Chesapeake
BAY CROSSING STUDY
TIER 2 NEPA

PROPOSED ALTERNATIVES RETAINED FOR DETAILED STUDY (ARDS) SCREENING SUMMARY DOCUMENT

Maryland Transportation Authority

MDTA

May 2025

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ABBREVIATIONS AND ACRONYMS

ADT	Average Daily Traffic
ARDS	Alternatives Retained for Detailed Study
BRT	Bus Rapid Transit
CBCA	Chesapeake Bay Critical Area
EIS	Environmental Impact Statement
FAA	Federal Aviation Administration
FEIS	Final Environmental Impact Statement
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
FTA	Federal Transit Administration
GI	Green Infrastructure
GIS	Geographic Information System
HRT	Heavy Rail Transit
ICE	Indirect and Cumulative Effects
ITT	Immersed Tube Tunnels
LOS	Level of Service
LRT	Light Rail Transit
MDTA	Maryland Transportation Authority
MPO	Metropolitan Planning Organization
MPA	Maryland Port Administration
MTA	Maryland Transit Administration
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NOI	Notice of Intent
O-Ds	Origins and Destinations
PTSU	Part-time Shoulder Use
ROD	Record of Decision
SHA	State Highway Administration
SUP	Shared-use Path
TDM	Transportation Demand Management
TSM	Transportation Systems Management
U.S.	United States
U.S.C.	United States Code
USACE	U.S. Army Corps of Engineers
WMATA	Washington Metropolitan Area Transit Authority
YBI	Yerba Buena Island

1 INTRODUCTION

The Chesapeake Bay Crossing Study (Bay Crossing Study) is a two-tiered preliminary engineering and environmental study being advanced by the Maryland Transportation Authority (MDTA), in coordination with the Federal Highway Administration (FHWA), to address existing and future transportation issues at the Bay Bridge and its approaches along U.S. 50/301. Each tier of the Bay Crossing Study involves development of an Environmental Impact Statement (EIS) in compliance with the National Environmental Policy Act (NEPA) to describe potential significant environmental effects and inform the evaluation of alternatives. Tier 1 of the Bay Crossing Study (Tier 1 Study) was completed in April 2022. At that time, the FHWA issued a Final EIS/Record of Decision (FEIS/ROD) identifying Corridor 7, the corridor including the Bay Bridge and its approaches, as the Selected Corridor Alternative for further evaluation.

The Tier 2 Study was launched in June 2022 to focus on project-level (site-specific) alternatives analysis within the Tier 1 Study EIS Selected Corridor Alternative (Corridor 7). The focus of the alternatives analysis is to identify the environmental impacts associated with alternatives that address the Tier 2 Study's Purpose and Need and objectives. The needs of the study include adequate capacity and reliable travel times, mobility, roadway deficiencies, existing and future maintenance needs, and navigation. The additional objectives include environmental responsibility, and cost and financial responsibility. In advance or and following the NOI, preliminary engineering work and analyses have been conducted to formulate the ARDS. Detailed engineering of the ARDS and assessment of their potential environmental impacts will be documented in the EIS. The work performed to date and the alternatives advancing to the DEIS are presented in this document.

Due to the magnitude and complexity of this Tier 2 Study, the alternatives development process was initiated prior to the NOI so that the EIS could focus on a reasonable range of alternatives. This process also ensures that the public and resource agencies were able to review the proposed ARDS and their impacts on sensitive environmental and community resources in the NOI.

The Tier 2 Study has identified key elements that are critical components needed to develop and evaluate reasonable alternatives. The key elements of alternatives are study limits, alignments off existing U.S. 50/301, the existing bridges, structure type, number of lanes, shared-use path (SUP), transit, Transportation System Management (TSM)/Transportation Demand Management (TDM) strategies, and structure location, as described in **Section 2** of this report. To date, Tier 2 Study activities have included identification of these key elements of alternatives and analysis of several options for each element. An engineering analysis was conducted using updated traffic counts from 2022, more in-depth land use data, and preliminary cost and impact assessments. This preliminary analysis included comparison of element options in relation to the Tier 2 Study's Purpose and Need to determine if an option was reasonable. This analysis led to development of the proposed ARDS, which are made up of the reasonable options of each element, as presented in the NOI. Subsequent to the NOI, the MDTA considered all public and agency comments and made some small changes to the information presented in the NOI in order to identify the ARDS. Options that were determined not reasonable are not included in the proposed ARDS but are discussed in **Section 4**.

Key environmental resources that may be impacted by the proposed ARDS (described in **Section 5** of this report) have also been identified as part of initial Tier 2 Study activities.

This Proposed ARDS Screening Summary Document is an abridged version of the proposed ARDS analysis that was attached to the NOI.

2 PROPOSED ARDS DEVELOPMENT PROCESS

The MDTA began the alternatives development process by determining the study limits and focusing the early evaluation and screening on the key elements of possible alternatives. Key elements include the existing bridges, structure type, alignments relative to existing U.S. 50/301, number of lanes, structure location, transit, TSM/TDM strategies, and inclusion of a SUP. This process was informed by public feedback received during the September 2022 Public Open Houses, the June 2023 Transit and Pedestrian/Bicycle Listening Meeting, and the September 2023 Public Open Houses. In turn, the evaluation and screening of the key elements supported the development of the proposed ARDS.

Section 2.1 describes the process and data used to determine the study limits. **Section 2.2** describes each of the key elements and the options that were considered in the development of the proposed ARDS. As discussed, each key element has been presented to the public at open houses and to the Cooperating and Participating agencies in 2023 and 2024. The MDTA considered all input received from agencies and the public when evaluating and screening the key elements. A detailed description of the analysis and screening results for each element is provided in **Section 3**. A description of MDTA's proposed ARDS for the NOI is provided in **Section 4**.

2.1 Study Limits

A NEPA action must have logical termini, which the FHWA defines as (1) rational endpoints for a transportation improvement, and (2) rational end points for a review of the environmental impacts.[1] Per 23 CFR 771.111(f), the FHWA requires that proposed improvements:

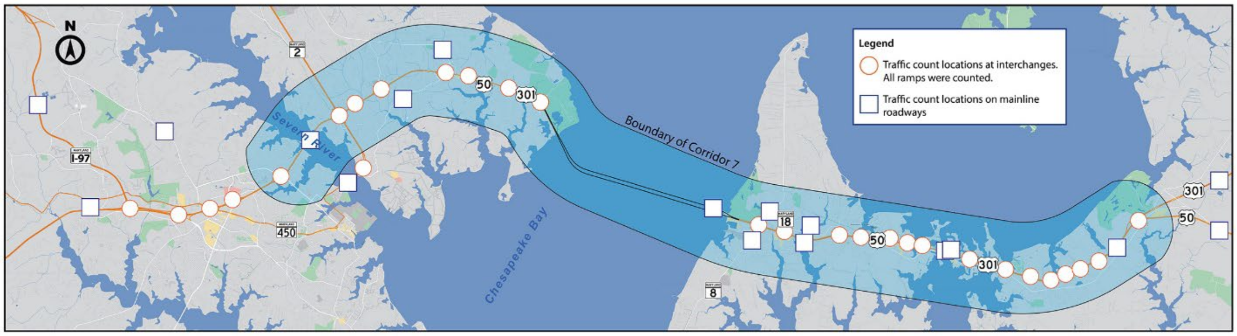
- Connect logical termini and be of sufficient length to address environmental matters on a broad scope;
- Have independent utility or independent significance, i.e., be usable and be a reasonable expenditure even if no additional transportation improvements in the area are made; and
- Not restrict consideration of alternatives for other reasonably foreseeable transportation improvements.

The Selected Corridor Alternative (Corridor 7) identified in the Tier 1 Study FEIS/ROD was used as the basis to determine the Tier 2 Study limits along U.S. 50/301. The MDTA collected and reviewed traffic data from April 1 to December 31, 2022, for the Bay Bridge and the U.S. 50/301 corridor. The effort included the collection of traffic volume data on both non-summer weekdays and summer weekends. The locations of the traffic counts can be seen in **Figure 2.1**. Traffic counts were also collected beyond the limits of Corridor 7 and were used to assist with the identification

[1] https://www.environment.fhwa.dot.gov/legislation/nepa/guidance_project_termini.aspx

of appropriate endpoints. The data collected was summarized and presented to the agencies and the public in 2023 in a series of graphics, as shown in **Figures 2.2** through 2**.7**. Additional traffic data was also collected at a small number of locations in 2023 and 2024.

Figure 2.1. Traffic Count Locations



On the Western Shore, approximately one-third of the traffic crossing the Bay Bridge traveling westbound exits from U.S. 50/301 onto the Broadneck Peninsula. **Figure 2.2** shows that 42 to 65 percent of the traffic crossing the Severn River traveling westbound enters U.S. 50/301 from the Broadneck Peninsula. At four of the five westbound interchanges between the Bay Bridge and the Severn River Bridge, more traffic enters U.S. 50/301 than exits U.S. 50/301. The ramp from southbound MD 2 alone accounts for approximately 16 to 28 percent of the vehicles on the Severn River Bridge. Therefore, there is a net increase in traffic from the Bay Bridge to the Severn River Bridge.

Traveling eastbound, **Figure 2.3** shows that approximately 55 to 71 percent of the traffic crossing the Severn River exits U.S. 50/301 to the Broadneck Peninsula, with most of that exiting traffic using MD 2/MD 450, Bay Dale Drive, or MD 179. The ramp from eastbound U.S. 50/301 to northbound MD 2 alone accounts for approximately 20 to 29 percent of the vehicles from the Severn River Bridge. Eastbound traffic across the Severn River Bridge is higher than across the Bay Bridge by approximately 39 percent on a non-summer weekday and 23 percent on a summer Friday. Overall, there is a net decrease in traffic from the Severn River Bridge to the Bay Bridge.

As noted, the traffic volumes across the Bay Bridge are lower than volumes across the Severn River Bridge on both non-summer weekdays and summer weekends. The analysis of the traffic volumes demonstrates that there is a clear distinction between traffic volumes on U.S. 50/301 associated with the Bay Bridge and traffic volumes at and west of the Severn River Bridge. Thus, while traffic on the Bay Bridge and Severn River Bridge is related, the two bridges are separate and not directly dependent on each other.

Additionally, volumes entering and exiting U.S. 50/301 at the MD 2/MD 450 interchange are more than twice as large as at any other interchange. Due to the high volumes on the MD 2/MD 450 interchange, the interchange acts as the changeover from the Severn River Bridge traffic to the Bay Bridge traffic. Therefore, a western study limit beyond the eastern end of the Severn River Bridge would go beyond the scope of addressing issues related to the crossing of the Chesapeake Bay.

Locating the logical terminus at the MD 2/MD 450 interchange allows any new lanes to be added/dropped at the interchange ramps or merged and transitioned into the existing mainline lanes within the interchange. The tie-in of the proposed improvements with the existing U.S. 50/301configuration at this interchange would not preclude any future improvements by SHA along U.S. 50/301, MD 2/MD 450, or the Severn River Bridge.

The MD 2/MD 450 interchange is therefore the western end of the logical termini given the possible extent of potential transportation improvements. This interchange is also a rational end point for a comprehensive review of environmental impacts that could result from adding transportation capacity across the Chesapeake Bay.

Conditions on the Eastern Shore are substantially different than on the Western Shore. Overall, the Eastern Shore traffic analysis showed that there is not a significant differential for eastbound or westbound traffic entering/exiting U.S. 50/301, nor is there a substantial change in traffic volume overall. The westbound traffic just west of the U.S. 50/301 split is similar to westbound traffic across the Kent Narrows Bridge, and westbound traffic across the Kent Narrows Bridge is also approximately the same as across the Bay Bridge, as shown in **Figures 2.4 and 2.5**. Eastbound, traffic across the Kent Narrows Bridge is similar to traffic crossing the Bay Bridge and also similar to traffic just west of the U.S. 50/301 split, as shown in **Figures 2.6 and 2.7**. Volumes at the MD 2/MD 450 interchange are also shown in **Figure 2.8.** While individual interchanges do show some differential between entering and exiting volumes, the overall volume on U.S. 50/301 remains relatively constant between the Bay Bridge and the U.S. 50/301 split, in both directions. The situation changes substantially at the U.S. 50/301 split, which is a major highway decision point for traffic heading north or south on the Eastern Shore. Nearly 60 percent of the traffic uses U.S. 50 and approximately 40 percent uses U.S. 301 on non-summer weekdays. On summer weekends, the traffic split is approximately 70 percent using U.S. 50 and approximately 30 percent using U.S. 301.

Locating the eastern logical terminus at the U.S. 50/301 split allows any mainline improvements that are carried to and through the interchange to be merged into the existing mainline lanes. Depending upon the lane configurations developed as part of the Tier 2 Study, it may be necessary to continue improvements just past the split, to allow transitions back to the existing typical sections of both U.S. 50 and U.S. 301. Regardless, this would not preclude any future improvements by SHA along either roadway.

The U.S. 50/301 split is therefore the western end of the logical termini given the possible extent of potential transportation improvements. This location is also a rational end point for a comprehensive review of environmental impacts that could result from adding transportation capacity across the Chesapeake Bay.

Figure 2.2. Westbound Traffic Volumes between the Severn River Bridge and the Bay Bridge

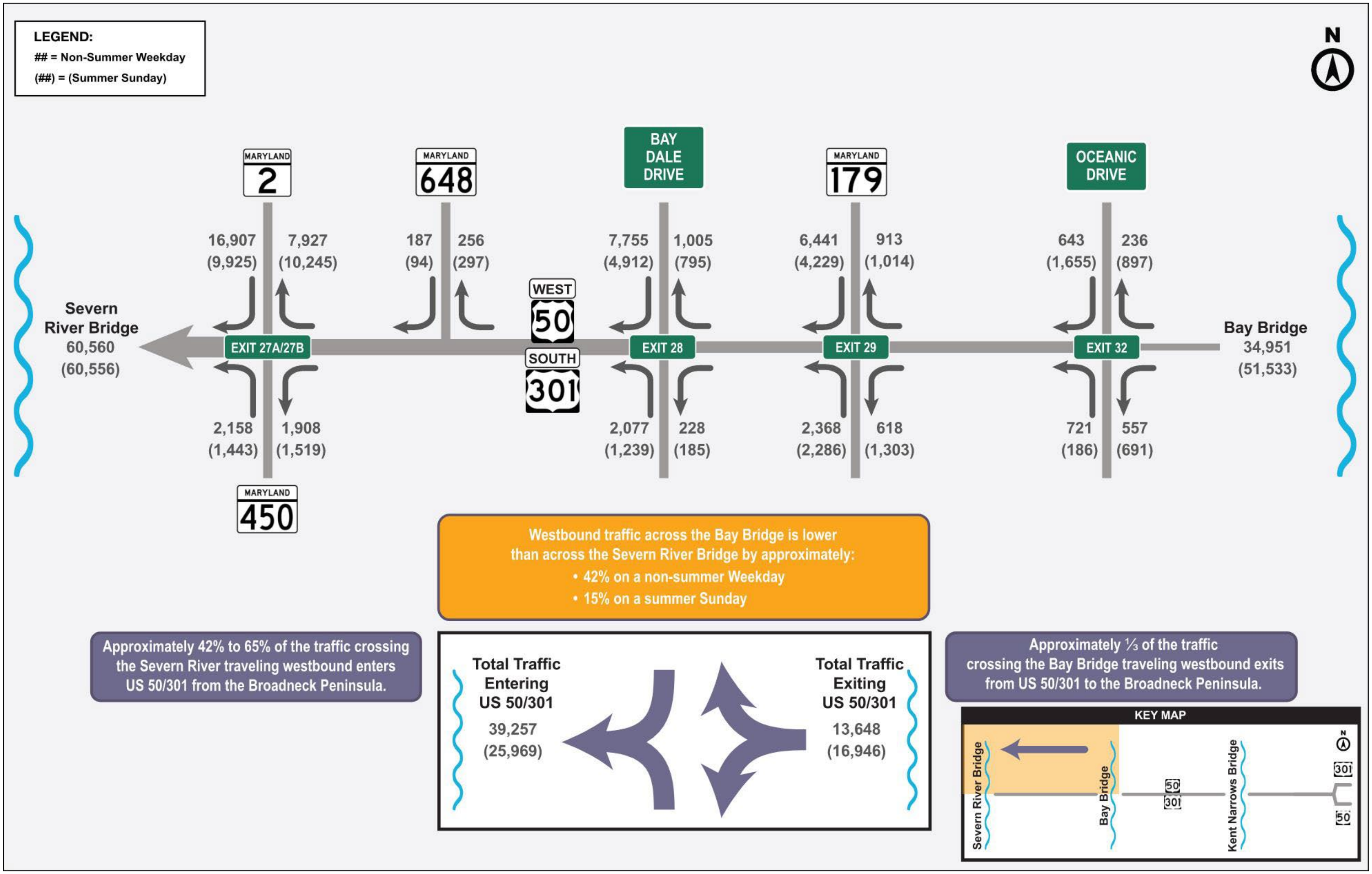


Figure 2.3. Eastbound Traffic Volumes between the Severn River Bridge and the Bay Bridge

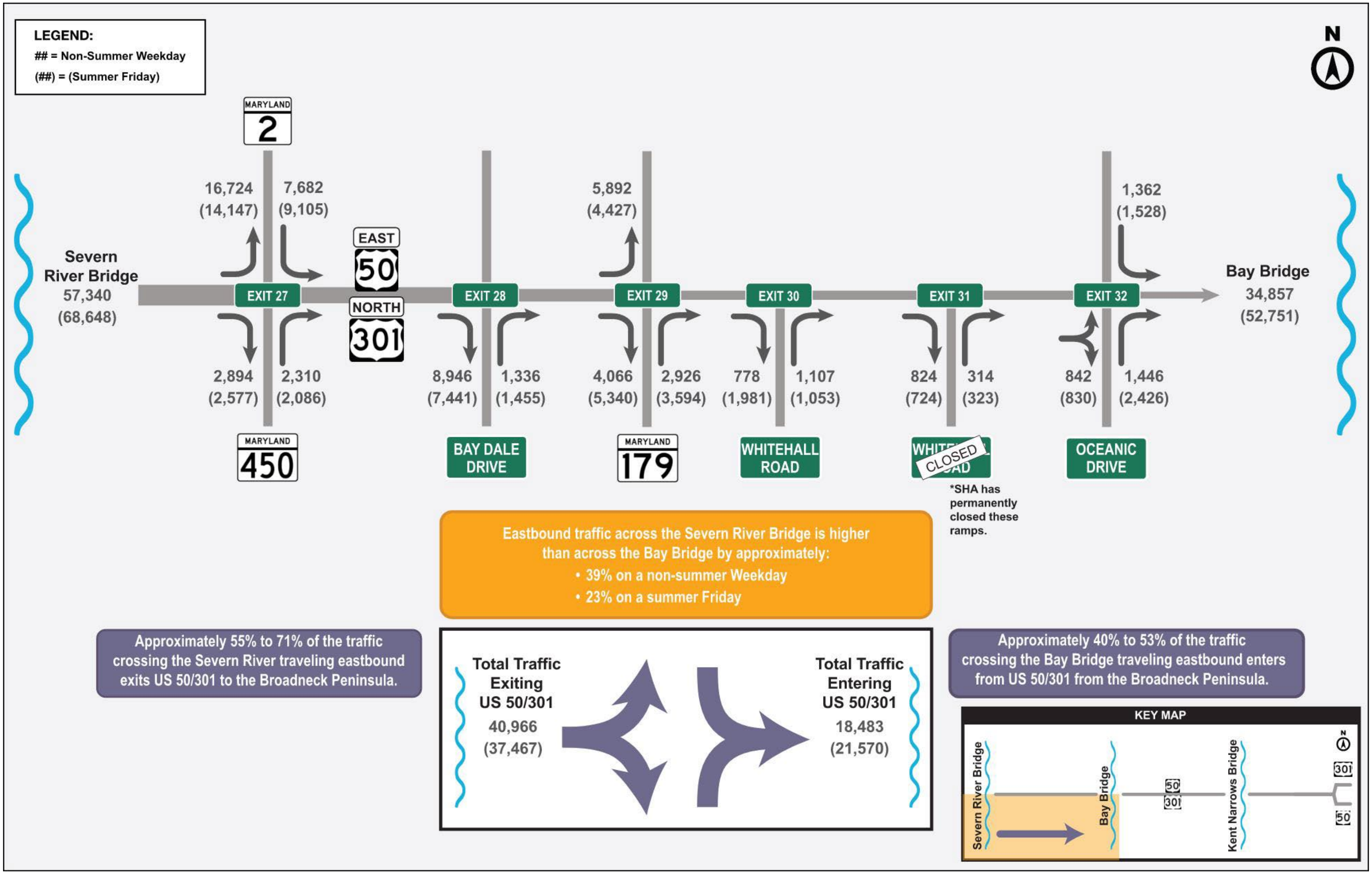


Figure 2.4. Westbound Traffic Volumes between the Kent Narrows Bridge and the U.S. 50/301 Split

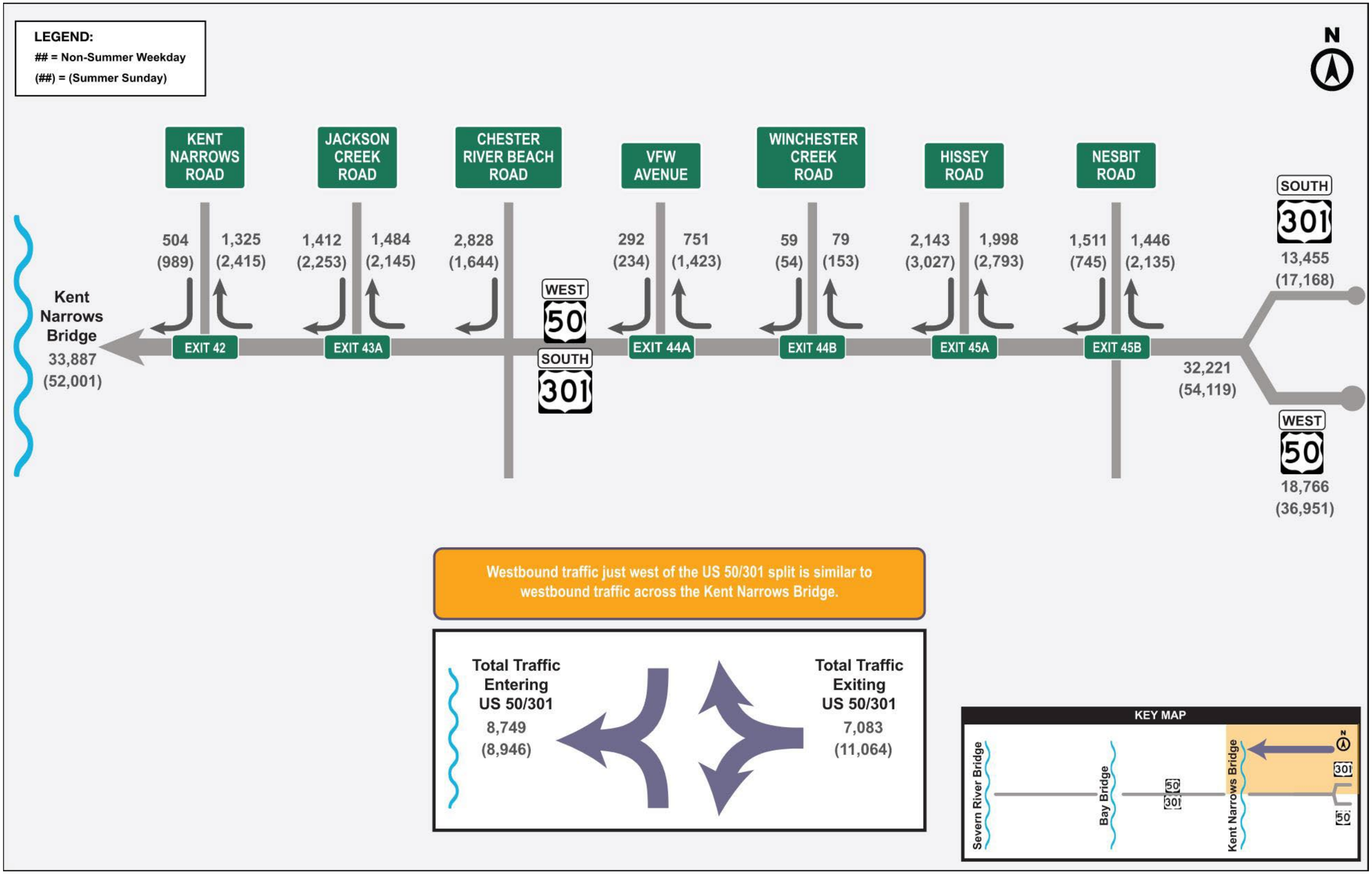


Figure 2.5. Westbound Traffic Volumes between the Bay Bridge and the Kent Narrows Bridge

