

Chesapeake
BAY CROSSING STUDY
TIER 2 NEPA

TRAFFIC ANALYSIS
TECHNICAL REPORT

JANUARY 2026

Maryland
Transportation
Authority
MDTA

Chesapeake BAY CROSSING STUDY
TIER 2 NEPA

TRAFFIC ANALYSIS TECHNICAL REPORT

Maryland Transportation Authority
MDTA

JANUARY 2026

TABLE OF CONTENTS

1 INTRODUCTION 1-1
2 BACKGROUND 2-1
2.1 The Tiered NEPA Process 2-1
2.2 Study Limits 2-1
2.3 Purpose and Need 2-2
3 ALTERNATIVES 3-1
3.1 Alternative A: No-Build 3-2
3.2 Alternative B: 6-8-6 North 3-2
3.3 Alternative C: 6-8-6 South 3-2
3.4 Alternative D: 8-8-8 North 3-4
3.5 Alternative E: 8-8-8 South 3-4
3.6 Alternative F: 8-10-8 North 3-4
3.7 Alternative G: 8-10-8 South 3-4
3.8 Other Components of the Build Alternatives ..... **Error! Bookmark not defined.**
4 TRAFFIC ANALYSIS METHODOLOGIES 4-1
4.1 Introduction 4-1
4.2 Study Area Limits for Traffic Analyses 4-1
4.3 Traffic Analysis Methodologies for Existing Conditions 4-17
4.4 Traffic Analysis Methodologies for Future Conditions 4-22
5 TRAFFIC ANALYSIS OF EXISTING CONDITIONS 5-1
5.1 HCM Analysis and Queuing Analysis of the Bay Bridge 5-1
5.2 HCM Analysis of U.S. 50/301 in the Remainder of the Study Area 5-4
5.3 VISSIM Analysis 5-11
6 TRAFFIC ANALYSIS OF FUTURE (2045) CONDITIONS 6-1
6.1 Introduction 6-1
6.2 Reliable Travel Times 6-2
6.3 VISSIM Analyses of 2045 Scenarios 6-3
6.4 2045 Alternative A (No-Build) 6-4
6.5 2045 Build Alternatives 6-23
6.6 Travel Demand Forecasts for Year 2045 Build Alternatives 6-23
6.7 Analysis of Alternatives B/C: 6-8-6 6-24
6.8 Analysis of Alternatives D/E: 8-8-8 6-42
6.9 Analysis of Alternatives F/G: 8-10-8 6-60
7 SENSITIVITY ANALYSIS 7-1
7.1 HCM Capacity Analysis of New Bridge 7-1
7.2 Connected and Automated Vehicles (CAV) 7-3

8 SUMMARY 8-1
8.1 Existing Conditions 8-1
8.2 Alternative A: No-Build in 2045 8-1
8.3 Alternative B/C: 6-8-6 8-1
8.4 Alternative D/E: 8-8-8 8-2
8.5 Alternative F/G: 8-10-8 8-2
8.6 Sensitivity Analysis Considerations 8-2
APPENDIX A A-1
APPENDIX B B-1
APPENDIX C C-1

