INTERSTATE 64 PENINSULA STUDY

ALTERNATIVES DEVELOPMENT TECHNICAL MEMORANDUM

DECEMBER 2013

VDOT
Virginia Department of Transportation

1401 EAST BROAD STREET
RICHMOND, VA 23219

Errata Record

Technical Memorandum: Alternatives Development Technical Memorandum

Errata Record Date: December 2013

Summary: As described in Chapter II of the Final Environmental Impact Statement (EIS), the implementation of the Preferred Alternative – Alternative 1 would occur via the construction of operationally independent sections as funding is identified. The study included in this errata record was completed after the Draft EIS to provide information on the first likely operationally independent section identified by the Hampton Roads Transportation Planning Organization. This study was prepared specifically to meet the planning needs of the Hampton Roads Transportation Planning Organization and does not represent a required format or process for the identification of future operationally independent sections. Additional information on the process for implementing operationally independent sections can be found in Appendix L – Phased Approach for Implementation – NEPA Process of the Final EIS.

Document Location	Differences in Original Text and Amendment (Amendment Text replaces the Original Text (where applicable) and the Original Text is no longer valid)
Appendix G	Original Text: Original Technical Memorandum did not include this study Amendment: The *I-64 Improvements Study – Exit 255 (Jefferson Avenue) to Exit 234 (Lightfoot Avenue) Study,* dated July 3, 2013, is included as part of this Errata Record as an Appendix.

I-64 Improvements Study

Exit 255 (Jefferson Avenue) to Exit 234 (Lightfoot)
York & James City Counties
City of Newport News

July 3, 2013

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Introduction:

The Federal Highway Administration (FHWA) and the Virginia Department of Transportation (VDOT) are in the process of preparing an Environmental Impact Statement (EIS) for the Interstate 64 Peninsula Study, a 75-mile long corridor from Richmond to Hampton. The Draft EIS was released for public review in November 2012 and Location Public Hearings were held in Richmond, Williamsburg, and Newport News in December 2012.

On April 17, 2013, the Commonwealth Transportation Board (CTB) identified the Preferred Alternative for the Interstate 64 Peninsula Study as Alternative 1 General Purpose Widening. Alternative 1 allows for the option to widen to the outside of the existing road corridor or within the median to be determined on a section-by-section basis. FHWA and VDOT are working to document the Preferred Alternative in a Final EIS which is scheduled to be published later this year.

The CTB action was informed by a resolution passed on April 4, 2013, by the Richmond Area Metropolitan Planning Organization identifying Alternative 1B in the Draft EIS as its locally preferred alternative, subject to conditions relating to right of way acquisition and design. In addition, at its March 6, 2013 meeting, the Hampton Roads Transportation Planning Organization (TPO) Transportation Technical Advisory Committee recommended Alternative 1A as the locally preferred alternative, with the caveat that Context Sensitive Design be applied, as well as a phased approach (build in fundable sections) for construction of the project. On May 15, 2013, VDOT then released the Draft 2014-2019 SYIP that includes $100 million in funding for Capacity Improvements to Interstate 64 (I-64) from the City of Newport News to the City of Williamsburg. In developing strategies to effectively utilize this funding, the Hampton Roads TPO approved and adopted a resolution on June 20, 2013, endorsing intermediate congestion relief for the operationally independent section of I-64 from Exit 255 (Jefferson Avenue) to Exit 242 (Humelsine Parkway) on the condition that this preference would not preclude the I-64 Peninsula expansion or future associated funding.

Once the Final EIS is published, the section identified in the Hampton Roads TPO resolution may be advanced as the first operationally independent section of the study. The identification of this section, along with additional details about road widening and subsequent impacts, would be documented by FHWA in a Record of Decision (ROD). The Metropolitan Planning Regulations (23 CFR 450) and the Clean Air Act (CAA) Transportation Conformity Rule (40 CFR 93) require that a project located in a metropolitan planning area and/or in a CAA nonattainment or maintenance area be contained in a conforming, fiscally-constrained LRTP. FHWA may issue a ROD only if the project improvements are included in a conforming, fiscally constrained LRTP. Once fiscal constraint is demonstrated for one of these operationally independent sections, FHWA will issue a ROD documenting the agency's Selected Action for the given section.

Once a ROD has been issued, considerable time will be required to prepare designs

and acquire necessary rights of way before construction can begin. To accelerate this process, the VDOT Hampton Roads District (the District) is seeking to refine the engineering and cost analysis included in the Draft EIS to provide the Hampton Roads TPO with a better understanding of the level of funding that would be required to achieve certain levels of improvement along the I-64 corridor. Specifically, the District and the Hampton Roads TPO are focusing on a 21-mile section of I-64 from the Lightfoot Interchange (Exit 234) to the Jefferson Avenue Interchange (Exit 255) in York and James City Counties and the City of Newport News. This 21-mile section is the most significantly congested section of the I-64 peninsula corridor, both during typical weekday peak hour conditions and summer weekends when this road is heavily utilized by beach-going traffic. The improvements being considered along this corridor are consistent with the Preferred Alternative and would contribute to the purpose and need elements of improved capacity, safety and hurricane evacuation.

The I-64 Improvement Study is designed to assist the District and Hampton Roads TPO in evaluating section improvements that are consistent with the Preferred Alternative and contribute to the purpose and need of the EIS. Section improvements are rated through the use of an evaluation matrix utilizing key elements such as cost, traffic operations and safety.

Study Sections:

The 21-mile study corridor was divided into four stand-alone sections (Figure 1):

1. Section I – Jefferson Avenue (Exit 255) to west of Route 105 (Exit 250)

2. Section II – west of Route 105 (Exit 250) to Route 199/Water Country (Exit 242)

3. Section III – Route 199/Water Country (Exit 242) to Route 143/Colonial Williamsburg (Exit 238)

4. Section IV – Route 143/Colonial Williamsburg (Exit 238) to Route 199/Lightfoot (Exit 234)

Existing Conditions:

The existing roadway section for the four Study Sections was determined using as-built plans from VDOT Project No. 0064-121-101. The existing section utilized two (2) 12' traffic lanes in each direction, 3' paved inside shoulders and 10' paved outside shoulders. Traffic lanes are 9" concrete pavement over stabilized base and crowned at the centerline of lanes. Existing shoulders are 3" of bituminous concrete over a stabilized base. The existing median width is 64'. Embankment width is 142' to slope hinge points.

Improvement Options:

Three improvement options (Figures 2 through 4) were developed for the I-64

Improvement Study. Options 1 and 2 were developed using at least minimum AASHTO design standards for lane and shoulder widths. The use of design exceptions to minimum AASHTO standards was not considered for the purpose of this study:

1. **Option 1: 6-Lane Widening** – This improvement option (Figure 2) includes the addition of one (1) 12' lane and 12' shoulder in each direction within the existing 64' wide median of I-64. Eastbound and westbound traffic would be separated by use of guardrail. New median drainage would be added along with stormwater management (SWM) facilities to control and treat runoff. Mainline bridges would require widening or reconstruction. This option would be consistent with the Preferred Alternative and would contribute to the purpose and need as identified in the EIS.

2. **Option 2: 8-Lane Widening** – This improvement option (Figure 3) includes the addition of two (2) 12' lanes and minimum width (AASHTO) 10' inside shoulders in each direction. Widening would be primarily to the inside with minor widening to the outside. By using the minimum width shoulders, the proposed typical section would require minimal embankment widening. Eastbound and westbound traffic will be separated by a concrete median barrier. New median drainage would be added along with SWM facilities to control and treat runoff.

   Option 2 was not considered for Sections III and IV, as the Draft EIS recommended only adding one through lane in each direction for those two sections. In Section II, a hybrid Option 2A was developed. Option 2A consists of adding one lane in each direction from Route 60/Busch Gardens (Exit 243) to the Yorktown Interchange (Exit 247) as described in Option 1, and then applying Option 2 to the section from Exit 247 to west of Route 105 (Exit 250). This hybrid Option 2A was developed to keep the Section limits to a reasonable length and conform to the Draft EIS. This option would be consistent with the Preferred Alternative and would contribute to the purpose and need of the EIS.

3. **Option 3: Peak Hour Managed Shoulder Usage** – This option (Figure 4) is outside of the EIS scope and could be developed independently of the EIS. It would include reconstructing the existing 10' wide outside shoulders to 14' wide to create peak hour managed shoulders (also known as "hard shoulder running"). The hard shoulder running lanes would be designated for use during peak hours only, similar to existing shoulders on I-66 in northern Virginia. Additional analysis would be needed to determine the hours of operations for these hard shoulder running lanes (both during weekday peak periods and summer weekends), as well as other operational details such as whether to allow buses and trucks to use the shoulder lanes.

   During off-peak times, the hard shoulder running lanes would not be used as a travel lane. Various forms of signage would be important to provide motorists with clear indications of when the shoulder is open for travel and when it is not. These would include static signs indicating the start and end locations and typical times of peak hour managed shoulder use, as well as dynamic overhead lane control

signals (red X or green down arrow indications) to indicate whether the shoulder is open or closed as a travel lane at that moment. The limits of the hard shoulder running lanes should also be indicated by different color pavement, which was done with light brown pavement in a section of managed shoulder on I-66 in Northern Virginia. Changeable message signs (CMS) would also be used to reinforce guidance to motorists. The overhead lane control signals and CMS should be linked to the VDOT Hampton Roads Traffic Operations Center, giving VDOT staff the ability to instantly change the indications and messages from a remote location as conditions warrant.

Emergency pull-out areas would be constructed to the outside of the shoulders to accommodate vehicle breakdowns during peak periods when the shoulder is being used as a travel lane. These pull-out areas would be constructed in logical locations where space is available and would depend on proximity to interchange ramps. Emergency pull-outs are recommended to be spaced at half-mile intervals wherever possible. Each emergency pull-off would be 1050' long and 16' wide.

The hard shoulder running lane would not carry through cloverleaf interchanges (Figure 5). It would end upstream of the cloverleaf interchange at the mainline exit ramp and would begin again on the downstream side of the interchange at the entrance ramp to the mainline roadway.

Evaluation of Improvement Options:

Each section was analyzed for the 3 improvement options noted above. Each section was first analyzed for any fatal flaws that may eliminate a particular improvement option. Option 2 has been eliminated for consideration in Sections III and IV as this is not an alternative under consideration in the Draft EIS at these locations. While several high cost features were noted in several sections, these were not considered fatal flaws.

An evaluation matrix was developed for each section to compare the costs and benefits of each option based on seven key project elements:

1. **Cost** – a planning level cost estimate utilizing estimated major construction items and appropriate contingencies, including consideration for providing context sensitive design features, was developed for all Options within each Section. These estimates were compared against estimates developed using average lane costs per mile (CPM) for reconstruction provided by VDOT. Right of way costs were estimated by acre. Right of way unit costs were coordinated through the VDOT Hampton Roads District Right of Way Section. Total construction and right of way costs have been tabulated in the Evaluation Matrices (Figures 6 through 9). Cost estimate details can be found in Appendix A.

   For the purposes of this study it was assumed that the existing mainline concrete pavement would not be replaced. It was also assumed that existing bridges could be widened where feasible. The existing inside and outside shoulder structural capacity is not sufficient to carry high volume traffic. In addition, under-drain failures have

been reported along the inside edge of the outside shoulder at several locations. These issues and constructability issues will require shoulders to be reconstructed as full depth shoulders capable of carrying traffic.

Additional assumptions made in developing the cost estimates are listed below:

- Option 1
  - Widening into the median to provide one additional 12' travel lane and a 12' inside shoulder in each direction.
  - Existing mainline concrete pavement to remain.
  - Existing inside and outside shoulders to be reconstructed.
  - Adjustments to shift the roadway crown location one lane to the inside were not considered.
  - A cost for adding mechanically stabilized earth walls in the median was included to account for grade differences due to superelevation and median bifurcation.
  - All I-64 mainline bridges were assumed to be widened rather than reconstructed except the bridge over Queen Creek.
  - All side road bridges over I-64 were assumed to remain in place unless the proposed I-64 mainline typical section could not be maintained when under passing these structures.
  - The number and locations of SWM facilities were estimated based on a planning level estimate of runoff created by additional paving. The SWM scenario for each particular Section which created the most runoff was used to calculate all other Option costs within that Section.
  - Right-of-way acquisition will be necessary for SWM facilities. It was assumed that each SWM facility would require approximately one acre of right of way acquisition.
  - Right-of-way costs were estimated on a per acre basis.
  - Interchange configurations would remain as is and interchange ramps would not be affected.
  - Sound walls were assumed as indicated in the I-64 Peninsula EIS *Noise Technical Memorandum*.

- Option 2
  - Widening into the median to provide two additional 12' travel lanes, and a 22' median with 2' concrete median barrier.
  - Adjustments to shift roadway crown and overlay existing mainline concrete pavement were assumed and included in estimate.
  - Existing inside and outside shoulders will be reconstructed.
  - A cost for adding mechanically stabilized earth walls in the median was included to account for grade differences due to superelevation and median bifurcation.
  - All I-64 mainline bridges will be replaced.
  - All side road bridges over I-64 will be replaced unless the I-64 mainline typical section could be accommodated.
  - The number and locations of SWM facilities were estimated based on a

planning level estimate of runoff created by additional paving. The SWM scenario for each particular Section which created the most runoff was used to calculate all other Option costs within that Section.
- Right-of-way acquisition will be necessary for SWM facilities. It was assumed that each SWM facility would require approximately one acre of right of way acquisition.
- Right-of-way costs were estimated on a per acre basis.
- Sound walls were assumed as indicated in the I-64 Peninsula EIS *Noise Technical Memorandum*.

- Option 3
  - Outside shoulder will be reconstructed to 14' wide.
  - Existing inside shoulders will be reconstructed.
  - 1050' long and 16' wide emergency pull-offs will be provided at approximately half-mile intervals.
  - ITS infrastructure will be added throughout the corridor.
  - Minor pavement overlays on ramps may be required to adjust striping but was not accounted for in the estimate.
  - The number and locations of SWM facilities were estimated based on a planning level estimate of runoff created by additional paving. The SWM scenario for each particular Section which created the most runoff was used to calculate all other Option costs within that Section.
  - Right-of-way acquisition will be necessary for SWM facilities. It was assumed that each SWM facility would require approximately one acre of right of way acquisition.
  - Right-of-way costs were estimated on a per acre basis.
  - Sound walls were assumed as indicated in the I-64 Peninsula EIS *Noise Technical Memorandum*.

2. **Traffic Operations** – As part of the Draft EIS, all the basic freeway sections between each interchange of I-64 were analyzed for the design year 2040 weekday AM and PM peak hours in accordance with the methodology of the *2010 Highway Capacity Manual*. For freeway sections, the analysis results are given as Level of Service (LOS) based on density (vehicles per mile per lane). In addition to the 2040 volumes, 2025 volumes were developed and analyzed for Sections I and II only. The detailed traffic analysis results were tabulated and are provided in Appendix B. The results include LOS as well as V/C (volume-to-capacity) ratios for each option, basic freeway section, direction, and peak hour (AM and PM). Basic LOS and V/C ratio results are also noted in the Evaluation Matrices (Figures 6 through 9).

   Appendix C provides a detailed explanation by Corridor Section of how each Improvement Option would be configured through each interchange and along freeway sections between interchanges.

3. **Safety** – Safety concerns were evaluated based on engineering judgment. This was done for each corridor section and each option, and the results are listed in the Evaluation Matrices (Figures 6 through 9).

4. **Environmental Impacts** – Data available from the I-64 Peninsula EIS *Historic Properties Documentation* and *Natural Resources Technical Memorandum* was used to make a qualitative assessment of environmental and historic property impacts for each improvement option. Impacts are documented in the Evaluation Matrices (Figures 6 through 9).

5. **Complexity** – Each improvement option was evaluated in terms of construction phasing complexity. Construction complexities due to the minimal structural capacity of the shoulders are common for all options and sections. Each option will require replacing the 3' inside shoulder with paving strong enough and wide enough to accommodate temporary traffic. It is anticipated that this work would be performed at night using a lane closure on I-64. Once the inside shoulder was reconstructed, traffic could then shift to allow for temporary concrete barrier to be placed along the outside shoulder in order to reconstruct the shoulder pavement and under-drains.

   Construction through wetlands, historic areas, interchanges and near military installations will also require complex phasing plans and additional coordination with resource agencies, military command and the public.

   Items are noted in the Evaluation Matrices (Figures 6 through 9).

6. **Major Risks** – Major risks that could affect the cost or feasibility of each option were identified including compatibility with EIS Preferred Alternative and documented in the Evaluation Matrices (Figures 6 through 9).

   I-64 is bounded by Department of Defense lands, Camp Peary and Yorktown Naval Weapons Station. During the I-64 Peninsula EIS study, these installations were noted as key constraints. The Department of Defense strongly objected to any alternatives which would expand I-64's footprint to the north at the Yorktown Naval Weapons Station, even within the existing ROW, as it would have a significant impact on their weapons testing operations.

   I-64 crosses the Newport News Reservoir just west of the Fort Eustis Interchange. This reservoir is the main fresh water source for the City of Newport News. As such, additional pollution control and sediment and erosion control measures will be necessary during construction.

7. **Time to Deliver** – The feasibility of Design-Build and Design-Bid-Build delivery methods were evaluated for their potential applicability to each Option. A time to deliver for each delivery method was also estimated. Estimated time to deliver and for delivery methods are included in the Evaluation Matrices (Figures 6 thorough 9) and detailed in Appendix D.

Independent Utility Review:

Each Section with varying Options has been determined to have logical termini and

independent utility since they have rational end points and can function on their own without requiring or causing additional improvements to be made along the corridor in the foreseeable future. Specific locations and details of transitions and tapers will be determined during the design phase.

However, if improvements need to be prioritized and built separately, it is recommended that the first priority improvement be considered Section I to avoid creating a bottleneck situation (I-64 westbound going from 4 lanes east of Exit 255, to 2 lanes, to 3 lanes, or vice versa). In addition, if Option 3 is selected for some Sections but not others, additional analysis would be required to assess how traffic will transition in and out of the shoulder lanes at those locations.

Evaluation Matrices Summary:

Evaluation matrices for each section comparing the costs and benefits of each option are included in Figures 6 thru 9. A summary matrix with recommended Option for each Section is shown in Figure 10.

1. Section I and Section II

Cost: Option 3 is the least expensive option for these sections. However, Option 3 would have significantly greater operational costs than Options 1 or 2 due to ITS infrastructure maintenance considerations. Additionally, daily operating costs would be incurred to monitor the opening and closing of the hard shoulder running lane. Option 3 ITS operating and maintenance costs were not included in cost estimates.

Option 1 is just over 2 times the cost of Option 3. Major cost items for Option 1 include 24' widening of mainline bridges over Industrial Parkway, Route 105, City Reservoir, Yorktown Road, Jefferson Avenue and Burma Road. Bridge replacement would be required for Route 199 over I-64.

Option 2/2A is over 1.5 times the cost of Option 1. Major cost items for Option 2/2A include mainline bridge replacement over Industrial Parkway and City Reservoir. Side road over I-64 bridge replacements are required at Denbigh Road, Bland Road and Route 199. Bridge widening of 24' is required for mainline bridges over Yorktown Road, Jefferson Avenue and Burma Road. Option 2/2A also will require reconstruction of the Fort Eustis interchange to a single point interchange configuration.

As noted above in the discussion on Improvement Options, Option 2A for Section II is a hybrid of Option 1 and Option 2. This is necessary to conform to EIS recommendations. Section II is 7.33 miles in length. Of that distance, 1.5 miles will contain 8 lanes when complete and 5.83 miles will contain 6 lanes when complete. As can be seen in the Evaluation Matrices this skews the difference in cost between Option 1 and Option 2 for this section as compared to Section I.

Traffic Operations and Safety: From a traffic operations and safety perspective, Option 2/2A would provide the most benefits for the Section I and Section II corridor.

Option 2/2A would provide two additional lanes in Section I and the eastern portion of Section II, and one additional lane in the western portion of Section II. It would result in LOS C or better for every basic freeway section in both directions of I-64.

Option 1 would provide less benefit in terms of traffic operations and safety for Section I and Section II as the freeway sections east of MP 247 would each operate at LOS C or LOS D during the peak hours.

Option 3 would provide higher peak period capacity than the no-build scenario. However, Option 3 adds the least capacity and least benefit from a traffic operations and safety perspective. An evaluation of Option 3 for the entire corridor indicates that many of the basic freeway sections in Section I and Section II would operate at LOS D, E, or F, especially in the off-peak direction where no capacity would be added (i.e., westbound during the morning peak and eastbound during the afternoon peak). In addition, the hard shoulder running lanes would not carry through the Fort Eustis Interchange or the Water Country Interchange.

Environmental Impacts: There are relatively minor differences between environmental impacts for all 3 options within Section I and Section II. Most of the potential environmental impacts would be from SWM facilities common to all options and emergency pull-off locations required by Option 3.

Complexity: Construction complexity is least for Option 3 in Section I and II, requiring a minimum of 2 phases to complete. Option 1 would require an additional construction phase in the mainline median to complete and would also require widening all mainline bridges as well as replacement of a side road bridge. In Section I and II, Option 2/2A is by far the most complex option to construct. It would require numerous phases for mainline widening, numerous bridge replacements and widening and reconstruction of the Fort Eustis Interchange.

Major Risks: In Section I and II, most of the infrastructure constructed for Option 1 could be incorporated into the ultimate I-64 build out section considered in the EIS. However, Option 1 mainline bridges located to the east of and including the Fort Eustis Interchange would need to be replaced to accommodate the full EIS build out section.

Some of the infrastructure constructed for Option 3 could also be incorporated into the ultimate build out considered in the EIS. However, much of the ITS infrastructure necessary to construct this option may not be practicable practical for reuse in the ultimate build out scenario. If Option 3 is implemented, a careful evaluation of sight distance will be required to assure feasibility. When traffic is running on the shoulder, their stopping sight distance for horizontal curves to the right will be less than the stopping sight distance for drivers in the regular travel lanes. In particular, any proposed noise barriers may need to be shifted away from the shoulder in order to avoid impacting stopping sight distance.

Other major risk factors such as SWM facility location, and environmental and right of way impacts are relatively equal for all options throughout Section I and II.

Time to Deliver: As shown in Appendix D, the Design/Build project delivery method would offer advantages to the traditional Design/Bid/.Build delivery method for Options 1 and 2. The Design/Bid/Build delivery method was preferred for Option 3 due to the short plan development time required for this option.

Recommendation: The operational efficiencies and safety benefits that Option 1 and Option 2/2A provide in Section I and Section II far outweigh the minimal increases realized by Option 3. Additionally, Option 3 would typically only be considered for highly urbanized corridors where expansion cannot occur within the existing right of way. I-64 through Section I and Section II has a 64' wide median available for roadway expansion and a right of way width that will accommodate construction of either Option 1 or Option 2/2A.

Based on these considerations and as shown in the Summary Evaluation Matrix in Figure 10, Option 1 is the recommended alternative for Sections I and II.

2. Section III and Section IV

Cost: Option 3 is almost 2 times less expensive than Option 1 in Section III and IV. However, Option 3 would have significantly greater operational costs than Options 1 or 2 due to ITS infrastructure maintenance considerations. Additionally, daily operating costs would be incurred to monitor the opening and closing of the hard running shoulders. Option 3 ITS operating and maintenance costs were not included in cost estimates.

Option 1 will require a 24' widening to all 4 mainline bridges within these sections. Bridge replacement would be required for side roads over I-64 at Route 716, Route 143 and Route 604.

Option 3 will require replacement of the I-64 mainline structure over Queen Creek and the Route 716 side road structure over I-64.

Traffic Operations and Safety: Option 1 would provide the most benefits for Section III and Section IV from a traffic operations perspective. As noted above this option is consistent with the Preferred Alternative and would contribute to the purpose and need as identified in the EIS. Option 1 freeway sections west of MP 247 would each operate at LOS B or LOS C during the peak hours.

Option 3 would provide higher peak period capacity than the no-build scenario. However, Option 3 adds the least capacity and least benefit from a traffic operations and safety perspective. An evaluation of Option 3 for the entire corridor indicates that many of the basic freeway sections in Section III and Section IV would operate at LOS C or D, especially in the off-peak direction where no capacity would be added (i.e., westbound during the morning peak and eastbound during the afternoon peak). In addition, the hard shoulder running lane would not carry through the westbound lanes of the Route 143 (Merrimac Trail) Interchange.

Environmental Impacts: There are relatively minor differences between environmental impacts for both options within Section III and Section IV. Most of the potential environmental impacts would be from SWM facilities and bridge widening/replacement common to both options and emergency pull-off locations required by Option 3.

Complexity: Construction complexity is least for Option 3 in Section III and IV, requiring a minimum of 2 phases to complete. Option 1 would require an additional construction phase in the mainline median to complete and would also require widening all mainline bridges as well as replacement of 3 side road bridges.

Interchange modifications would be very minimal for Option I with the exception of the Route 143 (Merrimac Trail) bridge located at the terminus of Section III/Section IV. Total reconstruction of this interchange should be evaluated for this Option.

Again, much of the ITS infrastructure necessary to construct Option 3 may not be practical for reuse in the ultimate build out scenario. Interchange ramp modifications would again be necessary for this option in order for the hard shoulder lanes to operate as intended during peak and non-peak hours. However, this would not require reconstruction of the interchanges and would therefore allow for separate programming of costly interchange improvements.

Major Risks: In Section III and IV, all Option 1 construction meets the ultimate I-64 build out section considered in the EIS.

Some of the infrastructure constructed for Option 3 could also be incorporated into the ultimate build out considered in the EIS. However, much of the ITS infrastructure necessary to construct this option may not be practical for reuse in the ultimate build out scenario. If Option 3 is implemented, a careful evaluation of sight distance will be required to assure feasibility. When traffic is running on the shoulder, their stopping sight distance for horizontal curves to the right will be less than the stopping sight distance for drivers in the regular travel lanes. In particular, any proposed noise barriers may need to be shifted away from the shoulder in order to avoid impacting stopping sight distance.

Other major risk factors such as SWM facility location, and environmental and right of way impacts are relatively equal for all options throughout Section III and IV.

Time to Deliver: Design/Bid/Build is the recommended delivery method for Option 1 in Section III and IV due to potential wetland impacts to the I-64 mainline structure over Queen Creek, potential impacts to the ornate structure over the Colonial National Historic Highway and potential right of way impacts to Camp Peary. The Design/Bid/Build delivery method was preferred for Option 3 due to the short plan development time required for this option.

Recommendation: Option 1 provides operational efficiencies and safety benefits in Section III and Section IV that outweigh those realized by Option 3. As noted above

Option 3 would typically only be considered for highly urbanized corridors where expansion cannot occur within the existing right of way. The Section III and Section IV corridor is not an urban corridor. Also, I-64 has a 64' wide median through Section III and Section IV which is sufficient width for construction of Option 1.

Based on these considerations and as shown in the Summary Evaluation Matrix shown in Figure 10, Option 1 is the recommended alternative for Sections III and IV.

Additional Considerations:

1. **Option 1A (Section I and II)**

   This option was suggested by VDOT and would utilize the **inside** shoulder constructed in Option 1 as a hard shoulder running lane. This option is operationally feasible and would require ITS facilities be located in the median. Emergency pull-off locations would also need to be constructed in the median. This could be accomplished by constructing separate emergency pull-off locations for eastbound and westbound traffic in series along the length of the median. The cost to include the inside hard shoulder running lanes in Option 1 would be approximately $1M/ mile.

   An LOS analysis was not performed for this option but it can be reasoned that the LOS will fall somewhere between that determined for Option 1 and Option 2.

   Environmental impacts and complexity would generally be the same as Option 2/2A for these sections.

   Much of the infrastructure constructed for this option between the Jefferson Avenue Interchange and the Fort Eustis Interchange would need to be removed to construct the final EIS recommended section in this area. Pavement and median drainage system could be reused if the full EIS section is accounted for during Option 1A design. Most of the ITS facilities would need to be removed.

   Option 1A was included in the Summary Matrix (Figure 10).

2. **Potential Locations for Design Exceptions**

   Many existing side road and interchange overpass bridges could remain in place with the proposed 6-lane section if Design Exceptions were obtained to allow for substandard inside shoulders at center pier locations. Pier crash walls would need to be constructed to protect existing bridge piers. The large cost savings realized by not having to replace a side road or interchange overpass bridge would generally outweigh the risk of narrowing of shoulders through the interchange or side road overpass areas. This would be true for the proposed 8-lane section if Design Exceptions were also obtained for substandard outside shoulders at end span pier locations.

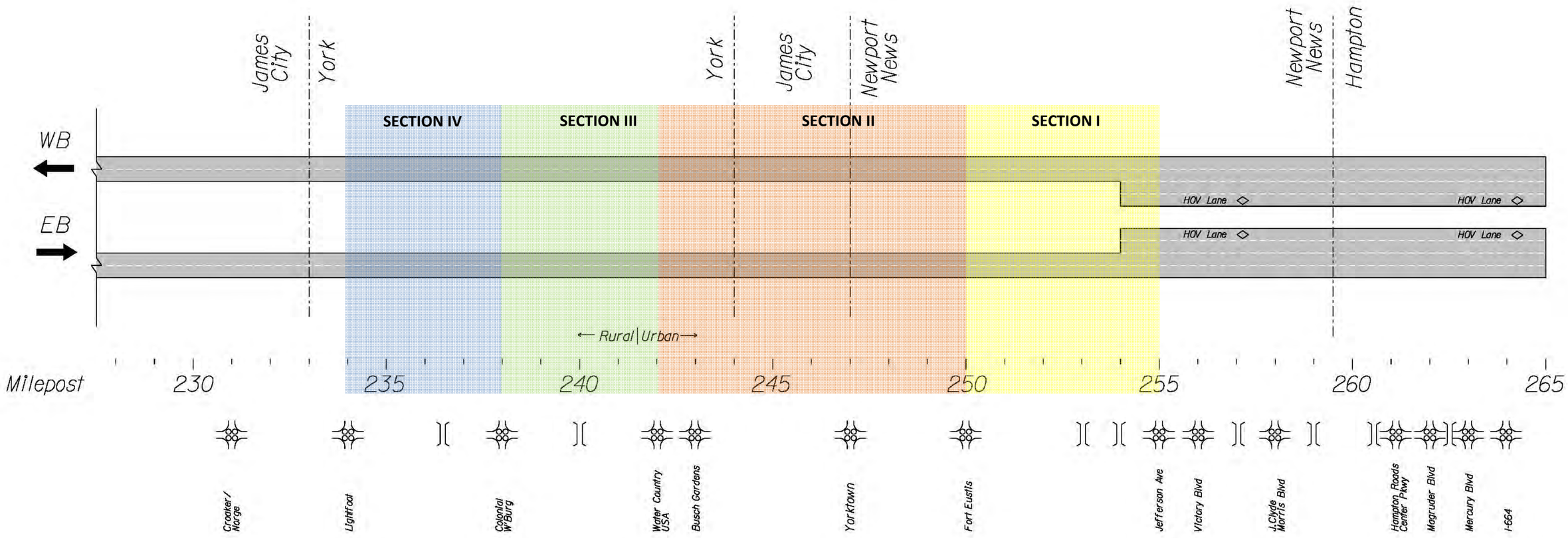
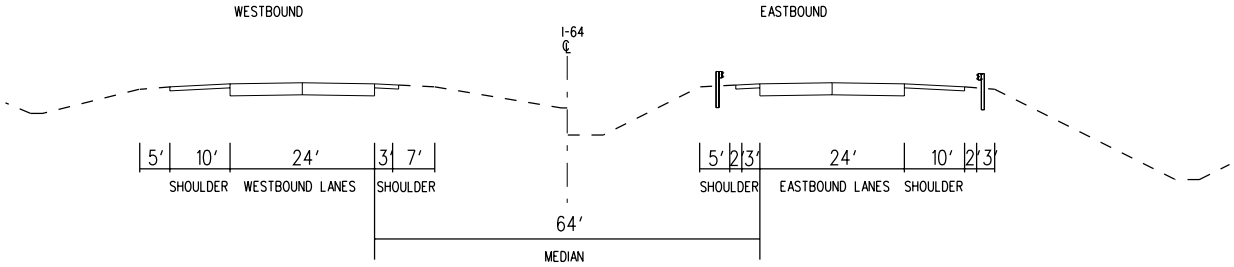


FIGURE 1

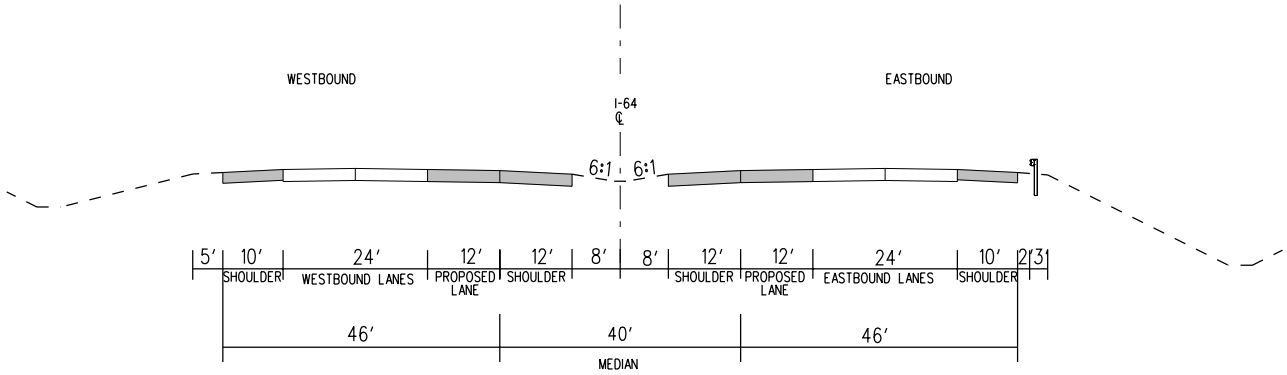
STUDY SEGMENTS

APRIL 2013



EXISTING CONDITIONS

(BASED ON PROJECT 0064-121-101)

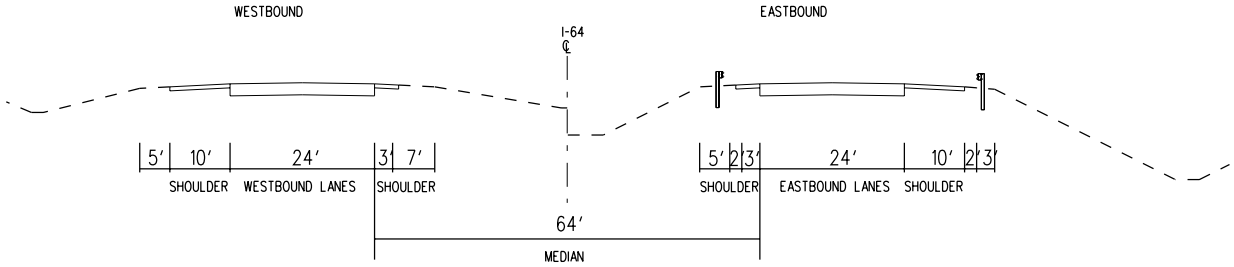


OPTION 1 (ADD ONE INSIDE LANE)

HALF SECTION WITHOUT GUARDRAIL

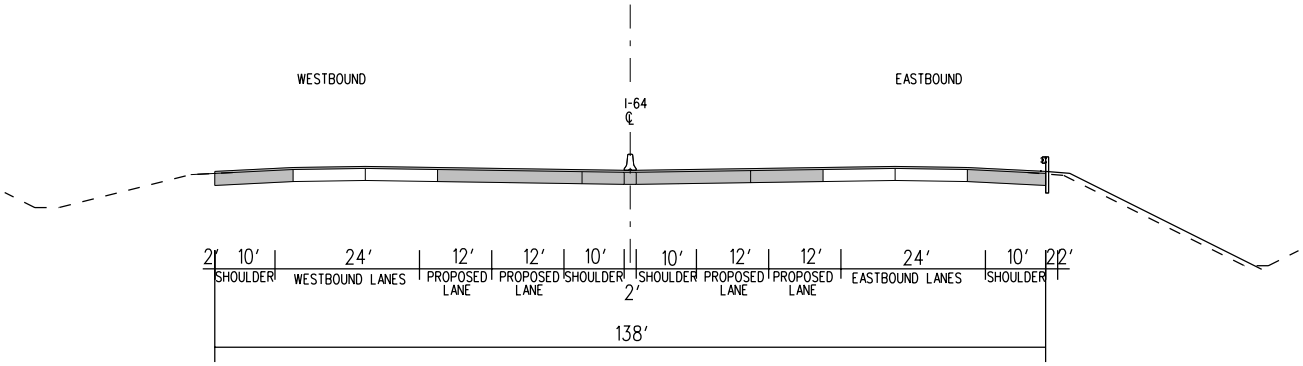
HALF SECTION WITH GUARDRAIL

FIGURE 2
TYPICAL SECTIONS EXISTING AND PROPOSED CONDITIONS OPTION 1
APRIL 2013



EXISTING CONDITIONS

(BASED ON PROJECT 0064-121-101)

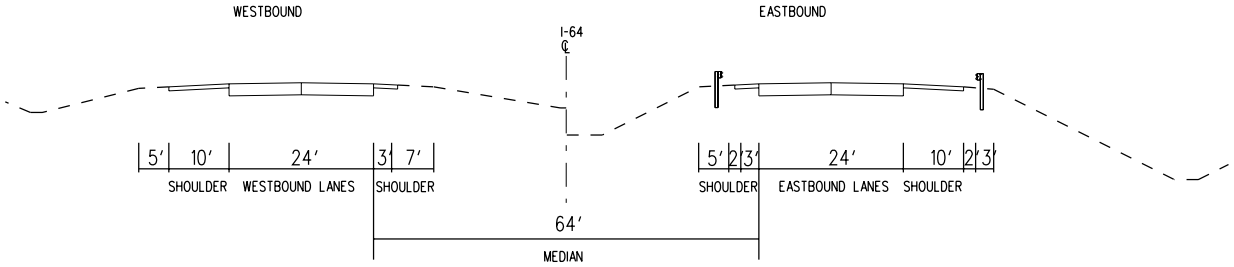


OPTION 2 (ADD TWO INSIDE LANES)

HALF SECTION WITHOUT GUARDRAIL

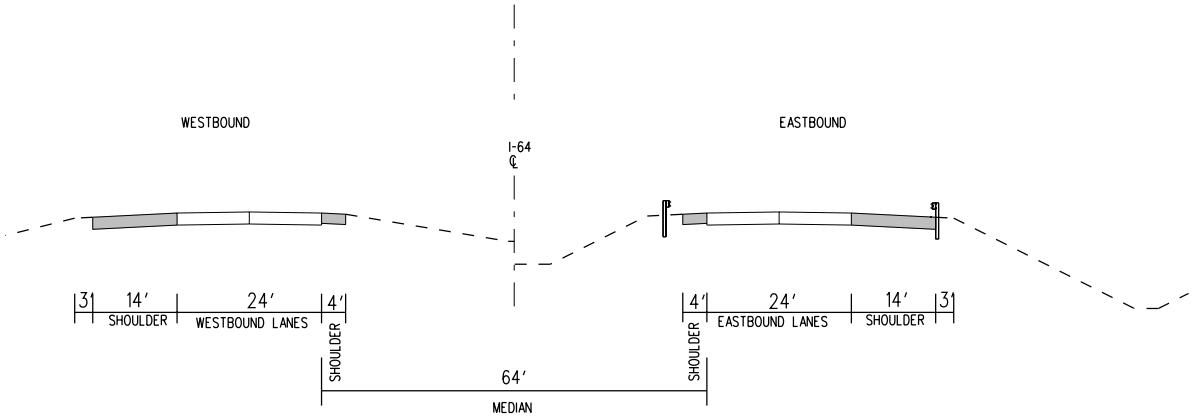
HALF SECTION WITH GUARDRAIL

FIGURE 3
TYPICAL SECTIONS EXISTING AND PROPOSED CONDITIONS OPTION 2
APRIL 2013



EXISTING CONDITIONS

(BASED ON PROJECT 0064-121-101)