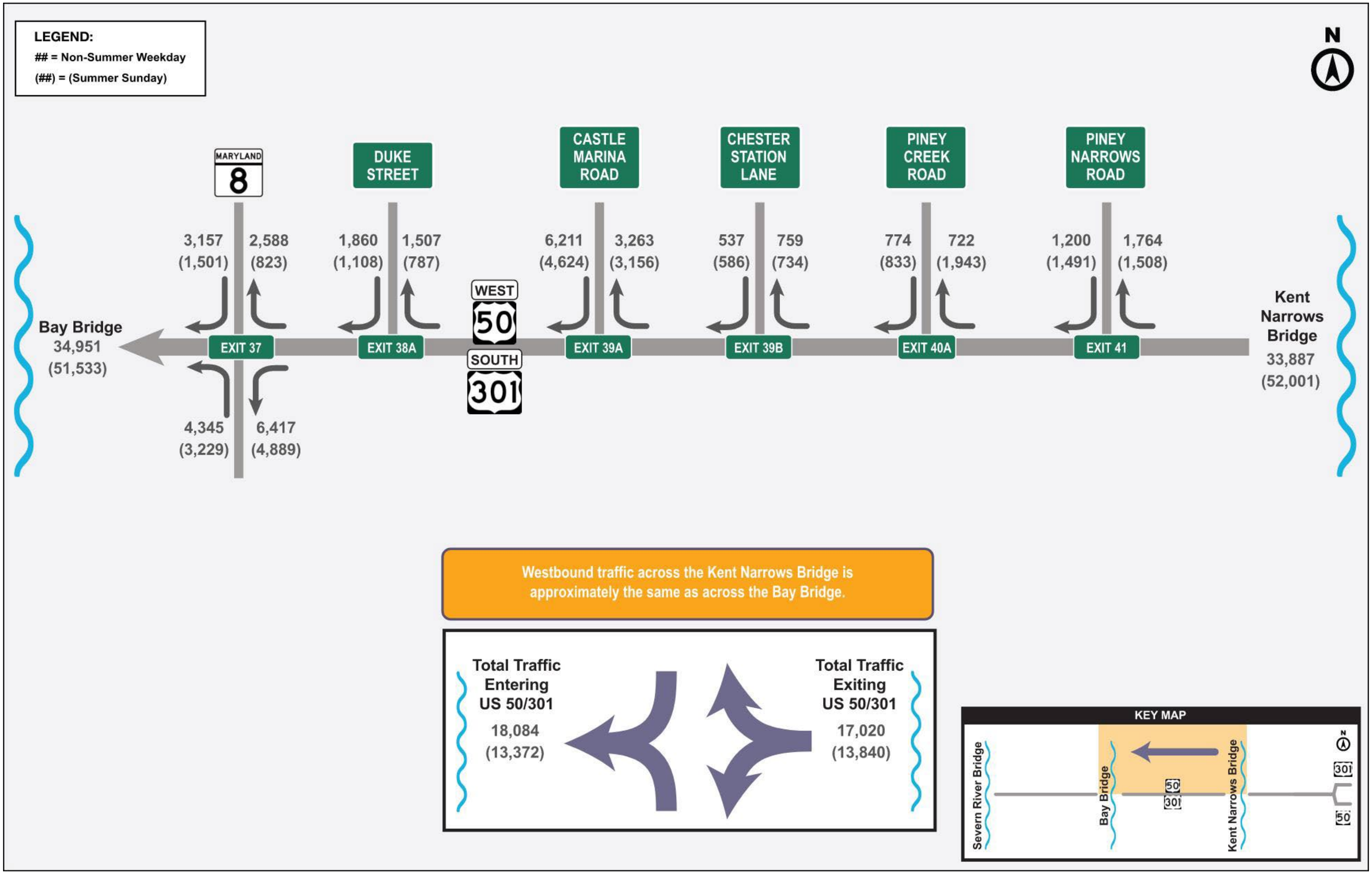


Figure 2.6. Eastbound Traffic Volumes between the Bay Bridge and the Kent Narrows Bridge

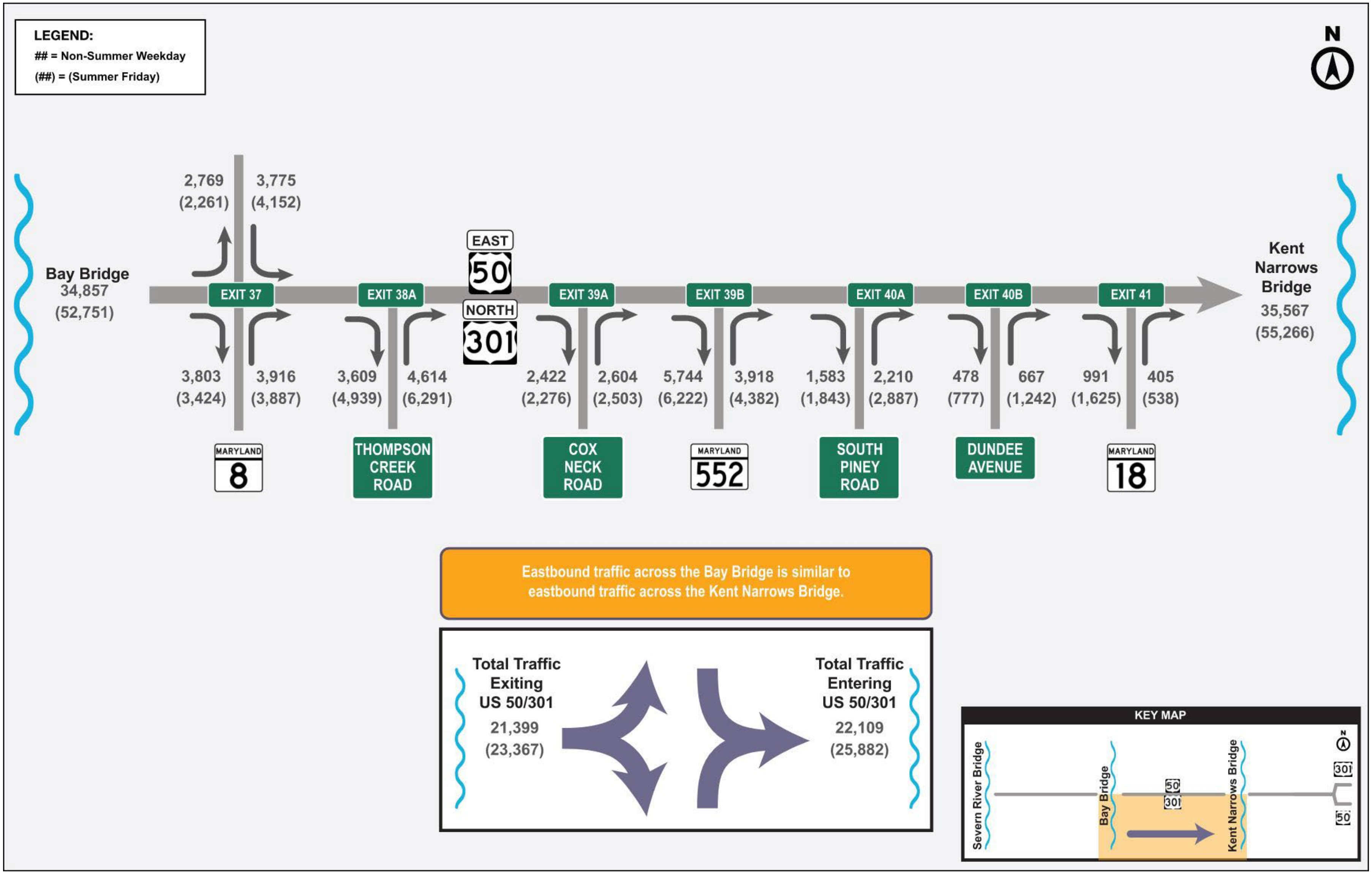


Figure 2.7. Eastbound Traffic Volumes between the Kent Narrows Bridge and the U.S. 50/301 Split

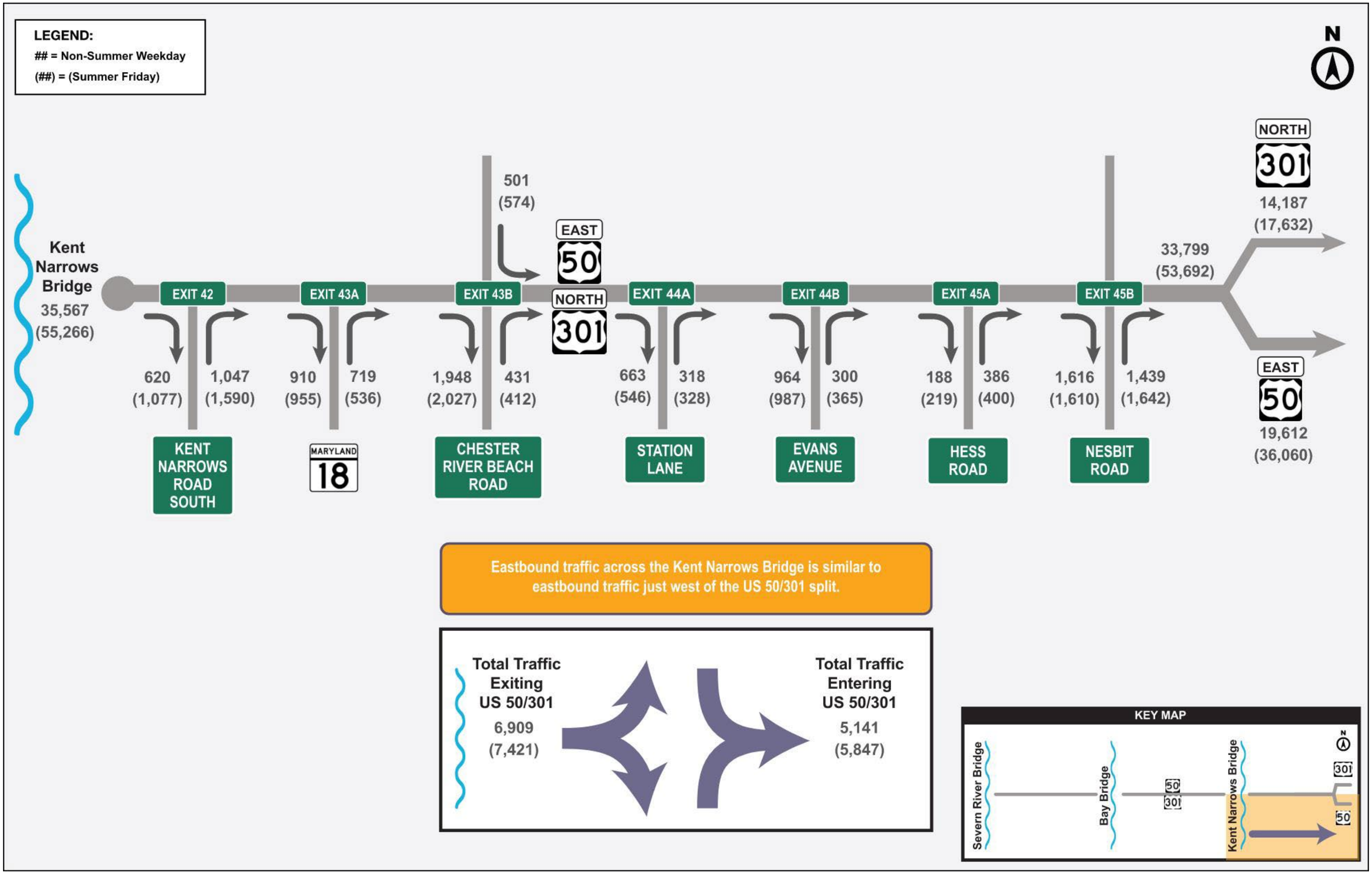
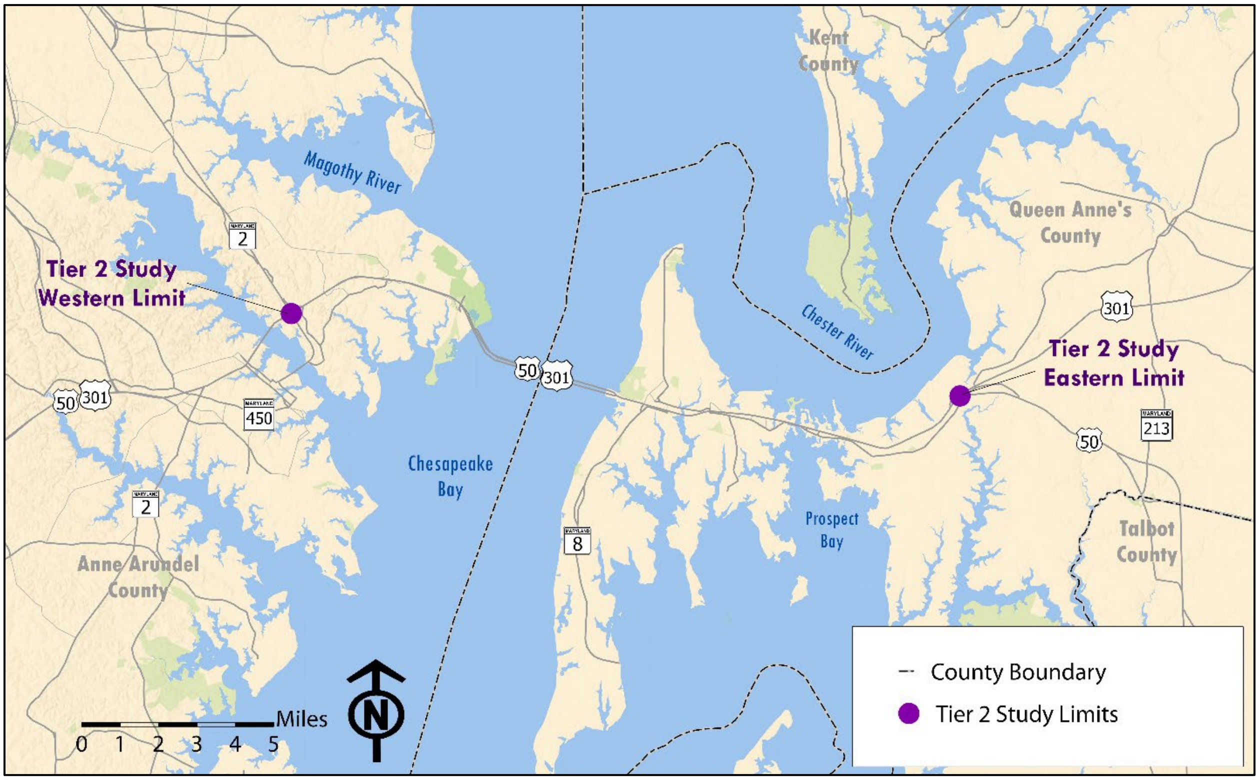


Figure 2.8. Total Traffic Volumes Entering and Exiting at Each Interchange on the Western Shore

The traffic data, analysis, and the MDTA's recommendation for proposed study limits were presented to the agencies and the public in September 2023. Based on the analysis, the western study limit is the MD 2/MD 450 interchange and the eastern study limit is the U.S. 50/301 split (see **Figure 2.9**).

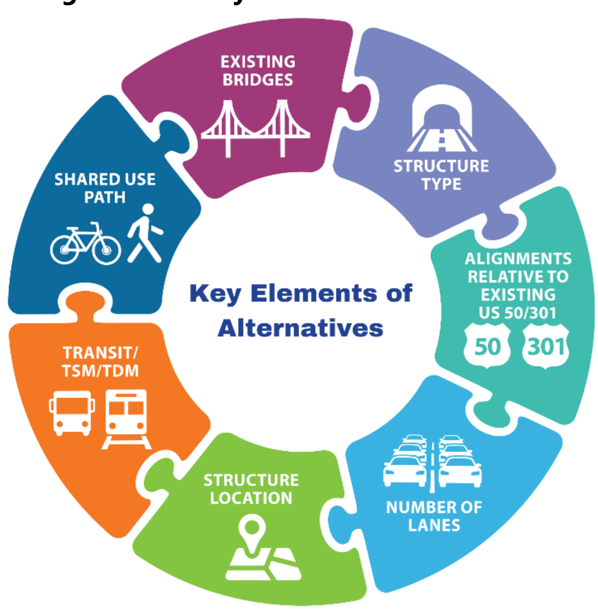
Figure 2.9. Study Limits



2.2 Summary of Key Elements of the Proposed ARDS

Key elements of alternatives were presented to the agencies for comment in the summer and fall of 2023, and to the public during the September 2023 Open Houses. They are graphically represented in **Figure 2.10** as puzzle pieces.

Figure 2.10. Key Elements of Alternatives



<u>Key Elements</u>

- **Existing Bridges:** The Bay Bridge consists of two spans: a two-lane span that handles eastbound traffic under normal conditions and a three-lane span that handles westbound traffic under normal conditions. The MDTA considered whether to remove both existing spans or to keep one or both existing spans in the future should a build alternative be implemented.
- **Structure Type:** Four main crossing structure types (full bridge – two spans, full bridge – double decker, full tunnel, and bridge-tunnel combination) were considered for a potential new Bay Crossing facility.
- **Alignment:** An alignment for the approach to a new crossing of the Chesapeake Bay off the existing U.S. 50/301 alignment was evaluated, including the consideration of unavoidable impacts to properties, environmental resources, and community resources on the Eastern and Western Shores and in the Chesapeake Bay.
- **Number of Lanes:** The following numbers of lanes were investigated: 6 lanes, 8 lanes, 10 lanes, and more than 10 lanes. These lane numbers were chosen based on preliminary traffic analysis from the Tier 1 Study and additional traffic analyses performed in Tier 2. The Tier 2 analyses used the updated traffic data and confirmed the need to provide more capacity. Proposed alternatives could include a number of lanes that varies between a future Bay crossing and the approach roadways.
- **Structure Location:** Four main crossing locations, relative to the existing crossing location (north, south, fully in-between, and far south), were considered for a potential new Bay Crossing facility.
- **Transit/Transportation Systems Management (TSM)/Transportation Demand Management (TDM):**
    - Transit: The Tier 2 Study has considered transit alternatives, such as ferry, high-capacity transit, including rail and bus rapid transit (BRT), and enhanced bus service.
    - TSM/TDM**:** The Tier 2 Study has considered TSM and TDM alternatives, in combination with other build alternatives, including options that could be implemented with or without additional lanes across the Bay (congestion pricing, ramp metering, park-and-ride facilities, and interchange consolidation) and options that can only be implemented with additional lanes across the Bay (express-local lanes, managed lanes, and part-time shoulder use lanes).
- **Pedestrian and Bicycle SUP:** The Tier 2 Study has considered the safe inclusion of a SUP in combination with other build alternatives. Any tunnel option would not be able to accommodate a SUP.

3 SCREENING PROCESS AND RESULTS

Due to the complexity of the project, the MDTA analyzed key elements described in **Section 2.2,** and screened options of each element to determine which options would be reasonable to include in the proposed ARDS. A reasonable alternative or option is one that is technically and economically feasible and meets the purpose and need for the proposed action (42 USC 4331 Sec. 102). Each element was evaluated independently, and the options that passed the screening were used to identify and develop the proposed ARDS. The intent was to develop alternatives that had potential to be reasonable.

3.1 Screening Process

The needs and objectives from the Purpose and Need were used as the screening criteria. Options that do not address the needs and objectives, and thus would not be able to address the Preliminary Purpose and Need for the proposed action, are not included in the proposed ARDS. The analysis performed for each element and the results of the screening are presented in **Sections 3.2** to **3.9**. Tables are provided that summarize the screening results for all options and indicate the needs and objectives that are addressed and likely to be met; not addressed and likely to not be met; or not determined or not applicable.

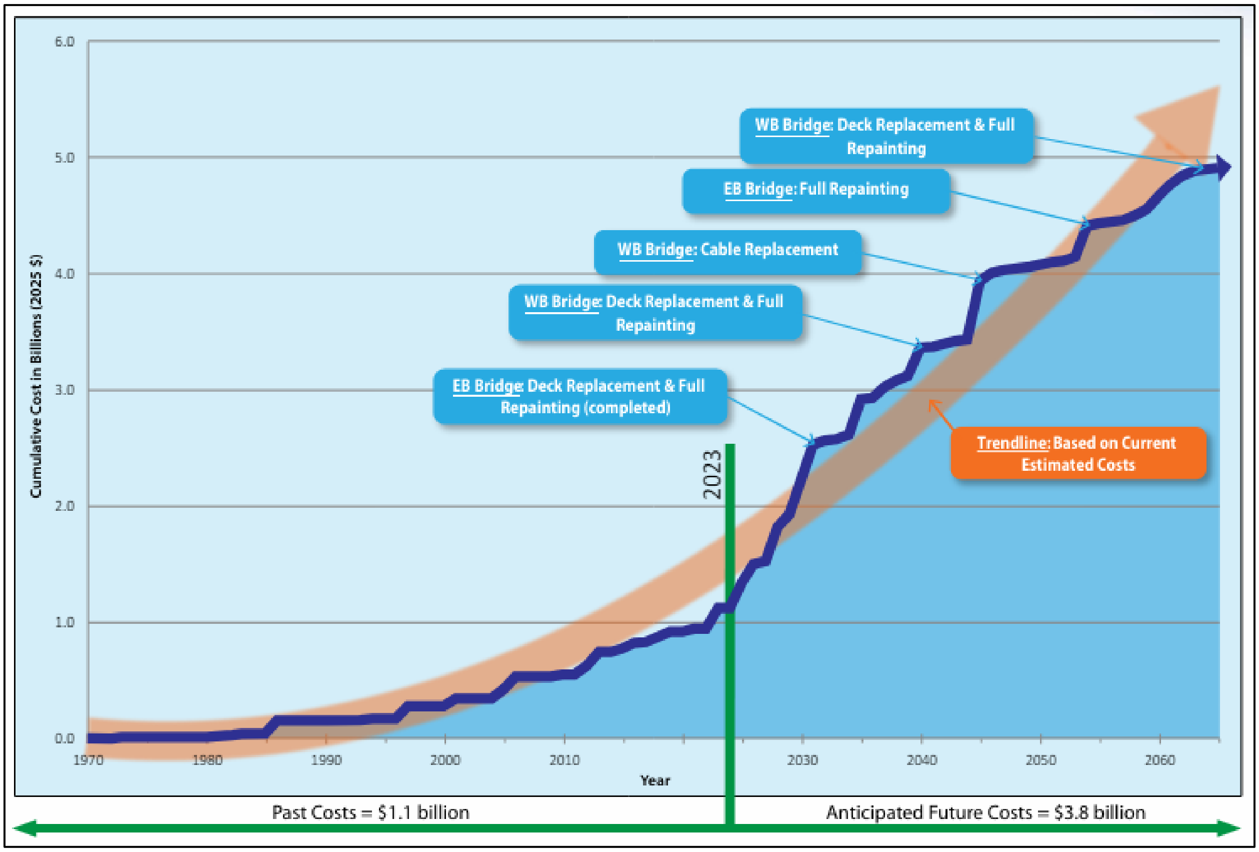
3.2 Existing Bridges

The eastbound span of the Bay Bridge is more than 70 years old, and the westbound span is more than 50 years old. The original design service life for the spans was 50 years. Keeping the spans in place will be costly from a maintenance and rehabilitation perspective and will require lane closures that would impact the traveling public. Repairs and rehabilitation are essential to keep the bridge safe and open to traffic.

There are two types of repairs performed on the bridge: repairs identified every two years during bridge inspections, such as spot painting or fixing concrete cracks; and major rehabilitation and reconstruction, such as full deck and beam replacements. Between 2023 and 2065, major reconstruction will be needed on the spans for nearly half of that time (approximately 18 years). The traveling public will be impacted by lane closures needed for this reconstruction. Though every effort will be made during these rehabilitation projects to perform lane closures only at night and during off-peak hours, the length of closures will extend into peak travel periods. Certain required major rehabilitation, like beam replacements, will require full time (24/7) lane closures, which historically have had severe traffic impacts, even in the winter months that are less affected by high vacation and weekend traffic volumes.

The cost of Bay Bridge maintenance and rehabilitation from 1970 to 2023 was $1.1 billion. Moving forward, significant ongoing investments will be necessary for ongoing maintenance repairs and major rehabilitation or reconstruction projects. The estimated cost of maintenance and rehabilitation from 2024 through 2065 is approximately $3.8 billion. A graph of the past and future maintenance and rehabilitation costs, which was presented to the agencies and the public in September 2023, can be seen in **Figure 3.1**.

Figure 3.1. Existing Bay Bridge Maintenance and Rehabilitation Costs



In addition to the high cost and prolonged impacts from necessary maintenance and rehabilitation, the current navigational vertical clearance of the Bay Bridge is 186 feet. This vertical clearance is not sufficient for existing and future ship navigation and traffic, and therefore, is also a constraint on existing and future shipping operations, employment, and economic development at the Port of Baltimore. Additionally, the roadway shoulders on the existing bridges are substandard. There are minimal offsets between the lanes and the bridge parapets, which have an impact on safety. There is no space for disabled vehicles to pull over or for emergency vehicles to quickly access an incident.

