

# Appendix A: Alternatives Development Technical Report

for the

## I-95 Access Improvements from Caton Avenue to Fort McHenry Tunnel – Environmental Assessment (EA) Baltimore City, Maryland

Prepared for:



Maryland  
Transportation  
Authority



and



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## **1 INTRODUCTION**

The Maryland Transportation Authority (MDTA) and the Baltimore City Department of Transportation (Baltimore City DOT), in coordination with the Federal Highway Administration (FHWA), are studying a suite of improvements to Interstate 95 (I-95) ramps and other nearby transportation facilities to support ongoing and planned redevelopment of the Port Covington peninsula in south Baltimore. These improvements are collectively known as the I-95 Access Improvements from Caton Avenue to the Fort McHenry Tunnel (I-95 Access Improvements).

The Port Covington peninsula is surrounded on three sides by the Middle Branch of the Patapsco River, with I-95 running on structure along the northern boundary. Transportation access to the peninsula is currently provided by east-west connections via ramps to/from I-95 and north-south connections via a principal arterial, Hanover Street, and a minor arterial, Key Highway. McComas Street is a minor arterial which provides direct access from the peninsula to these connections.

Interstate 95 is part of the Interstate Highway System in the City of Baltimore, and is owned, operated and maintained by MDTA. The Baltimore City DOT is responsible for other arterial and collector roadways in the project area. FHWA has approval authority over any changes to access points on the Interstate Highway System. Approval of any proposed modification to Interstate access constitutes a federal action subject to review under the National Environmental Policy Act (NEPA).

This report describes the alternatives development process and the screening criteria approach for the I-95 Access Improvements. Included is the identification of initial options considered, options retained and assembled as alternatives for analysis purposes, and the development of a recommended preferred alternative (Alternative 5) for detailed evaluation in the Environmental Assessment (EA). The results of this Technical Report will be summarized in the EA.

## 2 EXISTING CONDITIONS

As shown in **Figure 2-1**, the project is located along I-95 in southern Baltimore. The study area, shown in **Figure 2-2**, generally follows I-95 along the northern boundary of the Port Covington peninsula between Exit 50 (Caton Avenue) and the Fort McHenry Tunnel, and includes sections of Hanover Street, McComas Street and Key Highway. The study area is approximately five miles long. In this section, I-95 is generally eight lanes wide, with four lanes in both the northbound and southbound directions.

**Figure 2-1: Project Location**

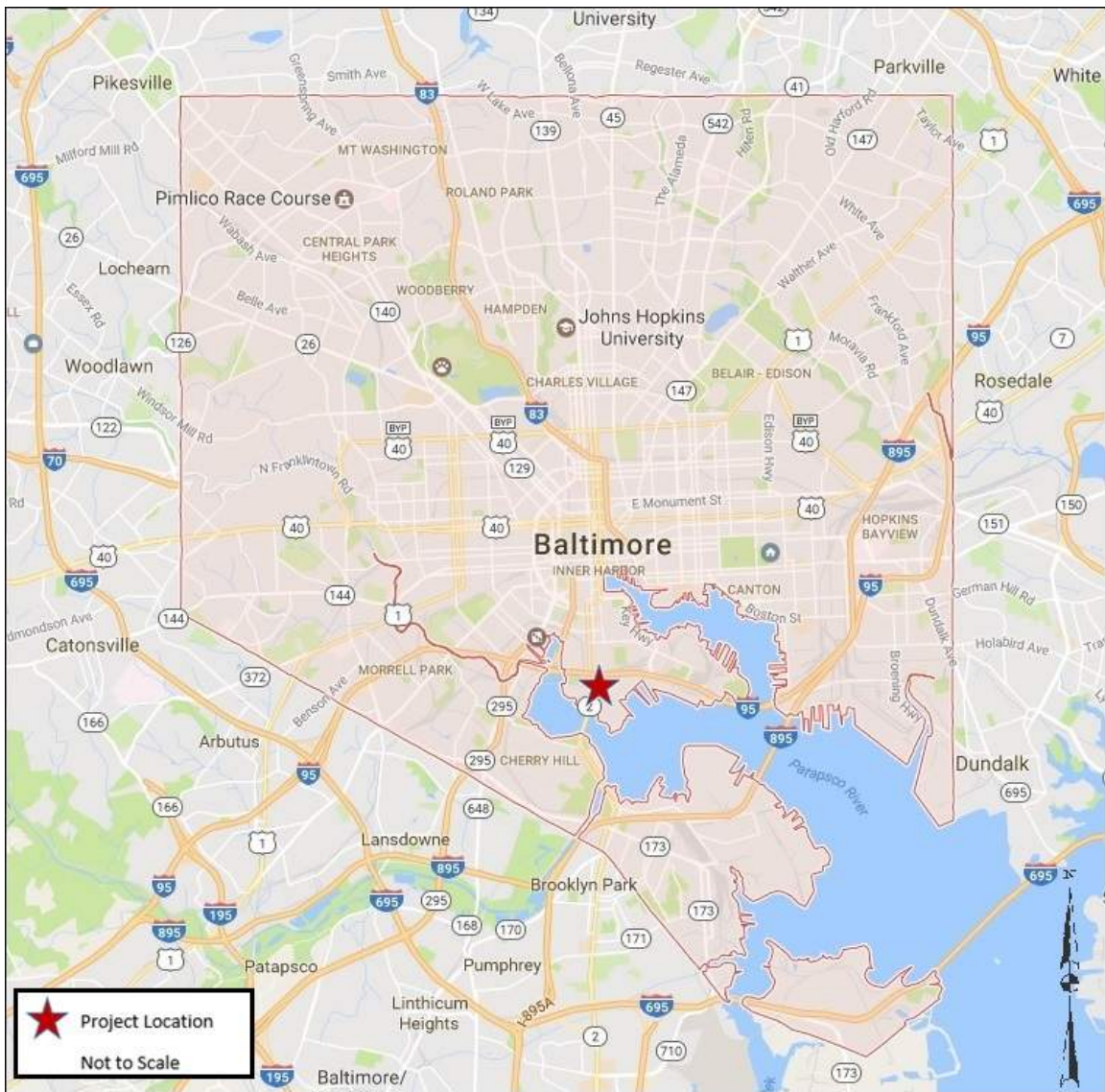
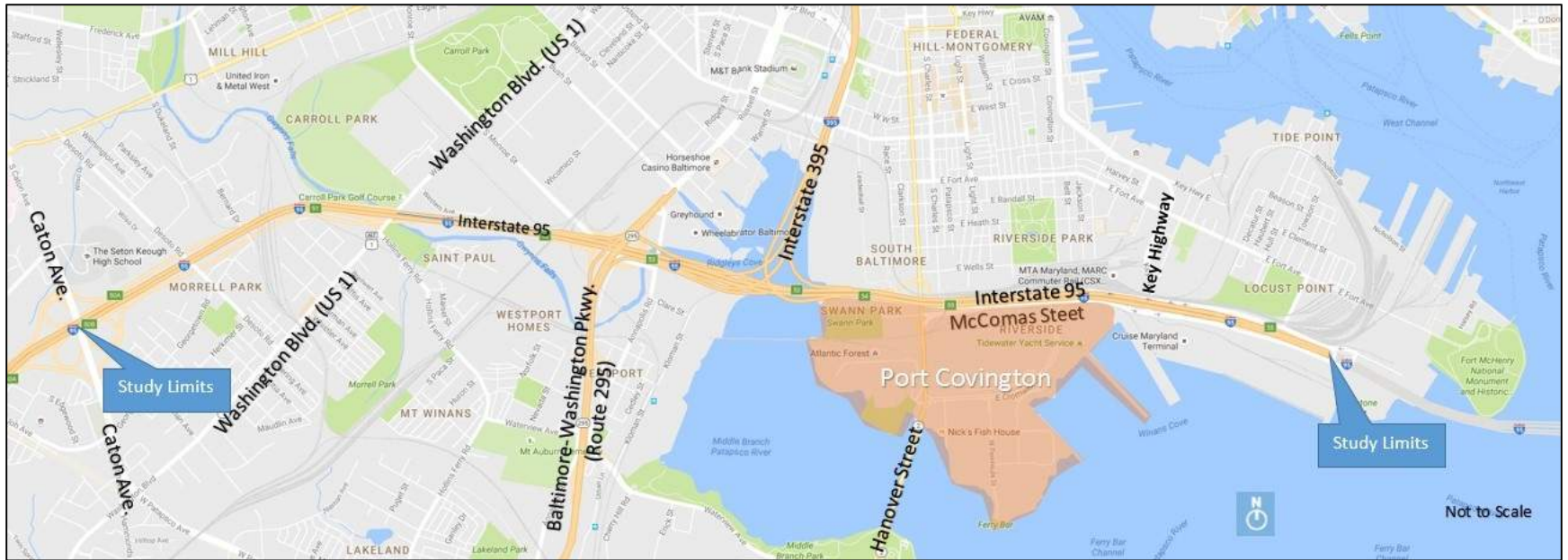


Figure 2-2: Study Area



## 2.1 Present Day

The Exit 54 (Hanover Street) and Exit 55 (Key Highway) interchanges currently provide access between I-95 and the Port Covington peninsula. These interchanges collectively provide a total of three exits from I-95, two northbound and one southbound, and three entrances to I-95, one northbound and two southbound, on the Port Covington peninsula. These existing I-95 exit and entrance ramps are all single lanes and limit the amount of traffic that is able to access the Port Covington area.

Within the study area, I-95 is located primarily on elevated structures as much as 50-ft above the existing ground. The majority of I-95 has four through travel lanes in both the northbound and southbound directions, with lane drops and auxiliary lanes in certain locations.

Exit 54 (Hanover Street) is a partial interchange which only provides a northbound I-95 exit ramp to southbound Hanover Street and a southbound I-95 entrance ramp from northbound Hanover Street. A northbound I-95 entrance ramp and a southbound I-95 exit ramp to or from Hanover Street do not exist at this interchange. The configuration of this interchange was designed to intentionally discourage through traffic in the neighborhoods north of Port Covington by limiting the available access to and from I-95. Traffic to and from these neighborhoods is currently directed to a jughandle at the signalized intersection of Hanover Street and Cromwell Street to obtain access to and from I-95. The ramps that do exist at this interchange function with the I-395 interchange to provide an important link for traffic traveling to and from downtown Baltimore City and points south of Port Covington. This is supported by the fact that approximately 60% of the traffic using the exit ramp at Exit 54 (Hanover Street) originates from southbound I-395.

Exit 55 (Key Highway) is considered a full interchange providing an exit and entrance ramp in both directions of I-95 to and from Key Highway via McComas Street. The southbound I-95 exit ramp is located immediately south of the Fort McHenry Tunnel. This requires southbound I-95 traffic to use the right-most lane of the right-most tunnel bore to access Port Covington, making it necessary for vehicles to position themselves almost 2 miles in advance of the exit due to the fact that lane changes are not permitted in the tunnel. As a result, travelers unfamiliar with this configuration often miss this exit and, because there are no other southbound exits providing access to Port Covington, they are forced to use a subsequent exit to turn around and return to Port Covington via northbound I-95, extending their trip an additional 5 to 10 miles.

Under existing conditions, the spacing of the I-95 ramps also contributes to the traffic congestion in the area. In the northbound direction, an 800-ft long weaving section exists between the entrance ramp from southbound I-395 at the Exit 53 interchange to the exit ramp at the Exit 54 (Hanover Street) interchange. In the southbound direction, the Exit 55 (Key Highway) and Exit 54 (Hanover Street) interchange entrance ramps are located approximately 3,000-ft apart, then immediately followed by a 600-ft long weaving section between the entrance ramp from Exit 54 (Hanover Street) and the exit ramp to northbound I-395 at the Exit 53 interchange. According to Figure 10-68 in *AASHTO's Policy on Geometric Design of Highways and Streets (2011)*, a 1,600-ft ramp terminal spacing is recommended for service to service interchange weaving sections on a full freeway. In both the northbound and southbound directions, the existing 800-ft and 600-ft weaving sections are substandard.



In the study area, between the Wells Street intersection and McComas Street intersection, Hanover Street is four lanes with two travel lanes in both the northbound and southbound directions. North of the study area and Wells Street, Hanover Street transitions to one travel lane in both directions with on-street parking adjacent to the sides and a landscaped center median. South of the study area and McComas Street, existing Hanover Street is five lanes with two northbound, two southbound, and one center reversible travel lane.

Existing McComas Street extends from Swann Park to the Fort McHenry Tunnel on the Port Covington peninsula, providing a key connection between Hanover Street, Key Highway, and the ramps to and from I-95. West of Hanover Street, McComas Street is an undivided minor arterial containing one travel lane in both the eastbound and westbound directions with on-street parking on both sides. East of Hanover Street, McComas Street is undivided for approximately 900-ft with two travel lanes in each direction. The eastbound and westbound lanes then split and become one-way two and three-lane sections until the Fort McHenry Tunnel. The one-way section of eastbound McComas Street traverses just to the south of the I-95 viaduct, while the majority of the one-way section of westbound McComas Street traverses directly beneath southbound I-95.

On the east side of the Port Covington peninsula, Key Highway intersects McComas Street under an elevated section of I-95. From McComas Street to McHenry Row, existing Key Highway has two travel lanes in both the northbound and southbound direction. The travel lanes are separated by a median. Just north of the I-95 viaduct, CSX railroad tracks cross Key Highway on an overhead bridge structure. The bridge has an existing pier centered in the median of Key Highway. The newly constructed McHenry Row commercial area is located on the east side of Key Highway and the CSX Riverside Railyard is located on the west side.

Sidewalks exist along some sections of Hanover Street, McComas Street, and Key Highway within the study area. However, there are currently no continuous pedestrian or bicycle facilities connecting the Port Covington peninsula to the neighborhoods located north of it because of the barriers created by the elevated I-95 freeway and the existing CSX rail facilities located just north of the I-95 viaduct.

## **2.2 Proposed Development**

The Port Covington peninsula in south Baltimore is currently undergoing redevelopment that is transforming a formerly industrial area into a mixed-use development, comprising new residential, retail, and office uses. The overall amount and type of development on this 260-acre peninsula is being guided by the Port Covington Master Plan, which was approved by the Baltimore City Planning Commission in June 2016. Sagamore Development Company LLC (Sagamore) is the largest property-owner in Port Covington and is leading the private real estate development activities within the site. Under Armour has announced its intention to locate its world headquarters within Port Covington; the Under Armour headquarters will be the centerpiece of the planned development.

**Figure 2-3: Port Covington Peninsula Present Day Birds Eye View**



The approved Port Covington Master Plan presents the redevelopment vision for the 260-acre peninsula. The plan includes a new street grid, transit facilities and links, and parks. The Master Plan lays out seven districts, each with its own defining characteristics, density, and planned development. The land uses of the planned development will be a mix of office, retail, residential, hotels, manufacturing, and public space and parkland. Visually, the changes the planned development proposes can be seen by comparing **Figure 2-3**, a view of present day Port Covington peninsula, with **Figure 2-4**, the anticipated view of the completed development.

**Figure 2-4: Port Covington Peninsula Proposed Development Birds Eye View**



From the Vietnam Veterans Memorial Bridge to McComas Street, Sagamore's completed development will reconstruct Hanover Street, converting the majority of the roadway into a six lane divided boulevard. Additionally, mass grading for the development will remove the existing railroad track located along the south side of McComas Street. The existing railroad track currently provides freight deliveries to the Baltimore Sun in Port Covington and to warehouses located in the South Locust Point Marine Terminal. The proposed development will relocate the Baltimore Sun and, therefore, freight deliveries will no longer be needed on the Port Covington peninsula. To maintain freight access to the South Locust Point Marine Terminal, Sagamore anticipates mitigating the removal of the existing railroad track by providing a connection to the warehouses via a new alignment over the Fort McHenry Tunnel. This relocation is necessary because CSX, the owner of the existing railroad track, has a policy which requires three existing

at-grade crossings to be removed for every new at-grade crossing proposed. The proposed development is proposing five new roadway connections with McComas Street between the Hanover Street intersection and the present day Cromwell Street intersection. Per CSX's policy, five new at-grade railroad crossings would require fifteen existing at-grading railroad crossings to be removed. As such, the removal of the existing railroad tracks by Sagamore is vital to providing additional connectivity between McComas Street and the Port Covington Development.