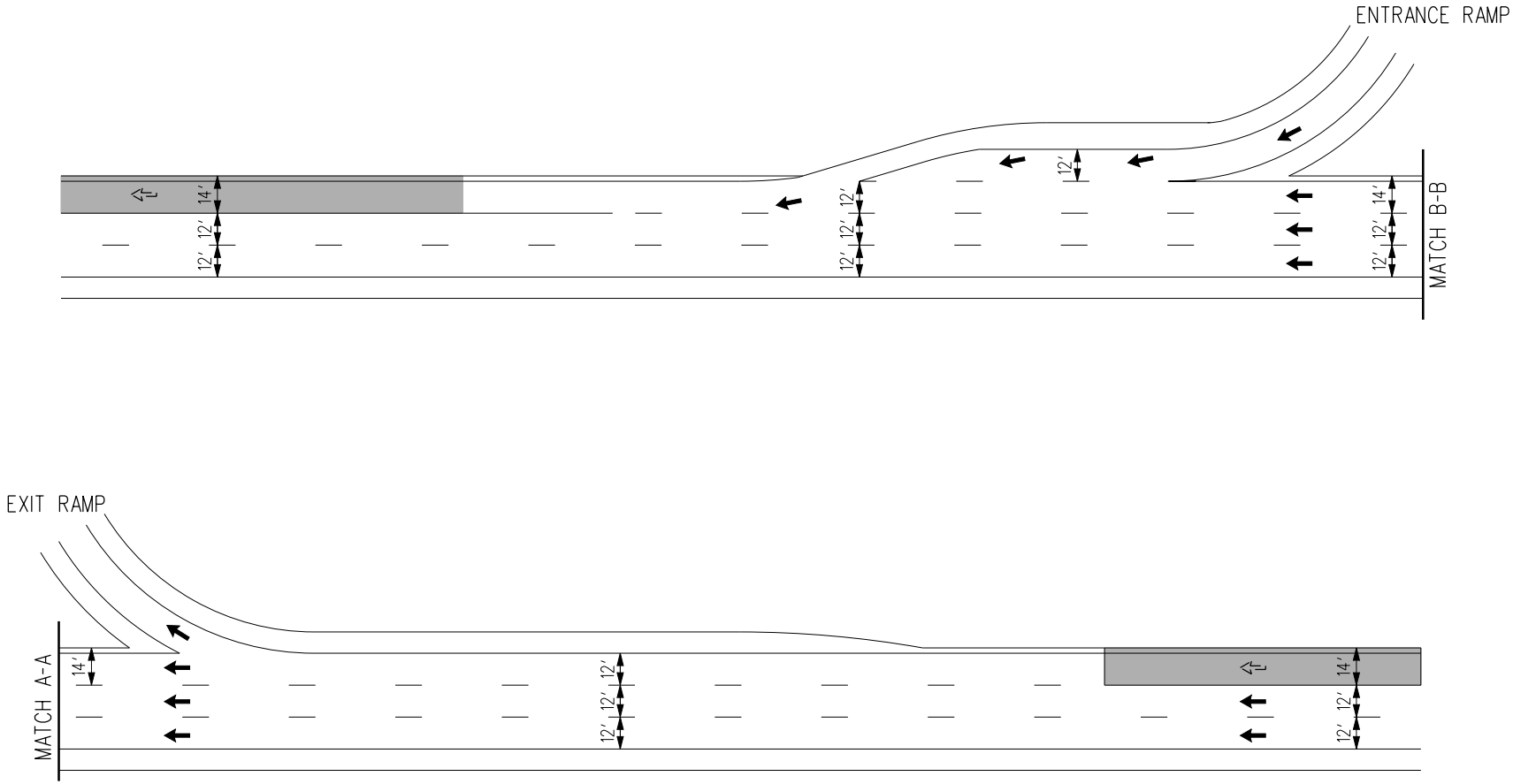


OPTION 3 (PEAK HOUR MANAGED SHOULDER)

HALF SECTION WITHOUT GUARDRAIL

HALF SECTION WITH GUARDRAIL

FIGURE 4
TYPICAL SECTIONS EXISTING AND PROPOSED CONDITIONS OPTION 3
APRIL 2013



NOTE: NOT APPLICABLE AT CLOVERLEAF INTERCHANGES

FIGURE 5
MANAGED SHOULDER AT INTERCHANGE DETAIL
APRIL 2013

VDOT I-64 Improvements Study
Jefferson Avenue (Exit 255) to Lightfoot (Exit 234)

Evaluation Matrix
Section I – Jefferson Avenue (Exit 255) to west of Route 105 (Exit 250) – City of Newport News

Option	Project Cost	Traffic Operations & Safety	Environmental Impacts	Complexities	Major Risks	Time to Deliver
Option 1	• VDOT CPM Low= $65,000,000 • VDOT CPM High= $86,000,000 • Planning= $100,000,000	• 2040 Freeway LOS D • 2040 Freeway V/C range: 0.75 - 0.83 • Additional capacity = fewer but more severe crashes • Guardrail in the median • Safest Option	• Battle of Yorktown Site • SWM locations • Wetland in median	• Construction phasing • R/W acquisition • 9 SWM ponds • Battle of Yorktown site • Near City Reservoir • Impacts 2 interchanges (250 & 255)	• Design bridge over Fort Eustis Blvd for ultimate EIS configuration. • R/W acquisition	• D/B/B – Fall 2017 • D/B – Summer 2016
Option 2	• VDOT CPM Low= $130,000,000 • VDOT CPM High= $160,000,000 • Planning= $220,000,000	• 2040 Freeway LOS C • 2040 Freeway V/C range: 0.56 - 0.63 • Additional capacity = fewer but more severe crashes • Two new lanes in median, shift existing travel lanes to outside, reconstruct outside shoulder • Adjust ramps to line up with shifted mainline lanes • Concrete barrier wall in the median • Second-safest Option	• Battle of Yorktown Site • SWM locations • Wetland in median	• Construction phasing • R/W acquisition • 9 SWM ponds • Battle of Yorktown site • Near City Reservoir • Impacts 2 interchanges (250 & 255) • Reconstruct Ft Eustis Interchange to SPUI	• R/W acquisition • Potential wetland impacts. • Potential City Reservoir impacts. • SSD concerns • 3 potential design exception requests for shoulder widths	• D/B/B – Spring 2019 • D/B – Fall 2016
Option 3	• VDOT CPM Low= $40,000,000 • VDOT CPM High= $51,000,000 • Planning= $60,000,000 • Higher operational costs due to ITS infrastructure and daily management of shoulder lane	• 2040 Freeway LOS varies D to F • 2040 Freeway V/C range: 0.83 - 1.10 • No shoulder as buffer = more crashes • No shoulder for emergency breakdowns = more crashes. Emergency pull-out areas will be spaced some distance apart. • Potential unsafe speed differential between shoulder lane and other lanes • Less lateral clearance under overpasses leads to more crashes and increased severity • Managed shoulder usage during peak may confuse drivers and lead to more crashes. • Least safe Option	• Battle of Yorktown Site • Embankment widening at emergency pull-offs	• Construction phasing • R/W acquisition • 9 SWM ponds • Battle of Yorktown site • Near City Reservoir • Impacts 2 interchanges (250 & 255)	• Emergency pull-offs could impact wetlands and require additional R/W. • SSD concerns • Noise barriers may need to be moved away from road • Option 3 is the least safe alternative.	• D/B/B – Spring 2016 • D/B – Not recommended for D/B due to short delivery time for D/B/B

Note: CPM: Cost Per Mile; LOS: Level of Service; V/C: Volume-to-Capacity Ratio; D/B/B: Design/Bid/Build; D/B: Design Build; SWM: Stormwater Management; ITS: Intelligent Transportation Systems; R/W: Right of Way; SSD: Stopping Sight Distance; CMS: Changeable Message Sign

Figure 6

VDOT I-64 Improvements Study
Jefferson Avenue (Exit 255) to Lightfoot (Exit 234)

Evaluation Matrix
Section II – West of Route 105 (Exit 250) to Route 199/Water Country USA (Exit 242) – City of Newport News, James City County & York County

Option	Project Cost	Traffic Operations & Safety	Environmental Impacts	Complexities	Major Risks	Time to Deliver
Option 1	• VDOT CPM Low= $103,000,000 • VDOT CPM High= $133,000,000 • Planning= $160,000,000	• 2040 Freeway LOS varies B to D • 2040 Freeway V/C range: 0.47 - 0.78 • Additional capacity = fewer but more severe crashes • WB I-64 left exit off-ramp at Busch Gardens Interchange must be modified • Guardrail in the median • Safest Option	• Battle of Yorktown Site • SWM locations • Yorktown Naval Weapons Station (YNWS)	• Construction phasing • R/W acquisition • 8 SWM ponds • Battle of Yorktown site • Near City Reservoir • Impacts 4 interchanges (242, 243, 247, and 250) • Impacts on WB I-64 left exit at Exit 243.	• Historic site impacts • Military site impacts • 1 potential design exception request for shoulder width (Water Country USA Interchange) • R/W acquisition	• D/B/B – Fall 2017 • D/B – Summer 2015
Option 2	• VDOT CPM Low= $110,000,000 • VDOT CPM High= $146,000,000 • Planning= $190,000,000	• 2040 Freeway LOS varies B to C • 2040 Freeway V/C range: 0.46 - 0.69 • Two additional lanes east of Exit 247 • One additional lane west of Exit 247 • Additional capacity = fewer but more severe crashes • Lane shifts on I-64 needed at transition from two new lanes to one new lane • Eastern portion: concrete barrier wall in the median • Western portion: Guardrail in the median • WB I-64 at Exit 247: outside lane would lead into a dedicated exit lane. • Second-safest Option	• Battle of Yorktown Site • SWM locations • Yorktown Naval Weapons Station (YNWS)	• Construction phasing • R/W acquisition • 8 SWM ponds • Battle of Yorktown site • Near City Reservoir • Impacts 4 interchanges (242, 243, 247, 250)	• Historic site impacts • Military site impacts • R/W acquisition • Potential wetland impacts. • Potential City Reservoir impacts. • SSD concerns	• D/B/B – Fall 2018 • D/B – Summer 2016
Option 3	• VDOT CPM Low= $47,000,000 • VDOT CPM High= $64,000,000 • Planning= $65,000,000 • Higher operational costs due to ITS infrastructure and daily management of shoulder lane	• 2040 Freeway LOS varies C to E • 2040 Freeway V/C range: 0.62 - 0.87 • No shoulder as buffer = more crashes • No shoulder for emergency breakdowns = more crashes. Emergency pull-out areas will be spaced some distance apart. • Potential unsafe speed differential between shoulder lane and other lanes • Less lateral clearance under overpasses leads to more crashes and increased severity • Managed shoulder usage during peak may confuse drivers and lead to more crashes. • Least safe Option	• Battle of Yorktown Site • Embankment widening at emergency pull-offs • Yorktown Naval Weapons Station (YNWS)	• Construction phasing • R/W acquisition • 8 SWM ponds • Battle of Yorktown site • Near City Reservoir • Impacts 4 interchanges (242, 243, 247, 250)	• Historic site impacts • Military site impacts • Emergency pull-offs could impact wetlands and require additional R/W. • SSD concerns • Noise barriers may need to be moved away from road • Option 3 is the least safe alternative.	• D/B/B – Spring 2015 • D/B – Not recommended for D/B due to short delivery time for D/B/B

Note: CPM: Cost Per Mile; LOS: Level of Service; V/C: Volume-to-Capacity Ratio; D/B/B: Design/Bid/Build; D/B: Design Build; SWM: Stormwater Management; ITS: Intelligent Transportation Systems; R/W: Right of Way; SSD: Stopping Sight Distance; CMS: Changeable Message Sign

Figure 7

VDOT I-64 Improvements Study
Jefferson Avenue (Exit 255) to Lightfoot (Exit 234)

Evaluation Matrix
Section III – Route 199/Water Country USA (Exit 242) to Route 143/Colonial Williamsburg (Exit 238) - York County

Option	Project Cost	Traffic Operations & Safety	Environmental Impacts	Complexities	Major Risks	Time to Deliver
Option 1	• VDOT CPM Low= $87,000,000 • VDOT CPM High= $97,000,000 • Planning= $155,000,000	• 2040 Freeway LOS varies B to C • 2040 Freeway V/C range: 0.40 - 0.61 • Additional capacity = fewer but more severe crashes • Guardrail in the median • Safer than Option 3	• Colonial National Historic Park/Parkway (bridge widening) • Confederate Peninsular Defenses Fort 9 • Queen Creek wetlands (bridge widening) • SWM locations	• Construction phasing • R/W acquisition • 10 SWM ponds • Replace bridge over Queen Creek. • Widen bridge over Colonial National Historic Highway. • Reduce inside shoulder width at West Queen Road underpass. • Impacts 2 interchanges (238 & 242)	• Bridge over Queen Creek will require widening or replacement. • Bridge over Colonial National Historic Highway will require widening. • R/W acquisition	• D/B/B – Summer 2018 • D/B – Not recommended due to impacts
Option 2	• N/A	• N/A	• N/A	• N/A	• N/A	• N/A
Option 3	• VDOT CPM Low= $61,000,000 • VDOT CPM High= $69,000,000 • Planning= $100,000,000 • Higher operational costs due to ITS infrastructure and daily management of shoulder lane	• 2040 Freeway LOS varies C to D • 2040 Freeway V/C range: 0.56 - 0.73 • No shoulder as buffer = more crashes • No shoulder for emergency breakdowns = more crashes. Emergency pull-out areas will be spaced some distance apart. • Potential unsafe speed differential between shoulder lane and other lanes • Less lateral clearance under overpasses leads to more crashes and increased severity • Managed shoulder usage during peak may confuse drivers and lead to more crashes. • WB I-64 at Exit 238: managed shoulder lane would lead into a dedicated exit lane. Managed shoulder lane could resume beyond interchange. • Less safe than Option 1	• Queen Creek wetlands due to bridge widening. • Embankment widening at emergency pull-offs	• Construction phasing • R/W acquisition • 10 SWM ponds • Permitting and cost concerns of widening 900' long bridge over Queen Creek wetland • Impacts 2 interchanges (238 & 242)	• Emergency pull-offs could impact wetlands and require additional R/W. • Bridge over Queen Creek wetland will require widening or replacement • SSD concerns • Noise barriers may need to be moved away from road • Less safe than Option 1	• D/B/B – Fall 2016 • D/B – Not recommended due to impacts

Note: CPM: Cost Per Mile; LOS: Level of Service; V/C: Volume-to-Capacity Ratio; D/B/B: Design/Bid/Build; D/B: Design Build; SWM: Stormwater Management; ITS: Intelligent Transportation Systems; R/W: Right of Way; SSD: Stopping Sight Distance; CMS: Changeable Message Sign

Figure 8

VDOT I-64 Improvements Study
Jefferson Avenue (Exit 255) to Lightfoot (Exit 234)

Evaluation Matrix
Section IV – Route 143/Colonial Williamsburg (Exit 238) to Route 199 Lightfoot (Exit 234) - York County

Option	Project Cost	Traffic Operations & Safety	Environmental Impacts	Complexities	Major Risks	Time to Deliver
Option 1	• VDOT CPM Low= $48,000,000 • VDOT CPM High= $59,000,000 • Planning= $85,000,000	• 2040 Freeway LOS varies B to C • 2040 Freeway V/C range: 0.36 - 0.64 • Additional capacity = fewer but more severe crashes • Cable guardrail in the median • Safer than Option 3	• No historic resources in this Segment. • SWM locations • Camp Peary	• Construction phasing • R/W acquisition • 9 SWM ponds • Replacement of Route 143 bridge over I-64 to accommodate widening. • Impacts 2 interchanges (234 & 238)	• Replacement of Route 143 bridge over I-64 to accommodate widening. • R/W acquisition	• D/B/B – Fall 2016 • D/B – Not recommended due to poss. R/W impacts with Camp Peary
Option 2	N/A	• N/A	• N/A	• N/A	• N/A	• N/A
Option 3	• VDOT CPM Low= $26,000,000 • VDOT CPM High= $35,000,000 • Planning= $40,000,000 • Higher operational costs due to ITS infrastructure and daily management of shoulder lane	• 2040 Freeway LOS varies B to D • 2040 Freeway V/C range: 0.48 - 0.65 • WB I-64: two locations (Exit 238 and Exit 234) where managed shoulder lane would lead into a dedicated exit lane. • No shoulder as buffer = more crashes • No shoulder for emergency breakdowns = more crashes. Emergency pull-out areas will be spaced some distance apart. • Potential unsafe speed differential between shoulder lane and other lanes • Less lateral clearance under overpasses leads to more crashes and increased severity • Managed shoulder usage during peak may confuse drivers and lead to more crashes. • Less safe than Option 1	• No historic resources in this Segment. • Embankment widening at emergency pull-offs • Camp Peary	• Construction phasing • R/W acquisition • 9 SWM ponds • Impacts 2 interchanges (234 & 238)	• Emergency pull-offs could impact wetlands and require additional R/W. • SSD concerns • Noise barriers may need to be moved away from road • Less safe than Option 1	• D/B/B – Fall 2015 • D/B - Not recommended due to poss. R/W impacts with Camp Peary

Note:
CPM: Cost Per Mile
LOS: Level of Service
V/C: Volume-to-Capacity Ratio
D/B/B: Design/Bid/Build
D/B: Design Build
SWM: Stormwater Management
ITS: Intelligent Transportation Systems
R/W: Right of Way
SSD: Stopping Sight Distance
CMS: Changeable Message Signs

Figure 9

VDOT I-64 Improvements Study
Jefferson Avenue (Exit 255) to Lightfoot (Exit 234)

Summary Evaluation Matrix

Segment	Option	Construction Cost	Traffic Operations and Safety (x2)	Environmental Impacts	Complexity	Major Risks	Time to Deliver	Total Score
Section I	6-Lane	3 ($100M)	4 (LOS D)	4 (Median Wetland)	3 (Widen Inside)	4	3 (12-24 mos)	20
	8-Lane	1 ($220M)	8 (LOS C)	1 (Widen Out, Median Wetland)	1 (Widen In/Out - Shift Crown)	1 (Fort Eustis)	1 (24-36 mos)	13
	Outside Shldr Lane	4 ($60M)	2 (LOS D-F)	2 (Embankment Widening)	4 (Shoulder Pull-Outs, ITS)	2 (RW, NW)	4 (12 mos)	18
	6-Lane plus inside shldr lane	2 ($105M)	6 (LOS C-D)	3 (Median Wetland)	2 (ITS, Median Pull-Outs)	3	2 (18-30 mos)	18
Section II	6-Lane	3 ($160M)	4 (LOS B-D)	4	3 (Widen Inside)	4	3 (12-24 mos)	21
	8-Lane	1 ($190M)	8 (LOS B-C)	1 (Widen Out)	1 (Widen In/Out - Shift Crown)	2	1 (24-36 mos)	14
	Outside Shldr Lane	4 ($65M)	2 (LOS C-E)	2 (Embankment Widening)	4(Shoulder Pull-Outs, ITS)	1 (RW, NW)	4 (12 mos)	17
	6-Lane plus inside shldr lane	2 ($170M)	6 (LOS B-D)	3	2 (ITS, Median Pull-Outs)	3	2 (18-30 mos)	17
Section III	6-Lane	2 ($155M)	4 (LOS B-C)	3	2 (Widen Inside)	3 (Replace Bridge)	2 (12-24 mos)	16
	Outside Shldr Lane	3 ($100M)	2 (LOS C-D)	1 (Embankment Widening)	3 (Shoulder Pull-Outs, ITS)	1 (RW, NW, Replace Bridge)	3 (12 mos)	13
	6-Lane plus inside shldr lane	1 ($160M)	6 (LOS B-C)	2	1 (ITS, Median Pull-Outs)	2 (Replace Bridge)	1 (18-30 mos)	13
Section IV	6-Lane	2 ($85M)	4 (LOS B-C)	3	2 (Widen Inside)	3	2 (12-24 mos)	16
	Outside Shldr Lane	3 ($40M)	2 (LOS B-D)	1 (Embankment Widening)	3 (Shoulder Pull-Outs, ITS)	1 (RW, NW)	3 (12 mos)	13
	6-Lane plus inside shldr lane	1 ($90M)	6 (LOS B-C)	2	1 (ITS, Median Pull-Outs)	2	1 (18-30 mos)	13

- The proposed Fort Eustis Interchange Improvement included in Section I, 8-Lane Option is a Single-Point Urban Interchange (SPUI). The construction cost estimate for that interchange improvement is $35M.
- When comparing costs in table above to EIS costs, note that EIS costs did not include noise walls. Bridge reconstruction / costs were evaluated more closely in this assessment. The options / costs in the table above do not require design exceptions.
- The cost per-mile for the inside managed shoulder, when added to the 6-Lane Option is approximately $1.0M per mile.

LOS – Level of Service
ITS – Intelligent Transportation Systems
RW – Right of Way
NW – Noise Walls

APPENDIX A

I-64 Improvements Items	Unit Prices
Clearing	$30,000/Ac
Excavation	$20/CY
E&S	$18/LF
Median Borrow (4:1 slope)	$45/LF
Median Borrow (2:1 slope)	$150/LF
Outside Borrow (Emergency Pull-off)	$30/LF
Outside Borrow (2:1 Slope)	$10/LF
Pavement	$11/SF - ($12/SF option 2)
Median Drainage	$125/LF
SWM Facilities	$95,000 EACH
Median Barrier	$75/LF
Guardrail	$20/LF
Pier Crash Walls	$330/LF
MSE Walls	$60/SF
Noise Wall	$37/SF
Cantilever Sign Structure	$85,000 EA
Overhead Sign Structure	$175,000 EA
ITS CMS Structure	$150,000 EA
Bridge Replacement	$360/SF
Bridge Widening	$400/SF
Temporary PCC Barrier	$25/LF
Mobilization	2%
Construction Engineering	3%
Contingency	20%
Context Sensitive Design	10%
Real Estate	$450,000/Ac.

64' Median Borrow Cost/LF

4:1 Slopes (assume 2' flat bottom) (1.5' box)	[3.5' x 2' + 3.5' x 14'] / 27 x $20/CY = $41.48/LF
	$45/LF
2:1 Slopes (assume 6.5' average depth) (8' - 1.5' box)	[6.5' x 13' + 6.5' x 18'] / 27 x $20/CY = $149.25/LF
	$150/LF

Outside Borrow Derivation

16' Widening for Emergency Pull-Off 4:1 Slopes (assume 2.5' average height) (4' - 1.5' box)	[16' x 2.5'] / 27 x $20/CY = $29.63/LF
	$30/LF
2' Widening 2:1 Slopes (assume 6.5' average height) (8'-1.5' box)	[2' x 6.5'] / 27 x $20/CY = $9.62/LF
	$10/LF

Pavement Cost/SF

PCC Pavement	$75/SY / 9 = $8.33/SF
Base	10"/12 x 150 lb/CF x 1 Ton/2000 lb x $35/Ton = $2.19/SF
Total	$8.33 + $2.19 = $10.52/SF
	$11/SF

Bituninous Pavement	16"/12 x 150 lb/CF x 1 Ton/2000 lb x $90/Ton = $9/SF
Base	8"/12 x 150 lb/CF x 1 Ton/2000 lb x $35/Ton = $1.75/SF
Total	$9 + $1.75
	$11/SF

Note: $1/SF added in option 2 to assume an overlay of the existing roadway

Median Drainage Cost/LF

Assume average 24" RCP $90/LF

Assume Drainage Inlets spaced at 300' $5000/inlet x 1 inlet/300' = $17/LF

Assume 6' average pipe excavation depth
{[24" DIA + 2x3" Walls + 2x18" Compaction] /12} x 6' /27 = 1.2 CY/LF x $15/CY = $18/LF

Total $90 + $17 + $18 = $125/LF

$125/LF

Pier Crash Wall Cost/LF

Excavation	43 CY x $20/CY = $860
PCC Masonry	53 CY x $350/CY = $18,550
Rebar	3266 lb x $1.10/lb = $3593
Total	[$860 + $18,550 + $3593] / 70 LF = $329/LF
	$330/LF

Option 1 NOTES

1	Clearing area bases an aerial measurements of the forested area within the median
2	The reconstruction of median shoulder to be 8" of deep lift hot mix for temporary pavment section. This work is to be done at night with lane closures
3	Borrow calculated to be 4:1 along the segement unless there was existing guardrail. In these sections the 2:1 item was used
4	All cantilever and overhead sign structures found on the aerial estimated to be replaced
5	Merrimac Trail bridge to be replaced due to the piers being just off the shoulders. Bridge just east of 143 interchange to be replaced instead of widened because of the condition seen from aerial
6	All widened bridges appeared to be in acceptable condition to widen or have enough clearance to the piers to widen underneath.
7	All noise wall estimates are from walls that were deemed feasable and reasonable in the EIS document
8	Estimate assumes that 10' outside shoulder can be reconstructed without impact to guardrail or sideslope
9	MSE walls assumed in the median of all major roadway horizontal curves due to grade differences associated with the roadway superelevation
10	Section length is based on centerline baseline

Section I Option 1

I-64 Improvements Items	Unit Prices				
Clearing	$ 30,000.00 /Ac			8.3	Ac
				$ 249,000.00	Price
Excavation	$ 20.00 /CY				
Location	Length (ft)	Width (ft)	Depth (ft)	Volume	
Westbound outside shoulder	26532	10	2.00	19653.33	
Westbound inside shoulder	26532	4	0.67	2620.44	
Westbound inside Widening	26532	24	2.00	47168.00	
Eastbound outside shoulder	26532	10	2.00	19653.33	
Eastbound inside shoulder	26532	4	0.67	2620.44	
Eastbound inside widening	26532	24	2.00	47168.00	
Total				138883.56	CY
				$ 2,777,671.11	Price
Median Borrow (4:1 slope)	$ 45.00 /LF				
Location	Length (ft)			Total Length	
Westbound median	21339			21339	
Eastbound median	21646			21646	
Total				42985	LF
				$ 1,934,325.00	Price
Median Borrow (2:1 slope)	$ 150.00 /LF				
Location	Length (ft)			Total Length	
Westbound median	5193			5193	
Eastbound median	4886			4886	
Total				10079	LF
				$ 1,511,850.00	Price
Pavement	$ 11.00 /SF				
Location	length (ft)	width (ft)		Area	
Westbound outside shoulder	26532	10		265320	
Westbound inside shoulder	26532	4		106128	
Westbound inside widening	26532	24		636768	
Eastbound outside shoulder	26532	10		265320	
Eastbound inside shoulder	26532	4		106128	
Eastbound inside widening	26532	24		636768	
Total				2016432	SF
				$ 22,180,752.00	Price
Median Drainage	$ 125.00 /LF				
Location	Length (ft)			Total Length	
Along entire median	26532			26532	
Total				26532	LF
				$ 3,316,500.00	Price

Section I Option 1

SWM Facilities	$ 95,000.00	/SMF			
Total				9	SMF
				$ 855,000.00	Price
Median Barrier	$ 75.00	/LF		NONE	
Guardrail Removal	$ 15.00	/LF			
Location	Length (ft)			Total Length	
Westbound median	5193			5193	
Eastbound median	4886			4886	
Total				10079	LF
				$ 151,185.00	Price
Guardrail	$ 20.00	/LF			
Location	Length (ft)			Total Length	
Along entire median	26532			26532	
Total				26532	LF
				$ 530,640.00	Price
Pier Crash Walls	$330/LF			NONE	
MSE Walls	$ 60.00	/SF			
Location	Length (ft)		Ave. Height (ft)	Area	
Within median of major horizontal	13266		5	66330	
curves	0		5	0	
Total				66330	SF
				$ 3,979,800.00	Price
Noise Wall	$ 37.00	/SF			
Location	Length (ft)		Ave. Height (ft)	Area	
EIS Barrier 46	4102		16	65632	
EIS Barrier 47 & 48	7115		12	85380	
Total				151012	SF
				$ 5,587,444.00	Price

Section I Option 1

Cantilever Sign Structure	$ 85,000.00	EA			
Location				Number	
Eastbound I-64				3	
Total				3	EA
				$ 255,000.00	Price
Overhead Sign Structure	$ 175,000.00	EA			
Location				Number	
Westbound				1	
Eastbound				2	
Total				3	LF
				$ 525,000.00	Price
ITS Sign Structure	$ 150,000.00	EA		NONE	
Bridge Replacement	$ 360.00	/SF		NONE	
Bridge Widening	$ 400.00	/SF			
Location	Length (ft)	Widen (ft)		Area	
WB I-64 over Industrial Dr	250	24		6000	
EB I-64 over Industrial Dr	250	24		6000	
WB I-64 over Route 105	190	24		4560	
EB I-64 over Route 105	190	24		4560	
Total				21120	SF
				$ 8,448,000.00	Price
Temporary PCC Barrier	$ 25.00	/LF			
Location	Length (ft)	# of times placed		Total Length	
Westbound outside shoulder	26532	2		53064	
Eastbound outside shoulder	26532	2		53064	
Total				106128	LF
				$ 2,653,200.00	Price
E&S	$ 18.00	/LF			
Location	Length (ft)			Total Length	
Westbound outside shoulder	26532			26532	
Eastbound outside shoulder	26532			26532	
Total				53064	LF
				$ 955,152.00	Price

Section I Option 1

Subtotal			$ 55,910,519.11
Mobilization	5%		$ 2,795,525.96
Construction Engineering	3%		$ 1,677,315.57
Contingency	20%		$ 11,182,103.82
Context Sensitive Design	10%		$ 5,591,051.91
Real Estate	$ 480,000.00	/Ac	$ 6,480,000.00
Planning Contingency	25%		$ 13,977,629.78
		Total	$ 91,134,146.15
		Not Including Real Estate	

Section II Option 1

I-64 Improvements Items	Unit Prices				
Clearing	$ 30,000.00	/Ac		27	Ac
				$ 810,000.00	Price
Excavation	$ 20.00	/CY			
Location	Length (ft)	Width (ft)	Depth (ft)	Volume	
Westbound outside shoulder	38725	10	2.00	28685.19	
Westbound inside shoulder	38725	4	0.67	3824.69	
Westbound inside widening	38725	24	2.00	68844.44	
Eastbound outside shoulder	38725	10	2.00	28685.19	
Eastbound inside shoulder	38725	4	0.67	3824.69	
Eastbound inside widening	38725	24	2.00	68844.44	
Total				202708.64	CY
				$ 4,054,172.84	Price
Median Borrow (4:1 slope)	$ 45.00	/LF			
Location	Length (ft)			Total Length	
Westbound median	29852			29852	
Eastbound median	27912			27912	
Total				57764	LF
				$ 2,599,380.00	Price
Median Borrow (2:1 slope)	$ 150.00	/LF			
Location	Length (ft)			Total Length	
Westbound median	8873			8873	
Eastbound median	10813			10813	
Total				19686	LF
				$ 2,952,900.00	Price
Pavement	$ 11.00	/SF			
Location	Length (ft)	Width (ft)		Area	
Westbound outside shoulder	38725	10		387250	
Westbound inside shoulder	38725	4		154900	
Westbound inside widening	38725	24		929400	
Eastbound outside shoulder	38725	10		387250	
Eastbound inside shoulder	38725	4		154900	
Westbound inside widening	38725	24		929400	
Total				2943100	SF
				$ 32,374,100.00	Price
Median Drainage	$ 125.00	/LF			
Location	Length (ft)			Total Length	
Entire segment median	38725			38725	
Total				38725	LF
				$ 4,840,625.00	Price

Section II Option 1

SWM Facilities		$ 95,000.00	/SMF			
	Total				10	SMF
				$	950,000.00	Price
Median Barrier		$ 75.00	/LF		NONE	
Guardrail Removal		$ 15.00	/LF			
	Location	Length (ft)			Length	
	Westbound median	8873			8873	
	Eastbound median	10813			10813	
	Total				19686	LF
				$	295,290.00	Price
Guardrail		$ 20.00	/LF			
	Location	Length (ft)			Length	
	Entire segment length	38725			38725	
	Total				38725	LF
				$	774,500.00	Price
Pier Crash Walls		$ 330.00	/LF		NONE	
MSE Walls		$ 60.00	/SF			
	Location	Length (ft)	Height (ft)		Area	
	Mile Marker 246	0	5		0	
	Mile Marker 247	0	5		0	
	Mile Marker 248	19400	5		97000	
	Total				97000	SF
				$	5,820,000.00	Price
Noise Wall		$ 37.00	/SF		NONE	
Cantilever Sign Structure		$ 85,000.00	EA			
	Location				Number	
	Westbound				1	
	Total				1	EA
				$	85,000.00	Price
Overhead Sign Structure		$ 175,000.00	EA			
	Location				Number	
	Westbound				2	
	Eastbound				1	
	Total				3	LF
				$	525,000.00	Price

Section II Option 1

ITS Sign Structure	$ 150,000.00	EA			
Total			3		EA
			$ 450,000.00		Price

Bridge Replacement	$ 360.00	SF		
Location	Length (ft)	Width (ft)	Area	
Route 199 (Humelsine Rd)	335	55	18425	
Route 199 (Humelsine Rd)	335	55	18425	
Total			36850	
			$ 13,266,000.00	

Bridge Widening	$ 400.00	/SF		
Location	Length (ft)	Widen (ft)	Area	
WB I-64 over City Reservoir	100	24	2400	
EB I-64 over City Reservior	100	24	2400	
WB I-64 over Yorktown Rd	200	24	4800	
EB I-64 over Yorktown Rd	200	24	4800	
WB I-64 over Jefferson Ave	340	24	8160	
EB I-64 over Jefferson Ave	340	24	8160	
WB I-64 over Burma Rd	250	24	6000	
EB I-64 over Burma Rd	270	24	6480	
Total			43200	SF
			$ 17,280,000.00	Price

Temporary PCC Barrier	$ 25.00	/LF		
Location	Length (ft)	# of times placed	Total Length	
Westbound outside shoulder	38725	2	77450	
Eastbound outside shoulder	38725	2	77450	
Total			154900	LF
			$ 3,872,500.00	Price

E&S	$ 18.00	/LF		
Location	Length (ft)		Total Length	
Westbound outside	38725		38725	
Eastbound outside	38725		38725	
Total			77450	LF
			$ 1,394,100.00	Price

Subtotal			$ 92,343,567.84
Mobilization	5%		$ 4,617,178.39
Construction Engineering	3%		$ 2,770,307.04
Contingency	20%		$ 18,468,713.57
Context Sensitive Design	10%		$ 9,234,356.78
Real Estate	$ 480,000.00	/Ac	$ 7,200,000.00
Planning Contingency	25%		$ 23,085,891.96
		Total	$ 150,520,015.58
		Not Including Real Estate	

Section III Option 1

I-64 Improvements Items	Unit Prices				
Clearing	$ 30,000.00 /Ac			18	Ac
				$ 540,000.00	Price

Excavation	$ 20.00 /CY				
Location	Length (ft)	Width (ft)	Depth (ft)	Volume	
Westbound outside shoulder	20356	10	2.00	15079	
Westbound inside shoulder	20356	4	0.67	2010	
Westbound inside widening	20356	24	2.00	36188	
Eastbound outside shoulder	20356	10	2.00	15079	
Eastbound inside shoulder	20356	4	0.67	2010	
Eastbound inside widening	20356	24	2.00	36188	
Total				106555	CY
				$ 2,131,097.28	Price

Median Borrow (4:1 slope)	$ 45.00 /LF		
Location	Length (ft)	Total Length	
Westbound median	11655	11655	
Eastbound median	9599	9599	
Total		21254	LF
		$ 956,430.00	Price

Median Borrow (2:1 slope)	$ 150.00 /LF		
Location	Length (ft)	Total Length	
Westbound median	8701	8701	
Eastbound median	10757	10757	
Total		19458	LF
		$ 2,918,700.00	Price

Pavement	$ 11.00 /SF			
Location	Length (ft)	Width (ft)	Area	
Westbound outside shoulder	20356	10	203560	
Westbound inside shoulder	20356	4	81424	
Westbound inside widening	20356	24	488544	
Eastbound outside shoulder	20356	10	203560	
Eastbound inside shoulder	20356	4	81424	
Eastbound inside widening	20356	24	488544	
Total			1547056	SF
			$ 17,017,616.00	Price

Median Drainage	$ 125.00 /LF		
Location	Length (ft)	Length	
Entire segment median	20356	20356	
Total		20356	LF
		$ 2,544,500.00	Price

Section III Option 1

SWM Facilities		$ 95,000.00	/SMF		
	Total			8	SMF
				$ 760,000.00	Price
Median Barrier		$ 75.00	/LF	NONE	
Guardrail Removal		$ 15.00	/LF		
Location		Length (ft)		Total Length	
Westbound median		8701		8701	
Eastbound median		10757		10757	
	Total			19458	LF
				$ 291,870.00	Price
Guardrail		$ 20.00	/LF		
Location		Length (ft)		Total Length	
Entire segment median		20356		20356	
	Total			20356	LF
				$ 407,120.00	Price
Pier Crash Walls		$ 330.00	/LF	NONE	
MSE Walls		$ 60.00	/SF		
Location		Length (ft)	Height (ft)	Area	
Mile Marker 240		0	5	0	
Mile Marker 241		10200	5	51000	
	Total			51000	SF
				$ 3,060,000.00	Price
Noise Wall		$ 37.00	/SF		
Location		Length (ft)	Ave Height (ft)	Area	
EIS Barrier 40 & 41		2242	19	42598	
EIS Barrier 42		2055	20	41100	
	Total			83698	SF
				$ 3,096,826.00	Price
Cantilever Sign Structure		$ 85,000.00	EA		
Location				Number	
Westbound				1	
Eastbound				2	
	Total			3	EA
				$ 255,000.00	Price

Section III Option 1

Overhead Sign Structure	$ 175,000.00	EA			
Location			Number		
Westbound			4		
Eastbound			4		
Total			8		LF
			$ 1,400,000.00		Price

ITS Sign Structure	$ 150,000.00	EA		
Total			1	EA
			$ 150,000.00	Price

Bridge Replacement	$ 360.00	/SF		
Location	Length (ft)	Width (ft)	Area	
WB Bridge Just East of 143	908	52	47216	
EB Bridge Just East of 143	931	52	48412	
Route 716 (W. Queen Dr.)	315	35	11025	
Total			106653	SF
			$ 38,395,080.00	Price

Bridge Widening	$ 400.00	/SF		
Location	Length (ft)	Widen (ft)	Area	
WB over Penniman Rd	190	24	4560	
EB over Penniman Rd	190	24	4560	
WB over Lakeshead Rd	150	24	3600	
EB over Lakeshead Rd	150	24	3600	
WB over Colonial National Historic Pkwy	150	24	3600	
EB over Colonial National Historic Pkwy	150	24	3600	
EB I-64 over Busch Garden Interch.	260	24	6240	
Total			29760	SF
			$ 11,904,000.00	Price

Temporary PCC Barrier	$ 25.00	/LF		
Location	Length (ft)	# of times placed	Total Length	
Westbound outside shoulder	20356	2	40712	
Eastbound outside shoulder	20356	2	40712	
Total			81424.00	LF
			$ 2,035,600.00	Price