Three options were evaluated for the existing bridges element:

- Remove both existing bridge spans and provide new transportation infrastructure across the Chesapeake Bay,
- Keep one existing bridge span, remove one existing bridge span, and add replacement/additional transportation infrastructure across the Chesapeake Bay; and
- Keep both existing bridge spans and add additional transportation infrastructure across the Chesapeake Bay.

3.2.1 Screening Results

The existing bridge options were evaluated using the screening criteria to determine which should advance to the proposed ARDS. To assess whether an option was reasonable, each option was evaluated independently for each need and objective.

Removing both existing bridge spans and replacing them with new transportation infrastructure across the Bay would meet the Tier 2 Study's Purpose and Need and would therefore be reasonable. Thus, the MDTA proposes to remove the existing bridge spans and replace the transportation infrastructure across the Chesapeake Bay.

Keeping one or both existing bridge spans would not address the roadway deficiencies, existing and future maintenance, and navigation needs. These options would also not address the objective of cost and financial responsibility. The justification is summarized below:

- Roadway Deficiencies: The shoulders on the existing bridges do not meet currently accepted highway design criteria.
- Existing and Future Maintenance: Keeping the spans would require lane closures that would continue to impact the traveling public as the magnitude of the repairs increases with the age of the spans. Repairs and rehabilitation are essential to keep the bridge safe and open to traffic.
- Navigation: The vertical clearance of the existing bridge spans is a constraint on shipping and does not meet the USCG's required clearance.
- Cost and Financial Responsibility: There is a high cost associated with keeping one or both bridge spans relative to the age and condition of the existing bridge spans.

Additionally, due to the future maintenance and navigation needs, maintaining one bridge for pedestrian and bicycle use would not be reasonable. The adequate capacity and reliable travel times, the mobility needs, and the environmental responsibility objectives were not evaluated since the other needs and objectives did not have the potential to be met. Overall, keeping one or both existing bridge spans would not address the Tier 2 Study's Purpose and Need and therefore would not be reasonable.

3.3 Structure Type

Four main crossing structure type options were considered for the proposed ARDS. The structure types are full bridge (two spans), full bridge (double decker), full tunnel, and bridge-tunnel combination. The full bridge (double decker) structure type was considered in response to public comments received during the September 2022 and September 2023 Open Houses. Coordination meetings were held with the FAA, MAA, MPA, USACE, USCG, SHA, and other agencies to identify design considerations and constraints as these crossing types were evaluated.

American Association of State Highway and Transportation Officials' (AASHTO) design criteria and existing mapping (including past surveys, Geographic Information System (GIS) data, bathymetric data, and as-built plans) were used to evaluate the feasibility of the different crossing types at the various potential crossing location alignments. Some key design considerations included the Bay Bridge Airport runway approach, the pier structures of the existing bridges, oyster beds, the navigation channels of the Bay, parklands on both shores of the Bay, future dredge elevation of the navigation channels, and practical tie-ins to existing U.S. 50/301 on both sides of the Bay. The design considerations account for sea level rise and future operations at the Port of Baltimore. Other considerations included truck restrictions, operational limitation on steep grades, and accommodations for pedestrians and bicyclists.

3.3.1 Full Bridge (Two Spans)

The full bridge structure would include an over-water bridge structure crossing the full width of the Chesapeake Bay. The MDTA conducted a preliminary evaluation to determine the potential impacts associated with a bridge structure. Advantages of a full bridge compared to the other structure types, which are described in the following sections, include a smaller environmental footprint, the ability to transport hazardous materials across the Bay, lower cost, and the opportunity for inclusion of a shared use path. Advantages of having two bridge spans instead of one bridge span include redundancy; flexibility in funding; maintenance of traffic during construction, maintenance, and inspections; and the ability to use existing right-of-way with staged construction. Preliminary footprints for several configurations of connecting a new bridge to the approach roadways are shown in **Figures 3.2** through **3.5.** These figures assume eight lanes of traffic on two bridge spans (four lanes on each span) for example purposes. A discussion on the number of lanes for the crossing is provided in **Section 3.5**.

3.3.2 Full Tunnel

A preliminary evaluation was conducted for a tunnel crossing under the full width of the Chesapeake Bay that would require the construction of a roughly four-mile-long tunnel; tunnel entrance and exit portals; ventilation structures or islands; and an emergency evacuation egress route. A tunnel was studied because it would eliminate the vertical clearance of a bridge and allow navigation through the channel by vessels of all sizes. It should be noted that SUPs are impractical in a four-mile-long tunnel due to several safety and security concerns. This includes ventilation for air quality, humidity, and temperature, as well as emergency and incident management in the enclosed length of the tunnel.

In addition, the tunnel would have restrictions on the transport of certain hazardous materials including propane, fuel oil, and certain farming chemicals, which would affect local/regional deliveries as well as long distance transport. There is no alternative route for the transport of these goods. Finally, the tunnel alignments included steeper maximum grades as compared to a new bridge in order to keep the tunnel portals closer to the shore, reduce potential impacts further inland, and reduce the overall length and costs. This results in slower truck speeds and reduced capacity; the configuration of a tunnel with lanes in separate tubes or stacked would be less flexible for maintenance of traffic and incident management.

Figure 3.2. Western Shore Approach, Northern Alignment, 8-Lane Bridge

Figure 3.3. Eastern Shore Approach, Northern Alignment, 8-Lane Bridge

Figure 3.4. Western Shore Approach, Southern Alignment, 8-Lane Bridge

Figure 3.5. Eastern Shore Approach, Southern Alignment, 8-Lane Bridge

Two types of tunnels were considered: immersed tube tunnels (ITT) and bored tunnels. ITTs could be placed ten feet below the channel bed in a dredged trench on top of a bedding layer and covered with soil or stone to provide protection. Bored tunnels do not require dredging; therefore, they can avoid direct physical impacts to resources in the Bay and to the navigational channels. Since bored tunnels need to go to a depth of approximately 60 feet below the channel bed, the length of the bored tunnel would be longer than the ITT to maintain the same grade. The full-length tunnel crossing option would only be reasonable with a bored tunnel because an ITT would impact the bottom of the Chesapeake Bay for the entire four-mile length of the tunnel.

Tunnels require the construction of approach and departure portals, which are structures that transition the tunnel from being fully below the surface to the existing roadway/ground elevation. Portals require a substantial footprint to transition traffic into and out of the tunnel. A four-mile-long tunnel would require ventilation to bring fresh air into the tunnel, remove pollution and gases produced by vehicles out of the tunnel, and clear smoke in the event of a fire or other incident in the tunnel. There are also design considerations for emergency access and evacuation if people need to leave their vehicles. Ventilation is provided by equipment which can include fans and ducts within the tunnel. Some longer tunnels have ventilation structures along their length as well as near the ends of the tunnel. In order to avoid the need for a ventilation structure on an island in the Chesapeake Bay, additional ventilation equipment and space for that equipment would be required in the tunnel. To accommodate the traffic and provide adequate ventilation for an approximately four-mile-long tunnel without the need for a ventilation structure in the Bay, more tunnel bores and a wider portal would be needed. Alternatively, manmade islands could be constructed in the middle of the Bay to provide ventilation.

For the purpose of this analysis, eight lanes of traffic were assumed. A full discussion of the number of lanes is provided in **Section 3.5.** The full tunnel option would require either ventilation structures or a larger tunnel structure. To provide eight lanes of traffic with tunnels that have ventilation structures, two 60-foot-diameter bores would be needed. Each of the two bores would carry four lanes of traffic, stacked in two levels. On the other hand, to provide eight lanes of traffic with tunnels that have ventilation ducts with additional fans, which is more common for new tunnel construction, four 50-foot-diameter bores that each carry two lanes of traffic would likely be more appropriate. The approximate footprint of impacts resulting from constructing tunnel portals for both types of tunnels with eight lanes of traffic are shown in **Figures 3.6** through **3.13**.

Figure 3.6. Western Shore Approach, Northern Alignment, 8-Lane, 2-Bore Tunnel

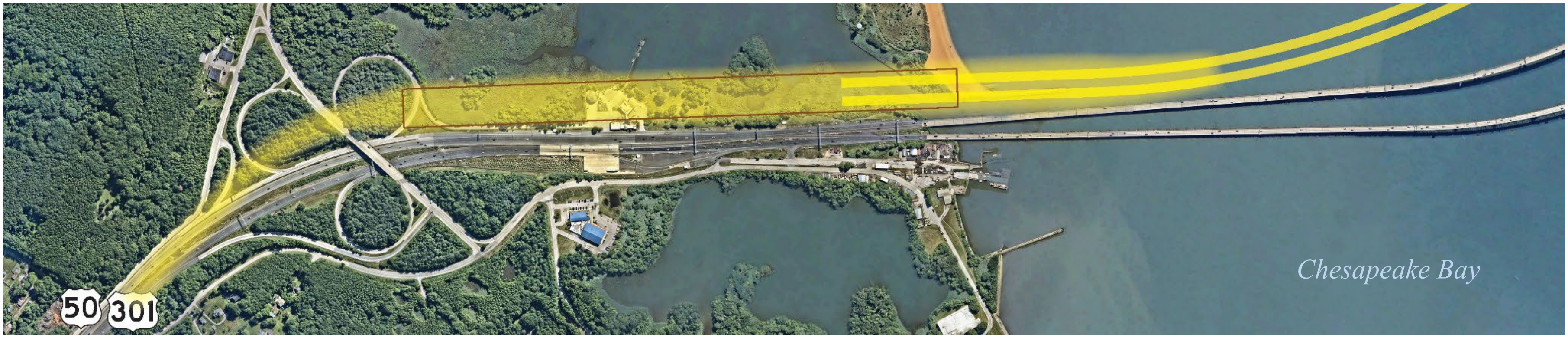


Figure 3.7. Western Shore Approach, Northern Alignment, 8-Lane, 4-Bore Tunnel

Figure 3.8. Western Shore Approach, Southern Alignment, 8-Lane, 2-Bore Tunnel

Figure 3.9. Western Shore Approach, Southern Alignment, 8-Lane, 4-Bore Tunnel

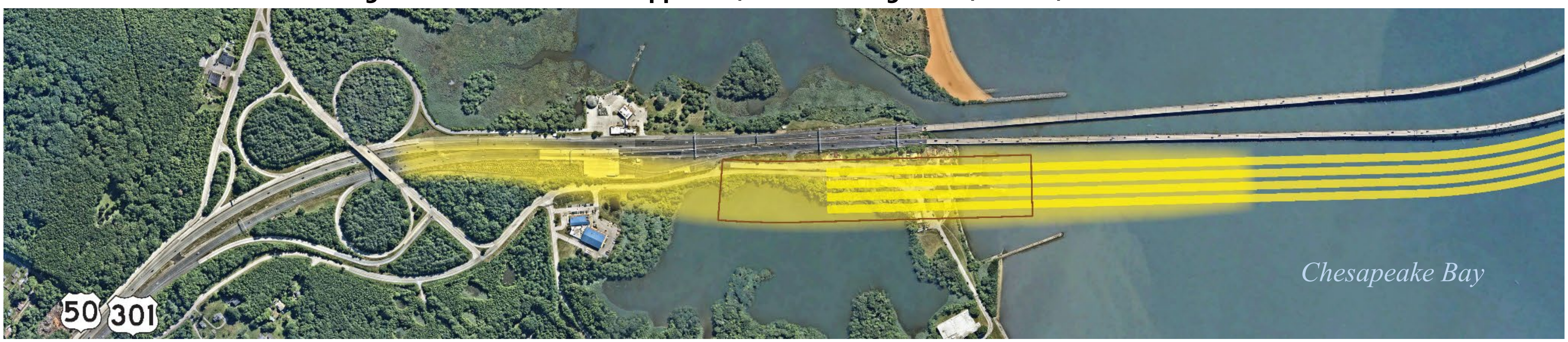


Figure 3.10. Eastern Shore Approach, Northern Alignment, 8-Lane, 2-Bore Tunnel

Figure 3.11. Eastern Shore Approach, Northern Alignment, 8-Lane, 4-Bore Tunnel

Figure 3.12. Eastern Shore Approach, Southern Alignment, 8-Lane, 2-Bore Tunnel

Figure 3.13. Eastern Shore Approach, Southern Alignment, 8-Lane, 4-Bore Tunnel

Tunneling under the entire Chesapeake Bay would result in the highest construction cost of all the evaluated structure types, as noted in **Table 3-1**. The table notes the cost for only the structure crossing. A full tunnel with eight lanes of traffic is approximately two to three-and-a-half times more expensive than a new bridge providing the same number of lanes. The environmental impact associated with tunneling would be substantial due to the depth of the Chesapeake Bay and/or increased shoreline impacts and would be much greater than the environmental effects associated with a new bridge. With a northern alignment, there would be impacts to Sandy Point State Park and Terrapin Nature Park. With a southern alignment, there would be impacts to Westinghouse Bay and the Bay Bridge Marina. Another environmental impact associated with bored tunnels would be the amount of boring spoils that would need to be disposed; nearly 100,000 cubic yards would need to be excavated and disposed. For tunnels with ten lanes of traffic, there would be greater impacts and cost than the eight lanes assumed for the analysis above.

Table 3-1. Bay Crossing Structure Cost Estimates

	8-Lane Bridge*	10-Lane Bridge*	8-Lane Tunnel	10-Lane Tunnel
Estimated Cost (2024$)	$7.2 billion to $7.5 billion	$ 8.2 billion to $8.7 billion	$16.8 billion to $17.5 billion	$21.0 billion to $21.8 billion

*Cost includes SUP and full shoulders on the bridge

The MDTA performed a review of possible environmental effects associated with the bridge and tunnel with either a north or south location. The analysis assumes eight lanes of traffic and presents the area where there would be a difference in effects for the bridge and tunnel options. The results of this analysis are presented in **Table 3-2**. Socioeconomic, cultural, and natural resources, as well as Section 4(f) and 6(f) impacts were evaluated. These impacts are for the bridge and tunnel approaches on land. In general, the north and south tunnel options have greater environmental impacts than the north and south bridge options. The north and south tunnel options would both require larger acreage of additional right-of-way (ROW). This includes impacts to Sandy Point State Park, Terrapin Nature Park, wetlands, forest areas, and Section 4(f) and 6(f) properties.

Table 3-2. All Bridge and All Tunnel Preliminary Environmental Effects (Approach Only)

Resource Type	Resource	Unit	Bridge	Tunnel
Socioeconomic Resources	ROW	acres	11-12	44-48
	Residential Property	acres	1	1-3
	Commercial Property	acres	1-2	1-18
	MDTA Police Station	acres	2-6	0-22
	Sandy Point State Park	acres	1-5	1-18
	Terrapin Nature Park	acres	1	1-22
Natural Resources	Forest Areas	acres	11-17	19-44
	Horseshoe Crab Habitat	linear ft	600-900	0-2500
	Wetlands	acres	7-9	5-17
	Surface Water*	acres	9	9
	100-Year Floodplain Area	acres	14-21	14-30

*Surface water does not include the Chesapeake Bay.

3.3.3 Bridge-Tunnel

Since a full tunnel would be approximately two to three-and-a-half times more expensive than a new bridge providing the same number of lanes, a bridge-tunnel combination was considered because it would also eliminate the vertical clearance of a bridge over the shipping channel and allow navigation through the channel by vessels of all sizes. The bridges in a bridge-tunnel combination would be shorter in length and lower in height than a full-length bridge. A bridge would cross most of the Chesapeake Bay near both shores and the tunnel would cross underneath the main navigational channel. A bridge-tunnel would eliminate the need for a long bridge span that provides the vertical clearance needed for the navigable channel, but it would require the construction of large portal islands in the middle of the Bay for the transitions between the bridge and tunnel. As noted in **Section 3.3.2**, the bridge-tunnel option would be impractical to include a SUP in the tunnel components of a bridge-tunnel crossing, would have restrictions on the transport of certain hazardous materials with no alternative route for the transport, and the tunnel alignment would have steeper grades as compared to a new bridge, which would result in slower truck speeds and reduced capacity. The configuration of a tunnel with lanes in separate tubes or stacked would be less flexible for maintenance of traffic and incident management.

Like a full tunnel option, two types of tunnels were considered for a bridge-tunnel combination: ITT and bored tunnels. An ITT would result in a bridge-tunnel combination where the tunnel would be needed under the main navigation channel and the bridge could provide sufficient vertical clearance over the secondary channel. Portal islands would be needed on both sides of the main channel in the middle of the Bay, and bridges would connect the portal islands to the existing shores. The portal islands would require a substantial amount of fill in the Bay due to the depth of the Bay. Based on preliminary analysis, the portal islands would be an average of 60 feet deep but reaching 90 feet in some areas. The dimensions of the portal islands at the Chesapeake Bay surface would be over 200 feet wide and over 0.3 miles long (a surface area of approximately 11 acres), with 2:1 slopes down to the bottom of the Bay (having a bottom surface area of approximately 17 to 23 acres). Another environmental impact associated with the ITT is the amount of excavated material; nearly 30,000 cubic yards of excavated material would need to be disposed of.

A bridge-tunnel constructed with a bored tunnel would not be feasible because the tunnel under the main channel would be deeper than an ITT, and it would not surface with enough distance to span the secondary channel with an appropriate grade and the required vertical clearance. Tunneling under both channels would require a tunnel of similar length to the full tunnel option.

3.3.4 Double Decker Bridge

A double decker bridge would be more complex than a single-deck bridge. To address the Tier 2 Study need of accommodating navigational clearance, the bottom elevation of a proposed two-level bridge would need to be the same height as a single-deck bridge, with a minimum of approximately 17 feet between the bridge deck of the lower level and the bottom of the girders of the upper level. This would put the top deck of the bridge at a higher elevation, more than 25 feet higher than the lower-level deck. To reach this higher elevation and get the upper level elevated before the bottom level comes underneath, while still meeting maximum mainline profiles, the length of structure would increase on both shorelines. If an incident on the existing bridge spans requires a temporary or permanent closure, the other bridge span can remain open. Without the redundancy of two structures, an incident that requires a closure could impact the whole crossing. One single bridge would not provide the redundancy that two separate structures would provide; this would not be reasonable from a resiliency perspective.

Additionally, it would not be safe or feasible to construct an upper-level roadway on top of an existing roadway with active traffic, so an upper level could not be added on top of existing U.S. 50/301. To construct a bridge with two levels, both levels of the approach to the bridge would need to be constructed completely off the existing approach roadway.

A double decker bridge would have fewer piers in the Bay compared to two single-deck bridges, but the piers would be larger to accommodate the additional weight of the upper level on the structure. There would be fewer towers for the main span of the bridge over the navigable channel with only one span, but these towers would be taller to accommodate the upper level, and thus require larger foundations. It is anticipated that the environmental impacts and cost for one double decker bridge would be similar to two single deck bridge spans. There would be less environmental impact to the bottom of the Bay as a result of having fewer piers, but constructing off the existing alignment for the approach to the bridges would have larger environmental impacts on the shorelines compared to a two-span single-deck bridge. A large portion of the structure cost associated with building a bridge is associated with the substructure. Building a double decker bridge would require fewer substructure elements, but those substructure elements would be larger to accommodate the larger bridge. Additionally, the structural elements for the upper deck would need to be larger than a single deck to support the cross-sectional span over the lower roadway.

3.3.5 Screening Results

The structure type options were evaluated using the screening criteria to determine which options to advance to the proposed ARDS. To assess whether an option was reasonable, each option was evaluated independently for each need and objective. The options were also evaluated relative to the other options for each objective. The results are shown in **Table 3-3**. Where a box is green, the option is likely to address the need or objective. Where a box is red, the option does not have the potential to address the need or an objective. A more detailed description of each option in relation to the screening criteria is presented below the table.

The full bridge would be designed to address all of the study's needs. The full bridge would also have the ability to better address the environmental responsibility and cost and financial responsibility objectives than the other structure type options because it would have a smaller environmental impact and cost. Additional detail can be found in **Section 3.3.1**. A full bridge option would be reasonable because it would have the ability to address the Tier 2 Study's Purpose and Need.

Table 3-3. Potential of Structure Type Options to Address the Needs and Objectives

Screening Criteria		Structure Type Options			
		Full Bridge	Full Tunnel	Bridge-Tunnel	Double-Decker Bridge
Does the option have the potential to address the need?	Adequate Capacity & Reliable Travel Times	Yes	Yes	Yes	Yes
	Mobility	Yes	No	No	Yes
	Roadway Deficiencies	Yes	Yes	Yes	No
	Existing and Future Maintenance	Yes	Yes	Yes	Yes
	Navigation	Yes	Yes	Yes	Yes
To what extent does the option address the objective?	Environmental Responsibility	Low Impact Relative to other Options (See **Table 4-2**)	High Impact Relative to other Options (See **Table 4-2**)	High Impact Relative to other Options	Low Impact Relative to other Options
	Cost and Financial Responsibility	Low Cost Relative to other Options	High Cost Relative to other Options	High Cost Relative to other Options	Low Cost Relative to other Options

The full tunnel would address the study's adequate capacity and reliable travel times, roadway deficiencies, existing and future maintenance, and navigation needs, but it would not have the potential to address the mobility need and the environmental responsibility and cost and financial responsibility objectives. The rationale is summarized below, and additional detail can be found in **Section 3.3.2**:

- **Mobility:**
  - Vehicles carrying hazardous and explosive materials, such as fertilizer and gasoline, would be prohibited from using a tunnel, and would have to be diverted to other routes.
  - A tunnel could not accommodate a pedestrian/bicycle SUP.
  - The tunnel would have steeper maximum grades than a bridge reducing speeds and capacity.

- **Environmental Responsibility:** A full tunnel would locate the transportation infrastructure below the bottom of the Chesapeake Bay and would be below grade at the

Bay's shorelines. This would eliminate impacts from lighting and reduce noise impacts from the bridge. Existing bridge piers would be removed, and the Bay bottom habitat restored at those areas. However, a full tunnel would also have substantial impacts to the Chesapeake Bay bottom due to the tunnel approach portals and manmade islands for ventilation. The portal islands would also have impacts to environmental resources on land. A north alignment would have substantial impacts to Sandy Point State Park and Terrapin Nature Park. A southern alignment would have substantial impacts to Westinghouse Bay and the Bay Bridge Marina. The full tunnel would require disposal of substantial degree of dredge and boring material, over 10 million cubic yards of spoil for an 8-lane tunnel. Additional details on the environmental impacts can be found in **Table 3-3**.

- **Cost and Financial Responsibility:** A full tunnel would be approximately two to three-and-a-half times more expensive than a new bridge that provides the same number of lanes, as noted in **Table 3-1**.

A full tunnel option would not be reasonable because it would not address the Tier 2 Study's Purpose and Need.

Similar to the full-length tunnel option, a bridge-tunnel would address the study's adequate capacity and reliable travel times, roadway deficiencies, existing and future maintenance, and navigation needs, but it would not have the potential to address the mobility need, the environmental responsibility, and cost and financial responsibility objectives. The justification is summarized below, and additional detail can be found in **Section 3.3.3**:

- **Mobility:**
  - Vehicles carrying hazardous and explosive materials, such as fertilizer and gasoline, would be prohibited from using a tunnel and would have to be diverted to other routes.
  - A tunnel could not accommodate a pedestrian/bicycle SUP.
  - The tunnel would have steeper maximum grades than a bridge thus reducing speeds and capacity.
- **Environmental Responsibility:** A bridge-tunnel option would require creation of large man-made portal islands in the Chesapeake Bay and substantial environmental impacts at the tunnel approach portals, thus resulting in substantial environmental impacts. An ITT would require the dredging of the Bay to place the tunnel segments.
- **Cost and Financial Responsibility:** A bridge-tunnel would also be more expensive than a new bridge that provides the same number of lanes. A bridge-tunnel would have the high costs associated with tunneling under a significant portion of the Bay and it would also have high costs associated with construction of the portal islands. The cost of a bridge-tunnel would be less than the cost of a full tunnel due to the shorter length of the tunnel components, but still substantially greater than a new bridge. Additionally, the preliminary cost estimates in Tier 1 showed that a bridge-tunnel would be about two to three times more expensive than a bridge.

A bridge-tunnel option would not be reasonable because it would not address the Tier 2 Study's Purpose and Need.

Compared to the full bridge option, a double decker bridge option would require additional structure to accommodate the grade change for the upper deck. Bridge piers and foundations would also need to be larger to accommodate the additional weight and height of a double decker bridge. The double decker bridge would meet the adequate capacity and reliable travel times, mobility, existing and future maintenance, and navigation needs. This option would also have the potential to address the environmental responsibility and cost and financial responsibility objectives. However, this option would not have the potential to address the roadway deficiencies need. The rationale is summarized below, and additional detail can be found in **Section 3.3.4**:

- **Roadway Deficiencies**: If an incident on the existing bridge spans requires a temporary or permanent closure, the other bridge span can remain open. Without the redundancy of two structures, an incident that requires a closure could impact the whole crossing. One single double-decker bridge would not provide the redundancy that the two existing bridge spans currently provide, and thus would not address the roadway deficiency need.