LIST OF FIGURES

Figure 3-1: Alternatives Summary 3-3
Figure 4-1: Tier 1 Study Selected Corridor Alternative 4-2
Figure 4-2: Traffic Count Locations 4-3
Figure 4-3: Westbound Daily Traffic Volumes between the Severn River Bridge and the Bay Bridge 4-7
Figure 4-4: Eastbound Daily Traffic Volumes between the Severn River Bridge and the Bay Bridge 4-8
Figure 4-5: Westbound Daily Traffic Volumes between the Kent Narrows Bridge and the U.S. 50/301 Split 4-9
Figure 4-6 Westbound Daily Traffic Volumes between the Bay Bridge and the Kent Narrows Bridge 4-10
Figure 4-7: Eastbound Daily Traffic Volumes between the Bay Bridge and the Kent Narrows Bridge 4-11
Figure 4-8: Eastbound Daily Traffic Volumes between the Kent Narrows Bridge and the U.S. 50/301 Split 4-12
Figure 4-9: Total Daily Traffic Volumes Entering and Exiting at Each Interchange on the Western Shore 4-15
Figure 5-1: Bottleneck Diagram: Existing Conditions Summer Weekend Scenario, Peak Hour of Queueing (Eastbound Friday and Westbound Sunday) 5-16
Figure 5-2: Bottleneck Diagram, Existing Conditions NSWD Scenario, Peak Hour of Queuing (Eastbound PM, Westbound AM) 5-21
Figure 6-1: Westbound Daily Traffic Volumes between the Severn River Bridge and the Bay Bridge: Alternative A: No-Build in 2045 6-5
Figure 6-2: Eastbound Daily Traffic Volumes between the Severn River Bridge and the Bay Bridge: Alternative A: No-Build in 2045 6-6
Figure 6-3: Westbound Daily Traffic Volumes between the Kent Narrows Bridge and the U.S. 50/301 Split: Alternative A: No-Build in 2045 6-7
Figure 6-4: Westbound Daily Traffic Volumes between the Bay Bridge and the Kent Narrows Bridge: Alternative A: No-Build in 2045 6-8
Figure 6-5: Eastbound Daily Traffic Volumes between the Bay Bridge and the Kent Narrows Bridge: Alternative A: No-Build in 2045 6-9
Figure 6-6: Eastbound Daily Traffic Volumes between the Kent Narrows Bridge and the U.S. 50/301 Split: Alternative A: No-Build in 2045 6-10
Figure 6-7: Bottleneck Diagram: No-Build Summer Weekend Scenario, Peak Hour of Queuing 6-15
Figure 6-8: Bottleneck Diagram: No-Build NSWD Scenario, Peak Hour of Queuing (Eastbound PM, Westbound AM) 6-21
Figure 6-9: Westbound Daily Traffic Volumes between the Severn River Bridge and the Bay Bridge: 2045 Alternatives B and C (6-8-6) 6-25