E&S	$ 18.00	/LF		
Location	Length (ft)		Total Length	
Westbound outside	20356		20356	
Eastbound outside	20356		20356	
Total			40712.00	LF
			$ 732,816.00	Price

Section III Option 1

Subtotal				$ 88,596,655.28
Mobilization	5%			$ 4,429,832.76
Construction Engineering	3%			$ 2,657,899.66
Contingency	20%			$ 17,719,331.06
Context Sensitive Design	10%			$ 8,859,665.53
Real Estate	$ 480,000.00	/Ac		$ 5,760,000.00
Planning Contingency	25%			$ 22,149,163.82
Total			Total	$ 144,412,548.11
			Not Including Real Estate	

Section IV Option 1

I-64 Improvements Items	Unit Prices				
Clearing	$ 30,000.00 /Ac			16	Ac
				$ 480,000.00	Price
Excavation	$ 20.00 /CY				
Location	Length (ft)	Width (ft)	Depth (ft)	Volume	
Westbound outside shoulder	22588	10	2.00	16732	
Westbound inside shoulder	22588	4	0.67	2231	
Westbound inside widening	22588	24	2.00	40156	
Eastbound outside shoulder	22588	10	2.00	16732	
Eastbound inside shoulder	22588	4	0.67	2231	
Eastbound inside widening	22588	24	2.00	40156	
Total				$ 118,238.42	CY
				$ 2,364,768.40	Price
Median Borrow (4:1 slope)	$ 45.00 /LF				
Location	Lenth (ft)			Total Length	
Westbound median	21847			21847	
Eastbound median	20612			20612	
Total				42459	LF
				$ 1,910,655.00	Price
Median Borrow (2:1 slope)	$ 150.00 /LF				
Location	Length (ft)			Total Length	
Westbound median	741			741	
Eastbound median	1976			1976	
Total				2717	LF
				$ 407,550.00	Price
Pavement	$ 11.00 /SF				
Location	Length (ft)	Width (ft)		Area	
Westbound outside shoulder	22588	10		225880	
Westbound inside shoulder	22588	4		90352	
Westbound inside widening	22588	24		542112	
Eastbound outside shoulder	22588	10		225880	
Eastbound inside shoulder	22588	4		90352	
Eastbound inside widening	22588	24		542112	
Total				1716688	SF
				$ 18,883,568.00	Price
Median Drainage	$ 125.00 /LF				
Location	Length (ft)			Total Length	
Entire median length	22588			22588	
Total				22588	LF
				$ 2,823,500.00	Price

Section IV Option 1

SWM Facilities		$ 95,000.00	/ SMF		
	Total			9	SMF
				$ 855,000.00	Price
Median Barrier		$ 75.00	/LF	NONE	
Guardrail Removal		$ 15.00	/LF		
Location		Length (ft)		Total Length	
Westbound median		741		741	
Eastbound median		1976		1976	
	Total			2717	LF
				$ 40,755.00	Price
Guardrail		$ 20.00	/LF		
Location		Length (ft)		Total Length	
Entire length of median		22588		22588	
	Total			22588	LF
				$ 451,760.00	Price
Pier Crash Walls		$ 330.00	/LF	NONE	
MSE Walls		$ 60.00	/SF		
Location		Length (ft)	Height (ft)	Area	
Median of major curves		11300	5	56500	
	Total			56500	SF
				$ 3,390,000.00	Price
Noise Wall		$ 37.00	/SF	NONE	
Cantilever Sign Structure		$ 85,000.00	EA		
Location				Number	
Westbound				1	
	Total			1	EA
				$ 85,000.00	Price
Overhead Sign Structure		$ 175,000.00	EA		
Location				Number	
Westbound				2	
Eastbound				1	
	Total			3	LF
				$ 525,000.00	Price

Section IV Option 1

ITS Sign Structure	$ 150,000.00	EA		NONE	

Bridge Replacement	$ 360.00	/SF			
Location	Length (ft)	Width (ft)		Area	
Merrimac Trail over I-64	290	69		20010	
Route 604 (Barlow Rd)	300	35		10500	
Total				30510	SF
			$	10,983,600.00	Price

Bridge Widening	$400/SF			NONE	

Temporary PCC Barrier	$ 25.00	/LF			
Location	Length (ft)	# of times placed		Total Length	
Westbound outside shoulder	22588	2		45176	
Eastbound outside shoulder	22588	2		45176	
Total				90352	LF
			$	2,258,800.00	Price

E&S	$ 18.00	/LF			
Location	Length (ft)			Total Length	
Westbound outside	22588			22588	
Eastbound outside	22588			22588	
Total				45176	LF
			$	813,168.00	Price

Subtotal			$	46,273,124.40
Mobilization	5%		$	2,313,656.22
Construction Engineering	3%		$	1,388,193.73
Contingency	20%		$	9,254,624.88
Context Sensitive Design	10%		$	4,627,312.44
Real Estate	$ 480,000.00	/Ac	$	6,480,000.00
Planning Contingency	25%		$	11,568,281.10
		Total	$	75,425,192.76
		Not Including Real Estate		

Option 1 Summary

Segment	1	2	3	4
Length (ft)	26532	38725	20356	22588
Length (mi)	5.03	7.33	3.86	4.28
Items				
Clearing	$ 249,000.00	$ 810,000.00	$ 540,000.00	$ 480,000.00
Excavation	$ 2,777,671.11	$ 4,054,172.84	$ 2,131,097.28	$ 2,364,768.40
Median Borrow (4:1 slope)	$ 1,934,325.00	$ 2,599,380.00	$ 956,430.00	$ 1,910,655.00
Median Borrow (2:1 slope)	$ 1,511,850.00	$ 2,952,900.00	$ 2,918,700.00	$ 407,550.00
Pavement	$ 22,180,752.00	$ 32,374,100.00	$ 17,017,616.00	$ 18,883,568.00
Median Drainage	$ 3,316,500.00	$ 4,840,625.00	$ 2,544,500.00	$ 2,823,500.00
SWM Facilities	$ 855,000.00	$ 950,000.00	$ 760,000.00	$ 855,000.00
Median Barrier	NONE	NONE	NONE	NONE
Guardrail Removal	$ 151,185.00	$ 295,290.00	$ 291,870.00	$ 40,755.00
Guardrail	$ 530,640.00	$ 774,500.00	$ 407,120.00	$ 451,760.00
Pier Crash Walls	NONE	NONE	NONE	NONE
MSE Walls	$ 3,979,800.00	$ 5,820,000.00	$ 3,060,000.00	$ 3,390,000.00
Noise Wall	$ 5,587,444.00	NONE	$ 3,096,826.00	NONE
Cantilever Sign Structure	$ 255,000.00	$ 85,000.00	$ 255,000.00	$ 85,000.00
Overhead Sign Structure	$ 525,000.00	$ 525,000.00	$ 1,400,000.00	$ 525,000.00
ITS CMS Structure	NONE	$ 450,000.00	$ 150,000.00	NONE
Bridge Replacement	NONE	$ 13,266,000.00	$ 38,395,080.00	$ 10,983,600.00
Bridge Widening	$ 8,448,000.00	$ 17,280,000.00	$ 11,904,000.00	NONE
Temporary PCC Barrier	$ 2,653,200.00	$ 3,872,500.00	$ 2,035,600.00	$ 2,258,800.00
E&S	$ 955,152.00	$ 1,394,100.00	$ 732,816.00	$ 813,168.00
Mobilization (2%)	$ 2,795,525.96	$ 4,617,178.39	$ 4,429,832.76	$ 2,313,656.22
Construction Engineering (3%)	$ 1,677,315.57	$ 2,770,307.04	$ 2,657,899.66	$ 1,388,193.73
Contingency (20%)	$ 11,182,103.82	$ 18,468,713.57	$ 17,719,331.06	$ 9,254,624.88
Context Sensitive Design (10%)	$ 5,591,051.91	$ 9,234,356.78	$ 8,859,665.53	$ 4,627,312.44
Real Estate (Total)	$ 6,480,000.00	$ 7,200,000.00	$ 5,760,000.00	$ 6,480,000.00
Planning Contingency (25%)	$ 13,977,629.78	$ 23,085,891.96	$ 22,149,163.82	$ 11,568,281.10
Total	$ 91,134,146.15	$ 150,520,015.58	$ 144,412,548.11	$ 75,425,192.76

Note: Real Estate cost are not computed in any total or lane mile costs

Total (w/Real Estate)	$ 97,614,146.15	$ 157,720,015.58	$ 150,172,548.11	$ 81,905,192.76
Total (Rounded)	$100,000,000	$160,000,000	$155,000,000	$85,000,000

Section I Option 2

I-64 Improvements Items	Unit Prices				
Clearing	$ 30,000.00 /Ac			8.3	Ac
				$ 249,000.00	Price
Excavation	$ 20.00 /CY				
Location	length (ft)	width (ft)	depth (ft)	volume	
Westbound outside shoulder	26532	13	2.00	25549.33	
Westbound inside shoulder	26532	4	0.67	2620.44	
Westbound inside Widening	26532	32	2.00	62890.67	
Eastbound outside shoulder	26532	13	2.00	25549.33	
Eastbound inside shoulder	26532	4	0.67	2633.55	
Eastbound inside widening	26532	32	2.00	62890.67	
Total				182134	CY
				$ 3,642,679.82	Price
Borrow (4:1 slope)	$ 45.00 /LF				
Location					
Westbound outside	14431			14431	
Eastbound outside	14125			14125	
Total				28556	LF
				$ 1,285,020.00	Price
Borrow (2:1 slope)	$ 150.00 /LF				
Location					
Westbound outside	12101			12101	
Eastbound outside	12407			12407	
Total				24508	LF
				$ 3,676,200.00	Price
Pavement	$ 12.00 /SF				
Location	length (ft)	width (ft)		Area	
Westbound outside shoulder	26532	13		344916	
Westbound inside shoulder	26532	4		106128	
Westbound inside widening	26532	32		849024	
Eastbound outside shoulder	26532	13		344916	
Eastbound inside shoulder	26532	4		106128	
Eastbound inside widening	26532	32		849024	
Total				2600136	SF
				$ 31,201,632.00	Price
Median Drainage	$ 125.00 /LF				
Location				Length	
Along entire Median				26532	
				26532	LF
				$ 3,316,500.00	Price

Section I Option 2

SWM Facilities	$ 95,000.00	/SMF			
				9	SMF
				$ 855,000.00	Price
Median Barrier	$ 75.00	/LF			
Location				Length	
Along entire Median				26532	
				26532	LF
				$ 1,989,900.00	Price
Guardrail Removal	$ 15.00	/LF			
Location				Length	
Westbound median				5193	
Westbound outside				12101	
Eastbound median				4886	
Eastbound outside				12407	
Total				34587	LF
				$ 518,805.00	Price
Guardrail	$ 20.00	/LF			
Location	length removed (ft)	% increase due to widening		Length	
Westbound outside shoulder	12101	10%		13311	
Eastbound outside shoulder	12407	10%		13648	
				26959	LF
				$ 539,176.00	Price
Pier Crash Walls	$ 330.00	/LF			
Location				Length	
Denbigh Road				100	
				100	LF
				$ 33,000.00	Price
MSE Walls	$ 60.00	/SF			
Location	Length (ft)	Height (ft)		Area	
Median in curves	0	5		0	
	13266	5		66330	
				66330	SF
				$ 3,979,800.00	Price

Section I Option 2

Noise Wall $ 37.00 /SF

Location	Length (ft)	Ave. Height (ft)	Area	
EIS Barrier 46	4102	16	65632	
EIS Barrier 47 & 48	7115	12	85380	
			151012	SF
			$ 5,587,444.00	Price

Cantilever Sign Structure $ 85,000.00 EA

Location	Number	
Eastbound	3	
Total	3	EA
	$ 255,000.00	Price

Overhead Sign Structure $ 175,000.00 EA

Location	Number	
Westbound	1	
Eastbound	2	
Total	3	LF
	$ 525,000.00	Price

ITS Sign Structure $ 150,000.00 EA NONE

Bridge Replacement $ 360.00 /SF

Location	Length (ft)	Width (ft)	Area	
WB over industrial parkway	250	52	13000	
EB over industrial parkway	250	52	13000	
Bland Road	510	89	45390	
Debigh Road	860	60	51600	
			122990	SF
For Eustis (SPUI option)			$ 19,846,000.00	Price
			$ 64,122,400.00	Price

Bridge Widening $ 400.00 /SF

Location	Length (ft)	Widen (ft)	Area	
			0	SF
			$ -	Price

Temporary PCC Barrier $ 25.00 /LF

Location	length (ft)	times placed	volume	
Westbound outside shoulder	26532	2	53064	
Eastbound outside shoulder	26532	2	53064	
Total			106128	LF

Section I Option 2

$	2,653,200.00	Price

Section I Option 2

E&S	$ 18.00 /LF			
Location	length (ft)	times placed	volume	
Westbound outside shoulder	26532	2	53064	
Eastbound outside shoulder	26532	2	53064	
Total			106128	LF
			$ 1,910,304.00	Price

Subtotal			$ 126,340,060.82
Mobilization	2%		$ 2,526,801.22
Construction Engineering	3%		$ 3,790,201.82
Contingency	20%		$ 25,268,012.16
Context Sensitive Design	10%		$ 12,634,006.08
Real Estate	$ 450,000.00	/Ac	$ 6,075,000.00
Planning Contingency	25%		$ 31,585,015.21
		Total	$ 202,144,097.32
		Not Including Real Estate	

Section I Option 2

Section II Option 2

I-64 Improvements Items	Unit Prices					
Clearing	$ 30,000.00 /Ac				27	Ac
					$ 810,000.00	Price
Excavation	$ 20.00 /CY					
Location		length (ft)	width (ft)	depth (ft)	volume	
Westbound outside shoulder		30797	10	2.00	22813	
Westbound outside shoulder		7928	13	2.00	7634	
Westbound inside shoulder		30797	4	0.67	3042	
Westbound inside shoulder		7928	4	0.67	783	
Westbound inside widening		30797	24	2.00	54750	
Westbound inside widening		7928	32	2.00	18792	
Eastbound outside shoulder		30797	10	2.00	22813	
Eastbound outside shoulder		7928	13	2.00	7634	
Eastbound inside shoulder		30797	4	0.67	3042	
Eastbound inside shoulder		7928	4	0.67	783	
Eastbound inside widening		30797	24	2.00	54750	
Eastbound inside widening		7928	32	2.00	18792	
	Total				215628.35	CY
					$ 4,312,566.91	Price
Median Borrow (4:1 slope)	$ 45.00 /LF					
Location						
Westbound outside		6196			6196	
Westbound median		22301			22301	
Eastbound outside		4534			4534	
Westbound median		21116			21116	
	Total				54147	LF
					$ 2,436,615.00	Price
Median Borrow (2:1 slope)	$ 150.00 /LF					
Location						
Westbound outside		1732			1732	
Westbound median		8496			8496	
Eastbound outside		3394			3394	
Eastbound median		9681			9681	
	Total				23303	LF
					$ 3,495,450.00	Price

Section II Option 2

Pavement	$ 11.00	/SF			
	$ 12.00	/SF			
Location	length (ft)	width (ft)	Area		
Westbound outside shoulder	30797	10	307970		
Westbound outside shoulder	7928	13	103064		
Westbound inside shoulder	30797	4	123188		
Westbound inside shoulder	7928	4	31712		
Westbound inside widening	30797	24	739128		
Westbound inside widening	7928	32	253696		
Eastbound outside shoulder	30797	10	307970		
Eastbound outside shoulder	7928	13	103064		
Eastbound inside shoulder	30797	4	123188		
Eastbound inside shoulder	7928	4	31712		
Westbound inside widening	30797	24	739128		
Westbound inside widening	7928	32	253696		
Subtotal			2340572	SF	
Subtotal			776944	SF	
			$ 35,069,620.00	Price	
Median Drainage	$ 125.00	/LF			
Location					
Entire Segment median			20719		
			20719	LF	
			$ 2,589,875.00	Price	
SWM Facilities	$ 95,000.00	/SMF			
			10	SMF	
			$ 950,000.00	Price	
Median Barrier	$ 75.00	/LF			
Location			Length		
2 lane section in median			7928		
			7928	LF	
			$ 594,600.00	Price	

Section II Option 2

Guardrail Removal	$ 15.00	/LF			
Location	length removed (ft)		Length		
Westbound median	8873		8873		
Westbound outside	1732		1732		
Eastbound median	10813		10813		
Eastbound outside	3394		3394		
Total			21418	LF	
			$ 321,270.00	Price	

Guardrail	$ 20.00	/LF		
Location	Length	% increase due to widening	Length	
1 lane section in median	30797		30797	
2 lane section outside	5126	10%	512.6	
Total			31309.6	LF
			$ 626,192.00	Price

Pier Crash Walls	$330/LF	NONE

MSE Walls	$ 60.00	/SF		
Location	Length (ft)	Height (ft)	Area	
Mile Marker 246	0	5	0	
Mile Marker 247	0	5	0	
Mile Marker 248	19400	5	97000	
			97000	SF
			$ 5,820,000.00	Price

Noise Wall	$ 37.00	/SF	NONE

Cantilever Sign Structure	$ 85,000.00	EA		
Location			Number	
Westbound			1	
Total			1	EA
			$ 85,000.00	Price

Overhead Sign Structure	$ 175,000.00	EA		
Location			Number	
Westbound			2	
Eastbound			1	
Total			3	LF
			$ 525,000.00	Price

Section II Option 2

ITS Sign Structure	$ 150,000.00	EA		
			3	EA
			$ 450,000.00	Price

Bridge Replacement	$ 360.00	/SF		
Location	Length (ft)	Widen (ft)	Area	
WB over City Reservoir	100	52	5200	
EB over city reservior	100	52	5200	
			10400	SF
			$ 3,744,000.00	Price

Bridge Widening	$ 400.00	/SF		
Location	Length (ft)	Widen (ft)	Area	
WB over yorktown rd	200	24	4800	
EB over yorktown rd	200	24	4800	
WB over jefferson ave	340	24	8160	
EB over jefferson ave	340	24	8160	
WB over burma rd	250	24	6000	
EB over Burma rd	270	24	6480	
			38400	SF
			$ 15,360,000.00	Price

Temporary PCC Barrier	$ 25.00	/LF		
Location	length (ft)	times placed	volume	
Westbound outside shoulder	30797	2	61594	
Eastbound outside shoulder	30797	2	61594	
Total			123188.00	LF
			$ 3,079,700.00	Price

E&S	$ 18.00	/LF		
Location	length (ft)	times placed	volume	
Westbound outside	30797	2	61594	
Eastbound outside	30797	2	61594	
Total			123188.00	LF
			$ 2,217,384.00	Price

Subtotal			$ 82,487,272.91
Mobilization	2%		$ 1,649,745.46
Construction Engineering	3%		$ 2,474,618.19
Contingency	20%		$ 16,497,454.58
Context Sensitive Design	10%		$ 8,248,727.29
Real Estate	$ 450,000.00	/Ac	$ 6,750,000.00
Planning Contingency	25%		$ 20,621,818.23

Section II Option 2

Total	$ 131,979,636.66
Not Including Real Estate	

Option 2 Summary

Segment	1	2
Length (ft)	26532	38725
Length (mi)	5.03	7.33
Items		
Clearing	$ 249,000.00	$ 810,000.00
Excavation	$ 3,642,679.82	$ 4,312,566.91
Median Borrow (4:1 slope)	$ 1,285,020.00	$ 2,436,615.00
Median Borrow (2:1 slope)	$ 3,676,200.00	$ 3,495,450.00
Pavement	$ 31,201,632.00	$ 35,069,620.00
Median Drainage	$ 3,316,500.00	$ 2,589,875.00
SWM Facilities	$ 855,000.00	$ 950,000.00
Median Barrier	$ 1,989,900.00	$ 594,600.00
Guardrail Removal	$ 518,805.00	$ 321,270.00
Guardrail	$ 539,176.00	$ 626,192.00
Pier Crash Walls	$ 33,000.00	NONE
MSE Walls	$ 3,979,800.00	$ 5,820,000.00
Noise Wall	$ 5,587,444.00	NONE
Cantilever Sign Structure	$ 255,000.00	$ 85,000.00
Overhead Sign Structure	$ 525,000.00	$ 525,000.00
ITS CMS Structure	NONE	$ 450,000.00
Bridge Replacement	$ 64,122,400.00	$ 3,744,000.00
Bridge Widening	$ -	$ 15,360,000.00
Temporary PCC Barrier	$ 2,653,200.00	$ 3,079,700.00
E&S	$ 1,910,304.00	$ 2,217,384.00
Mobilization (2%)	$ 2,526,801.22	$ 1,649,745.46
Construction Engineering (3%)	$ 3,790,201.82	$ 2,474,618.19
Contingency (20%)	$ 25,268,012.16	$ 16,497,454.58
Context Sensitive Design (10%)	$ 12,634,006.08	$ 8,248,727.29
Real Estate (Total)	$ 6,075,000.00	$ 6,750,000.00
Planning Contingency (25%)	$ 31,585,015.21	$ 20,621,818.23
Total	$ 202,144,097.32	$ 131,979,636.66

Note: Real Estate cost are not computed in any total or lane mile costs

Option 2 Full Shoulders NOTES

1 2 additional lane section ends at the eastern ramps of yorktown interchange

2 Pavement cost in this section higher in this option to allow for final overlay in additional 2 lane section

3 Clearing area bases an aerial measurements of the forested area within the median

4 The reconstruction of median shoulder to be 8" of deep lift hot mix for temporary pavment section. This work is to be done at night with lane closures

5 Borrow calculated to be 4:1 along the segement unless there was existing guardrail. In these sections the 2:1 item was used. No borrow used in the median section where 2 lanes were added

6 All canttilever and overhead sign structures found on the aerial estimated to be replaced

7 Denbigh Blvd bridge to be replaced due to the piers being just off the shoulders. Only portion of multiple span bridge that is over I-64 assumed to be reconstucted

8 All widened bridges appeared to be in acceptable condition to widen or have enough clearance to the piers to widen underneath.

9 All noise wall estimates are from walls that were deemed feasable and reasonable in the EIS document

10 Estimate assumes that 10' outside shoulder can be reconstructed with impact to guardrail or sideslope

11 MSE walls assumed on in the median of all major roadway horizontal curves due to grade differences associated with the roadway superelevation

12 Section length is based on centerline baseline

13 Ft Eustis Interchange improvements are to construct a SPUI interchange ($10M), Intersection improvements ($1M), and bridge reconstruction with 100' additional length (300' total) at the high price ($410/sf) totaling ($8,8560,00)

Section I Option 2 Full Shld

I-64 Improvements Items	Unit Prices				
Clearing	$ 30,000.00 /Ac			8.3	Ac
				$ 249,000.00	Price
Excavation	$ 20.00 /CY				
Location	length (ft)	width (ft)	depth (ft)	volume	
Westbound outside shoulder	26532	17	2.00	33410.67	
Westbound inside shoulder	26532	4	0.67	2620.44	
Westbound inside Widening	26532	32	2.00	62890.67	
Eastbound outside shoulder	26532	17	2.00	33410.67	
Eastbound inside shoulder	26532	4	0.67	2620.44	
Eastbound inside widening	26532	32	2.00	62890.67	
Total				197844	CY
				$ 3,956,871.11	Price
Borrow (4:1 slope)	$ 45.00 /LF				
Location	Length (ft)			Total Length	
Westbound outside	14431			14431	
Eastbound outside	14125			14125	
Total				28556	LF
				$ 1,285,020.00	Price
Borrow (2:1 slope)	$ 150.00 /LF				
Location	Length (ft)			Total Length	
Westbound outside	12101			12101	
Eastbound outside	12407			12407	
Total				24508	LF
				$ 3,676,200.00	Price
Pavement	$ 12.00 /SF				
Location	Length (ft)	Width (ft)		Area	
Westbound outside shoulder	26532	17		451044	
Westbound inside shoulder	26532	4		106128	
Westbound inside widening	26532	32		849024	
Eastbound outside shoulder	26532	17		451044	
Eastbound inside shoulder	26532	4		106128	
Eastbound inside widening	26532	32		849024	
Total				2812392	SF
				$ 33,748,704.00	Price
Median Drainage	$ 125.00 /LF				
Location	Length (ft)			Total Length	
Along entire Median	26532			26532	
Total				26532	LF
				$ 3,316,500.00	Price

Section I Option 2 Full Shld

SWM Facilities		$ 95,000.00	/SMF		
	Total			9	SMF
				$ 855,000.00	Price

Median Barrier		$ 75.00	/LF		
Location		Length (ft)		Total Length	
Along entire Median		26532		26532	
	Total			26532	LF
				$ 1,989,900.00	Price

Guardrail Removal		$ 15.00	/LF		
Location		Length (ft)		Total Length	
Westbound median		5193		5193	
Westbound outside		12101		12101	
Eastbound median		4886		4886	
Eastbound outside		12407		12407	
	Total			34587	LF
				$ 518,805.00	Price

Guardrail		$ 20.00	/LF		
Location		Length (ft)	% increase due to	Total Length	
Westbound outside shoulder		12101	10%	13311	
Eastbound outside shoulder		12407	10%	13648	
	Total			26959	LF
				$ 539,176.00	Price

Pier Crash Walls		$ 330.00	/LF		
					LF
				$ -	Price

MSE Walls		$ 60.00	/SF		
Location		Length (ft)	Height (ft)	Area	
Median in curves		0	5	0	
		13266	5	66330	
	Total			66330	SF
				$ 3,979,800.00	Price

Section I Option 2 Full Shld

Noise Wall	$ 37.00	/SF			
Location	Length (ft)	Ave. Height (ft)	Area		
EIS Barrier 46	4102	16	65632		
EIS Barrier 47 & 48	7115	12	85380		
Total			151012	SF	
			$ 5,587,444.00	Price	
Cantilever Sign Structure	$ 85,000.00	EA			
Location			Number		
Eastbound			3		
Total			3	EA	
			$ 255,000.00	Price	
Overhead Sign Structure	$ 175,000.00	EA			
Location			Number		
Westbound			1		
Eastbound			2		
Total			3	LF	
			$ 525,000.00	Price	
ITS Sign Structure	$ 150,000.00	EA	NONE		
Bridge Replacement	$ 360.00	/SF			
Location	Length (ft)	Width (ft)	Area		
WB over industrial parkway	250	52	13000		
EB over industrial parkway	250	52	13000		
Denbigh Road	860	60	51600		
Bland Road	510	89	45390		
			122990	SF	
For Eustis (SPUI option)			$ 19,846,000.00	Price	
			$ 64,122,400.00	Price	
Bridge Widening	$ 400.00	/SF			
Location	Length (ft)	Widen (ft)	Area		
				SF	
			$ -	Price	
Temporary PCC Barrier	$ 25.00	/LF			
Location	Length (ft)	# of times placed	Total Length		
Westbound outside shoulder	26532	2	53064		
Eastbound outside shoulder	26532	2	53064		
Total			106128	LF	
			$ 2,653,200.00	Price	

Section I Option 2 Full Shld

E&S	$ 18.00 /LF			
Location	Length (ft)		Total Length	
Westbound outside shoulder	26532		26532	
Eastbound outside shoulder	26532		26532	
Total			53064	LF
			$ 955,152.00	Price

Subtotal			$ 128,213,172.11
Mobilization	5%		$ 6,410,658.61
Construction Engineering	3%		$ 3,846,395.16
Contingency	20%		$ 25,642,634.42
Context Sensitive Design	10%		$ 12,821,317.21
Real Estate	$ 480,000.00 /Ac		$ 6,480,000.00
Planning Contingency	25%		$ 32,053,293.03
		Total	$ 208,987,470.54
		Not Including Real Estate	

Section II Option 2 Full Shld

I-64 Improvements Items	Unit Prices				
Clearing	$ 30,000.00	/Ac		27	Ac
				$ 810,000.00	Price

Excavation	$ 20.00	/CY			
Location	Length (ft)	Width (ft)	Depth (ft)	Volume	
Westbound outside shoulder	30797	10	2.00	22813	
Westbound outside shoulder	7928	17	2.00	9983	
Westbound inside shoulder	30797	4	0.67	3042	
Westbound inside shoulder	7928	4	0.67	783	
Westbound inside widening	30797	24	2.00	54750	
Westbound inside widening	7928	32	2.00	18792	
Eastbound outside shoulder	30797	10	2.00	22813	
Eastbound outside shoulder	7928	17	2.00	9983	
Eastbound inside shoulder	30797	4	0.67	3042	
Eastbound inside shoulder	7928	4	0.67	783	
Eastbound inside widening	30797	24	2.00	54750	
Eastbound inside widening	7928	32	2.00	18792	
Total				220326.42	CY
				$ 4,406,528.40	Price

Median Borrow (4:1 slope)	$ 45.00	/LF			
Location	Length (ft)			Total Length	
Westbound outside	6196			6196	
Westbound median	22301			22301	
Eastbound outside	4534			4534	
Westbound median	21116			21116	
Total				54147	LF
				$ 2,436,615.00	Price

Median Borrow (2:1 slope)	$ 150.00	/LF			
Location	Length (ft)			Total Length	
Westbound outside	1732			1732	
Westbound median	8496			8496	
Eastbound outside	3394			3394	
Eastbound median	9681			9681	
Total				23303	LF
				$ 3,495,450.00	Price

Section II Option 2 Full Shld

Pavement	$	11.00	/SF		
	$	12.00	/SF		

Location	Length (ft)	Width (ft)	Area	
Westbound outside shoulder	30797	10	307970	
Westbound outside shoulder	7928	17	134776	
Westbound inside shoulder	30797	4	123188	
Westbound inside shoulder	7928	4	31712	
Westbound inside widening	30797	24	739128	
Westbound inside widening	7928	32	253696	
Eastbound outside shoulder	30797	10	307970	
Eastbound outside shoulder	7928	17	134776	
Eastbound inside shoulder	30797	4	123188	
Eastbound inside shoulder	7928	4	31712	
Westbound inside widening	30797	24	739128	
Westbound inside widening	7928	32	253696	
Subtotal			2340572	SF
Subtotal			840368	SF
			$ 35,830,708.00	Price

Median Drainage	$	125.00	/LF		

Location	Length (ft)	Total Length	
Entire Segment median	38725	38725	
Total		38725	LF
		$ 4,840,625.00	Price

SWM Facilities	$	95,000.00	/SMF		
Total				10	SMF
				$ 950,000.00	Price

Median Barrier	$	75.00	/LF		

Location	Length (ft)	Total Length	
2 lane section in median	7928	7928	
		7928	LF
		$ 594,600.00	Price

Section II Option 2 Full Shld

Guardrail Removal $ 15.00 /LF

Location	Length (ft)	Total Length	
Westbound median	8873	8873	
Westbound outside	1732	1732	
Eastbound median	10813	10813	
Eastbound outside	3394	3394	
Total		24812	LF
		$ 372,180.00	Price

Guardrail $ 20.00 /LF

Location	Length (ft)	% increase due to widening	Total Length	
1 lane section in median	30797		30797	
2 lane section outside	5126	10%	5638.6	
Total			36435.6	LF
			$ 728,712.00	Price

Pier Crash Walls $330/LF NONE

MSE Walls $ 60.00 /SF

Location	Length (ft)	Height (ft)	Area	
Mile Marker 246	0	5	0	
Mile Marker 247	0	5	0	
Mile Marker 248	19400	5	97000	
Total			97000	SF
			$ 5,820,000.00	Price

Noise Wall $ 37.00 /SF NONE

Cantilever Sign Structure $ 85,000.00 EA

Location	Number	
Westbound	1	
Total	1	EA
	$ 85,000.00	Price

Overhead Sign Structure $ 175,000.00 EA

Location	Number	
Westbound	2	
Eastbound	1	
Total	3	LF
	$ 525,000.00	Price

Section II Option 2 Full Shld

ITS Sign Structure	$ 150,000.00	EA			
Total			3		EA
			$ 450,000.00		Price

Bridge Replacement	$ 360.00	/SF		
Location	Length (ft)	Widen (ft)	Area	
WB over City Reservoir	100	52	5200	
EB over city reservior	100	52	5200	
Route 199 (Humelsine Rd)	335	55	18425	
Route 199 (Humelsine Rd)	335	55	18425	
Total			47250	SF
			$ 17,010,000.00	Price

Bridge Widening	$ 400.00	/SF		
Location	Length (ft)	Widen (ft)	Area	
WB over yorktown rd	200	24	4800	
EB over yorktown rd	200	24	4800	
WB over jefferson ave	340	24	8160	
EB over jefferson ave	340	24	8160	
WB over burma rd	250	24	6000	
EB over Burma rd	270	24	6480	
Total			38400	SF
			$ 15,360,000.00	Price

Temporary PCC Barrier	$ 25.00	/LF		
Location	Length (ft)	# of times placed	Total Length	
Westbound outside shoulder	38725	2	77450	
Eastbound outside shoulder	38725	2	77450	
Total			154900	LF
			$ 3,872,500.00	Price

E&S	$ 18.00	/LF		
Location	Length (ft)		Total Length	
Westbound outside	38725		38725	
Eastbound outside	38725		38725	
Total			77450	LF
			$ 1,394,100.00	Price

Subtotal			$ 98,982,018.40
Mobilization	5%		$ 4,949,100.92
Construction Engineering	5%		$ 4,949,100.92
Contingency	20%		$ 19,796,403.68
Context Sensitive Design	20%		$ 19,796,403.68
Real Estate	$ 480,000.00	/Ac	$ 7,200,000.00
Planning Contingency	25%		$ 24,745,504.60
		Total	$ 173,218,532.19
		Not Including Real Estate	

Section I Option 2 SPUI

I-64 Improvements Items	Unit Prices			
Bridge Replacement	$ 360.00 /SF			
Location				
For Eustis (SPUI option)			$ 19,846,000.00	Price
			$ 19,846,000.00	Price

Subtotal			$ 19,846,000.00
Mobilization	2%		$ 396,920.00
Construction Engineering	3%		$ 595,380.00
Contingency	20%		$ 3,969,200.00
Context Sensitive Design	10%		$ 1,984,600.00
Real Estate	$ 480,000.00 /Ac		
Planning Contingency	25%		$ 4,961,500.00
		Total	$ 31,753,600.00

Option 2 Full Shld Summary

Segment	1	2	3	4
Length (ft)	26532	38725	20356	22588
Length (mi)	5.03	7.33	3.86	4.28
Items				
Clearing	$ 249,000.00	$ 810,000.00	N/A	N/A
Excavation	$ 3,956,871.11	$ 4,406,528.40	N/A	N/A
Median Borrow (4:1 slope)	$ 1,285,020.00	$ 2,436,615.00	N/A	N/A
Median Borrow (2:1 slope)	$ 3,676,200.00	$ 3,495,450.00	N/A	N/A
Pavement	$ 33,748,704.00	$ 35,830,708.00	N/A	N/A
Median Drainage	$ 3,316,500.00	$ 4,840,625.00	N/A	N/A
SWM Facilities	$ 855,000.00	$ 950,000.00	N/A	N/A
Median Barrier	$ 1,989,900.00	$ 594,600.00	N/A	N/A
Guardrail Removal	$ 518,805.00	$ 372,180.00	N/A	N/A
Guardrail	$ 539,176.00	$ 728,712.00	N/A	N/A
Pier Crash Walls	$ -	NONE	N/A	N/A
MSE Walls	$ 3,979,800.00	$ 5,820,000.00	N/A	N/A
Noise Wall	$ 5,587,444.00	NONE	N/A	N/A
Cantilever Sign Structure	$ 255,000.00	$ 85,000.00	N/A	N/A
Overhead Sign Structure	$ 525,000.00	$ 525,000.00	N/A	N/A
ITS CMS Structure	NONE	$ 450,000.00	N/A	N/A
Bridge Replacement	$ 64,122,400.00	$ 17,010,000.00	N/A	N/A
Bridge Widening	$ -	$ 15,360,000.00	N/A	N/A
Temporary PCC Barrier	$ 2,653,200.00	$ 3,872,500.00	N/A	N/A
E&S	$ 955,152.00	$ 1,394,100.00	N/A	N/A
Mobilization (2%)	$ 6,410,658.61	$ 4,949,100.92	N/A	N/A
Construction Engineering (3%)	$ 3,846,395.16	$ 4,949,100.92	N/A	N/A
Contingency (20%)	$ 25,642,634.42	$ 19,796,403.68	N/A	N/A
Context Sensitive Design (10%)	$ 12,821,317.21	$ 19,796,403.68	N/A	N/A
Real Estate (Total)	$ 6,480,000.00	$ 7,200,000.00	N/A	N/A
Planning Contingency (25%)	$ 32,053,293.03	$ 24,745,504.60		
Total	$ 208,987,470.54	$ 173,218,532.19	$ -	$ -

Note: Real Estate cost are not computed in any total or lane mile costs

Total (w/Real Estate)	$ 215,467,470.54	$ 180,418,532.19
Total (Rounded)	$220,000,000	$190,000,000

Option 3 NOTES

1	Clearing Area equal to the area of emergency pull off area plus 25% then rounded to the nearest 1/2 acre
2	At all interchanges with a conflict it is assumed that the managed shoulder will drop at the exit and resume after the interchange
3	Reconstruction of median shoulder with 8" hot mix temporary pavement to be done during nightime construction under lane closure
4	All non interchange bridges throughout the segments are assume to have sufficient shoulders to continue the managed shoulder across except for the bridge between mile markers 239 and 240 which is to be replaced
6	Emergency pull off meaured as 1050' long with 350' tapers in and out and 350' tangent area 16' wide
7	All noise wall estimates are from walls that were deemed feasable and reasonable in the EIS document
8	Estimate assumes that 10' outside shoulder can be reconstructed with impact to guardrail or sideslope
9	Section length is based on centerline baseline
10	All canttilever and overhead sign structures found on the aerial estimated to be replaced
11	All interchanges that may need design exception due to managed should to remain unmodified and the managed shoulder shall drop at exit ramp and return at entrance ramp

Section I Option 3

I-64 Improvements Items	Unit Prices				
Clearing	$ 30,000.00 /Ac				
				6.5	Ac
				$ 195,000.00	Price
Excavation	$ 20.00 /CY				
Location	Length (ft)	Width (ft)	Depth (ft)	Volume	
Westbound outside shoulder	26532	14	2.00	27514.67	
Westbound inside shoulder	26532	4	0.67	2620.44	
Eastbound outside shoulder	26532	14	2.00	27514.67	
Eastbound inside shoulder	26532	4	0.67	2620.44	
Total				60270.22	CY
				$ 1,205,404.44	Price
Median Borrow (4:1 slope)	$ 30.00 /LF				
Location	Length (ft)			Total Length	
WB Emergency Pull-Off Locations	10500			10500	
EB Emergency Pull-Off Locations	10500			10500	
Westbound outside shoulder	3931			3931	
Eastbound outside shoulder	3625			3625	
Total				28556	LF
				$ 856,680.00	Price
Outside Borrow (2:1 slope)	$ 10.00 /LF				
Location	Length (ft)			Total Length	
Westbound outside shoulder	12101			12101	
Eastbound outside shoulder	12407			12407	
Total				24508	LF
				$ 245,080.00	Price
Pavement	$ 11.00 /SF				
Location	length (ft)	width (ft)		Area	
Westbound outside shoulder	26532	14		371448	
Westbound inside shoulder	26532	4		106128	
Eastbound outside shoulder	26532	14		371448	
Eastbound inside shoulder	26532	4		106128	
	Area				
WB Emergency pull off (every 1/2mi)	112000			112000	
EB Emergency pull off (every 1/2mi)	112000			112000	
Total				1179152	SF
				$ 12,970,672.00	Price
Median Drainage	$ 125.00 /LF			NONE	

