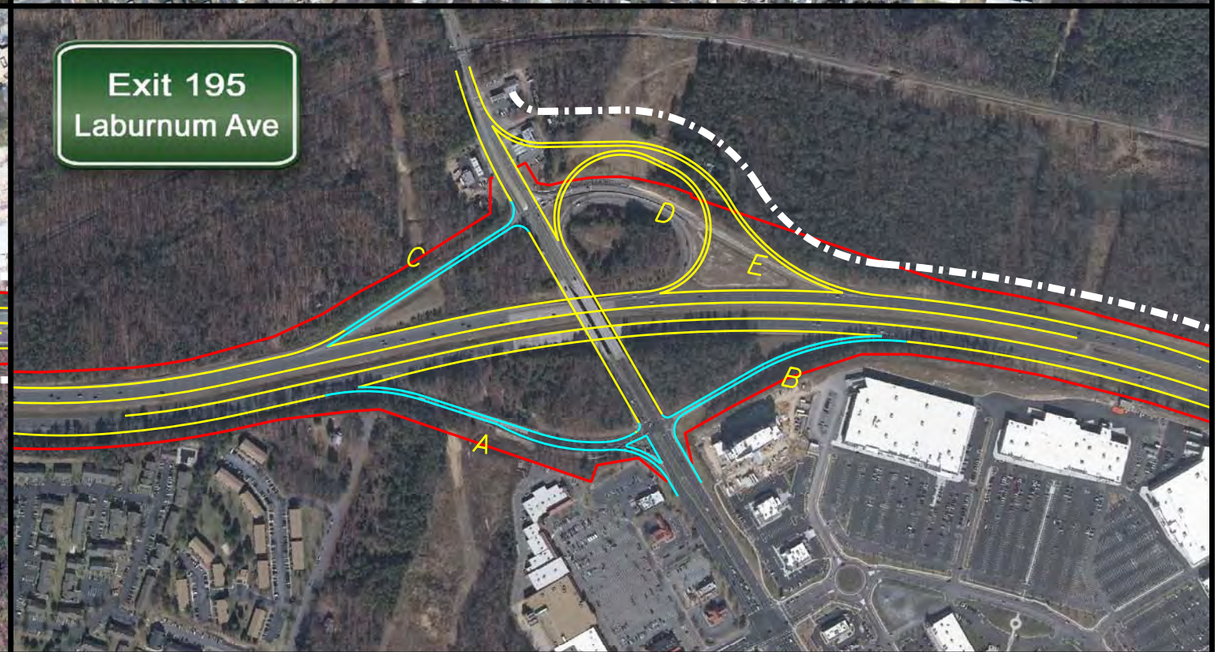
INTERSTATE 64 PENINSULA STUDY

APPENDIX E

Interchange Concepts







INTERSTATE 64 PENINSULA STUDY

Potential Interchange Configurations - Conceptual Design

August 2012

Sheet 1 of 7

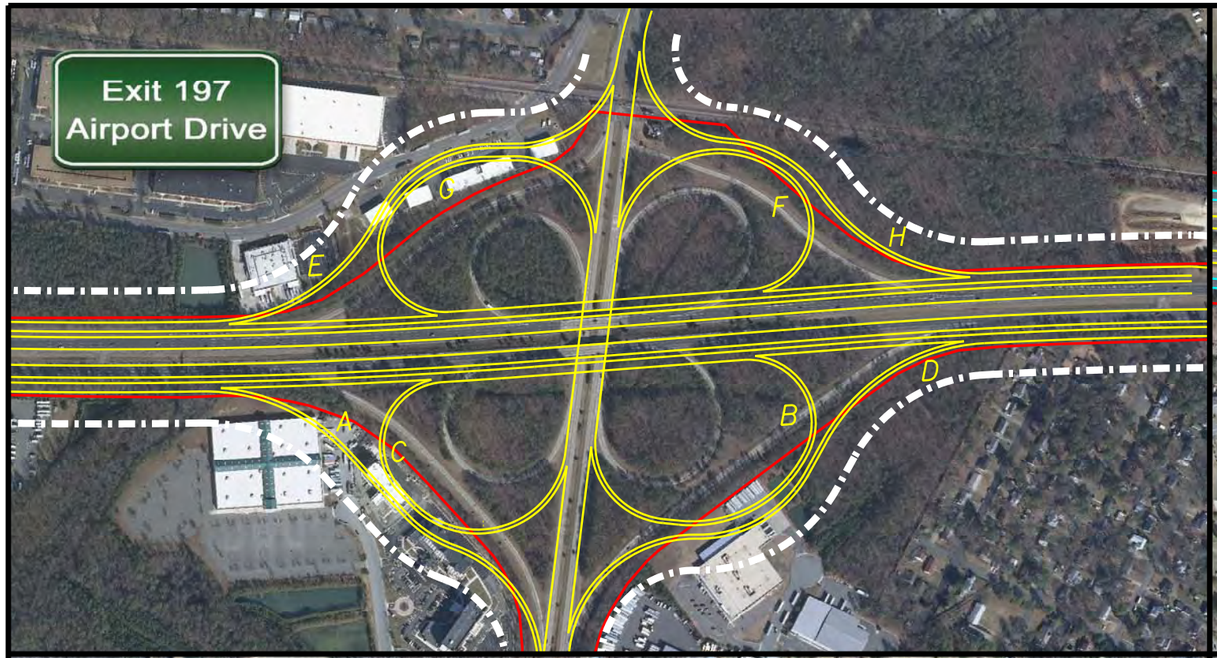
LEGEND

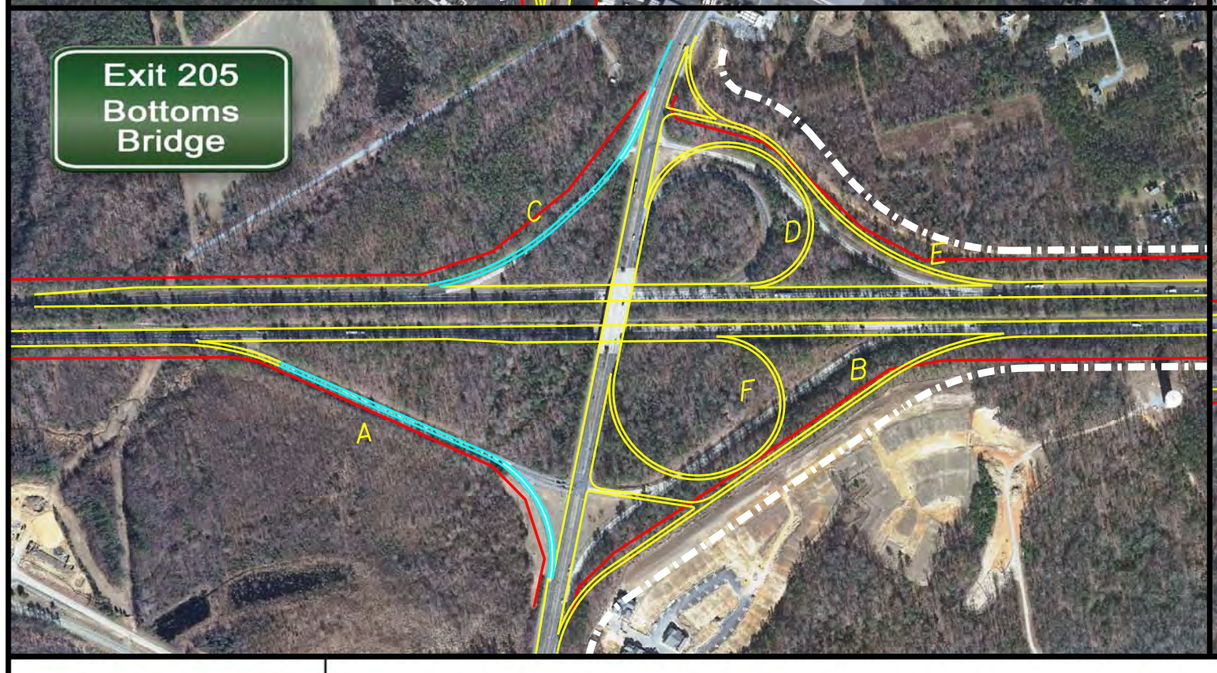
- Ramp Alignment to Remain
- Ramp Alignment to be Improved
- Potential Limit of Disturbance
- *E* Ramp Designation