The approved Master Plan does not specify a target or limit for the total amount of development, but Sagamore intends to build the Port Covington Development to the greatest extent practicable, with or without the I-95 Access Improvements project. For the purposes of this study, it is assumed 14 million square feet of development will occur by 2040 with or without improvements to the connectivity between south Baltimore, I-95, and the Port Covington peninsula. The following is a list of the development's land use anticipated by 2040:

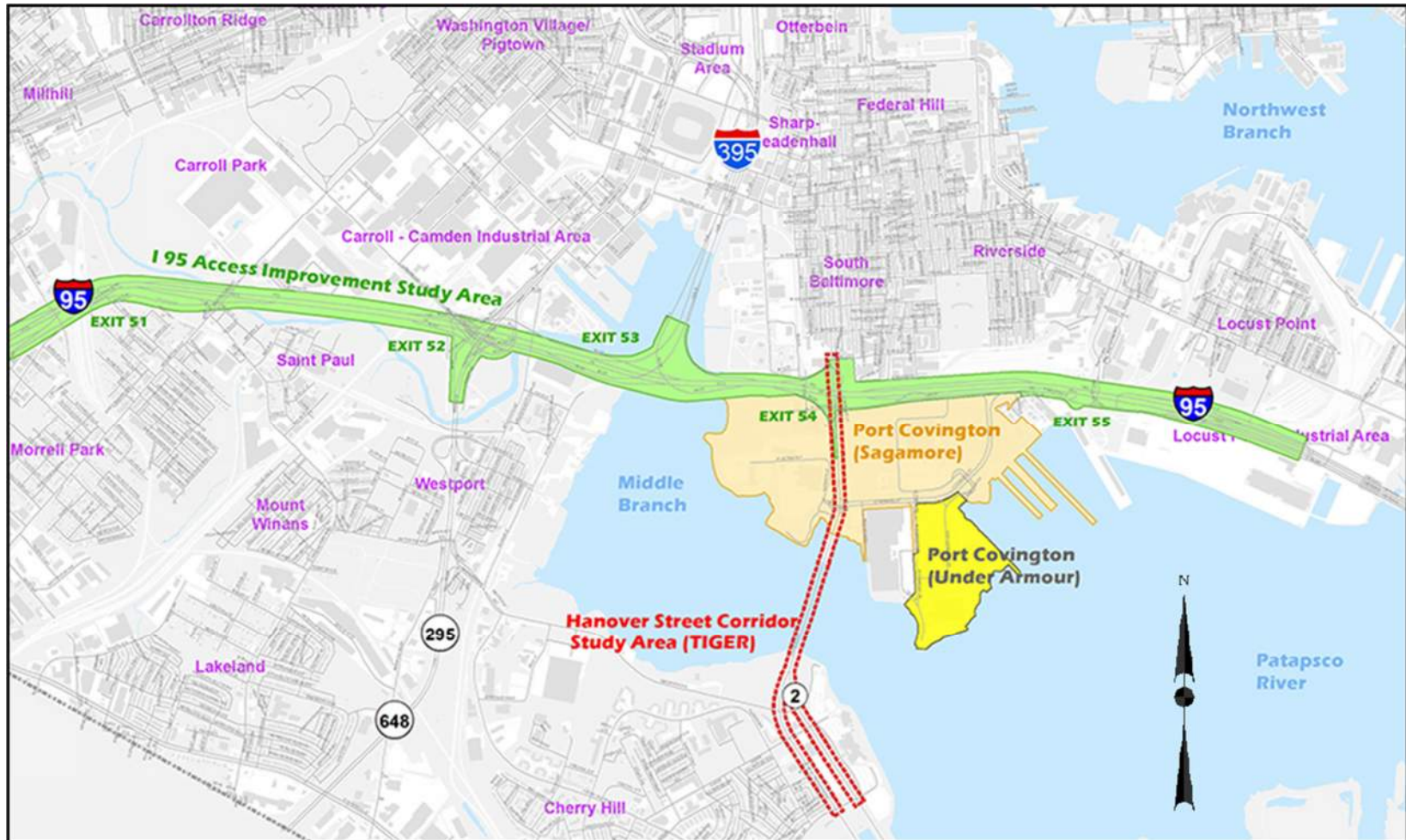
- 1.3 million square feet of retail
- 4.3 million square feet of office space (including 3.9 million square feet for the Under Armour World Headquarters)
- Over 5,300 residential units, including rental and for-sale properties at various price-points
- 303,000 square feet of maker and industrial/light manufacturing space
- 200+ hotel rooms
- Almost 10,000 square feet of civic and cultural uses as well as 40+ acres of public parks, a public waterfront, and other public facilities
- Total development: 11.33 million square feet (in addition to 3.4 million square feet of parking)

Construction of the proposed development has already begun and is anticipated to continue regardless of the I-95 Access Improvements project. Because the Master Plan is approved, the proposed development is being used as the No-Build condition for the I-95 Access Improvements project.

### **2.3 Hanover Street Corridor Study**

Baltimore City DOT is also conducting a study of improvements to Hanover Street, including the Vietnam Veterans Memorial Bridge over the Middle Branch of the Patapsco River. A Transportation Investments Generating Economic Recovery (TIGER) Discretionary Grant is being used for the study. The purpose of the study is to identify feasible methods of rehabilitating or replacing the Hanover Street Bridge, improve multi-modal corridor accessibility and freight access, and highlight ways to enhance access to economic opportunities and recreational amenities, quality of life, and safety throughout the corridor. **Figure 2-5** shows the study area of the Hanover Street Corridor Study, along with its proximity to the I-95 Access Improvements and Port Covington Development projects. As the figure shows, the Hanover Street Corridor Study overlaps both the I-95 Access Improvements and Port Covington Development projects. Pending approval, the Recommended Preferred Alternative of the I-95 Access Improvements project will be used as the No-Build condition for the Hanover Street Corridor Study.

Figure 2-5: Projects in the Area



Note: The Study Area for the I-95 Access Improvements extend south/west to Exit 50 (Caton Avenue).

### 3 STUDY OF PROPOSED IMPROVEMENTS

#### 3.1 Purpose of Proposed Action

The purpose of the I-95 Access Improvements Project is to accommodate forecasted increased transportation demand on I-95 and the surrounding transportation network by minimizing effects on mobility and safety, as well as enhancing multi-modal connections to the Port Covington peninsula.

#### 3.2 Need of Proposed Action

The proposed action will address the following needs:

1. Ongoing and planned development in the Port Covington peninsula will result in **increased transportation demand** to Port Covington resulting in vehicular trips that are projected to be more than double today’s volumes to and from the site on I-95, I-395, and Hanover Street by 2040.
2. **Existing capacity and roadway geometry are not adequate** to meet projected traffic demands, with operations on most ramp segments and links within the study corridor projected to degrade to unacceptable Levels of Service (LOS) by 2040.
3. Existing public infrastructure in and around the peninsula cannot efficiently support the City’s approved **economic development and land use changes** at Port Covington.
4. The **limited multi-modal connections** around and across I-95 between the nearby neighborhoods and the Port Covington peninsula are insufficient to support future planned growth on the peninsula.

#### 3.3 Study Approach

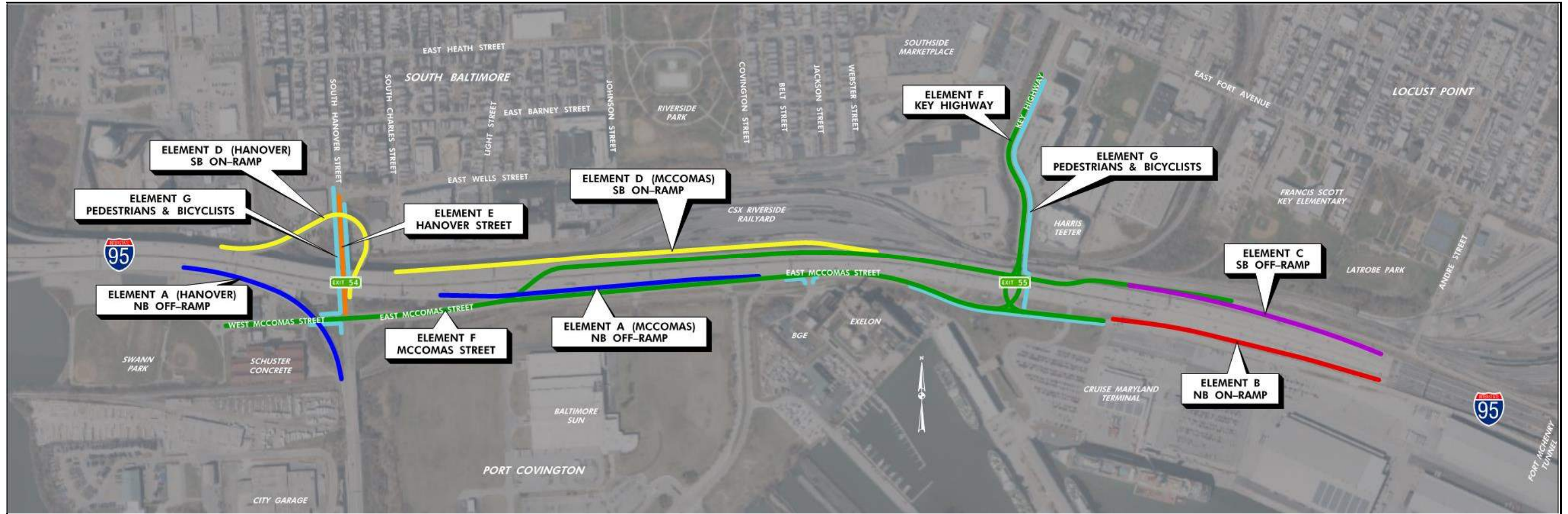
The existing connectivity between south Baltimore, I-95, and the Port Covington peninsula is provided by various ramps to and from I-95, McComas Street, Hanover Street, and Key Highway. In an effort to simplify a complex project, these ramps and streets providing the existing connectivity have been classified as seven distinct elements listed in **Table 3-1**. **Figure 3-1** is provided to show a map of the area with the elements color coded.

**Table 3-1: Classification of Elements**

Designation	Element	Locations/Limits
A	I-95 Northbound Off-Ramps	<ul style="list-style-type: none"> <li>• I-95 NB to Hanover Street SB</li> <li>• I-95 NB to McComas Street</li> </ul>
B	I-95 Northbound On-Ramps	<ul style="list-style-type: none"> <li>• Key Highway to I-95 NB</li> </ul>
C	I-95 Southbound Off-Ramps	<ul style="list-style-type: none"> <li>• I-95 SB to Key Highway</li> </ul>
D	I-95 Southbound On-Ramps	<ul style="list-style-type: none"> <li>• McComas Street WB to I-95 SB</li> <li>• Hanover Street NB to I-95 SB</li> </ul>
E	Hanover Street	<ul style="list-style-type: none"> <li>• Between Wells Street and McComas Street</li> </ul>
F	McComas Street and Key Highway	<ul style="list-style-type: none"> <li>• Swann Park to Key Highway</li> <li>• McComas Street to McHenry Row</li> </ul>
G	Pedestrian and Bicycle Connections	<ul style="list-style-type: none"> <li>• Hanover Street</li> <li>• Key Highway</li> <li>• McComas Street</li> <li>• Shared-Use Path</li> </ul>



Figure 3-1: Map of Elements



Due to the size of the study area and the extents of potential improvements, a significant number of possible alternatives could have been developed by combining different improvements for the seven elements. Rather than developing an alternative for every possible combination, each element was first focused on individually, and an effort was made to develop multiple options for each element. Next, the various options were combined into discrete alternatives for analysis purposes. Initially four alternatives were identified: Alternative 1 (the No-Build Alternative), and three Build Alternatives. Normally, the No-Build Alternative maintains the present day conditions as they exist. This project is unique, however, because the Master Plan for the proposed development is already approved. Therefore, the proposed development is being used as the No-Build condition in anticipation of Port Covington being developed, regardless of whether or not improvements to access the development are proposed as part of this project. The three Build Alternatives were assembled to tie into the proposed development in an attempt to meet the project's purpose and need, designed to accommodate the increased transportation demand, improve upon the existing capacity and roadway geometry inadequacies, support economic development, and improve multi-modal connections to and from the Port Covington peninsula. The four alternatives were then analyzed to determine how well each alternative met the project's stated purpose and need and the effects each would have on future traffic operations, both on I-95 and on the surface streets. Key performance measures included travel times, vehicle throughput, vehicle queuing, and level of service. A discussion of the options developed for each element are presented in Section 4. The alternatives development and evaluation process is presented in Section 5.

Ultimately, it was determined that options from each of the initial four Alternatives could be recombined to create a fifth alternative that would better meet the project's purpose and need. Each element's options were compared against one another to identify the most optimal ones. The most optimal options were then combined to form Alternative 5, which was subsequently identified as the MDTA/Baltimore City Team Recommended Preferred Alternative. The development and evaluation for the Recommended Preferred Alternative is presented in Section 6 of this report.

#### 4 OPTIONS DEVELOPED FOR ANALYSIS

In an effort to meet the project's purpose and need, developing options for improvements to the seven distinctly classified elements were initially focused on individually. Several options were developed for each element, attempting to provide solutions designed to accommodate the increased transportation demand, improve upon the existing capacity and roadway geometry inadequacies, support economic development, and improve multi-modal connections to and from the Port Covington peninsula.

##### 4.1 Design Criteria

The options were developed based on design criteria published in the American Association of State Highway and Transportation Officials (AASHTO) *A Policy on the Geometric Design of Highways and Streets, 2011* (Green Book) and applicable FHWA, MDTA, and Baltimore City Standards. The roadway geometric design guidelines used in the development of the options are presented in **Tables 4-1** and **4-2**. Elements A, B, C, and D are MDTA facilities. Elements E, F, and G are Baltimore City facilities



**Table 4-1: Geometric Design Criteria for MDTA Facilities**

Design Element	I-95 Mainline	I-95 Ramps
<b>Functional Classification</b>	Interstate Principal Arterial/Urban Interstate	1/4 Diamond Ramp
		Ramp Connection to Local Street
<b>Design Speed</b>	60 mph	1/4 Diamond Ramp: 45 mph
		Ramp Connection to Local Street: 30 mph
<b>Horizontal Alignment</b>	Minimum Radius: 1,500'	Minimum Radius (1/4 Diamond Ramp): 643'
		Minimum Radius (Ramp Connection to Local Street): 231' (Low Speed Urban Streets)
<b>Vertical Alignment</b>	Match Existing Grade	Minimum Grade: 0.5%
		Maximum Grade: 6%
<b>Stopping Sight Distance</b>	Minimum: 570' (60 mph)	Minimum: 360' (45 mph)
		Minimum: 200' (30 mph)
<b>Lane Width</b>	Minimum: 12'	Minimum: 12'
<b>Shoulder Width</b>	Right: 12' paved with concrete barrier	Minimum Right: 8' paved with concrete barrier
		Minimum Left: 1' paved with concrete barrier
<b>Structure Width</b>	N/A	Minimum: 21'
<b>Cross Slope/Superelevation</b>	Normal: 2%	Normal: 2%
	Superelevation: 4%	Superelevation: 6%
<b>Vertical Clearance</b>	Minimum: 16'-6"	Minimum: 16'-6"
<b>Clear Zone Width</b>	Minimum: 30'	Minimum: 30'
<b>Roadside Barrier</b>	F-Shape Jersey Concrete Barrier	F-Shape Jersey Concrete Barrier, Impact Attenuators and End Treatments
<b>Median Barrier</b>	N/A	N/A
<b>Side Slopes</b>	2H:1V w/barrier	2H:1V w/barrier
<b>Clearance over Channel/Navigational Waterways</b>	N/A	45'
<b>Clearance over CSX</b>	Minimum: 23'	Minimum: 23'
<b>Horizontal Offset from Existing Structure</b>	N/A	Minimum: 1'

**Table 4-2: Geometric Design Criteria for Baltimore City Facilities**

Design Element	City Streets	Shared-Use Path
Functional Classification	Hanover Street: Principal Arterial Key Highway: Minor Arterial McComas Street: Minor Arterial	N/A
Design Speed	Minimum: 35 mph	Minimum: 20 mph
Horizontal Alignment	Minimum Radius: 371' (Low Speed Urban Streets)	Minimum Radius: 74'
Vertical Alignment	Minimum Grade: 0.5% Maximum Grade: 5%	Minimum Grade: 0.5%
		Maximum Grade: 5%
Stopping Sight Distance	Minimum: 250' (35 mph)	Minimum: 195'
Lane Width	Minimum: 11'	Minimum: 10'
Shoulder Width	N/A	Minimum: 2' paved area adjacent to the trail/shared use path
Structure Width	N/A	Minimum: 12' (10'+2')
Cross Slope/Superelevation	Normal: 2%	Normal: 2%
	Superelevation: 4%	
Vertical Clearance	Minimum: 16'-6"	Minimum: 8'
Clear Zone Width	N/A	N/A
Roadside Barrier	F-Shape Jersey Concrete Barrier, Traffic Barrier W-Beam and End Treatments	F-Shape Jersey Concrete Barrier, Traffic Barrier W-Beam and End Treatments
Median Barrier	Grass Median, Concrete Median	N/A
Side Slopes	2H:1V w/Traffic Barrier W-Beam	2H:1V w/Traffic Barrier W-Beam
Clearance over Channel/Navigational Waterways	N/A	N/A
Clearance over CSX	Minimum: 23'	Minimum: 23'
Horizontal Offset from Existing Structure	Minimum: 1'	Minimum: 1'

#### 4.2 Options Retained for Analysis

Several options were developed for each element and three to four of the more optimal options were selected and retained for further analysis. These options are briefly summarized in a **Table 4-3** and were presented at the Public Open House Meetings held in November 2016. They were also made available on the project's web page.