Section I Option 3

SWM Facilities	$ 95,000.00	/SMF			
Total				9	
				$ 855,000.00	Price

Median Barrier	$ 75.00	/LF	NONE	

Guardrail Removal	$ 15.00	/LF		
Location	Length (ft)		Total Length	
Westbound outside shoulder	12101		12101	
Eastbound outside shoulder	12407		12407	
Total			24508	LF
			$ 367,620.00	Price

Guardrail	$ 20.00	/LF		
Location	length removed (ft)	% increase due to widening	Length	
Westbound outside shoulder	12101	10%	13311	
Eastbound outside shoulder	12407	10%	13648	
Total			26959	LF
			$ 539,176.00	Price

Pier Crash Walls	$ 330.00	/LF		
Location			Length	
Denbigh road bridge			200	
Total			200	LF
			$ 66,000.00	Price

MSE Walls	$ 60.00	/SF	NONE	

Noise Wall	$ 37.00	/SF		
Location	Length (ft)	Ave. Height (ft)	Area	
EIS Barrier 46	4102	16	65632	
EIS Barrier 47 & 48	7115	12	85380	
Total			151012	SF
			$ 5,587,444.00	Price

Section I Option 3

Cantilever Sign Structure	$ 85,000.00	EA			
Location			Number		
Eastbound			3		
Total			3		EA
			$ 255,000.00		Price
Overhead Sign Structure	$ 175,000.00	EA			
Location			Number		
Westbound			1		
Eastbound			2		
Total			3		LF
			$ 525,000.00		Price
ITS Sign Structure	$ 150,000.00	EA			
	$ 85,000.00	EA			
Type			Number		
Overhead			0		
Cantilever			6		
			$ -		Sub
			$ 510,000.00		Sub
			$ 510,000.00		Price
Bridge Replacement	$ 360.00	/SF	NONE		
Bridge Widening	$ 400.00	/SF	NONE		
Temporary PCC Barrier	$ 25.00	/LF			
Location	Length (ft)		Total Length		
Westbound outside shoulder	26532		26532		
Eastbound outside shoulder	26532		26532		
Total			53064.00		LF
			$ 1,326,600.00		Price
E&S	$ 18.00	/LF			
Location	Length (ft)		Total Length		
Westbound outside shoulder	26532		26532		
Eastbound outside shoulder	26532		26532		
Total			53064.00		LF
			$ 955,152.00		Price

Subtotal			$ 26,459,828.44
Mobilization	5%		$ 1,322,991.42
Construction Engineering	3%		$ 793,794.85
Contingency	20%		$ 5,291,965.69
Context Sensitive Design	10%		$ 2,645,982.84
Real Estate	$ 480,000.00	/Ac	$ 8,948,319.56
Plannning Contingency	25%		$ 6,614,957.11
		Total	$ 43,129,520.36

Section I Option 3

Not Including Real Estate

Section II Option 3

I-64 Improvements Items	Unit Prices					
Clearing	$ 30,000.00	/Ac				
					7	Ac
					$ 210,000.00	Price
Excavation	$ 20.00	/CY				
Location	Length (ft)	Width (ft)	Depth (ft)	Volume		
Westbound outside shoulder	38725	14	2.00	40159.26		
Westbound inside shoulder	38725	4	0.67	3824.69		
Eastbound outside shoulder	38725	14	2.00	40159.26		
Eastbound inside shoulder	38725	4	0.67	3824.69		
Total				87967.90	CY	
				$ 1,759,358.02	Price	
Outside Borrow (4:1 slope)	$ 30.00	/LF				
Location	Length (ft)			Total Length		
WB Emergency Pull-Off Locations	14700			14700		
EB Emergency Pull-Off Locations	14700			14700		
Westbound outside shoulder	12105			12105		
Eastbound outside shoulder	9543			9543		
Total				51048	LF	
				$ 1,531,440.00	Price	
Outside Borrow (2:1 slope)	$ 10.00	/LF				
Location	Length (ft)			Total Length		
Westbound outside shoulder	11920			11920		
Eastbound outside shoulder	14482			14482		
Total				26402	LF	
				$ 264,020.00	Price	
Pavement	$ 11.00	/SF				
Location	Length (ft)	Width (ft)		Area		
Westbound outside shoulder	38725	14		542150		
Westbound inside shoulder	38725	4		154900		
Eastbound outside shoulder	38725	14		542150		
Eastbound inside shoulder	38725	4		154900		
	Area					
WB Emergency pull off (every 1/2mi)	156800			156800		
EB Emergency pull off (every 1/2mi)	156800			156800		
Total				1707700	SF	
				$ 18,784,700.00	Price	
Median Drainage	$ 125.00	/LF		NONE		

Section II Option 3

SWM Facilities	$	95,000.00	/SMF		
Total				10	
				$ 950,000.00	Price

Median Barrier	$	75.00	/LF	NONE	

Guardrail Removal	$	15.00	/LF		
Location		Length (ft)		Total Length	
Westbound outside shoulder		11920		11920	
Eastbound outside shoulder		14482		14482	
Total				26402	LF
				$ 396,030.00	Price

Guardrail	$	20.00	/LF		
Location		Length (ft)	% increase due to	Total Length	
Westbound outside shoulder		11920	10%	13112	
Eastbound outside shoulder		14482	10%	15930	
Total				29042.2	LF
				$ 580,844.00	Price

Pier Crash Walls	$	330.00	/LF	NONE	

MSE Walls	$	60.00	/SF	NONE	

Noise Wall	$	37.00	/SF	NONE	

Cantilever Sign Structure	$	85,000.00	EA		
Location				Number	
Westbound				1	
Total				1	EA
				$ 85,000.00	Price

Overhead Sign Structure	$	175,000.00	EA		
Location				Number	
Westbound				2	
Eastbound				1	
Total				3	LF
				$ 525,000.00	Price

Section II Option 3

ITS Sign Structure	$ 150,000.00	EA			
	$ 85,000.00	EA			
Type			Number		
Overhead			3		
Cantilever			10		
			$ 450,000.00	Sub	
			$ 850,000.00	Sub	
			$ 1,300,000.00	Price	
Bridge Replacement	$360/SF		NONE		
Bridge Widening	$400/SF		NONE		
Temporary PCC Barrier	$ 25.00	/LF			
Location	Length (ft)		Total Length		
Westbound outside shoulder	38725		38725		
Eastbound outside shoulder	38725		38725		
Total			77450	LF	
			$ 1,936,250.00	Price	
E&S	$ 18.00	/LF			
Location	Length (ft)		Total Length		
Westbound outside shoulder	38725		38725		
Eastbound outside shoulder	38725		38725		
Total			77450.00	LF	
			$ 1,394,100.00	Price	

Subtotal			$ 29,716,742.02
Mobilization	5%		$ 1,485,837.10
Construction Engineering	3%		$ 891,502.26
Contingency	20%		$ 5,943,348.40
Context Sensitive Design	10%		$ 2,971,674.20
Real Estate	$ 480,000.00	/Ac	$ 10,655,647.38
Planning Contingency	25%		$ 7,429,185.51
		Total	$ 48,438,289.50
		Not Including Real Estate	

Section III Option 3

I-64 Improvements Items	Unit Prices				
Clearing	$ 30,000.00 /Ac				
				7	Ac
				$ 210,000.00	Price
Excavation	$ 20.00 /CY				
Location	length (ft)	width (ft)	depth (ft)	volume	
Westbound outside shoulder	20356	14	2.00	21109.93	
Westbound inside shoulder	20356	4	0.67	2010.47	
Eastbound outside shoulder	20356	14	2.00	21109.93	
Eastbound inside shoulder	20356	4	0.67	2010.47	
Total				46240.79	CY
				$ 924,815.80	Price
Outside Borrow (4:1 slope)	$ 30.00 /LF				
Location	Length (ft)			Total Length	
WB Emergency Pull-Off Locations	8400			8400	
EB Emergency Pull-Off Locations	8400			8400	
Total				16800	LF
				$ 504,000.00	Price
Outside Borrow (2:1 slope)	$ 10.00 /LF				
Location	Length (ft)			Total Length	
Westbound outside shoulder	15978			15978	
Eastbound outside shoulder	18165			18165	
Total				34143	LF
				$ 341,430.00	Price
Pavement	$ 11.00 /SF				
Location	length (ft)	width (ft)		Area	
Westbound outside shoulder	20356	14		284984	
Westbound inside shoulder	20356	4		81424	
Eastbound outside shoulder	20356	14		284984	
Eastbound inside shoulder	20356	4		81424	
	Area				
WB Emergency pull off (every 1/2mi)	89600			89600	
EB Emergency pull off (every 1/2mi)	89600			89600	
Total				912016	SF
				$ 10,032,176.00	Price
Median Drainage	$ 125.00 /LF			NONE	

Section III Option 3

SWM Facilities	$	95,000.00	/SMF		
Total				8	
				$ 760,000.00	Price
Median Barrier	$	75.00	/LF	NONE	
Guardrail Removal	$	15.00	/LF		
Location		Length (ft)		Total Length	
Westbound outside shoulder		15978		15978	
Eastbound outside shoulder		18165		18165	
Total				34143	LF
				$ 512,145.00	Price
Guardrail	$	20.00	/LF		
Location		Length (ft)	% increase due to	Total Length	
Westbound outside shoulder		15978	10%	17575.8	
Eastbound outside shoulder		18165	10%	19981.5	
Total				37557.3	LF
				$ 751,146.00	Price
Pier Crash Walls	$	330.00	/LF		
Location				Length	
716 crossing				100	
Total				100	LF
				$ 33,000.00	Price
MSE Walls	$60/SF			NONE	
Noise Wall	$	37.00	/SF		
Location		Length (ft)	Ave Height (ft)	Area	
EIS Barrier 40 & 41		2242	19	42598	
EIS Barrier 42		2055	20	41100	
Total				83698	SF
				$ 3,096,826.00	Price

Section III Option 3

Cantilever Sign Structure	$ 85,000.00	EA			
Location				Number	
Westbound				1	
Eastbound				2	
Total				3	EA
				$ 255,000.00	Price
Overhead Sign Structure	$ 175,000.00	EA			
Location				Number	
Westbound				4	
Eastbound				4	
Total				8	LF
				$ 1,400,000.00	Price
ITS Sign Structure	$ 150,000.00	EA			
	$ 85,000.00	EA			
Type				Number	
Overhead				1	
Cantilever				5	
				$ 150,000.00	Sub
				$ 425,000.00	Sub
				$ 575,000.00	Price
Bridge Replacement	$ 360.00	/SF			
Location	Length (ft)		Width (ft)	Area	
Westbound I-64 over Queens Creek	908		52	47216	
Eastbound I-64 over Queens Creek	931		52	48412	
Total				95628	SF
				$ 34,426,080.00	Price
Bridge Widening	$400/SF			NONE	
Temporary PCC Barrier	$ 25.00	/LF			
Location	Length (ft)			Total Length	
Westbound outside shoulder	20356			20356	
Eastbound outside shoulder	20356			20356	
Total				40712	LF
				$ 1,017,800.00	Price
E&S	$ 18.00	/LF			
Location	Length (ft)			Total Length	
Westbound outside shoulder	20356			20356	
Eastbound outside shoulder	20356			20356	
Total				40712	LF
				$ 732,816.00	Price

Section III Option 3

Subtotal			$	55,572,234.80
Mobilization	5%		$	2,778,611.74
Construction Engineering	3%		$	1,667,167.04
Contingency	20%		$	11,114,446.96
Context Sensitive Design	10%		$	5,557,223.48
Real Estate	$ 480,000.00	/Ac	$	7,734,655.65
Planning Contingency	25%		$	13,893,058.70
		Total	$	90,582,742.73
		Not Including Real Estate		

Section IV Option 3

I-64 Improvements Items	Unit Prices				
Clearing	$ 30,000.00 /Ac				
				5	Ac
				$ 150,000.00	Price
Excavation	$ 20.00 /CY				
Location	Length (ft)	Width (ft)	Depth (ft)	Volume	
Westbound outside shoulder	22588	14	2.00	23424.59	
Westbound inside shoulder	22588	4	0.67	2230.91	
Eastbound outside shoulder	22588	14	2.00	23424.59	
Eastbound inside shoulder	22588	4	0.67	2230.91	
Total				51311.01	CY
				$ 1,026,220.25	Price
Outside Borrow (4:1 slope)	$ 30.00 /LF				
Location	Length (ft)			Total Length	
WB Emergency Pull-Off	8400			8400	
EB Emergency Pull-Off	8400			8400	
Westbound outside shoulder	11533			11533	
Eastbound outside shoulder	9753			9753	
Total				38086	LF
				$ 1,142,580.00	Price
Outside Borrow (2:1 slope)	$ 10.00 /LF				
Location	Length (ft)			Total Length	
Westbound outside shoulder	2655			2655	
Eastbound outside shoulder	4435			4435	
Total				7090	LF
				$ 70,900.00	Price
Pavement	$ 11.00 /SF				
Location	Lenth (ft)	Width (ft)		Area	
Westbound outside shoulder	22588	14		316232	
Westbound inside shoulder	22588	4		90352	
Eastbound outside shoulder	22588	14		316232	
Eastbound inside shoulder	22588	4		90352	
	Area				
WB Emergency pull off (every 1/2mi)	89600			89600	
EB Emergency pull off (every 1/2mi)	89600			89600	
Total				992368	SF
				$ 10,916,048.00	Price
Median Drainage	$ 125.00 /LF			NONE	

Section IV Option 3

SWM Facilities	$ 95,000.00	/SMF			
Total				9	
				$ 855,000.00	Price
Median Barrier	$ 75.00	/LF		NONE	
Guardrail Removal	$ 15.00	/LF			
Location	Length (ft)			Total Length	
Westbound outside shoulder	2655			2655	
Eastbound outside shoulder	4435			4435	
Total				7090	LF
				$ 106,350.00	Price
Guardrail	$ 20.00	/LF			
Location	Length (ft)	% increase due to widening		Length	
Westbound outside shoulder	2655	10%		2920.5	
Eastbound outside shoulder	4435	10%		4878.5	
Total				7799	LF
				$ 155,980.00	Price
Pier Crash Walls	$ 330.00	/LF		NONE	
MSE Walls	$ 60.00	/SF		NONE	
Noise Wall	$ 37.00	/SF		NONE	
Cantilever Sign Structure	$ 85,000.00	EA			
Location				Number	
Westbound				1	
Eastbound				0	
Total				1	EA
				$ 85,000.00	Price
Overhead Sign Structure	$ 175,000.00	EA			
Location				Number	
Westbound				2	
Eastbound				1	
Total				3	LF
				$ 525,000.00	Price

Section IV Option 3

ITS Sign Structure	$ 150,000.00	EA			
	$ 85,000.00	EA			
Type			Number		
Overhead			0		
Cantilever			5		
			$ -	Sub	
			$ 425,000.00	Sub	
			$ 425,000.00	Price	
Bridge Replacement	$ 360.00	/SF	NONE		
Bridge Widening	$ 400.00	/SF	NONE		
Temporary PCC Barrier	$ 25.00	/LF			
Location	Length (ft)		Total Length		
Westbound outside shoulder	22588		22588		
Eastbound outside shoulder	22588		22588		
Total			45176	LF	
			$ 1,129,400.00	Price	
E&S	$ 18.00	/LF			
Location	Length (ft)		Total Length		
Westbound outside shoulder	22588		22588		
Eastbound outside shoulder	22588		22588		
Total			45176	LF	
			$ 813,168.00	Price	
Subtotal			$ 17,400,646.25		
Mobilization	5%		$ 870,032.31		
Construction Engineering	3%		$ 522,019.39		
Contingency	20%		$ 3,480,129.25		
Context Sensitive Design	10%		$ 1,740,064.62		
Real Estate	$ 480,000.00	/Ac	$ 8,454,655.65		
Planning Contingency	25%		$ 4,350,161.56		
		Total	$ 28,363,053.38		
		Not Including Real Estate			

Option 3 Summary

Segment	1	2	3	4
Length (ft)	26532	38725	20356	22588
Length (mi)	5.03	7.33	3.86	4.28
Items				
Clearing	$ 195,000.00	$ 210,000.00	$ 210,000.00	$ 150,000.00
Excavation	$ 1,205,404.44	$ 1,759,358.02	$ 924,815.80	$ 1,026,220.25
Median Borrow (4:1 slope)	$ 856,680.00	$ 1,531,440.00	$ 504,000.00	$ 1,142,580.00
Median Borrow (2:1 slope)	$ 245,080.00	$ 264,020.00	$ 341,430.00	$ 70,900.00
Pavement	$ 12,970,672.00	$ 18,784,700.00	$ 10,032,176.00	$ 10,916,048.00
Median Drainage	NONE	NONE	NONE	NONE
SWM Facilities	$ 855,000.00	$ 950,000.00	$ 760,000.00	$ 855,000.00
Median Barrier	NONE	NONE	NONE	NONE
Guardrail Removal	$ 367,620.00	$ 396,030.00	$ 512,145.00	$ 106,350.00
Guardrail	$ 539,176.00	$ 580,844.00	$ 751,146.00	$ 155,980.00
Pier Crash Walls	$ 66,000.00	NONE	$ 33,000.00	NONE
MSE Walls	NONE	NONE	NONE	NONE
Noise Wall	$ 5,587,444.00	NONE	$ 3,096,826.00	NONE
Cantilever Sign Structure	$ 255,000.00	$ 85,000.00	$ 255,000.00	$ 85,000.00
Overhead Sign Structure	$ 525,000.00	$ 525,000.00	$ 1,400,000.00	$ 525,000.00
ITS CMS Structure	$ 510,000.00	$ 1,300,000.00	$ 575,000.00	$ 425,000.00
Bridge Replacement	NONE	NONE	$ 34,426,080.00	NONE
Bridge Widening	NONE	NONE	NONE	NONE
Temporary PCC Barrier	$ 1,326,600.00	$ 1,936,250.00	$ 1,017,800.00	$ 1,129,400.00
E&S	$ 955,152.00	$ 1,394,100.00	$ 732,816.00	$ 813,168.00
Mobilization (2%)	$ 1,322,991.42	$ 1,485,837.10	$ 2,778,611.74	$ 870,032.31
Construction Engineering (3%)	$ 793,794.85	$ 891,502.26	$ 1,667,167.04	$ 522,019.39
Contingency (20%)	$ 5,291,965.69	$ 5,943,348.40	$ 11,114,446.96	$ 3,480,129.25
Context Sensitive Design (10%)	$ 2,645,982.84	$ 2,971,674.20	$ 5,557,223.48	$ 1,740,064.62
Real Estate (Total)	$ 8,948,319.56	$ 10,655,647.38	$ 7,734,655.65	$ 8,454,655.65
Planning Contingency (25%)	$ 6,614,957.11	$ 7,429,185.51	$ 13,893,058.70	$ 4,350,161.56
Total	$ 43,129,520.36	$ 48,438,289.50	$ 90,582,742.73	$ 28,363,053.38

Note: Real Estate cost are not computed in any total or lane mile costs

Total (W/RealEstate)	$ 52,077,839.92	$ 59,093,936.88	$ 98,317,398.38	$ 36,817,709.03
Total (Rounded)	$60,000,000	$65,000,000	$100,000,000	$40,000,000

Segment	Length (ft)	85% CPM Low	Description	VDOT Low Subtotal	Bridge Cost	Noise Wall Cost	Real Estate	VDOT Low Total	Estimate Total	% Difference	85% CPM High	VDOT High Subtotal	VDOT High Total	% Difference
Segment IV	22588													
Option 1		$6,970,000	Richmond Rural 4 Lane Diveded 48' New	$29,817,871	$ 10,983,600	-	$ 6,480,000	$47,281,471	$ 75,425,193	60%	$9,664,500	$41,345,024	$ 58,808,624	22%
Option 3		$3,986,500	Richmond Rural 2 Lane 24' New/Recon	$17,054,368	-	-	$ 8,454,656	$25,509,023	$ 28,363,053	11%	$5,975,500	$25,563,370	$ 34,018,026	-20%
Segment III	20356													
Option 1		$6,970,000	Richmond Rural 4 Lane Diveded 48' New	$26,871,462	$ 50,299,080	$ 3,096,826	$ 5,760,000	$86,027,368	$ 144,412,548	68%	$9,664,500	$37,259,576	$ 96,415,482	33%
Option 3		$3,986,500	Richmond Rural 2 Lane 24' New/Recon	$15,369,166	$ 34,426,080	$ 3,096,826	$ 7,734,656	$60,626,727	$ 90,582,743	49%	$5,975,500	$23,037,363	$ 68,294,925	25%
Segment II	38725													
Option 1		$8,865,500	Richmond Rural 4 Lane Diveded 48' New	$65,022,062	$ 30,546,000	-	$ 7,200,000	$102,768,062	$ 150,520,016	46%	$12,945,500	$94,945,926	$ 132,691,926	12%
Option 2A		$9,711,250	Richmond Rural 4 Lane/Rural 6 Lane New	$71,225,030	$ 32,370,000	-	$ 7,200,000	$110,795,030	$ 173,218,532	56%	$14,488,250	$106,260,887	$ 145,830,887	16%
Option 3		$4,879,000	Richmond Rural 2 Lane 24' New/Recon	$35,783,954	-	-	$ 10,655,647	$46,439,601	$ 48,438,290	4%	$7,216,500	$52,927,834	$ 63,583,481	-31%
Segment I	26532													
Option 1		$8,865,500	Hampton Rural 4 Lane Divided 48' New	$44,549,138	$ 8,448,000	$ 5,587,444	$ 6,480,000	$65,064,582	$ 91,134,146	40%	$12,945,500	$65,051,138	$ 85,566,582	6%
Option 2		$10,557,000	Hampton Rural 6 Lane 72' New	$53,048,925	$ 64,122,400	$ 5,587,444	$ 6,480,000	$129,238,769	$ 208,987,471	62%	$16,031,000	$80,555,775	$ 156,745,619	25%
Option 3		$4,879,000	Hampton Rural 2 Lane 24' New/Recon	$24,516,975	-	$ 5,587,444	$ 8,948,320	$39,052,739	$ 43,129,520	10%	$7,216,500	$36,262,913	$ 50,798,676	-18%

Section I Option 1 A

I-64 Improvements Items	Unit Prices					
Excavation	$ 20.00	/CY				
Location	length (ft)	width (ft)	depth (ft)	volume		
Emergency Pull Off Area	1750	16	2.00	2074.07		
Total				2074.07	CY	
				$ 41,481.48	Price	
Pavement	$ 11.00	/SF				
Location	length (ft)	width (ft)		Area		
Emergency Pull Off Area	1750	16		28000		
Total				28000	SF	
				$ 308,000.00	Price	
Median Barrier	$ 75.00	/LF				
Median Emergency Pull Off				2200		
				$ 2,200.00		
				$ 165,000.00		
Guardrail	$ 20.00	/LF				
Location				Length		
Offset from median barrier				-1750		
Total				-1750	LF	
				$ (35,000.00)	Price	
ITS Sign Structure	Average Cost Per Mile From Option 3			$ 140,000.00		

Subtotal			$ 619,481.48
Mobilization	2%		$ 12,389.63
Construction Engineering	3%		$ 18,584.44
Contingency	20%		$ 123,896.30
Context Sensitive Design	10%		$ 61,948.15
Real Estate	$ 150,000.00	/Ac	$ -
Planning Contingency	25%		$ 154,870.37
		Total	$ 991,170.37

Option 1 A Summary

Items		
Excavation	$	41,481.48
Pavement	$	308,000.00
Median Barrier	$	165,000.00
Guardrail	$	(35,000.00)
ITS CMS Structure	$	140,000.00
Mobilization (2%)	$	12,389.63
Construction Engineering (3%)	$	18,584.44
Contingency (20%)	$	123,896.30
Context Sensitive Design (10%)	$	61,948.15
Planning Contingency (25%)	$	154,870.37
Total	$	991,170.37

APPENDIX B

I-64 Freeway Sections LOS and V/C ratios

2011 Existing

From Exit	To Exit	Lanes	2011 Eastbound				2011 Westbound			
			AM Peak Volume[1]	AM Peak LOS	PM Peak Volume[1]	PM Peak LOS	AM Peak Volume[1]	AM Peak LOS	PM Peak Volume[1]	PM Peak LOS
250	255	EB: 2, WB: 2	4069	E	3891	D	3496	D	3893	D
247	250	EB: 2, WB: 2	3818	D	3053	C	2841	C	3638	D
243	247	EB: 2, WB: 2	3286	D	2797	C	2743	C	3559	D
242	243	EB: 2, WB: 2	3258	D	2789	C	2456	C	3246	D
238	242	EB: 2, WB: 2	2329	C	2166	B	1658	B	2526	C
234	238	EB: 2, WB: 2	2315	C	2002	B	1440	B	2481	C

[1] vehicles per hour, per 2011 Existing volumes in Draft EIS

Note: LOS for basic freeway segments is defined by density (pc/mi/ln).

From Exit	To Exit	Lanes	2011 Eastbound						2011 Westbound					
			AM Peak Volume[1]	AM Peak Capacity	AM Peak V/C	PM Peak Volume[1]	PM Peak Capacity	PM Peak V/C	AM Peak Volume[1]	AM Peak Capacity	AM Peak V/C	PM Peak Volume[1]	PM Peak Capacity	PM Peak V/C
250	255	EB: 2, WB: 2	4069	4700	0.87	3891	4700	0.83	3496	4700	0.74	3893	4700	0.83
247	250	EB: 2, WB: 2	3818	4700	0.81	3053	4700	0.65	2841	4700	0.60	3638	4700	0.77
243	247	EB: 2, WB: 2	3286	4700	0.70	2797	4700	0.60	2743	4700	0.58	3559	4700	0.76
242	243	EB: 2, WB: 2	3258	4700	0.69	2789	4700	0.59	2456	4700	0.52	3246	4700	0.69
238	242	EB: 2, WB: 2	2329	4700	0.50	2166	4700	0.46	1658	4700	0.35	2526	4700	0.54
234	238	EB: 2, WB: 2	2315	4700	0.49	2002	4700	0.43	1440	4700	0.31	2481	4700	0.53

[1] vehicles per hour, per 2011 Existing volumes in Draft EIS

Note: V/C ratios shown are based on peak hour demand volumes (veh/hr), and are provided for purpose of comparison. The volumes have not been adjusted using factors such as truck % or PHF.

I-64 Freeway Sections LOS and V/C ratios

2025 No-Build

From Exit	To Exit	Lanes	2025 Eastbound				2025 Westbound			
			AM Peak Volume[1]	AM Peak LOS	PM Peak Volume[1]	PM Peak LOS	AM Peak Volume[1]	AM Peak LOS	PM Peak Volume[1]	PM Peak LOS
250	255	EB: 2, WB: 2	4714	F	4508	F	4142	E	4594	F
247	250	EB: 2, WB: 2	4408	F	3561	D	3386	D	4281	E
243	247	EB: 2, WB: 2	3710	D	3187	C	3186	C	4093	E
242	243	EB: 2, WB: 2	3643	D	3149	C	2752	C	3663	D

[1] vehicles per hour, year 2025 volumes per growth rate between 2011 Existing and 2040 No-Build volumes in Draft EIS

Note: LOS for basic freeway segments is defined by density (pc/mi/ln).

From Exit	To Exit	Lanes	2025 Eastbound						2025 Westbound					
			AM Peak Volume[1]	AM Peak Capacity	AM Peak V/C	PM Peak Volume[1]	PM Peak Capacity	PM Peak V/C	AM Peak Volume[1]	AM Peak Capacity	AM Peak V/C	PM Peak Volume[1]	PM Peak Capacity	PM Peak V/C
250	255	EB: 2, WB: 2	4714	4700	1.00	4508	4700	0.96	4142	4700	0.88	4594	4700	0.98
247	250	EB: 2, WB: 2	4408	4700	0.94	3561	4700	0.76	3386	4700	0.72	4281	4700	0.91
243	247	EB: 2, WB: 2	3710	4700	0.79	3187	4700	0.68	3186	4700	0.68	4093	4700	0.87
242	243	EB: 2, WB: 2	3643	4700	0.78	3149	4700	0.67	2752	4700	0.59	3663	4700	0.78

[1] vehicles per hour, year 2025 volumes per growth rate between 2011 Existing and 2040 No-Build volumes in Draft EIS

Note: V/C ratios shown are based on peak hour demand volumes (veh/hr), and are provided for purpose of comparison. The volumes have not been adjusted using factors such as truck % or PHF.

I-64 Freeway Sections LOS and V/C ratios

Option 1: 2025 with add one lane MP 234 to MP 254

LOS Results

From Exit	To Exit	Lanes	2040 Eastbound				2040 Westbound			
			AM Peak Volume[1]	AM Peak LOS	PM Peak Volume[1]	PM Peak LOS	AM Peak Volume[1]	AM Peak LOS	PM Peak Volume[1]	PM Peak LOS
250	255	EB: 3, WB: 3	4946	D	4728	C	4348	C	4823	C
247	250	EB: 3, WB: 3	4632	C	3744	C	3562	C	4503	C
243	247	EB: 3, WB: 3	3841	C	3281	B	3248	B	4175	C
242	243	EB: 3, WB: 3	3807	C	3263	B	2863	B	3813	C

[1] vehicles per hour, year 2025 volumes per growth rate between 2011 Existing and 2040 Alternative 1B volumes in Draft EIS

Note: LOS for basic freeway segments is defined by density (pc/mi/ln).

V/C Results

From Exit	To Exit	Lanes	2040 Eastbound						2040 Westbound					
			AM Peak Volume[1]	AM Peak Capacity	AM Peak V/C	PM Peak Volume[1]	PM Peak Capacity	PM Peak V/C	AM Peak Volume[1]	AM Peak Capacity	AM Peak V/C	PM Peak Volume[1]	PM Peak Capacity	PM Peak V/C
250	255	EB: 3, WB: 3	4946	7050	0.70	4728	7050	0.67	4348	7050	0.62	4823	7050	0.68
247	250	EB: 3, WB: 3	4632	7050	0.66	3744	7050	0.53	3562	7050	0.51	4503	7050	0.64
243	247	EB: 3, WB: 3	3841	7050	0.54	3281	7050	0.47	3248	7050	0.46	4175	7050	0.59
242	243	EB: 3, WB: 3	3807	7050	0.54	3263	7050	0.46	2863	7050	0.41	3813	7050	0.54

[1] vehicles per hour, year 2025 volumes per growth rate between 2011 Existing and 2040 Alternative 1B volumes in Draft EIS

Note: V/C ratios shown are based on peak hour demand volumes (veh/hr), and are provided for purpose of comparison. The volumes have not been adjusted using factors such as truck % or PHF

I-64 Freeway Sections LOS and V/C ratios

Option 2: 2025 with add one lane MP 234 to MP 247, and add two lanes MP 247 to MP 254

LOS Results

From Exit	To Exit	Lanes	2040 Eastbound				2040 Westbound			
			AM Peak Volume[1]	AM Peak LOS	PM Peak Volume[1]	PM Peak LOS	AM Peak Volume[1]	AM Peak LOS	PM Peak Volume[1]	PM Peak LOS
250	255	EB: 4, WB: 4	4946	C	4728	C	4348	B	4823	C
247	250	EB: 4, WB: 4	4632	C	3744	B	3562	B	4503	B
243	247	EB: 3, WB: 3	3841	C	3281	B	3248	B	4175	C
242	243	EB: 3, WB: 3	3807	C	3263	B	2863	B	3813	C

[1] vehicles per hour, year 2025 volumes per growth rate between 2011 Existing and 2040 Alternative 1B volumes in Draft EIS

Note: LOS for basic freeway segments is defined by density (pc/mi/ln).

V/C Results

From Exit	To Exit	Lanes	2040 Eastbound						2040 Westbound					
			AM Peak Volume[1]	AM Peak Capacity	AM Peak V/C	PM Peak Volume[1]	PM Peak Capacity	PM Peak V/C	AM Peak Volume[1]	AM Peak Capacity	AM Peak V/C	PM Peak Volume[1]	PM Peak Capacity	PM Peak V/C
250	255	EB: 4, WB: 4	4946	9400	0.53	4728	9400	0.50	4348	9400	0.46	4823	9400	0.51
247	250	EB: 4, WB: 4	4632	9400	0.49	3744	9400	0.40	3562	9400	0.38	4503	9400	0.48
243	247	EB: 3, WB: 3	3841	7050	0.54	3281	7050	0.47	3248	7050	0.46	4175	7050	0.59
242	243	EB: 3, WB: 3	3807	7050	0.54	3263	7050	0.46	2863	7050	0.41	3813	7050	0.54

[1] vehicles per hour, year 2025 volumes per growth rate between 2011 Existing and 2040 Alternative 1B volumes in Draft EIS

Note: V/C ratios shown are based on peak hour demand volumes (veh/hr), and are provided for purpose of comparison. The volumes have not been adjusted using factors such as truck % or PHF.

I-64 Freeway Sections LOS and V/C ratios

Option 3: 2025 with hardened shoulder MP 234 to MP 254

LOS Results

From Exit	To Exit	Lanes	2040 Eastbound				2040 Westbound			
			AM Peak Volume[1]	AM Peak LOS	PM Peak Volume[2]	PM Peak LOS	AM Peak Volume[2]	AM Peak LOS	PM Peak Volume[1]	PM Peak LOS
250	255	EB: 3 AM, 2 PM WB: 2 AM, 3 PM	4946	D	4508	F	4142	E	4823	C
247	250	EB: 3 AM, 2 PM WB: 2 AM, 3 PM	4632	C	3561	D	3386	D	4503	C
243	247	EB: 3 AM, 2 PM WB: 2 AM, 3 PM	3841	C	3187	C	3186	C	4175	C
242	243	EB: 3 AM, 2 PM WB: 2 AM, 3 PM	3807	C	3149	C	2752	C	3813	C

[1] vehicles per hour, year 2025 volumes per growth rate between 2011 Existing and 2040 Alternative 1B volumes in Draft EIS
[2] vehicles per hour, year 2025 volumes per growth rate between 2011 Existing and 2040 No-Build volumes in Draft EIS

Note: LOS for basic freeway segments is defined by density (pc/mi/ln).

V/C Results

From Exit	To Exit	Lanes	2040 Eastbound						2040 Westbound					
			AM Peak Volume[1]	AM Peak Capacity	AM Peak V/C	PM Peak Volume[2]	PM Peak Capacity	PM Peak V/C	AM Peak Volume[2]	AM Peak Capacity	AM Peak V/C	PM Peak Volume[1]	PM Peak Capacity	PM Peak V/C
250	255	EB: 3 AM, 2 PM WB: 2 AM, 3 PM	4946	7050	0.70	4508	4700	0.96	4142	4700	0.88	4823	7050	0.68
247	250	EB: 3 AM, 2 PM WB: 2 AM, 3 PM	4632	7050	0.66	3561	4700	0.76	3386	4700	0.72	4503	7050	0.64
243	247	EB: 3 AM, 2 PM WB: 2 AM, 3 PM	3841	7050	0.54	3187	4700	0.68	3186	4700	0.68	4175	7050	0.59
242	243	EB: 3 AM, 2 PM WB: 2 AM, 3 PM	3807	7050	0.54	3149	4700	0.67	2752	4700	0.59	3813	7050	0.54

[1] vehicles per hour, year 2025 volumes per growth rate between 2011 Existing and 2040 Alternative 1B volumes in Draft EIS
[2] vehicles per hour, year 2025 volumes per growth rate between 2011 Existing and 2040 No-Build volumes in Draft EIS

Note: V/C ratios shown are based on peak hour demand volumes (veh/hr), and are provided for purpose of comparison. The volumes have not been adjusted using factors such as truck % or PHF.

I-64 Freeway Sections LOS and V/C ratios

2040 No-Build

From Exit	To Exit	Lanes	2040 Eastbound				2040 Westbound			
			AM Peak Volume[1]	AM Peak LOS	PM Peak Volume[1]	PM Peak LOS	AM Peak Volume[1]	AM Peak LOS	PM Peak Volume[1]	PM Peak LOS
250	255	EB: 2, WB: 2	5405	F	5170	F	4835	F	5345	F
247	250	EB: 2, WB: 2	5040	F	4105	E	3970	E	4970	F
243	247	EB: 2, WB: 2	4165	E	3605	D	3660	D	4665	F
242	243	EB: 2, WB: 2	4055	E	3535	D	3070	C	4110	E
238	242	EB: 2, WB: 2	3635	D	3410	D	2635	C	4000	E
234	238	EB: 2, WB: 2	3620	E	3075	D	2245	B	3955	E

[1] vehicles per hour, per 2040 No-Build volumes in Draft EIS

Note: LOS for basic freeway segments is defined by density (pc/mi/ln).

From Exit	To Exit	Lanes	2040 Eastbound						2040 Westbound					
			AM Peak Volume[1]	AM Peak Capacity	AM Peak V/C	PM Peak Volume[1]	PM Peak Capacity	PM Peak V/C	AM Peak Volume[1]	AM Peak Capacity	AM Peak V/C	PM Peak Volume[1]	PM Peak Capacity	PM Peak V/C
250	255	EB: 2, WB: 2	5405	4700	1.15	5170	4700	1.10	4835	4700	1.03	5345	4700	1.14
247	250	EB: 2, WB: 2	5040	4700	1.07	4105	4700	0.87	3970	4700	0.84	4970	4700	1.06
243	247	EB: 2, WB: 2	4165	4700	0.89	3605	4700	0.77	3660	4700	0.78	4665	4700	0.99
242	243	EB: 2, WB: 2	4055	4700	0.86	3535	4700	0.75	3070	4700	0.65	4110	4700	0.87
238	242	EB: 2, WB: 2	3635	4700	0.77	3410	4700	0.73	2635	4700	0.56	4000	4700	0.85
234	238	EB: 2, WB: 2	3620	4700	0.77	3075	4700	0.65	2245	4700	0.48	3955	4700	0.84

[1] vehicles per hour, per 2040 No-Build volumes in Draft EIS

Note: V/C ratios shown are based on peak hour demand volumes (veh/hr), and are provided for purpose of comparison. The volumes have not been adjusted using factors such as truck % or PHF.

I-64 Freeway Sections LOS and V/C ratios

Option 1: 2040 with add one lane MP 234 to MP 254

LOS Results

From Exit	To Exit	Lanes	2040 Eastbound				2040 Westbound			
			AM Peak Volume[1]	AM Peak LOS	PM Peak Volume[1]	PM Peak LOS	AM Peak Volume[1]	AM Peak LOS	PM Peak Volume[1]	PM Peak LOS
250	255	EB: 3, WB: 3	5885	D	5625	D	5260	D	5820	D
247	250	EB: 3, WB: 3	5505	D	4485	C	4335	C	5430	D
243	247	EB: 3, WB: 3	4435	C	3800	C	3790	C	4835	C
242	243	EB: 3, WB: 3	4395	C	3770	C	3300	B	4420	C
238	242	EB: 3, WB: 3	3985	C	3675	B	2840	B	4310	C
234	238	EB: 3, WB: 3	4120	C	3500	C	2555	B	4500	C

[1] vehicles per hour, per 2040 Alternative 1B volumes in Draft EIS

Note: LOS for basic freeway segments is defined by density (pc/mi/ln).