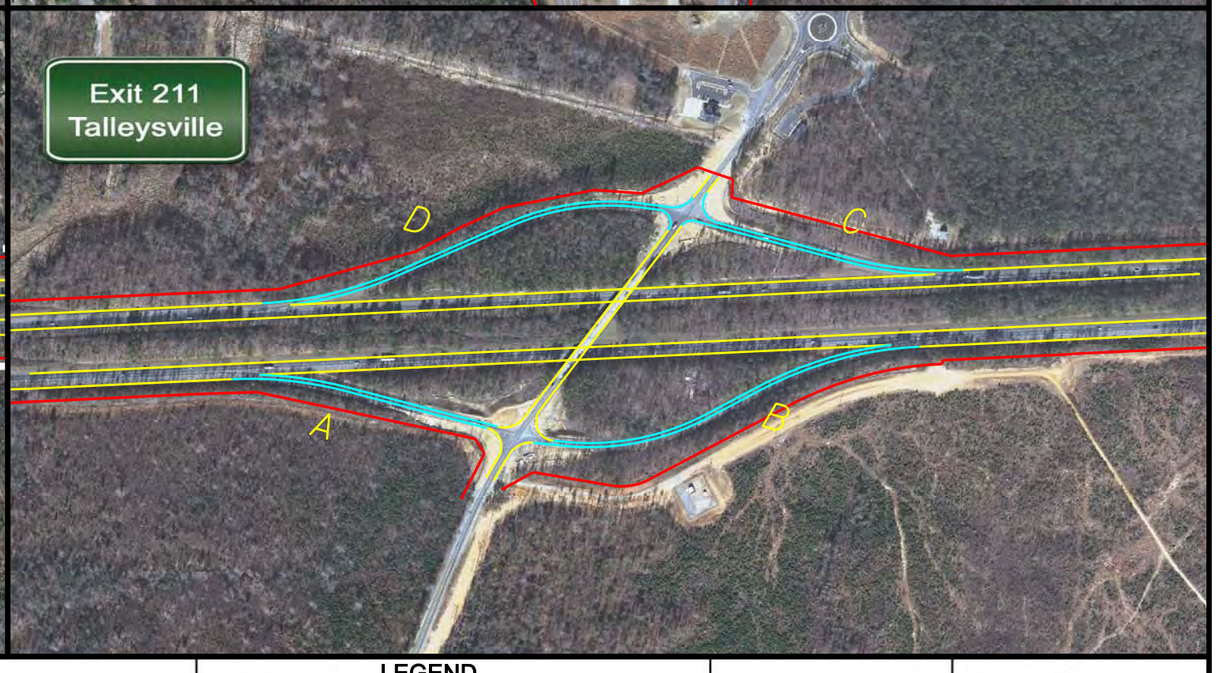
VDOT

N

0 300 600 Feet







INTERSTATE 64 PENINSULA STUDY

Potential Interchange Configurations - Conceptual Design

August 2012

Sheet 2 of 7

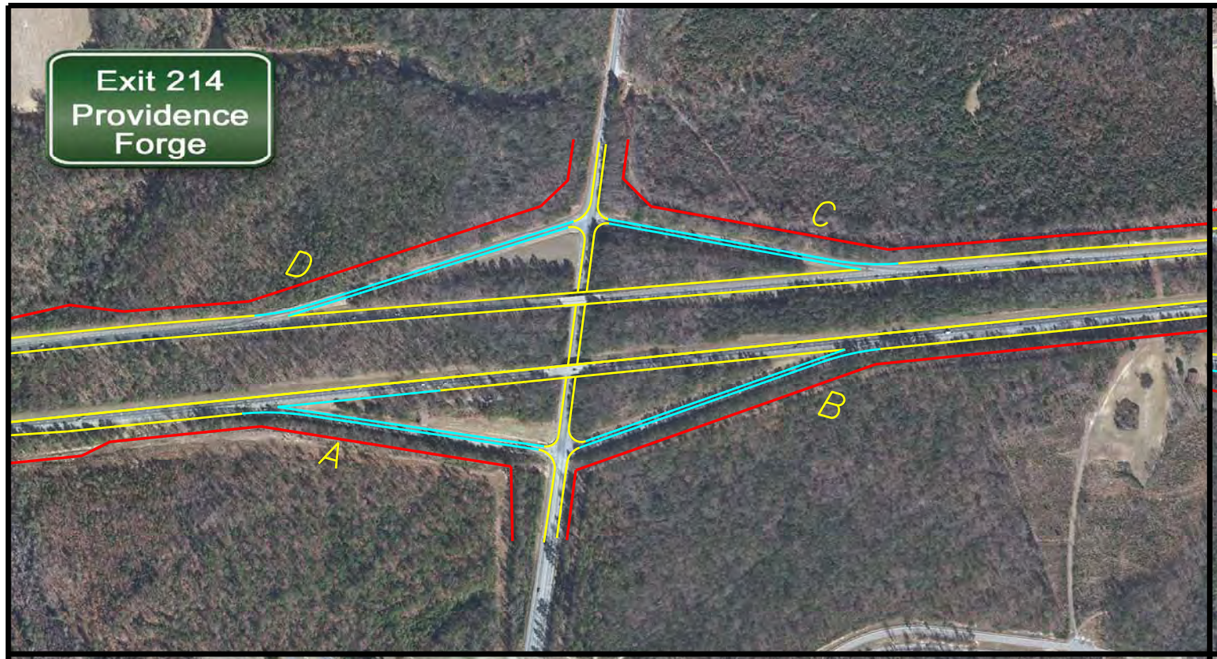
LEGEND

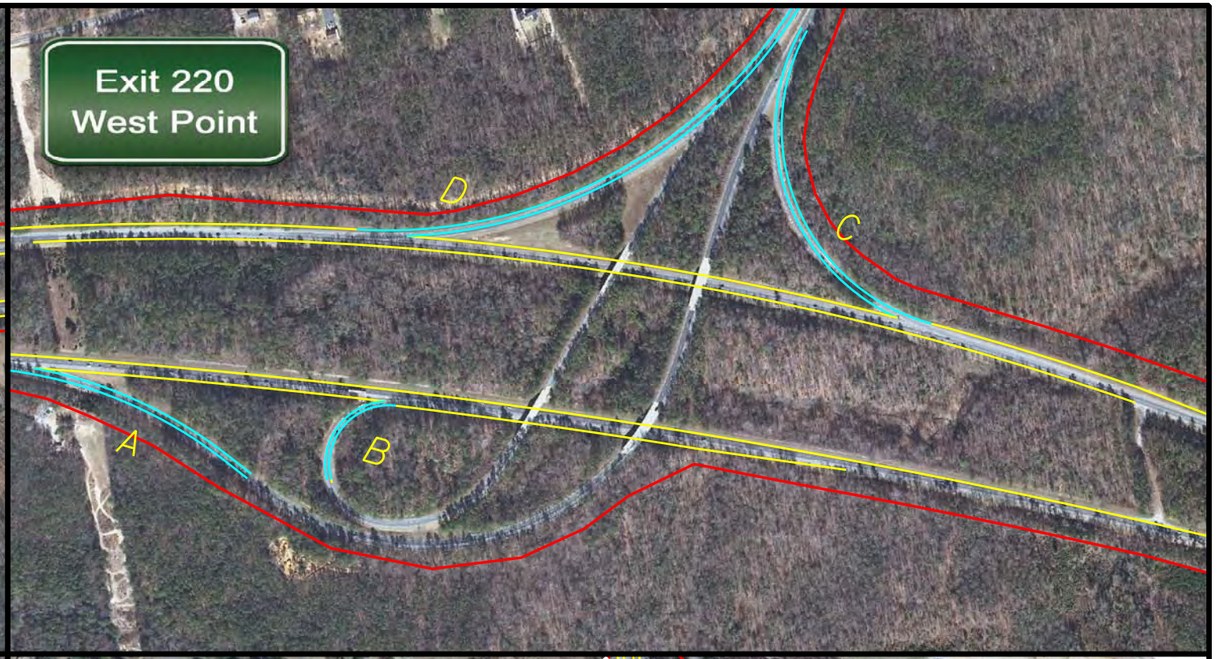
- Ramp Alignment to Remain
- Ramp Alignment to be Improved
- Potential Limit of Disturbance
- *E* Ramp Designation

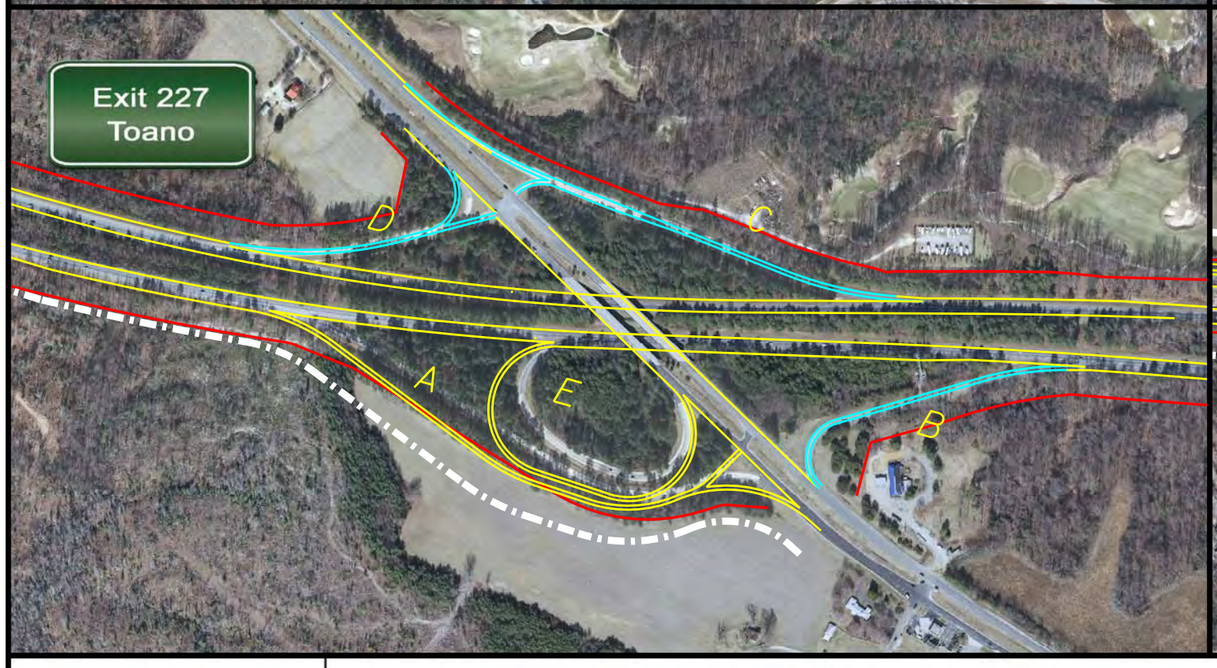
VDOT

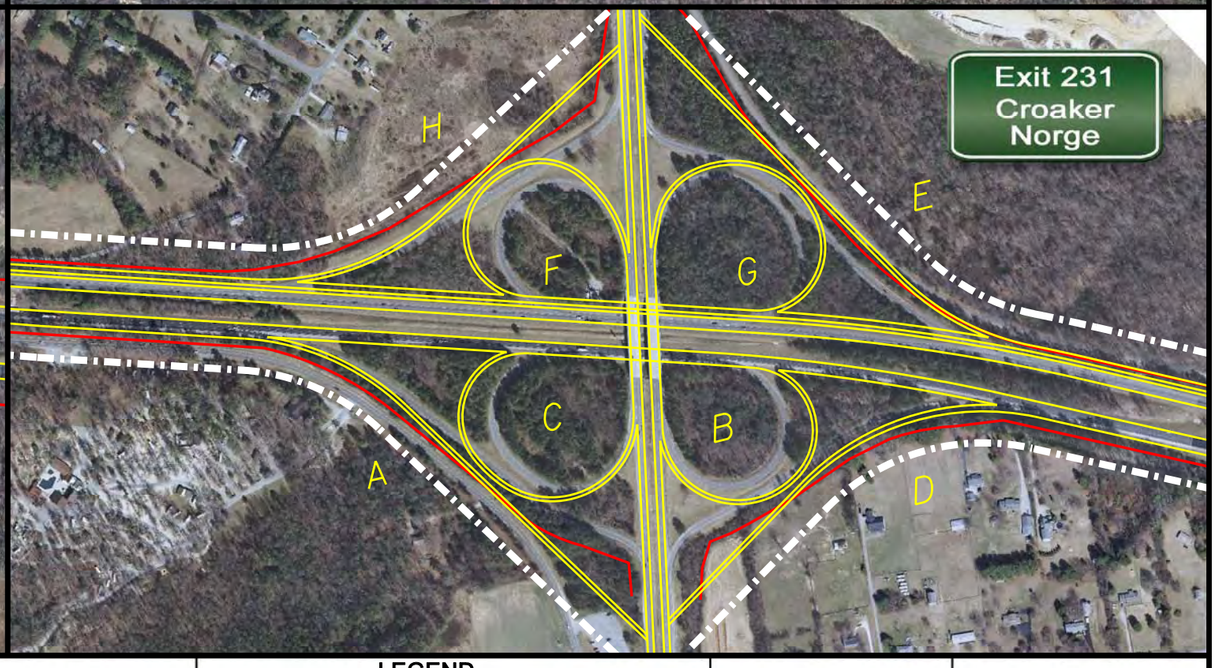
N

0 300 600 Feet









INTERSTATE 64 PENINSULA STUDY

Potential Interchange Configurations - Conceptual Design

August 2012

Sheet 3 of 7

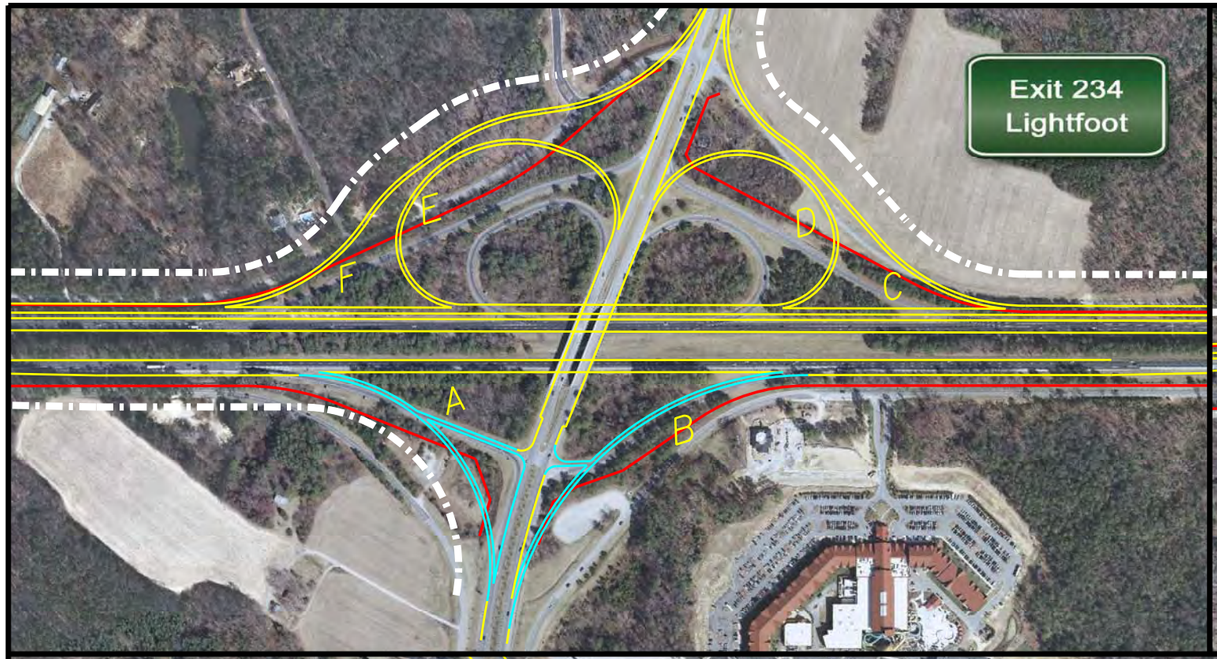
LEGEND

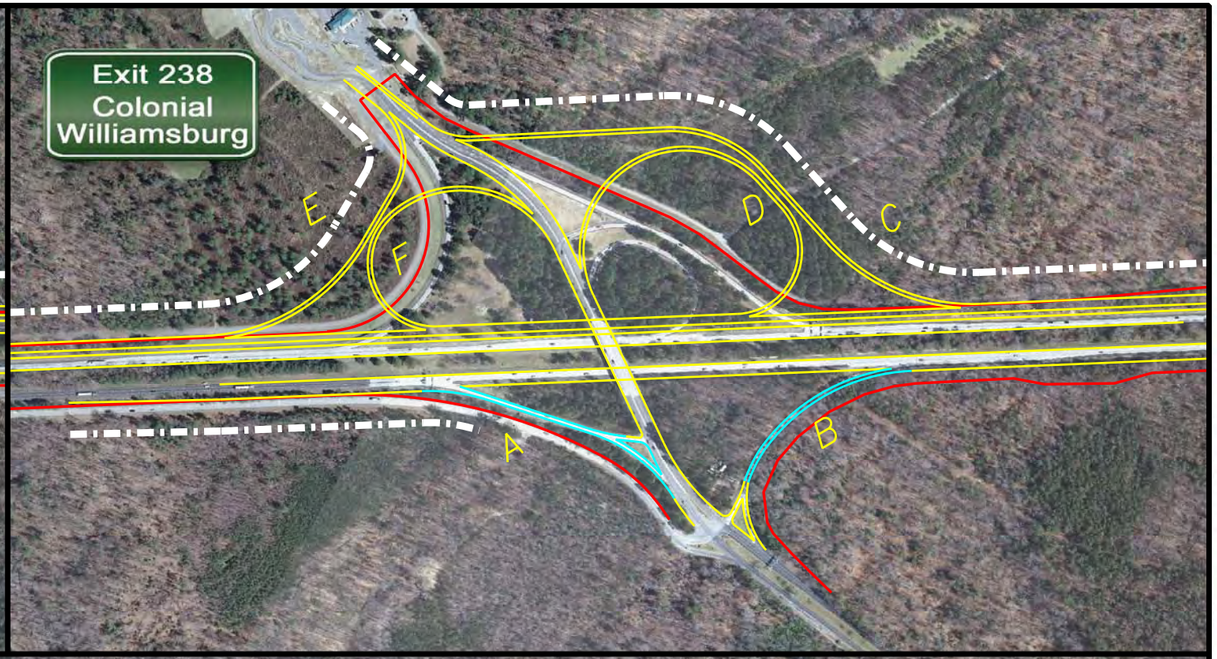
- Ramp Alignment to Remain
- Ramp Alignment to be Improved
- Potential Limit of Disturbance
- *E* Ramp Designation