Table 4-3: Summary of Elements & Options

	Element A I-95 Northbound Off-Ramps	Element B I-95 Northbound On-Ramps	Element C I-95 Southbound Off-Ramps	Element D I-95 Southbound On-Ramps	Element E Hanover Street	Element F McComas Street and Key Highway	Element G Pedestrians and Bicycle Connections
Option 1 / No-Build	- EXIT 54 - Maintain Existing Ramp from NB I-95 to SB Hanover St  -EXIT 55 - Maintain Existing Ramp from NB I-95 to EB McComas St	- EXIT 55 Interchange - Maintain Existing Ramp from McComas St to NB I-95	- EXIT 55 - Maintain Existing Ramp from SB I-95 to McComas St	- EXIT 55 Interchange- Maintain Existing Ramp from WB McComas St to SB I-95  - EXIT 54 Interchange- Maintain Existing Ramp from NB Hanover St to SB I-95	Maintain Existing Hanover St	Maintain Existing Two-Way Section of McComas St  Maintain Existing EB and WB One-Way Sections of McComas St	Maintain Existing Sidewalks on Hanover St and Key Hwy
Option 2	- EXIT 52 & EXIT 53 - Ramp Spur from MD 295 On-Ramp & Ramp Spur from NB I-395 Ramp to McComas St  - EXIT 55 - Reconstruct Ramp from NB I-95 to McComas St	- EXIT 54 Interchange - Ramp from Hanover St to NB I-95  - EXIT 55 Interchange - Maintain Existing Ramp from McComas St to NB I-95	- EXIT 55 - Reconstruct Ramp from SB I-95 to McComas St as One-Lane Exit	- EXIT 55 Interchange- Maintain Existing Ramp from WB McComas St to SB I-95  - EXIT 54 Interchange- Reconstruct Ramp from NB Hanover St to SB I-95	Widen Existing Hanover St & Match Proposed Two-Lane Ramp	Proposed Two-Way McComas St Boulevard  Maintain Existing WB One-Way Section of McComas St	Widen Existing Sidewalks on Hanover St and Key Hwy & Proposed Sidewalk Adjacent to E McComas St & Proposed Share Use Path Over CSX Tracks/Under I-95
Option 3	- EXIT 52 - Ramp from NB I-95 to McComas St  - EXIT 54 - Maintain Existing Ramp from NB I-95 to SB Hanover St  - EXIT 55 - Ramp from NB I-95 to McComas St Weaving Between I-95 Piers	- EXIT 54 Interchange - Ramp from McComas St to NB I-95  - EXIT 55 Interchange - Maintain Existing Ramp from McComas St to NB I-95	- EXIT 55 - Reconstruct Ramp from SB I-95 to McComas St as Two-Lane Exit	- EXIT 55 Interchange- Reconstruct Ramp from WB McComas St to SB I-95 to Braid with New SB Off-Ramp  - EXIT 54 Interchange- Relocate Ramp from NB Hanover St to SB I-95	Widen Existing Hanover St & Match Existing Ramp	Proposed Two-Way McComas St Boulevard & Weave Around Existing Ramp Piers  Maintain Existing WB One-Way Section of McComas St	Widen Existing Sidewalks on Hanover St and Key Hwy & Proposed Sidewalk Adjacent to E McComas St & Proposed Share Use Path Over CSX Tracks/Under I-95
Option 4	- EXIT 50 & EXIT 53 Interchange - Ramp Spur from Caton Ave On-Ramp & Ramp Spur from SB I-395 Ramp to McComas St  - EXIT 55 - Ramp from NB I-95 to Diverging McComas St and Port Covington Development		- EXIT 55 - Maintain Existing Ramp from SB I-95 to McComas St to McComas St  - EXIT 54 - Ramp from SB I-95 to McComas St under Elevated SB I-95		Widen Existing Hanover St & Match Proposed Relocated Ramp	Proposed Two-Way McComas St Boulevard with Diverging Section  Maintain Existing WB One-Way Section of McComas St	Widen Existing Sidewalks on Hanover St and Key Hwy & Proposed Sidewalk Adjacent to Diverging E McComas St & Proposed Share Use Path Over CSX Tracks/Under I-95

#### 4.2.1 Element A – I-95 Northbound Off-Ramps

Element A represents the existing and proposed northbound I-95 Off-Ramps to the Port Covington peninsula. Conceptual plan views of the options retained for analysis are shown in **Figures 4-1** and **4-2**.

##### A. Element A – Option 1/No-Build

Option 1/No-Build has two existing off-ramps providing access from northbound I-95 to the Port Covington peninsula:

- Exit 54 – Maintain Existing Ramp from Northbound I-95 to Southbound Hanover Street
  - The ramp would terminate as a full width lane on Hanover Street in the middle of the Port Covington Development. The lane would be separated from two southbound Hanover Street lanes by a bifurcated barrier until the vertical grades tie together approximately 600-ft north of the present day Hanover Street at Cromwell Street intersection.
- Exit 55 – Maintain Existing Ramp from Northbound I-95 to Eastbound One-Way Section of McComas Street

##### B. Element A – Option 2

Option 2 proposes two new spur off-ramps, removing an existing off-ramp, and reconstructing an existing off-ramp providing access from northbound I-95 to the Port Covington peninsula:

- Exit 52 & Exit 53 – Ramp Spur from MD 295 On-Ramp and Ramp Spur from Northbound I-395 Ramp to western end of McComas Street
  - Both ramp spurs would originate as taper exits; one from northbound I-395 ramp and one from the northbound MD 295 ramp.
  - Both ramp spurs would provide a single travel lane.
  - The entire length of both ramp spurs would be on elevated structures.
  - Both ramp spurs would merge together over the Middle Branch of the Patapsco River to provide a two-lane wide ramp.
  - The two-lane wide ramp would be on an elevated structure over the Middle Branch of the Patapsco River and in retained fill or at-grade as it approaches its end.
  - The two-lane wide ramp would terminate as a leg of the first at-grade signalized intersection proposed on the westernmost end of McComas Street in the Port Covington Development. The proposed intersection would occur with Brown Street, a street currently proposed within the grid of the development, located approximately 1,100-ft west of the intersection of Hanover Street and McComas Street. The two-lanes from the ramp would become eastbound McComas Street on the opposite leg of the intersection.
- Exit 54 – Remove Existing Ramp from northbound I-95 to southbound Hanover Street
  - The removal of the ramp would allow northbound I-95 to be widened, extending the auxiliary lane that begins at the gore of the Southbound I-395 on-ramp at the Exit 53 Interchange through the overpass of Hanover Street.
- Exit 55 – Reconstruct Ramp from Northbound I-95 to McComas Street
  - The ramp would originate as a full width auxiliary lane where southbound I-395 begins to merge with northbound I-95. The auxiliary lane would be approximately 1,800-ft long, beginning at the gore of the southbound I-395 on-ramp that is part of the Exit 53 Interchange.

- The width of the ramp would accommodate a single lane at the beginning of the ramp, but expand to three lanes wide for storage at the end of the ramp.
- The beginning of the ramp would be on an elevated structure. The end of the ramp would be in retained fill or at-grade as it approaches McComas Street.
- The three-lane wide ramp would terminate at an at-grade signalized intersection with McComas Street in the vicinity of the present day Cromwell Street intersection. Due to the proximity of the ramp, a 90 degree turn with a sharp radius would be proposed for the ramp at the intersection with McComas Street.

**C. Element A – Option 3**

Option 3 proposes a new off-ramp, maintaining an existing off-ramp, and reconstructing an existing off-ramp providing access from northbound I-95 to the Port Covington peninsula:

- Exit 52 – Ramp from Northbound I-95 to western end of McComas Street
  - Existing northbound I-95 between the Caton Avenue on-ramp and the Russell Street off-ramp (Exit 52) would be widened to provide six travel lanes. One auxiliary lane is provided today; two auxiliary lanes would be provided under Option 3.
  - The ramp would originate as the left lane of a two-lane exit beginning in the vicinity of the existing gore for the Russell Street off-ramp (Exit 52).
  - The right lane of a two-lane exit would maintain the existing off-ramp to Russell Street (Exit 52), but a portion of it would be reconstructed to accommodate the new off-ramp to McComas Street.
  - The width of the ramp to McComas Street would accommodate a single lane at the beginning of the ramp, but expand to two lanes wide for storage at the end of the ramp.
  - The beginning of the ramp to McComas Street would be on an elevated structure. To avoid impacts to an existing warehouse property, a portion of the proposed ramp would be elevated directly above the existing ramp from northbound MD 295 to northbound I-95. The end of the ramp would be in retained fill or at-grade as it approaches McComas Street.
  - The ramp would terminate as a leg of the first at-grade signalized intersection proposed on the westernmost end of McComas Street in the Port Covington Development. The proposed intersection would occur with Brown Street, a street currently proposed within the grid of the development, located approximately 1,100-ft west of the intersection of Hanover Street and McComas Street. The ramp would become eastbound McComas Street on the opposite leg of the intersection.
- Exit 54 – Maintain Existing Ramp from Northbound I-95 to Southbound Hanover Street
  - The ramp would terminate as a full width lane on Hanover Street in the middle of the Port Covington Development. The lane would be separated from two southbound Hanover Street lanes by a bifurcated barrier until the vertical grades tie together approximately 600-ft north of the present day Hanover Street at the Cromwell Street intersection. A portion of the end of the ramp would be reconstructed to allow the ramp to tie into Hanover Street at a lower vertical elevation that would allow the Port Covington Development to be constructed on a more level plane.
- Exit 55 – Reconstruct Ramp from Northbound I-95 to McComas Street Weaving Between I-95 Piers

- The ramp would originate as a taper exit from northbound I-95.
- The width of the ramp would accommodate a single lane at the beginning of the ramp, but expand to three lanes wide for storage at the end of the ramp.
- The beginning of the ramp would be on an elevated structure and in retained fill or at-grade as it approaches the end of the ramp.
- The three-lane wide ramp would terminate at an at-grade signalized intersection with McComas Street in the vicinity of the present day Cromwell Street intersection. Due to the proximity of the ramp, the end of the ramp would weave between the existing piers of northbound I-95 to create a perpendicular intersection with McComas Street.

**D. Element A – Option 4**

Option 4 proposes two new spur off-ramps, removing an existing off-ramp, and reconstructing an existing off-ramp providing access from northbound I-95 to the Port Covington peninsula:

- Exit 50 & Exit 53 Interchange – Ramp Spur from Caton Avenue On-Ramp and Ramp Spur from Southbound I-395 Ramp to western end of McComas Street
  - The ramp spur from Caton Avenue On-Ramp would originate as a full width lane beginning near the end of the Caton Avenue Collector-Distributor (CD) Road requiring vehicles to exit northbound I-95 at Caton Avenue (Exit 50) in order to access it.
  - The ramp spur from southbound I-395 would originate as a taper exit.
  - Each ramp spur would provide a single travel lane.
  - The entire length of both ramp spurs would be on elevated structures. To avoid impacts to an existing warehouse property, a portion of the proposed ramp spur from Caton Avenue ramp would be elevated directly above the existing ramp from northbound MD 295 to northbound I-95.
  - Both ramp spurs would merge together over the Middle Branch of the Patapsco River to provide a two-lane wide ramp.
  - The two-lane wide ramp would be on an elevated structure over the Middle Branch of the Patapsco River and in retained fill or at-grade as it approaches its end.
  - The two-lane wide ramp would terminate as a leg of the first at-grade signalized intersection proposed on the westernmost end of McComas Street in the Port Covington Development. The proposed intersection would occur with Brown Street, a street currently proposed within the grid of the development, located approximately 1,100-ft west of the intersection of Hanover Street and McComas Street. The two-lanes from the ramp would become eastbound McComas Street on the opposite leg of the intersection.
- Exit 54 – Remove Existing Ramp from Northbound I-95 to Southbound Hanover Street
- Exit 55 – Proposes Reconstructing Ramp from Northbound I-95 to Diverging Section of McComas Street
  - The ramp would originate as a full width auxiliary lane adjacent to northbound I-95. The auxiliary lane is approximately 1,800-ft long, beginning at the gore of the southbound I-395 on-ramp that is part of the Exit 53 Interchange.
  - The width of the ramp would provide for a single travel lane.
  - The ramp would split, providing an option to access the Port Covington Development via an overpass of McComas Street or an option to continue on and merge with a divergent diamond section of McComas Street.

- The beginning of the ramp would be on an elevated structure through the area where the split in the ramp occurs. The end of the two ramp options would be in retained fill or at-grade as they approach Port Covington Development and McComas Street.



Figure 4-1: Options for Element A – I-95 Northbound Off-Ramps (Exits 50, 52, 53, & 54)

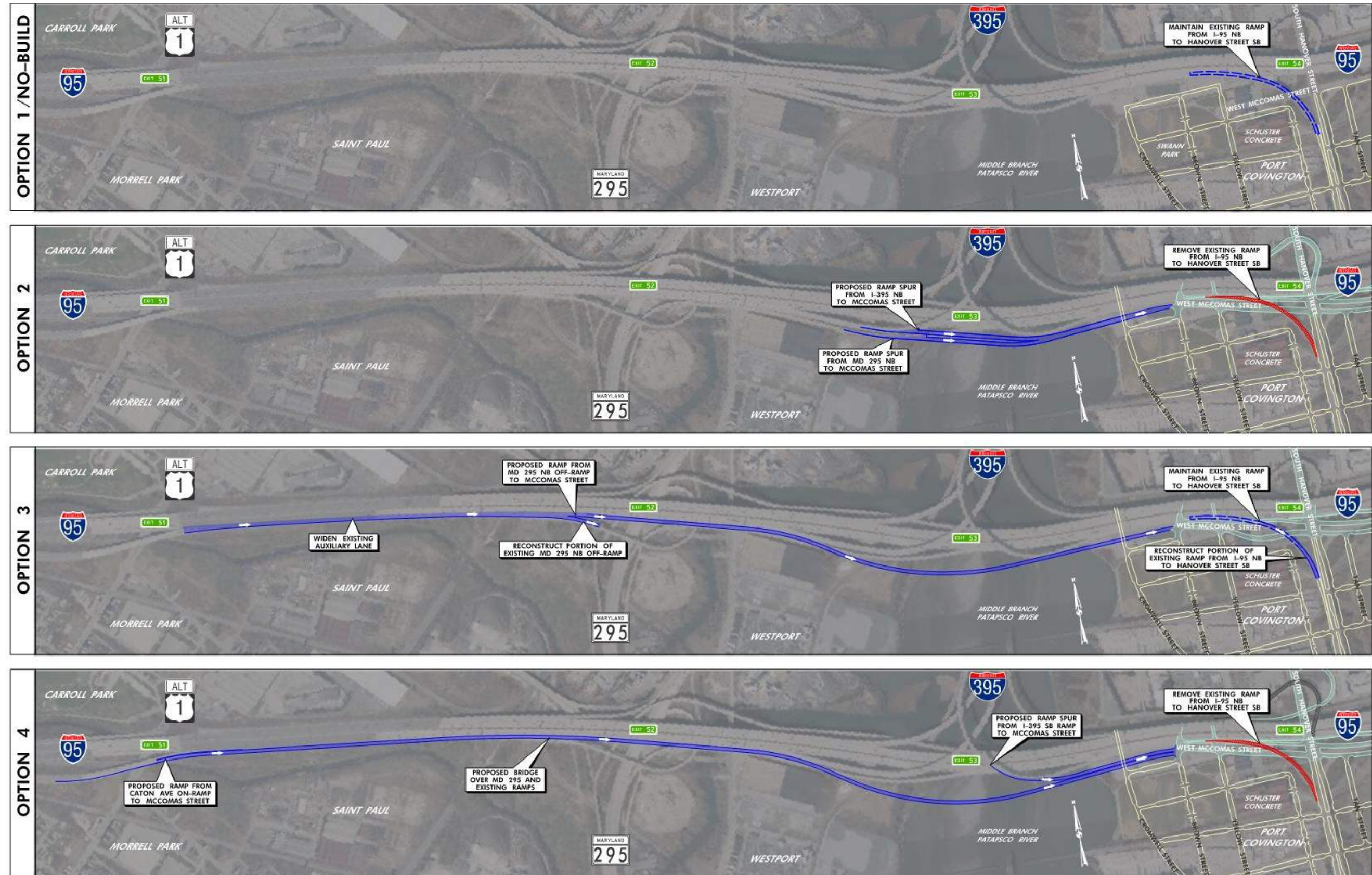




Figure 4-2: Options for Element A – I-95 Northbound Off-Ramps (Exit 55)





#### 4.2.2 Element B – I-95 Northbound On-Ramps

Element B represents the existing and proposed northbound I-95 On-Ramps from the Port Covington peninsula. Conceptual plan views of the options retained for analysis are shown in **Figure 4-3**.