A double decker bridge option is therefore not reasonable because it does not address the Tier 2 Study's Purpose and Need.

3.4 Approach Alignments Relative to Existing U.S. 50/301

The MDTA has evaluated the feasibility of a new alignment off the existing U.S. 50/301 approach alignment. This analysis looked at diverting U.S. 50/301 from the existing U.S. 50/301 approach alignment, however, any new crossing structure on alignment would likely require diverting from the existing alignment in the vicinity of the shoreline. The MDTA used GIS data to map community and environmental resources within Corridor 7 to assist in evaluating whether an alignment off the existing U.S. 50/301 approach roadway should be advanced. The evaluation considered the resources identified as constraints to new approach alignments off the existing U.S. 50/301 alignment on both the Western Shore and Eastern Shore. Tables identifying the community, historic, and natural environmental resources within Corridor 7 were presented to the public at the September 2022 Open Houses and a map showing identified environmental, historic, and community resources within Corridor 7 was presented to the public at the September 2023 Open Houses. Important resources on each shore of the Bay are described below.

Western Shore: From MD 2/MD 450 to the existing Bay Bridge there are dense neighborhoods, parks, wetlands, commercial facilities, and community facilities. Specific constraints on the north side of U.S. 50/301 include Broadneck Park, Bay Head Park, Sandy Point State Park, Corcoran Environmental Study Area, seven schools, six churches, Mill Creek, and Little Magothy River. Specific constraints on the south side of U.S. 50/301 include St. Margarets Day School, Holly Beach Farm, Mill Creek, Whitehall Creek, Rideout Creek, and Meredith Creek.

Eastern Shore: Between the existing Bay Bridge eastern approach and the Kent Narrows Bridge, there are dense community areas and various environmental resources near the Kent Narrows Bridge. Specific constraints on the north side of U.S. 50/301 include Terrapin Nature Park, Kent

Island Narrows Landing, Long Point Park, Piney Creek Nature Area, Waterman's Basin, six schools, the Historic Stevensville neighborhood, and Cox Creek. Specific constraints on the south side of U.S. 50/301 include various neighborhoods and commercial areas of Stevensville and Chester; Cox, Crab Alley, Kirwan, and Goodhands Creeks; and the Bay Bridge Airport.

The area between the Kent Narrows Bridge and the U.S. 50/301 split has neighborhoods, many environmental resources, and Grasonville. Specific constraints on the north side of U.S. 50/301 include wetlands, Jackson Creek, and Winchester Creek. Specific constraints on the south side include community facilities of Grasonville, wetlands, natural oyster bars, and Marshy Creek. It is important to note that alternative alignments through this section would most likely include a new crossing of Kent Narrows.

3.4.1 Screening Results

The approach alignments relative to existing U.S. 50/301 options were evaluated using the screening criteria to determine which options to advance to the proposed ARDS. To assess whether an option was reasonable, each option was evaluated independently for each need and objective. The options were also evaluated relative to the other options for each objective. The results are shown in **Table 3-4**. Where a box is green, the option is likely to address the need or objective. Where a box is red, the option does not have the potential to address the need or an objective. Where a box is white, the need was not applicable to the option because the need applies only to the existing Bay Bridge, and this element applies only to the approach roadways. A more detailed description of each option in relation to the screening criteria is presented below the table.

An approach alignment on existing U.S. 50/301 would be designed to meet the adequate capacity and reliable travel times and mobility needs. This option would have the ability to address the environmental responsibility and cost and financial responsibility objectives, relative to an alignment off existing U.S. 50/301. The roadway deficiencies, existing and future maintenance, and navigation needs are not applicable to this option because these needs apply to the existing Bay Bridge. As such, an approach alignment on the existing U.S. 50/301 centerline is reasonable to advance because it has the ability to address the Tier 2 Study's Purpose and Need.

An approach alignment off the existing U.S. 50/301 centerline would be designed to meet the adequate capacity and reliable travel times and mobility needs, but it would have a higher relative environmental impact and cost compared to an alignment along existing U.S 50/301. The roadway deficiencies, existing and future maintenance, and navigation needs are not applicable to this option because these needs apply to the existing Bay Bridge.

Table 3-4. Potential of Approach Alignment Options to Address the Needs and Objectives

Screening Criteria		Alignment Options Relative to Existing U.S. 50/301	
		Approach Alignment on Existing	Approach Alignment off Existing
Does the option have the potential to address the need?	Adequate Capacity & Reliable Travel Times	Yes	Yes
	Mobility	Yes	Yes
	Roadway Deficiencies	Not Applicable	Not Applicable
	Existing and Future Maintenance	Not Applicable	Not Appliable
	Navigation	Not Applicable	Not Applicable
To what extent does the option address the objective?	Environmental Responsibility	Low Impact Relative to other Options	High Impact Relative to other Options
	Cost and Financial Responsibility	Low Cost Relative to other Options	High Cost Relative to other Options

An approach alignment off the existing U.S. 50/301 centerline would not have the potential to address the study's objectives. The justification is summarized below:

- Environmental Responsibility: There would be substantial unavoidable impacts to environmental and community resources. This would include Section 4(f) properties such as Sandy Point State Park, Holly Beach Farm, Terrapin Nature Preserve, and historic sites; Section 6(f) properties including Sandy Point State Park and Holly Beach Farm; community facilities; numerous wetlands, tidal and non-tidal waters; forests; and private property.
- Cost and Financial Responsibility: There would be substantial cost associated with constructing a completely new roadway, including costs for both construction itself and ROW acquisition.

An approach alignment off the existing U.S. 50/301 centerline therefore would not be reasonable because it would not address the Tier 2 Study's Purpose and Need.

3.5 Number of Lanes

The MDTA has considered a wide range of lane configurations for the approach roads and the bridge, including: six lanes, eight lanes, 10 lanes, and more than 10 lanes. These lane numbers were chosen based on preliminary traffic analysis from the Tier 1 Study EIS and the need to provide more capacity. The lower limit was chosen as six lanes because that would provide an additional lane across the Bay compared to the existing condition but would match the existing condition on the approach roadways. The upper limit was chosen as more than 10 lanes because the U.S. 50/301 corridor is heavily developed with commercial properties, residential properties, frontage roads, and a variety of cultural and natural resources adjacent to the roadway on both shores. Based on preliminary analysis, substantially greater environmental and community impacts would be expected with widening the approach roads to more than twice their existing footprint to accommodate more than 10 lanes.

The existing Bay Bridge has less capacity than the approach roadways for several reasons. The bridge has two eastbound lanes and three westbound lanes, one of which can be reversed to provide a third lane for eastbound traffic. Assuming weather conditions permit the use of two-way operations on the westbound bridge, the off-peak direction only has two lanes of capacity, compared to the approaches with 3 lanes. Additionally, the following factors contribute to a reduction in capacity on the Bay Bridge:

- The steep vertical grades across the bridge cause trucks to travel at a speed that is slower than the other vehicles;
- The lack of shoulders across the bridge and the height of the bridge above the Bay create fear for some individuals, causing them to drive more slowly;
- The speed limit across the bridge is lower than on the approach roads; and
- Maintenance activities and incident management often require lane closures due to lack of space on the roadway and shoulders, as noted in **Section 2.4**.

Potential lane combinations are based on the number of lanes provided across the new bridge and the approaches on U.S. 50/301. However, the locations of transition between the number of approach lanes and number of crossing lanes have not been identified yet. The number of lanes in each area and the locations of transitions will be informed by future traffic and capacity analysis, using combinations of the number of lanes as described above as a starting point.

The evaluated lane combinations included:

- **"6-6-6":** 6 lanes on the Western Shore, 6 lanes on the crossing, and 6 lanes on the Eastern Shore;
- **"6-8-6":** 6 lanes on the Western Shore, 8 lanes on the crossing, and 6 lanes on the Eastern Shore;
- **"8-8-8":** 8 lanes on the Western Shore, 8 lanes on the crossing, and 8 lanes on the Eastern Shore;
- **"8-10-8":** 8 lanes on the Western Shore, 10 lanes on the crossing, and 8 lanes on the Eastern Shore; and
- **"10-10-10":** 10 lanes on the Western Shore, 10 lanes on the crossing, and 10 lanes on the Eastern Shore.

Travel demand forecasts were prepared for the year 2045 for the No-Build condition and for the five combinations of lane configurations described above. These volumes were prepared through use of the Maryland Statewide Transportation Model; for each alternative under consideration, two sets of forecasts were prepared:

- Non-Summer Weekday, which represents typical non-summer Tuesdays and Wednesdays for both the eastbound and westbound directions, and
- Summer Weekend, which represents Summer Fridays in the eastbound direction and Summer Sundays in the westbound direction.

Capacity analyses were then performed at a preliminary level. These analyses focused on the Bay Crossing itself (not the approach roads), because, as noted above, the existing Bay Bridge has a lower capacity than its approach roadways and the purpose of the study is to address existing and future transportation capacity needs and access across the Chesapeake Bay and at the Chesapeake Bay Bridge approaches. The results of these analyses showed the preliminary maximum queue lengths anticipated and the preliminary number of hours during which queues would be expected to exceed one mile in length; they are summarized in **Table 3-5**.

Table 3-5. Preliminary Traffic Analysis for Number of Lanes

			Eastbound		Westbound	
Scenario	Conditions	Daily Traffic Volume	Maximum Queue (miles)	Duration of Queues >1 Mile (hours)	Maximum Queue (miles)	Duration of Queues > 1 Mile (hours)
No-Build 6-5-6	NSWD (1)	91,150	4.1	4	4.9	11
	SWED	130,500	>10	14	>10	14
6-6-6	NSWD	91,800	4.3	4	1.2	2
	SWED	130,500	>10	14	>10	14
6-8-6	NSWD	92,600	0.0	0	0.0	0
	SWED	143,150	7.3	10	8.0	10
8-8-8	NSWD	93,450	0.1	0	0.0	0
	SWED	148,600	7.5	11	8.4	11
8-10-8	NSWD	93,850	0.0	0	0.0	0
	SWED	148,650	0.0	0	0.0	0
10-10-10	NSWD	94,450	0.0	0	0.0	0
	SWED	150,900	0.0	0	0.0	0

NSWD = Non-Summer Weekday
SWED = Summer Weekend Day
(1) Assumes three lanes eastbound during any hours that eastbound queuing would occur with only two lanes eastbound.

Examination of **Table 3-5** reveals the following:

- Under 2045 no-build conditions, extensive queues, both in terms of physical length and duration, would be expected under both Non-Summer Weekday conditions and Summer Weekend conditions.
- The 6-6-6 option would also show queuing under both Non-Summer Weekday conditions and Summer Weekend conditions. (The 6-6-6 scenario is identical to no-build on Summer Weekends.)
- None of the other options are expected to show queuing at the Bay Crossing on Non-Summer Weekdays.

- The 8-10-8 and 10-10-10 options would show no queuing at the Bay Crossing on Summer Weekends.

The lane combination options are described below.

3.5.1 Six Lanes on Western Shore, Six Lanes on Bridge, Six Lanes on Eastern Shore (6-6-6)

The 6-6-6 lane configuration would add one additional lane on the bridge and maintain the existing number of lanes on both shores. This configuration could be provided with either two new three-lane spans or with maintaining the existing westbound span and providing one new three-lane eastbound span. In the existing condition, there are five total lanes with three of those lanes operating in the peak direction, weather permitting. The use of contraflow allows one lane on the westbound bridge to be converted to an eastbound lane when the eastbound direction is the peak direction. Adding a sixth lane on the bridge would always provide a third lane for both directions, regardless of weather conditions. The preliminary traffic analysis summarized in **Table 3-5** indicated that there would still be queues with a maximum length of 4.3 miles in the non-summer weekday eastbound direction; queues of one mile or longer would persist for four hours. Queues up to 1.2 miles in the non-summer weekday westbound direction would be expected to occur, with queues of one mile or longer persisting for two hours. Queues of over ten miles would be expected on summer weekends in both directions. Queues of one mile or longer would be expected in each direction for 14 hours.

One additional lane on the crossing would not reduce queuing in the peak direction on summer weekends, compared to the no-build configuration in 2045. This would be the case with both two new three-lane spans and with maintaining the existing westbound span and constructing one new span.

3.5.2 Six Lanes on Western Shore, Eight Lanes on Bridge, Six Lanes on Eastern Shore (6-8-6)

The 6-8-6 lane configuration would add three additional lanes on the bridge and maintain the existing number of lanes on both shores. This configuration would be provided with two new four-lane spans. The preliminary traffic analysis summarized in **Table 3-5** indicated that there would generally not be queues on non-summer weekdays. However, queues over seven miles would be expected on summer weekends in both directions. Queues of one mile or longer would be expected in each direction for up to 10 hours.

3.5.3 Eight Lanes on Western Shore, Eight Lanes on Bridge, Eight Lanes on Eastern Shore (8-8-8)

The 8-8-8 lane configuration would add three additional lanes on the bridge and add one lane in each direction on both shores. This configuration would be provided with two new four-lane spans. The preliminary traffic analysis summarized in **Table 3-5** indicated that there would generally not be queues on non-summer weekdays, except possibly a short eastbound queue. However, queues over seven to eight miles would be expected on summer weekends in both directions. Queues of one mile or longer would be expected in each direction for up to 11 hours.

3.5.4 Eight Lanes on Western Shore, Ten Lanes on Bridge, Eight Lanes on Eastern Shore (8-10-8)

The 8-10-8 lane configuration would add five additional lanes on the bridge and add one lane in each direction on both shores. This configuration would be provided with two new five-lane spans. The preliminary traffic analysis summarized in **Table 3-5** indicated that an 8-10-8 configuration would perform well with 2045 Build traffic volumes, with no anticipated queuing on the bridge during the peak periods.

3.5.5 Ten Lanes on Western Shore, Ten Lanes on Bridge, Ten Lanes on Eastern Shore (10-10-10)

The 10-10-10 lane configuration would add five additional lanes on the bridge and add two lanes in each direction on both shores. This configuration could be provided with two new five-lane spans. More than eight lanes on the Eastern and Western Shores and more than ten lanes on the bridge are not proposed to be included in the proposed ARDS. The preliminary traffic analysis summarized in **Table 3-5** indicated that an 8-10-8 configuration would perform well with 2045 Build traffic volumes, with no anticipated queuing on the bridge during the peak periods. Thus, a larger 10-10-10 lane configuration would not be necessary to accommodate 2045 traffic volumes. Additionally, early resource analysis indicated that a design footprint larger than the 8-10-8 lane configuration would have greater environmental impacts.

3.5.6 Screening Results

The number of lanes options were evaluated using the screening criteria to determine the options that would advance to the proposed ARDS. To assess whether an option was reasonable, each option was evaluated independently for each need and objective. The options were also evaluated relative to the other options for each objective. The results are shown in **Table 3-6**. Where a box is green, the option is likely to address the need or objective. Where a box is red, the option does not have the potential to address the need or an objective. A more detailed description of each option in relation to the screening criteria is presented below the table.

The 6-8-6, 8-8-8, and 8-10-8 options would be designed to address the study's needs. These options also have the ability to address the study's objectives. Additional detail can be found in **Table 3-6** and **Sections 3.5.2** through **3.5.4**. The 6-8-6, 8-8-8, and 8-10-8 options are reasonable because they have the ability to address the Tier 2 Study's Purpose and Need.

Because the 6-6-6 lane configuration option would add only one travel lane across the Chesapeake Bay and would not add any travel lanes to U.S. 50/301 east and west of the existing Bay Bridge, this option would result in less environmental impact than the other proposed build alternatives. Expanding the existing crossing from five to six lanes would also be less costly than the other options, which would expand the crossing to eight or ten lanes. The 6-6-6 option would address the study's mobility, roadway deficiencies, existing and future maintenance, and navigation needs, but it would not have the ability to address the adequate capacity and reliable travel times need. The justification is summarized below, and additional details can be found in **Section 3.5.1**:

- **Adequate Capacity and Reliable Travel Times:** The 6-6-6 option would not appreciably reduce congestion or improve the travel time reliability relative to existing and 2045 no-build conditions.

Table 3-6. Potential of Number of Lanes Options to Address the Needs and Objectives

Screening Criteria		Number of Lanes				
		6-6-6	6-8-6	8-8-8	8-10-8	10-10-10
Does the option have the potential to address the need?	Adequate Capacity & Reliable Travel Times	No	Yes	Yes	Yes	Yes
	Mobility	Yes	Yes	Yes	Yes	Yes
	Roadway deficiencies	Yes	Yes	Yes	Yes	Yes
	Existing and Future Maintenance	Yes	Yes	Yes	Yes	Yes
	Navigation	Yes	Yes	Yes	Yes	Yes
To what extent does the option address the objective?	Environmental Responsibility	Low Impact Relative to 10-10-10 Option	Low Impact Relative to 10-10-10 Option	Low Impact Relative to 10-10-10 Option	Low Impact Relative to 10-10-10 Option	High Impact Relative to other Options
	Cost and Financial Responsibility	Low Cost Relative to 10-10-10 Option	Low Cost Relative to 10-10-10 Option	Low Cost Relative to 10-10-10 Option	Low Cost Relative to 10-10-10 Option	High Cost Relative to other Options

A 6-6-6 option is therefore not reasonable because it does not address the Tier 2 Study's Purpose and Need.

The 10-10-10 option would address the study's needs. However, preliminary analysis shows that the 8-10-8 option would provide sufficient additional capacity to alleviate congestion and improve travel time reliability compared to existing and 2045 no-build conditions. Thus, a larger 10-10-10 option, which would add an additional lane in each direction along the U.S. 50/301 approaches compared to the 8-10-8 lane configuration, would not be necessary to accommodate future traffic volumes and would provide more transportation capacity than necessary. Additionally, the 10-10-10 option would not have the potential to address the environmental responsibility and cost and financial viability objectives compared to the other options. The justification is summarized below, and additional detail can be found in **Table 3-5** and **Section 3.5.5**:

- **Environmental Responsibility:** The 10-10-10 configuration would have a larger footprint and require additional right-of-way along U.S. 50/301 on both the Eastern and Western Shores, which would have greater impacts to the environment and local communities compared to any of the other lane options.
- **Cost and Financial Responsibility:** The 10-10-10 lane configuration would include substantial additional roadway infrastructure construction and thus would be more costly than any of the other lane options.

Constructing a roadway larger than the 8-10-8 lane configuration would have greater impacts, cost more money, and have diminishing returns in terms of traffic improvement. The 10-10-10 option, and any number of lane combinations that have more than eight lanes on the Eastern and Western Shores and more than ten lanes on the bridge, are therefore not being advanced, because they would not address the Tier 2 Study's Purpose and Need.

3.6 Structure Location

The MDTA has evaluated the location of a new bridge. The alignments for the roadway east and west of a new bridge would remain along the existing U.S. 50/301 alignment to reduce environmental effects, but at the shorelines, the approach alignment would be adjusted to connect the approach roads to a new bridge. The alignment options for a new bridge were evaluated at a "north bridge location," a "south bridge location," an "in-between bridge location," and a "far south bridge location." The MDTA has proposed these locations in relation to the existing Bay Bridge.

3.6.1 North Bridge Location

A north bridge location could include the following options, which are also shown in **Figure 3.14**:

- Two spans to the north of the existing westbound Bay Bridge span; or
- One span north of the westbound Bay Bridge span and one span between the existing westbound and eastbound span.

There are different advantages to both options. A new bridge could be located completely to the north to avoid conflicting with the existing spans during construction. If one of the existing Bay Bridge spans is removed after construction of one of the new bridge spans, the other new bridge span could be constructed between the existing bridge span locations. For both options, removal of the existing spans could be sequenced into the maintenance of traffic to maintain the number of existing lanes during construction of the new bridge spans.

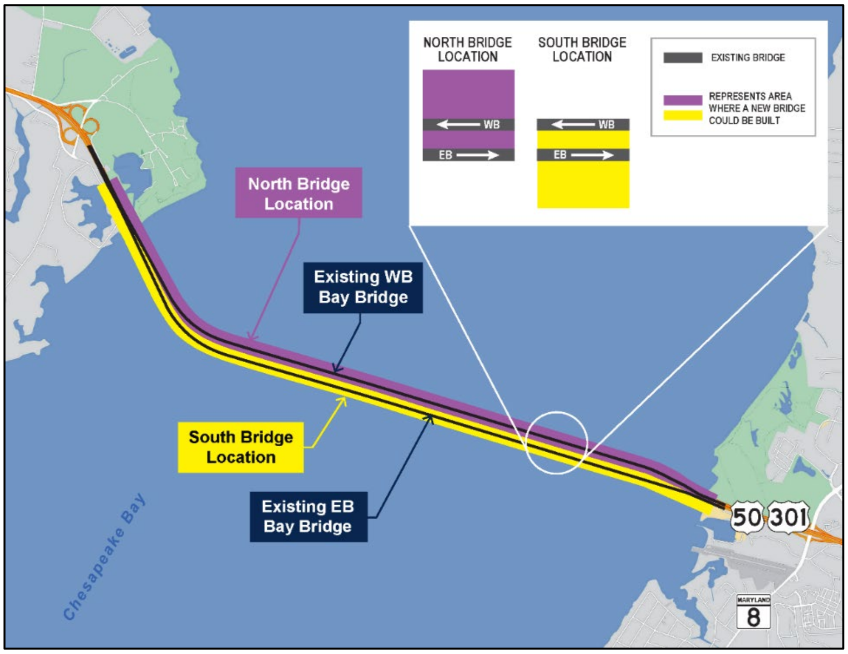
3.6.2 South Bridge Location

A south bridge location could include the following options, which are also shown in **Figure 3.14**:

- Two spans to the south of the existing eastbound Bay Bridge span; or
- One span south of the eastbound Bay Bridge span and one span between the existing westbound and eastbound span.

Like the north bridge location, there are different advantages to both options. A new bridge could be located completely to the south to avoid conflicting with the existing spans during construction. If one of the existing Bay Bridge spans is removed after construction of one of the new bridge spans, the other new bridge span could be constructed between the existing bridge span locations. For both options, removal of the existing spans could be sequenced into the maintenance of traffic to maintain the number of existing lanes during construction of the new bridge spans.

Figure 3.14. Potential Bridge Location



3.6.3 In-Between Bridge Location

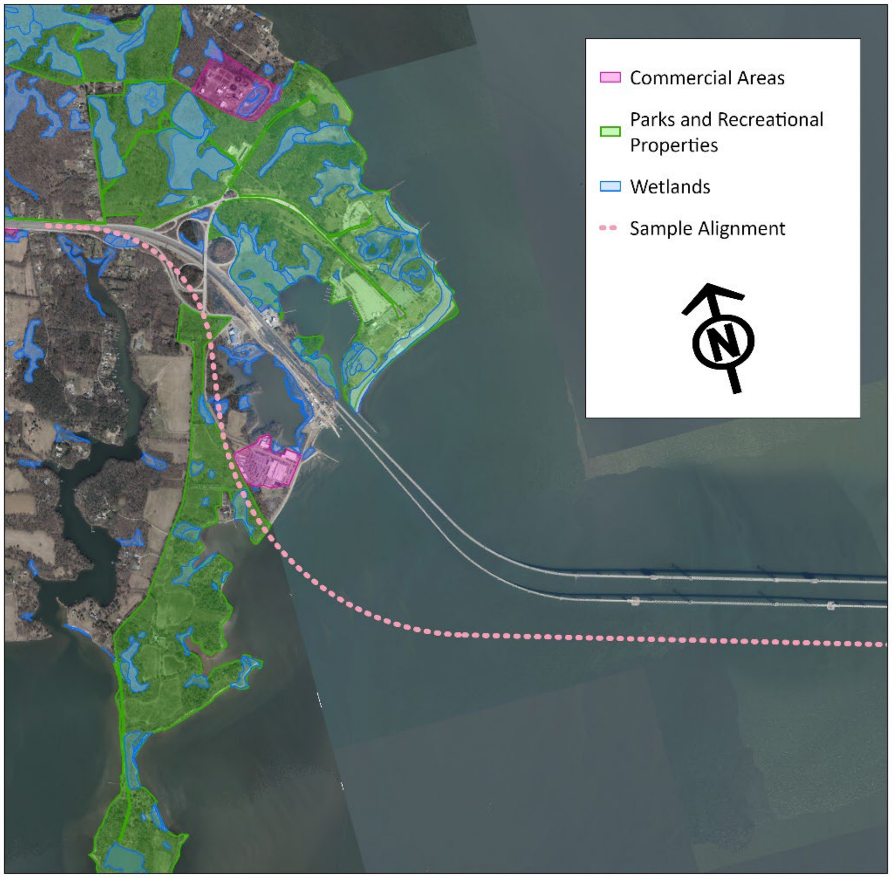
It would not be practical to locate a new bridge in between the existing bridges. For example, with an 8-lane new bridge, proposed with the 6-8-6 or 8-8-8 number of lanes, the footprint of just one new four-lane bridge span including shoulders would be 78 feet wide, which would be greater than the space available at the Western Shore between the two existing Bay Bridge spans (approximately 51 feet) (**Figure 3.15**). The 8-10-8 number of lanes option would require even more width and would be impractical as well. Construction of any new bridge in between the existing spans would thus require demolition of one of the existing spans before construction of the new bridge could be completed. This would reduce the number of existing travel lanes during construction and result in severe congestion and unreliable travel conditions.