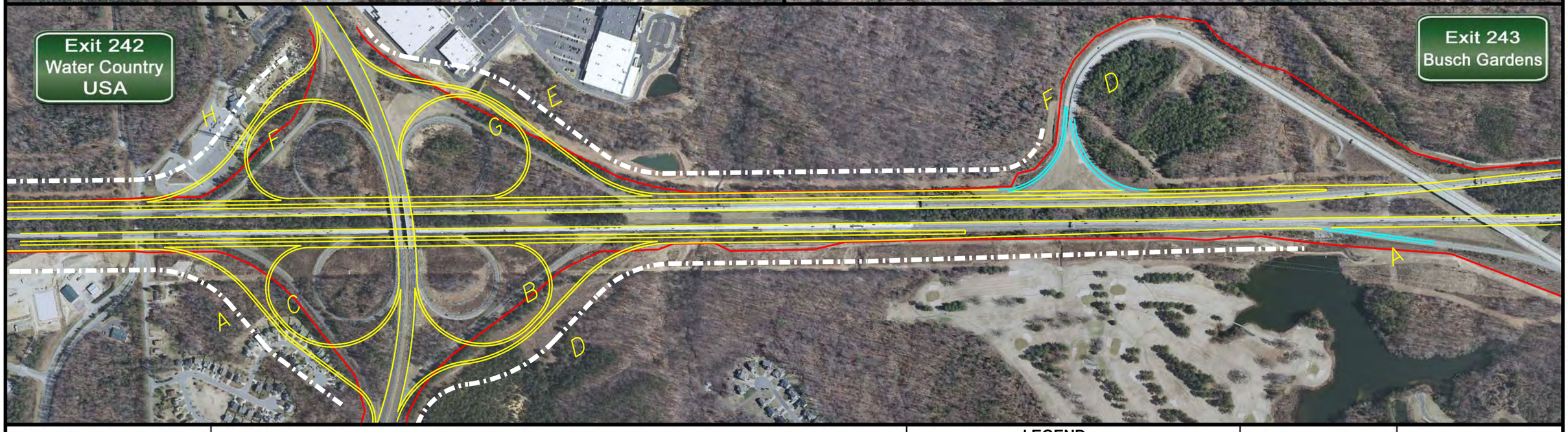
VDOT

N

0 300 600 Feet







INTERSTATE 64 PENINSULA STUDY

Potential Interchange Configurations - Conceptual Design
August 2012
Sheet 4 of 7

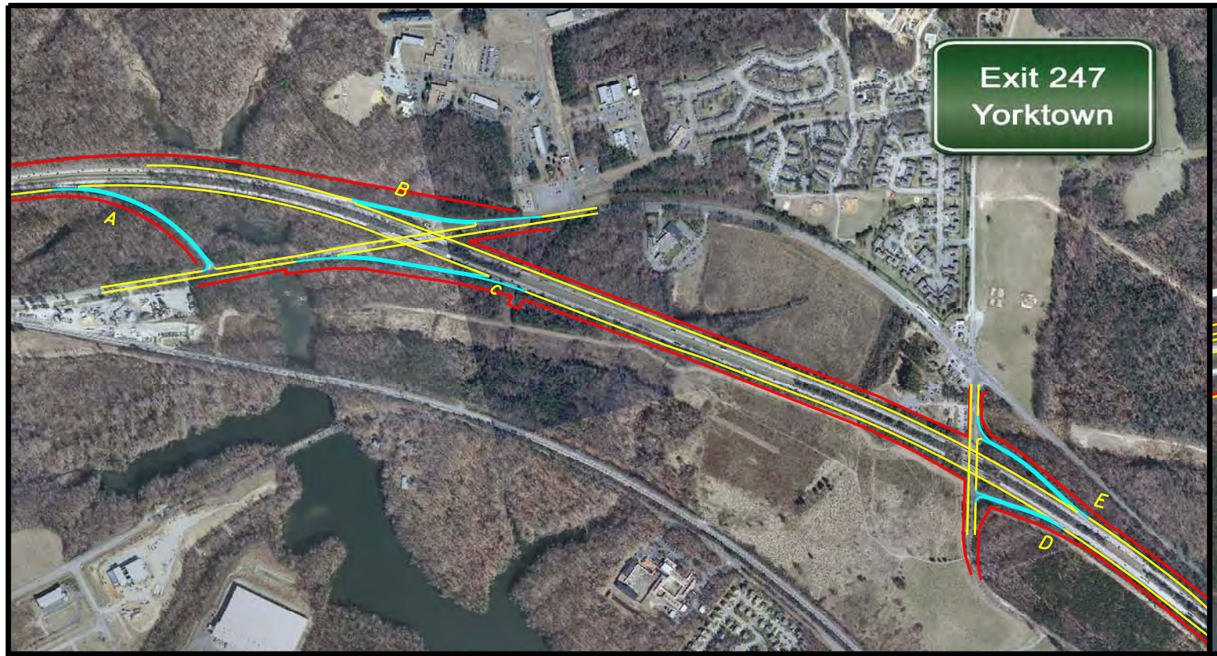
LEGEND

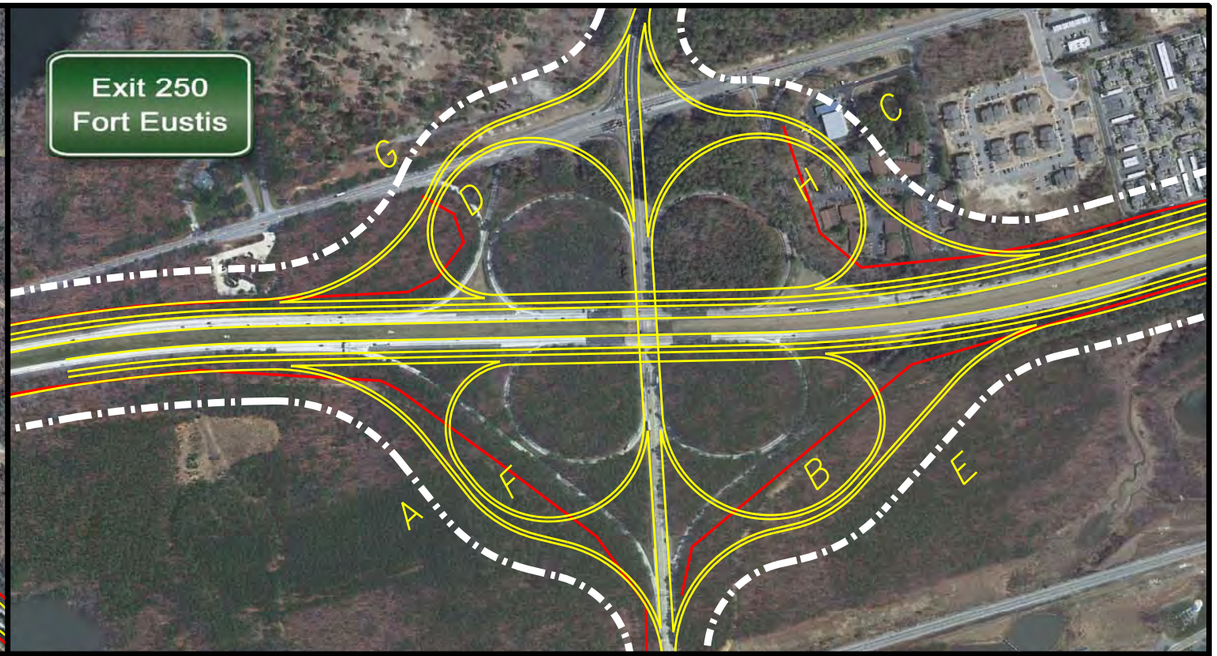
- Ramp Alignment to Remain
- Ramp Alignment to be Improved
- Potential Limit of Disturbance
- *E* Ramp Designation

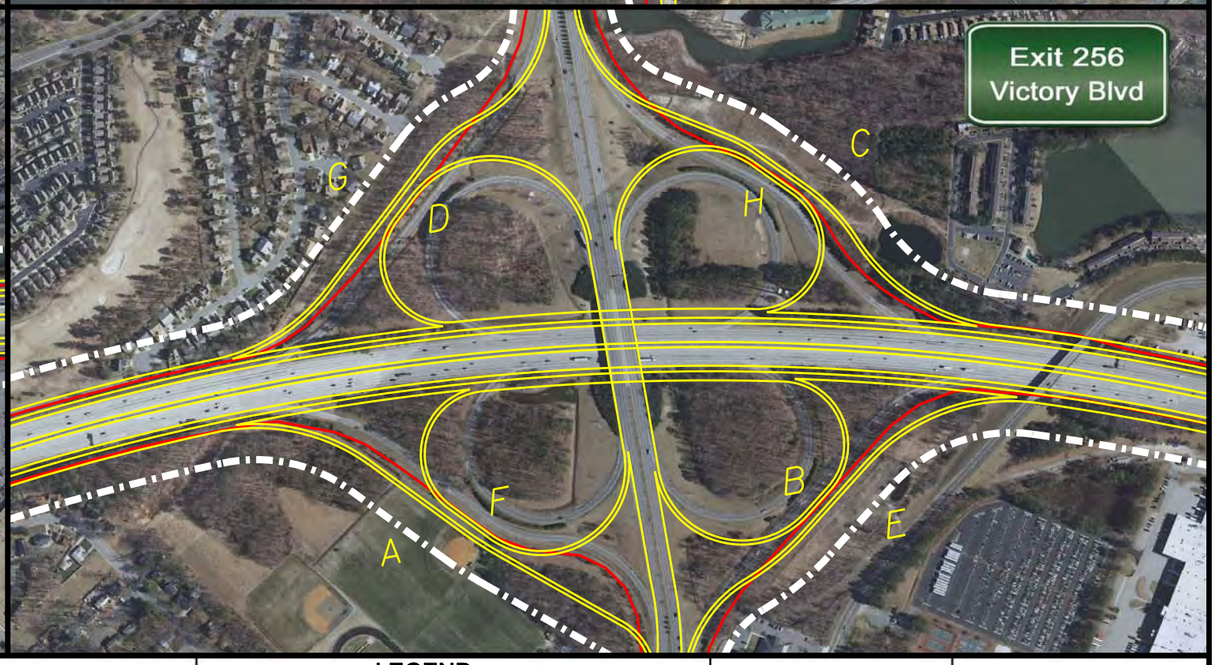
VDOT

N

0 300 600 Feet







INTERSTATE 64 PENINSULA STUDY

Potential Interchange Configurations - Conceptual Design

August 2012

Sheet 5 of 7

LEGEND

- Ramp Alignment to Remain
- Ramp Alignment to be Improved
- Potential Limit of Disturbance
- *E* Ramp Designation