##### A. Element B – Option 1/No-Build

Option 1/No-Build has one existing on-ramp providing access from the Port Covington peninsula to northbound I-95:

- Exit 55 Interchange – Maintain Existing Ramp from Eastbound One-Way Section of McComas Street to Northbound I-95

##### B. Element B – Option 2

Option 2 proposes a new on-ramp with a spur and maintaining an existing on-ramp providing access from the Port Covington peninsula to northbound I-95:

- Exit 54 Interchange – Ramp from Hanover Street to Northbound I-95
  - The ramp would originate as a fifth leg of a reconstructed Hanover Street at McComas Street intersection.
  - The width of the ramp would provide a single travel lane.
  - A spur to the ramp would be provided for westbound McComas Street traffic to access the ramp from the proposed intersection of Gray Street, a street currently proposed within the grid of the development, located approximately 600-ft east of the intersection of Hanover Street and McComas Street. The spur would join the ramp as a parallel entrance.
  - The beginning of the ramp would be at-grade or in retained fill until for the first 900-ft. The remaining length of the ramp would be on an elevated structure to access the elevated section of northbound I-95.
  - Minimum vertical clearances would be provided under the Exit 55 Off-Ramp and over the one-way section of westbound McComas Street.
  - The ramp would terminate at as a parallel entrance onto the elevated section of northbound I-95.
- Exit 55 Interchange – Maintain Existing Ramp from Eastbound One-Way Section of McComas Street to Northbound I-95
  - The ramp would remain unchanged from Option 1/No-Build.

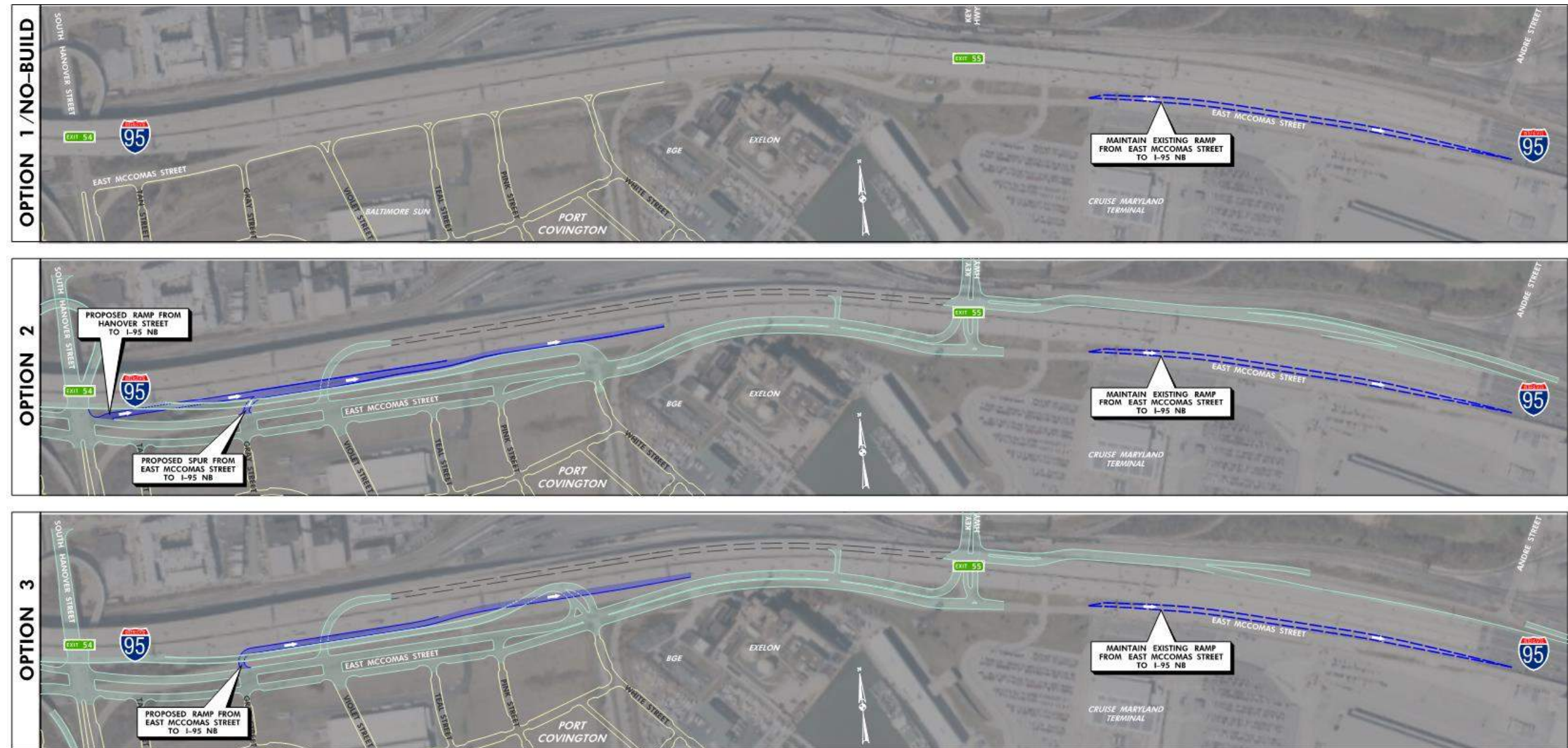
##### C. Element B – Option 3

Option 3 proposes a new on-ramp and maintaining an existing on-ramp providing access from the Port Covington peninsula to northbound I-95:

- Exit 54 Interchange – Ramp from McComas Street to Northbound I-95
  - The ramp would originate from the proposed intersection of Gray Street, a street currently proposed within the grid of the development, located approximately 600-ft east of the intersection of Hanover Street and McComas Street.
  - The width of the ramp would provide a single travel lane.
  - The beginning of the ramp would be at-grade or in retained fill until for the first 200-ft. The remaining length of the ramp would be on an elevated structure to access the elevated section of northbound I-95.

- Minimum vertical clearances would be provided under the Exit 55 Off-Ramp and over the one-way section of westbound McComas Street.
  - The ramp would terminate at as a parallel entrance onto the elevated section of northbound I-95.
- Exit 55 Interchange – Maintain Existing Ramp from Eastbound One-Way Section of McComas Street to Northbound I-95
  - The ramp would remain unchanged from Option 1/No-Build.

Figure 4-3: Options for Element B – I-95 Northbound On-Ramps



### 4.2.3 Element C – I-95 Southbound Off-Ramps

Element C represents the existing and proposed southbound I-95 Off-Ramps to the Port Covington peninsula. Conceptual plan views of the options retained for analysis are shown in **Figure 4-4**.

#### A. Element C – Option 1/No-Build

Option 1/No-Build has one existing off-ramp providing access from southbound I-95 to the Port Covington peninsula:

- Exit 55 – Maintain Existing Ramp from Southbound I-95 to Westbound One-Way Section of McComas Street

#### B. Element C – Option 2

Option 2 proposes reconstructing the existing off-ramp providing access from southbound I-95 to the Port Covington peninsula:

- Exit 55 – Reconstruct Ramp from Southbound I-95 to McComas Street as One-Lane Exit
  - The ramp would originate as a taper exit from southbound I-95.
  - The width of the ramp would provide for a single travel lane at the beginning of the ramp, but immediately widen to a two lane travel width shortly after the gore.
  - The entire ramp would be at-grade.
  - The two-lane wide ramp would terminate when it joins with a single lane of westbound McComas Street. At that point, westbound McComas Street would continue as a three-lane section as it approaches the Key Highway intersection. However, sufficient width is only available for two lanes between the piers under the elevated section of southbound I-95, so the wider three lane section proposes a right turn lane on the outside of the existing I-95 piers for vehicles turning right from westbound McComas Street to northbound Key Highway.

#### C. Element C – Option 3

Option 3 proposes reconstructing the existing off-ramp and widening southbound I-95 providing access from southbound I-95 to the Port Covington peninsula:

- Exit 55 – Reconstruct Ramp from Southbound I-95 to McComas Street as Two-Lane Exit
  - The ramp would originate as a two-lane taper exit from southbound I-95. A 1300-ft long full width auxiliary lane would be constructed immediately after the Fort McHenry Tunnel requiring an existing retaining wall to be reconstructed. One of the exit lanes would be developed from the new auxiliary lane, the second exit lane would be a choice lane giving vehicles the option to exit or continue on the outermost southbound I-95 travel lane.
  - The width of the ramp would provide for two travel lanes.
  - The entire ramp would be at-grade.
  - The two-lane wide ramp would terminate when it joins with a single lane of westbound McComas Street. At that point, westbound McComas Street would continue as a three-lane section as it approaches the Key Highway intersection. However, sufficient width is only available for two lanes between the piers under the elevated section of southbound I-95, so the wider three lane section proposes a right turn lane on the outside of the existing I-95 piers for vehicles turning right from westbound McComas Street to northbound Key Highway.

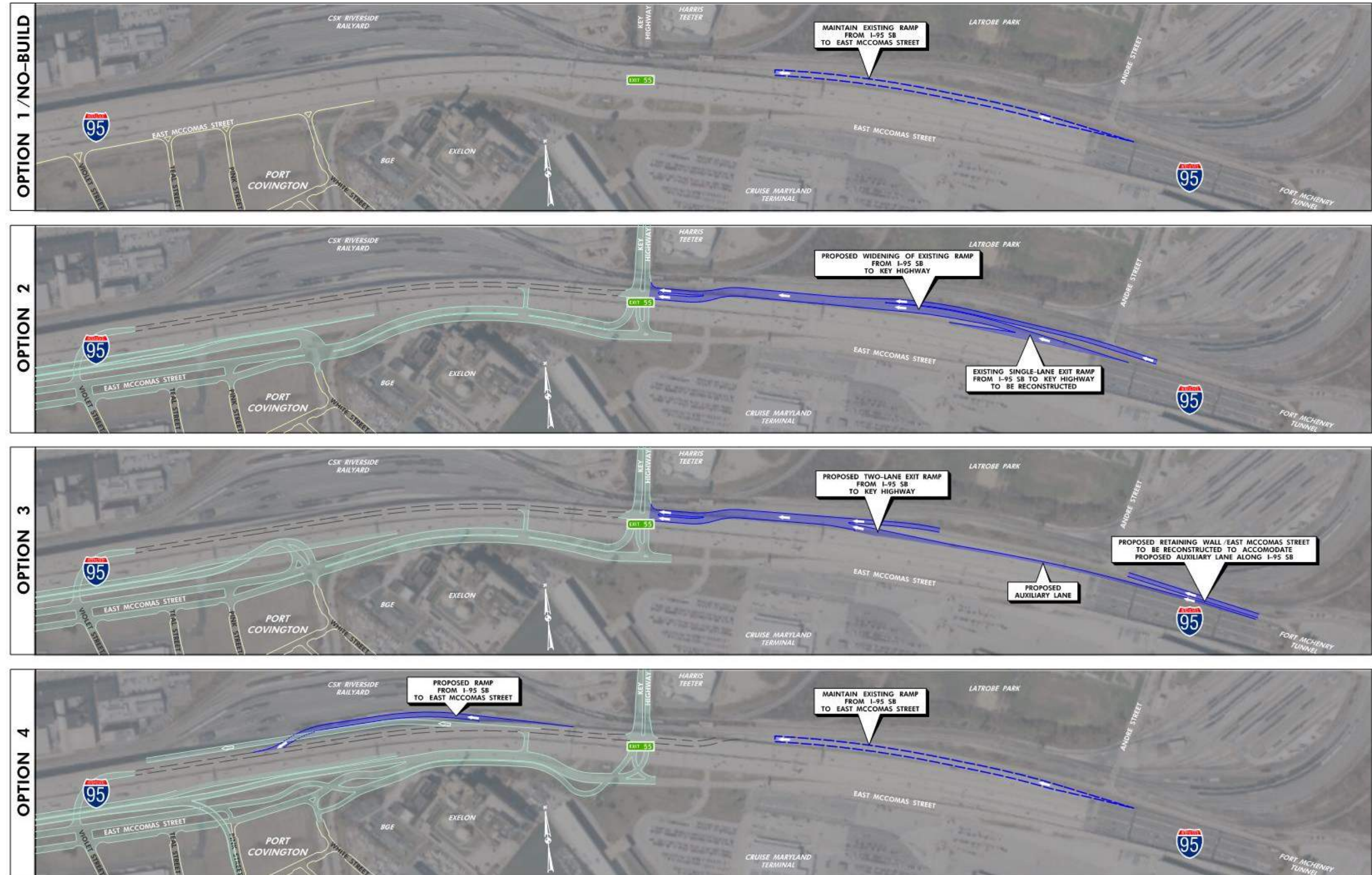
**D. Element C – Option 4**

Option 4 proposes maintaining the existing off-ramp and a new off-ramp providing access from southbound I-95 to the Port Covington peninsula:

- Exit 55 – Maintain Existing Ramp from Southbound I-95 to Westbound One-Way Section of McComas Street
  - The ramp would remain unchanged from Option 1/No-Build.
- Exit 54 – Ramp from Southbound I-95 to Westbound One-Way Section of McComas Street under Elevated Southbound I-95
  - The ramp would originate as a taper exit from southbound I-95.
  - The width of the ramp would accommodate a single travel lane.
  - The beginning of the ramp would be on an elevated structure and the end of the ramp would be in retained fill or at-grade as it approaches McComas Street.
  - The ramp would terminate as a full width lane on the one-way section of westbound McComas Street after weaving between the existing piers of southbound I-95.
  - This option would require two CSX Railroad Storage Tracks and the CSX Access Road to be relocated in the CSX Riverside Railyard. It would also require the existing On-ramp to southbound I-95 to be reconstructed to allow the two ramps to braid with each other with sufficient vertical clearances.



Figure 4-4: Options for Element C – I-95 Southbound Off-Ramps



#### 4.2.4 Element D – I-95 Southbound On-Ramps

Element D represents the existing and proposed southbound I-95 On-Ramps from the Port Covington peninsula. Conceptual plan views of the options retained for analysis are shown in Figure 4-5.

##### A. Element D – Option 1/No-Build

Option 1/No-Build has the two existing on-ramps providing access from the Port Covington peninsula to southbound I-95:

- Exit 55 Interchange – Maintain Existing Ramp from Westbound One-Way Section of McComas Street to Southbound I-95
- Exit 54 Interchange – Maintain Existing Ramp from Northbound Hanover Street to Southbound I-95

##### B. Element D – Option 2

Option 2 proposes maintaining an existing on-ramp and reconstructing an existing on-ramp providing access from southbound I-95 to the Port Covington peninsula:

- Exit 55 Interchange – Maintain Existing Ramp from Westbound One-Way Section of McComas Street to Southbound I-95
  - The ramp would remain unchanged from Option 1/No-Build.
- Exit 54 Interchange – Reconstruct Ramp from Northbound Hanover Street to Southbound I-95
  - The ramp would originate from a full lane width and a choice lane from Hanover Street, maintaining a similar alignment of the existing ramp.
  - The width of the ramp would begin as two travel lanes until approximately 200-ft prior to the existing gore with southbound I-95 where it would narrow back to match the existing single lane that exists today.
  - The entire length of the ramp would be on an elevated structure.
  - The ramp would terminate as a full width auxiliary lane and remain unchanged from Option 1/No-Build.

##### C. Element D – Option 3

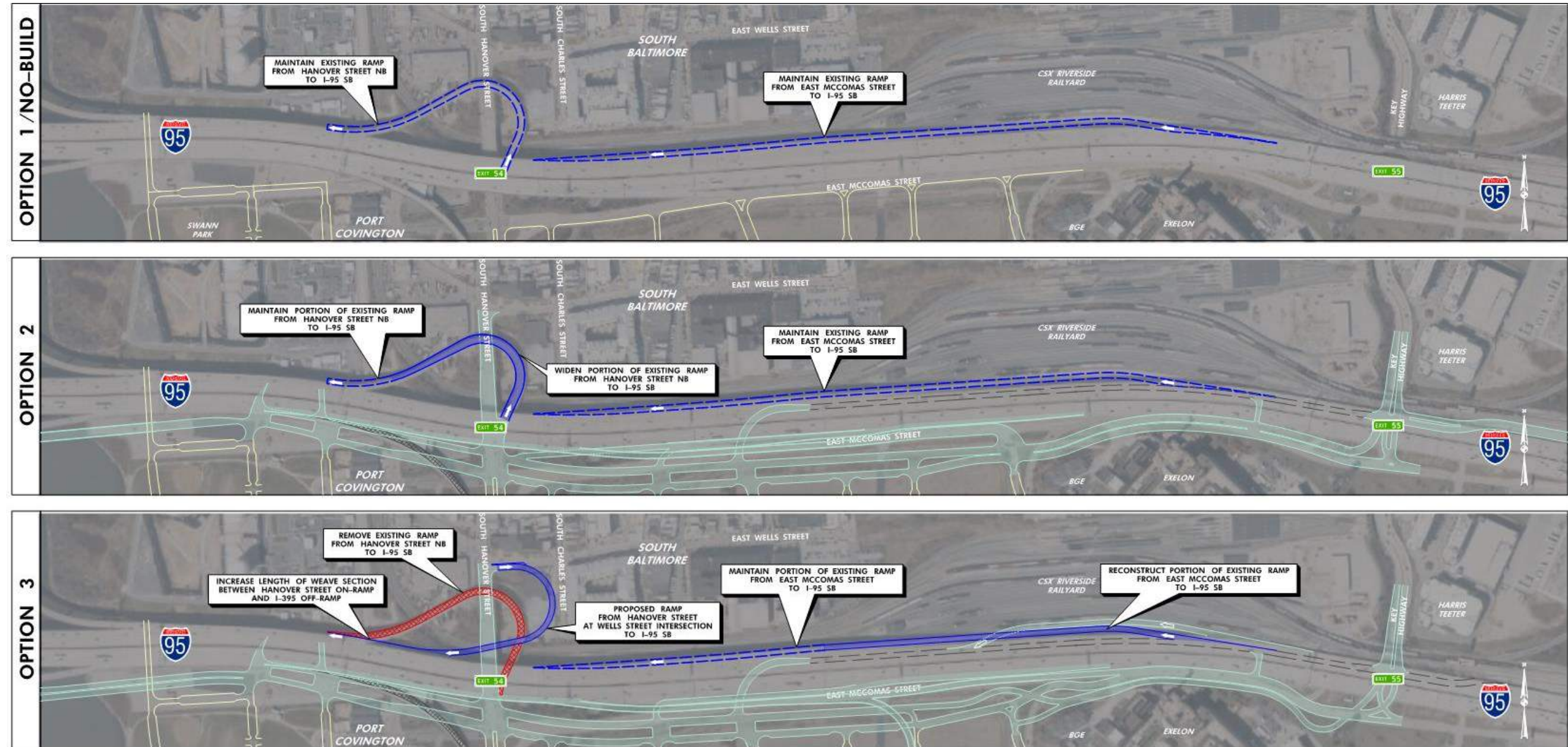
Option 3 proposes reconstructing an existing on-ramp and relocating an existing on-ramp providing access from southbound I-95 to the Port Covington peninsula:

- Exit 55 Interchange – Reconstruct Existing Ramp from Westbound One-Way Section of McComas Street to Southbound I-95
  - The horizontal location and functionality of the ramp would remain unchanged from Option 1/No-Build, however, reconstruction of it would be necessary to adjust the vertical alignment and allow the ramp to braid with the off-ramp proposed as Option 4 under Element C.
- Exit 54 Interchange – Relocate Ramp from Northbound Hanover Street to Southbound I-95
  - The ramp would originate as a full width lane from the intersection of Hanover Street and Wells Street. The ramp could be configured to allow traffic to access it from both directions of Hanover Street or channelized to only permit northbound Hanover Street vehicles to access it.
  - The width of the ramp would provide for a single travel lane.