Figure 3.15. In-Between Bridge Position in Relation to Existing Bridge Spans

3.6.4 Far-South Bridge Location

A "far-south bridge location" alignment was evaluated to determine if there was an alignment for the bridge that could flatten the horizontal curve of the existing bridges while still crossing straight across the Chesapeake Bay navigational channel within the limits of study area. An example of an alignment is shown in **Figure 3.16**. A far south bridge location alignment was determined unreasonable because it would deviate from the existing U.S. 50/301 alignment prior to the shoreline (likely near the Oceanic Drive Interchange or further west) and would have increased environmental impacts to Westinghouse Bay and Holly Beach Farm, as well as wetlands and the FEMA 100-year floodplain, compared to an alignment that remains on existing U.S. 50/301 and uses the existing right-of-way up to the shoreline. The Oceanic Drive Interchange would also need to be completely reconstructed.

Figure 3.16. Sample Alignment for a Far South Bridge Location



3.6.5 Screening Results

The structure location options were evaluated using the screening criteria to determine which options would advance to the proposed ARDS. To assess whether an option was reasonable, each option was evaluated independently for each need and objective. The options were also evaluated relative to the other options for each objective. The results are shown in **Table 3-7**. Where a box is green, the option is likely to address the need or objective. Where a box is red, the option does not have the potential to address the need or an objective. A more detailed description of each option in relation to the screening criteria is presented below the table.

Table 3-7. Potential of Structure Location Options to Address the Needs and Objectives

Screening Criteria		Structure Location Options			
		North Bridge Location	South Bridge Location	In-Between Bridge Location	Far-South Bridge Location
Does the option have the potential to address the need?	Adequate Capacity & Reliable Travel Times	Yes	Yes	No	Yes
	Mobility	Yes	Yes	No	Yes
	Roadway Deficiencies	Yes	Yes	Yes	Yes
	Existing and Future Maintenance	Yes	Yes	Yes	Yes
	Navigation	Yes	Yes	Yes	Yes
To what extent does the option address the objective?	Environmental Responsibility	Low Impact Relative to the Far-South Option	Low Impact Relative to the Far-South Option	Low Impact Relative to the Far-South Option	High Impact Relative to other Options
	Cost and Financial Responsibility	Low Cost Relative to the Far-South Option	Low Cost Relative to the Far-South Option	Low Cost Relative to the Far-South Option	High Cost Relative to other Options

The north bridge location and a south bridge location would be designed to address the study's needs and would address the study's objectives better than the far-south bridge location because they would have a smaller environmental impact and a lower cost. Additional details can be found in **Sections 3.6.1** and **3.6.2**. The north bridge location option and the south bridge location option are reasonable because they would have the ability to address the Tier 2 Study's Purpose and Need.

The in-between bridge location would be designed to meet the study's needs following construction. However, the in-between bridge location is infeasible to construct without demolishing one of the existing spans before constructing the new span because there is not enough space between the existing spans on the Western Shore approach to construct a new span. Demolishing one of the existing spans before constructing a new span would reduce the number of existing travel lanes during construction and result in severe congestion and extremely unreliable travel conditions. Therefore, during construction, the in-between bridge location would not have the potential to address the adequate capacity and reliable travel times and mobility needs. The in-between bridge location option would therefore not be reasonable because it is not practical to construct and because it does not address the Tier 2 Study's Purpose and Need.

The far-south bridge location would address the study's needs but would not address the study's environmental responsibility and cost and financial responsibility objectives because it would have a substantially larger environmental impact and cost than the north bridge location and the south bridge location. Additional detail is located in **Section 3.6.4** and the justification is summarized below:

- **Environmental Responsibility**: The far-south option would have substantially greater unavoidable impacts to environmental and community resources compared to the other structure location options. This would include the Holly Beach Farm Section 4(f) and Section 6(f) property; historic properties; community facilities; numerous wetlands, tidal and non-tidal waters; forests; and private property including residences, Northrup Grumman, and a marina.
- **Cost and Financial Responsibility**: There would be substantial cost associated with constructing a far-south bridge location, including costs for both construction itself and ROW acquisition.

A far-south bridge location option would not be reasonable because it does not address the Tier 2 Study's Purpose and Need.

3.7 Transit / Transportation Systems Management / Transportation Demand Management

3.7.1 Transit

Transit alternatives including ferry service, BRT, and rail modes were evaluated as part of the Tier 1 NEPA Study. The Tier 1 Study eliminated those options from consideration as stand-alone alternatives. The Tier 2 Study is considering transit alternatives within this corridor and in combination with other build alternatives. This study acknowledges the need to find multiple ways to move people reliably and efficiently across the Chesapeake Bay and seeks to identify solutions to this challenge that might include enhanced transit if warranted by demand, based on a thorough analysis of existing conditions; planned and predicted conditions; and stakeholder and community input.

There are no existing ferries or high-capacity transit options across the Chesapeake Bay. High-capacity transit is transit that offers frequent scheduled service, limited stops, and fast travel speeds that operates within its own ROW, such as passenger rail, commuter rail, heavy rail, light rail, and BRT. Bus service that crosses the Bay Bridge today is limited to one deviated fixed route which crosses the bridge three times in each direction (operated by QAC Ride) and three commuter bus routes that cross the bridge during peak periods only (one to/from Baltimore and two to/from Washington, D.C., operated by the MTA). While there are few transit options today between the Eastern Shore and the rest of the State, the MTA *Maryland Statewide Transit Plan* recognizes that improved transit connections would help Eastern Shore residents and visitors travel to/from the State's major metropolitan areas.[2] Therefore, facilitating an intercity transit

[2] https://s3.amazonaws.com/mta-website-staging/mta-website-staging/files/Transit%20Projects/Statewide%20Transit%20Plan/Maryland%20Statewide%20Transit%20Plan_DRAFT_January%202022.pdf

connection between the Eastern Shore and Baltimore/Washington, D.C. is part of the long-term transit vision for the State.

In June 2023, the MDTA hosted a virtual Transit & Bicycle/Pedestrian Listening Meeting for the public to learn more and provide feedback on transit, bicycle, and pedestrian considerations in the study area. This Listening Meeting provided information on the Tier 1 Study transit findings and existing transit service in the study area. Only about 20 percent of meeting participants currently use/rely on transit in the corridor (including bus and paratransit). A little more than half of the meeting participants feel it is very important to have transit options to cross the Chesapeake Bay, and another quarter of participants feels it is somewhat important. Ease of access to transit, a convenient transit schedule, desirable destinations, reliability, and time efficiency were the top factors that would encourage meeting participants to use transit in the corridor. The meeting participants were also surveyed on the types of trips they would use for transit travel across the Chesapeake Bay. The top responses were recreation, personal reasons, dining, and shopping.

3.7.1.1 Ferry

Based on analysis completed during the Tier 1 Study, implementing a vehicular ferry would not provide enough capacity to result in a sufficient reduction in traffic volumes crossing the Bay Bridge to reduce congestion. It is estimated that a ferry could only accommodate up to 1.07 percent of the total volume of anticipated crossings in 2045. A comparison of daily existing and projected Bay Bridge traffic volumes and ferry capacity updated based on 2022 average daily traffic (ADT) is presented in **Table 3-8**.

Table 3-8. Comparison of Daily Existing & Projected Bay Bridge Traffic Volumes & Ferry Capacity

Time Frame	Existing (2022) ADT	Projected 2045 No-Build ADT	Maximum Daily Ferry Vehicle Capacity	Ferry as a percentage of 2045 volumes
Non-Summer Weekday Average	69,588	91,150	972	1.07%
Summer Weekend Average	104,284	130,500	972	0.74%

The analysis determined that the capacity of a ferry service operating at maximum capacity could accommodate less than five percent of the anticipated growth in traffic volume between 2017 and 2045 and would not reduce existing volumes. Additionally, fare revenues generated by most ferry route locations would not be enough to cover operational costs. As a result, a ferry was not carried forward in the Tier 1 Study EIS as a stand-alone alternative.

If a ferry alternative was included in combination with the proposed ARDS that include additional highway capacity, it would only provide a small amount of additional capacity as compared to the capacity added from an additional highway lane. It would also require additional infrastructure within the corridor for the ferry terminals and access roads, which would have additional environmental impacts.

Exploring the potential for a passenger ferry network that would connect communities on both sides of the Chesapeake Bay and its potential to augment travel options offered by the new Bay Bridge is worthwhile and is currently being studied by Visit Annapolis & AAC. A new passenger ferry service could potentially connect to local transit service, but that service would need to have a similar frequency as the ferry service and the routes would need to be modified to connect to new ferry terminals.

3.7.1.2 High-Capacity Transit

High-capacity transit is transit that offers frequent scheduled service, limited stops, and fast travel speeds that operates within its own ROW, such as passenger rail, commuter rail, heavy rail, light rail, and BRT.

A. Rail Option

The types of rail that were considered for the Bay Crossing Study include intracity and intercity rail. Intracity service connects major activity centers within a single city or metropolitan area and includes heavy rail transit (HRT) and light rail transit (LRT). Intercity rail connects multiple cities over longer distances and includes commuter rail, long-haul, express, and regional service.

For the Tier 2 Study, the MDTA evaluated commuter rail, HRT, or LRT that would cross the Chesapeake Bay on a new structure. The MDTA's 2019 *Bay Crossing Study Modal and Operational Alternative: Transit Service Report* (Transit Service Report)[3] estimated the potential of transit to remove vehicles from the bridge. The calculations conducted in the Transit Service Report were updated based on 2022 existing traffic volumes and the projection for transit to remove 294 vehicles from the bridge on non-summer weekdays and 774 vehicles on summer weekends. This reduction would be approximately 0.3 percent of the traffic on a non-summer weekday and 0.6 percent of traffic on a summer weekend. Rail would therefore not effectively relieve congestion and improve travel times at the existing Bay Bridge.

Rail on a new bridge would require additional engineering considerations that would substantially increase the cost of the alternatives. For example, larger foundation and structural improvements would be needed to accommodate future rail, rail may require more gradual grades resulting in a longer structure and additional roadway and interchange improvements, and the structure would need to be designed to accommodate rail loads and vibrations. Additionally, new, extensive rail infrastructure would need to be constructed on the approaches to connect to the nearest rail systems on both shores. On the Western Shore, the Bay Bridge is more than 18 miles from the nearest MARC/Amtrak/CSX line and more than 20 miles from the nearest Washington Metropolitan Area Transit Authority (WMATA) transit line. On the Eastern Shore, the Bay Bridge is approximately 14 to 20 miles from the nearby rail lines, however the railroad lines on the Eastern Shore are not used for passenger service, they are short-line railroad lines associated with the Maryland and Delaware Railroad (14 miles away) or the Chesapeake Railroad (20 miles away) and are partially abandoned. Intercity rail and transit options would also incur operational costs and require rail vehicles and maintenance facilities. Depending on the layout of a new bridge, inspection and routine maintenance of the rail facility may affect the adjacent roadway travel lanes.

[3] https://baycrossingstudy.com/images/nepa_process/Appendix%20B%20-%20BCS%20Tier%201%20NEPA%20-%20Transit%20Service%20Evaluation.pdf

Intercity rail and transit would necessitate additional safety considerations from the perspective of design and operations:

- Barriers – Vertical barriers would be needed to protect the adjacent automobiles, limit the impact of a derailment on the adjacent roadway lanes, and limit the likelihood of a train falling off the bridge if it derails.
- Breakdowns – The bridge would need to accommodate equipment to clear or repair an inoperable train.
- Emergency egress for passengers – Adequate space would be needed within the design to offload and shelter passengers in the event of a breakdown.

Rail options would create greater environmental impacts. Including rail on the bridge would necessitate a larger project footprint due to the taller, flatter, wider, and longer structure needed, as well as the substantial additional impacts resulting from the construction of new rail connections beyond the bridge to the existing rail network. In combination with a build alternative, rail would not be an effective strategy for reducing congestion, and the reduction in congestion would not justify the cost and environmental impacts.

B. Bus Rapid Transit Option

The FTA defines BRT as "a high-quality bus-based transit system that delivers fast and efficient service that may include dedicated lanes, busways, traffic signal priority, off-board fare collection, elevated platforms and enhanced stations." For the Tier 2 Study, BRT would consist of a dedicated bus lane for BRT across the bridge. As previously stated in **Section 3.7.2.1**, the MDTA's Transit Service Report[4] estimated the potential of transit to remove vehicles from the bridge and estimated that transit would only remove 294 vehicles from the bridge on Non-Summer Weekdays and 774 vehicles on Summer Weekends. BRT would not effectively relieve congestion and improve travel times at the existing Bay Bridge.

BRT would require additional engineering considerations that would increase the cost of the alternatives. BRT is typically implemented on corridors with higher-density activity centers or development nodes providing connections between large city centers and outlying residential and commercial centers. Study area land use is low density on either side of the bridge, when compared to major urban areas, and existing transit demand is low. With existing LRT and HRT servicing Baltimore and Washington, D.C., a likely BRT connection would include service from the Kent Island Park and Ride to either the Glen Burnie LRT station or the New Carrolton or Largo Town Center WMATA Metrorail stations. New, extensive BRT infrastructure would need to be constructed on the approach roads to connect to existing service, which on the Western Shore in particular is many miles away. While major activity centers exist on the west side of the bridge in Annapolis, major activity centers on the east side of the bridge, such as Ocean City or Salisbury, are much further away from the Bay Bridge than a typical BRT corridor, and there is no existing infrastructure to connect to them. BRT options would also incur operational costs and require new buses and maintenance facilities.

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[4] https://baycrossingstudy.com/images/nepa_process/Appendix%20B%20-%20BCS%20Tier%201%20NEPA%20-%20Transit%20Service%20Evaluation.pdf

BRT options would have greater environmental impacts from the construction of new connections beyond the bridge to the existing transit network. BRT can only be included with the construction of a new crossing to provide space for the dedicated BRT lane. Even in combination with a build alternative, BRT would not be an effective strategy for reducing congestion, and the reduction in congestion would not justify the cost and environmental impacts.

3.7.1.3 Enhanced Bus Service

Enhancements to bus service could include potential expanded bus service and potential transit priority treatments. Potential enhancements to bus service include:

- **Local Bus Service** – Currently, QAC Ride operates one deviated fixed route three times a day in each direction on weekdays across the bridge. Enhanced service could provide a connection to the new planned Parole Transit Center allowing riders to access Annapolis Transit and AAC Transit routes to reach other destinations. Expanded local bus service will be evaluated in the EIS.
- **Commuter Bus Service** – The existing commuter bus service across and adjacent to the Bay Bridge is operated by the MTA as MTA Commuter Bus. Today, the MTA operates three commuter bus routes across the bridge (one to Baltimore, with three trips in each direction per day, and two to Washington, D.C., one with five trips in the morning and six trips in the afternoon, and the other with six trips in each direction per day). The trips occur during AM and PM peak periods only. Expanded commuter bus service will be evaluated in the EIS.
- **Intercity Bus Service** – Intercity bus services are typically operated privately and connect multiple cities over longer distances than local bus service. New or expanded intercity service may be warranted to connect to and from Baltimore, Washington D.C., Annapolis, Ocean City and elsewhere. Intercity bus service will be studied in the EIS.

These three types of bus service could operate with or without potential transit priority treatments, as discussed below. Bus services would incur operational costs and require vehicles and potentially expanded maintenance facility capacity.

The proposed build alternatives may also include potential bus transit priority treatments, including 24-hour dedicated transit lanes, congested-period-only dedicated transit lanes, bus-on-shoulder operation, and queue jump lanes. These priority treatments are described as follows:

- A 24-hour dedicated transit lane involves providing a lane in each direction on the bridge exclusively for transit use. There would need to be sufficient existing and anticipated transit demand and service to justify the cost of a fully dedicated lane. Signage and enforcement would be needed to prevent other drivers from using the dedicated transit lane.
- A congested-period only dedicated transit lane is similar to a 24-hour dedicated transit lane but only operates during designated time periods.
- Bus-on-shoulder operation is the conversion of shoulders to travel lanes for transit vehicles during certain hours of the day or under certain conditions as a strategy for improving transit reliability. Transit vehicles would operate along the approach shoulders and/or

bridge shoulders. For bus-on-shoulder operation on the bridge, a new bridge would need to be designed to include bus shoulders.

- Queue jump lanes provide travel lanes for transit vehicles to bypass queued traffic on the approach to the bridge and then use a queue jump signal or a merge lane to enter general traffic lanes prior to the bridge. This option could use bus-on-shoulder operation as the queue jump lane on the approaches to the bridge.

Compared to other bus service enhancements, bus transit priority infrastructure would result in additional capital costs and would likely result in additional environmental effects that would be evaluated in the EIS.

3.7.1.4 Screening Results

The transit options were evaluated using the screening criteria to determine the options to advance to the proposed ARDS. To assess whether an option was reasonable, each option was evaluated independently for each need and objective. The options were also evaluated relative to the other options for each objective. The results are shown in **Table 3-9**. Where a box is green, the option is likely to address the need or objective. Where a box is red, the option does not have the potential to address the need or an objective. Where a box is white, the need was not applicable to the option because the need applies only to the existing Bay Bridge. A more detailed description of each option in relation to the screening criteria is presented below the table.

The ferry option would provide an additional mode of transportation across the Bay and as such, would address the study's mobility need. However, the ferry option would not have the potential to address the adequate capacity and reliable travel times need or the environmental responsibility and cost and financial responsibility objectives. The justification is summarized below, and additional details can be found in **Section 3.7.2.8**:

- **Adequate Capacity and Reliable Travel Times:** A ferry would be able to accommodate less than five percent of the anticipated growth in traffic volume between 2017 and 2045; therefore, it would not appreciably reduce existing volumes. In combination with proposed ARDS that include additional highway capacity, a ferry would only provide a small amount of additional capacity.
- **Environmental Responsibility:** A ferry would require additional infrastructure within the corridor for the ferry terminals and access roads, which would have environmental impacts.
- **Cost and Financial Responsibility:** Fare revenues generated by most ferry route locations would not be adequate to cover operational costs; therefore, there would be substantial additional cost associated with the additional infrastructure needed for ferry terminals and access roads.

Table 3-9. Potential of Transit Options to Address the Needs and Objectives

Screening Criteria		Transit Options			
		Ferry	Rail	BRT	Enhanced Bus Service
Does the option have the potential to address the need?	Adequate Capacity & Reliable Travel Times	No	No	No	Yes
	Mobility	Yes	Yes	Yes	Yes
	Roadway Deficiencies	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Existing and Future Maintenance	Not Applicable	Applicable	Not Applicable	Not Applicable
	Navigation	Not Applicable	Not Appliable	Not Applicable	Not Applicable
To what extent does the option address the objective?	Environmental Responsibility	Moderate Impact Relative to other Options	High Impact Relative to other Options	Moderate Impact Relative to other Options	Low Impact Relative to other Options
	Cost and Financial Responsibility	Moderate Cost Relative to other Options	High Cost Relative to other Options	Moderate Cost Relative to other Options	Low Cost Relative to other Options

The roadway deficiencies, existing and future maintenance, and navigation needs are not applicable to this option because these needs apply to the existing Bay Bridge. A ferry option would not be reasonable because it would not address the Tier 2 Study's Purpose and Need. The Tier 2 Study does not preclude implementation of a new ferry service resulting from another study.

The rail option would provide an additional mode of transportation across the Bay and as such, would address the study's mobility need. However, the rail option would not have the potential to address the adequate capacity and reliable travel times need or the environmental responsibility and cost and financial responsibility objectives. The justification is summarized below, and additional detail can be found in **Section 3.7.2.8**:

- **Adequate Capacity and Reliable Travel Times:** Rail is estimated to have the potential to remove less than 2 percent of traffic from vehicular travel lanes, which would not appreciably relieve congestion nor improve travel times.
- **Environmental Responsibility:** Providing rail on a new bridge, either on the same bridge as roadway lanes or on a separate bridge, would necessitate a larger structure or an additional structure. This option would also require construction of lengthy new rail

connections to reach the existing rail networks on both shores, resulting in substantial environmental impacts.

- **Cost and Financial Responsibility:** The larger or additional structure and the lengthy new rail connections would also have substantial cost.

The roadway deficiencies, existing and future maintenance, and navigation needs are not applicable to this option because these needs apply to the existing Bay Bridge. A rail option would not be reasonable because it would not address the Tier 2 Study's Purpose and Need.

The BRT option would provide an additional mode of transportation across the Bay and as such, would address the study's mobility need. However, the BRT option would not have the potential to address the adequate capacity and reliable travel times need or the environmental responsibility and cost and financial responsibility objectives. The justification is summarized below, and additional details can be found in **Section 3.7.2.8**:

- **Adequate Capacity and Reliable Travel Times:** BRT is estimated to have the potential to remove less than 2 percent of traffic from vehicular travel lanes, which would not appreciably relieve congestion and improve travel times.
- **Environmental Responsibility:** A BRT option would require construction of lengthy new connections to reach appropriate high-capacity end points, resulting in substantial environmental impacts.
- **Cost and Financial Responsibility:** The lengthy new BRT connections would also have substantial cost.

The roadway deficiencies, existing and future maintenance, and navigation needs are not applicable to this option because these needs apply to the existing Bay Bridge. A BRT option would not be reasonable because it would not address the Tier 2 Study's Purpose and Need.

Enhanced bus service would be designed to address the study's adequate capacity and reliable travel times and mobility needs. The roadway deficiencies, existing and future maintenance, and navigation needs are not applicable to this option because these needs apply to the existing Bay Bridge. Enhanced bus service would also have the ability to better meet the environmental responsibility and cost and financial viability objectives than the other transit options because it would have a substantially smaller environmental impact and cost. Additional details can be found in **Section 3.7.2.8**. Enhanced bus service would be reasonable because it would have the ability to address the Tier 2 Study EIS's Purpose and Need.

3.7.2 Transportation Systems Management/Transportation Demand Management

TSM and TDM alternatives were evaluated as part of the Tier 1 Study EIS. TSM and TDM strategies are used to increase the efficiency and operations of transportation systems. The Tier 1 Study EIS eliminated those options from consideration as stand-alone alternatives. This Tier 2 Study is considering TSM and TDM alternatives in combination with other build alternatives. The TSM and TDM alternatives were allocated into two categories.

- TSM and TDM alternatives that could be implemented with or without additional lanes across the Chesapeake Bay include congestion pricing, ramp metering, park-and-ride facilities, and interchange consolidation.

- TSM and TDM alternatives that can only be implemented with additional lanes across the Chesapeake Bay include express-local lanes, managed lanes, and part-time shoulder use lanes.

3.7.2.1 Congestion Pricing

Congestion pricing uses variable tolls to shift some peak period travel to the off-peak period in order to reduce congestion and provide a more reliable trip.[5]

3.7.2.2 Ramp Metering

Ramp metering is an approach that controls or "meters" the traffic entering a highway at ramps by using traffic signals; the intent is to reduce merging friction along the corridor. For this corridor, ramp metering could be considered at eastbound entrance ramps on the Western Shore and westbound entrance ramps on the Eastern Shore. Under the right conditions, ramp metering can be an effective strategy to reduce congestion along freeway segments without widening the mainline. Ramp metering was considered as a potential TSM/TDM solution for improving traffic operations at the Bay Bridge, but a pilot study conducted by SHA in summer 2022 demonstrated that ramp metering did not improve travel times at the Bay Bridge. In fact, the ramp metering resulted in negative impacts including queuing and severe congestion along the ramps and frontage roads.

During SHA's pilot study, the ramp meter was installed at the Oceanic Drive entrance ramp to eastbound U.S. 50/301. SHA presented the results of the pilot study to the Broadneck Council of Communities in the fall of 2022[6] and noted that as part of the pilot study, it was determined that without the ramp meter in place, the primary cause of congestion and diversions on U.S. 50/301 eastbound on summer Fridays and Saturdays was the unavailability of contraflow due to weather and/or incidents. With the ramp meter in place, it was determined that travel times were still more influenced by weather and contraflow availability than the implementation of ramp metering. The pilot study demonstrated that the congestion and diversions onto the local road network are caused by a lack of capacity across the bridge. Ramp metering is not an effective solution to reduce congestion on its own since it does not add capacity to the bridge. Given the results of the pilot study and the negative impacts to the local road network, ramp metering would not enhance a build alternative, but rather detract from it, and would not be reasonable for implementation.