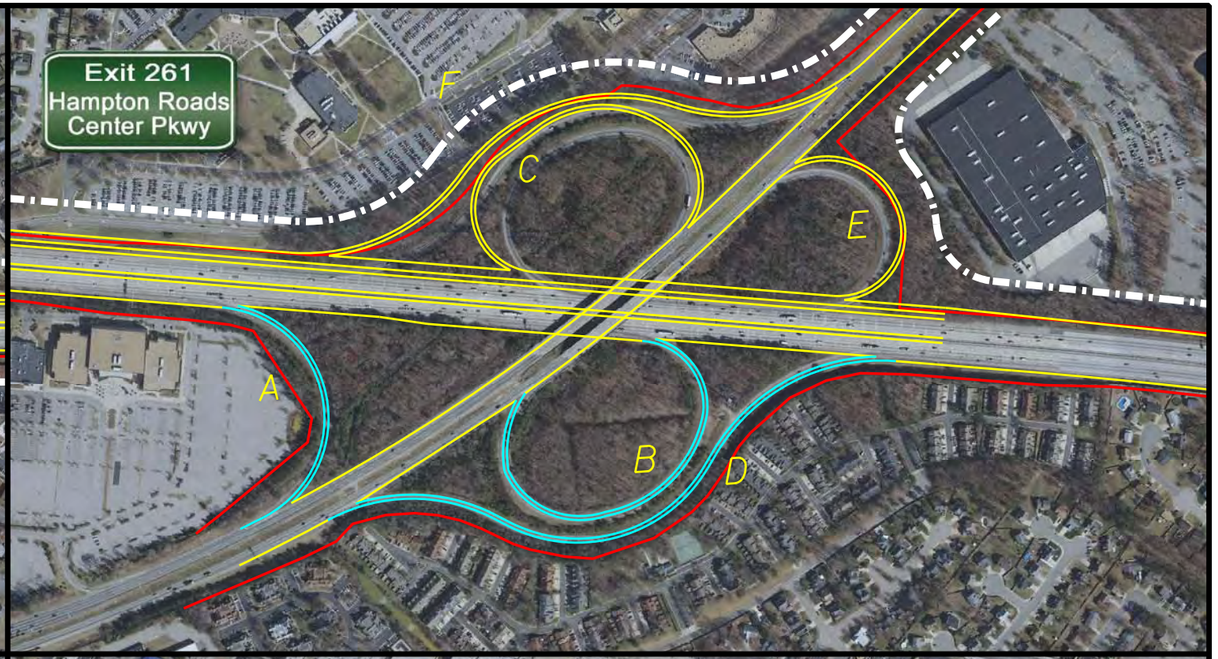
VDOT

N

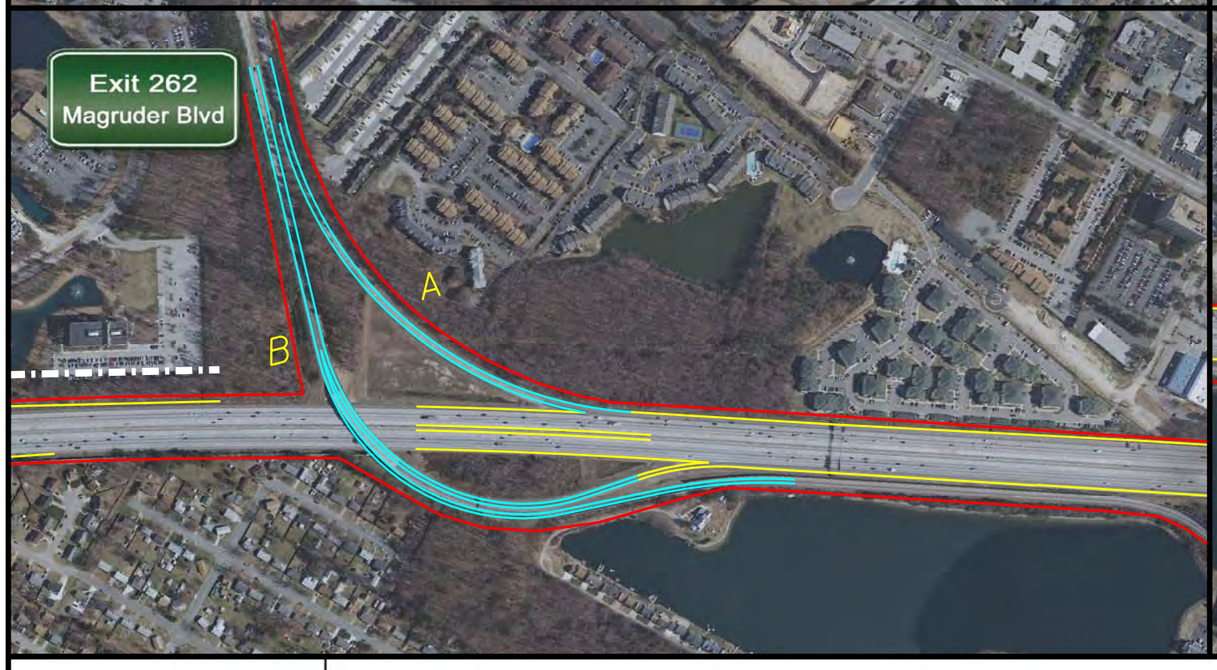
0 300 600 Feet

Exit 258
J Clyde
Morris Blvd

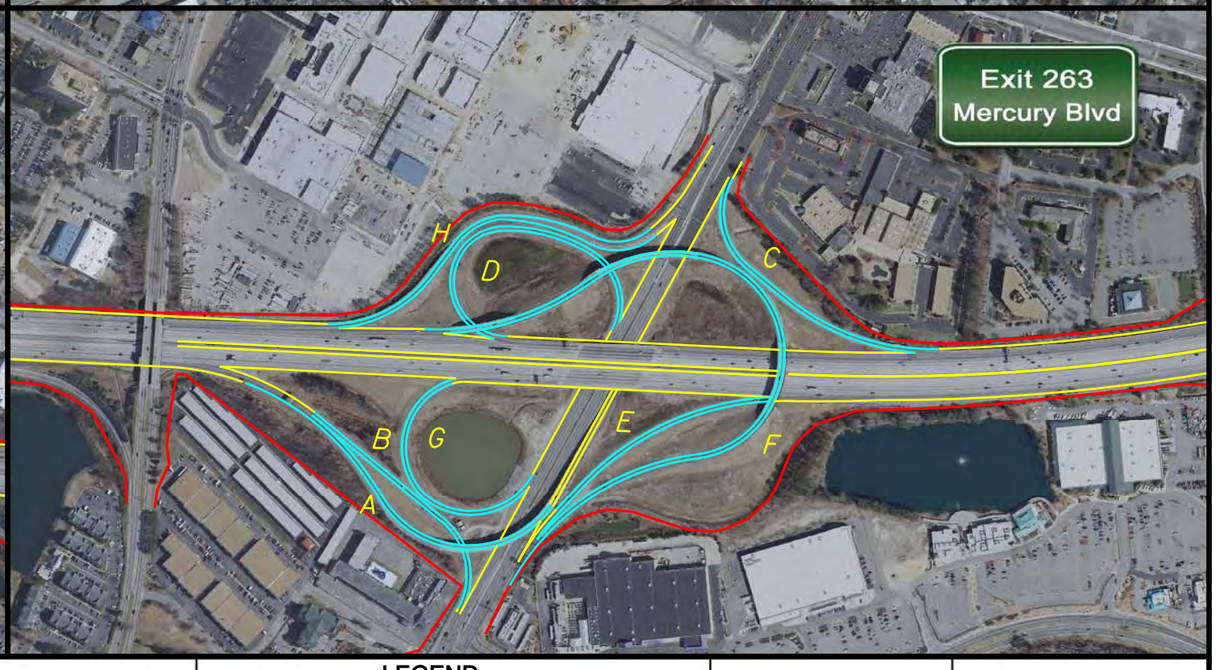
Exit 261
Hampton Roads
Center Pkwy



Exit 262
Magruder Blvd



Exit 263
Mercury Blvd



INTERSTATE 64 PENINSULA STUDY

Potential Interchange Configurations - Conceptual Design

August 2012

Sheet 6 of 7

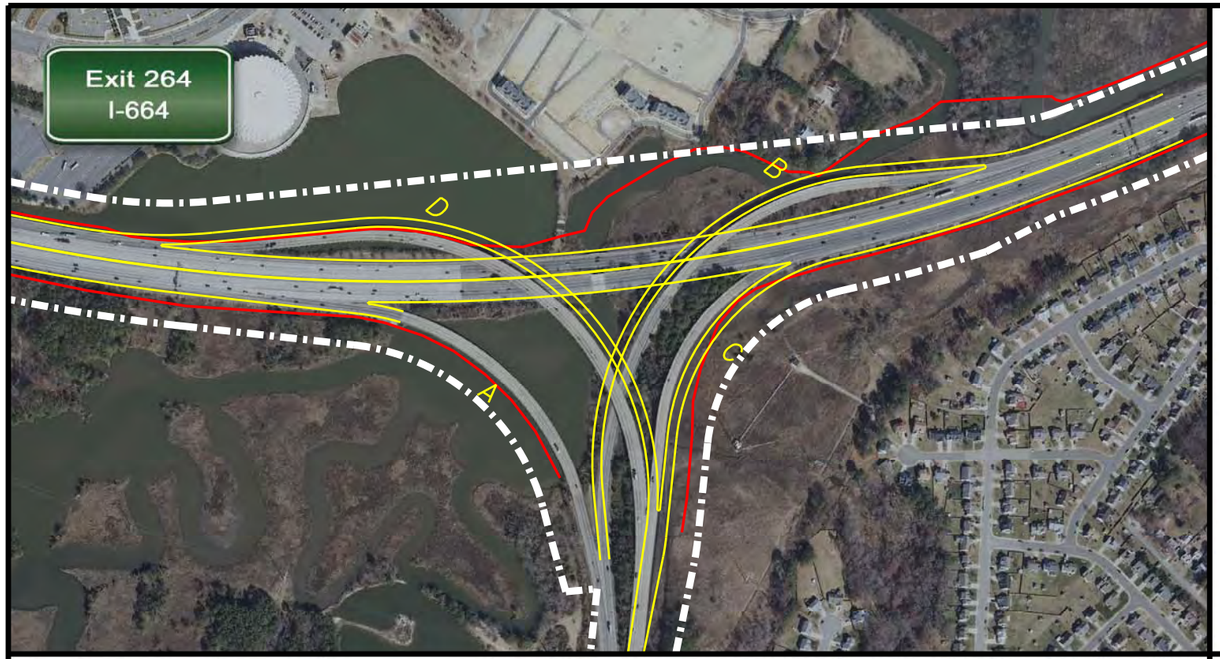
LEGEND

- Ramp Alignment to Remain
- Ramp Alignment to be Improved
- Potential Limit of Disturbance
- *E* Ramp Designation

VDOT

N

0 300 600 Feet



INTERSTATE 64 PENINSULA STUDY

Potential Interchange Configurations - Conceptual Design

August 2012

Sheet 7 of 7

LEGEND

- Ramp Alignment to Remain
- Ramp Alignment to be Improved
- Potential Limit of Disturbance
- *E* Ramp Designation

VDOT

N

0 300 600 Feet

INTERSTATE 64 PENINSULA STUDY

APPENDIX F

Cost Estimate

TRANSPORTATION & MOBILITY PLANNING DIVISION
STATEWIDE PLANNING LEVEL COST ESTIMATES

Costs Reflected as of January 2009

Inflation Rate 2.0% annually

To inflate cost to year of expenditure, please enter year below: **2017**

Costs include 25% for PE and Construction Contingencies

The following typical section estimates do not include bridge, right-of-way (ROW) or other improvement costs. Use the bridge unit costs, ROW percentages and other improvement costs (highlighted in gray) figures provided below to add these additional costs to the planning level construction estimate.