V/C Results

From Exit	To Exit	Lanes	2040 Eastbound						2040 Westbound					
			AM Peak Volume[1]	AM Peak Capacity	AM Peak V/C	PM Peak Volume[1]	PM Peak Capacity	PM Peak V/C	AM Peak Volume[1]	AM Peak Capacity	AM Peak V/C	PM Peak Volume[1]	PM Peak Capacity	PM Peak V/C
250	255	EB: 3, WB: 3	5885	7050	0.83	5625	7050	0.80	5260	7050	0.75	5820	7050	0.83
247	250	EB: 3, WB: 3	5505	7050	0.78	4485	7050	0.64	4335	7050	0.61	5430	7050	0.77
243	247	EB: 3, WB: 3	4435	7050	0.63	3800	7050	0.54	3790	7050	0.54	4835	7050	0.69
242	243	EB: 3, WB: 3	4395	7050	0.62	3770	7050	0.53	3300	7050	0.47	4420	7050	0.63
238	242	EB: 3, WB: 3	3985	7050	0.57	3675	7050	0.52	2840	7050	0.40	4310	7050	0.61
234	238	EB: 3, WB: 3	4120	7050	0.58	3500	7050	0.50	2555	7050	0.36	4500	7050	0.64

[1] vehicles per hour, per 2040 Alternative 1B volumes in Draft EIS

Note: V/C ratios shown are based on peak hour demand volumes (veh/hr), and are provided for purpose of comparison. The volumes have not been adjusted using factors such as truck % or PHF

I-64 Freeway Sections LOS and V/C ratios

Option 2: 2040 with add one lane MP 234 to MP 247, and add two lanes MP 247 to MP 254

LOS Results

From Exit	To Exit	Lanes	2040 Eastbound				2040 Westbound			
			AM Peak Volume[1]	AM Peak LOS	PM Peak Volume[1]	PM Peak LOS	AM Peak Volume[1]	AM Peak LOS	PM Peak Volume[1]	PM Peak LOS
250	255	EB: 4, WB: 4	5885	C	5625	C	5260	C	5820	C
247	250	EB: 4, WB: 4	5505	C	4485	B	4335	C	5430	C
243	247	EB: 3, WB: 3	4435	C	3800	C	3790	C	4835	C
242	243	EB: 3, WB: 3	4395	C	3770	C	3300	B	4420	C
238	242	EB: 3, WB: 3	3985	C	3675	B	2840	B	4310	C
234	238	EB: 3, WB: 3	4120	C	3500	C	2555	B	4500	C

[1] vehicles per hour, per 2040 Alternative 1B volumes in Draft EIS

Note: LOS for basic freeway segments is defined by density (pc/mi/ln).

V/C Results

From Exit	To Exit	Lanes	2040 Eastbound						2040 Westbound					
			AM Peak Volume[1]	AM Peak Capacity	AM Peak V/C	PM Peak Volume[1]	PM Peak Capacity	PM Peak V/C	AM Peak Volume[1]	AM Peak Capacity	AM Peak V/C	PM Peak Volume[1]	PM Peak Capacity	PM Peak V/C
250	255	EB: 4, WB: 4	5885	9400	0.63	5625	9400	0.60	5260	9400	0.56	5820	9400	0.62
247	250	EB: 4, WB: 4	5505	9400	0.59	4485	9400	0.48	4335	9400	0.46	5430	9400	0.58
243	247	EB: 3, WB: 3	4435	7050	0.63	3800	7050	0.54	3790	7050	0.54	4835	7050	0.69
242	243	EB: 3, WB: 3	4395	7050	0.62	3770	7050	0.53	3300	7050	0.47	4420	7050	0.63
238	242	EB: 3, WB: 3	3985	7050	0.57	3675	7050	0.52	2840	7050	0.40	4310	7050	0.61
234	238	EB: 3, WB: 3	4120	7050	0.58	3500	7050	0.50	2555	7050	0.36	4500	7050	0.64

[1] vehicles per hour, per 2040 Alternative 1B volumes in Draft EIS

Note: V/C ratios shown are based on peak hour demand volumes (veh/hr), and are provided for purpose of comparison. The volumes have not been adjusted using factors such as truck % or PHF

I-64 Freeway Sections LOS and V/C ratios

Option 3: 2040 with hardened shoulder MP 234 to MP 254

LOS Results

From Exit	To Exit	Lanes	2040 Eastbound				2040 Westbound			
			AM Peak Volume[1]	AM Peak LOS	PM Peak Volume[2]	PM Peak LOS	AM Peak Volume[2]	AM Peak LOS	PM Peak Volume[1]	PM Peak LOS
250	255	EB: 3 AM, 2 PM WB: 2 AM, 3 PM	5885	D	5170	F	4835	F	5820	D
247	250	EB: 3 AM, 2 PM WB: 2 AM, 3 PM	5505	D	4105	E	3970	E	5430	D
243	247	EB: 3 AM, 2 PM WB: 2 AM, 3 PM	4435	C	3605	D	3660	D	4835	C
242	243	EB: 3 AM, 2 PM WB: 2 AM, 3 PM	4395	C	3535	D	3070	C	4420	C
238	242	EB: 3 AM, 2 PM WB: 2 AM, 3 PM	3985	C	3410	D	2635	C	4310	C
234	238	EB: 3 AM, 2 PM WB: 2 AM, 3 PM	4120	C	3075	D	2245	B	4500	C

[1] vehicles per hour, per 2040 Alternative 1B volumes in Draft EIS
[2] vehicles per hour, per 2040 No-Build volumes in Draft EIS

Note: LOS for basic freeway segments is defined by density (pc/mi/ln).

V/C Results

From Exit	To Exit	Lanes	2040 Eastbound						2040 Westbound					
			AM Peak Volume[1]	AM Peak Capacity	AM Peak V/C	PM Peak Volume[2]	PM Peak Capacity	PM Peak V/C	AM Peak Volume[2]	AM Peak Capacity	AM Peak V/C	PM Peak Volume[1]	PM Peak Capacity	PM Peak V/C
250	255	EB: 3 AM, 2 PM WB: 2 AM, 3 PM	5885	7050	0.83	5170	4700	1.10	4835	4700	1.03	5820	7050	0.83
247	250	EB: 3 AM, 2 PM WB: 2 AM, 3 PM	5505	7050	0.78	4105	4700	0.87	3970	4700	0.84	5430	7050	0.77
243	247	EB: 3 AM, 2 PM WB: 2 AM, 3 PM	4435	7050	0.63	3605	4700	0.77	3660	4700	0.78	4835	7050	0.69
242	243	EB: 3 AM, 2 PM WB: 2 AM, 3 PM	4395	7050	0.62	3535	4700	0.75	3070	4700	0.65	4420	7050	0.63
238	242	EB: 3 AM, 2 PM WB: 2 AM, 3 PM	3985	7050	0.57	3410	4700	0.73	2635	4700	0.56	4310	7050	0.61
234	238	EB: 3 AM, 2 PM WB: 2 AM, 3 PM	4120	7050	0.58	3075	4700	0.65	2245	4700	0.48	4500	7050	0.64

[1] vehicles per hour, per 2040 Alternative 1B volumes in Draft EIS
[2] vehicles per hour, per 2040 No-Build volumes in Draft EIS

Note: V/C ratios shown are based on peak hour demand volumes (veh/hr), and are provided for purpose of comparison. The volumes have not been adjusted using factors such as truck % or PHF.

APPENDIX C

I-64 Improvements – Traffic Operations

Corridor Section I: Jefferson Avenue (Exit 255) to west of Route 105 (Exit 250)

Option 1 – Add One Lane in Each Direction

In each direction, one additional travel lane and a full shoulder would be constructed in the median. The proposed typical section would consist of three travel lanes with full inside and outside shoulders, compared to existing conditions of two travel lanes with a full shoulder on the outside and a narrow shoulder on the inside. At the eastern end of the section, the additional lanes would tie in neatly with the existing wider section that begins just west of Bland Blvd. At the Fort Eustis Interchange, the additional lanes in the median would be carried through the interchange with no impact on the existing ramps.

Option 2 – Add Two Lanes in Each Direction

In each direction, two additional travel lanes and a full shoulder would be constructed in the median. However, the total width of these additional lanes is greater than the width of the existing median. Therefore, the existing travel lanes would need to be shifted to the outside, the existing outside shoulder (now proposed as the outside travel lane) would be reconstructed, and additional pavement would be added for the new outside shoulder. The proposed typical section would consist of four travel lanes with full inside and outside shoulders, compared to existing conditions of two travel lanes with a full shoulder on the outside and a narrow shoulder on the inside. The Fort Eustis Interchange would be reconstructed as a single point interchange.

At the eastern end of the section, in the eastbound direction the proposed typical section would continue until the point where the existing HOV lane begins, at which point additional widening to the outside would be needed to accommodate the four regular travel lanes plus one HOV lane. This section would then continue to the east and the outside lane would become a dedicated exit lane for the Jefferson Avenue collector-distributor road. In the westbound direction, the outside lane would begin as a continuation of the Jefferson Avenue collector-distributor road and the inside lane would begin by eliminating the existing inside lane drop at the Bland Blvd. overpass. With these changes, there would be four travel lanes in the westbound direction.

Option 3 – Peak Hour Shoulder Use (eastbound – AM peak, westbound – PM peak)

In the eastbound direction, the proposed typical section entering Corridor Section I at the Newport News Reservoir Bridge would consist of two regular lanes and a managed shoulder lane. The eastbound managed shoulder lane would lead into the first off-ramp deceleration lane at the Fort Eustis Blvd. interchange and this would be a dedicated exit-only lane (not a choice lane). Motorists who had been in the managed shoulder

lane and do not wish to exit here will need to change lanes into one of the two westbound through lanes. Signage will clearly indicate this condition. The managed shoulder lane would resume at the east end of the interchange where the acceleration lane of the on-ramp from northbound Fort Eustis Blvd. transitions onto the shoulder. The basic section of two regular lanes and a managed shoulder lane, plus occasional pull-out areas (and adding lanes to the inside further east), would continue east until the managed shoulder lane ends by leading directly into the exit lane for the Jefferson Avenue collector-distributor road.

In the westbound direction, the managed shoulder would begin as a continuation of the Jefferson Avenue collector-distributor road. Just west of the Bland Blvd. overpass, the inside travel lane would drop (same as existing), leaving two regular travel lanes and a managed shoulder lane. This basic section, including occasional pull-out areas, would continue for approximately four miles to the Fort Eustis Blvd. interchange. At that point, the managed shoulder lane would lead directly into the first off-ramp deceleration lane.and this would be a dedicated exit-only lane (not a choice lane). Motorists who had been in the managed shoulder lane and do not wish to exit here will need to change lanes into one of the two westbound through lanes. Signage will clearly indicate this condition. The managed shoulder lane would resume at the west end of the interchange past the on-ramp from VA Route 143, where the acceleration lane transitions into the existing shoulder. The basic section of two regular travel lanes and a managed shoulder lane would continue west to the end of Corridor Section I.

Corridor Section II: West of Route 105 (Exit 250) to Route 199 / Water Country USA (Exit 242)

<u>Option 1 – Add One Lane in Each Direction</u>

In each direction, one additional travel lane and a full shoulder would be constructed in the median. The proposed typical section would consist of three travel lanes with full inside and outside shoulders, compared to existing conditions of two travel lanes with a full shoulder on the outside and a narrow shoulder on the inside. At the Yorktown Interchange (VA Route 238 at MP 247) and the ramps to and from VA Route 143 just west of VA Route 238, the additional lanes in the median would be carried through the interchange with no impact on any of the existing ramps.

At the Busch Gardens Interchange (MP 242), in the eastbound direction the additional lane in the median would also be carried right through the interchange with no impact on the existing ramps. However, in the westbound direction at the Busch Gardens Interchange, there is a left exit from westbound I-64 to westbound VA Route 143. As such, when the additional lane is constructed in the median, the beginning of that off-ramp will need to be shifted into the median to provide a proper exit. The other ramps along westbound I-64 at the Busch Gardens Interchange would not be impacted by the additional lane in the median.

Option 2A – Add One Lane in Each Direction MP 242 to MP 247 and Add Two Lanes in Each Direction MP 247 to MP 250

In each direction of the western portion of Section II, beginning at the western end of the corridor at the Water Country USA Interchange (VA Route 199 at MP 242) and continuing to near the middle of the corridor at the Yorktown Interchange (VA Route 238 at MP 247), one additional travel lane and a full shoulder would be constructed in the median. The proposed typical section in the western portion of Section II would consist of three travel lanes with full inside and outside shoulders, compared to existing conditions of two travel lanes with a full shoulder on the outside and a narrow shoulder on the inside.

As described above for Option 1, in the eastbound direction at the Busch Gardens Interchange (MP 243), the additional lane in the median would be carried through the interchange with no impact on the existing ramps. However, in the westbound direction at the Busch Gardens Interchange, there is a left exit from westbound I-64 to westbound VA Route 143. As such, when the additional lane is constructed in the median, the beginning of that off-ramp will need to be shifted into the median to provide a proper exit. The other ramps along westbound I-64 at the Busch Gardens Interchange would not be impacted by the additional lane in the median.

In each direction of the eastern portion of Section II, beginning at the Yorktown Interchange and continuing to the east end of the Newport News Reservoir Bridge, two additional travel lanes and a full shoulder would be constructed in the median of I-64. However, the total width of these additional lanes is greater than the width of the existing median. Therefore, the existing travel lanes would need to be shifted to the outside, the existing outside shoulder (now proposed as the outside travel lane) would be reconstructed, and additional pavement would be added for the new outside shoulder. The proposed typical section in the eastern portion of Corridor Section II would consist of four travel lanes with full inside and outside shoulders, compared to existing conditions of two travel lanes with a full shoulder on the outside and a narrow shoulder on the inside.

In the eastbound direction, the second additional lane would begin as a continuation of the on-ramp from VA Route 238, which would join the three eastbound travel lanes coming from upstream of the interchange. The four travel lanes continuing downstream of the interchange would then be shifted as needed to form the aforementioned typical section.

In the westbound direction approaching the Yorktown Interchange, the four travel lanes would line up so the right lane would lead into the off-ramp deceleration lane. This would be a dedicated exit-only lane (not a choice lane). Motorists who had been in the right lane and do not wish to exit here will need to change lanes. Signage will clearly indicate this condition. Upon dropping the fourth lane at the off-ramp for VA Route 238, and continuing past the gore area, the proposed typical section would consist of three travel lanes with full inside and outside shoulders.

Option 3 – Peak Hour Shoulder Use (eastbound – AM peak, westbound – PM peak)

In the eastbound direction, the proposed typical section of two regular lanes and a managed shoulder lane would enter Corridor Section II beginning just east of the off-ramp deceleration lane for the exit to westbound VA Route 143. This would be a choice lane instead of a dedicated exit lane, and continuing past the gore area eastbound I-64 would consist of three regular travel lanes (no shoulder) until the two-lane on-ramp from Busch Gardens. The two-lane on-ramp would be shifted to the right by one lane width (onto the existing shoulder), then the two on-ramp lanes would merge to one lane, and then that lane would merge with the third through lane (outside lane) of eastbound I-64. The third lane would then transition onto the shoulder where it would go back to being a managed shoulder for peak hour use. The basic section of two regular lanes and a managed shoulder lane, plus occasional pull-out areas, would continue east to VA Route 143 (part of the Yorktown Interchange at MP 247) where the eastbound managed shoulder lane would lead into the off-ramp deceleration lane. This would be a choice lane instead of a dedicated exit lane, and the managed shoulder lane would continue past the off-ramp gore area and across the overpass until the on-ramp from VA Route 143. Just before the on-ramp gore area, the managed shoulder lane would become a regular travel lane (resulting in three regular lanes on eastbound I-64). The acceleration lane of the on-ramp from VA Route 143 would then be shifted onto the existing shoulder before merging with the outside travel lane, which would then transition onto the shoulder where it would go back to being a managed shoulder for peak hour use. Less than one mile downstream, at the on-ramp from VA Route 238, the same configuration would occur. Just before the on-ramp gore area, the managed shoulder lane would become a regular travel lane. The acceleration lane of the on-ramp from VA Route 238 would then be shifted onto the existing shoulder before merging with the outside travel lane, which would then transition onto the shoulder where it would go back to being a managed shoulder for peak hour use. The basic section of two regular lanes and a managed shoulder lane, plus occasional pull-out areas, would continue east into Corridor Section I.

In the westbound direction, the proposed typical section of two regular lanes and a managed shoulder lane would enter Corridor Section II from the east. The westbound managed shoulder lane would lead into the deceleration lane of the off-ramp at VA Route 238 (Yorktown Interchange at MP 247). This would be a choice lane instead of a dedicated exit lane, and the managed shoulder lane would continue past the off-ramp gore area for just over one mile until the on-ramp from VA Route 143. Just before the on-ramp gore area, the managed shoulder lane would become a regular travel lane (resulting in three regular lanes on westbound I-64). The acceleration lane of the on-ramp from VA Route 143 would then be shifted onto the existing shoulder before merging with the outside travel lane, which would then transition onto the shoulder where it would go back to being a managed shoulder for peak hour use. From there, the proposed typical section of two regular travel lanes and a managed shoulder lane, plus occasional pull-out areas, would continue west to the left exit for westbound VA Route 143 (which is just east of the Busch Gardens Interchange at MP 243). That

proposed section would continue past the left exit with no impact on the existing ramp. Moving west, the managed shoulder lane would lead into the deceleration lane of the two-lane off-ramp at the Busch Gardens Interchange and this would be a dedicated exit-only lane (not a choice lane). Motorists who had been in the managed shoulder lane and do not wish to exit here will need to change lanes into one of the two westbound through lanes. Signage will clearly indicate this condition.

Corridor Section III: Route 199 / Water Country USA (Exit 242) to Route 143 / Colonial Williamsburg (Exit 238)

Option 1 – Add One Lane in Each Direction

In each direction, one additional travel lane and a full shoulder would be constructed in the median. The proposed typical section would consist of three travel lanes with full inside and outside shoulders, compared to existing conditions of two travel lanes with a full shoulder on the outside and a narrow shoulder on the inside. At the Water Country USA Interchange (VA Route 199 at MP 242), the additional lanes in the median would be carried through the interchange with no impact on the existing ramps.

Option 3 – Peak Hour Shoulder Use (eastbound – AM peak, westbound – PM peak)

In the eastbound direction, the proposed typical section of two regular lanes and a managed shoulder lane would enter Corridor Section III beginning just east of the Colonial Williamsburg Interchange. To carry this typical section over the bridge over the Queen Creek, the bridge would need to be widened. The proposed typical section, including occasional pull-out areas, would continue east to the Water Country USA Interchange (VA Route 199 at MP 242) where the eastbound managed shoulder would lead into the first off-ramp deceleration lane.

In the westbound direction, starting at the west end of the interchange past the on-ramp from southbound VA Route 199, where the acceleration lane would transition onto the shoulder where it would become a managed shoulder for peak hour use. The basic section of two regular travel lanes and a managed shoulder lane, plus occasional pull-out areas, would continue west to the end of Corridor Section III. To carry this typical section over the bridge over the Queen Creek toward the west end of Corridor Section III, the bridge would need to be widened.

Corridor Section IV: Route 143 / Colonial Williamsburg (Exit 238) to Route 199 / Lightfoot (Exit 234)

Option 1 – Add One Lane in Each Direction

In each direction, one additional travel lane and a full shoulder would be constructed in the median. The proposed typical section would consist of three travel lanes with full inside and outside shoulders, compared to existing conditions of two travel lanes with a full shoulder on the outside and a narrow shoulder on the inside.

In the eastbound direction, the lane would be added in the median beginning just to the east of the VA Route 199 overpass. It would be configured such that the on-ramp from VA Route 199 would have free-flow entry (no merge) into the right lane of I-64, thus requiring the two existing travel lanes to shift to the left by one lane width. The typical section would continue east through the VA Route 143 interchange with no impact on the existing ramps.

In the westbound direction, the proposed typical section would enter Corridor Section IV from the east with the additional lane in the median being carried through the VA Route 143 interchange. The typical section would continue west through the VA Route 199 interchange with no impact on the existing ramps. Immediately downstream of the southbound VA Route 199 on-ramp merge to westbound I-64, the additional through lane in the median would be dropped and the proposed typical section would tie back into the existing typical section.

Option 3 – Peak Hour Shoulder Use (eastbound – AM peak, westbound – PM peak)

In the eastbound direction, the managed shoulder would begin as a continuation of the on-ramp from VA Route 199. The proposed typical section of two regular lanes and a managed shoulder lane, plus occasional pull-out areas, would continue east to the VA Route 143 interchange where the eastbound managed shoulder lane would lead into the off-ramp deceleration lane. This would be a choice lane instead of a dedicated exit lane, and the managed shoulder lane would continue past the off-ramp gore area and under the overpass until the on-ramp from VA Route 143. Just before the on-ramp gore area, the managed shoulder lane would become a regular travel lane (resulting in three regular lanes on eastbound I-64). The acceleration lane of the on-ramp would then be shifted onto the existing shoulder (which would need to be widened) before merging with the outside travel lane, which would then transition onto the shoulder where it would go back to being a managed shoulder for peak hour use. The basic section of two regular lanes and a managed shoulder lane, plus occasional pull-out areas, would continue east into Corridor Section III.

In the westbound direction, the proposed typical section of two regular lanes and a managed shoulder lane would enter Corridor Section IV from the east. The managed shoulder lane would lead into the deceleration lane of the off-ramp at VA Route 143, and this would be a dedicated exit-only lane (not a choice lane). Motorists who had been in the managed shoulder lane and do not wish to exit here will need to change lanes into one of the two westbound through lanes. Signage will clearly indicate this condition. Continuing past the off-ramp, the basic section will remain the same as existing until just west of the VA Route 143 overpass, where the current acceleration lane of the on-ramp from northbound VA Route 143 would transition onto the existing shoulder as a regular lane. As such, westbound I-64 would consist of three regular travel lanes (no shoulder) until the on-ramp from southbound VA Route 143. The acceleration lane of the southbound VA Route 143 on-ramp would then be shifted onto the existing shoulder (which would need to be widened) before merging with the outside

travel lane, which would then transition onto the shoulder where it would go back to being a managed shoulder for peak hour use. The basic section of two regular lanes and a managed shoulder lane, plus occasional pull-out areas, would continue west to the VA Route 199 / Lightfoot Interchange, where the managed shoulder lane would lead into the deceleration lane of the off-ramp for northbound VA Route 199. This would be a dedicated exit-only lane (not a choice lane). Again, motorists who had been in the managed shoulder lane and do not wish to exit here will need to change lanes into one of the two westbound through lanes. Signage will clearly indicate this condition. This is where the proposed Option 3 improvements would end in the westbound direction.

APPENDIX D

TIME TO DELIVER (NTP Design to NTP Construction) *						
	Option 1		Option 2		Option 3	
Delivery Method	Design/Bid/Build	Design/Build	Design/Bid/Build	Design/Build	Design/Bid/Build	Design/Build
Section I	Fall 2017	Summer 2016	Spring 2019	Fall 2016	Spring 2016	Note 1
Section II	Fall 2017	Summer 2015	Fall 2018	Summer 2016	Spring 2015	Note 1
Section III	Summer 2018	Note 2	N/A	N/A	Fall 2016	Note 2
Section IV	Fall 2016	Note 3	N/A	N/A	Fall 2015	Note 3

Note 1 Not recommended for Design/Build due to short delivery time for Design/Bid/Build

Note 2 Not recommended for Design/Build due to large wetland impacts at Queen Creek Bridge and historic impact at bridge over Colonial National Historic Highway.

Note 3 Not recommended for Design/ Build delivery due to potential R/W impacts with Camp Peary (Merrimac Trail over I-64)

* NTP Design assumed to be Fall 2013

APPENDIX E

APPENDIX E - Bridge/Interchange Assessment

Bridge/Interchange Assessment	Option 1	Option 2	Option 3	Comments
Section I				
Bland Road over I-64	OK	Replace	OK	
Debigh Road over I-64	OK	Replace	OK	
I-64 over Industrial Park Dr/RR Spur	Widen 1 lane/shoulder	Replace	OK	Replace due to crown line shift
I-64 over Route 105 (Fort Eustis Blvd) Fort Eustis Interchange	Widen 1 lane/shoulder	Replace	OK - See Comment	Exit managed shoulder lane at exit ramps and resume after interchange
Section II				
I-64 over City Reservoir	Widen 1 lane/shoulder	Replace	OK	Replace due to crown line shift
I-64 over Route 238 (Yorktown Road) Yorktown Interchange	Widen 1 lane/shoulder	See Option 1	OK	Shift lanes inside through approach curves to match road/bridge crown line
I-64 over Route 143 (Jefferson Ave) Yorktown Interchange	Widen 1 lane/shoulder	See Option 1	OK	Shift lanes inside through approach curves to match road/bridge crown line
I-64 over Burma Rd	Widen 1 lane/shoulder	See Option 1	OK	
Route 199 (Humelsine Rd) over I-64 Water Country Interchange	Replace	See Option 1	OK - See Comment	Exit managed shoulder lane at exit ramps and resume after interchange
Section III				
I-64 EB over Ramp to Route 143	Widen 1 lane/shoulder	N/A	OK	
Ramp to Route 143 over I-64 Busch Gardens Interchange	OK	N/A	OK	
I-64 over Perriman Rd	Widen 1 lane/shloulder	N/A	OK	
I-64 over Colonial National Historic Parkway	Widen 1 lane/shoulder	N/A	OK	Decorative filled arch bridge
I-64 over Lakeshead Dr	Widen 1 lane/shoulder	N/A	OK	
Route 716 (W. Queens Dr) over I-64	Replace	N/A	Replace	No room for 14' outside shoulder for Option 3
I-64 over Queen Creek	Replace	N/A	Replace	Major structure - assumed replacement
Section IV				
Route 143 (Merrimac Trail) over I-64 Colonial Williamsburg Interchange	Replace	N/A	OK - See Comment	Exit managed shoulder lane at exit ramps and resume after interchange Cannot widen due to pier location
Route 604 (Barlow Rd) over I-64	Replace	N/A	OK	
Route 646 (Newman Rd) over I-64 Lightfoot Interchange	OK	N/A	OK	End managed shoulder lane

INTERSTATE 64 PENINSULA STUDY

ALTERNATIVES DEVELOPMENT TECHNICAL MEMORANDUM

OCTOBER 2012

VDOT
Virginia Department of Transportation

1401 EAST BROAD STREET
RICHMOND, VA 23219

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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:

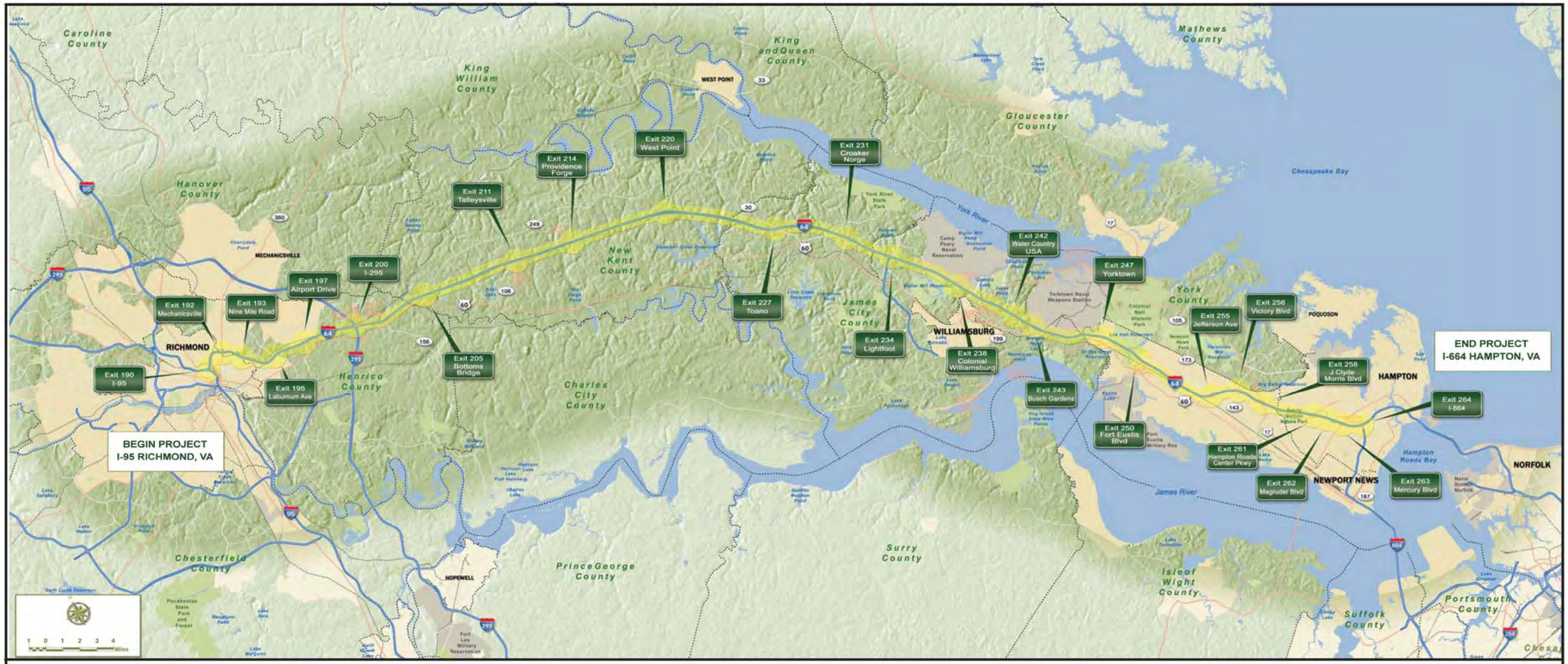


Figure 1
Project Location Map

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**.

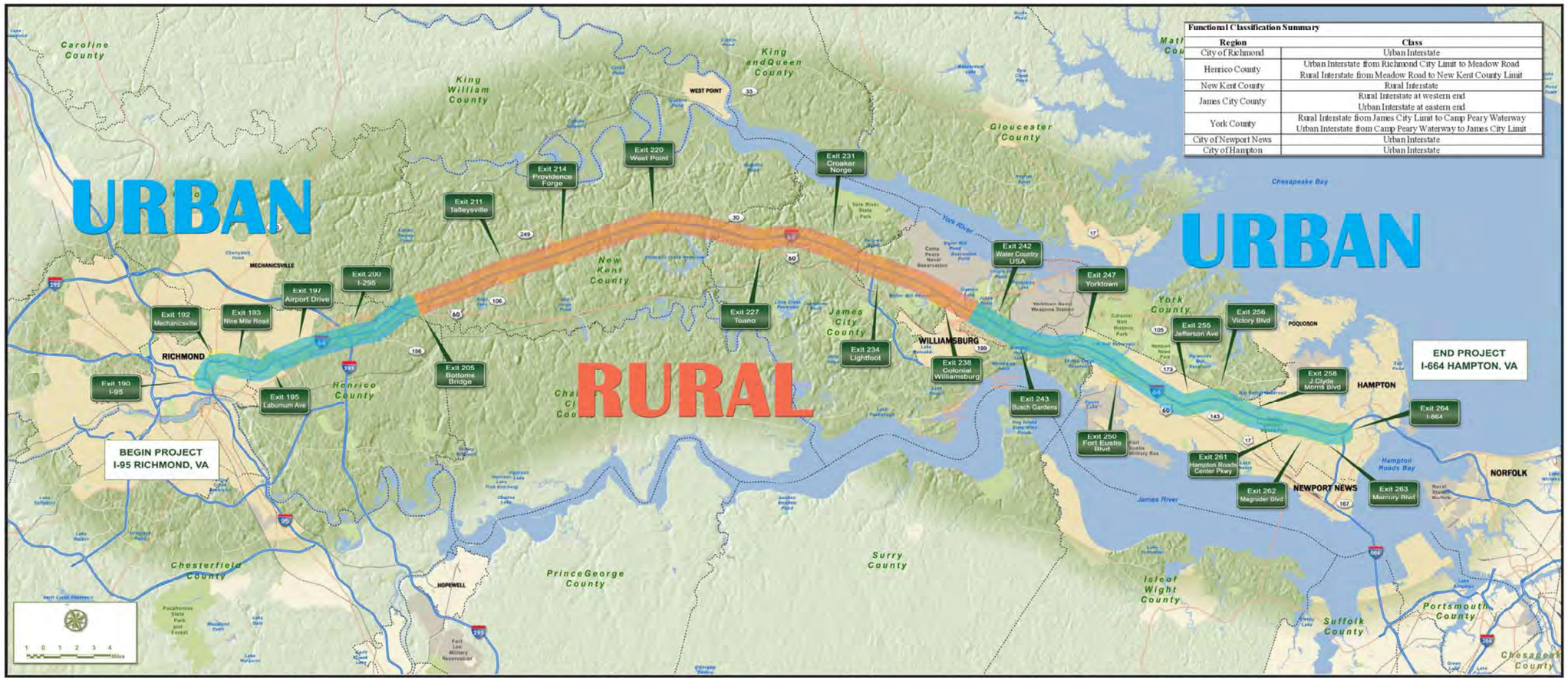


Figure 2
Functional Classification

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	No	Yes	Yes	Yes	Yes	Yes

			General Purpose Lanes Alternatives		Full Toll Lanes Alternatives		Managed Lanes with General Purpose Lanes Alternative
	installations						
	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**.

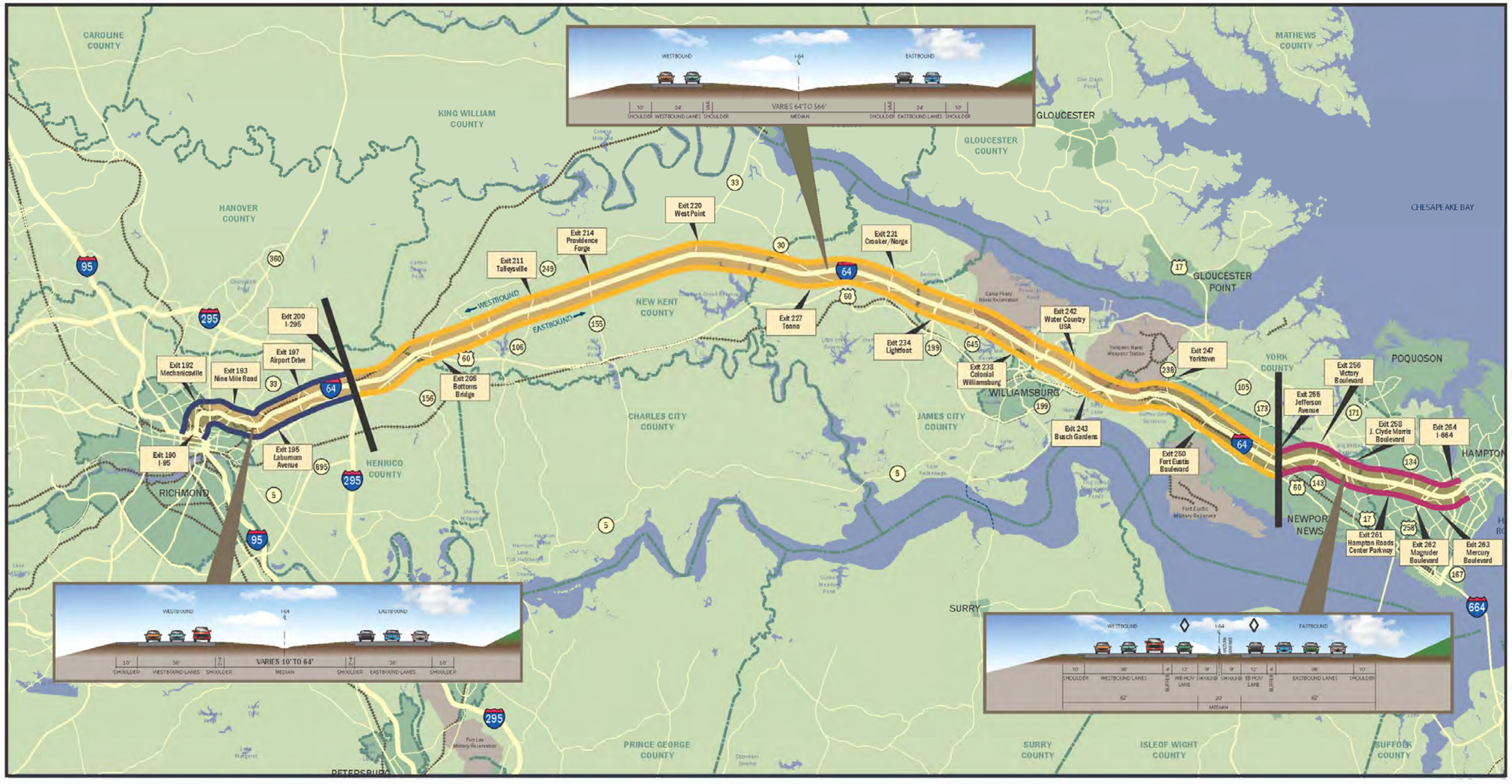


Figure 3
Existing Number of Lanes/No-Build Alternative

LEGEND

- = Existing Two-Lanes
- = Existing Three-Lanes
- = Existing Three-Lanes with one HOV Lane

N

1 0 4 Miles

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***.