- The first part of the ramp would be on retained fill or at-grade, the end of the ramp would be on an elevated structure.
- The relocated ramp would require acquisition of the existing warehouse/property located in the southeast quadrant of the Hanover Street at Wells Street intersection.
- The ramp would terminate as a full width auxiliary lane extension adjacent to southbound I-95. The 300-ft extension of the auxiliary lane would provide a 900-ft long auxiliary lane that ends at the gore of the northbound I-395 off-ramp (Exit 53).

Figure 4-5: Options for Element D – I-95 Southbound On-Ramps



#### **4.2.5 Element E – Hanover Street**

Element E represents the existing and proposed Hanover Street between the at-grade intersections of McComas Street and Wells Street. Conceptual plan views of the options retained for analysis are shown in **Figure 4-6**.

##### **A. Element E – Option 1/No-Build**

Option 1/No-Build maintains existing Hanover Street between the intersections with Wells Street and McComas Street. Within these limits, Hanover Street is a 4-lane undivided roadway with two lanes in each direction. 8-ft wide sidewalks exist along both sides of the street from the Wells Street intersection to the bridge over the CSX Railroad Tracks. South of the bridge, however, sidewalk only exists on the west side of the street. . The roadway traverses under an elevated section of I-95 and over CSX Railroad tracks via Bridge No. BC5209.

##### **B. Element E – Options 2, 3, & 4**

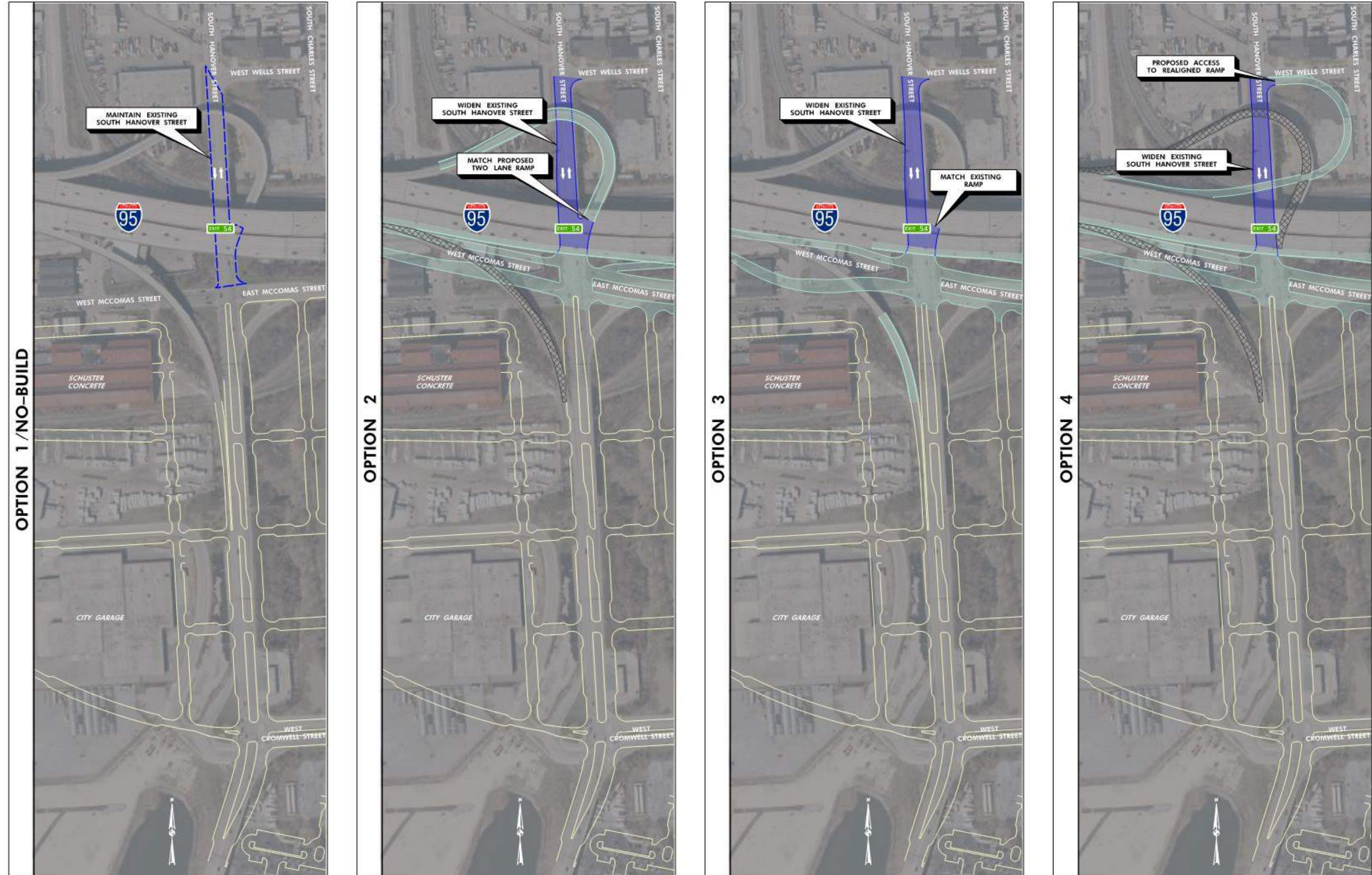
Options 2, 3, and 4 propose to reconstruct Hanover Street between the intersections with Wells Street and McComas Street as well as the bridge over the CSX Railroad tracks that exists within these limits. The reconstructed street/bridge is proposed to be 65-ft wide from face of curb to face of curb with five 11-ft lanes and 5-ft shoulders on both sides. The proposed lanes are three southbound lanes (a through/right turn outer lane, a through middle, and a left turn inner lane for McComas St) and two northbound lanes (a through/left turn lane and a right turn lane for Wells Street). The proposed sidewalks across the bridge are 12-ft wide with an additional 4-ft buffer to the face of curb on both sides of the bridge. With the parapet walls, the total out-to-out structure width is approximately 100-ft.

North of the bridge over the CSX Railroad tracks, Hanover Street would remain four lanes as it exists today; two southbound lanes and two northbound lanes. The inner northbound lane would continue to provide through access along Hanover Street, the outer northbound lane would remain a right turn only lane onto Wells Street.

The main difference between the three build options is how Hanover Street would connect to the southbound I-95 On-Ramp from northbound Hanover Street. Option 2 would connect to the two-lane wide On-Ramp from northbound Hanover Street which is proposed as part of Element D Option 2. Option 3 would connect to the existing one-lane wide On-Ramp from northbound Hanover Street that is proposed as part of Element D Option 1/No-Build. Option 4 would accommodate the relocated On-Ramp from northbound Hanover Street that is proposed as part of Element D Option 3.



Figure 4-6: Options for Element E – Hanover Street



#### **4.2.6 Element F – McComas Street and Key Highway**

Element F represents the existing and proposed McComas Street and Key Highway on the Port Covington peninsula. Conceptual plan views of the options retained for analysis are shown in **Figure 4-7**.

##### **A. Element F – Option 1/No-Build**

Option 1/No-Build maintains existing McComas Street, establishing it as the northern boundary of the Port Covington Development. West of Hanover Street, McComas Street is a two-way undivided roadway which terminates at the roundabout located adjacent to present day Swann Park. On-street parking is available on both sides of the street. East of Hanover Street, McComas Street is a four-lane undivided roadway for approximately 900-ft before the eastbound and westbound lanes split to form separate one-way sections.

The eastbound one-way section of McComas Street is aligned adjacent to northbound I-95 and has existing CSX railroad tracks located along the south side of the street. These CSX railroad tracks provide rail access to warehouses located in the Locust Point Marine Terminal. These railroad tracks are anticipated to be removed as part of the Port Covington Development. The removal would allow the Development's proposed grid to tie-in to McComas Street with several at-grade stop- and signal-controlled intersections, without the need for at-grade railroad crossings.

The westbound one-way section of McComas Street begins adjacent to southbound I-95 in the vicinity of the Fort McHenry Tunnel. Prior to the Key Highway intersection, westbound McComas Street is two lanes wide and weaves directly under the elevated southbound I-95, traversing between the piers until it connects back to the two-way section of McComas Street.

Option 1/No-Build also maintains existing Key Highway. Key Highway intersects McComas Street on the eastern edge of the Port Covington peninsula. A CSX Bridge carries railroad tracks over Key Highway just north of the Key Highway at McComas Street intersection. North of the CSX bridge, the recently developed McHenry Row is located along the east side of Key Highway and the turntable for the CSX Riverside Railyard is located immediately behind an existing retaining wall along the west side of Key Highway.

##### **B. Element F – Option 2**

Option 2 is designed to convert the two-way and one-way sections of existing McComas Street to a two-directional boulevard from the western side of the Port Covington Development to the Key Highway intersection. The existing one-way section of westbound McComas Street located under southbound I-95 would largely be maintained except for the west end of it which would be reconstructed to tie-in perpendicularly at a signal controlled intersection with the new McComas Street two-way boulevard. The two-way boulevard immediately adjacent to the Port Covington Development is proposed with a wide median designed to accommodate a potential future light rail spur that could branch off the existing light rail tracks in Westport.

Option 2 also proposes to widen Key Highway for a few hundred feet north of the McComas Street intersection. The widening would provide for the addition of an exclusive right turn lane in the southbound direction and require the CSX Bridge to be reconstructed to accommodate the

additional span length that would be required for the railroad tracks over Key Highway, just north of the McComas Street intersection.

**C. Element F – Option 3**

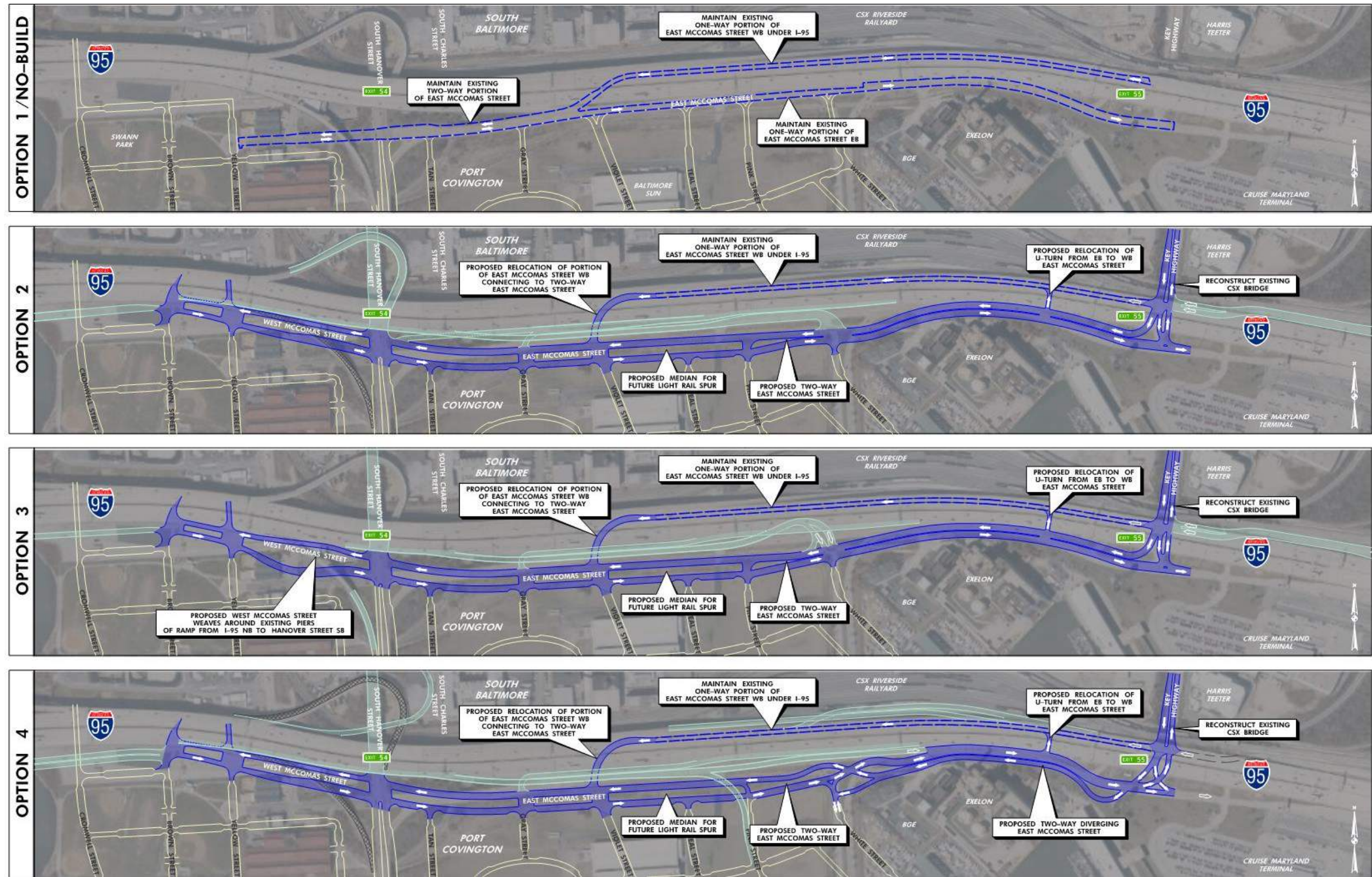
Option 3 is very similar to Element F Option 2. The main difference would be accommodations have been incorporated in the design, at the western end of McComas Street, to weave both sides of the street around existing piers of the Off-Ramp from northbound I-95 to southbound Hanover Street should that ramp not be removed. The other difference between the two options would be along the north side of the Port Covington Development in the vicinity of the present day Cromwell Street intersection. In Option 2, the tangent section of McComas Street extends through the intersection whereas, in Option 3, the alignment curves and provides additional space for the development and the existing BGE substation in the vicinity of the intersection.

**D. Element F – Option 4**

Option 4 is nearly identical to Element F Option 2 west of the present day Cromwell Street intersection. From the present day Cromwell Street intersection to Key Highway, though, Option 4 proposes an extended divergent diamond intersection. In the extended divergent diamond intersection, traffic would unconventionally drive on the opposite side of the road between the two intersections. Eastbound traffic would drive on the right side and westbound traffic would drive on the left side when looking at the extended divergent section from the Key Highway intersection. The design of this section would be intended to facilitate Element A Option 1/No-Build or Option 4 for the Off-Ramp from northbound I-95 to McComas Street. By shifting traffic to the opposite side of the road through this section, traffic entering the roadway from that Off-Ramp could use a parallel or taper entrance to merge with eastbound McComas Street without the need for additional overpasses or signalized intersections.



Figure 4-7: Options for Element F – MComas Street and Key Highway





#### **4.2.7 Element G – Pedestrian and Bicycle Connections**

Element G represents the existing and proposed pedestrian and bicyclist connections to the Port Covington peninsula. Conceptual plan views of the options retained for analysis are shown in **Figure 4-8**.

##### **A. Element G – Option 1/No-Build**

Option 1/No-Build maintains the limited existing connections for pedestrians and bicyclists along Hanover Street, McComas Street, and Key Highway on the Port Covington peninsula. Along Hanover Street, existing sidewalks are present along both sides of the street from the Wells Street intersection to the bridge over the CSX Railroad Tracks. South of the bridge, however, sidewalk only exists on the west side of the street. Along McComas Street, narrow sidewalks exist intermittently within the project limits. Along Key Highway, sidewalk exists along the east side of the street under the CSX Railroad Bridge.