				Cost Per Mile	Bristol, Culpeper, Fredericksburg, Lynchburg, Richmond, Salem, Staunton LOW	Bristol, Culpeper, Fredericksburg, Lynchburg, Richmond, Salem, Staunton HIGH	NOVA Hampton Roads LOW	NOVA Hampton Roads HIGH	Average Costs Zone 1	Average Costs Zone 2
Urban Typical Sections										
Bike Lanes		4' pavement both sides		CPM	$ 520,000	$ 770,000	$ 600,000	$ 910,000	**$645,000**	**$755,000**
2 lanes	U2	26'-30' pavement	Reconstruct or New	CPM	$ 4,220,000	$ 6,330,000	$ 5,270,000	$ 7,910,000	**$5,275,000**	**$6,590,000**
3 lanes	U3	36'-40' pavement	Reconstruct or New	CPM	$ 5,980,000	$ 9,020,000	$ 7,380,000	$ 11,720,000	**$7,500,000**	**$9,550,000**
4 lanes	U4	40'-48' pavement	Reconstruct or New	CPM	$ 9,840,000	$ 14,650,000	$ 11,950,000	$ 17,570,000	**$12,245,000**	**$14,760,000**
4 lanes divided	U4D	48' pavement w/16' raised median	Reconstruct or New	CPM	$ 10,430,000	$ 15,820,000	$ 12,420,000	$ 18,750,000	**$13,125,000**	**$15,585,000**
4 lanes divided	U4D	48' pavement w/28' raised median	Reconstruct or New	CPM	$ 11,370,000	$ 16,990,000	$ 13,590,000	$ 20,500,000	**$14,180,000**	**$17,045,000**
					$ -	$ -	$ -	$ -		
6 lanes divided	U6D	72' pavement w/16' raised median	Reconstruct or New	CPM	$ 12,420,000	$ 16,640,000	$ 15,470,000	$ 23,430,000	**$14,530,000**	**$19,450,000**
6 lanes divided	U6D	72' pavement w/28' raised median	Reconstruct or New	CPM	$ 13,010,000	$ 17,220,000	$ 16,050,000	$ 24,600,000	**$15,115,000**	**$20,325,000**
					$ -	$ -	$ -	$ -		
8 lanes divided	U8D	96' pavement w/16' raised median	Reconstruct or New	CPM	$ 14,060,000	$ 19,570,000	$ 17,220,000	$ 25,780,000	**$16,815,000**	**$21,500,000**
8 lanes divided	U8D	96' pavement w/ 28' raised median	Reconstruct or New	CPM	$ 14,650,000	$ 20,150,000	$ 17,810,000	$ 26,950,000	**$17,400,000**	**$22,380,000**
Rural Typical Sections										
Bike Lanes		4' pavement both sides		CPM	$ 520,000	$ 760,000	$ 600,000	$ 910,000	**$640,000**	**$755,000**
1 lane		12' pavement		CPM	$ 460,000	$ 700,000	$ 560,000	$ 820,000	**$580,000**	**$690,000**
2 lanes	R2	18' pavement	Reconstruct or New	CPM	$ 2,230,000	$ 3,510,000	$ 2,690,000	$ 4,100,000	**$2,870,000**	**$3,395,000**
2 lanes	R2	20' pavement	Reconstruct or New	CPM	$ 2,810,000	$ 4,100,000	$ 3,510,000	$ 5,270,000	**$3,455,000**	**$4,390,000**
2 lanes	R2	22' pavement	Reconstruct or New	CPM	$ 3,750,000	$ 5,570,000	$ 4,690,000	$ 7,030,000	**$4,660,000**	**$5,860,000**
2 lanes	R2	24' pavement	Reconstruct or New	CPM	$ 4,690,000	$ 7,030,000	$ 5,740,000	$ 8,490,000	**$5,860,000**	**$7,115,000**
3 lanes	R3	36' pavement	Reconstruct or New	CPM	$ 5,860,000	$ 8,790,000	$ 7,150,000	$ 10,540,000	**$7,325,000**	**$8,845,000**
4 lanes divided	R4D	48'pavement	Reconstruct	CPM	$ 6,440,000	$ 9,020,000	$ 8,200,000	$ 11,720,000	**$7,730,000**	**$9,960,000**
4 lanes divided	R4D	48' pavement	New	CPM	$ 8,200,000	$ 11,370,000	$ 10,430,000	$ 15,230,000	**$9,785,000**	**$12,830,000**
4 lanes divided	R4D	48' pavement	Parallel	CPM	$ 5,510,000	$ 6,440,000	$ 6,800,000	$ 7,620,000	**$5,975,000**	**$7,210,000**
4 lanes divided	R4D	48' pavement w/16' raised median	Reconstruct or New	CPM	$ 8,790,000	$ 11,830,000	$ 10,780,000	$ 14,530,000	**$10,310,000**	**$12,655,000**
4 lanes divided	R4D	48' pavement w/28' raised median	Reconstruct or New	CPM	$ 9,370,000	$ 12,420,000	$ 11,370,000	$ 15,110,000	**$10,895,000**	**$13,240,000**
6 lanes divided	R6D	72' pavement widen 4-6 lanes	Reconstruct	CPM	$ 6,800,000	$ 9,960,000	$ 7,850,000	$ 11,950,000	**$8,380,000**	**$9,900,000**
6 lanes divided	R6D	72' pavement w/depress median	New	CPM	$ 10,190,000	$ 15,350,000	$ 12,420,000	$ 18,860,000	**$12,770,000**	**$15,640,000**
8 lanes divided	R8D	96' pavement widen 6-8 lanes	Reconstruct	CPM	$ 6,800,000	$ 9,960,000	$ 7,850,000	$ 11,950,000	**$8,380,000**	**$9,900,000**
8 lanes divided	R8D	96' pavement widen 4-8 lanes		CPM	$ 11,480,000	$ 18,630,000	$ 13,360,000	$ 22,960,000	**$15,055,000**	**$18,160,000**

The following turn-lanes costs are for stand alone turn-lane projects. The standard typical section CPM figures above assume turn lanes - do not add these turn-lanes costs when developing a planning level estimate for a widening, reconstruction, or new location improvement.

Right and Left Turn Lanes on a Four Lane Road										
Right turn lane		100' parallel and 100' taper		@	$ 210,000	$ 320,000	$ 260,000	$ 370,000	**$265,000**	**$315,000**
Left turn lane		200' parallel and 200' taper		@	$ 250,000	$ 360,000	$ 320,000	$ 470,000	**$305,000**	**$395,000**
Crossover				@	$ 190,000	$ 290,000	$ 230,000	$ 350,000	**$240,000**	**$290,000**
Provide new crossover with two right and two left turn lanes				@	$ 880,000	$ 1,460,000	$ 1,170,000	$ 1,760,000	**$1,170,000**	**$1,465,000**
Right and Left Center Turn Lane on a Two Lane Road										
		Design speed 55 M.P.H.								
One left turn lane		500' parallel and two 700' taper	0.36 mi.	@	$ 1,050,000	$ 1,640,000	$ 1,290,000	$ 1,870,000	**$1,345,000**	**$1,580,000**
Two left turn lanes		900' parallel and two 700' taper	0.44 mi.	@	$ 1,290,000	$ 2,050,000	$ 1,640,000	$ 2,340,000	**$1,670,000**	**$1,990,000**
Right and left turn lane				@	$ 1,290,000	$ 2,050,000	$ 1,640,000	$ 2,340,000	**$1,670,000**	**$1,990,000**
Two right and two left turn lanes				@	$ 1,640,000	$ 2,340,000	$ 1,990,000	$ 2,930,000	**$1,990,000**	**$2,460,000**

As noted above, bridge costs are not included in the typical section CPM figures above. Bridges represent a significant cost and it is important to use the figures below to estimate bridge costs for a planned improvement. Estimates are calculated based on the square footage of the bridge ->Bridge Cost = (total bridge length in feet x total bridge width in feet) x Square Footage Costs

Bridge Cost										
Over 25' to 200' in length			Widen Reconst or New	per sq ft	$ 250	$ 360	$ 290	$ 410	**$305**	**$350**
Over 200' in length			Widen Reconst or New	per sq ft	$ 250	$ 360	$ 290	$ 410	**$305**	**$350**

When applicable, the costs highlighted in gray should be added to the construction costs when developing a planning level estimate. All other improvement costs (not highlighted in gray) are for developing stand alone improvement cost estimates.

Other Improvement Cost									
Estimate parking, restripe (both sides)			CPM	$ 120,000	$ 180,000	$ 120,000	$ 180,000	**$150,000**	**$150,000**
Provide signal at unsignalized intersection			@	$ 140,000	$ 230,000	$ 470,000	$ 700,000	**$185,000**	**$585,000**
Improve, replace signal at intersection			@	$ 190,000	$ 290,000	$ 230,000	$ 350,000	**$240,000**	**$290,000**
Improve phasing as system, signalized intersections			@	$ 90,000	$ 150,000	$ 120,000	$ 180,000	**$120,000**	**$150,000**
Provide pedestrian signal phase			@	$ 50,000	$ 50,000	$ 60,000	$ 90,000	**$50,000**	**$75,000**
Provide pedestrian crosswalk			@	$ 20,000	$ 20,000	$ 30,000	$ 40,000	**$20,000**	**$35,000**
Downtown signage			CPM	$ 50,000	$ 50,000	$ 60,000	$ 90,000	**$50,000**	**$75,000**
Close open ditch drainage and provide curb & gutter			CPM	$ 2,810,000	$ 2,810,000	$ 3,510,000	$ 5,270,000	**$2,810,000**	**$4,390,000**
Widen radius for truck turning			@	$ 90,000	$ 90,000	$ 120,000	$ 180,000	**$90,000**	**$150,000**
Install railroad warning lights (no gates)			@	$ 90,000	$ 90,000	$ 120,000	$ 180,000	**$90,000**	**$150,000**
Provide park & ride facility			COST PER PARKING SPACE	$ 10,000	$ 10,000	$ 10,000	$ 10,000	**$10,000**	**$10,000**
Provide 5 ft. sidewalk			CPM	$ 280,000	$ 280,000	$ 350,000	$ 530,000	**$280,000**	**$440,000**
Wide Curb Lane (2 additional feet of pavement in each direction			CPM	$ 280,000	$ 280,000	$ 350,000	$ 530,000	**$280,000**	**$440,000**
Paved Shoulder (4 foot wide paved shoulder in both directions)			CPM	$ 520,000	$ 520,000	$ 600,000	$ 880,000	**$520,000**	**$740,000**
Provide 10 ft. paved shared use path off road			CPM	$ 840,000	$ 840,000	$ 1,050,000	$ 1,520,000	**$840,000**	**$1,285,000**
Sound barrier wall (multiply height x length)			per sq ft	$ 80	$ 80	$ 80	$ 120	**$80**	**$100**
Improve grade separated interchange			@	$ 29,290,000	$ 46,870,000	$ 35,150,000	$ 70,300,000	**$38,080,000**	**$52,725,000**
Provide new grade separated interchange (Rural) LOW			@	$ 35,150,000	$ 35,150,000	$ 41,010,000	$ 41,010,000	**$35,150,000**	**$41,010,000**
Provide new grade separated interchange (Rural) HIGH			@	$ 64,440,000	$ 64,440,000	$ 76,160,000	$ 76,160,000	**$64,440,000**	**$76,160,000**
Provide new grade separated interchange (Urban) LOW			@	$ 41,010,000	$ 41,010,000	$ 46,870,000	$ 46,870,000	**$41,010,000**	**$46,870,000**
Provide new grade separated interchange (Urban) HIGH			@	$ 76,160,000	$ 76,160,000	$ 87,870,000	$ 87,870,000	**$76,160,000**	**$87,870,000**
Roundabouts	1 lane			$ 880,000	$ 1,460,000	$ 1,170,000	$ 1,760,000	**$1,170,000**	**$1,465,000**
Roundabouts	2 lanes			$ 2,050,000	$ 2,930,000	$ 2,340,000	$ 3,510,000	**$2,490,000**	**$2,925,000**

Once a planning level construction estimate has been developed using the information above, use the following figures to estimate ROW costs based on the prevalent land use adjacent to the project. ROW costs are shown as a percentage of construction costs.

Right of Way & Utilities Cost % of Cost Estimate				
Rural	25%	35%	30%	40%
Residential/Suburban low density	50%	65%	55%	70%
Outlying business/Suburban high density	60%	100%	75%	125%
Central business district	100%	125%	125%	150%

Planning Level Cost Estimate = ((Typical Section CPM x project length in miles) + (Other Improvement Costs) x (ROW%+1)); Bridge Costs =(Bridge 1 total square footage x bridge unit cost)+(Bridge 2 total square footage x bridge unit cost)…

In the 2006 session, the General Assembly passed a bill directing local governments to include cost estimates when planning road improvements. HB 1521 directs local governments to include in their comprehensive plans maps showing costs for road and transportation improvements as those costs are available from VDOT. The legislation becomes effective July 1, 2006. District planners will act as the point-of-contact in assisting local governments, at their request, to develop planning level cost estimates for proposed transportation improvements in local comprehensive plans.

The Project Cost Estimation System (PCES) is VDOT's tool for calculating the costs for transportation improvements, and is generally used after the project's scoping phase. PCES is not always an ideal tool for determining costs at the planning level, given the number of planned improvements and the limited amount of detailed information known at the planning stage.