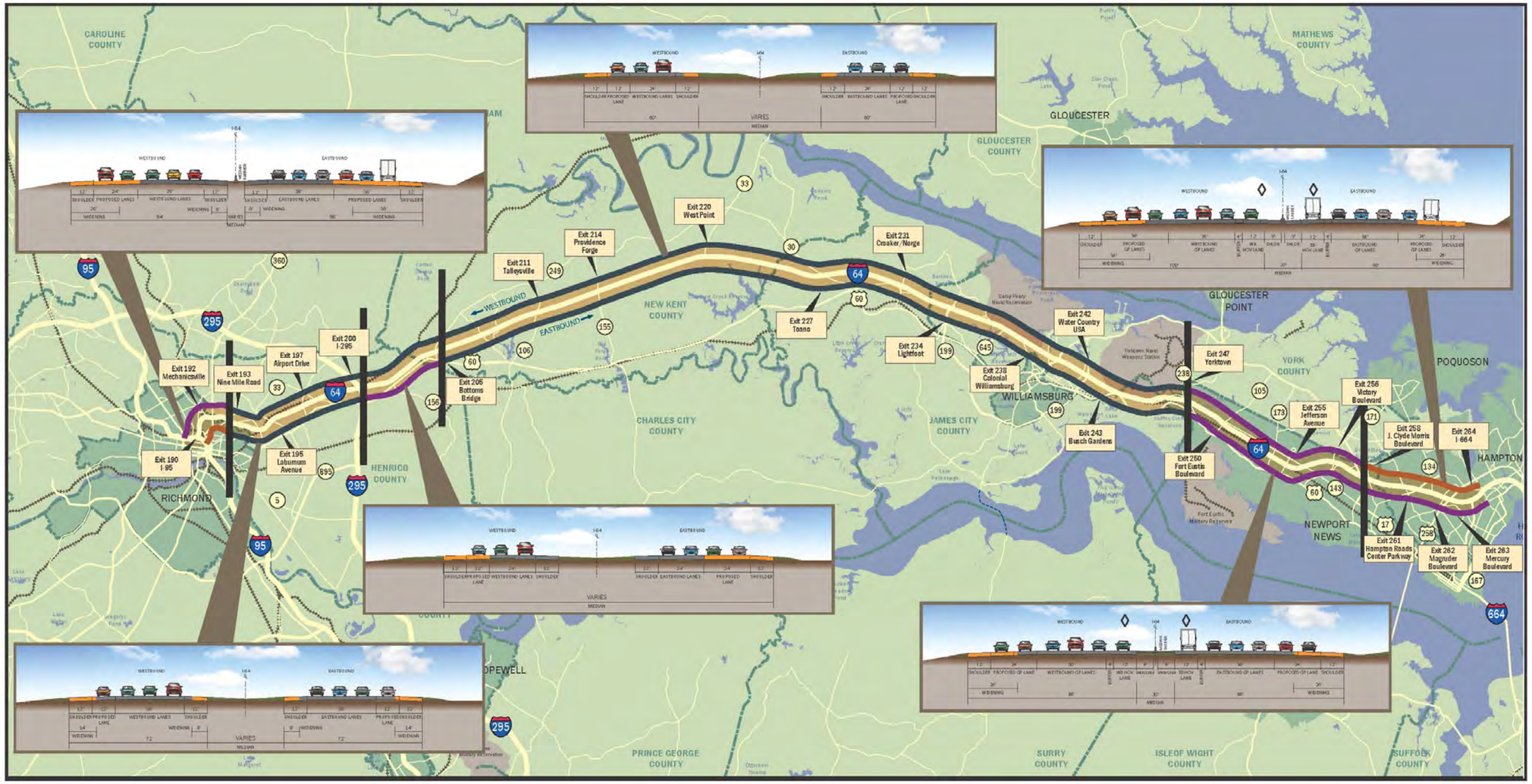
The numbers of lanes that are proposed to be added to I-64 mainline along with typical sections showing the lane configurations are shown in **Figure 4** for Alternative 1A and in **Figure 5** for Alternative 1B. Lane diagrams for Alternatives 1A/1B are found in **Appendix C** and typical sections for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

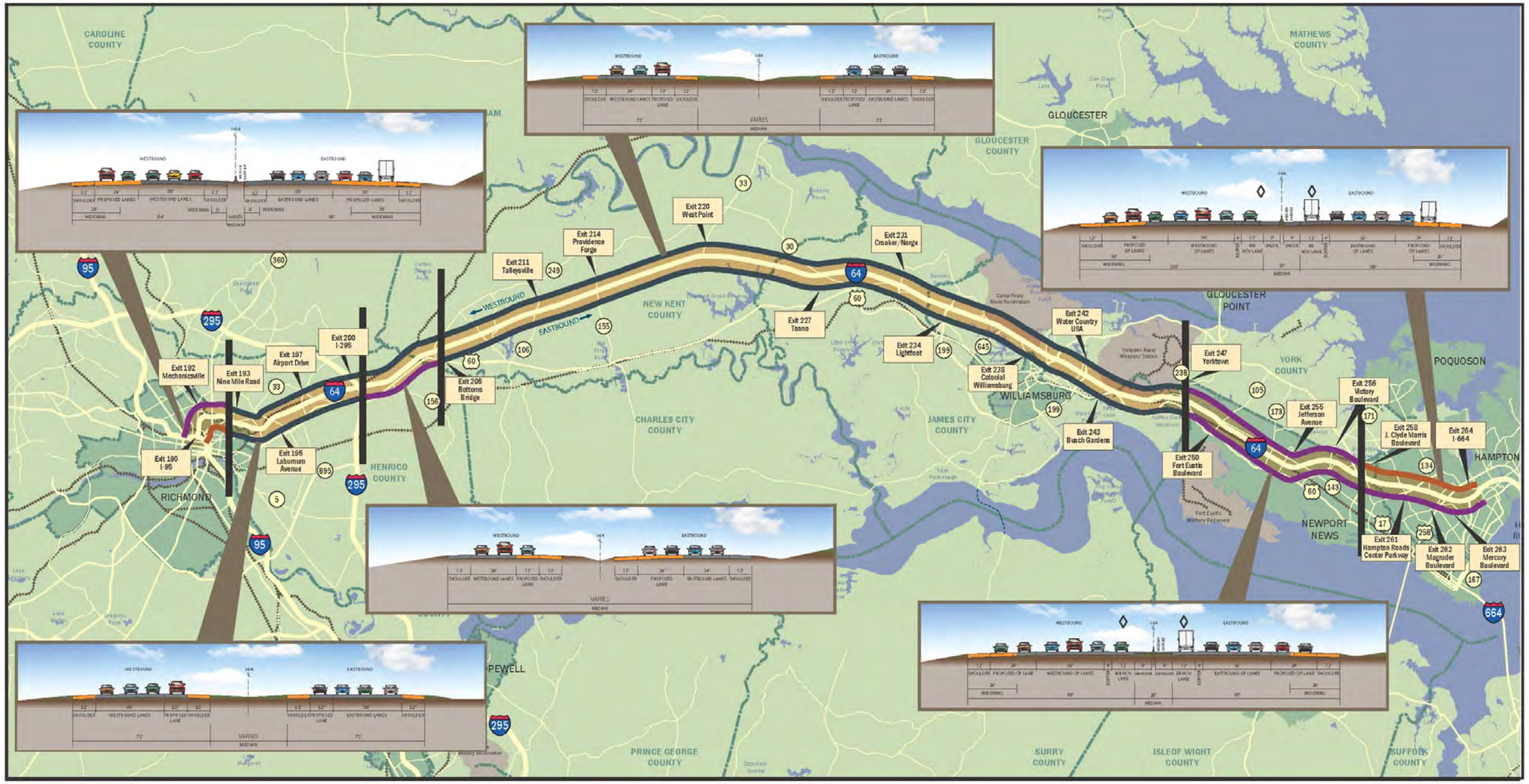


LEGEND

- = 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



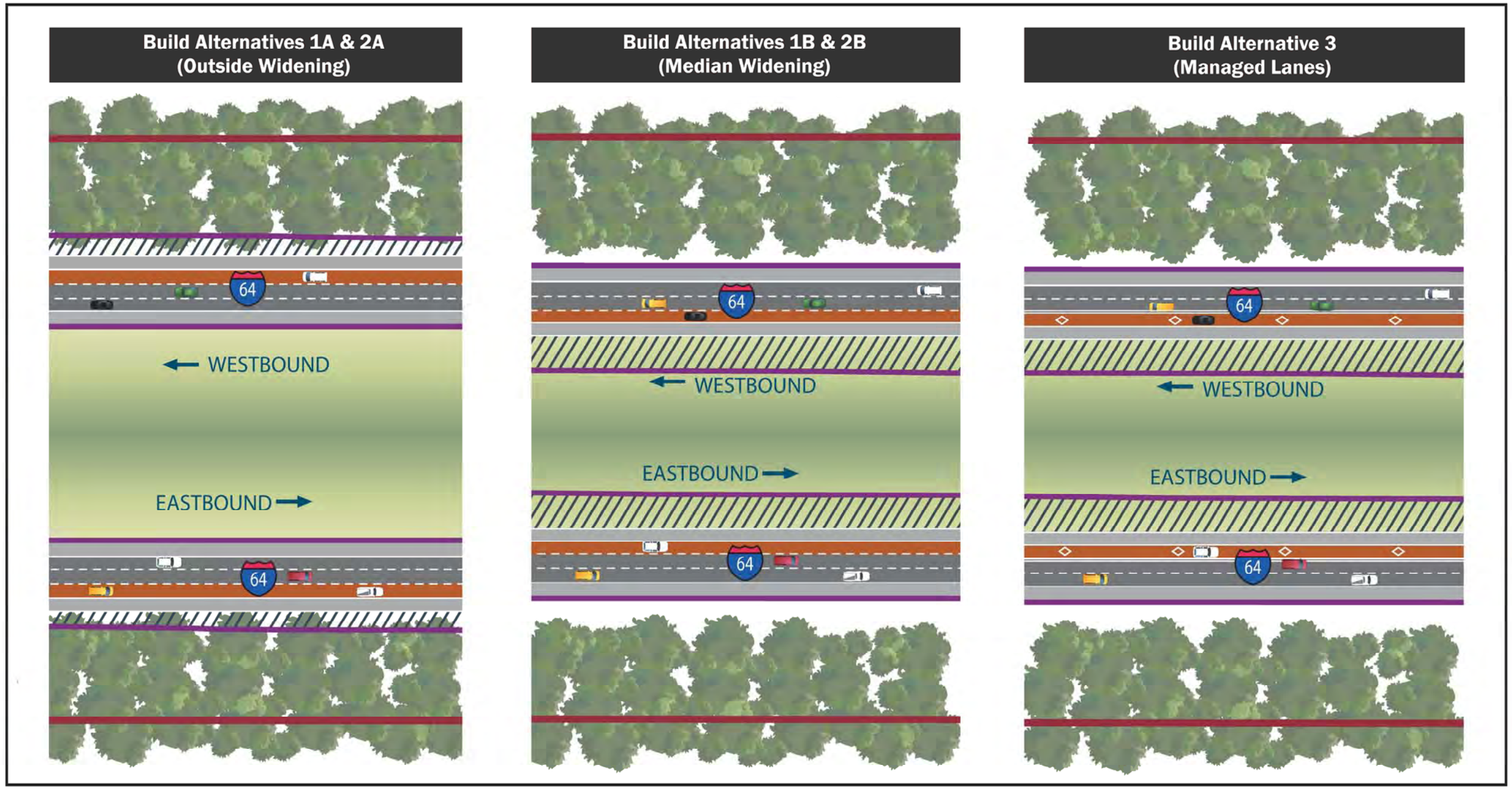
LEGEND

- = 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



N

0 200 Feet

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

Figure 7A
Proposed Interchange Study Area Footprint

LEGEND

= Study Area Inside Existing Right of Way

= Study Area Outside Existing Right of Way

Figure 7B
Proposed Interchange Study Area Footprint

LEGEND

= Study Area Inside Existing Right of Way

= Study Area Outside Existing Right of Way

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.

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

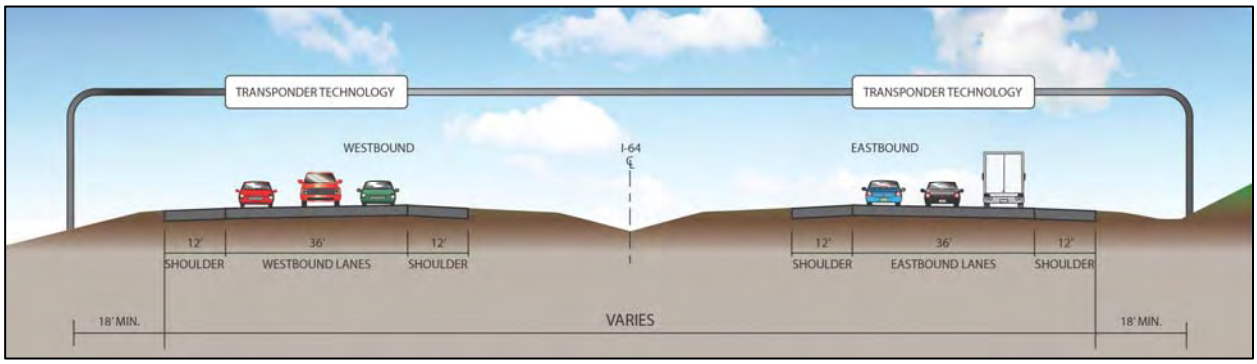
Exit	Interchange	Locality	Improvement Description	Additional Right of Way Required
231	Route 607 (Croaker)	James City	Full reconfiguration of all ramps in all quadrants	Yes
234	VA 199 (Lightfoot)	York	Reconfiguration of ramps in Northwest, Southwest, and Northeast quadrants	Yes
238	VA 143 (Colonial Williamsburg)	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.

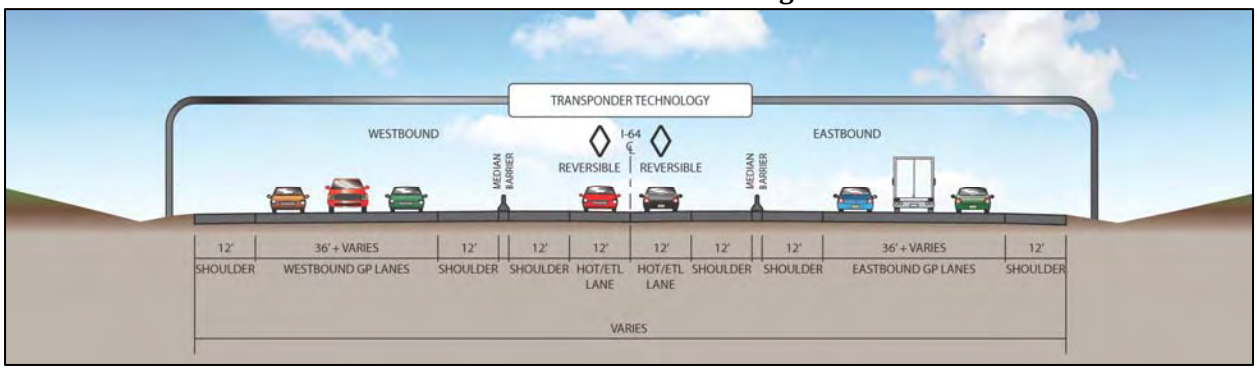
- Locations of access points to and from the HOT lanes, at intermediate locations as well as the end points.
- Separation between the HOT lanes and the general purpose lanes (barrier/ bollards/pylons, painted buffer area, double white line).

- 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.

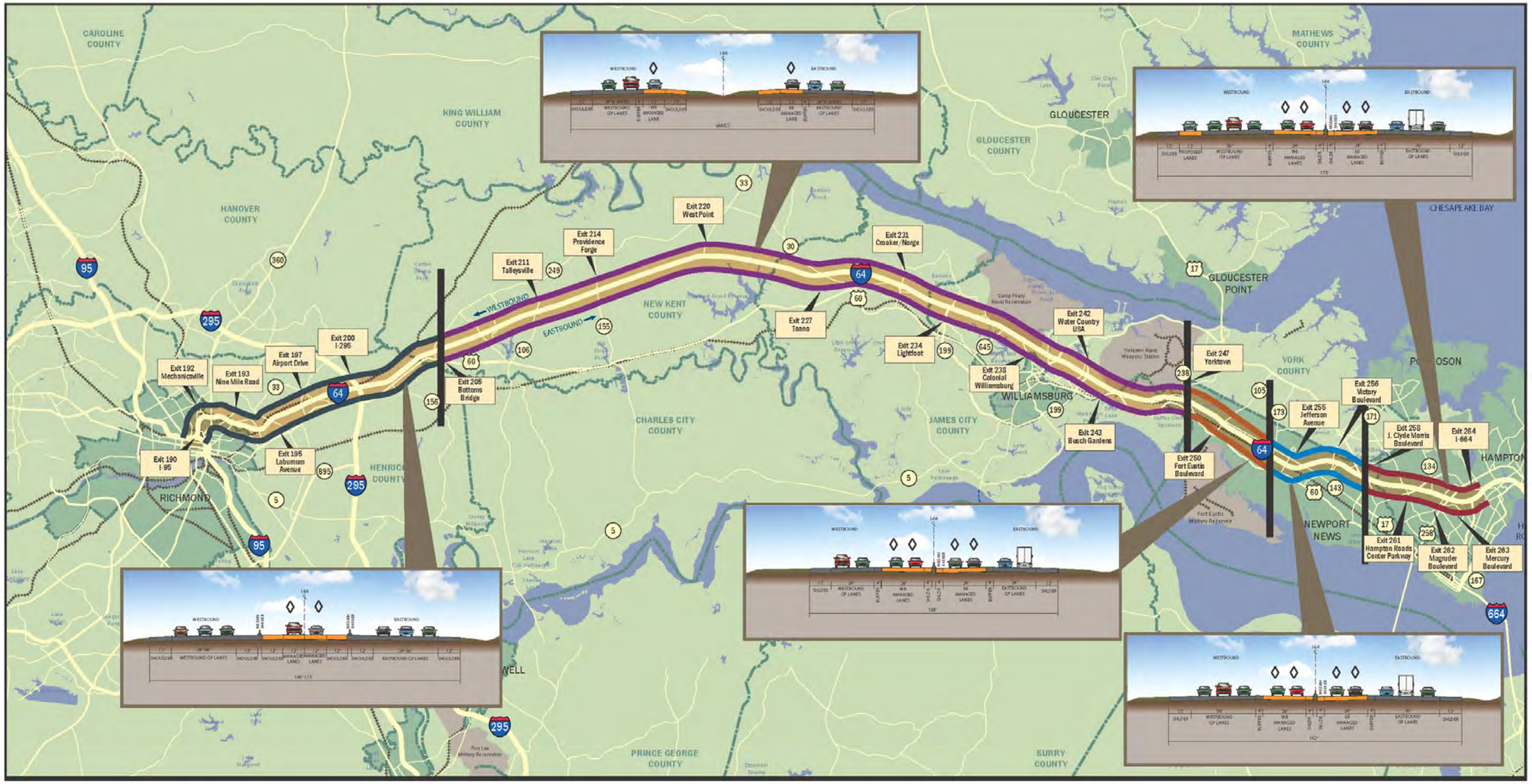
The following assumptions were made for Alternative 3 for the purposes of the EIS:

- 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



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

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).

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

APPENDIX B

Interstate 64 Structures - Data from VDOT Inventory

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

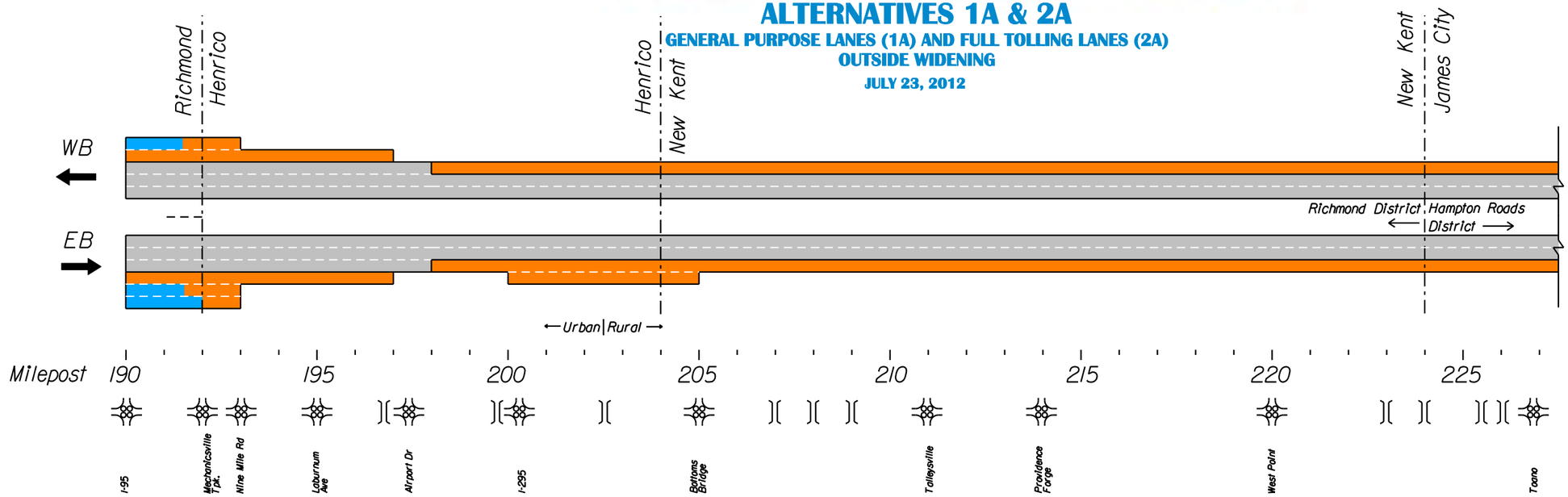
Lane Diagrams

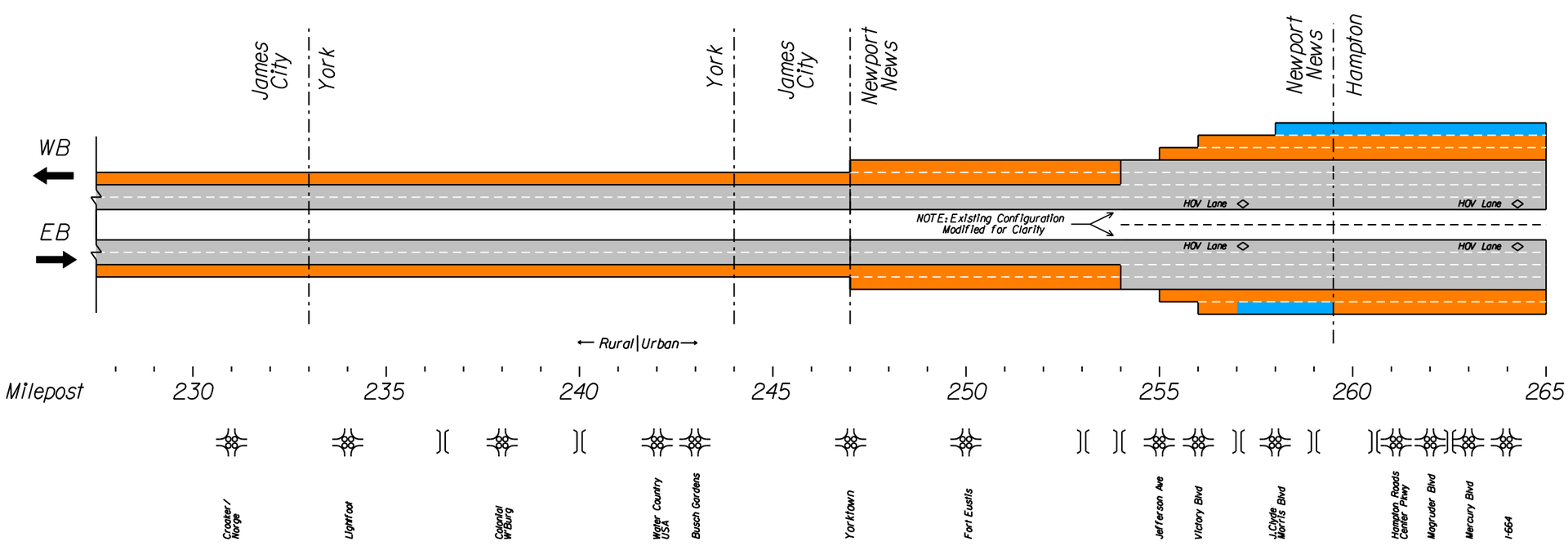
INTERSTATE 64 PENINSULA STUDY ENVIRONMENTAL IMPACT STATEMENT

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

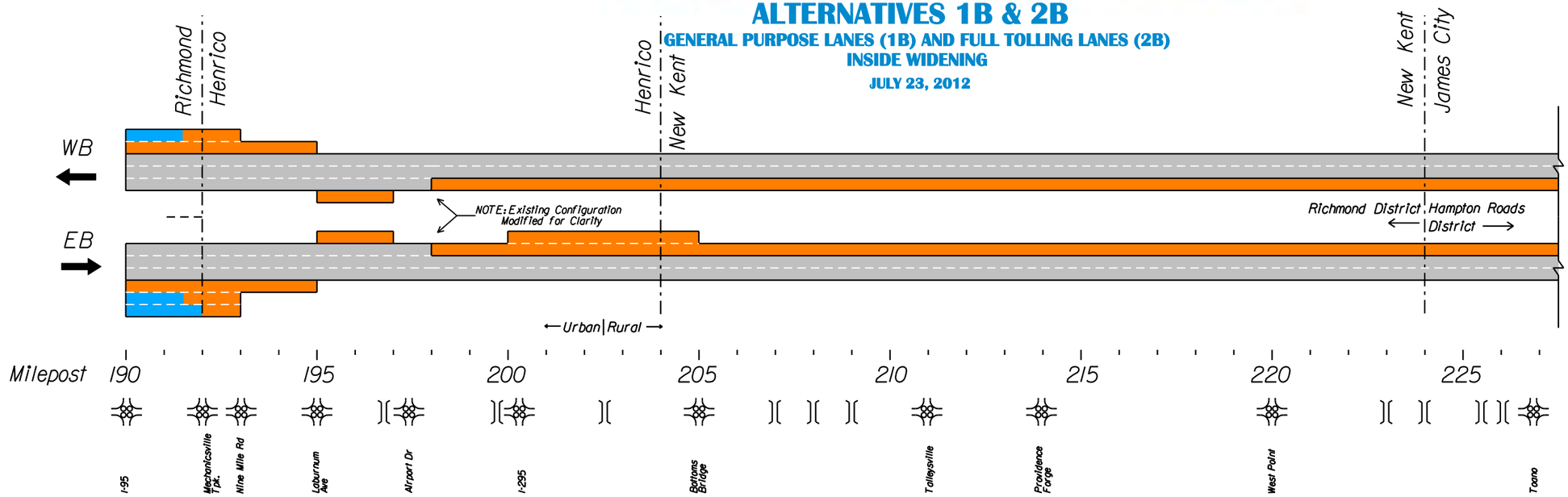
NOTE: This graphic is solely intended to display the number of lanes required to achieve a level of service "C" along the I-64 mainline. Furthermore, this graphic does not depict any required right-of-way needed for interchange improvements.

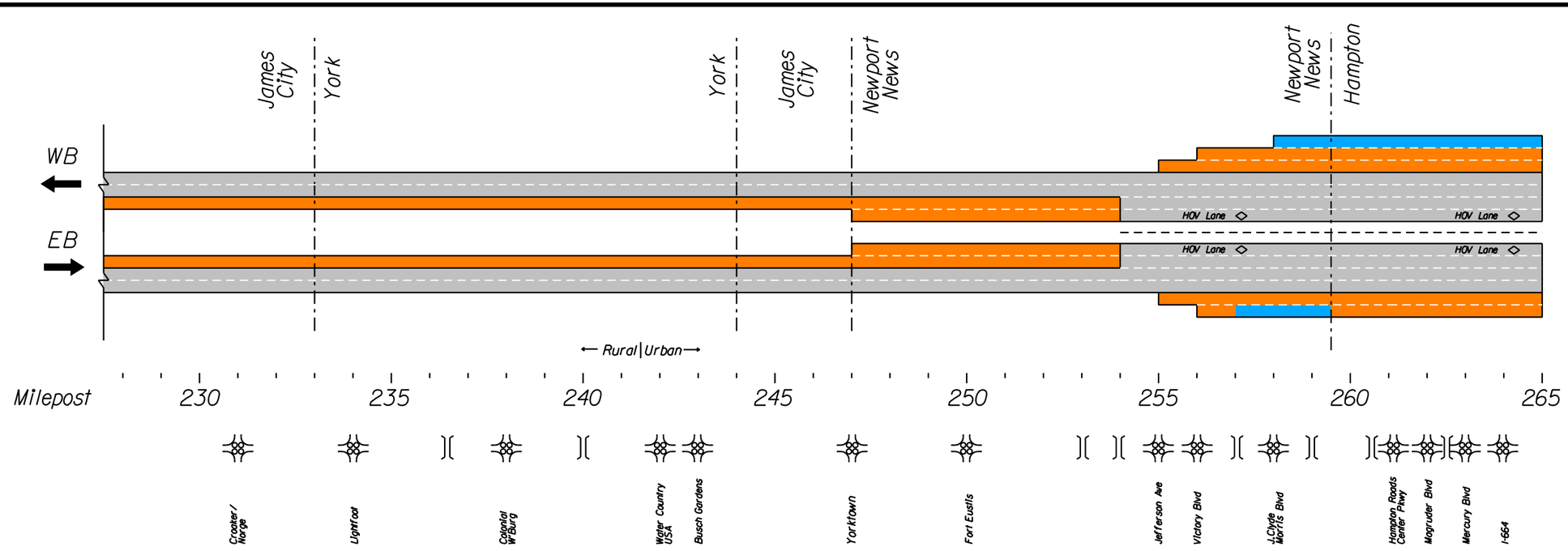
INTERSTATE 64 PENINSULA STUDY ENVIRONMENTAL IMPACT STATEMENT

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

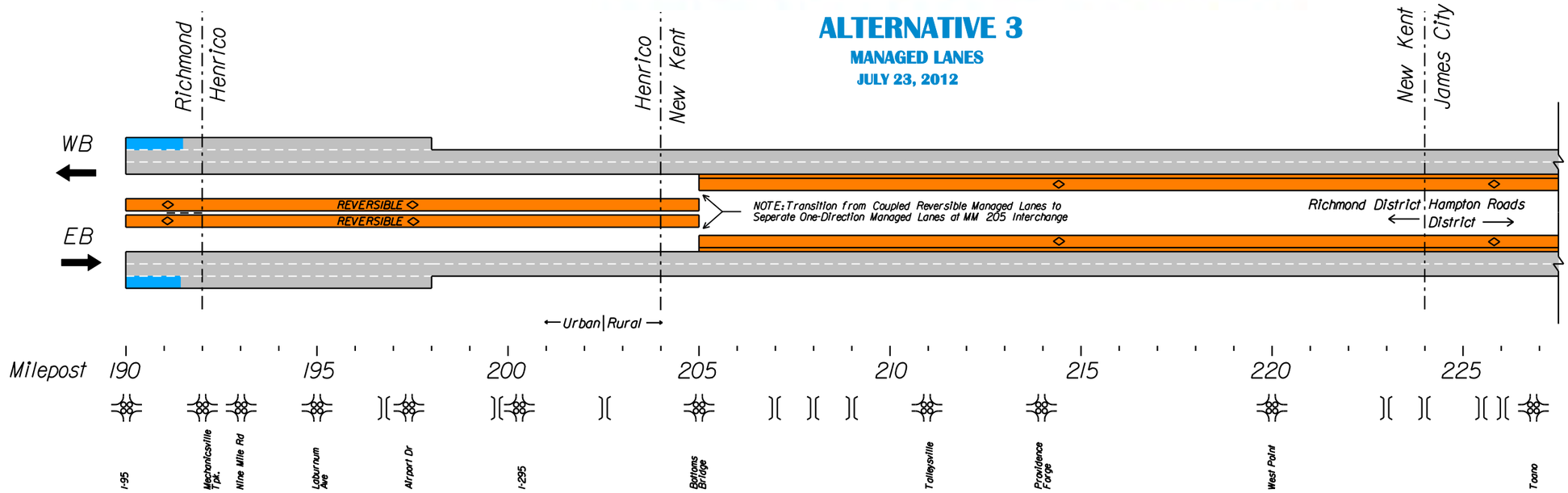
NOTE: This graphic is solely intended to display the number of lanes required to achieve a level of service "C" along the I-64 mainline. Furthermore, this graphic does not depict any required right-of-way needed for interchange improvements.

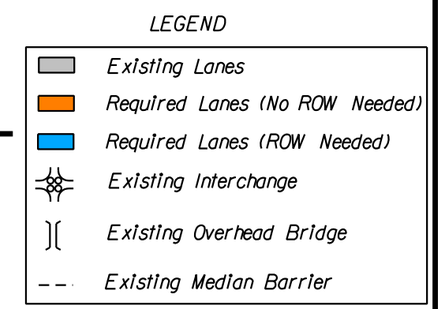
INTERSTATE 64 PENINSULA STUDY ENVIRONMENTAL IMPACT STATEMENT

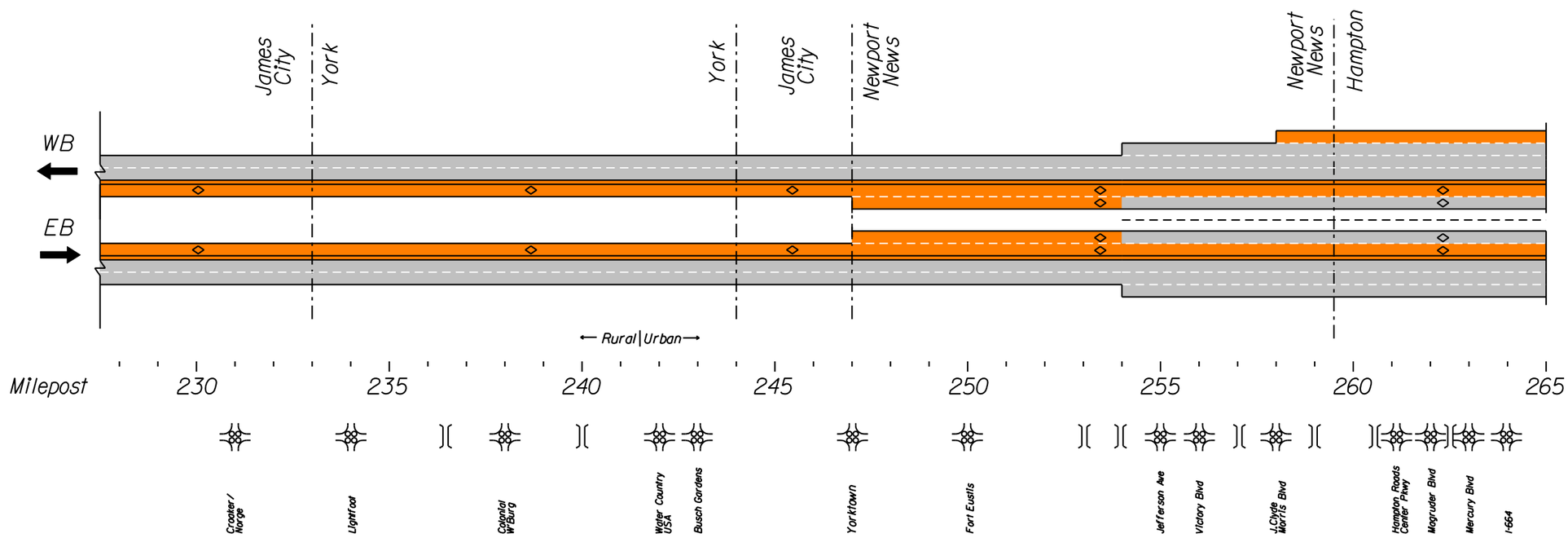
ALTERNATIVE 3

MANAGED LANES

JULY 23, 2012





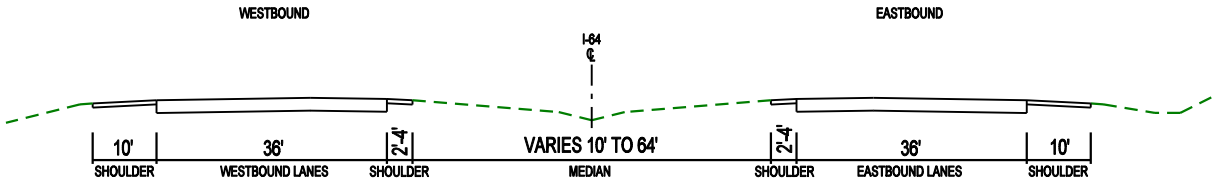


NOTE: This graphic is solely intended to display the number of lanes required to satisfy the requirements for managed lanes along the I-64 mainline. Furthermore, this graphic does not depict any required right-of-way needed for interchange improvements.