3.7.2.3 Park-and-Ride Facilities

Park-and-ride facilities can be used to encourage carpooling and bus use across a new bridge. Currently, there are three existing Park and Ride locations within the study area for drivers who utilize local and commuter bus networks or carpool. The Stevensville Park and Ride is located on the southeastern side of the U.S. 50/301 and MD 8 (Romancoke Road) interchange. The Kent

[5] FHWA, "Congestion Pricing" https://ops.fhwa.dot.gov/publications/fhwahop08039/fhwahop08039.pdf
[6] https://maryland.maps.arcgis.com/sharing/rest/content/items/bdee1cca2a8d4eceb2032c326063b960/data

Narrows Park and Ride is located beneath U.S. 50/301 at Kent Narrows, between Piney Narrows Road and Main Street. The Castle Marina Park and Ride is located on the northern side of U.S. 50/301 off Castle Marina Road. The MDTA will further assess park and ride services and the potential for new facilities as part of the transit analyses that will be completed for the proposed ARDS, including whether existing park and ride capacity is adequate for future travel demand.

3.7.2.4 Interchange Consolidation

Along U.S. 50/301 on the Eastern Shore, there are many closely spaced interchanges. Interchange consolidation could be used to control access to highways to manage congestion and reduce crashes. However, in light of potential impacts to communities on the Eastern Shore, the MDTA will only consider interchange consolidation at interchanges where the proposed ARDS create geometric issues to the existing ramp configurations.

3.7.2.5 Express-Local Lanes

An express-local system would separate local traffic entering and exiting the highway at the interchanges from the traffic traveling through the study area from end to end. The express lanes could be separated from the local lanes by some type of buffer or physical barrier but could only be provided across the Chesapeake Bay on a new bridge. This separation would increase the width of the roadway, leading to potentially more environmental impacts and higher cost. Additionally, to implement an express-local system, proper advance guide signs would be required a significant distance in advance of the start of the express-local system. Due to the close spacing of the interchanges throughout the study limits, there is not adequate space to accommodate multiple ingress/egress movements, so the express system would likely need to extend for most of the study area. This would make mobility difficult and hinder ease of access to businesses and other locations off U.S. 50/301.

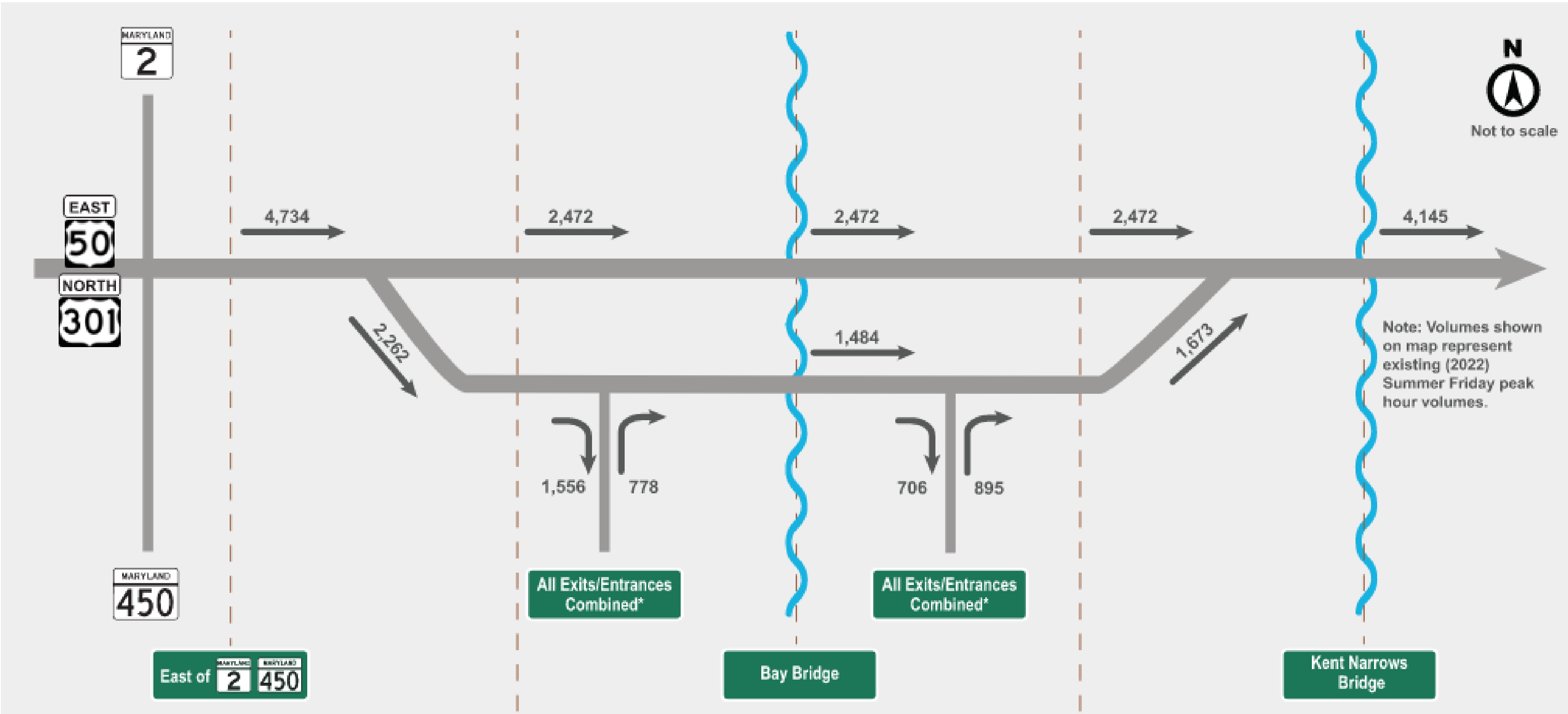
One of the features of an express-local system is that it requires local traffic to use the local lanes but does not limit "through" traffic (traffic that does not use entrance or exit ramps within the limits) to the express lanes. If congestion were to occur in the express lanes, due to heavy traffic volumes or an incident, through traffic would be expected to divert to the local lanes, potentially congesting the local lanes. If congestion or an incident were to occur in the local lanes, local traffic would not have the option of diverting to the express lanes.

A preliminary traffic analysis was performed for this option, for the eastbound direction, using existing (2022) Summer Friday peak hour volumes. For the purposes of the preliminary traffic analysis, the following simplifying assumptions were made:

1. The express-local system would extend from just east of the MD 2/MD 450 interchange to just west of the Kent Narrows Bridge.
2. All access/egress to/from the express lanes would occur at the endpoints of the system. That is, traffic entering U.S. 50/301 at a local interchange would be required to remain on the local lanes until the endpoint of the system.

Origin-destination information was obtained from StreetLight Data and was analyzed to determine the amount of traffic on U.S. 50/301 that is truly through traffic. The results of the analyses are summarized in **Figure 3.17**, which demonstrates the following:

Figure 3.17. Potential Express-Local System on Eastbound U.S. 50/301, with Summer Friday Volumes



Scenario		Number of Lanes Needed: Computed	Rounded
Without Express-Local		2.93	3
With Express-Local	Express Lanes	2.93	3
	Local Lanes	0	0
	Total	2.93	3

Scenario		Number of Lanes Needed: Computed	Rounded
Without Express-Local		2.93	3
With Express-Local	Express Lanes	1.53	2
	Local Lanes	1.40	2
	Total	2.93	4

Scenario		Number of Lanes Needed: Computed	Rounded
Without Express-Local		3.17	4
With Express-Local	Express Lanes	1.98	2
	Local Lanes	1.19	2
	Total	3.17	4

Scenario		Number of Lanes Needed: Computed	Rounded
Without Express-Local		2.56	3
With Express-Local	Express Lanes	1.53	2
	Local Lanes	1.03	2
	Total	2.56	4

Scenario		Number of Lanes Needed: Computed	Rounded
Without Express-Local		2.56	3
With Express-Local	Express Lanes	2.56	3
	Local Lanes	0	0
	Total	2.56	3

* Does not include vehicles that both enter the Local Lanes at an interchange and also exit the Local Lanes at an interchange.

- Prior to the start of the express-local system, 2.93 lanes would be needed to handle the peak hour traffic volumes. Since it is not possible to provide fractions of lanes, three lanes would be needed.
- Once the express-local system begins, 1.53 *express* lanes would be needed to handle the peak hour traffic volumes—meaning that two lanes would be required. Similarly, 1.40 *local* lanes would be needed—meaning, again, that two lanes would be required. Thus, a total volume that can be accommodated in three general-purpose lanes requires four lanes in an express-local system. (This is a common occurrence with express-local systems.)
- Similar conditions would be found downstream of the Bay Bridge, where the total number of general-purpose lanes would be lower than the sum of the express-local components.
- At the Bay Crossing itself, four lanes would be needed under either scenario.

An express-local lanes option would make trips along U.S. 50/301 more complex and hinder movements between the express and local systems. It could also make trips to local destinations such as businesses on Kent Island more difficult. Additionally, this option would require more right-of-way than the proposed build alternatives, and thus would incur greater environmental impact and be more costly.

3.7.2.6 Priced Managed Lanes

Priced managed lanes along U.S. 50/301 for this study would be tolled lanes that operate similarly to an express-local system with the addition of congestion pricing to the express, managed lanes. Since the Bay Bridge is already a toll facility, providing managed lanes across a new bridge would require those lanes to have a surcharge in addition to the base toll. The two tolls would be challenging to communicate to users.

To maintain free flow speeds in the managed lanes as congestion increases in the corridor, the price to use the managed lanes would increase. While congestion in the general-purpose lanes would improve slightly because some vehicles would use the managed lanes, there would still be significant congestion in the general-purpose lanes. Managed lanes would provide the same challenges as express-local lanes in terms of a greater footprint likely causing more environmental impacts. Also, similar to the express-local lanes, through traffic cannot be prevented from using the general-purpose lanes, from beginning to end. If congestion were to occur in the managed lanes, due to heavy traffic volumes or an incident, through traffic would be expected to divert to the general-purpose lanes, potentially congesting the general-purpose lanes. If congestion or an incident were to occur in the general-purpose lanes, local traffic would not have the option of diverting to the managed lanes.

With the managed lanes option more congestion would remain in general purpose lanes; trips along U.S. 50/301 would be more complex and access to local destinations would be hindered; and there would be greater environmental impacts and cost because of the additional footprint and additional infrastructure to support the managed lanes.

3.7.2.7 Part-Time Shoulder Use (PTSU) Lanes

PTSU lanes use the shoulder of a roadway for temporary travel during certain hours of the day, typically during peak hours where there is recurring congestion. As a strategy for addressing congestion and reliability issues, PTSU can be a cost-effective solution where geometric clearances, visibility, and pavement requirements can be met.[7] Part-time shoulder use will be studied for both bus-only operations and general vehicular operations.

3.7.2.8 Combined Transit/TSM/TDM Option

The Tier 1 Study EIS concluded that ferry service, BRT, rail transit, and TSM/TDM would not be carried forward for further evaluation as stand-alone alternatives. Throughout the preliminary evaluation process, agencies and local communities emphasized the need for accommodating a broad range of users across the Chesapeake Bay and the opportunities for regional transportation connectivity. There were many comments received at the September 2022 Open Houses, the June 2023 Transit & Bicycle/Pedestrian Listening Meetings, and the September 2023 Open Houses that supported further consideration of transit and TSM/TDM options, including evaluation of the ability for several transit and TSM/TDM options in combination with each other to reduce congestion. Based on agency and public feedback, the MDTA considered an option that combines various transit, TSM, and TDM elements and improves travel conditions across the Chesapeake Bay and along U.S. 50/301 without proposing a new crossing structure.

Although this alternative would not include a new bridge or modification to the existing number of lanes, it was evaluated including bus enhancements, ferry, interchange consolidation, park-and-ride facilities, congestion pricing, and PTSU as part of a package to determine its ability to provide additional capacity and improve travel time reliability. There is no way to provide additional physical vehicular capacity across the existing Bay Bridge since it does not have shoulders; this would require a new structure.

The total reduction of vehicles crossing the bridge due to transit would not equal the sum of all transit options' vehicle reduction, since the same people may use multiple different transit options. Ferry would only reduce the projected 2045 daily traffic volumes by 1.07 percent on a non-summer weekend and 0.74 percent on a summer weekend. Improvements could be made to bus service and park-and-ride facilities to support the bus service but buses would need to continue to use the existing Bay Bridge lanes. Thus, transit priority treatments, such as dedicated transit lanes or bus-on-shoulder, could not be implemented across the bridge without reducing the number of general-purpose travel lanes. The bridge would still be the bottleneck, and bus travel times would continue to be unreliable. Like bus service, PTSU could add capacity to the approaches during peak periods but could not be provided across the bridge, and the bridge would remain the bottleneck. The PTSU lanes would allow more traffic to get to the bridge but would not influence how much traffic can get across the bridge. Interchange consolidation could reduce friction along the approach roads but would not add any capacity to the bridge. Congestion pricing could allow the existing capacity across the bridge to be utilized more efficiently by spreading out the demand, but in the no-build condition there are queues greater than one mile on non-summer weekdays that last four hours eastbound and 11 hours westbound and there are queues greater than one mile on summer weekends that last 14 hours in both directions. Since the congested

[7] FHWA, "Use of Freeway Shoulders for Travel" https://ops.fhwa.dot.gov/publications/fhwahop15023/ch1.htm

periods are so long, there is less ability for congestion pricing to shift trips to periods with less congestion, particularly since many of those periods without congestion would be overnight.

Without additional capacity across the Bay Bridge, it is not expected that there would be any improvements to travel time reliability. Moreover, because the existing Bay Bridge would continue to be used and there would be no new crossing structure, this option would not address the study's roadway deficiencies, existing and future maintenance, or navigation needs.

3.7.2.9 Screening Results

The TSM and TDM options were evaluated using the screening criteria to determine the options to advance to the proposed ARDS. To assess whether an option was reasonable, each option was evaluated independently for each need and objective. The options were also evaluated relative to the other options for each objective. The results are shown in **Table 3-10**. Where a box is green, the option is likely to address the need or objective. Where a box is red, the option does not have the potential to address the need or an objective. Where a box is white, the need was not applicable to the option because the need applies only to the existing Bay Bridge. A more detailed description of each option in relation to the screening criteria is presented below the table.

Congestion pricing has the ability to address the study's adequate capacity and reliable travel times and mobility needs. This option also has the ability to address the environmental responsibility and cost and financial responsibility objectives because it is an operational strategy, and the only physical infrastructure would be toll gantries and signing. Thus, the environmental impact and cost would be low. Additional detail can be found in **Section 3.7.2.1**. The ability for congestion pricing to enhance the proposed ARDS will be studied in the EIS. Congestion pricing would be reasonable because it would have the potential to address the Tier 2 Study's Purpose and Need.

Although ramp metering would have relatively low environmental impacts and cost compared to the other options, it would not have the potential to address the adequate capacity and reliable travel times and mobility needs. The justification is summarized below, and additional detail can be found in **Section 3.7.2.2**:

- **Adequate Capacity and Reliable Travel Times:** Ramp metering would not add capacity to the Bay Bridge or the U.S. 50/301 approaches.
- **Mobility:** Ramp metering could result in queuing at ramps and worsen backups on local roadways in some areas, thereby hindering local trips.

Ramp metering would not be reasonable because it would not address the Tier 2 Study's Purpose and Need.

Table 3-10. Potential of TSM/TDM Options to Address the Needs and Objectives

Screening Criteria		TSM/TDM Options							
		Congestion Pricing	Ramp Metering	Park-and-Ride Facilities	Interchange Consolidation	Express-Local Lanes	Priced Managed Lanes	Part-Time Shoulder Use (PTSU) Lanes	Combined Transit / TSM / TDM Option
Does the option have the potential to address the need?	Adequate Capacity & Reliable Travel Times	Yes	No	Yes	Yes	Yes	No	Yes	No
	Mobility	Yes	No	Yes	Yes	No	No	Yes	Yes
	Roadway Deficiencies	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	No
	Existing and Future Maintenance	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	No
	Navigation	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	No
To what extent does the option address the objective?	Environmental Responsibility	Low Impact Relative to other Options	Low Impact Relative to other Options	Low Impact Relative to other Options	Low Impact Relative to other Options	High Impact Relative to other Options	High Impact Relative to other Options	Low Impact Relative to other Options	Moderate Impact Relative to Other Transit/TSM/ TDM Options
	Cost and Financial Responsibility	Low Cost Relative to Other Options	Low Cost Relative to Other Options	Low Cost Relative to Other Options	Low Cost Relative to Other Options	High Cost Relative to Other Options	High Cost Relative to Other Options	Low Cost Relative to Other Options	Moderate Cost Relative to Other Transit/TSM/ TDM Options

*In this table, the combined transit/TSM/TDM option is the only stand-alone alternative. All other options would need to be in combination with other build alternatives. Therefore, the potential for the option to address the roadway deficiencies, existing and future maintenance, and navigation needs are not applicable.

The park-and-ride option has the potential to address the study's adequate capacity and reliable travel times and mobility needs. This option also has the ability to address the environmental responsibility and cost and financial responsibility objectives because it would have relatively low environmental impacts and cost. Additional detail can be found in **Section 3.7.2.3**. The ability for the park-and-ride option to enhance the proposed ARDS will be studied in the EIS. Park-and-ride would be reasonable because it would have the potential to address the Tier 2 Study's Purpose and Need.

The interchange consolidation option has the potential to address the study's adequate capacity and reliable travel times and mobility needs. This option also has the ability to address the environmental responsibility and cost and financial responsibility objectives because it would prevent large environmental impacts and have relatively low cost. Additional detail can be found in **Section 3.7.2.4**. The ability for the interchange consolidation option to enhance the proposed ARDS will be studied in the EIS. Interchange consolidation would be reasonable because it would have the potential to address the Tier 2 Study's Purpose and Need.

Express-local lanes would address the study's need for adequate capacity and reliable travel times. However, this option would not address the study's mobility need and the environmental responsibility and cost and financial responsibility objectives. The justification is summarized below, and additional detail can be found in **Section 3.7.2.5**.

- **Mobility:** Express-local lanes require local traffic to use the local lanes but do not limit through traffic to the express lanes. Through traffic can use the local lanes when the express lanes are congested, but local traffic cannot use the express lanes when local lanes are congested.
- **Environmental Responsibility:** Express and local lanes need some type of physical separation between each other, which increases the width of the roadway, leading to potentially more environmental impacts than the same number of general purpose lanes.
- **Cost and Financial Responsibility:** The additional roadway width needed for physical separation would also lead to a larger cost than the same number of general purpose lanes.

The express-local lanes option would not be reasonable because it would not address the Tier 2 Study's Purpose and Need.

Priced managed lanes would not address the study's adequate capacity and reliable travel time and mobility needs and the environmental responsibility and cost and financial responsibility objectives. The justification is summarized below, and additional detail can be found in **Section 3.7.2.6**.

- **Adequate Capacity and Reliable Travel Times:** Priced managed lanes are intended to maintain free-flow speed in the managed lanes. While congestion in the general-purpose lanes would improve slightly because some vehicles would use the managed lanes, there would still be significant congestion in the general purpose lanes.

- **Mobility:** Managed Lane traffic can use the local lanes when the managed lanes are congested, but local traffic cannot use the managed lanes when local lanes are congested.
- **Environmental Responsibility:** Priced managed lanes need some type of physical separation between the managed lanes and the general purpose lanes, which increases the width of the roadway, leading to potentially more environmental impacts than the same number of general purpose lanes.
- **Cost and Financial Responsibility:** The additional roadway width needed for physical separation would also lead to a larger cost than the same number of only general purpose lanes.

The priced managed lanes option would not be reasonable because it would not address the Tier 2 Study's Purpose and Need.

The PTSU option has the potential to address the study's adequate capacity and reliable travel times and mobility needs. This option also has the ability to address the environmental responsibility and cost and financial responsibility objectives because it would have few environmental impacts and lower cost than the same number of full-time lanes. Additional detail can be found in **Section 3.7.2.7**. The ability for the PTSU option to enhance the proposed ARDS will be studied in the EIS. PTSU would be reasonable because it would have the potential to address the Tier 2 Study's Purpose and Need.

The combined transit/TSM/TDM option would have the ability to address the study's mobility need, however, this option would not address the study's adequate capacity and reliable travel times, roadway deficiencies, existing and future maintenance, and navigation needs. The justification is summarized below, and additional detail can be found in **Section 3.7.2.8**:

- **Adequate Capacity and Reliable Travel Times:** Without a new structure, there is no way to provide additional physical capacity. Even in combination, the transit, TSM, and TDM options do not have the ability to shift enough vehicles to other modes to improve travel times.
- **Roadway Deficiencies:** Without a new structure, the roadway deficiency concerns with the existing Bay Bridge would remain.
- **Existing and Future Maintenance:** Without a new structure, the existing and future maintenance concerns with the existing Bay Bridge would remain.
- **Navigation:** Without a new structure, there is no way to provide additional navigational vertical clearance.
- **Environmental Responsibility:** The combined transit/TSM/TDM option would have less environmental impacts than the rail and BRT transit options, but would have more environmental impacts than congestion pricing, park-and-ride, interchange consolidation, and PTSU options.

  Cost and Financial Responsibility: The combined transit/TSM/TDM option would have lower cost than the rail and BRT transit options, but would have greater cost than congestion pricing, park-and-ride, interchange consolidation, and PTSU options.

A combined transit/TSM/TDM option would not be reasonable because it would not address the Tier 2 Study's Purpose and Need.

3.8 Pedestrian and Bicycle Shared Use Path (SUP)

Public comments received in response to the Tier 1 Study EIS expressed support for the safe inclusion of a SUP on a new crossing. In June 2023, the MDTA hosted a virtual Transit & Bicycle/Pedestrian Listening Meeting for the public to learn more and provide feedback on transit, bicycle, and pedestrian considerations in the study area. This Listening Meeting provided information on existing and proposed trails and additional SUP considerations. Slightly more than half of meeting participants currently use bicycle or pedestrian facilities in the Tier 2 corridor or near the Bay Bridge, and of those participants, the majority of them use the facilities for exercise/recreation. About two-thirds of meeting participants said they would use a SUP across the Chesapeake Bay if it were available. Over half of meeting participants feel it is very important to have access across the Chesapeake Bay for bicycle/pedestrian use.

As presented in the Listening Meeting, there are currently planned improvements, extensions, and connections for existing trails on both approaches to the Bay Bridge in QAC and AAC. However, there is no way for bicyclists and pedestrians to cross the Bay Bridge, other than getting a vehicle to transport them.

A SUP across a new Bay Bridge would be a two-way pedestrian and bicycle facility that is part of a new bridge structure and is separated from the adjacent travel lanes by a physical barrier. The SUP could extend for the full length of the bridge, connecting to adjacent trails, parks, or parking facilities on either shore, or it could extend part-way across the bridge from one shore only with a turnaround point somewhere along the bridge. The primary purpose of the facility would be for recreational activities, but a SUP that extends across the full length of the Bay could be used for commuting purposes as well.

Connecting the shores of the two counties over the Chesapeake Bay with a SUP on a new Bay Bridge would provide connectivity for pedestrians and bicyclists between the Eastern and Western Shores and allow users to cross the Chesapeake Bay without the need for vehicular assistance. Safety and design elements would be considered to provide sufficient comfort and safety for SUP users, such as:

- The height of railing needed to protect against falls and climbing, while maintaining views of the Chesapeake Bay;
- The impact of wind loads on SUP users and design requirements; and
- The impact of deflections and vibrations that are felt SUP users.

Additional SUP considerations would include:

- Time restrictions for SUP use (e.g. daylight only);
- Use by roller skaters, people on scooters, skateboarders, people with pets, anglers, and vendors;
- Lighting and security;
- Trash receptacles and restrooms;
- Surface material and drainage; and

- Benches, overlooks and charging stations.

The MDTA has reviewed design considerations for SUPs on large bridges and will further evaluate them as part of the proposed ARDS. Additional research on safety measures for including a SUP on a future Bay crossing will also be included in the proposed ARDS.

The MDTA completed a review of similar large structures across the U.S. to better understand bicycle and pedestrian access and that review is summarized below. It should be noted that SUPs are impractical in a tunnel the length of the Bay Crossing due to the limited space available and several safety and security concerns.

Maryland: The Woodrow Wilson Bridge is a 1.15-mile-long bridge with an over 3-mile-long SUP that opened in 2009 and carries I-495/I-95 between the City of Alexandria in Virginia and National Harbor in Prince George's County, Maryland. The bridge crosses over the Potomac River with the SUP located on the outside of the I-495/I-95 westbound traffic lanes. The SUP's 14-foot width allows for bicycle and pedestrian traffic in both directions. At the highest points on the bridge, the SUP runs at a height of approximately 98 feet above the Potomac River.

Opened in 1940, the Thomas J. Hatem Memorial Bridge carries U.S. 40 over the Susquehanna River in northeastern Maryland. The 1.4-mile-long structure has a height of approximately 85 feet above Susquehanna River and has a four-lane, two-way road separated by a center concrete barrier and has no shoulders or sidewalks. Bicyclists and pedestrians were prohibited from crossing the bridge until July 2016, when the MDTA granted bicyclists permission to do so on weekdays from 9 AM to 3 PM, and from dawn to dusk on weekends and State holidays. In September 2016, the policy was amended to only allow bicycle traffic from dawn to dusk on weekends, and on weekdays on a State holiday.