The Statewide Planning Level Cost Estimate Sheet above has been updated from 2006 to reflect higher costs in all districts due to cost increases in construction materials. This sheet shall be used to provide consistent planning level cost estimates when planners are contacted by local governments pursuant to HB 1521. For extremely complex improvements or improvements with unique characteristics, please work with your district Location and Design section or TMPD's Project Planning Group to develop the cost estimate. It is also recommended that when displaying planning level cost estimates for public review use ranges. If enough information is available to derive cost estimates using PCES, then you are encouraged to use that method to develop the planning level estimate.

zone 1	zone 2	urban	rural

Alternative 1A EB

Roadway									
From	To	Length (miles)	# of Lanes	CPM AVERAGE	Cost AVERAGE	CPM LOW	Cost LOW	CPM HIGH	Cost HIGH
190	193	3	6	**$14,530,000**	$43,590,000	**$12,420,000**	$37,260,000	**$16,640,000**	$49,920,000
193	197	4	4	**$12,245,000**	$48,980,000	**$9,840,000**	$39,360,000	**$14,650,000**	$58,600,000
197	200	3	3	**$7,500,000**	$22,500,000	**$5,980,000**	$17,940,000	**$9,020,000**	$27,060,000
200	202.5	2.5	4	**$12,245,000**	$30,612,500	**$9,840,000**	$24,600,000	**$14,650,000**	$36,625,000
202.5	205	2.5	4	**$7,730,000**	$19,325,000	**$6,440,000**	$16,100,000	**$9,020,000**	$22,550,000
205	224.0	19	3	**$7,325,000**	$139,175,000	**$5,860,000**	$111,340,000	**$8,790,000**	$167,010,000
224	241.5	17.5	3	**$8,845,000**	$154,787,500	**$7,150,000**	$125,125,000	**$10,540,000**	$184,450,000
241.5	247	5.5	3	**$9,550,000**	$52,525,000	**$7,380,000**	$40,590,000	**$11,720,000**	$64,460,000
247	255	8	4	**$14,760,000**	$118,080,000	**$11,950,000**	$95,600,000	**$17,570,000**	$140,560,000
255	256	1	5	**$17,143,500**	$17,143,500	**$13,662,000**	$13,662,000	**$20,625,000**	$20,625,000
256	265	9	6	**$19,450,000**	$175,050,000	**$15,470,000**	$139,230,000	**$23,430,000**	$210,870,000
Total Roadway this Alternative					**$821,768,500**		**$660,807,000**		**$982,730,000**

Bridge									
			Area	CPSF Average	Cost AVERAGE	CPM LOW	Cost LOW	CPM HIGH	Cost HIGH
Zone 1	Mainline		349042	**$305**	$106,457,810	**$250**	$87,260,500	**$360**	$125,655,120
	Overpass		63223	**$305**	$19,283,015	**$250**	$15,805,750	**$360**	$22,760,280
Zone 2	Mainline		190435	**$350**	$66,652,250	**$290**	$55,226,150	**$410**	$78,078,350
	Overpass		122820	**$350**	$42,987,000	**$290**	$35,617,800	**$410**	$50,356,200
Total Bridge this Alternative					**$235,380,075**		**$193,910,200**		**$276,849,950**

	AVERAGE		**LOW**		**HIGH**
Total EB Roadway & Bridges this Alternative	**$1,057,148,575**		**$854,717,200**		**$1,259,579,950**

Alternative 1A WB

Roadway									
From	To	Length (miles)	# of Lanes	CPM AVERAGE	Cost AVERAGE	CPM LOW	Cost LOW	CPM HIGH	Cost HIGH
190	193	3	5	**$14,437,500**	$43,312,500	**$11,473,000**	$34,419,000	**$17,402,000**	$52,206,000
193	197	4	4	**$12,245,000**	$48,980,000	**$9,840,000**	$39,360,000	**$14,650,000**	$58,600,000
197	202.5	5.5	3	**$7,500,000**	$41,250,000	**$5,980,000**	$32,890,000	**$9,020,000**	$49,610,000
202.5	224	21.5	3	**$7,325,000**	$157,487,500	**$5,860,000**	$125,990,000	**$8,790,000**	$188,985,000
224	241.5	17.5	3	**$8,845,000**	$154,787,500	**$7,150,000**	$125,125,000	**$10,540,000**	$184,450,000
241.5	247	5.5	3	**$9,550,000**	$52,525,000	**$7,380,000**	$40,590,000	**$11,720,000**	$64,460,000
247	255	8	4	**$14,760,000**	$118,080,000	**$11,950,000**	$95,600,000	**$17,570,000**	$140,560,000
255	256	1	5	**$17,143,500**	$17,143,500	**$13,662,000**	$13,662,000	**$20,625,000**	$20,625,000
256	258	2	6	**$19,450,000**	$38,900,000	**$15,470,000**	$30,940,000	**$23,430,000**	$46,860,000
258	265	7	7	**$21,395,000**	$149,765,000	**$17,017,000**	$119,119,000	**$25,773,000**	$180,411,000
Total Roadway this Alternative					**$822,231,000**		**$657,695,000**		**$986,767,000**

Bridge									
			Area	CPSF Average	Cost AVERAGE	CPM LOW	Cost LOW	CPM HIGH	Cost HIGH
Zone 1	Mainline		301433	**$305**	$91,937,065	**$250**	$75,358,250	**$360**	$108,515,880
	Overpass		63223	**$305**	$19,283,015	**$250**	$15,805,750	**$360**	$22,760,280
Zone 2	Mainline		162784	**$350**	$56,974,400	**$290**	$47,207,360	**$410**	$66,741,440
	Overpass		122820	**$350**	$42,987,000	**$290**	$35,617,800	**$410**	$50,356,200
Total Bridge this Alternative					**$211,181,480**		**$173,989,160**		**$248,373,800**

	AVERAGE		**LOW**		**HIGH**
Total WB Roadway & Bridges this Alternative	**$1,033,412,480**		**$831,684,160**		**$1,235,140,800**

Alternative 1A Interchanges

Interchanges									
			Quantity	CPEach Average	Cost Average	CPEach LOW	Cost LOW	CPEach HIGH	Cost HIGH
Zone 1									
Urban	New		3	**$58,585,000**	$175,755,000	**$41,010,000**	$123,030,000	**$76,160,000**	$228,480,000
	Improve		3	**$38,080,000**	$114,240,000	**$29,290,000**	$87,870,000	**$46,870,000**	$140,610,000
Rural	New		0	**$49,795,000**	$0	**$35,150,000**	$0	**$64,440,000**	$0
	Improve		4	**$38,080,000**	$152,320,000	**$29,290,000**	$117,160,000	**$46,870,000**	$187,480,000
Zone 2									
Urban	New		5	**$67,370,000**	$336,850,000	**$46,870,000**	$234,350,000	**$87,870,000**	$439,350,000
	Improve		6	**$52,725,000**	$316,350,000	**$35,150,000**	$210,900,000	**$70,300,000**	$421,800,000
Rural	New		2	**$58,585,000**	$117,170,000	**$41,010,000**	$82,020,000	**$76,160,000**	$152,320,000
	Improve		2	**$52,725,000**	$105,450,000	**$35,150,000**	$70,300,000	**$70,300,000**	$140,600,000
Total Interchanges this Alternative					**$1,318,135,000**		**$925,630,000**		**$1,710,640,000**

No Tolling Costs Included for Alternative 1A

Alternatives 1A Sub-Totals			
	AVERAGE	*LOW*	*HIGH*
Zone 1 (Richmond District)	$1,274,488,405	$1,001,549,250	$1,547,427,560
Zone 2 (Hampton Roads District)	$2,134,207,650	$1,610,482,110	$2,657,933,190
Total Per Zone/District	**$3,408,696,055**	**$2,612,031,360**	**$4,205,360,750**

Alternatives 1A Totals			
	AVERAGE	*LOW*	*HIGH*
Total Roadway	$1,643,999,500	$1,318,502,000	$1,969,497,000
Total Bridges	$446,561,555	$367,899,360	$525,223,750
Total Interchanges	$1,318,135,000	$925,630,000	$1,710,640,000
Total Construction	**$3,408,696,055**	**$2,612,031,360**	**$4,205,360,750**

zone 1 | zone 2 | urban | rural

Alternative 2A EB

Roadway

From	To	Length (miles)	# of Lanes	CPM AVERAGE	Cost AVERAGE	CPM LOW	Cost LOW	CPM HIGH	Cost HIGH
190	193	3	6	**$14,530,000**	$43,590,000	**$12,420,000**	$37,260,000	**$16,640,000**	$49,920,000
193	197	4	4	**$12,245,000**	$48,980,000	**$9,840,000**	$39,360,000	**$14,650,000**	$58,600,000
197	200	3	3	**$7,500,000**	$22,500,000	**$5,980,000**	$17,940,000	**$9,020,000**	$27,060,000
200	202.5	2.5	4	**$12,245,000**	$30,612,500	**$9,840,000**	$24,600,000	**$14,650,000**	$36,625,000
202.5	205	2.5	4	**$7,730,000**	$19,325,000	**$6,440,000**	$16,100,000	**$9,020,000**	$22,550,000
205	224.0	19	3	**$7,325,000**	$139,175,000	**$5,860,000**	$111,340,000	**$8,790,000**	$167,010,000
224	241.5	17.5	3	**$8,845,000**	$154,787,500	**$7,150,000**	$125,125,000	**$10,540,000**	$184,450,000
241.5	247	5.5	3	**$9,550,000**	$52,525,000	**$7,380,000**	$40,590,000	**$11,720,000**	$64,460,000
247	255	8	4	**$14,760,000**	$118,080,000	**$11,950,000**	$95,600,000	**$17,570,000**	$140,560,000
255	256	1	5	**$17,143,500**	$17,143,500	**$13,662,000**	$13,662,000	**$20,625,000**	$20,625,000
256	265	9	6	**$19,450,000**	$175,050,000	**$15,470,000**	$139,230,000	**$23,430,000**	$210,870,000
Total Roadway this Alternative					**$821,768,500**		**$660,807,000**		**$982,730,000**

Bridge

			Area	CPSF Average	Cost AVERAGE	CPM LOW	Cost LOW	CPM HIGH	Cost HIGH
Zone 1	Mainline		349042	**$305**	$106,457,810	**$250**	$87,260,500	**$360**	$125,655,120
	Overpass		63223	**$305**	$19,283,015	**$250**	$15,805,750	**$360**	$22,760,280
Zone 2	Mainline		190435	**$350**	$66,652,250	**$290**	$55,226,150	**$410**	$78,078,350
	Overpass		122820	**$350**	$42,987,000	**$290**	$35,617,800	**$410**	$50,356,200
Total Bridge this Alternative					**$235,380,075**		**$193,910,200**		**$276,849,950**

	AVERAGE		**LOW**		**HIGH**
Total EB Roadway & Bridges this Alternative	**$1,057,148,575**		**$854,717,200**		**$1,259,579,950**

Alternative 2A WB

Roadway

From	To	Length (miles)	# of Lanes	CPM AVERAGE	Cost AVERAGE	CPM LOW	Cost LOW	CPM HIGH	Cost HIGH
190	193	3	5	**$14,437,500**	$43,312,500	**$11,473,000**	$34,419,000	**$17,402,000**	$52,206,000
193	197	4	4	**$12,245,000**	$48,980,000	**$9,840,000**	$39,360,000	**$14,650,000**	$58,600,000
197	202.5	5.5	3	**$7,500,000**	$41,250,000	**$5,980,000**	$32,890,000	**$9,020,000**	$49,610,000
202.5	224	21.5	3	**$7,325,000**	$157,487,500	**$5,860,000**	$125,990,000	**$8,790,000**	$188,985,000
224	241.5	17.5	3	**$8,845,000**	$154,787,500	**$7,150,000**	$125,125,000	**$10,540,000**	$184,450,000
241.5	247	5.5	3	**$9,550,000**	$52,525,000	**$7,380,000**	$40,590,000	**$11,720,000**	$64,460,000
247	255	8	4	**$14,760,000**	$118,080,000	**$11,950,000**	$95,600,000	**$17,570,000**	$140,560,000
255	256	1	5	**$17,143,500**	$17,143,500	**$13,662,000**	$13,662,000	**$20,625,000**	$20,625,000
256	258	2	6	**$19,450,000**	$38,900,000	**$15,470,000**	$30,940,000	**$23,430,000**	$46,860,000
258	265	7	7	**$21,395,000**	$149,765,000	**$17,017,000**	$119,119,000	**$25,773,000**	$180,411,000
Total Roadway this Alternative					**$822,231,000**		**$657,695,000**		**$986,767,000**

Bridge

			Area	CPSF Average	Cost AVERAGE	CPM LOW	Cost LOW	CPM HIGH	Cost HIGH
Zone 1	Mainline		301433	**$305**	$91,937,065	**$250**	$75,358,250	**$360**	$108,515,880
	Overpass		63223	**$305**	$19,283,015	**$250**	$15,805,750	**$360**	$22,760,280
Zone 2	Mainline		162784	**$350**	$56,974,400	**$290**	$47,207,360	**$410**	$66,741,440
	Overpass		122820	**$350**	$42,987,000	**$290**	$35,617,800	**$410**	$50,356,200
Total Bridge this Alternative					**$211,181,480**		**$173,989,160**		**$248,373,800**

	AVERAGE		**LOW**		**HIGH**
Total WB Roadway & Bridges this Alternative	**$1,033,412,480**		**$831,684,160**		**$1,235,140,800**

Alternative 2A Interchanges

Interchanges

			Quantity	CPEach Average	Cost Average	CPEach LOW	Cost LOW	CPEach HIGH	Cost HIGH
Zone 1									
Urban	New		3	**$58,585,000**	$175,755,000	**$41,010,000**	$123,030,000	**$76,160,000**	$228,480,000
	Improve		3	**$38,080,000**	$114,240,000	**$29,290,000**	$87,870,000	**$46,870,000**	$140,610,000
Rural	New		0	**$49,795,000**	$0	**$35,150,000**	$0	**$64,440,000**	$0
	Improve		4	**$38,080,000**	$152,320,000	**$29,290,000**	$117,160,000	**$46,870,000**	$187,480,000
Zone 2									
Urban	New		5	**$67,370,000**	$336,850,000	**$46,870,000**	$234,350,000	**$87,870,000**	$439,350,000
	Improve		6	**$52,725,000**	$316,350,000	**$35,150,000**	$210,900,000	**$70,300,000**	$421,800,000
Rural	New		2	**$58,585,000**	$117,170,000	**$41,010,000**	$82,020,000	**$76,160,000**	$152,320,000
	Improve		2	**$52,725,000**	$105,450,000	**$35,150,000**	$70,300,000	**$70,300,000**	$140,600,000
Total Interchanges this Alternative					**$1,318,135,000**		**$925,630,000**		**$1,710,640,000**