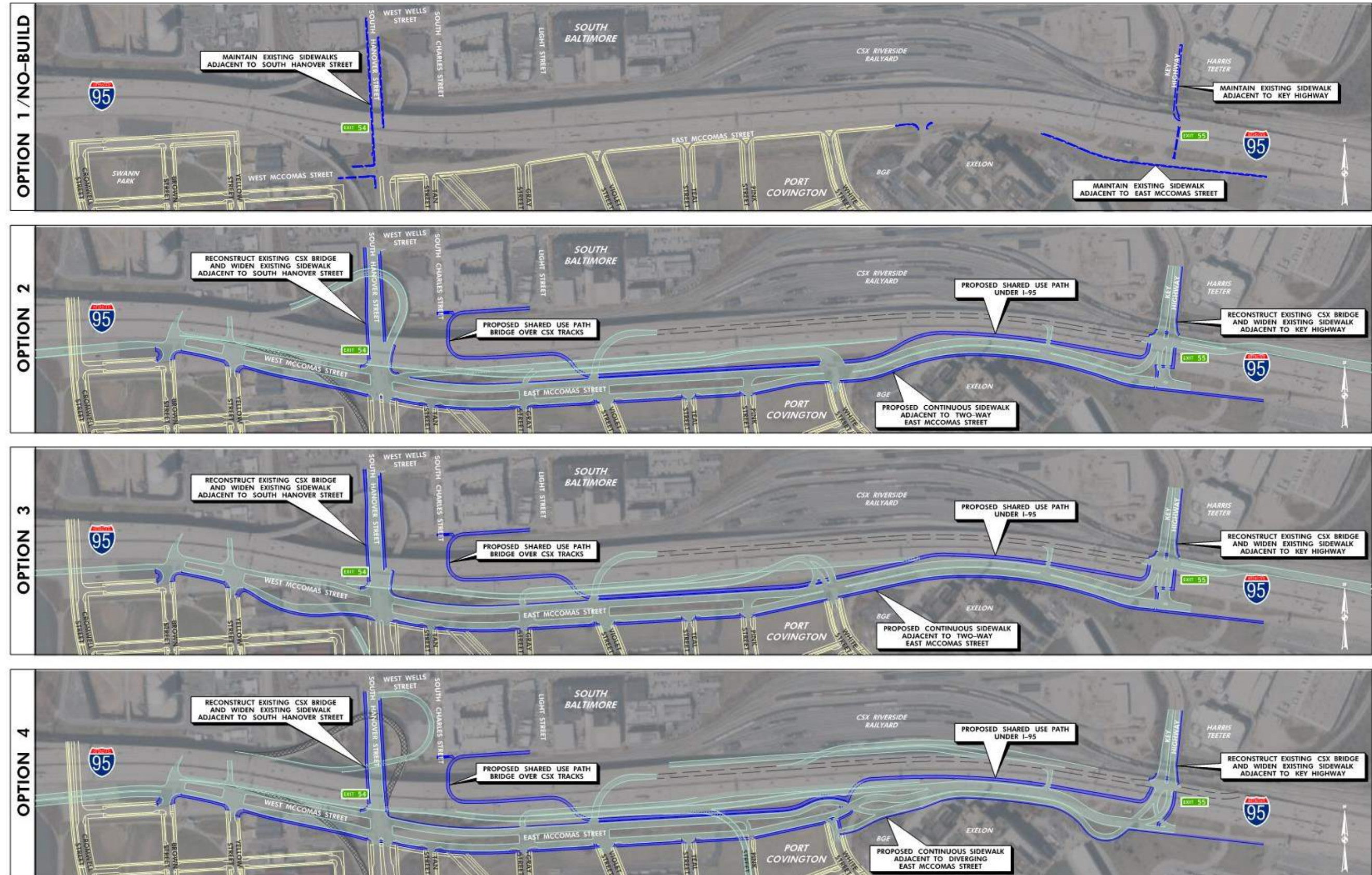
##### **B. Element G – Options 2, 3, & 4**

Options 2, 3, and 4 all propose similar improvements to the connections for pedestrians and bicyclists along Hanover Street, McComas Street, and Key Highway on the northern side of the Port Covington peninsula. All options propose sidewalk along the entire length of these three streets. The only differences among the options would be directly related to the differences between Element F Options 2, 3, and 4.

All three options also propose the same shared-use path bridging over the CSX railroad tracks and under the elevated section of I-95. The shared-use path would begin ramping up from Light Street on the north side of the CSX railroad tracks. A staircase would be proposed to access the path from Charles Street. The path would then traverse over the tracks and under I-95 on an elevated structure, then join up with McComas Street in the vicinity of the potential intersection of the two-way McComas Street boulevard and the one-way section of westbound McComas Street (located under southbound I-95). From that point to the east, the shared-use path would remain at-grade and run adjacent to the north side of the McComas Street boulevard until the Key Highway intersection. At the Key Highway intersection, crosswalks would be proposed to connect the shared-use path to the existing shared-use path located on the east side of Key Highway.



Figure 4-8: Options for Element G – Pedestrians and Bicycle Connections





#### **4.2.8 Options Not Retained For Further Consideration**

Additional options were considered as part of the I-95 Access Improvement Study, but ultimately were not retained for further consideration for various reasons.

##### **A. Element A – I-95 Northbound Off-Ramps**

Element A represents the existing and proposed northbound I-95 Off-Ramps to the Port Covington peninsula. Preliminary traffic operations analyses of the configuration of the existing off-ramps found the weave section along northbound I-95 between I-395 and Hanover Street operates at LOS F during the AM peak hour. The following options were developed in an attempt to improve the operations along I-95 within the corridor, but were not retained for further consideration for various reasons described below.

##### **Exit 54 – Complete Hanover Street Interchange**

This option was developed to convert the Hanover Street Interchange (Exit 54) to a Single Point Urban Interchange (SPUI). The SPUI configuration is similar to a diamond interchange except that all ramp movements are controlled by a single signalized intersection. This alternative would have also allowed for the Hanover Street interchange to be completed by providing an additional northbound I-95 On-Ramp and a southbound I-95 Off-Ramp.

While this option would have allowed for the Hanover Street interchange to be completed by providing an additional northbound I-95 On-Ramp and a southbound I-95 Off-Ramp, thus alleviating capacity concerns on the two existing ramps that lack redundancy, preliminary analyses projected that the SPUI would operate at LOS F with ramp queues spilling back onto mainline I-95. Additionally, SPUIs are not easy to navigate for pedestrians and bicycles because of the size of the intersection and many ramp conflicts. For these reasons, this option was not retained for further consideration.

##### **Exit 54 – Relocate Hanover Street Off-Ramp**

This option was developed to remove the existing weave between I-395 and Hanover Street while still providing access to the Port Covington Development site. The option proposed a new northbound I-95 Off-Ramp that exited the mainline between the northbound MD 295 On-Ramp and the southbound I-395 On-Ramp gores. The ramp touched down west of Hanover Street, and once at grade, was designed to become McComas Street.

This option was not retained for further consideration due to vertical clearance issues that would have required the southbound I-395 On-Ramp to be reconstructed. In addition, a small weave segment of approximately 300 feet in length would be created between the northbound MD 295 On-Ramp and the new exit ramp gore, further exacerbating existing congestion with a substandard weave. Although this option was dropped from consideration, it was the genesis for further discussion and consideration of options that remove the existing Hanover Street ramp and weave section and propose a new ramp that accesses the Port Covington Development site west of Hanover Street.

##### **Exit 54 – Add Spur to Hanover Street Off-Ramp**

A set of options were developed that maintained the existing weave between the I-395 and Hanover Street Ramps, but attempted to address operational concerns related to how the ramp would tie-in to the surface streets and intersections at-grade.

### **Convert Existing Hanover Street Off-Ramp to an A-B Exit**

This option proposed to convert Exit 54 into an A-B ramp. The exit ramp was proposed to remain a single lane exit, but would have split with Exit 54A proposed to exit onto southbound Hanover Street while Exit 54B would exit to eastbound McComas Street. The Exit 54B ramp was proposed to cross over Hanover Street and run along the south side of McComas Street until it touched down in the Port Covington Development site.

This option was not retained for further consideration due to concerns with the vertical clearance over Hanover Street. The option would have also restricted access to the intersection of Hanover Street and McComas Street and the first intersection east of Hanover Street on McComas Street. It also could have restricted access to other future surface streets that may be proposed by the Port Covington Development.

### **Reconstruct Hanover Street Off-Ramp as an A-B Exit**

This option was developed to reconstruct the off-ramp as an A-B Exit that tied the Hanover Street Off-Ramp exit into Hanover Street and McComas Street as quickly as possible to avoid impacts to future surface streets proposed by the Port Covington Development.

These two options were not retained for further consideration because of safety concerns with vehicles needing to decelerate off the mainline to the ramp's 20 MPH design speed. There were also issues with inadequate superelevation transitions and vertical clearances over the at-grade roadways. Additionally, this option eliminated the feasibility of McComas Street continuing to the west of Hanover Street, limiting vehicular access to the western side of the Port Covington Development.

## **B. Element C – I-95 Southbound Off-Ramps**

Element C represents the existing and proposed southbound I-95 Off-Ramps to the Port Covington peninsula. Under existing conditions, only one single lane ramp provides access from southbound I-95 to the Port Covington peninsula and it is located immediately after exiting the Fort McHenry Tunnel. In order to access the exit, vehicles must use the right lane in the rightmost bore when travelling south. If they miss the exit, a detour of significant length is required to turn around on I-95 and return to Port Covington via northbound I-95. Additionally, preliminary traffic operations analyses of southbound I-95 found significant congestion on the existing ramp which in turn causes significant congestion on southbound I-95. The following options were developed in an attempt to improve the operations along I-95 within the corridor, but were dropped from further consideration for various reasons described below.

### **Exit 54 – Construct New Off-Ramp Over I-95**

This option proposed to construct a new off-ramp immediately after the Key Highway overpass. The proposed ramp was designed to elevate above I-95, McComas Street and Hanover Street. The terminal of the ramp was designed to tie-in to southbound Hanover Street just prior to the intersection with present day Cromwell Street.

While this ramp was expected to improve traffic operations on southbound I-95, giving traffic unimpeded direct access to the Port Covington Development, the option was not retained for further consideration due to the substantial impacts it would have had on the surrounding areas. Approximately 0.7 miles of new structure would have been required, a portion of which would have had to span above the eight lanes of an elevated I-95. The option would have also impacted three storage tracks in the CSX Riverside Railyard and likely required a jughandle to remain at the intersection of Hanover Street and present day Cromwell Street, forcing

additional traffic into and back out of the Port Covington Development instead of providing a more direct option to access points north of I-95.

**Exit 55 – Convert Existing Key Highway Off-Ramp to A-B Exit**

This option was developed in case interchange spacing requirements became an issue and new off-ramps from the I-95 mainline would not be permitted. As such, this option maintained the gore for the existing Key Highway Off-Ramp, but converted Exit 55 into an A-B Ramp. Exit 55A was designed to exit onto Key Highway and Exit 55B was designed to exit to McComas Street. The alignment of the ramp for Exit 55B ran parallel to southbound I-95 until after the overpass of Key Highway, then separated and braided with the existing On-Ramp from McComas Street.

This option was not retained for further consideration because it was developed when maintaining existing gore spacing was believed to be a requirement and the costs involved with extending a structure all the way to the existing Exit 55 gore could not be justified when simply providing a new exit ramp west of the Key Highway overpass proved viable. Additionally, this option still required vehicles to be in the right lane of the rightmost bore to access it and was not anticipated to provide substantial improvements to the traffic operations.

**C. Element D – I-95 Southbound On-Ramps**

Element D represents the existing and proposed southbound I-95 On-Ramps from the Port Covington peninsula. Preliminary traffic operations analyses of the configuration of the existing on-ramps found significant congestion in the vicinity of the weave section along southbound I-95 between Hanover Street and I-395. The following options were developed in an attempt to improve the operations along I-95 within the corridor, but were dropped from further consideration for various reasons described below.

**Exit 54 Interchange – Roundabout at Hanover Street and McComas Street**

This option proposed a two-lane roundabout at the intersection of Hanover Street and McComas Street. The On-Ramp to southbound I-95 was proposed to originate as a fifth leg of the roundabout and weave through the existing piers beneath elevated I-95 before tying into the mainline at the same location as it does today.

This option was not retained for further consideration because the roundabout failed the preliminary traffic operations analysis and did not improve congestion on the I-95 mainline. It was also dropped because a five-legged roundabout could be challenging for unfamiliar motorists, pedestrians, and bicyclists to navigate.

**Exit 54 Interchange – Roundabout at Hanover Street and Wells Street**

This option proposed a two-lane roundabout at the intersection of Hanover Street and Wells Street. The On-Ramp to southbound I-95 was proposed to originate as a fifth leg of the roundabout and tie-in to the mainline at the same location as it does today.

This option was not retained for further consideration because the roundabout failed the preliminary traffic operations analysis and did not improve congestion on the I-95 mainline. In order for it to tie-in at the same location of the existing on-ramp, significant grading and right-of-way acquisition would have been required. It was also dropped because a five-legged roundabout could be challenging for unfamiliar motorists, pedestrians, and bicyclists to navigate.



## 5 ALTERNATIVES DEVELOPMENT

Due to the size of the study area and the extents of potential improvements, numerous alternatives could have been developed in an attempt to meet the projected traffic demand of the Port Covington Development. Rather than developing and analyzing every possible alternative, each of the existing features providing connectivity to the Port Covington peninsula were classified as elements, each element was focused on individually, and various options were developed for each element. The various options that were retained for further analysis have been described in Section 4 of this report and briefly summarized in **Table 4-3**. Ultimately, four options were retained for Elements A, C, E, F, and G and three options were retained for Elements B and D. For analysis purposes, these retained options were then combined into four discrete alternatives – Alternative 1, the No-Build Alternative, and three Build Alternatives. The composition of these Alternatives was as follows:

- Alternative 1/No-Build
  - Element A – Option 1/No-Build
  - Element B – Option 1/No-Build
  - Element C – Option 1/No-Build
  - Element D – Option 1/No-Build
  - Element E – Option 1/No-Build
  - Element F – Option 1/No-Build
  - Element G – Option 1/No-Build
- Alternative 2
  - Element A – Option 2
  - Element B – Option 2
  - Element C – Option 2
  - Element D – Option 2
  - Element E – Option 2
  - Element F – Option 2
  - Element G – Option 2
- Alternative 3
  - Element A – Option 3
  - Element B – Option 3
  - Element C – Option 3
  - Element D – Option 1/No-Build
  - Element E – Option 3
  - Element F – Option 3
  - Element G – Option 3
- Alternative 4
  - Element A – Option 4
  - Element B – Option 3
  - Element C – Option 4
  - Element D – Option 3
  - Element E – Option 4
  - Element F – Option 4
  - Element G – Option 4

**Figures 5-1, 5-2, and 5-3** are provided to show a Key Map of the proposed improvements, color coded by element, for Alternatives 2, 3, and 4.