The existing American Legion Memorial Bridge opened to traffic in 1962 and is on the I-495 Capital Beltway highway system, crossing over the Potomac River connecting McLean, Virginia and Bethesda, Maryland. The current bridge does not have an SUP; however, plans for a reconstructed dual-span bridge include an SUP located on the outside of the I-495 Inner Loop travel lanes. The new structure is anticipated to be similar in length to the existing structure (1,443 feet) and cross over the Potomac River in the same location as the existing structure, with a height of approximately 140 feet above the Potomac River.

Other Locations: The San Francisco-Oakland Bay Bridge in California is a 3.9-mile-long bridge that opened in 2013 and carries I-80 between Oakland, California and San Francisco, California. The bridge consists of three sections. The SUP is a partial crossing over the San Francisco Bay and is located on the outside (south side) of the I-80 eastbound traffic lanes to the east of Yerba Buena Island (YBI) only. The SUP stops on YBI at the San Francisco-Oakland Bay Bridge Trail lookout, which is approximately 2.3 miles from the closest entry point, just east of the bridge abutment on the Oakland side. The SUP's 15.5-foot width allows for bicycle traffic in both directions and an outside lane for pedestrians. The SUP is part of the San Francisco Bay Trail which is currently under construction. There are plans to extend the SUP to downtown San Francisco across the San Francisco Bay west of YBI. Since the bridge has a vertical clearance of 220 feet, the SUP is taller than 220 feet at its highest point.

In New York, the Mario M. Cuomo (Tappan Zee) Bridge is a 3-mile-long structure with a 3.6-mile SUP that opened in 2020 and carries I-287 between South Nyack in Rockland County, New York and Tarrytown in Westchester County, New York. The bridge crosses over the Hudson River with the SUP located on the outside of the I-287 westbound traffic lanes. The SUP's 12-foot width allows for bicycle and pedestrian traffic in both directions. There are six overlooks along the length of the structure and landings with amenities at each end. The overlook with the tallest elevation is Half Moon Overlook at 140 feet above the water; however, this overlook is not located at the highest point across the bridge. The SUP connects to the Raymond G. Esposito Trail in South Nyack and a parking lot in Tarrytown.

3.8.1 Screening Results

The SUP options were evaluated using the screening criteria to determine which options to advance to the proposed ARDS. To assess whether an option was reasonable, each option was evaluated independently for each need and objective. The options were also evaluated relative to the other options for each objective. The results are shown in **Table 3-11**. Where a box is green, the option is likely to address the need or objective. Where a box is red, the option does not have the potential to address the need or an objective. Where a box is white, the option is not applicable because an SUP is not a standalone option and is being considered as a potential supplemental transportation improvement to a new Bay crossing. A more detailed description of each option in relation to the screening criteria is presented below the table.

Table 3-11. Potential of SUP Options to Address the Needs and Objectives

Screening Criteria		Consider Inclusion of Shared Use Path
Does the option have the potential to address the need?	Adequate Capacity & Reliable Travel Times	Not Applicable
	Mobility	Yes
	Roadway Deficiencies	Not Applicable
	Existing and Future Maintenance	Not Applicable
	Navigation	Not Applicable
To what extent does the option address the objective?	Environmental Responsibility	Not Applicable
	Cost and Financial Responsibility	Not Applicable

The inclusion of an SUP has received strong interest from the public, and it would address the study's mobility need. Additional detail can be found in **Section 3.9**. The ability for an SUP to safely and reasonably enhance the proposed ARDS will be studied in the EIS. At this time, the MDTA will continue to consider an SUP because it could have the potential to address the Tier 2 Study's Purpose and Need but additional analysis is needed.

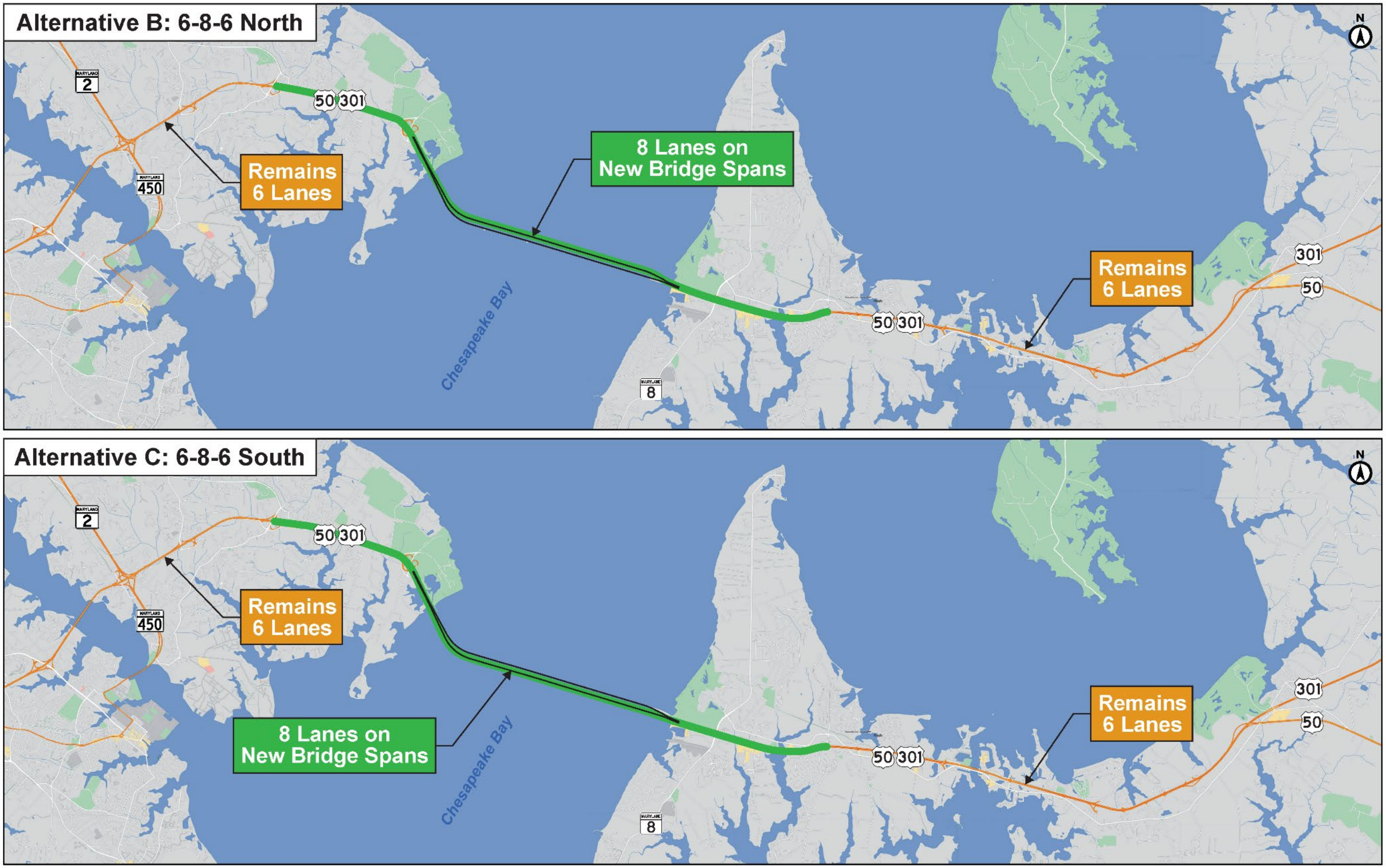
4 PROPOSED ACTION AND PROPOSED ARDS

The proposed action would remove the existing Bay Bridge spans and replace them with a new bridge over the Chesapeake Bay. The new bridge would consist of two spans for the reasons discussed in **Section 3.3.1**. The proposed action also includes bus service improvements, TSM/TDM improvements, and pedestrian/bicycle SUP considerations.

Based on the results of the screening analysis as described in **Section 3**, the MDTA identified seven alternatives for the proposed action, including the No-Build Alternative and six build alternatives. The alternatives comprise the reasonable range of alternatives that would be evaluated in the EIS and are the ARDS. They are based on the number of lanes provided across the new bridge and on the approaches as well as the bridge location. Consistent with FHWA regulations, the No-Build Alternative is being advanced as baseline and will be evaluated in the EIS. The proposed ARDS are:

- **Alternative A – No-Build, 6-5-6**: retains the existing Chesapeake Bay Bridge, the U.S. 50/301 alignment, and the existing number of lanes;
- **Alternative B - 6-8-6 North:** 6 lanes along U.S. 50/301 on the Western Shore, 8 lanes across the Chesapeake Bay on a new bridge to the north of the existing bridge, and 6 lanes along U.S. 50/301 on the Eastern Shore;
- **Alternative C - 6-8-6 South**: 6 lanes along U.S. 50/301 on the Western Shore, 8 lanes across the Chesapeake Bay on a new bridge to the south of the existing bridge, and 6 lanes along U.S. 50/301 on the Eastern Shore;
- **Alternative D - 8-8-8 North**: 8 lanes along U.S. 50/301 on the Western Shore, 8 lanes across the Chesapeake Bay on a new bridge to the north of the existing bridge, 8 lanes along U.S. 50/301 on the Eastern Shore;
- **Alternative E - 8-8-8 South**: 8 lanes along U.S. 50/301 on the Western Shore, 8 lanes across the Chesapeake Bay on a new bridge to the south of the existing bridge, 8 lanes along U.S. 50/301 on the Eastern Shore;
- **Alternative F - 8-10-8 North**: 8 lanes along U.S. 50/301 on the Western Shore, 10 lanes across the Chesapeake Bay on a new bridge to the north of the existing bridge, 8 lanes along U.S. 50/301 on the Eastern Shore and
- **Alternative G - 8-10-8 South**: 8 lanes along U.S. 50/301 on the Western Shore, 10 lanes across the Chesapeake Bay on a new bridge to the south of the existing bridge, 8 lanes along U.S. 50/301 on the Eastern Shore.

Figure 4.1. Proposed Build Alternatives Retained for Detailed Study (ARDS)



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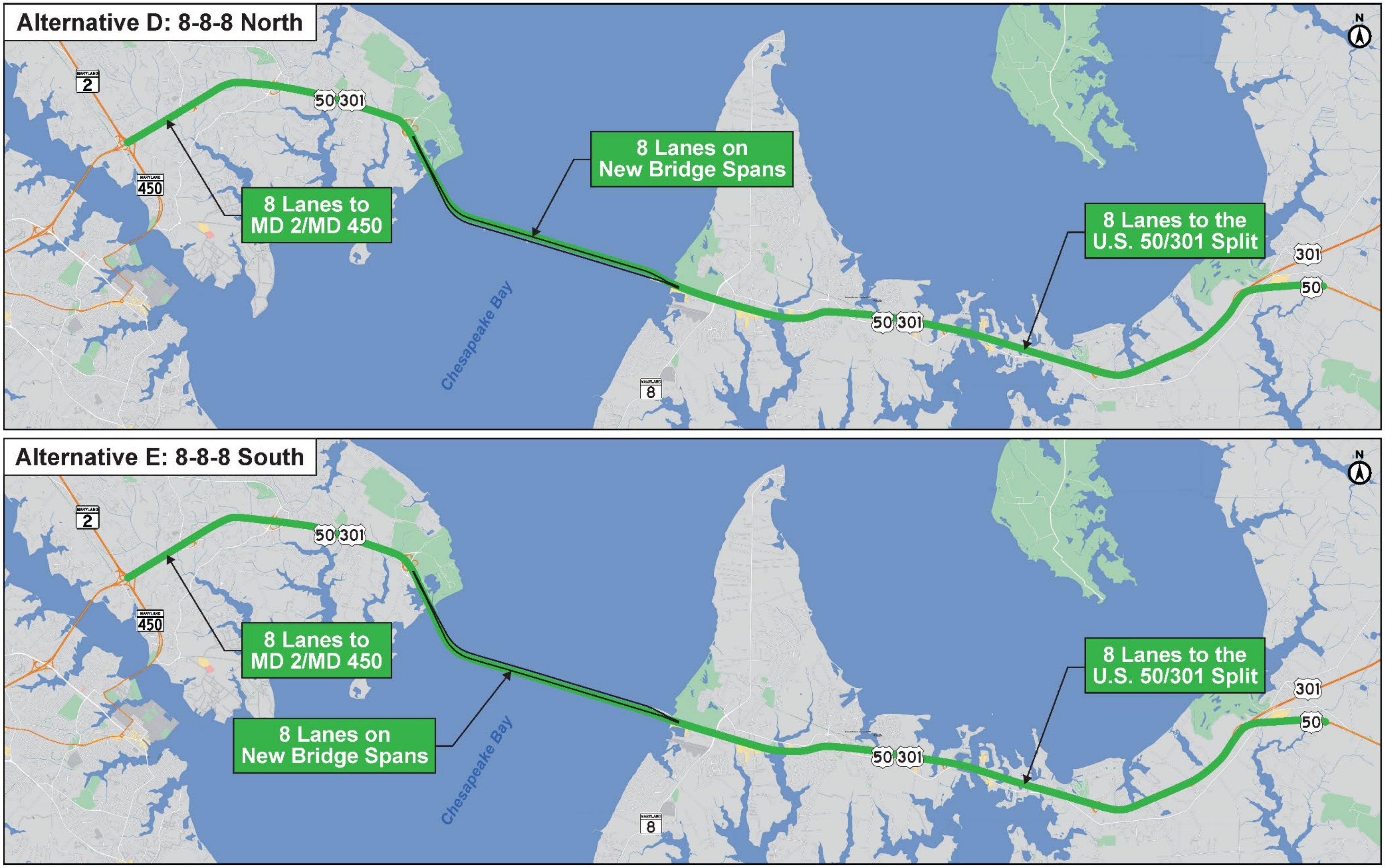

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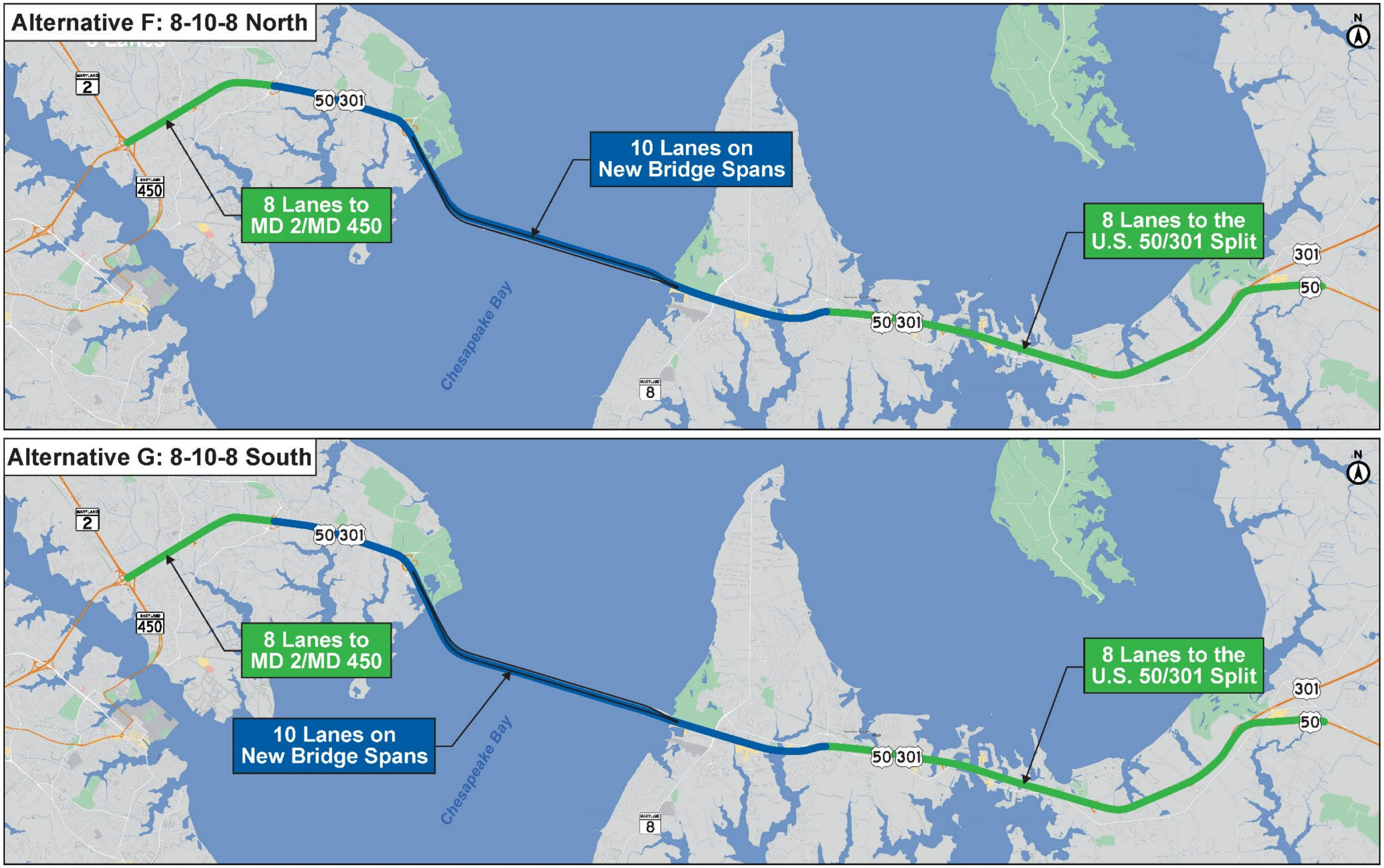


Other options considered in the development of the proposed build alternatives that have been screened out are described in **Section 3**. The MDTA and the FHWA will finalize a reasonable range of alternatives that will be retained for detailed study in the EIS based on comments received in response to this NOI and NOI Additional Project Information Document. The following sections describe other considerations included in the proposed ARDS.

4.1 Considerations Included in all Proposed Build Alternatives

All proposed build alternatives will include options for bus improvements, TSM/TDM improvements, and the safe inclusion of a pedestrian/bicycle SUP as described below.

4.1.1 Bus Improvements

The proposed ARDS will include potential bus improvements, such as enhanced local and intercity bus service, as described in **Section 3.7.1.3**. The MDTA will also further consider potential transit priority treatments. Impacts and feasibility associated with these improvements will be studied as part of the proposed ARDS.

4.1.2 TSM / TDM Improvements

Several TSM/TDM measures will be considered with the proposed ARDS, including congestion pricing (**Section 3.7.2.1**), park-and-ride facilities (**Section 3.7.2.3**), interchange consolidation (**Section 3.7.2.4**), and part-time shoulder use (PTSU) lanes (**Section 3.7.2.7**). The MDTA will evaluate if the implementation of congestion pricing with the proposed ARDS could improve the ability of the alternative to address the Purpose and Need. As part of the enhanced bus service analysis in the proposed ARDS, the MDTA will look at ways existing park-and-ride facilities can be better utilized or expanded to make bus service, carpooling, and vanpooling more efficient. In an effort to keep current access locations open for nearby residents and businesses, the MDTA will continue to consider interchange consolidation where needed based on the proposed mainline improvements in the proposed ARDS. The MDTA will continue to study options for both bus-only operations and general vehicular operations to determine if a PTSU configuration for the proposed ARDS could provide adequate capacity without a full-time lane.

4.1.3 Pedestrian / Bicycle Shared Use Path (SUP)

The MDTA will consider the option of including a safe SUP along a new bridge as part of the proposed ARDS. This analysis will include study of the environmental impacts, potential tie-in locations to existing pedestrian and bicycle facilities, and the cost associated with constructing an SUP. This analysis will be used to determine whether the MDTA's Recommended Preferred Alternative will include an SUP.

4.2 Alternative A (No-Build, 6-5-6)

The EIS will consider a No-Build Alternative ("no-action alternative") that would retain the existing Chesapeake Bay Bridge, U.S. 50/301 alignment, and number of lanes. This alternative would retain six lanes on the approaches on the Eastern and Western Shores and five lanes on the Bay Bridge, referred to as 6-5-6 similar to the build alternative terminology. The No-Build Alternative will include regular maintenance of the Chesapeake Bay Bridge and U.S. 50/301, but no capital improvements other than currently planned and programmed projects.

The No-Build Alternative would not address the Tier 2 Study's Purpose and Need but will be retained as a baseline for comparison with the proposed ARDS. A preliminary evaluation of the No-Build Alternative (Alternative A) and how it relates to the Purpose and Need is provided in **Table 4-1**.

Table 4-1. Potential to Address Purpose and Need–Alternative A (No-Build, 6-5-6)

Needs	
Adequate Capacity and Reliable Travel Times	This alternative would not provide additional capacity or improve travel reliability. The corridor would retain six lanes on the approaches and five lanes across the Chesapeake Bay with no other changes to transit or bridge operations. Current and future traffic conditions would remain. This alternative would not provide safer conditions through increased capacity or congestion alleviation.
Mobility	By providing no additional capacity on U.S. 50/301, this alternative would not improve mobility for users traveling across the Chesapeake Bay. Spillover traffic in local communities would remain. Transit users would have the same options for travel across the Chesapeake Bay. Pedestrians and bicyclists would not be able to cross the Chesapeake Bay.
Roadway Deficiencies	This alternative would not provide safer conditions through wider lanes and shoulders. It would retain the existing bridge spans and there would be no change to narrow lane and shoulder widths. Traffic operations, congestion rates, and incident management practices would remain as they currently are. Fall prevention would not be addressed.
Existing and Future Maintenance Needs	The alternative would retain the aging structures and would continue requiring significant construction/maintenance in order to remain operable for future decades. The spans would continue to have limited space for maintenance workers and construction/ maintenance projects would continue to exacerbate congested conditions in the future.
Navigation	This alternative would retain the existing vertical clearances. Current limitations to shipping traffic would remain, and further limit the growth and operation of the Port of Baltimore as freighters and cruise ships continue to increase in size.
Objectives	
Environmental Responsibility	This alternative would result in no environmental effects to resources within the Chesapeake Bay and areas along the U.S. 50/301 roadway at either shore. Local communities would not experience any impacts through implementation of a build alternative but would retain existing conditions of the structure.
Cost and Financial Responsibility	This alternative would have continued costs of approximately $3.8 billion through 2065 in order to keep the existing structures in adequate condition.

4.3 Alternative B (6-8-6 North)

As described above for all proposed build alternatives, Alternative B would replace the existing Bay Bridge spans with two new bridge spans. Alternative B (6-8-6 North) would consist of six lanes along U.S. 50/301 on the Western Shore (three per direction), eight lanes crossing the Bridge (four per direction) north of the existing bridge, and six lanes along U.S. 50/301 on the Eastern Shore (three per direction). With Alternative B (6-8-6 North), the five existing bridge lanes would be increased to eight bridge lanes; however, the number of lanes on the Western Shore and

Eastern Shore would not change. This proposed alternative retained for detailed study will be further evaluated in the EIS.

For the purposes of this NOI and NOI Additional Project Information Document, the MDTA has assumed the typical sections for Alternative B (6-8-6 North) as shown in **Figure 4.2**. The lanes and shoulders would be 12 feet wide, and the median width would vary. A potential SUP could be 10 feet wide with 2-foot-wide offsets to the vertical barriers on both sides of the SUP.[8] In order for the shoulder to be used as a PTSU lane during congested periods, the shoulder must be at least 12 feet wide with an offset to the median barrier. For the purposes of the Tier 2 Study as shown in the typical section, the PTSU lane would be 12 feet wide with a 2-foot offset to the concrete median barrier.

Preliminary footprints for an eight-lane bridge approach connecting with a north bridge location on the Western Shore and the Eastern Shore are provided in **Figures 3.2 and 3.3**, respectively. The footprints show one potential alignment for the north bridge location, but it is not the only potential alignment. The alignment was used to determine a preliminary magnitude of impacts. The location for the transition between eight lanes across the bridge and six lanes on the approaches has not yet been identified and will be identified in the DEIS.