Alternative 2A Tolling Costs

For Alternative 2A Full Toll Lanes, there were 24 tolling gantries assumed at a per gantry cost of @220,000 per gantry and toll shelter.
The TTMS which includes tolling equipment, software, back office work, and testing was approximately $2,000,000 per location.
The ITS duct bank of conduit and fiber was included at approximately $25 per linear foot for the 75 mile long corridor.
For Richmond District, the interchanges include Exit 190 – Exit 220; for Hampton Roads District, the interchanges include Exit 227 – Exit 264
For Richmond District, the mileage includes MM 190 to MM 224.6; for Hampton Roads District, the mileage includes MM 224.6 to MM 265

Using these assumptions the total estimated costs for Corridor Tolling are:
24 gantries @ $2,220,000 = $53,280,000
ITS Duct and Fiber @ 396,000 feet x $25 / ft = $9,900,000
Corridor Total = $63,180,000

	# of Interchanges	$ Gantry x # Interchanges	I-64 Mileage	$ ITS Duct x Miles	Tolling Costs
Zone 1 (Richmond District)	10	$22,200,000	34.6	$4,567,200	$26,767,200
Zone 2 (Hampton Roads District)	14	$31,080,000	40.4	$5,332,800	$36,412,800
Total Per Zone/District	**24**	**$53,280,000**	**75.0**	**$9,900,000**	**$63,180,000**

Alternative 2A Sub-Totals

	AVERAGE	*LOW*	*HIGH*
Zone 1 (Richmond District)	$1,301,255,605	$1,028,316,450	$1,574,194,760
Zone 2 (Hampton Roads District)	$2,170,620,450	$1,646,894,910	$2,694,345,990
Total Per Zone/District	**$3,471,876,055**	**$2,675,211,360**	**$4,268,540,750**

Alternative 2A Totals

	AVERAGE	*LOW*	*HIGH*
Total Roadway	$1,643,999,500	$1,318,502,000	$1,969,497,000
Total Bridges	$446,561,555	$367,899,360	$525,223,750
Total Interchanges	$1,318,135,000	$925,630,000	$1,710,640,000
Corridor Tolling	$63,180,000	$63,180,000	$63,180,000
Total Construction	**$3,471,876,055**	**$2,675,211,360**	**$4,268,540,750**

zone 1 | zone 2 | urban | rural

Alternative 1B EB

Roadway									
From	To	Length (miles)	# of Lanes	CPM AVERAGE	Cost AVERAGE	CPM LOW	Cost LOW	CPM HIGH	Cost HIGH
190	193	3	6	**$14,530,000**	$43,590,000	**$12,420,000**	$37,260,000	**$16,640,000**	$49,920,000
193	197	4	4	**$12,245,000**	$48,980,000	**$9,840,000**	$39,360,000	**$14,650,000**	$58,600,000
197	200	3	3	**$7,500,000**	$22,500,000	**$5,980,000**	$17,940,000	**$9,020,000**	$27,060,000
200	202.5	2.5	4	**$12,245,000**	$30,612,500	**$9,840,000**	$24,600,000	**$14,650,000**	$36,625,000
202.5	205	2.5	4	**$7,730,000**	$19,325,000	**$6,440,000**	$16,100,000	**$9,020,000**	$22,550,000
205	224.0	19	3	**$7,325,000**	$139,175,000	**$5,860,000**	$111,340,000	**$8,790,000**	$167,010,000
224	241.5	17.5	3	**$8,845,000**	$154,787,500	**$7,150,000**	$125,125,000	**$10,540,000**	$184,450,000
241.5	247	5.5	3	**$9,550,000**	$52,525,000	**$7,380,000**	$40,590,000	**$11,720,000**	$64,460,000
247	255	8	4	**$14,760,000**	$118,080,000	**$11,950,000**	$95,600,000	**$17,570,000**	$140,560,000
255	256	1	5	**$17,143,500**	$17,143,500	**$13,662,000**	$13,662,000	**$20,625,000**	$20,625,000
256	265	9	6	**$19,450,000**	$175,050,000	**$15,470,000**	$139,230,000	**$23,430,000**	$210,870,000
Total Roadway this Alternative					**$821,768,500**		**$660,807,000**		**$982,730,000**

Bridge									
			Area	CPSF Average	Cost AVERAGE	CPM LOW	Cost LOW	CPM HIGH	Cost HIGH
Zone 1	Mainline		349042	**$305**	$106,457,810	**$250**	$87,260,500	**$360**	$125,655,120
	Overpass		51215	**$305**	$15,620,575	**$250**	$12,803,750	**$360**	$18,437,400
Zone 2	Mainline		190435	**$350**	$66,652,250	**$290**	$55,226,150	**$410**	$78,078,350
	Overpass		113155	**$350**	$39,604,250	**$290**	$32,814,950	**$410**	$46,393,550
Total Bridge this Alternative					**$228,334,885**		**$188,105,350**		**$268,564,420**

	AVERAGE		**LOW**		**HIGH**
Total EB Roadway & Bridges this Alternative	**$1,050,103,385**		**$848,912,350**		**$1,251,294,420**

Alternative 1B WB

Roadway									
From	To	Length (miles)	# of Lanes	CPM AVERAGE	Cost AVERAGE	CPM LOW	Cost LOW	CPM HIGH	Cost HIGH
190	193	3	5	**$14,437,500**	$43,312,500	**$11,473,000**	$34,419,000	**$17,402,000**	$52,206,000
193	197	4	4	**$12,245,000**	$48,980,000	**$9,840,000**	$39,360,000	**$14,650,000**	$58,600,000
197	202.5	5.5	3	**$7,500,000**	$41,250,000	**$5,980,000**	$32,890,000	**$9,020,000**	$49,610,000
202.5	224	21.5	3	**$7,325,000**	$157,487,500	**$5,860,000**	$125,990,000	**$8,790,000**	$188,985,000
224	241.5	17.5	3	**$8,845,000**	$154,787,500	**$7,150,000**	$125,125,000	**$10,540,000**	$184,450,000
241.5	247	5.5	3	**$9,550,000**	$52,525,000	**$7,380,000**	$40,590,000	**$11,720,000**	$64,460,000
247	255	8	4	**$14,760,000**	$118,080,000	**$11,950,000**	$95,600,000	**$17,570,000**	$140,560,000
255	256	1	5	**$17,143,500**	$17,143,500	**$13,662,000**	$13,662,000	**$20,625,000**	$20,625,000
256	258	2	6	**$19,450,000**	$38,900,000	**$15,470,000**	$30,940,000	**$23,430,000**	$46,860,000
258	265	7	7	**$21,395,000**	$149,765,000	**$17,017,000**	$119,119,000	**$25,773,000**	$180,411,000
Total Roadway this Alternative					**$822,231,000**		**$657,695,000**		**$986,767,000**

Bridge									
			Area	CPSF Average	Cost AVERAGE	CPM LOW	Cost LOW	CPM HIGH	Cost HIGH
Zone 1	Mainline		301433	**$305**	$91,937,065	**$250**	$75,358,250	**$360**	$108,515,880
	Overpass		51215	**$305**	$15,620,575	**$250**	$12,803,750	**$360**	$18,437,400
Zone 2	Mainline		162784	**$350**	$56,974,400	**$290**	$47,207,360	**$410**	$66,741,440
	Overpass		113155	**$350**	$39,604,250	**$290**	$32,814,950	**$410**	$46,393,550
Total Bridge this Alternative					**$204,136,290**		**$168,184,310**		**$240,088,270**

	AVERAGE		**LOW**		**HIGH**
Total WB Roadway & Bridges this Alternative	**$1,026,367,290**		**$825,879,310**		**$1,226,855,270**

Alternative 1B Interchanges

Interchanges									
			Quantity	CPEach Average	Cost Average	CPEach LOW	Cost LOW	CPEach HIGH	Cost HIGH
Zone 1									
Urban	New		3	**$58,585,000**	$175,755,000	**$41,010,000**	$123,030,000	**$76,160,000**	$228,480,000
	Improve		3	**$38,080,000**	$114,240,000	**$29,290,000**	$87,870,000	**$46,870,000**	$140,610,000
Rural	New		0	**$49,795,000**	$0	**$35,150,000**	$0	**$64,440,000**	$0
	Improve		4	**$38,080,000**	$152,320,000	**$29,290,000**	$117,160,000	**$46,870,000**	$187,480,000
Zone 2									
Urban	New		5	**$67,370,000**	$336,850,000	**$46,870,000**	$234,350,000	**$87,870,000**	$439,350,000
	Improve		6	**$52,725,000**	$316,350,000	**$35,150,000**	$210,900,000	**$70,300,000**	$421,800,000
Rural	New		2	**$58,585,000**	$117,170,000	**$41,010,000**	$82,020,000	**$76,160,000**	$152,320,000
	Improve		2	**$52,725,000**	$105,450,000	**$35,150,000**	$70,300,000	**$70,300,000**	$140,600,000
Total Interchanges this Alternative					**$1,318,135,000**		**$925,630,000**		**$1,710,640,000**

No Tolling Costs Included for Alternative 1B

Alternative 1B Sub-Totals

	AVERAGE	*LOW*	*HIGH*
Zone 1 (Richmond District)	$1,267,163,525	$995,545,250	$1,538,781,800
Zone 2 (Hampton Roads District)	$2,127,442,150	$1,604,876,410	$2,650,007,890
Total Per Zone/District	**$3,394,605,675**	**$2,600,421,660**	**$4,188,789,690**

Alternative 1B Totals

	AVERAGE	*LOW*	*HIGH*
Total Roadway	$1,643,999,500	$1,318,502,000	$1,969,497,000
Total Bridges	$432,471,175	$356,289,660	$508,652,690
Total Interchanges	$1,318,135,000	$925,630,000	$1,710,640,000
Total Construction	**$3,394,605,675**	**$2,600,421,660**	**$4,188,789,690**

zone 1 | zone 2 | urban | rural

Alternative 2B EB

Roadway									
From	To	Length (miles)	# of Lanes	CPM AVERAGE	Cost AVERAGE	CPM LOW	Cost LOW	CPM HIGH	Cost HIGH
190	193	3	6	**$14,530,000**	$43,590,000	**$12,420,000**	$37,260,000	**$16,640,000**	$49,920,000
193	197	4	4	**$12,245,000**	$48,980,000	**$9,840,000**	$39,360,000	**$14,650,000**	$58,600,000
197	200	3	3	**$7,500,000**	$22,500,000	**$5,980,000**	$17,940,000	**$9,020,000**	$27,060,000
200	202.5	2.5	4	**$12,245,000**	$30,612,500	**$9,840,000**	$24,600,000	**$14,650,000**	$36,625,000
202.5	205	2.5	4	**$7,730,000**	$19,325,000	**$6,440,000**	$16,100,000	**$9,020,000**	$22,550,000
205	224.0	19	3	**$7,325,000**	$139,175,000	**$5,860,000**	$111,340,000	**$8,790,000**	$167,010,000
224	241.5	17.5	3	**$8,845,000**	$154,787,500	**$7,150,000**	$125,125,000	**$10,540,000**	$184,450,000
241.5	247	5.5	3	**$9,550,000**	$52,525,000	**$7,380,000**	$40,590,000	**$11,720,000**	$64,460,000
247	255	8	4	**$14,760,000**	$118,080,000	**$11,950,000**	$95,600,000	**$17,570,000**	$140,560,000
255	256	1	5	**$17,143,500**	$17,143,500	**$13,662,000**	$13,662,000	**$20,625,000**	$20,625,000
256	265	9	6	**$19,450,000**	$175,050,000	**$15,470,000**	$139,230,000	**$23,430,000**	$210,870,000
Total Roadway this Alternative					**$821,768,500**		**$660,807,000**		**$982,730,000**

Bridge									
			Area	CPSF Average	Cost AVERAGE	CPM LOW	Cost LOW	CPM HIGH	Cost HIGH
Zone 1	Mainline		349042	**$305**	$106,457,810	**$250**	$87,260,500	**$360**	$125,655,120
	Overpass		51215	**$305**	$15,620,575	**$250**	$12,803,750	**$360**	$18,437,400
Zone 2	Mainline		190435	**$350**	$66,652,250	**$290**	$55,226,150	**$410**	$78,078,350
	Overpass		113155	**$350**	$39,604,250	**$290**	$32,814,950	**$410**	$46,393,550
Total Bridge this Alternative					**$228,334,885**		**$188,105,350**		**$268,564,420**

	AVERAGE		**LOW**		**HIGH**
Total EB Roadway & Bridges this Alternative	**$1,050,103,385**		**$848,912,350**		**$1,251,294,420**