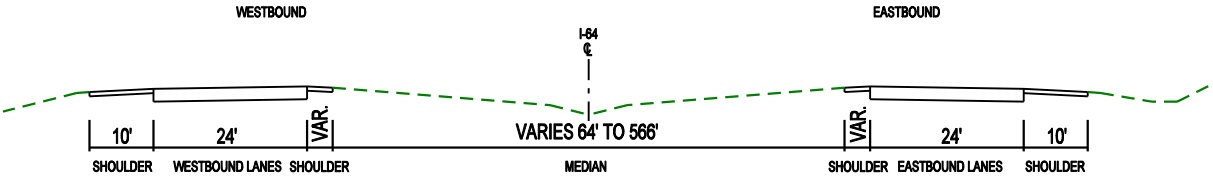
INTERSTATE 64 PENINSULA STUDY

APPENDIX D

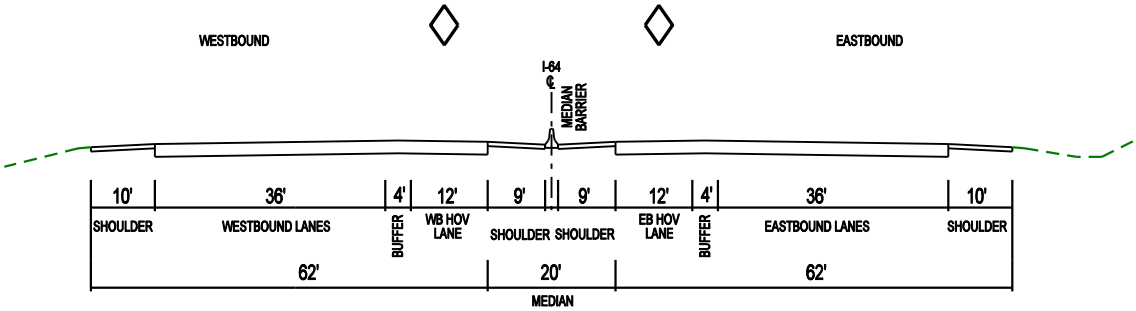
Typical Sections



NO BUILD: EXISTING CONDITIONS
(6 - LANE SECTION)



NO BUILD: EXISTING CONDITIONS
(4 - LANE SECTION)

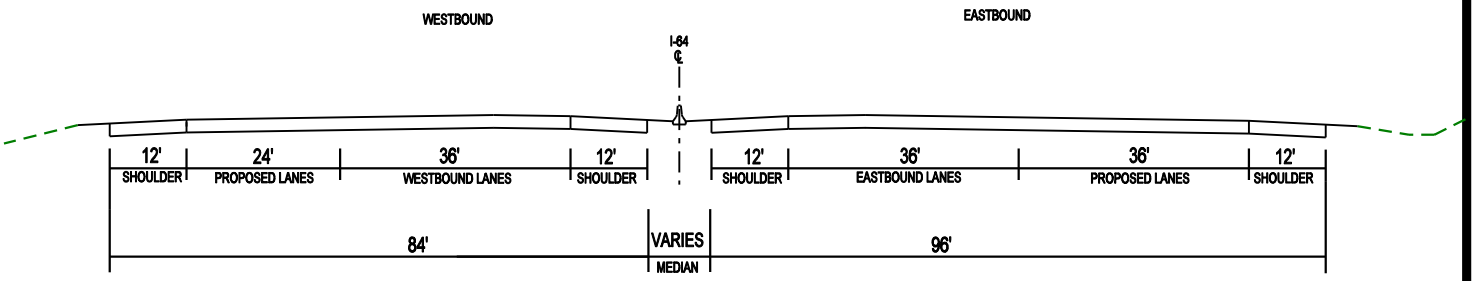


NO BUILD: EXISTING CONDITIONS
(8 - LANE SECTION WITH HOV)

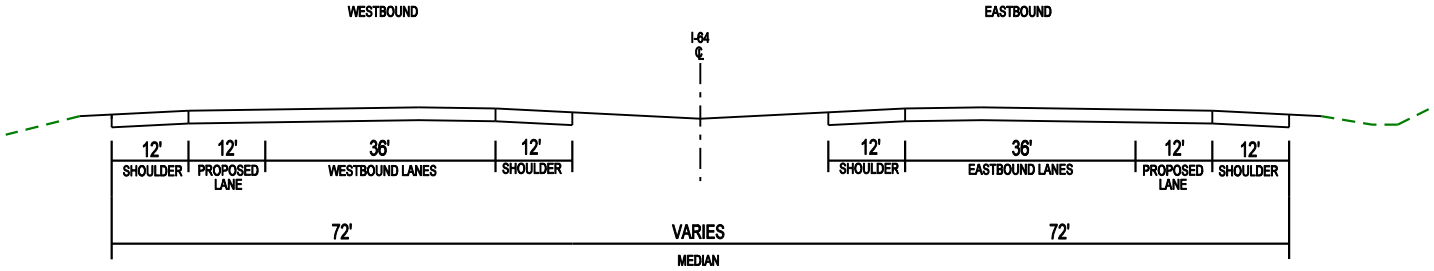
INTERSTATE 64 PENINSULA STUDY ENVIRONMENTAL IMPACT STATEMENT

TYPICAL SECTIONS
EXISTING CONDITIONS

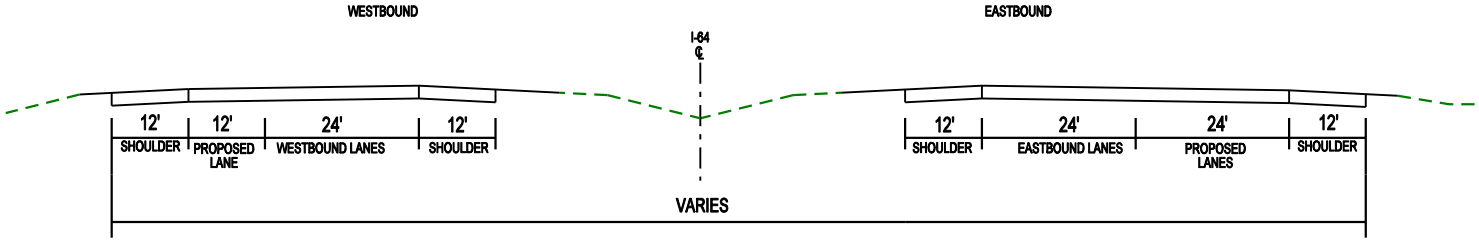
JULY 2012



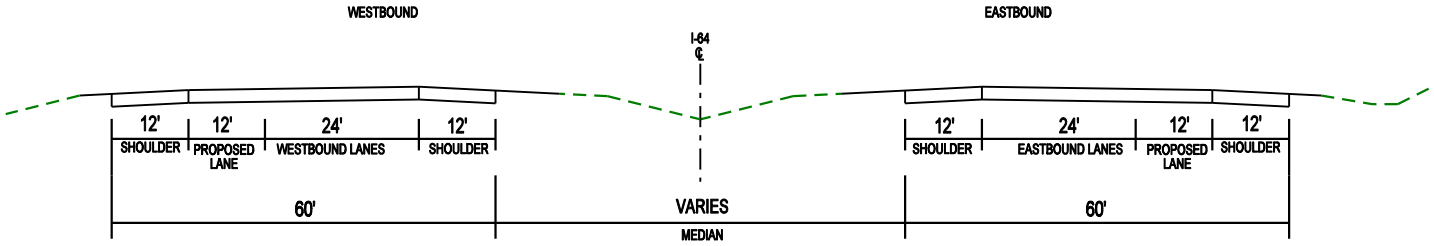
BUILD: ADD TWO OUTSIDE LANES WB, THREE OUTSIDE LANES EB
(11 - LANE SECTION)



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



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

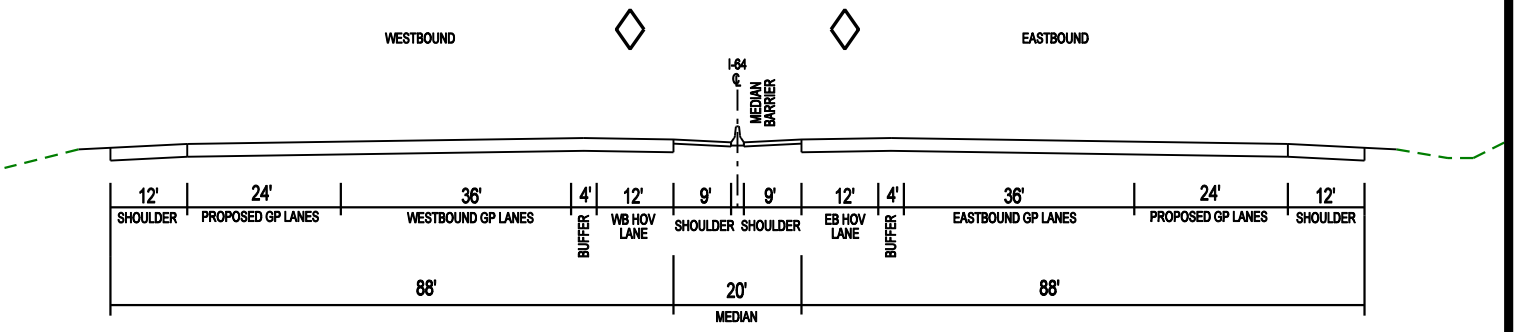


BUILD: ADD ONE OUTSIDE LANE
(6 - LANE SECTION)

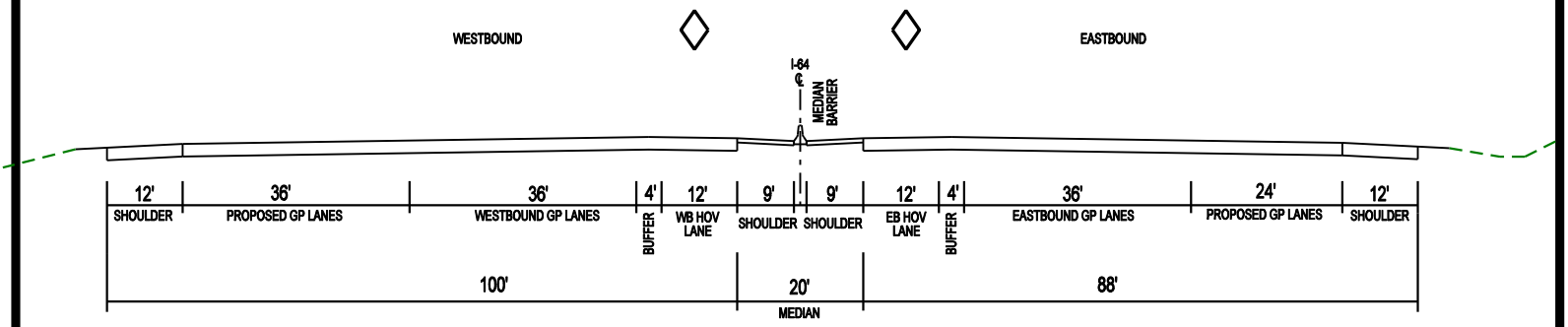
INTERSTATE 64 PENINSULA STUDY ENVIRONMENTAL IMPACT STATEMENT

TYPICAL SECTIONS
ALTERNATIVE 1A / 2A

JULY 2012



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

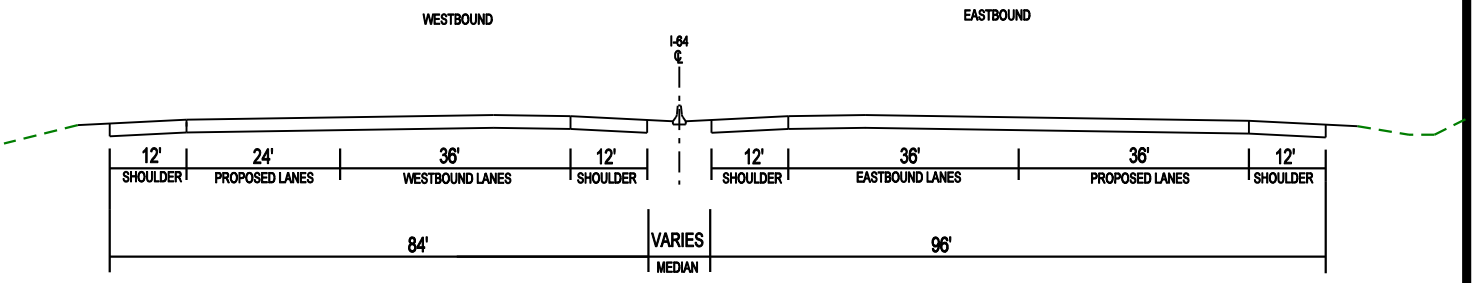


BUILD: ADD THREE GENERAL PURPOSE LANES WB, TWO GENERAL PURPOSE LANES EB
MAINTAIN EXISTING HOV-2 LANES
(13 - LANE SECTION)

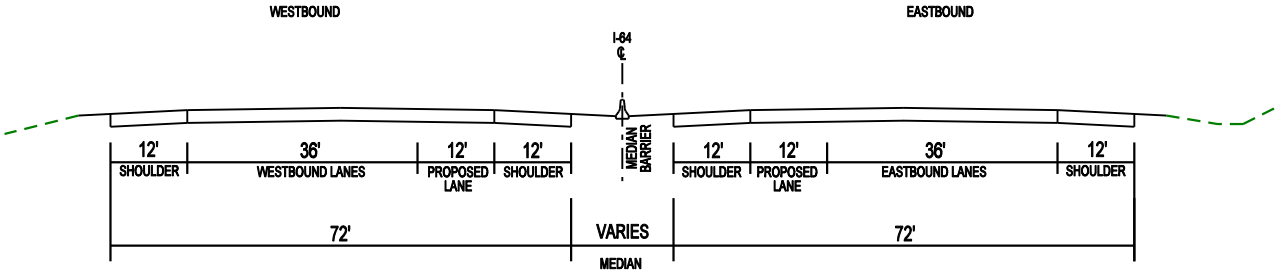
INTERSTATE 64 PENINSULA STUDY ENVIRONMENTAL IMPACT STATEMENT

TYPICAL SECTIONS
ALTERNATIVE 1A / 2A

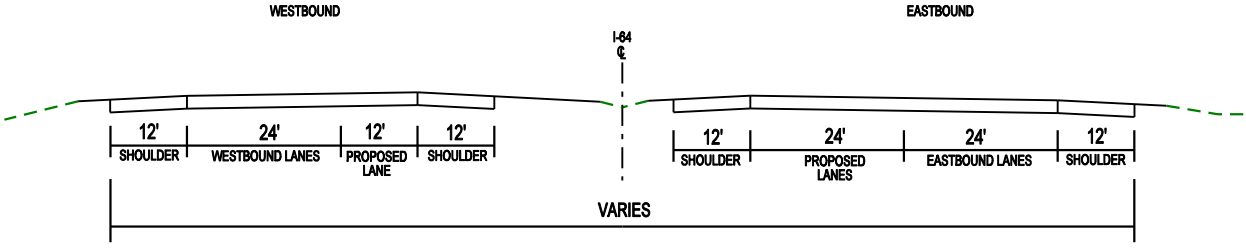
JULY 2012



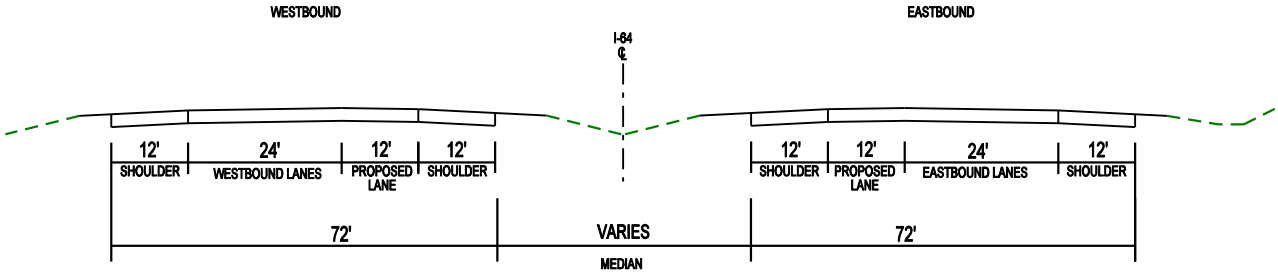
BUILD: ADD TWO OUTSIDE LANES WB, THREE OUTSIDE LANES EB
(11 - LANE SECTION)



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



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

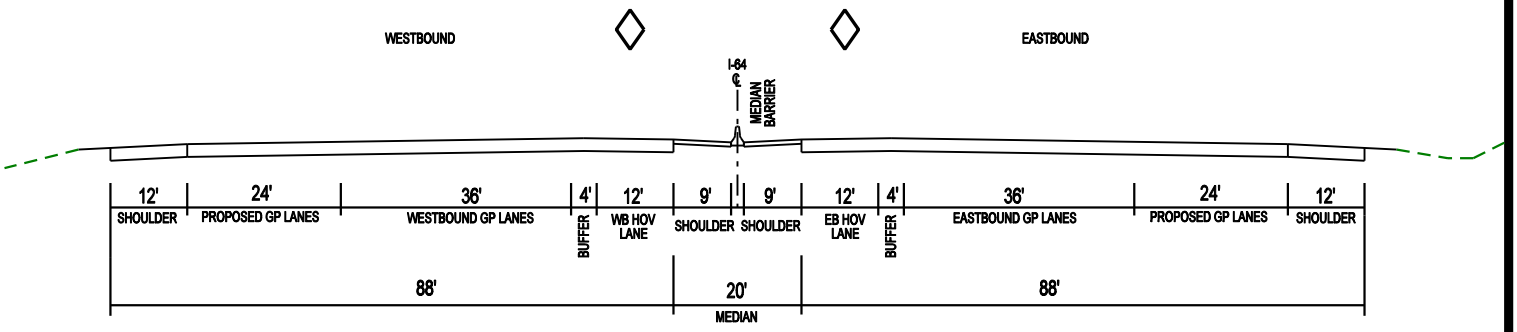


BUILD: ADD ONE INSIDE LANE
(6 - LANE SECTION)

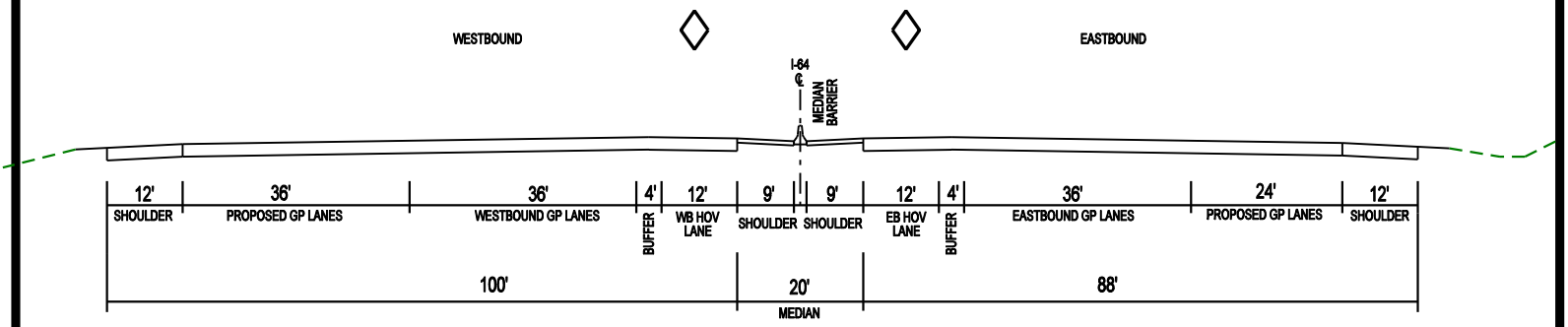
INTERSTATE 64 PENINSULA STUDY ENVIRONMENTAL IMPACT STATEMENT

TYPICAL SECTIONS
ALTERNATIVE 1B / 2B

JULY 2012



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

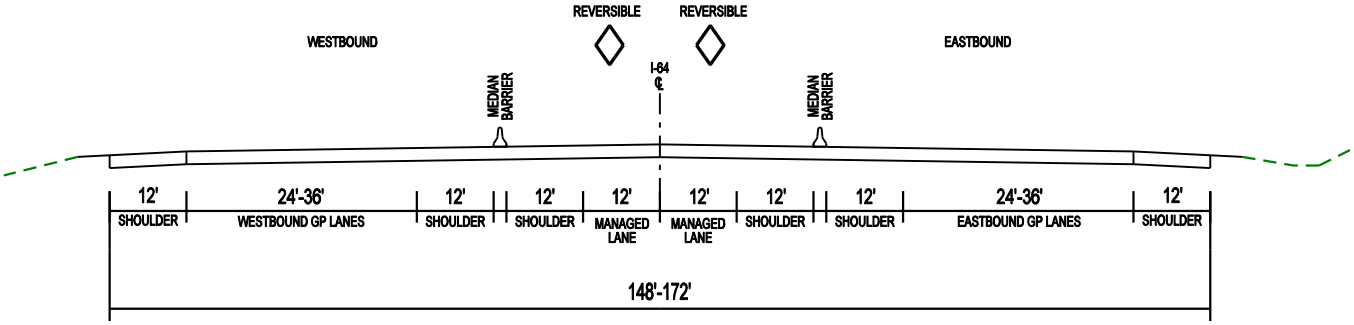


BUILD: ADD THREE GENERAL PURPOSE LANES WB, TWO GENERAL PURPOSE LANES EB
MAINTAIN EXISTING HOV-2 LANES
(13 - LANE SECTION)

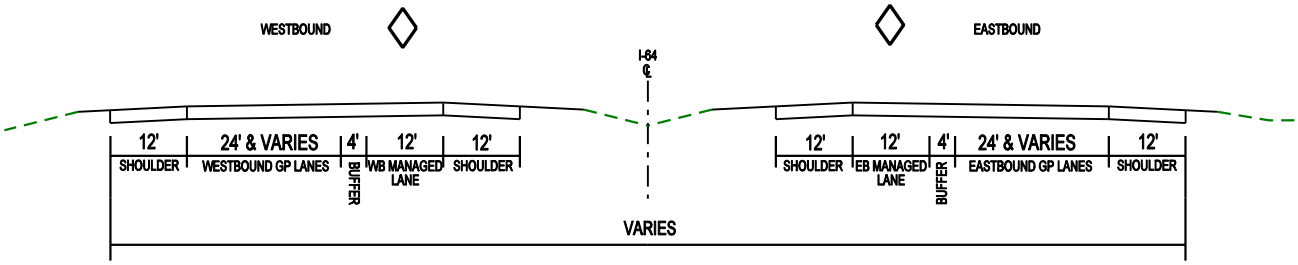
INTERSTATE 64 PENINSULA STUDY ENVIRONMENTAL IMPACT STATEMENT

TYPICAL SECTIONS
ALTERNATIVE 1B / 2B

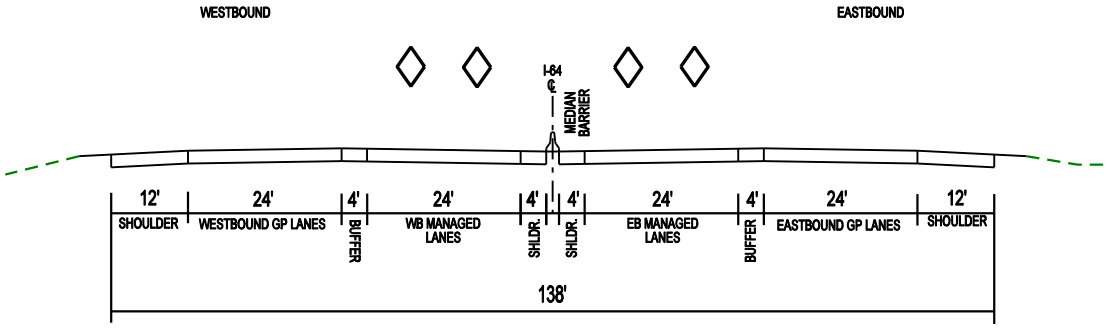
JULY 2012



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

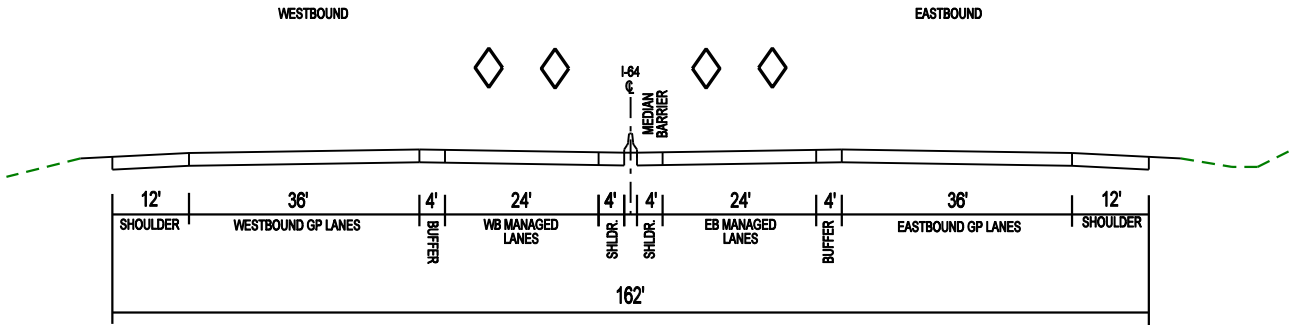


BUILD: ADD TWO MANAGED INSIDE LANES
(8- LANE SECTION)
MM 247 - 254

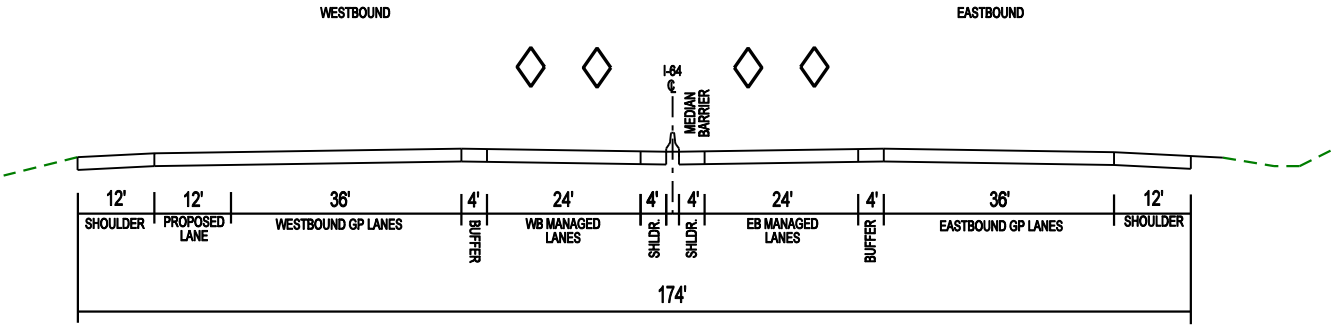
INTERSTATE 64 PENINSULA STUDY ENVIRONMENTAL IMPACT STATEMENT

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

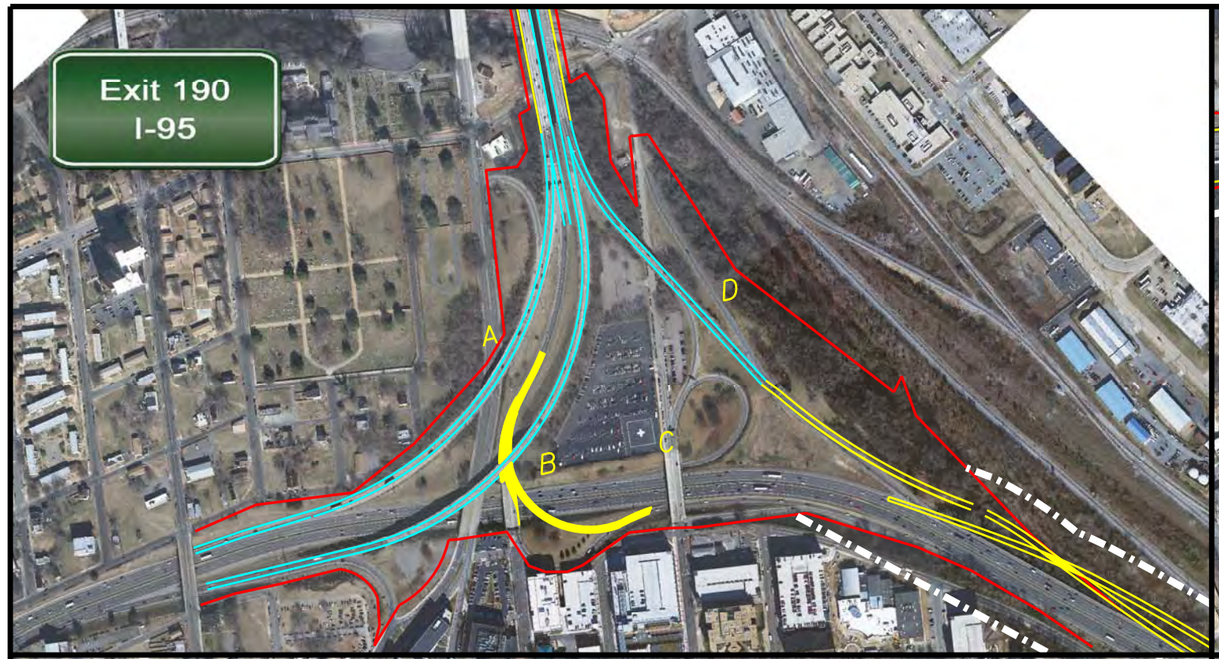
TYPICAL SECTIONS
ALTERNATIVE 3

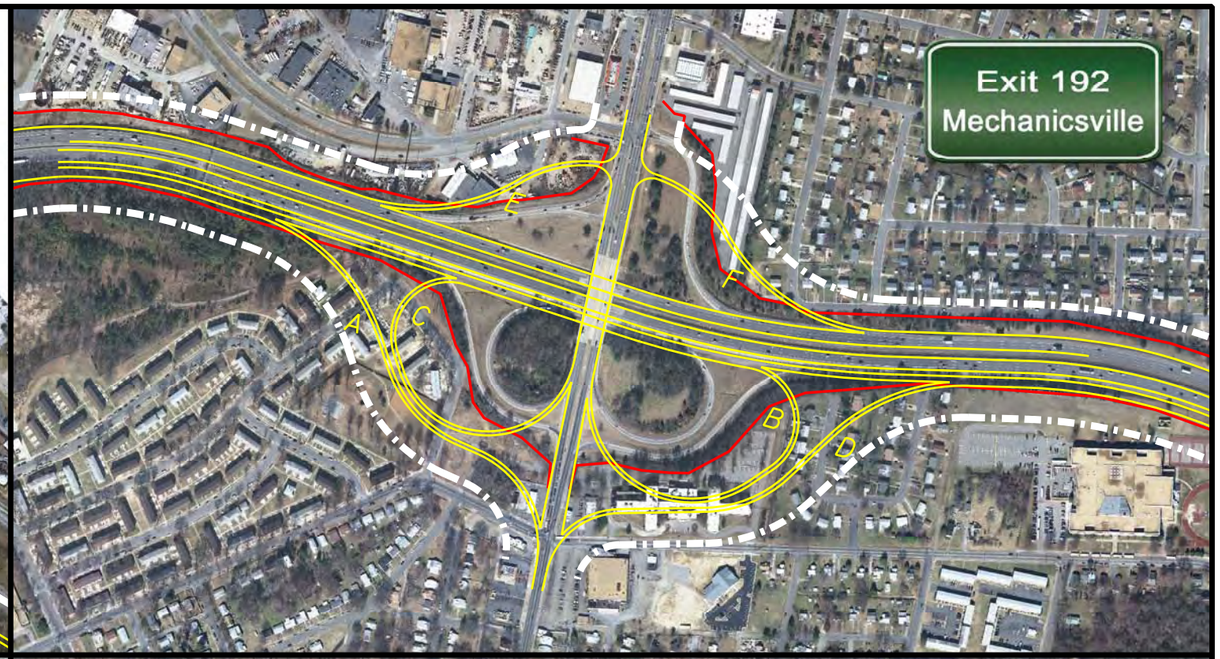
JULY 2012

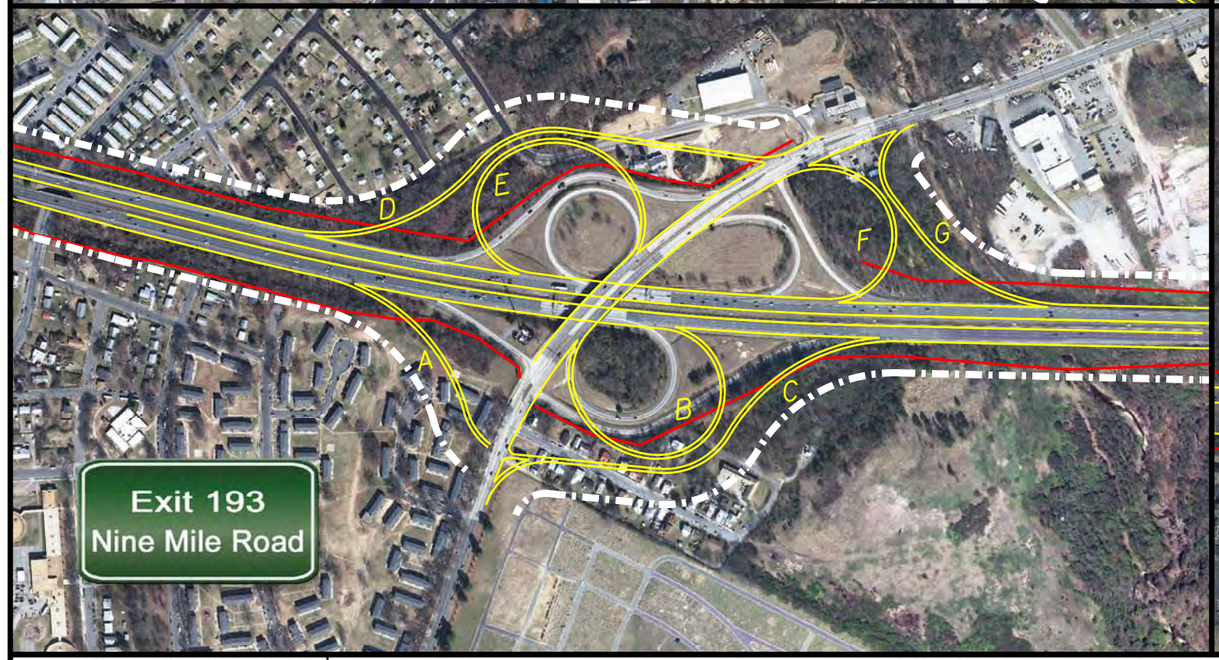
INTERSTATE 64 PENINSULA STUDY

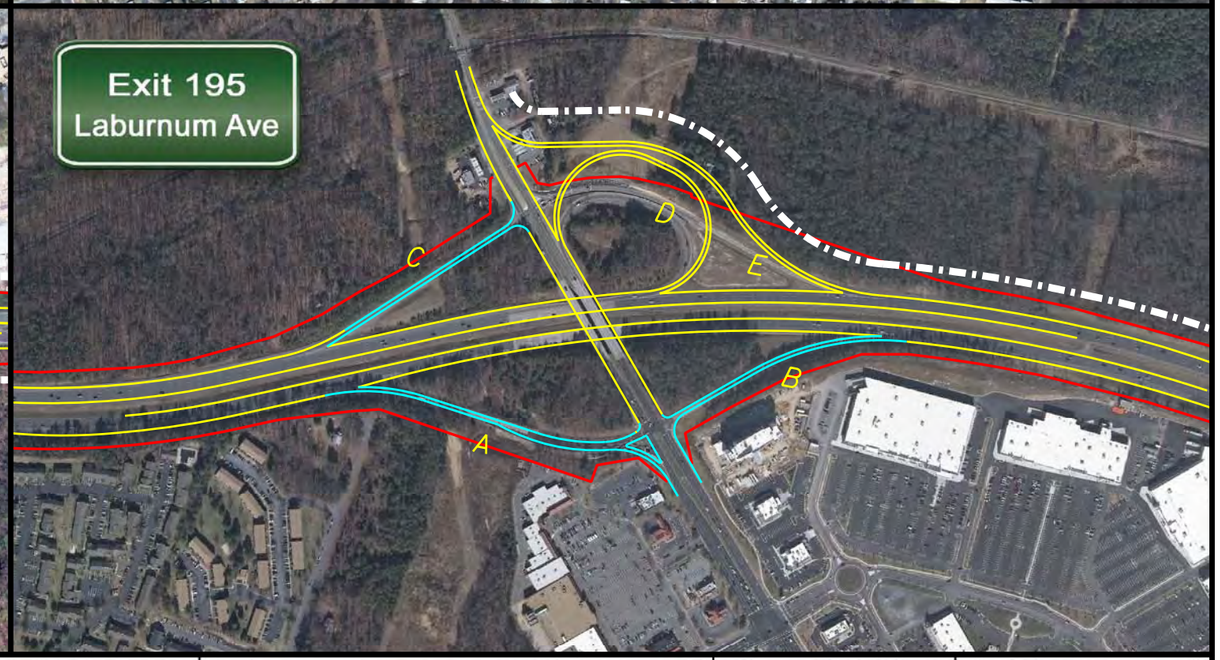
APPENDIX E

Interchange Concepts









INTERSTATE 64 PENINSULA STUDY

Potential Interchange Configurations - Conceptual Design
August 2012
Sheet 1 of 7

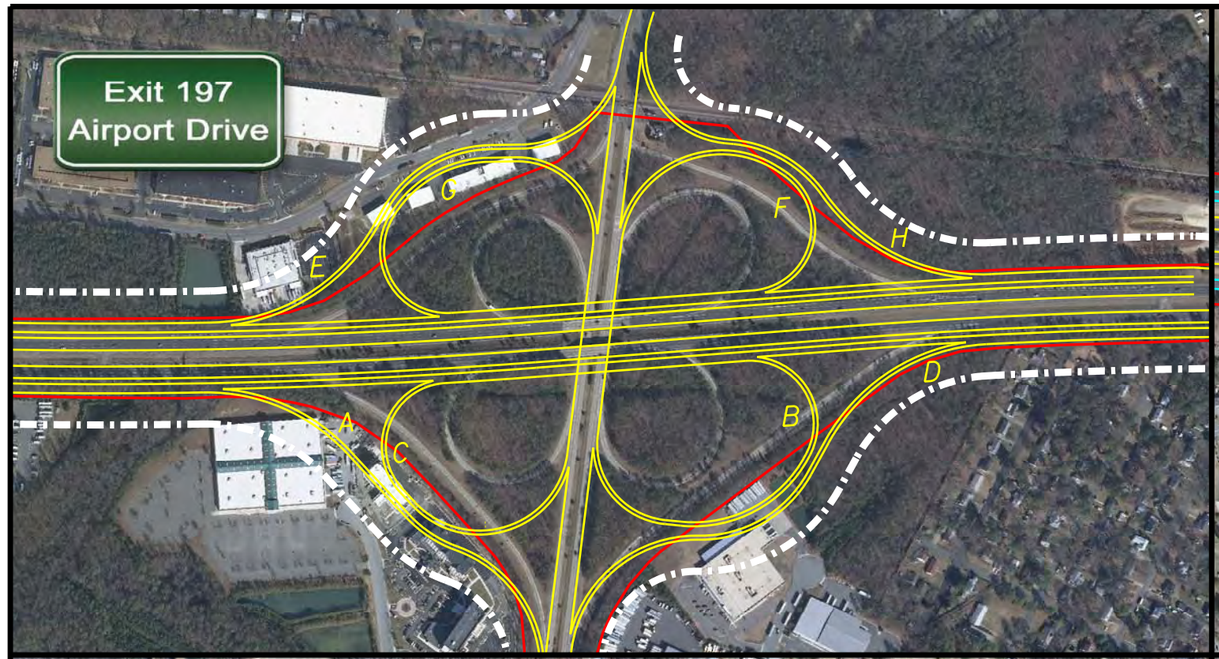
LEGEND

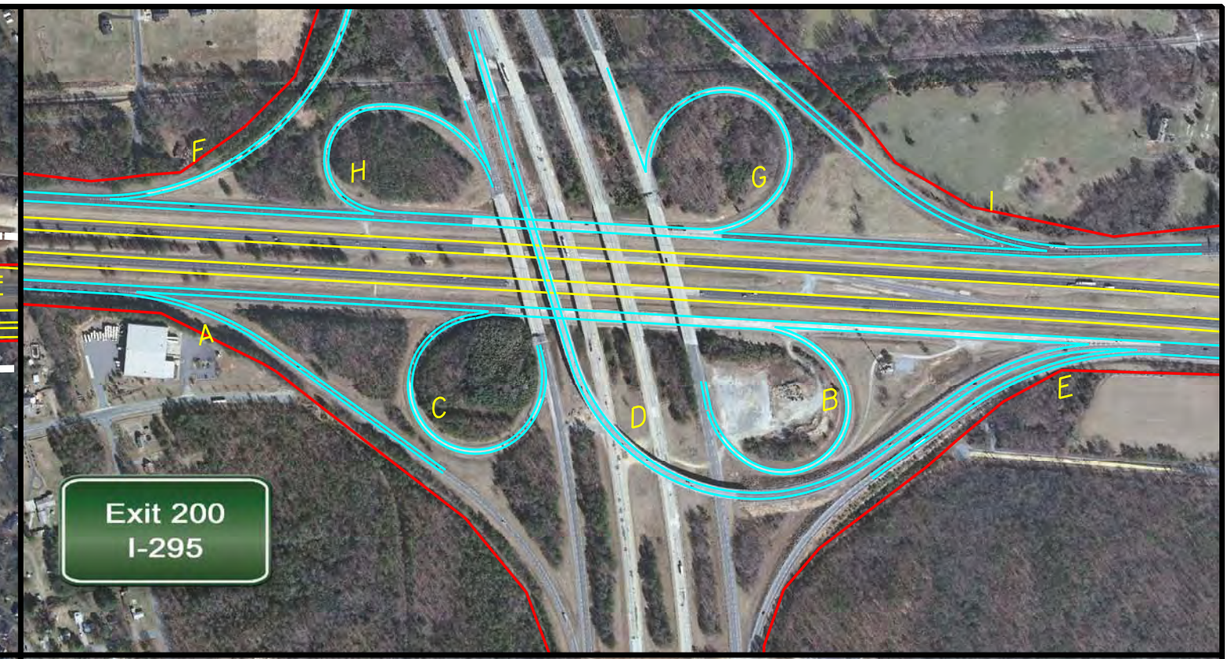
- Ramp Alignment to Remain
- Ramp Alignment to be Improved
- Potential Limit of Disturbance
- *E* Ramp Designation