Figure 5-1: Key Map – Alternative 2

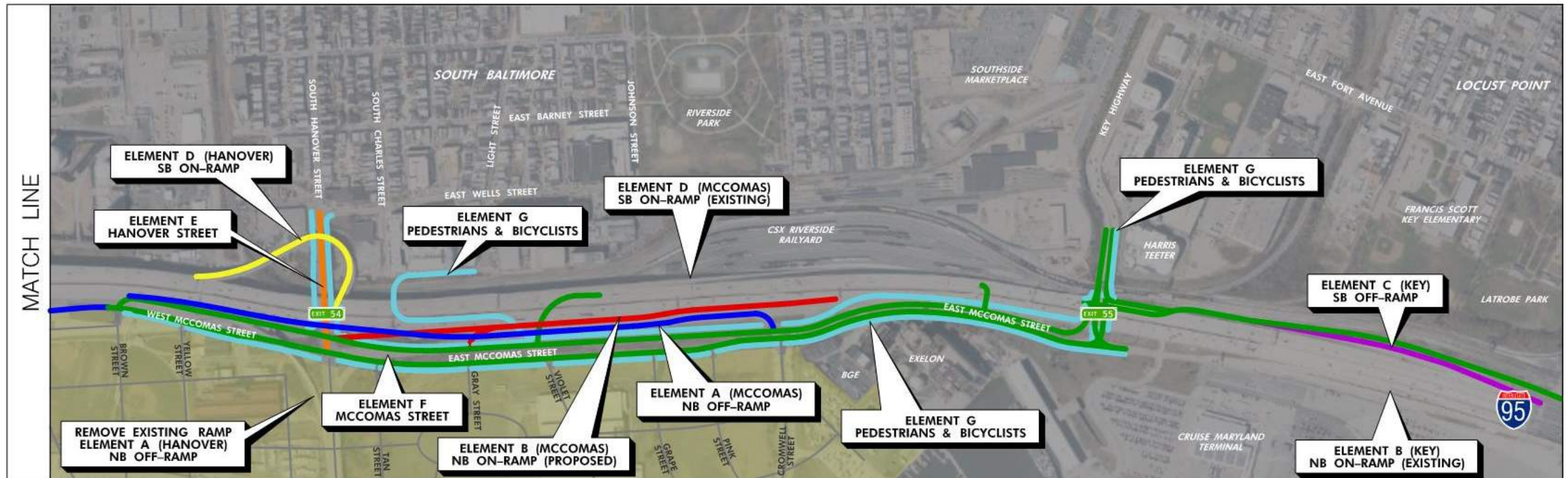




Figure 5-2: Key Map – Alternative 3

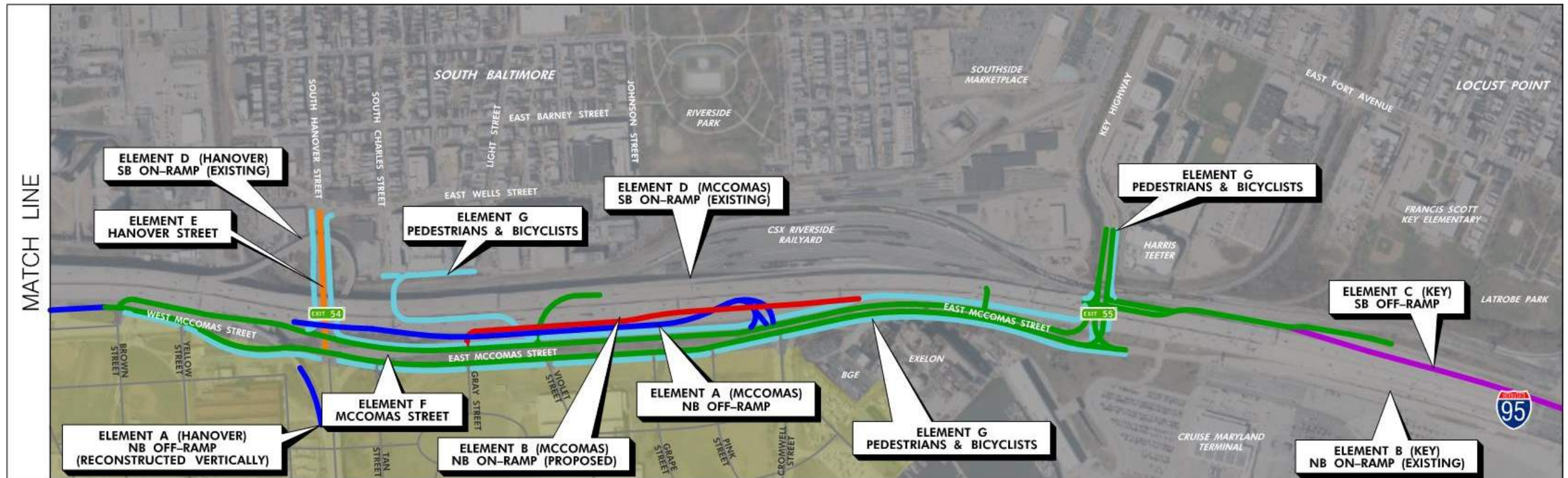
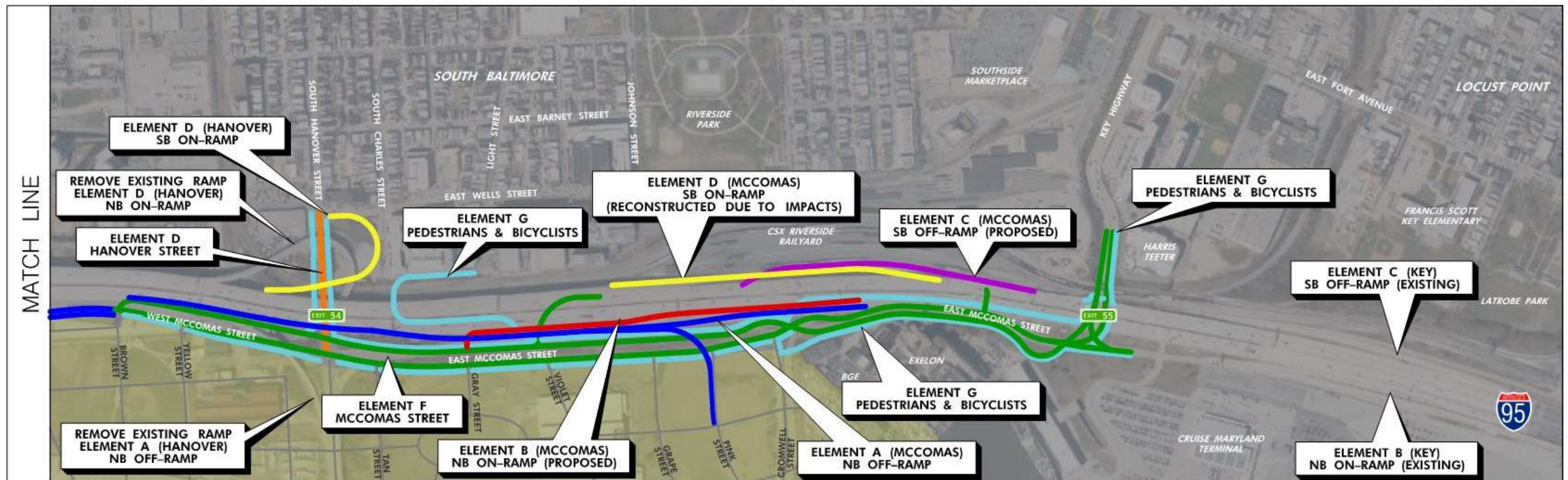




Figure 5-3: Key Map – Alternative 4





Once assembled, the four alternatives were analyzed to determine how well they met the project’s stated purpose and need of providing solutions designed to accommodate the increased transportation demand, improve upon the existing capacity and roadway geometry inadequacies, support economic development, and improve multi-modal connections to and from the Port Covington peninsula. Because no distinguishable differences were initially anticipated between the environmental impacts of each alternative, the analysis primarily focused on the effects each alternative had on the future traffic operations of I-95 and the surface streets. Key performance measures included I-95 peak travel times, average speeds, total delay, and unserved vehicle demand. The travel times and average speeds were estimated based on the average time and speeds for a vehicles travelling on I-95 between the southwest I-695 interchange to the Fort McHenry Toll Plaza. The total delay for vehicles travelling in the network was based on the accumulated difference between the peak travel times for each alternative and the travel times expected for the posted speed limits. The unserved demand was based on the number of vehicles estimated to be unable to access the network due to congestion. **Table 5-1** below contains a brief summary of the traffic impacts anticipated for each alternative. The project's **Traffic Analysis Technical Report** contains additional details of the analysis that was completed.

**Table 5-1: Alternatives Comparison Summary**

	Traffic Impacts											
	Network Measures of Effectiveness (from VISSIM)				Travel Time Comparison (I-695 to/from Fort McHenry Toll Plaza)							
	AM		PM		AM				PM			
	Total Delay (Hours)	Unserved Demand (Vehicles)	Total Delay (Hours)	Unserved Demand (Vehicles)	NB Travel Time (MM:SS)	NB Average Speed (MPH)	SB Travel Time (MM:SS)	SB Average Speed (MPH)	NB Travel Time (MM:SS)	NB Average Speed (MPH)	SB Travel Time (MM:SS)	SB Average Speed (MPH)
Alternative 1 / No-Build	5,221	11,304	7,312	22,629	21:30	21	13:17	33	20:20	22	13:26	33
Alternative 2	4,055	9,557	4,903	9,719	16:40	27	13:11	33	13:44	33	14:58	29
Alternative 3	3,670	8,149	3,615	9,726	11:10	40	13:17	33	9:19	48	13:15	33
Alternative 4	3,699	8,519	3,506	7,403	10:47	41	12:59	34	8:53	50	13:37	32

When the alternatives were compared to one another, the Build Alternatives (2, 3, and 4) were found to have less delay, lower unserved demand, and faster travel times than Alternative 1/No-Build. In the northbound direction, the travel times for Alternatives 3 and 4 were found to be approximately half of the travel times for Alternative 1/No-Build. These findings supported the need for connectivity improvements to be constructed as part of the I-95 Access Improvements project.

## 6 DEVELOPMENT OF ALTERNATIVE 5

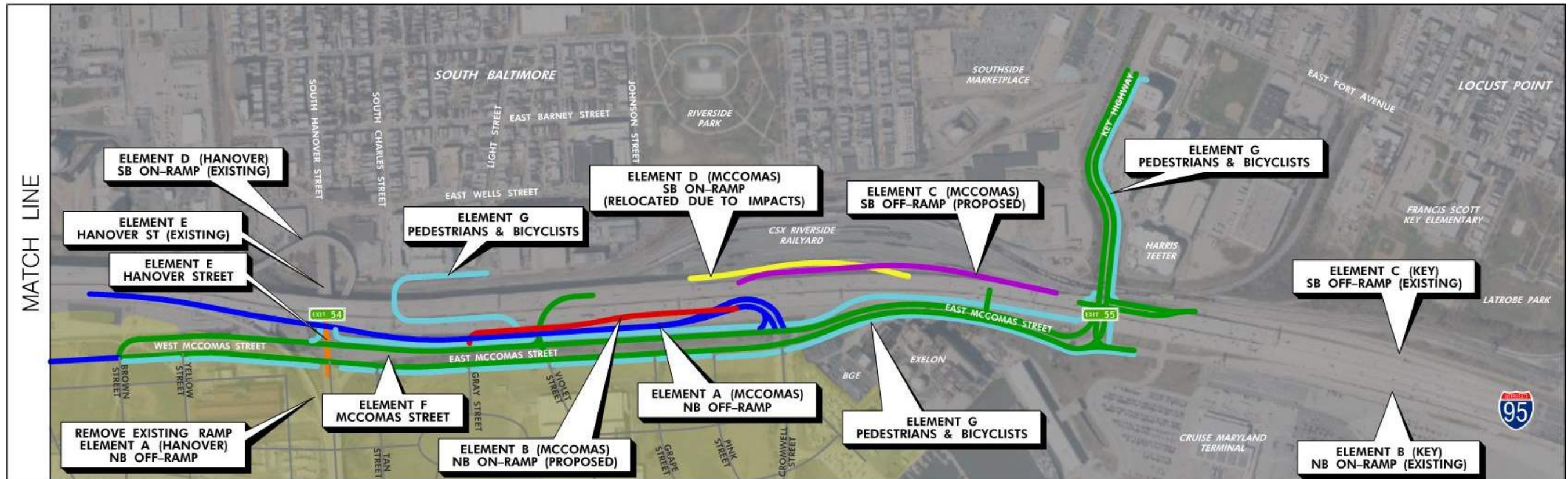
The traffic impacts of each of the Build Alternatives (2, 3, and 4) provided noticeable improvements over the traffic impacts of Alternative 1/No-Build. The improvements, however, varied in effectiveness and a better combination of the element options was believed to exist that could improve upon the results. By comparing the performance of each element's options, the most optimal options or variations of options for each element were combined to develop a fourth Build Alternative – Alternative 5. Additionally, after the traffic analysis was completed, highly contaminated soils were discovered on the property located at 2000 Race Street on the northwest side of the peninsula. The draft of Alternative 5 was then fine-tuned by making minor modifications to the elements that were found to improve the key performance measures and avoid impacting the 2000 Race Street property. As a result, the final version of Alternative 5 was combined from the various elements as follows:

- Element A – Modified Combination of Option 3 and Option 4
- Element B – Option 3
- Element C – Option 4
- Element D – Modified Option 1/No-Build
- Element E – Modified Option 1/No-Build
- Element F – Modified Option 2
- Element G – Modified Option 2

**Figure 6-1** is provided to show a Key Map of the proposed improvements, color coded by element, for Alternative 5.



Figure 6-1: Key Map – Alternative 5



## **6.1 Element A: I-95 Northbound Off-Ramps**

The traffic analysis found Element A's Options 3 and 4 to produce similar results, but both had better travel times, vehicle throughput, and vehicle queuing than Option 2 and significantly better travel times, vehicle throughput, and vehicle queuing than Option 1/No-Build. Option 3 provided better levels of service than Option 4, but because of the substandard weave section that exists between I-395 and the Hanover Street Off-Ramp, Option 3 was found to cause queuing issues along I-95, I-395, and MD 295. Subsequently, variations of Options 3 and 4 were combined to form Element A in Alternative 5 as described in the following sections.

### **6.1.1 Exit 52 – Ramp from Russell Street Off-Ramp**

A variation of original Option 3, the existing auxiliary lane between the Caton Avenue On-Ramp and the Russell Street Off-Ramp will be widened to two lanes. The Russell Street Off-Ramp will also be widened to two lanes until it overpasses MD 295, at which point the two lanes will split. One lane will continue along the existing ramp alignment to northbound Russell Street. The second will continue east, over the Middle Branch, as a new ramp spur parallel to the existing ramps adjacent to northbound I-95, and merge with the new spur ramp from southbound I-395, connecting to McComas Street at an at-grade intersection with Brown Street, a street currently proposed within the grid of the development, located approximately 1,100 ft west of the intersection of Hanover Street and McComas Street. The alignment of the merged ramps will pass through the north side of existing Swann Park to avoid any impacts to the 2000 Race Street property.

Consideration was given to not widening, and instead maintaining, the existing single auxiliary lane on northbound I-95 between the Caton Avenue On-Ramp and the Russell Street Off-Ramp. However, the proposed widening of the auxiliary lane from one to two lanes provided a noticeable improvement to traffic operations in this area. The widening proposed is a variation of the original Option 3 which assumed widening of a full lane width would be needed along the entire length of the existing auxiliary lane. Further investigation found less widening will be required than originally anticipated as sufficient width already exists to accommodate two lanes for the first several hundred feet of the existing auxiliary lane.

This variation of the original Option 3 will also require acquisition of the warehouse located in the southeast quadrant of the MD 295 at I-95 interchange. The original Option 3 did not require the warehouse to be acquired, but did require the new ramp to be constructed directly above the existing ramp located adjacent to the north side of the warehouse. The construction of such a ramp was anticipated to be difficult and estimated to cost significantly more than acquiring the warehouse.

### **6.1.2 Exit 53 Interchange – Spur from Southbound I-395 Ramp**

A part of the original Option 4, a new ramp spur, splitting off from the existing southbound I-395 Ramp to northbound I-95 where it overpasses I-95, is proposed. It will run southeast, merge with the new ramp coming from the Russell Street Off-Ramp, connecting to McComas Street at an at-grade intersection with Brown Street, a street currently proposed within the grid of the development, located approximately 1,100-ft west of the intersection of Hanover Street and McComas Street. The alignment of the merged ramps will pass through the north side of existing Swann Park to avoid any impacts to the 2000 Race Street property.



The construction of this spur, combined with the removal of the existing ramp at Exit 54 (Hanover Street), will provide an important link for traffic traveling from downtown Baltimore City to points south of Port Covington. This is supported by field observations of the present day conditions which found approximately 60% of the traffic using the exit ramp at Exit 54 (Hanover Street) originates from southbound I-395.

### **6.1.3 Exit 54 – Ramp from Northbound I-95 to Southbound Hanover Street**

A part of the original Option 4, the existing ramp will be removed. Vehicles traveling from southbound I-395 to southbound Hanover Street will be accommodated by the new spur from southbound I-395. The removal of this ramp also eliminates the existing substandard weaving section located between I-395 and this ramp which was found to cause significant queuing issues along I-95, I-395, and MD 295.

### **6.1.4 Exit 55 – Ramp from Northbound I-95 to McComas Street**

A variation of the original Option 3, the existing ramp will remain in a similar location, but will be realigned to accommodate the new northbound I-95 On-Ramp (Element B), modifications to McComas Street (Element F), and the removal of the existing Hanover Street ramp from northbound I-95. The realigned ramp will extend the existing auxiliary lane that terminates at the Hanover Street exit to a two lane exit gore located approximately 1,600 feet from the existing southbound I-395 on-ramp gore. The new two-lane exit ramp will run under northbound I-95, braid through the existing piers, and daylight perpendicular to an at-grade signalized intersection with McComas Street near the present day intersection of McComas and Cromwell Streets.

If selected, variations of Options 2 and 4 would have produced similar results in the traffic analysis. However, Option 2 was not selected because there were safety concerns with having a sharp radius located at the end of the ramp, just prior to the signalized intersection with McComas Street. Option 4 was not selected because it could only be accommodated with a divergent diamond section of McComas Street, which would have been an unusual traffic operation that could have potentially confused drivers. Option 4 also was not selected because it would have provided undesirable uncontrolled access to the Port Covington Development. Subsequently, a variation of the original Option 3 was selected, proposing a two-lane exit instead of the one-lane exit Option 3 proposed. The two-lane exit improved traffic operations in the area by reducing queuing issues along I-95.