Figure 6-10: Eastbound Daily Traffic Volumes between the Severn River Bridge and the Bay Bridge: 2045 Alternatives B and C (6-8-6) 6-26
Figure 6-11: Westbound Daily Traffic Volumes between the Kent Narrows Bridge and the U.S. 50/301 Split: 2045 Alternatives B and C (6-8-6) 6-27
Figure 6-12: Westbound Daily Traffic Volumes between the Bay Bridge and the Kent Narrows Bridge: 2045 Alternatives B and C (6-8-6) 6-28
Figure 6-13: Eastbound Daily Traffic Volumes between the Bay Bridge and the Kent Narrows Bridge: 2045 Alternatives B and C (6-8-6) 6-29
Figure 6-14: Eastbound Daily Traffic Volumes between the Kent Narrows Bridge and the U.S. 50/301 Split: 2045 Alternatives B and C (6-8-6) 6-30
Figure 6-15: Bottleneck Diagram: Alternatives B and C (6-8-6) Summer Weekend Scenario 6-35
Figure 6-16: Bottleneck Diagram: Alternatives B and C (6-8-6) NSWD Scenario (Eastbound PM, Westbound AM) 6-41
Figure 6-17: Westbound Daily Traffic Volumes between the Severn River Bridge and the Bay Bridge: 2045 Alternatives D and E (8-8-8) 6-43
Figure 6-18: Eastbound Daily Traffic Volumes between the Severn River Bridge and the Bay Bridge: 2045 Alternatives D and E (8-8-8) 6-44
Figure 6-19: Westbound Daily Traffic Volumes between the Kent Narrows Bridge and the U.S. 50/301 Split: 2045 Alternatives D and E (8-8-8) 6-45
Figure 6-20: Westbound Daily Traffic Volumes between the Bay Bridge and the Kent Narrows Bridge: 2045 Alternatives D and E (8-8-8) 6-46
Figure 6-21: Eastbound Daily Traffic Volumes between the Bay Bridge and the Kent Narrows Bridge: 2045 Alternatives D and E (8-8-8) 6-47
Figure 6-22: Eastbound Daily Traffic Volumes between the Kent Narrows Bridge and the U.S. 50/301 Split: 2045 Alternatives D and E (8-8-8) 6-48
Figure 6-23: Bottleneck Diagram: Alternatives D and E (8-8-8) Summer Weekend Scenario 6-53
Figure 6-24: Bottleneck Diagram: Alternatives D and E (8-8-8) NSWD Scenario (Eastbound PM, Westbound AM) 6-59
Figure 6-25: Westbound Daily Traffic Volumes between the Severn River Bridge and the Bay Bridge: 2045 Alternatives F and G (8-10-8) 6-61
Figure 6-26: Eastbound Daily Traffic Volumes between the Severn River Bridge and the Bay Bridge: 2045 Alternatives F and G (8-10-8) 6-62
Figure 6-27: Westbound Daily Traffic Volumes between the Kent Narrows Bridge and the U.S. 50/301 Split: 2045 Alternatives F and G (8-10-8) 6-63
Figure 6-28: Westbound Daily Traffic Volumes between the Bay Bridge and the Kent Narrows Bridge: 2045 Alternatives F and G (8-10-8) 6-64
Figure 6-29: Eastbound Daily Traffic Volumes between the Bay Bridge and the Kent Narrows Bridge: 2045 Alternatives F and G (8-10-8) 6-65
Figure 6-30: Eastbound Daily Traffic Volumes between the Kent Narrows Bridge and the U.S. 50/301 Split: 2045 Alternatives F and G (8-10-8) 6-66
Figure 6-31: Bottleneck Diagram: Alternatives F and G (8-10-8) Summer Weekend Scenario 6-71
Figure 6-32: Bottleneck Diagram: Alternatives F and G (8-10-8) NSWD Scenario (Eastbound PM, Westbound AM) 6-77
Figure 7-1: SAE Levels of Driving Automation 7-4

LIST OF TABLES

Table 4-1: Interchanging Roadways 4-16
Table 4-2: LOS Criteria for Basic Freeway and Multilane Highway Segments 4-18
Table 4-3: Best-Case Condition LOS Breakpoints for Bay Bridge (Maximum Hourly Volumes) 4-19
Table 4-4: LOS Breakpoints for Approach/Departure Roadways 4-20
Table 5-1: Existing Hourly Levels of Service and Queue Lengths across the Bay Bridge 5-2