Alternative 2B WB

Roadway									
From	To	Length (miles)	# of Lanes	CPM AVERAGE	Cost AVERAGE	CPM LOW	Cost LOW	CPM HIGH	Cost HIGH
190	193	3	5	**$14,437,500**	$43,312,500	**$11,473,000**	$34,419,000	**$17,402,000**	$52,206,000
193	197	4	4	**$12,245,000**	$48,980,000	**$9,840,000**	$39,360,000	**$14,650,000**	$58,600,000
197	202.5	5.5	3	**$7,500,000**	$41,250,000	**$5,980,000**	$32,890,000	**$9,020,000**	$49,610,000
202.5	224	21.5	3	**$7,325,000**	$157,487,500	**$5,860,000**	$125,990,000	**$8,790,000**	$188,985,000
224	241.5	17.5	3	**$8,845,000**	$154,787,500	**$7,150,000**	$125,125,000	**$10,540,000**	$184,450,000
241.5	247	5.5	3	**$9,550,000**	$52,525,000	**$7,380,000**	$40,590,000	**$11,720,000**	$64,460,000
247	255	8	4	**$14,760,000**	$118,080,000	**$11,950,000**	$95,600,000	**$17,570,000**	$140,560,000
255	256	1	5	**$17,143,500**	$17,143,500	**$13,662,000**	$13,662,000	**$20,625,000**	$20,625,000
256	258	2	6	**$19,450,000**	$38,900,000	**$15,470,000**	$30,940,000	**$23,430,000**	$46,860,000
258	265	7	7	**$21,395,000**	$149,765,000	**$17,017,000**	$119,119,000	**$25,773,000**	$180,411,000
Total Roadway this Alternative					**$822,231,000**		**$657,695,000**		**$986,767,000**

Bridge									
			Area	CPSF Average	Cost AVERAGE	CPM LOW	Cost LOW	CPM HIGH	Cost HIGH
Zone 1	Mainline		301433	**$305**	$91,937,065	**$250**	$75,358,250	**$360**	$108,515,880
	Overpass		51215	**$305**	$15,620,575	**$250**	$12,803,750	**$360**	$18,437,400
Zone 2	Mainline		162784	**$350**	$56,974,400	**$290**	$47,207,360	**$410**	$66,741,440
	Overpass		113155	**$350**	$39,604,250	**$290**	$32,814,950	**$410**	$46,393,550
Total Bridge this Alternative					**$204,136,290**		**$168,184,310**		**$240,088,270**

	AVERAGE		**LOW**		**HIGH**
Total WB Roadway & Bridges this Alternative	**$1,026,367,290**		**$825,879,310**		**$1,226,855,270**

Alternative 2B Interchanges

Interchanges									
			Quantity	CPEach Average	Cost Average	CPEach LOW	Cost LOW	CPEach HIGH	Cost HIGH
Zone 1									
Urban	New		3	**$58,585,000**	$175,755,000	**$41,010,000**	$123,030,000	**$76,160,000**	$228,480,000
	Improve		3	**$38,080,000**	$114,240,000	**$29,290,000**	$87,870,000	**$46,870,000**	$140,610,000
Rural	New		0	**$49,795,000**	$0	**$35,150,000**	$0	**$64,440,000**	$0
	Improve		4	**$38,080,000**	$152,320,000	**$29,290,000**	$117,160,000	**$46,870,000**	$187,480,000
Zone 2									
Urban	New		5	**$67,370,000**	$336,850,000	**$46,870,000**	$234,350,000	**$87,870,000**	$439,350,000
	Improve		6	**$52,725,000**	$316,350,000	**$35,150,000**	$210,900,000	**$70,300,000**	$421,800,000
Rural	New		2	**$58,585,000**	$117,170,000	**$41,010,000**	$82,020,000	**$76,160,000**	$152,320,000
	Improve		2	**$52,725,000**	$105,450,000	**$35,150,000**	$70,300,000	**$70,300,000**	$140,600,000
Total Interchanges this Alternative					**$1,318,135,000**		**$925,630,000**		**$1,710,640,000**

Alternative 2B Tolling Costs

For Alternative 2B Full Toll Lanes, there were 24 tolling gantries assumed at a per gantry cost of @220,000 per gantry and toll shelter.
The TTMS which includes tolling equipment, software, back office work, and testing was approximately $2,000,000 per location.
The ITS duct bank of conduit and fiber was included at approximately $25 per linear foot for the 75 mile long corridor.
For Richmond District, the interchanges include Exit 190 – Exit 220; for Hampton Roads District, the interchanges include Exit 227 – Exit 264
For Richmond District, the mileage includes MM 190 to MM 224.6; for Hampton Roads District, the mileage includes MM 224.6 to MM 265

Using these assumptions the total estimated costs for Corridor Tolling are:
24 gantries @ $2,220,000 = $53,280,000
ITS Duct and Fiber @ 396,000 feet x $25 / ft = $9,900,000
Corridor Total = $63,180,000

	# of Interchanges	$ Gantry x # Interchanges	I-64 Mileage	$ ITS Duct x Miles	Tolling Costs
Zone 1 (Richmond District)	10	$22,200,000	34.6	$4,567,200	$26,767,200
Zone 2 (Hampton Roads District)	14	$31,080,000	40.4	$5,332,800	$36,412,800
Total Per Zone/District	**24**	**$53,280,000**	**75.0**	**$9,900,000**	**$63,180,000**

Alternative 2B Sub-Totals			
	AVERAGE	*LOW*	*HIGH*
Zone 1 (Richmond District)	$1,293,930,725	$1,022,312,450	$1,565,549,000
Zone 2 (Hampton Roads District)	$2,163,854,950	$1,641,289,210	$2,686,420,690
Total Per Zone/District	**$3,457,785,675**	**$2,663,601,660**	**$4,251,969,690**

Alternative 2B Totals			
	AVERAGE	*LOW*	*HIGH*
Total Roadway	$1,643,999,500	$1,318,502,000	$1,969,497,000
Total Bridges	$432,471,175	$356,289,660	$508,652,690
Total Interchanges	$1,318,135,000	$925,630,000	$1,710,640,000
Corridor Tolling	$63,180,000	$63,180,000	$63,180,000
Total Construction	**$3,457,785,675**	**$2,663,601,660**	**$4,251,969,690**

zone 1 | zone 2 | urban | rural

Alternative 3 EB

Roadway

From	To	Length (miles)	# of Lanes	CPM AVERAGE	Cost AVERAGE	CPM LOW	Cost LOW	CPM HIGH	Cost HIGH
190	198	8	4	**$12,367,450**	$98,939,600	**$9,938,400**	$79,507,200	**$14,796,500**	$118,372,000
198	202.5	4.5	3	**$7,575,000**	$34,087,500	**$6,039,800**	$27,179,100	**$9,110,200**	$40,995,900
202.5	224	21.5	3	**$7,398,250**	$159,062,375	**$5,918,600**	$127,249,900	**$8,877,900**	$190,874,850
224	241.5	17.5	3	**$8,933,450**	$156,335,375	**$7,221,500**	$126,376,250	**$10,645,400**	$186,294,500
241.5	247	5.5	3	**$9,645,500**	$53,050,250	**$7,453,800**	$40,995,900	**$11,837,200**	$65,104,600
247	254	7	4	**$14,907,600**	$104,353,200	**$12,069,500**	$84,486,500	**$17,745,700**	$124,219,900
254	265	11	5	**$16,236,000**	$178,596,000	**$13,145,000**	$144,595,000	**$19,327,000**	$212,597,000
Total Roadway this Alternative					**$784,424,300**		**$630,389,850**		**$938,458,750**

Bridge

			Area	CPSF Average	Cost AVERAGE	CPM LOW	Cost LOW	CPM HIGH	Cost HIGH
Zone 1	Mainline		349042	**$308**	$107,522,388	**$253**	$88,133,105	**$364**	$126,911,671
	Overpass		50668	**$308**	$15,608,277	**$253**	$12,793,670	**$364**	$18,422,885
Zone 2	Mainline		190435	**$354**	$67,318,773	**$293**	$55,778,412	**$414**	$78,859,134
	Overpass		111943	**$354**	$39,571,851	**$293**	$32,788,105	**$414**	$46,355,596
Total Bridge this Alternative					**$230,021,289**		**$189,493,291**		**$270,549,286**

	AVERAGE		**LOW**		**HIGH**
Total EB Roadway & Bridges this Alternative	**$1,014,445,589**		**$819,883,141**		**$1,209,008,036**

Alternative 3 WB

Roadway

From	To	Length (miles)	# of Lanes	CPM AVERAGE	Cost AVERAGE	CPM LOW	Cost LOW	CPM HIGH	Cost HIGH
190	198	8	4	**$12,367,450**	$98,939,600	**$9,938,400**	$79,507,200	**$14,796,500**	$118,372,000
198	202.5	4.5	3	**$7,575,000**	$34,087,500	**$6,039,800**	$27,179,100	**$9,110,200**	$40,995,900
202.5	224	21.5	3	**$7,398,250**	$159,062,375	**$5,918,600**	$127,249,900	**$8,877,900**	$190,874,850
224	241.5	17.5	3	**$8,933,450**	$156,335,375	**$7,221,500**	$126,376,250	**$10,645,400**	$186,294,500
241.5	247	5.5	3	**$9,645,500**	$53,050,250	**$7,453,800**	$40,995,900	**$11,837,200**	$65,104,600
247	254	7	4	**$14,907,600**	$104,353,200	**$12,069,500**	$84,486,500	**$17,745,700**	$124,219,900
254	258	4	5	**$16,398,360**	$65,593,440	**$13,276,450**	$53,105,800	**$19,520,270**	$78,081,080
258	265	7	6	**$19,644,500**	$137,511,500	**$15,624,700**	$109,372,900	**$23,664,300**	$165,650,100
Total Roadway this Alternative					**$808,933,240**		**$648,273,550**		**$969,592,930**

Bridge

			Area	CPSF Average	Cost AVERAGE	CPM LOW	Cost LOW	CPM HIGH	Cost HIGH
Zone 1	Mainline		301433	**$308**	$92,856,436	**$253**	$76,111,833	**$364**	$109,601,039
	Overpass		50668	**$308**	$15,608,277	**$253**	$12,793,670	**$364**	$18,422,885
Zone 2	Mainline		162784	**$354**	$57,544,144	**$293**	$47,679,434	**$414**	$67,408,854
	Overpass		111943	**$354**	$39,571,851	**$293**	$32,788,105	**$414**	$46,355,596
Total Bridge this Alternative					**$205,580,708**		**$169,373,041**		**$241,788,374**

	AVERAGE		**LOW**		**HIGH**
Total WB Roadway & Bridges this Alternative	**$1,014,513,948**		**$817,646,591**		**$1,211,381,304**

Alternative 3 Interchanges

Interchanges

			Quantity	CPEach Average	Cost Average	CPEach LOW	Cost LOW	CPEach HIGH	Cost HIGH
Zone 1									
Urban	New		3	**$58,585,000**	$210,906,000	**$41,010,000**	$147,636,000	**$76,160,000**	$274,176,000
	Improve		3	**$38,080,000**	$137,088,000	**$29,290,000**	$105,444,000	**$46,870,000**	$168,732,000
Rural	New		0	**$49,795,000**	$0	**$35,150,000**	$0	**$64,440,000**	$0
	Improve		4	**$38,080,000**	$182,784,000	**$29,290,000**	$140,592,000	**$46,870,000**	$224,976,000
Zone 2									
Urban	New		5	**$67,370,000**	$404,220,000	**$46,870,000**	$281,220,000	**$87,870,000**	$527,220,000
	Improve		6	**$52,725,000**	$379,620,000	**$35,150,000**	$253,080,000	**$70,300,000**	$506,160,000
Rural	New		2	**$58,585,000**	$140,604,000	**$41,010,000**	$98,424,000	**$76,160,000**	$182,784,000
	Improve		2	**$52,725,000**	$126,540,000	**$35,150,000**	$84,360,000	**$70,300,000**	$168,720,000
Total Interchanges this Alternative					**$1,581,762,000**		**$1,110,756,000**		**$2,052,768,000**

*20 percent added to interchanges totals because of managed lanes needs

No Tolling Costs Included for Alternative 3

Alternative 3 Managed Lanes costs do not include any tolling gantries.
If High Occupancy / Toll (HOT) Lanes or Express Toll Lanes (ETL) are selected, additional costs would be needed for gantries and tolling equipment.

Alternative 3 Sub-Totals

	AVERAGE	*LOW*	*HIGH*
Zone 1 (Richmond District)	$1,346,552,329	$1,051,376,678	$1,641,727,980
Zone 2 (Hampton Roads District)	$2,264,169,208	$1,696,909,055	$2,831,429,361
Total Per Zone/District	**$3,610,721,536**	**$2,748,285,732**	**$4,473,157,340**

Alternative 3 Totals

	AVERAGE	*LOW*	*HIGH*
Total Roadway	$1,593,357,540	$1,278,663,400	$1,908,051,680
Total Bridges	$435,601,996	$358,866,332	$512,337,660
Total Interchanges	$1,581,762,000	$1,110,756,000	$2,052,768,000
Total Construction	**$3,610,721,536**	**$2,748,285,732**	**$4,473,157,340**


Richmond
Wmsr
Ft Eustis Blvd
Ft Eustis
Exit
Ft Eustis Blvd
Yorktown


1971