## **6.2 Element B: I-95 Northbound On-Ramps**

The traffic analysis found all three Element B options to produce similar levels of service, travel times, and vehicle queuing. However, Options 2 and 3 produced more than five times as much vehicle throughput along northbound I-95 and the ramps during the PM peak period and nearly twice as much during the AM peak period. As such, Option 1/No-Build was eliminated from further consideration due to a second ramp being needed to accommodate the additional 2,100 vehicles trying to access northbound I-95 in the PM peak period. Between Options 2 and 3, the differences in the traffic analysis were negligible, so Option 2 was eliminated because it consisted of adding a potentially confusing fifth leg to the intersection of McComas Street and Hanover Street. Subsequently, Option 3 was selected for Element B in Alternative 5 as described in the following sections.

### **6.2.1 Exit 54 Interchange – Ramp from McComas Street to Northbound I-95**

A part of the original Option 3, a new ramp is proposed from the intersection of McComas Street and Gray Street, a street currently proposed within the grid of the development, located

approximately 600-ft east of the intersection of Hanover Street and McComas Street. The new ramp will braid with the realigned ramp from northbound I-95 to McComas Street (Element A) and modifications to the realigned one-way section of westbound McComas Street (Element F).

### **6.2.2 Exit 55 Interchange – Ramp from Key Highway to Northbound I-95**

No modifications to the existing ramp are proposed.

## **6.3 Element C: I-95 Southbound Off-Ramps**

The traffic analysis found Element C's Option 1/No-Build and Option 2 to have failing level of service during the AM peak period, Options 3 and 4 did not. The travel times associated with Option 4 were found to be approximately 25% faster than the other three options. The analysis also showed that Option 4 was the only option that did not have queuing issues on the ramps, minimizing impacts to southbound I-95. Subsequently, Option 4 was selected for Element C in Alternative 5 as described in the following sections.

### **6.3.1 Exit 55 – Ramp from Southbound I-95 to Key Highway**

No modifications to the existing ramp are proposed.

### **6.3.2 Exit 54 – Ramp from Southbound I-95 to Westbound McComas Street**

A variation of the original Option 4, a new ramp, with a gore located approximately 400 feet west of the Key Highway overpass is proposed. It will provide access to the one-way section of westbound McComas Street located directly beneath southbound I-95. The new ramp will braid with the realigned ramp from westbound McComas Street to southbound I-95 (Element D). The improvements will require the relocation of two CSX storage tracks.

The original Option 4 proposed for the existing ramp from westbound McComas Street to southbound I-95 (Element D) to remain in place horizontally, but be reconstructed vertically to accommodate the braiding of Element C. This variation swaps the horizontal locations of Elements C and D in an effort to minimize the closure time of Element D during construction.

## **6.4 Element D: I-95 Southbound On-Ramps**

The traffic analysis found all the Element D options to have similar levels of service, travel times, vehicle throughput, and vehicle queuing. Without any discernable differences, the cost associated with Options 2 and 3 cannot be justified. Subsequently, a variation of Option 1/No-Build was selected for Element D in Alternative 5 as described in the following sections.

### **6.4.1 Exit 55 Interchange – Ramp from Westbound McComas Street to Southbound I-95**

No modifications to the functionality of the existing ramp are proposed, but the ramp must be geometrically reconstructed to allow it to braid with the new ramp from southbound I-95 to westbound McComas Street (Element C). This variation of Option 1/No-Build will continue to provide access from the one-way section of westbound McComas Street to southbound I-95 and maintain the existing gore locations. However, the ramp will be realigned to allow a portion of it to be constructed while the existing ramp continues to maintain traffic. The realignment is anticipated to reduce the overall construction costs and the duration of construction.

### **6.4.2 Exit 54 Interchange – Ramp from Northbound Hanover Street to Southbound I-95**

No modifications to the existing ramp are proposed.

## **6.5 Element E: Hanover Street**

The traffic analysis found all of the Element E options to function similarly for all measures of effectiveness. Therefore, other than preventing queues from backing up onto I-95, traffic was not a deciding factor for Element E. Instead, the selection of the Element E option was dictated by the costs and benefits of the improvements. Option 1/No-Build maintained the existing bridge with four lanes of traffic over the CSX railroad tracks. The existing bridge has sidewalks adjacent to both sides, no accommodations for bicyclists, and has a Bridge Sufficiency Rating of 51.7. Options 2, 3, and 4 proposed to reconstruct the bridge. The new bridge would have provided an additional southbound travel lane, wider sidewalks, and accommodations for bicyclists. Subsequently, a variation of Option 1/No-Build was selected for Element E in Alternative 5 because adding a travel lane did not noticeably improve traffic and the cost to reconstruct the bridge could not be justified. The cost to reconstruct the bridge could not be justified to improve the accommodations for pedestrians and bicyclists either. Instead, accommodations for pedestrians and bicyclists will be proposed as part of the selected options for Elements F and G.

The decision whether to reconstruct the bridge or not was also aided by the knowledge that when the Bridge Sufficiency Rating drops below 50, the existing bridge will become eligible for replacement or rehabilitation. As such, improvements to this bridge are anticipated to be required in the near future, outside the scope of the I-95 Access Improvements project.

### **6.5.1 From Wells Street to McComas Street**

Vertical grade adjustments will be required along Hanover Street between the southern end of the CSX bridge and the McComas Street intersection in order to tie-in with the elevations of the Port Covington Development. Minor widening is proposed in this area as well to accommodate the transition of lanes to the divided boulevard the Port Covington Development is proposing for Hanover Street south of the McComas Street intersection. The widening will also allow for a short left turn lane for southbound vehicles turning eastbound onto McComas Street. No other modifications to this section of Hanover Street are proposed.

## **6.6 Element F: McComas Street and Key Highway**

The traffic analysis found all of the Element F options to function similarly for all measures of effectiveness. Therefore, other than preventing queues from backing up onto I-95, traffic was not a deciding factor for Element F. Instead, the selection of the Element F option was dictated by the ramp options selected for Elements A, B, C, and D. Subsequently, a variation of Option 2 was selected for Element F in Alternative 5 as described in the following sections.

### **6.6.1 McComas Street**

A part of the original Option 2, the existing two-way section of McComas Street and the one-way section of eastbound McComas Street will be converted to a two-way boulevard from the western side of the Port Covington peninsula to Key Highway. The boulevard will accommodate vehicular and multi-modal connections between South Baltimore, I-95, and the Port Covington Development. The median will be designed to accommodate a future light rail spur from Westport anticipated to terminate prior to the existing intersection of McComas and Cromwell Streets. The existing one-way section of westbound McComas Street beneath southbound I-95 will remain in its current location, but be modified to accommodate the addition of an exclusive right-turn lane at the approach to the Key Highway intersection, the addition of the southbound I-95 to westbound McComas Street ramp (Element C), and the tie-in to the proposed two-way McComas Street boulevard. The tie-in to the proposed two-way McComas Street boulevard will

occur at the proposed intersection of Violet Street, a street currently proposed within the grid of the development, located approximately 1,100-ft east of the intersection of Hanover Street and McComas Street. West of Hanover Street, the proposed two-way McComas Street boulevard will pass through the north side of existing Swann Park to avoid any impacts to the 2000 Race Street property.

### **6.6.2 Key Highway**

A variation of the original Option 2, the existing roadway will be widened from a 4-lane section (2 northbound and 2 southbound) to a 5-lane section (3 northbound & 2 southbound) between the McHenry Row and McComas Street intersections. Additionally, a 450-ft long southbound right-turn lane will be added at the McComas Street intersection. The widening will occur on the west side of existing Key Highway to avoid impacting the newly constructed retaining wall adjacent to the McHenry Row commercial area along the east side of Key Highway. The added right-turn lane will begin just south of the existing retaining wall located on the west side of Key Highway which supports the CSX Railyard.

The CSX bridge over Key Highway, just north of the McComas Street intersection, will be reconstructed to accommodate the new width of Key Highway. The additional lanes were added to Key Highway to improve traffic operations, ultimately reducing queuing on the ramps and mainline of I-95.

## **6.7 Element G: Pedestrian and Bicycle Connections**

The options developed for Element G are generally dependent on the options developed for Elements E and F. The exception to this dependency is the shared use path bridge over the CSX railroad tracks which is proposed in Options 2, 3, and 4. Providing accommodations for pedestrians and bicyclists is necessary to improve the multi-modal connections between South Baltimore and the Port Covington Development. Because Option 1/No-Build was selected for Hanover Street (Element E), the selection of a build option for Element G was important. Subsequently, a variation of Option 2 was selected for Element G in Alternative 5 as described in the following sections.

### **6.7.1 Hanover Street**

A variation of the original Option 2, the existing sidewalk along the west side of Hanover Street will be reconstructed between the bridge over the CSX tracks and the McComas Street intersection to accommodate the minor widening of Hanover Street and to connect to a shared-use path Sagamore intends to build across the existing bridge over the CSX tracks. In conjunction with building the shared-use path along the west side of Hanover Street, Sagamore intends on removing the existing sidewalk along the east side of Hanover Street, between the Wells Street intersection and the northern end of the bridge over the CSX tracks to discourage hazardous pedestrian crossings of the entrance ramp to southbound I-95 (Element D) located on the east side of Hanover Street immediately north of the McComas Street intersection. The existing sidewalk on the east side of the bridge will remain in place for the time being, but ultimately be removed when the Bridge Sufficiency Rating drops below 50 and the existing bridge becomes eligible for replacement or rehabilitation. Subsequently, no sidewalk is proposed along the east side of Hanover Street as part of this project.

### **6.7.2 Key Highway**

A variation of the original Option 2, an 11-foot wide shared-use path will be provided on the east side of Key Highway between the intersections of McHenry Row and McComas Street.



### 6.7.3 McComas Street

As part of the original Option 2, Sidewalks will be installed along both sides of the new McComas Street boulevard. Likewise, a shared-use path will be installed along the north side of McComas Street between the Cromwell Street and Key Highway intersections.

### 6.7.4 New Shared-Use Bridge/Path

As part of the original Option 2, a new shared-use path, linking south Baltimore to Port Covington will be constructed. The path will run parallel to the south side of Winder Street, ramping up from the Light Street intersection. A stair case will connect to the path from the Charles Street intersection. At the Charles Street intersection, the ramp will turn south, bridge over the CSX tracks and under I-95, then turn east to connect to the shared-use path proposed along the north side of McComas Street at the proposed intersection of Violet Street, a street currently proposed within the grid of the development, located approximately 1,100-ft east of the intersection of Hanover Street and McComas Street.

## 6.8 Alternative 5 - Recommended Preferred Alternative

Once assembled, Alternative 5 was analyzed and the key performance factors were compared to the first four alternatives. **Table 6-1** below contains a brief summary of the traffic impacts anticipated for all five alternatives. The project's **Traffic Analysis Technical Report** contains additional details of the analysis that was completed.

**Table 6-1: Alternatives Comparison Summary with Alternative 5**

	Traffic Impacts											
	Network Measures of Effectiveness (from VISSIM)				Travel Time Comparison (I-695 to/from Fort McHenry Toll Plaza)							
	AM		PM		AM				PM			
	Total Delay (Hours)	Unserviced Demand (Vehicles)	Total Delay (Hours)	Unserviced Demand (Vehicles)	NB Travel Time (MM:SS)	NB Average Speed (MPH)	SB Travel Time (MM:SS)	SB Average Speed (MPH)	NB Travel Time (MM:SS)	NB Average Speed (MPH)	SB Travel Time (MM:SS)	SB Average Speed (MPH)
Alternative 1 / No-Build	5,221	11,304	7,312	22,629	21:30	21	13:17	33	20:20	22	13:26	33
Alternative 2	4,055	9,557	4,903	9,719	16:40	27	13:11	33	13:44	33	14:58	29
Alternative 3	3,670	8,149	3,615	9,726	11:10	40	13:17	33	9:19	48	13:15	33
Alternative 4	3,699	8,519	3,506	7,403	10:47	41	12:59	34	8:53	50	13:37	32
Alternative 5	3,355	6,910	3,027	7,025	10:42	42	12:44	34	8:28	53	13:09	33

The results showed Alternative 5 has the lowest total delay, lowest unserved demand, lowest travel time, and highest average speeds. For these reasons, Alternative 5 was selected as the Recommended Preferred Alternative. This designation has been approved by MDTA and Baltimore City DOT.

**6.9 Alternative 5 – Conceptual Cost Estimate**

Conceptual cost estimates for the improvements proposed by Alternative 5 were developed using the Maryland Department of Transportation’s (MDOT’s) State Highway Administration’s (SHA) 2016 Highway Cost Estimating Manual as guidance. The estimate used major quantities and conservatively estimated unit prices. Percentages were applied to Category 1 (Preliminary/MOT), Category 3 (SWM/Drainage), and Category 7 (Landscaping). Utility relocation costs were assumed to be 8% for elevated elements and 15% for at-grade elements. A 40% contingency and 12.3% overhead and administration were applied. An additional 7.91% was applied as a general overhead rate for the elements anticipated to require CSX coordination. The conceptual estimated costs per element is provided in **Table 6-2**.

Right-of-way will be acquired to accommodate the proposed improvements. The acquisitions will provide access to the proposed improvements from public right-of-way and provide sufficient space for all construction and staging activities. Preliminary right-of-way acquisition costs have been estimated to be a total \$15 to \$20 million. The right-of-way costs include one property displacement for the warehouse being impacted by Element A, full and partial acquisitions, and temporary construction easements. The land values and displacement costs were estimated based on recent transactions in the area and information included in the Maryland Department of Taxation and Assessment Real Property Database, Maryland Land Records Database, and Costar Database.

**Table 6-2: Conceptual Cost Estimate\* – Recommended Preferred Alternative**

<b>Project Element</b>	<b>Estimated Cost</b>
Right of Way**	\$15M to \$20M
Element A: I-95 Northbound Off-Ramps	\$300M to \$315M
Element B: I-95 Northbound On-Ramps	\$20M to \$25M
Element C: I-95 Southbound Off-Ramps	\$25M to \$30M
Element D: I-95 Southbound On-Ramps	\$10M to \$15M
Element E: Hanover Street	\$0M
Element F – McComas Street & Key Highway	\$60M to \$65M
Element G – Pedestrian & Bicycle Connections	\$20M to \$25M
<b>Total</b>	<b>\$450M to \$495M</b>

*\*Estimated construction costs only*

*\*\* Does not include CSX acquisition or track costs*



## **7 SUMMARY**

This Alternatives Development Technical Report details the process and screening criteria approach used for developing the Recommended Preferred Alternative for the I-95 Access Improvements in Baltimore, MD. The process began with defining the purpose and need, then proceeded to developing various proposed options to improve the connectivity between south Baltimore, I-95, and the Port Covington peninsula. For analysis purposes, the various options were then combined into four discrete alternatives: Alternative 1 (the No-Build Alternative), and three Build Alternatives. A combination of the most optimal options were then combined to form Alternative 5. Further analysis found Alternative 5 to have the lowest total delay, lowest unserved demand, lowest travel time, and highest average speeds. Subsequently, MDTA and Baltimore City DOT approved Alternative 5 as the Recommended Preferred Alternative and selected it for a detailed evaluation in the EA currently being prepared.

## **8 REFERENCES**

### **8.1 General**

- MDOT State Highway Administration's Highway Construction Cost Estimating Manual, 2016
- MDOT State Highway Administration's Standard Specifications for Construction and Materials, July 2008

### **8.2 Highway Design**

- American Association of State Highway and Transportation Officials (AASHTO) – A Policy on Geometric Design of Highways and Streets, 2011 Edition
- American Association of State Highway and Transportation Officials (AASHTO) – Guide for the Planning, Design and Operations of Pedestrian Facilities
- American Association of State Highway and Transportation Officials (AASHTO) – Roadside Design Guide (RDG), 4th Edition 2011
- American Railway Engineering and Maintenance-of-Way Association (AREMA), 2015
- Baltimore City Department of Transportation – Book of Standards
- City of Baltimore Standard Specifications 2006C
- City of Baltimore – The Green Book
- City of Baltimore – Supplemental Specifications Based on Materials, Highways, Bridges, Utilities and Incidental Structures
- MDOT State Highway Administration's Book of Standards for Highway and Incidental Structures

### **8.3 Structural/Bridge Design**

- American Association of State Highway and Transportation Officials (AASHTO) – LRFD, 7th Edition
- CSX Standard Specifications
- Federal Highway Bridge Program Guidelines for Local Governments
- Highway Development Manual and applicable directives
- MDOT State Highway Administration – Office of Bridge Development, Aesthetic Bridges Users Guide, January 2005
- MDOT State Highway Administration – Office of Bridge Development, Policy and Procedure Manual
- MDOT State Highway Administration – Office of Bridge Development, Structural Standards Manual Volume I and II

### **8.4 Stormwater Management (SWM), Erosion and Sediment Control (E&SC) and Stormdrain Design**

- 2000 Maryland Stormwater Design Manual Volume I and II, 2009 Edition
- 2011 Maryland Standards and Specifications for Soil Erosion and Sediment Control
- 2010 Maryland Stormwater Management Guidelines for State and Federal Projects
- City of Baltimore Stormwater Management Manual, 2003 Edition
- City of Baltimore Stormwater Ordinance
- MDOT State Highway Administration - Highway Drainage Manual
- MDOT State Highway Administration – Manual for Hydrologic and Hydraulic Design, 2015 Revision
- MDOT State Highway Administration - Sediment and Stormwater Guidelines and Procedures