Table 5-2: Existing Hourly Levels of Service and Queue Lengths across the Bay Bridge without Two-Way Operation....5-3
Table 5-3: Highway Capacity Manual Computations: Eastbound U.S. 50/301 Existing Conditions....5-5
Table 5-4: Highway Capacity Manual Computations: Westbound U.S. 50/301 Existing Conditions....5-8
Table 5-5: VISSIM Eastbound US 50/301 Segment Results: Existing Conditions Summer Weekend, Peak Hour of Volume with Three Eastbound Lanes....5-13
Table 5-6: VISSIM Westbound US 50/301 Segment Results:....5-14
Table 5-7: VISSIM Queuing Results: Existing Conditions Summer Weekend, with Three Eastbound Lanes on Friday and Three Westbound Lanes on Sunday....5-15
Table 5-8: Travel Time Results for Existing Conditions during SWED, Peak Hour of Queuing....5-16
Table 5-9: VISSIM Eastbound US 50/301 Segment Results: Existing Conditions Non-Summer Weekday, Peak Hour of Volume, with Three Lanes in Eastbound Direction....5-18
Table 5-10: VISSIM Westbound US 50/301 Segment Results: Existing Conditions NSWD, Peak Hour of Volume, with Three Lanes in Westbound Direction....5-19
Table 5-11: VISSIM Queuing Results: Existing Conditions NSWD, with Three Lanes Eastbound in PM and Three Lanes Westbound in AM....5-20
Table 5-12: Travel Time Results for Existing Conditions during NSWD, Peak Hour of Queuing....5-22
Table 6-1: Results of Preliminary Traffic Analyses for the Bay Bridge and Its Approaches....6-1
Table 6-2: Daily Trips Across the Bay Bridge (vehicles per day)....6-4
Table 6-3: VISSIM Eastbound U.S. 50/301 Segment Results - No-Build Summer Weekend, Peak Hour of Volume....6-12
Table 6-4: VISSIM Westbound U.S. 50/301 Segment Results – No-Build Summer Weekend, Peak Hour of Volume....6-13
Table 6-5: VISSIM Queuing Results – No-Build Summer Weekend....6-14
Table 6-6: Travel Time Results for Alternative A (No-Build) during SWED, Peak Hour of Queuing....6-16
Table 6-7: SWED Throughput at Bay Bridge in Peak Hour of Volume....6-16
Table 6-8: VISSIM Eastbound U.S. 50/301 Segment Results: No-Build NSWD, Peak Hour of Volume 6-18
Table 6-9: VISSIM Westbound U.S. 50/301 Segment Results: No-Build NSWD, Peak Hour of Volume6-18
Table 6-10: VISSIM Queuing Results: No-Build NSWD....6-20
Table 6-11: Travel Time Results for Alternative A (No-Build) during NSWD, Peak Hour of Queuing....6-22
Table 6-12: NSWD Throughput in Peak Hour of Volume....6-22
Table 6-13: Daily Trips Across the Bay Bridge (vehicles per day), 2045....6-23
Table 6-14: VISSIM Eastbound US 50/301 Segment Results: Alternatives B and C (6-8-6) Summer Weekend Scenario....6-32
Table 6-15: VISSIM Westbound US 50/301 Segment Results: Alternatives B and C (6-8-6) Summer Weekend Scenario....6-33
Table 6-16: VISSIM Queuing Results: Alternatives B and C (6-8-6) Summer Weekend Scenario....6-34
Table 6-17: Travel Time Results for Alternatives B and C: 6-8-6 during SWED, Peak Hour of Queuing6-36
Table 6-18: SWED Throughput at Bay Bridge in Peak Hour of Volume....6-36
Table 6-19: VISSIM Eastbound U.S. 50/301 Segment Results: Alternatives B and C (6-8-6) NSWD Scenario....6-38
Table 6-20: VISSIM Westbound U.S. 50/301 Segment Results: Alternatives B and C (6-8-6) NSWD Scenario....6-39
Table 6-21: VISSIM Queuing Results: Alternatives B and C (6-8-6) NSWD Scenario....6-40
Table 6-22: Travel Time Results for Alternatives B and C: 6-8-6 during NSWD, Peak Hour of Queuing6-42
Table 6-23: NSWD Throughput in Peak Hour of Volume....6-42
Table 6-24: VISSIM Eastbound US 50/301 Segment Results: Alternatives D and E (8-8-8) Summer Weekend Scenario....6-50
Table 6-25: VISSIM Westbound US 50/301 Segment Results: Alternatives D and E (8-8-8) Summer Weekend Scenario....6-51
Table 6-26: VISSIM Queuing Results: Alternatives D and E (8-8-8) Summer Weekend Scenario....6-52
Table 6-27: Travel Time Results for Alternatives D and E: 8-8-8 during SWED, Peak Hour of Queuing6-54