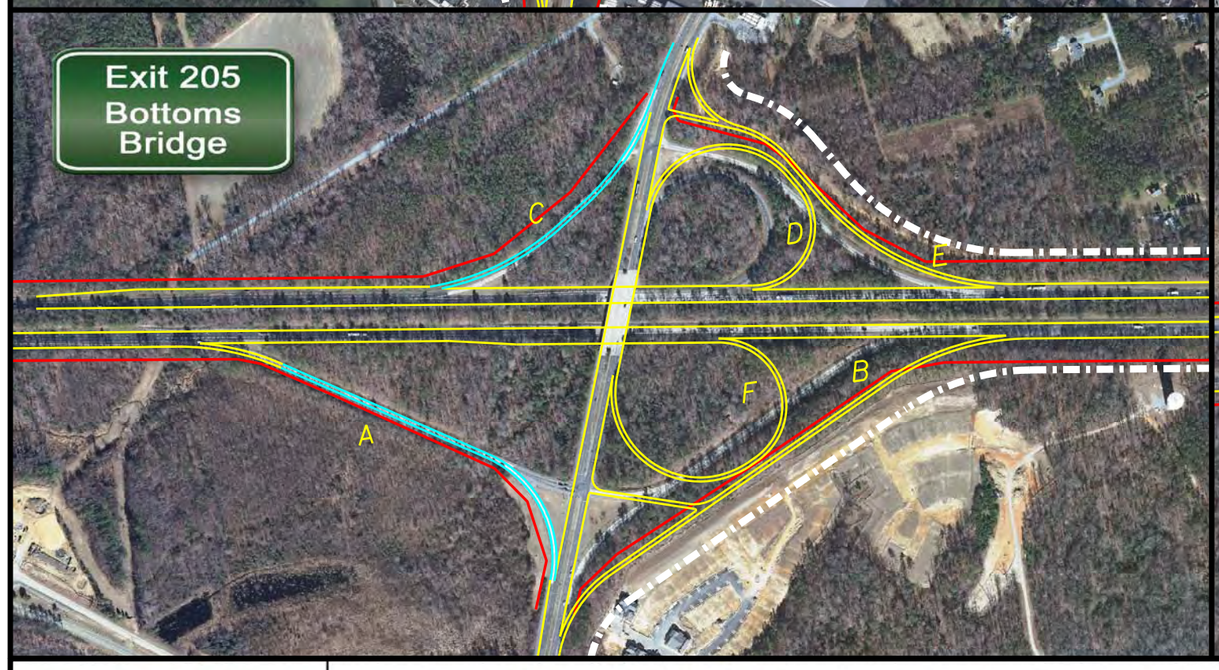
VDOT

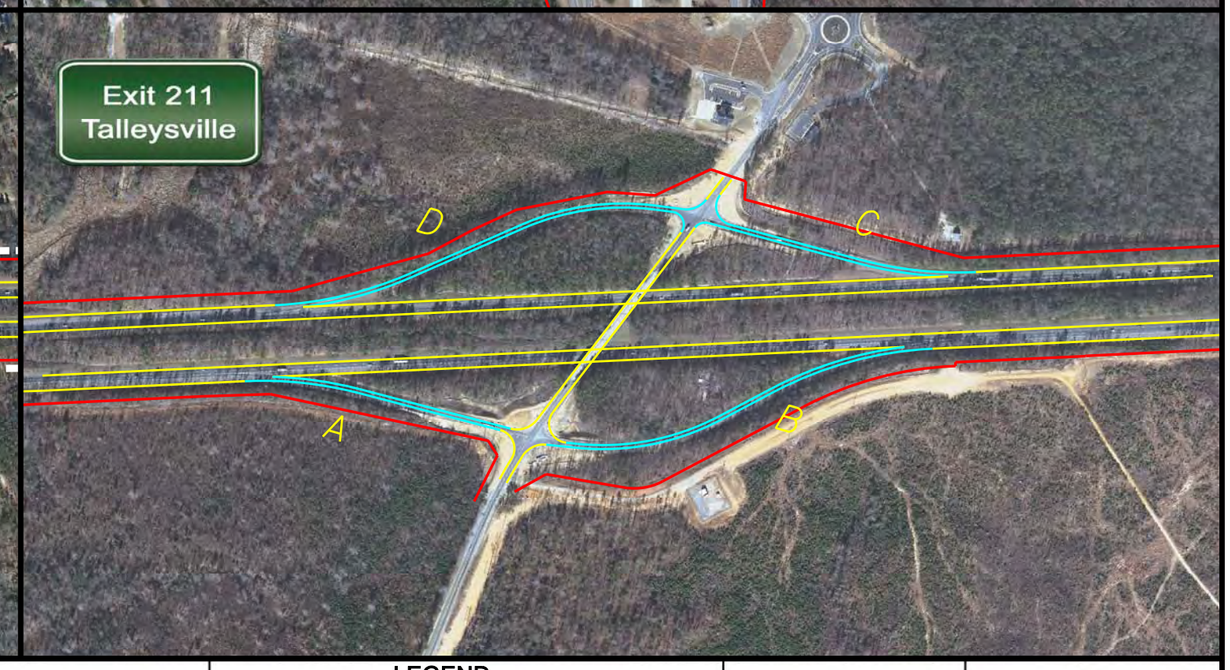
N

0 300 600 Feet









INTERSTATE 64 PENINSULA STUDY

Potential Interchange Configurations - Conceptual Design
August 2012
Sheet 2 of 7

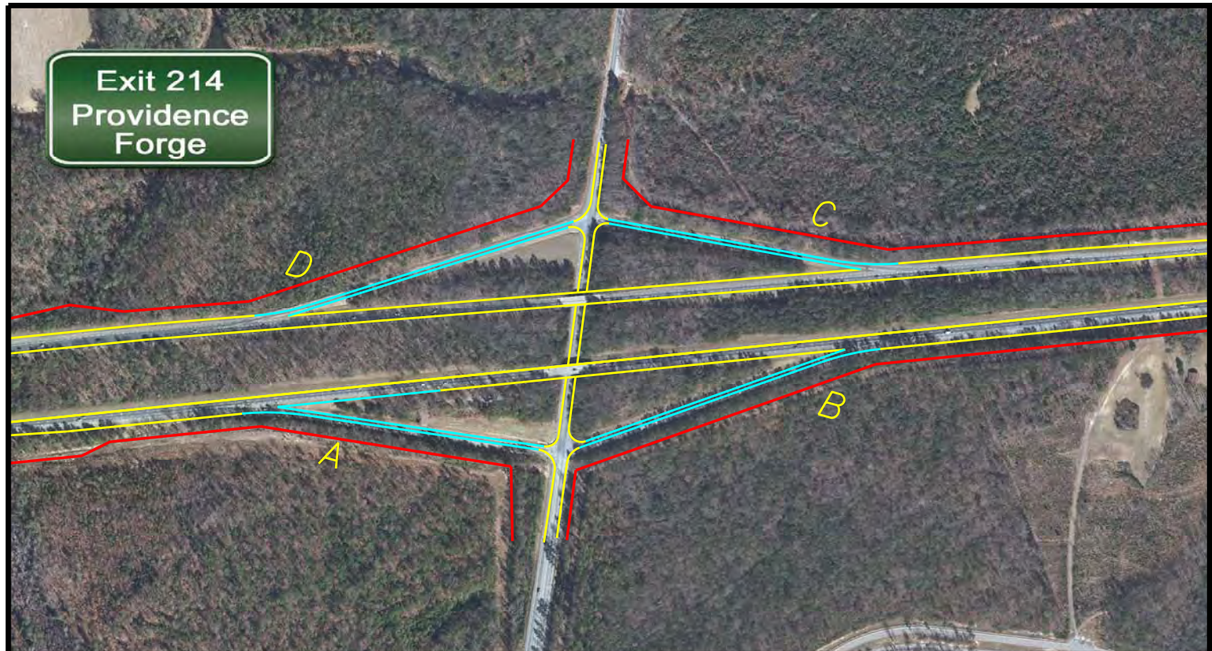
LEGEND

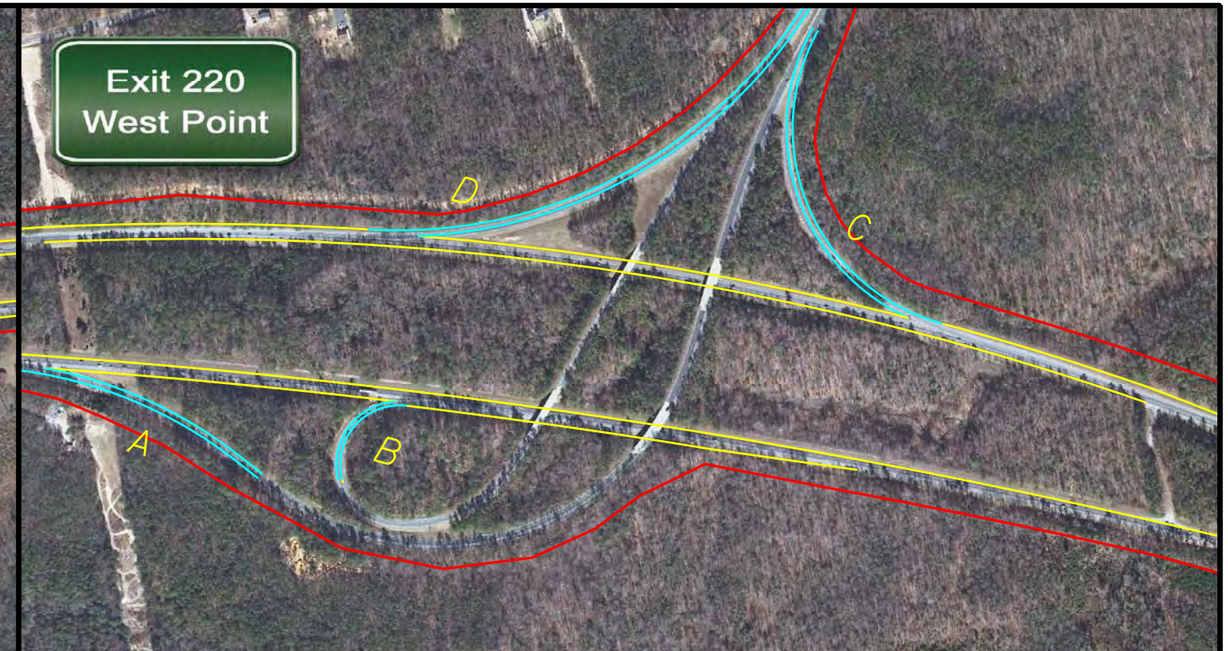
- Ramp Alignment to Remain
- Ramp Alignment to be Improved
- Potential Limit of Disturbance
- *E* Ramp Designation

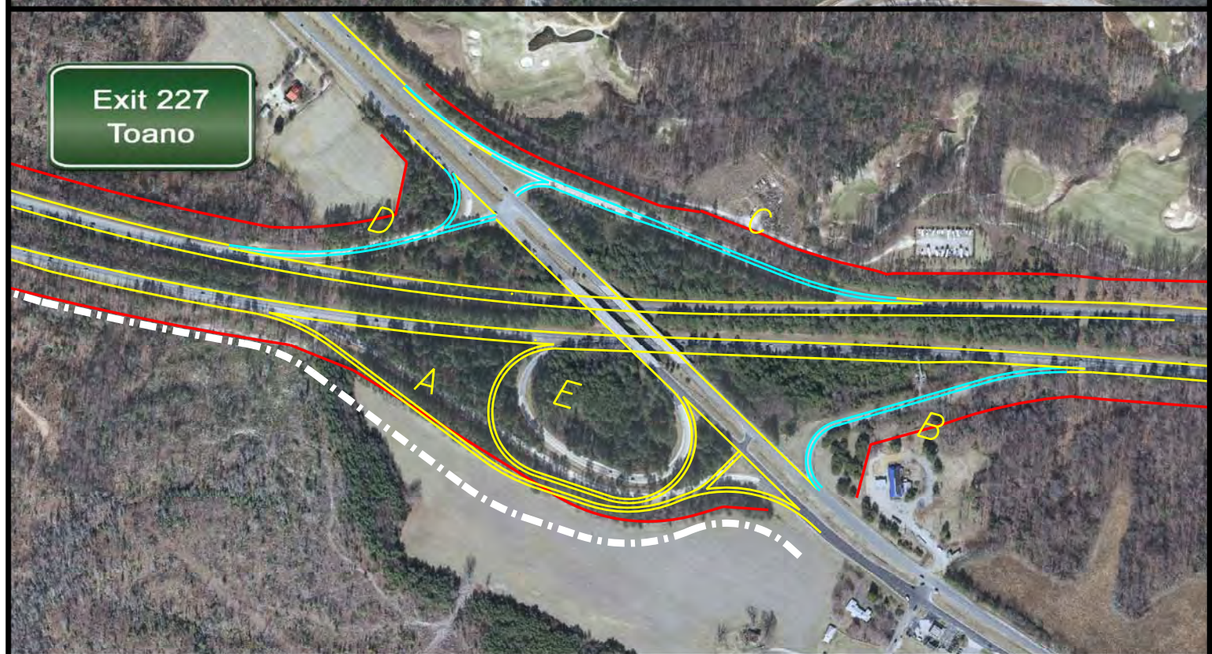
VDOT

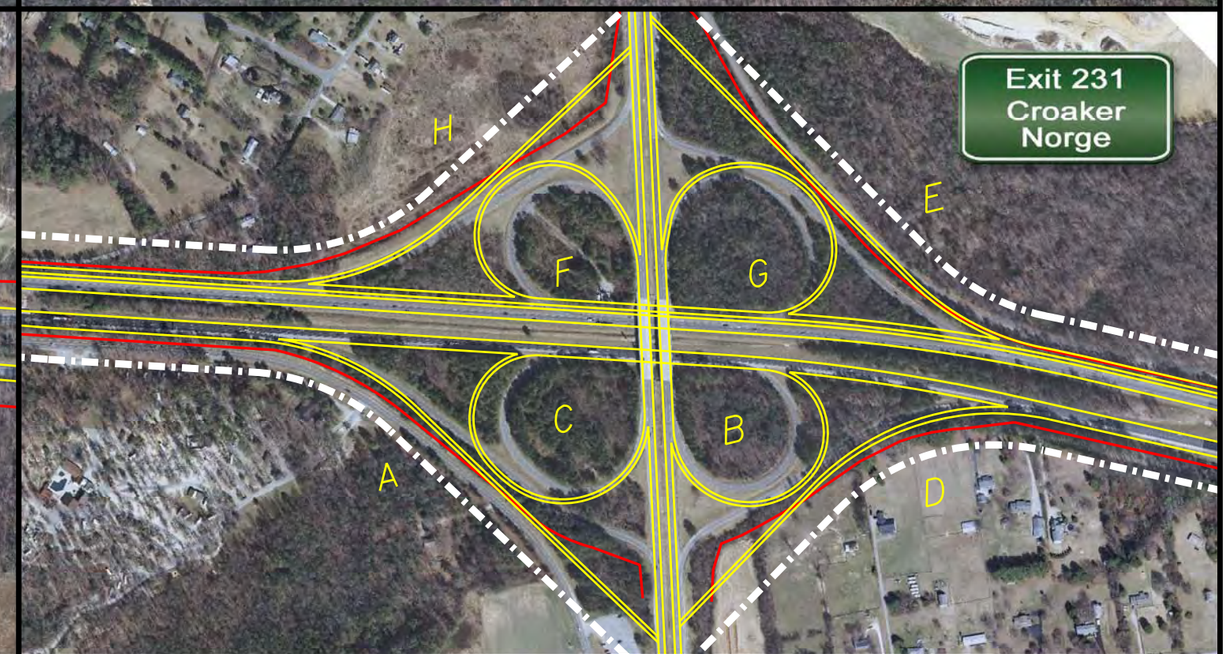
N

0 300 600 Feet









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Potential Interchange Configurations - Conceptual Design
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LEGEND

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

VDOT

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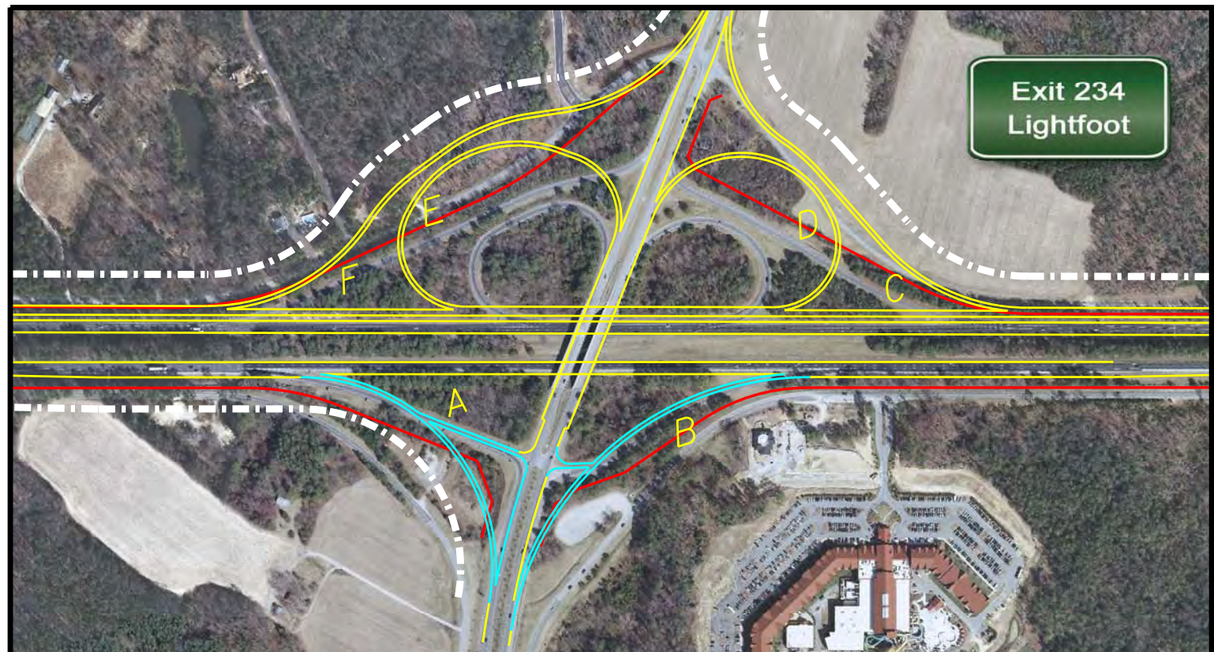
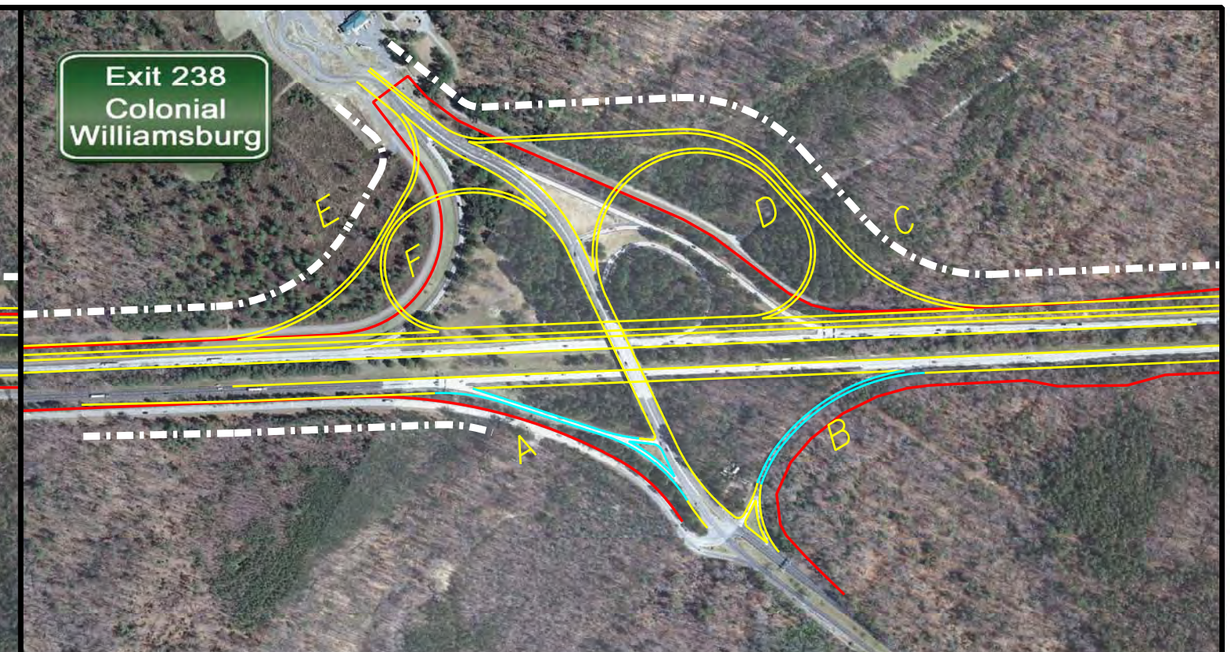
0 300 600 Feet





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Potential Interchange Configurations - Conceptual Design
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LEGEND

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

VDOT

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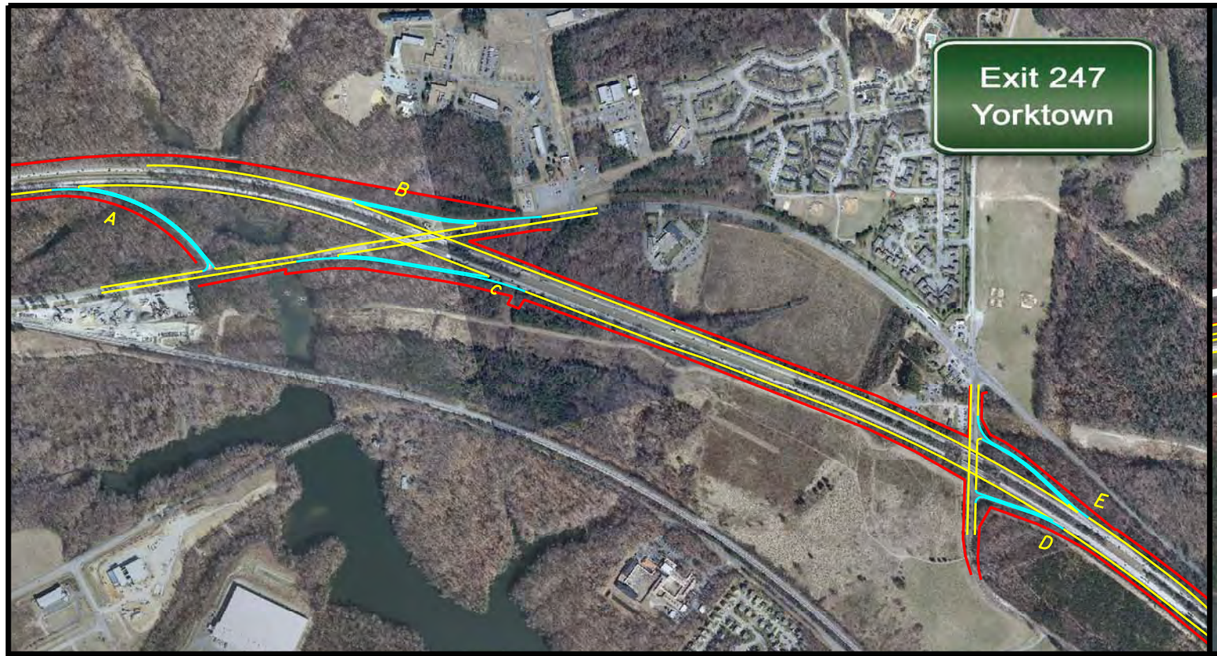
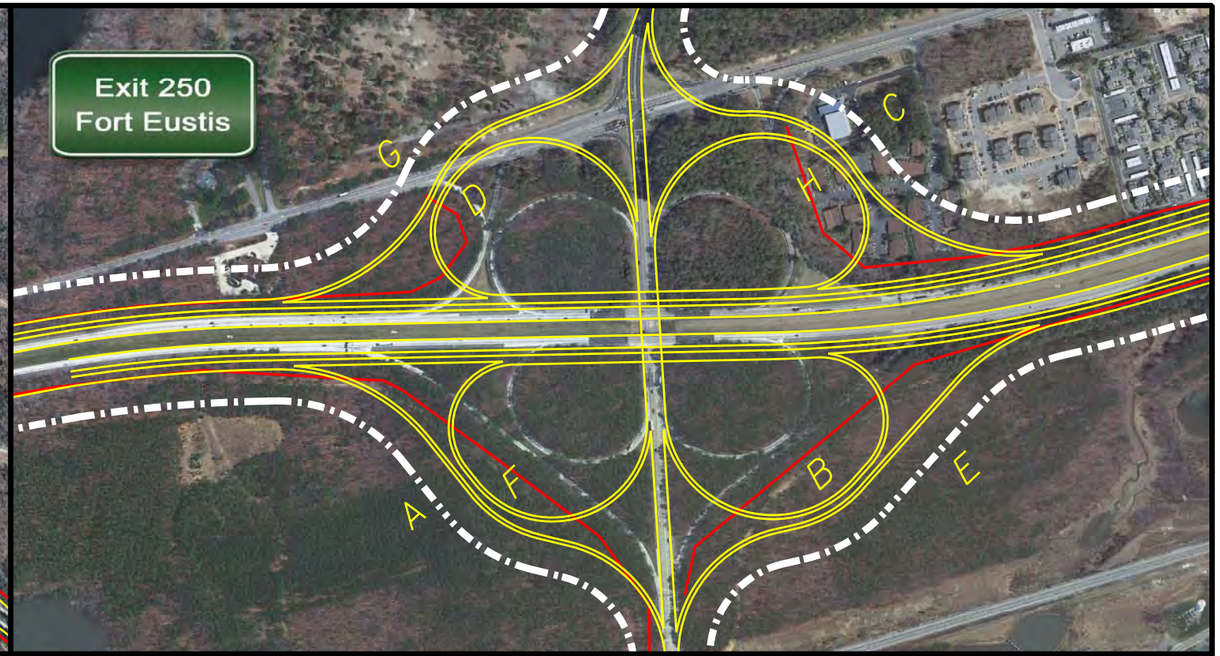
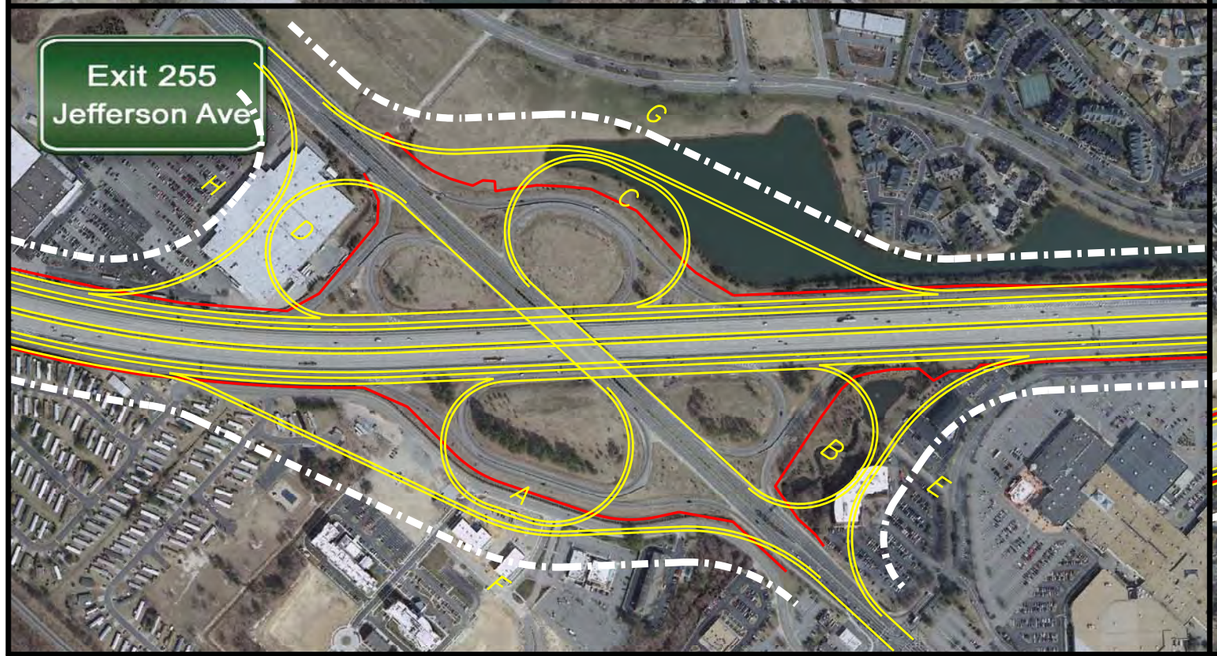
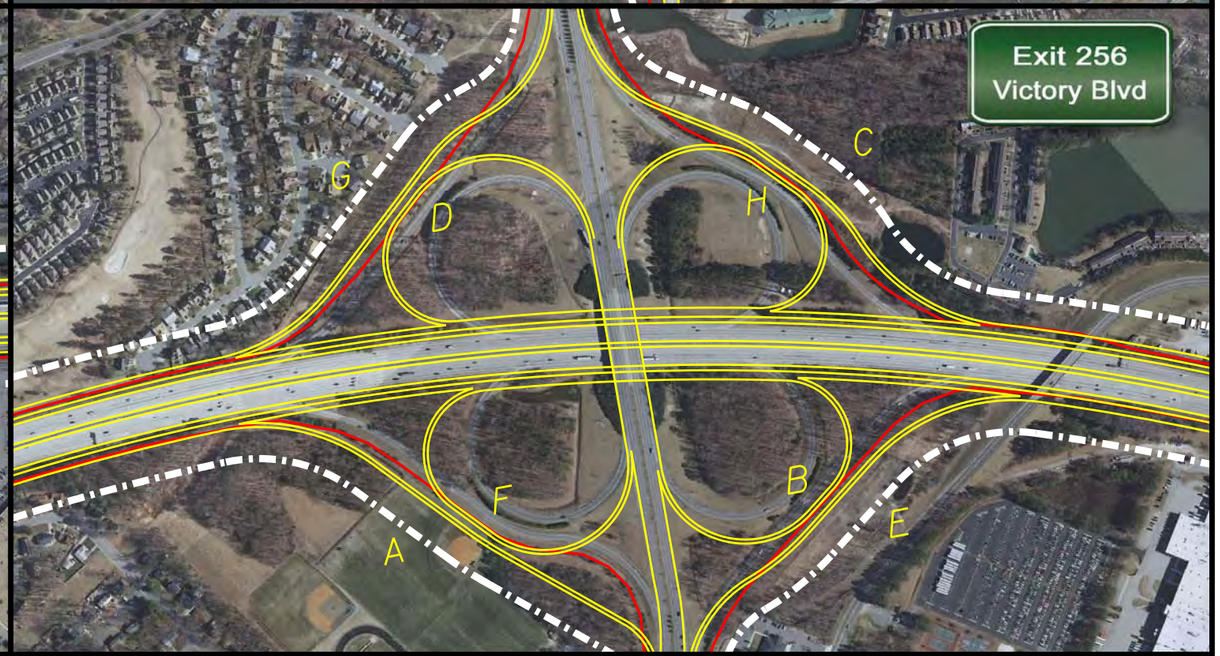
0 300 600 Feet









INTERSTATE 64 PENINSULA STUDY

Potential Interchange Configurations - Conceptual Design
August 2012
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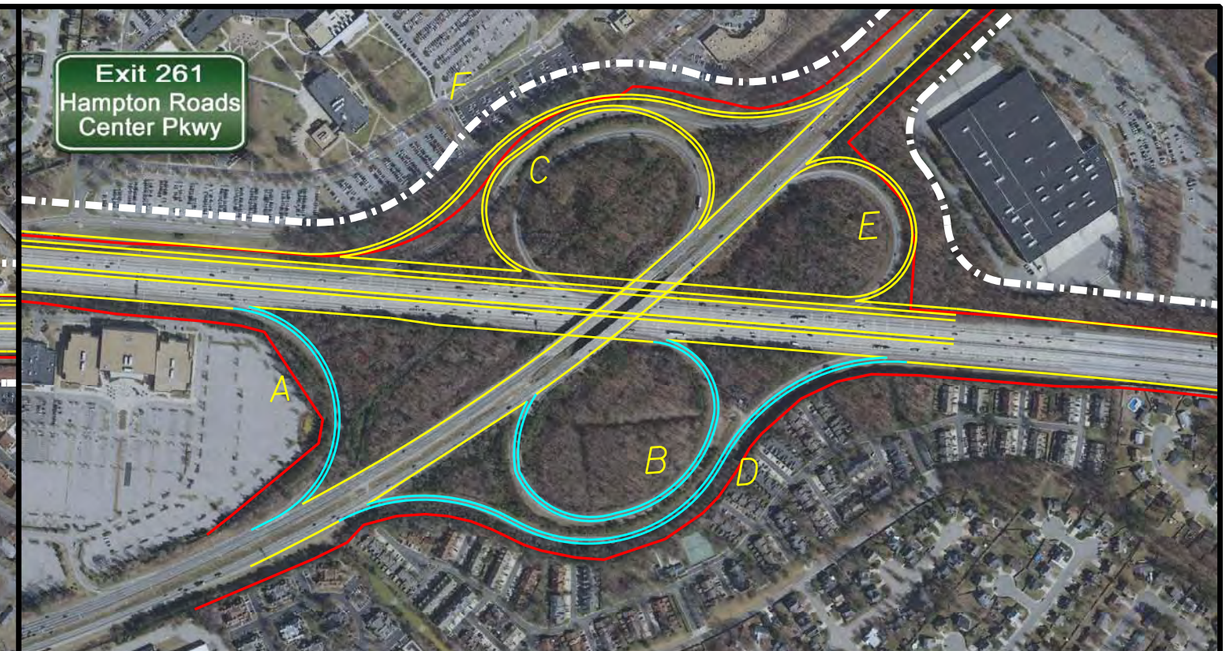
LEGEND

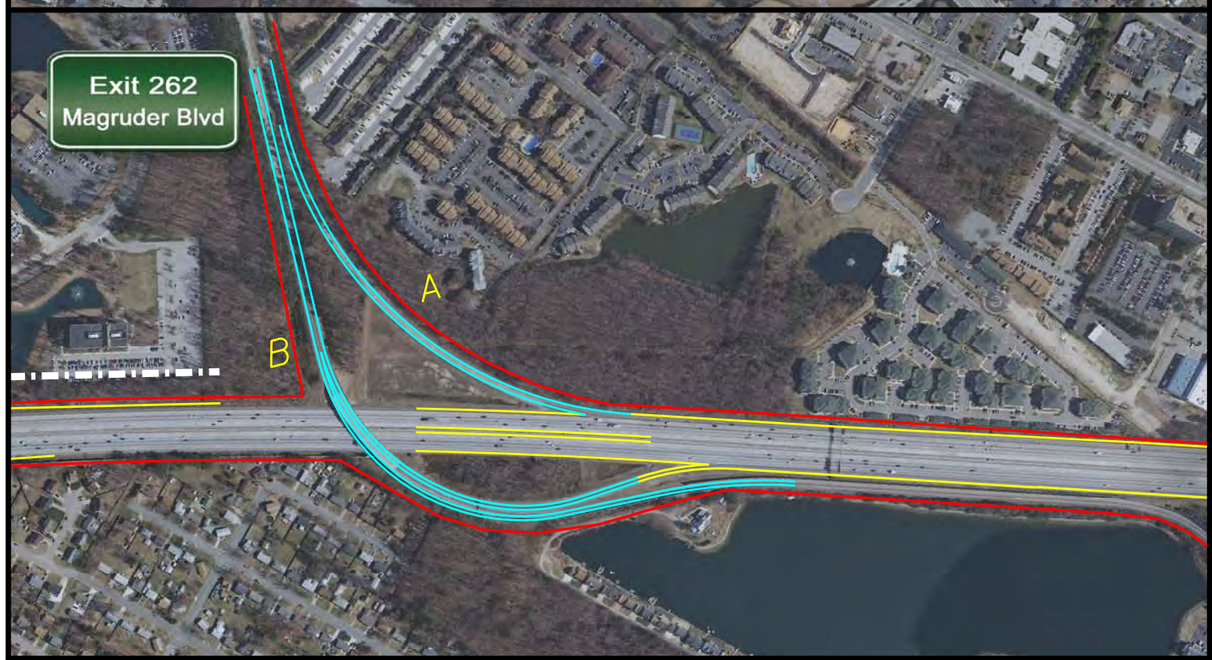
- Ramp Alignment to Remain
- Ramp Alignment to be Improved
- Potential Limit of Disturbance
- *E* Ramp Designation

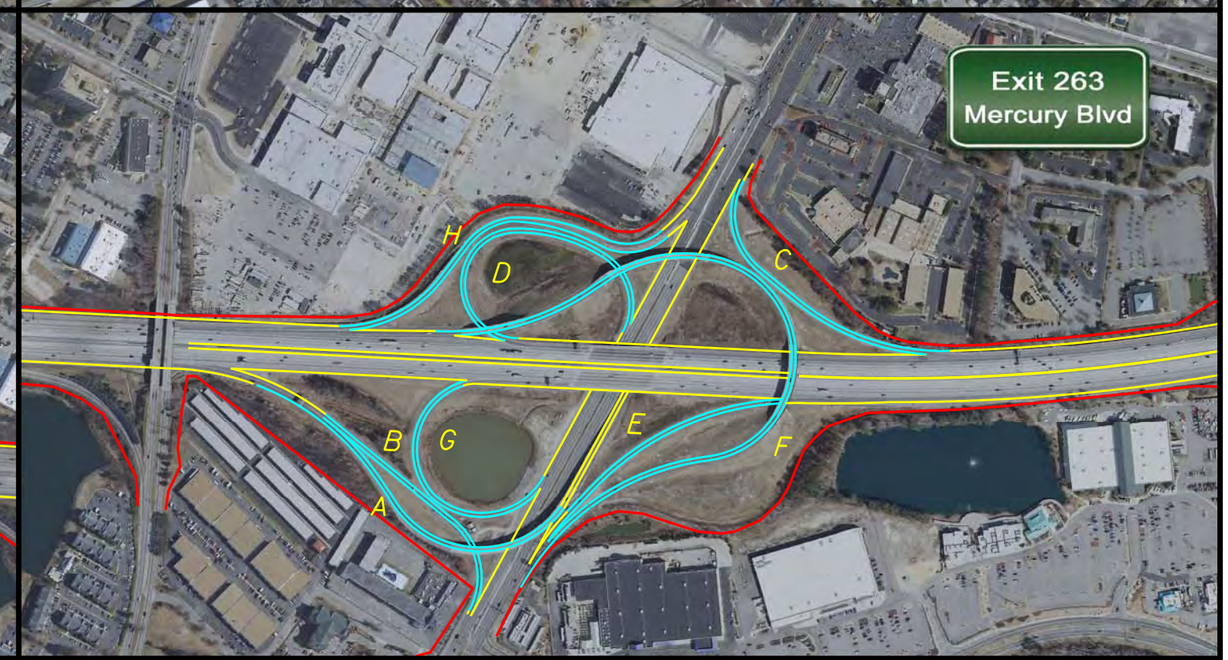
VDOT

N

0 300 600 Feet







INTERSTATE 64 PENINSULA STUDY

Potential Interchange Configurations - Conceptual Design
August 2012
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LEGEND

- Ramp Alignment to Remain
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VDOT

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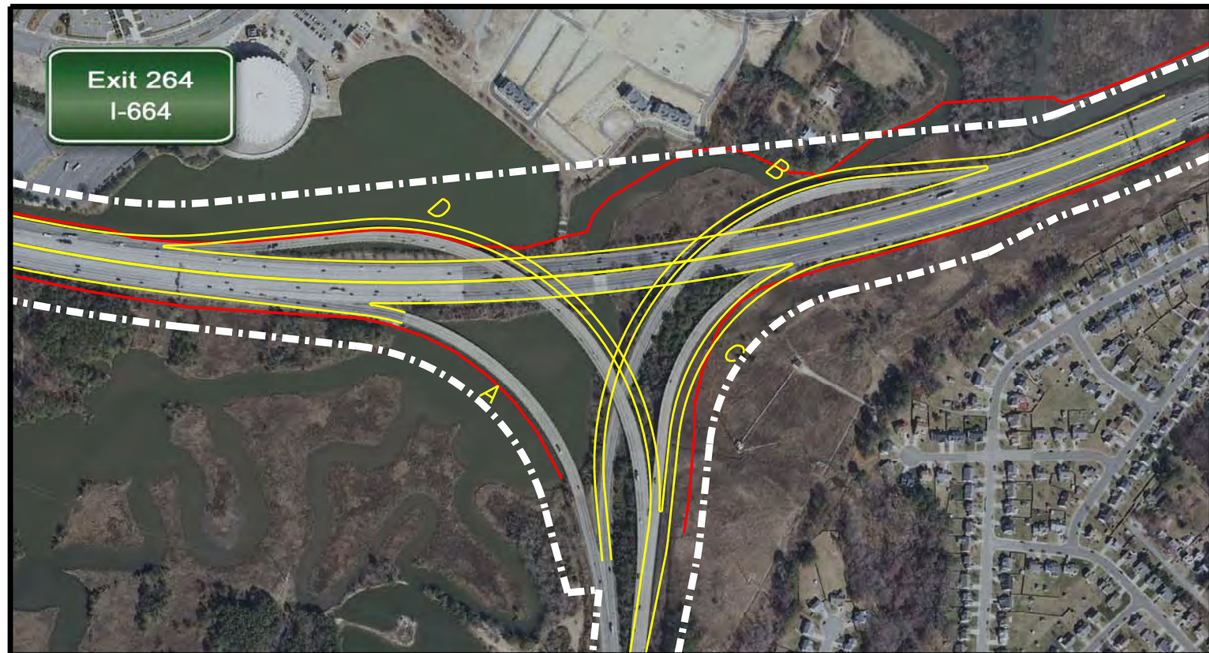

INTERSTATE 64 PENINSULA STUDY

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

LEGEND

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VDOT

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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
West
Ft Eustis Blvd
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East
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