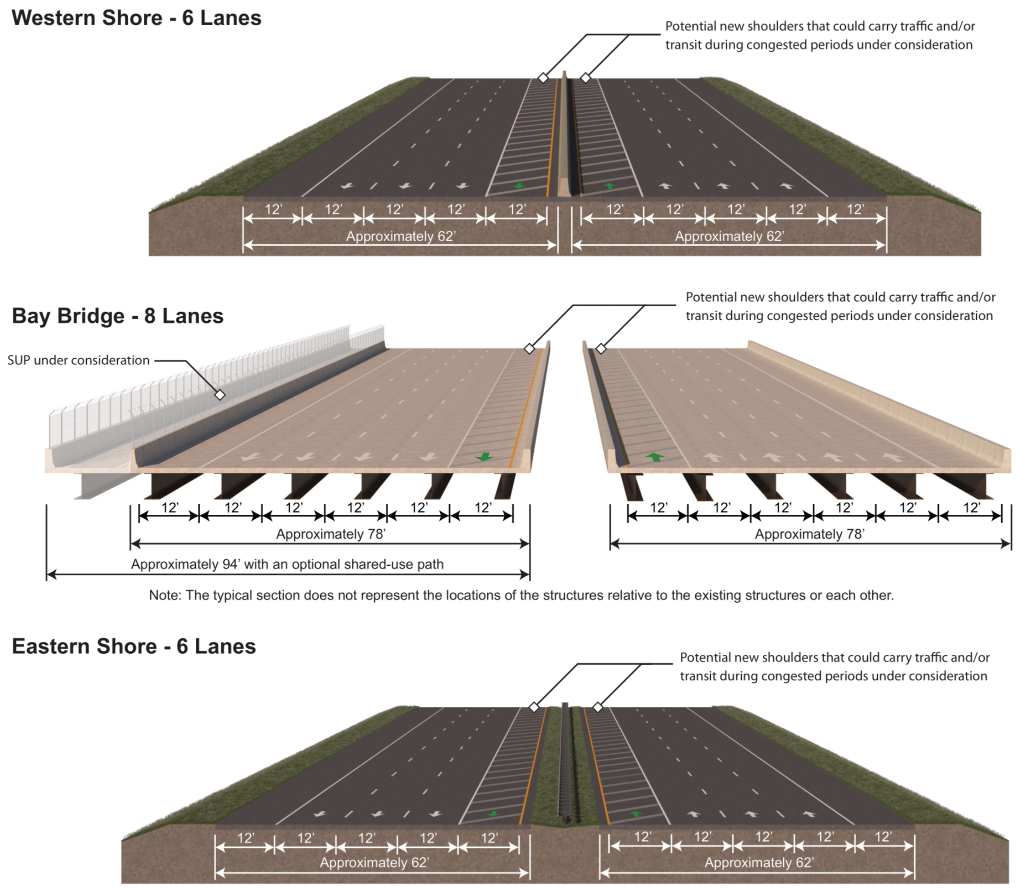
4.4 Alternative C (6-8-6 South)

As described above for all proposed ARDS, Alternative C would replace the existing Bay Bridge spans with two new bridge spans. Alternative C (6-8-6 South) would consist of six lanes along U.S. 50/301 on the Western Shore (three per direction), eight lanes crossing the Bridge (four per direction) south of the existing bridge, and six lanes along U.S. 50/301 on the Eastern Shore (three per direction). With Alternative C (6-8-6 South), the five existing bridge lanes would be increased to eight bridge lanes; however, the number of lanes on the Western Shore and Eastern Shore would not change. This proposed ARDS will be further evaluated in the EIS. For the purposes of this NOI and NOI Additional Project Information Document, the MDTA has assumed the typical sections for Alternative C (6-8-6 South), would be the same as those for Alternative B (6-8-6 North), as shown in **Figure 4.2**.

Preliminary footprints for an eight-lane bridge approach connecting with a south bridge location on the Western Shore and the Eastern Shore are provided in **Figures 3.4 and 3.5**, respectively. The footprints show one potential alignment for the south bridge location, but it is not the only potential alignment. The alignment was used to determine a preliminary magnitude of impacts. The location for the transition between eight lanes across the bridge and six lanes on the approaches has not yet been identified.

[8] Lane and shoulder widths are preliminary and subject to change.

Figure 4.2. Alternatives B and C (6-8-6) Typical Sections



4.5 Alternative D (8-8-8 North)

As described above for all proposed build alternatives, Alternative D would replace the existing Bay Bridge spans with two new bridge spans. Unlike Alternatives B and C, Alternative D (8-8-8 North) would increase the number of lanes along the U.S. 50/301 approaches to eight lanes. Thus, the alternative would consist of eight lanes along U.S. 50/301 on the Western Shore (four per direction), eight lanes crossing the Bridge (four per direction) north of the existing bridge, and eight lanes along U.S. 50/301 on the Eastern Shore (four per direction). This proposed alternative retained for detailed study will be further evaluated in the EIS.

With Alternative D (8-8-8 North), the five existing bridge lanes would be increased to eight bridge lanes. The number of lanes on the Western Shore and Eastern Shore would increase to eight total lanes. On the Western Shore, widening would occur to the outside in both directions to provide the eight-lane section: four lanes per direction plus shoulders. On the Eastern Shore, widening would occur first to the inside in both directions, and then to the outside where there is not sufficient space in the median for the full typical section.

For the purposes of this NOI and NOI Additional Project Information Document, the MDTA has assumed the typical sections for Alternative D (8-8-8 North) as shown in **Figure 4.3**. The lanes and shoulders would be 12 feet wide, and the median width would vary. In order for the shoulder to be used as a lane during congested periods, the shoulder must be at least 12 feet wide with an offset to the median barrier. For the purposes of the Tier 2 Study as shown in the typical section, the PTSU lane would be 12 feet wide with a 2-foot offset to the concrete median barrier.

Preliminary footprints for an eight-lane bridge approach connecting with a north bridge location on the Western Shore and the Eastern Shore are shown in **Figures 3.2 and 3.3**, respectively. The footprints show one potential alignment for the north bridge location, but it is not the only potential alignment. The alignment was used to determine a preliminary magnitude of impacts.

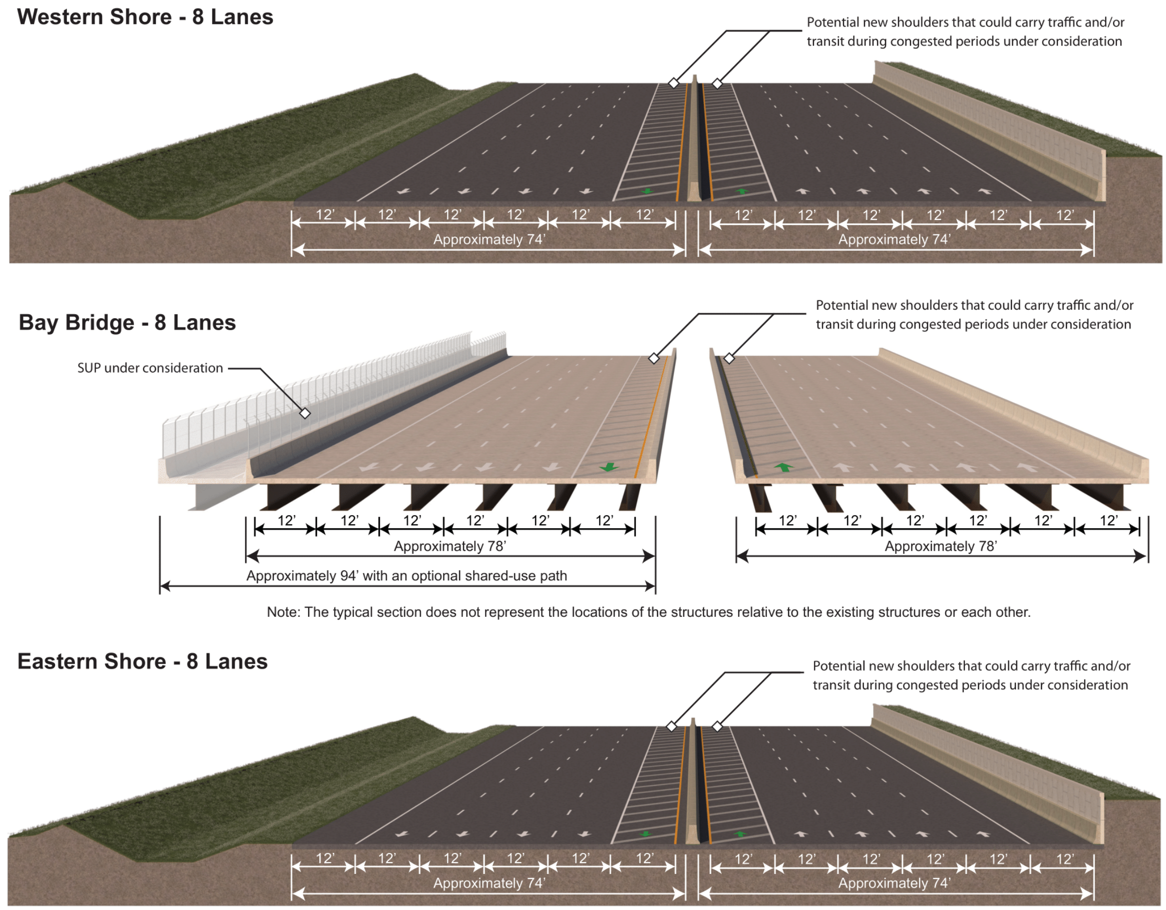
4.6 Alternative E (8-8-8 South)

As described above for all proposed build alternatives, Alternative E would replace the existing Bay Bridge spans with two new bridge spans. Unlike Alternatives B and C, Alternative E (8-8-8 South) would increase the number of lanes along the U.S. 50/301 approaches to eight lanes. Thus, the alternative would consist of eight lanes along U.S. 50/301 on the Western Shore (four per direction), eight lanes crossing the Bridge (four per direction) south of the existing bridge, and eight lanes along U.S. 50/301 on the Eastern Shore (four per direction). This proposed alternative retained for detailed study will be further evaluated in the EIS.

With Alternative E (8-8-8 South), the five existing bridge lanes would be increased to eight bridge lanes. The number of lanes on the Western Shore and Eastern Shore would increase to eight total lanes. On the Western Shore, widening would occur to the outside in both directions to provide the eight-lane section: four lanes per direction plus shoulders. On the Eastern Shore, widening would occur first to the inside in both directions, and then to the outside where there is not sufficient space in the median for the full typical section. For the purposes of this NOI and NOI Additional Project Information Document, the MDTA has assumed the typical sections would be the same as the typical sections for Alternative D, as shown in **Figure 4.3**.

Preliminary footprints for an eight-lane bridge approach connecting with a south bridge location on the Western Shore and the Eastern Shore are shown in **Figures 3.4 and 3.5**, respectively. The footprints show one potential alignment for the south bridge location, but it is not the only potential alignment. The alignment was used to determine a preliminary magnitude of impacts.

Figure 4.3. Alternatives D and E (8-8-8) Typical Sections



4.7 Alternative F (8-10-8 North)

As described above for all proposed ARDS, Alternative F would replace the existing Bay Bridge spans with two new bridge spans. However, unlike Alternatives D and E, Alternative F (8-10-8 North) would increase the number of lanes across the Bay to ten lanes. Thus, the alternative would consist of eight lanes along U.S. 50/301 on the Western Shore (four per direction), ten lanes crossing the Bridge (five per direction) north of the existing bridge, and eight lanes along U.S. 50/301 on the Eastern Shore (four per direction). This proposed alternative retained for detailed study will be further evaluated in the EIS.

On the Western Shore, widening would occur to the outside in both directions to provide the eight-lane section: four lanes per direction plus shoulders. On the Eastern Shore, widening would occur first to the inside in both directions, and then to the outside where there is not sufficient space in the median for the full typical section.

For the purposes of this NOI and NOI Additional Project Information Document, the MDTA has assumed the typical sections for Alternative F (8-10-8 North) as shown in **Figure 4.4**. The lanes and shoulders would be 12 feet wide, and the median width would vary. For the shoulder to be used as a lane during congested periods, the shoulder must be at least 12 feet wide with an offset to the median barrier. For the purposes of the Tier 2 Study as shown in the typical section, the PTSU lane would be 12 feet wide with a 2-foot offset to the concrete median barrier.

Preliminary footprints for a ten-lane bridge approach connecting with a north bridge location on the Western Shore and the Eastern Shore are shown in **Figures 4.5 and 4.6**, respectively. The footprints show one potential alignment for the north bridge location, but it is not the only potential alignment. The alignment was used to determine a preliminary magnitude of impacts. The location of the transition between ten lanes across the bridge and eight lanes on the approaches has not yet been determined.

4.8 Alternative G (8-10-8 South)

As described above for all proposed ARDS, Alternative G would replace the existing Bay Bridge spans with two new bridge spans. However, unlike Alternatives D and E, Alternative G (8-10-8 South) would increase the number of lanes across the Bay to ten lanes. Thus, the alternative would consist of eight lanes along U.S. 50/301 on the Western Shore (four per direction), ten lanes crossing the Bridge (five per direction) south of the existing bridge, and eight lanes along U.S. 50/301 on the Eastern Shore (four per direction). This proposed alternative retained for detailed study will be further evaluated in the EIS.

On the Western Shore, widening would occur to the outside in both directions to provide the eight-lane section: four lanes per direction plus shoulders. On the Eastern Shore, widening would occur first to the inside in both directions, and then to the outside where there is not sufficient space in the median for the full typical section. For the purposes of this NOI and NOI Additional Project Information Document, the MDTA has assumed the typical sections for Alternative G (8-10-8 South) would be the same as the typical sections for Alternative F, as shown in **Figure 4.5**.

Preliminary footprints for a ten-lane bridge approach connecting with a south bridge location on the Western Shore and the Eastern Shore are shown in **Figures 4.7 and 4.8**, respectively. The footprints show one potential alignment for the south bridge location, but it is not the only potential alignment. The alignment was used to determine a preliminary magnitude of impacts. The location of the transition between ten lanes across the bridge and eight lanes on the approaches has not yet been determined.

Figure 4.4. Alternatives F and G (8-10-8) Typical Sections

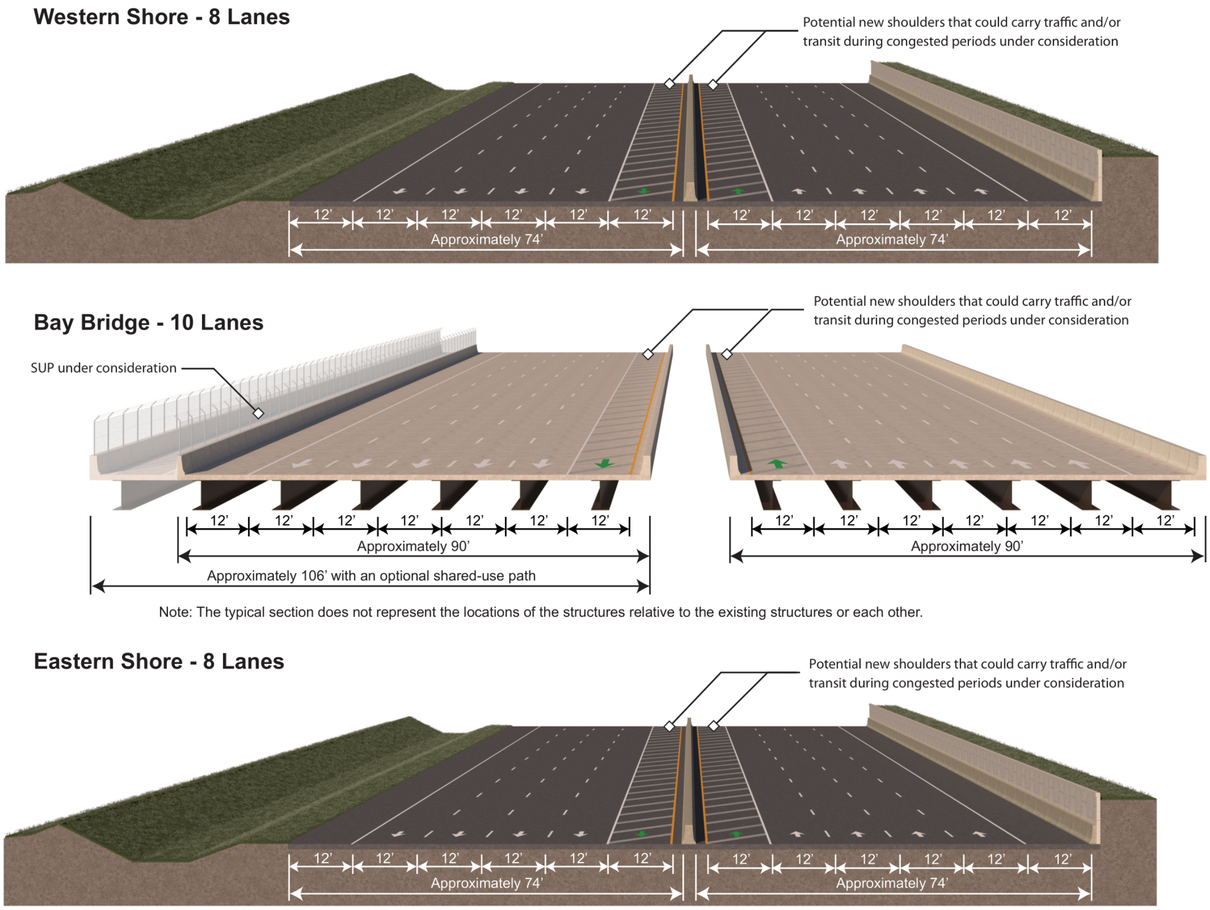


Figure 4.5. Western Shore Approach, Northern Alignment, 10-Lane Bridge

Figure 4.6. Eastern Shore Approach, Northern Alignment, 10-Lane Bridge

Figure 4.7. Western Shore Approach, Southern Alignment, 10-Lane Bridge

Figure 4.8. Eastern Shore Approach, Southern Alignment, 10-Lane Bridge

4.9 Summary

A preliminary evaluation of the proposed ARDS and how they relate to the Purpose and Need is provided in **Table 4-2**. Preliminary cost estimates for the proposed ARDS are provided in **Table 4-3**. Additional study will be performed on the proposed ARDS in the EIS.

Table 4-2. Potential to Address Purpose and Need – Proposed Build Alternatives (Alternatives B-G)

Needs	
Adequate Capacity and Reliable Travel Times	All proposed ARDS would provide additional capacity across the bridge, and Alternatives D through G would provide additional capacity on the approaches. All proposed ARDS will be evaluated to determine the degree to which they have the ability to provide adequate capacity and improve reliability relative to the No-Build Alternative. Enhancements to bus service and transit priority treatments could provide greater transit capacity and improve reliability for transit users. TSM/TDM improvements such as part-time shoulder use could provide additional capacity and greater reliability, particularly during peak periods. Reduced congestion compared to the no-build condition could reduce the rate of crashes during high-volume periods.
Mobility	By providing additional capacity and reducing congestion on U.S. 50/301, the proposed build alternatives could improve mobility for users across the Chesapeake Bay and potentially alleviate spillover traffic in local communities. Enhancements to bus service and transit priority treatments could improve mobility for transit users. Bus, TSM/TDM, and pedestrian/bicycle facility improvements could improve mobility for other travel modes.
Roadway Deficiencies	The proposed ARDS would include new bridge spans that would have wider lanes and shoulders than the existing bridge spans. This could provide safer conditions for drivers, the MDTA workers, and first responders by providing a space for vehicles to pull over. The proposed ARDS would provide an equal number of lanes in each direction, eliminating the need for frequent contraflow operations.
Existing and Future Maintenance Needs	The proposed ARDS would all include a newly constructed bridge, which would require substantially less major maintenance than the existing bridge. Wider shoulders would provide more room for maintenance workers and may not necessitate lane closures for regular maintenance.
Navigation	The proposed ARDS would all involve construction of a new bridge that could have a higher vertical clearance than the existing Bay Bridge. The new bridge could better accommodate maritime transport through the Chesapeake Bay and to the Port of Baltimore.
Objectives	
Environmental Responsibility	The proposed ARDS would result in environmental effects to resources within the Chesapeake Bay and along the tie-ins to the U.S. 50/301 roadway on both shores. Bus enhancements could also reduce a small number of vehicles crossing the Chesapeake Bay and provide greater access to transportation modes that cause less air pollution. A summary of expected impacts for the approach roadways of each proposed ARDS for the north bridge location and the south bridge location can be seen in **Section 5**.
Cost and Financial Responsibility	The proposed ARDS would have costs associated with construction of two new bridge spans over the Chesapeake Bay and the approach roadways. There would also be costs associated with the demolition of the existing Bay Bridge, enhancements to bus service, transit priority treatments, and TSM/TDM improvements such as part-time shoulder use. Preliminary cost estimates for the proposed ARDS are provided in **Table 4-3**.

Table 4-3. Preliminary Cost Estimates for the Proposed ARDS

Alternative	Estimated Cost (2024$)
Alternative A (No-Build, 6-5-6)	$3.8 billion*
Alternative B (6-8-6 North)	$8.6 – $9 billion
Alternative C (6-8-6 South)	
Alternative D (8-8-8 North)	$10.4 – $11.1 billion
Alternative E (8-8-8- South)	
Alternative F (8-10-8 North)	$11.6 – $12.3 billion
Alternative G (8-10-8 South)	

*Estimated cost of maintenance and rehabilitation of the existing bridge spans from 2024 through 2065, see **Figure 3.1**.

5 POTENTIAL ENVIRONMENTAL EFFECTS

The MDTA, in coordination with the FHWA, has initiated data collection, preliminary resource evaluations, and agency coordination to identify the possible environmental, cultural, and socio-economic resources present in the Tier 2 Study EIS limits. These resources could potentially incur direct or reasonably foreseeable impacts from the proposed action. Based on preliminary review of existing conditions within and in proximity to the study limits, the proposed action could affect the following resources and environmental considerations:

- Socioeconomic resources and land use (including communities and land use; economics and employment; and visual resources);
- Cultural and historic resources;
- Section 4(f) and Section 6(f) properties (including parks and recreational areas);
- Natural resources (such as wetlands and waters, floodplains, water quality, and Chesapeake Bay Critical Areas (CBCAs); aquatic and terrestrial habitat and biota; rare, threatened, and endangered species; and unique and sensitive areas; and hydrodynamics);
- Hazardous materials;
- Air quality; and
- Noise.

Table 5-1 presents the quantified potential environmental effects from the ARDS. These are impacts caused by the approach roadways, not the proposed new bridge spans, and include effects to community resources, historic resources, natural resources, and preservation areas. The impact values provided are estimated based on approximate footprints of the ARDS on the Eastern Shore and Western Shore. As the ARDS are evaluated in the EIS, the expected effects will be further refined and identified in greater detail.

Table 5-1. Potential Effects from the Proposed ARDS on the Approaches

Resource Type	Resource	Unit	Alt A No-Build, 6-5-6	Alt B 6-8-6 North	Alt C 6-8-6 South	Alt D 8-8-8 North	Alt E 8-8-8 South	Alt F 8-10-8 North	Alt G 8-10-8 South
Community Resources	Total Area of Additional ROW	acres	0	10-40	10-40	60	60	60-70	60-70
	Residential Property Area	acres	0	0-5	0-5	8	8	8-11	8-11
	Commercial Property Area	acres	0	1-7	2-8	15	16	15-18	16-19
	Number of Community Facilities	#	0	3-6	1-6	8	7	8	8
	Community Facility Property Area	acres	0	7-8	6	8	6	8-9	6-7
	Number of Parks	#	0	2-4	0-3	5	4	5-6	5-6
	Park Property Area	acres	0	5-6	0-1	7	2	7	2-3
Historic Resources	Number of Historic Properties*	#	0	3	3	4	4	4	4
	Historic Property Area	acres	0	6-7	1	7	2	7	2
Natural Resources	SSPRA Habitat	#	0	2-4	2-4	7-8	7-8	7-8	7-8
	FIDS Habitat	acres	0	7-9	7-9	20	20	20-21	20-21
	Forest Areas	acres	0	20-30	10-30	100	90-100	100-110	100
	Agricultural Land	acres	0	0	0	1	1	1	1
	Critical Areas	acres	0	80-200	80-190	400	390-400	400-410	390-400
	Critical Area (100-ft) Buffer	acres	0	19-24	15-21	36	32	36	32-33
	Wetlands (Field Delineated)	acres	0	7-15	5-12	28	25	28	25-26
	100-Year Floodplain Area	acres	0	30	20	60	50	60	50
	Surface Waters - Non-tidal Area	acres	0	7-8	8	10	10	10	10
	Surface Waters - Tidal Area	acres	0	2-3	1	7	5	7	5-6
	Benthic Habitat	acres	0	0	0	3	3	3	3

Resource Type	Resource	Unit	Alt A No-Build, 6-5-6	Alt B 6-8-6 North	Alt C 6-8-6 South	Alt D 8-8-8 North	Alt E 8-8-8 South	Alt F 8-10-8 North	Alt G 8-10-8 South
	Submerged Aquatic Vegetation	acres	0	3	1	3	1	3	1
	Horseshoe Crab Habitat	linear ft	0	3,200	700	3,200	700	3,200	700
	Public Shellfishery Areas	acres	0	0	0	4	4	4	4
	Oyster Sanctuaries	acres	0	0-1	0-1	1	1	1-2	1-2
	Historic Oyster Bottom	acres	0	0	0	4	4	4	4
Other Resources/ Preservation Areas	Number of Section 4f Properties	#	0	5-7	3-6	9	8	9-10	9-10
	Number of Section 6f Properties	#	0	2	2	2	2	2	2
	Section 6f Properties	acres	0	6-7	1	7	1	7	1
	Conservation Easements	acres	0	20-40	20-30	40	30	40	30
	Green Infrastructure	acres	0	0-1	0-1	18	18	18	18
	Local Protected Land	acres	0	1	1	2	2	2	2
	Environmental Trust Easements	acres	0	0-1	0-1	6	6	6	6

* Historic properties include two bridges, the Chesapeake Bay Bridge and the MD 18 Kent Narrows Bridge. These historic bridges are not included in impact area calculation