Table 6-28: SWED Throughput at Bay Bridge in Peak Hour of Volume....6-54
Table 6-29: VISSIM Eastbound U.S. 50/301 Segment Results: Alternatives D and E (8-8-8) NSWD Scenario....6-56
Table 6-30: VISSIM Westbound U.S. 50/301 Segment Results: Alternatives D and E (8-8-8) NSWD Scenario....6-57
Table 6-31: VISSIM Queuing Results: Alternatives D and E (8-8-8) NSWD Scenario....6-58
Table 6-32: Travel Time Results for Alternatives D and E: 8-8-8 during NSWD, Peak Hour of Queuing6-60
Table 6-33: NSWD Throughput in Peak Hour of Volume....6-60
Table 6-34: VISSIM Eastbound US 50/301 Segment Results: Alternatives F and G (8-10-8) Summer Weekend Scenario....6-68
Table 6-35: VISSIM Westbound US 50/301 Segment Results: Alternatives F and G (8-10-8) Summer Weekend Scenario....6-69
Table 6-36: VISSIM Queuing Results: Alternatives F and G (8-10-8) Summer Weekend Scenario....6-70
Table 6-37: Travel Time Results for Alternatives F and G: 8-10-8 during SWED, Peak Hour of Queuing 6-72
Table 6-38: SWED Throughput at Bay Bridge in Peak Hour of Volume....6-72
Table 6-39: VISSIM Eastbound U.S. 50/301 Segment Results: Alternatives F and G (8-10-8) NSWD Scenario....6-74
Table 6-40: VISSIM Westbound U.S. 50/301 Segment Results: Alternatives F and G (8-10-8) NSWD Scenario....6-75
Table 6-41: VISSIM Queuing Results: Alternatives F and G (8-10-8) NSWD Scenario....6-76
Table 6-42: Travel Time Results for Alternatives F and G: 8-10-8 during NSWD, Peak Hour of Queuing 78
Table 6-43: NSWD Throughput in Peak Hour of Volume....78
Table 7-1: Sensitivity Analyses of Bay Bridge Per Lane Capacity....7-2

APPENDICES

Appendix A	Development of Proposed Level of Service Breakpoints for the Bay Bridge
Appendix B	Derivation of "Queue Start Volume" on the Approaches to the Bay Bridge
Appendix C	Highway Capacity Manual and Queuing Spreadsheet Analyses

ABBREVIATIONS AND ACRONYMS

ARDS	Alternatives Retained for Detailed Study
BCST2	Bay Crossing Study Tier 2
BMC	Baltimore Metropolitan Council
CAF	Capacity Adjustment Factor
CAV	Connected and Automated Vehicle
D.C.	District of Columbia
EIS	Environmental Impact Statement
FEIS	Final Environmental Impact Statement
FHWA	Federal Highway Administration
HCM	Highway Capacity Manual
LOS	Level of Service
MD	Maryland
MDTA	Maryland Transportation Authority
MOE	Measure of Effectiveness
MPH	Miles per Hour
MPO	Metropolitan Planning Organization
MSTM	Maryland Statewide Transportation Model
MWCOG	Metropolitan Washington Council of Governments
NEPA	National Environmental Policy Act
NSWD	Non-Summer Weekday
PC	Passenger Car
Pc/ln/mi	Passenger Cars per Lane per Mile
PTSU	Part-time Shoulder Use
QAC	Queen Anne's County
ROD	Record of Decision
SHA	State Highway Administration
SUP	Shared Use Path
SWED	Summer Weekend Day
TATR	Traffic Analysis Technical Report
TDM	Transportation Demand Management
TSM	Transportation Systems Management
U.S.	United States
VPH	Vehicles per Hour
VPHPL	Vehicles per Hour per Lane

1 INTRODUCTION

The Chesapeake Bay Crossing Study (Bay Crossing Study) is a two-tiered engineering and environmental study being advanced by the Maryland Transportation Authority (MDTA) in coordination with the Federal Highway Administration (FHWA). The Bay Crossing Study is addressing existing and future transportation issues at the William Preston Lane, Jr. Memorial Bridge (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. Tier 2 of the Bay Crossing Study (Tier 2 Study) was launched in June 2022 to focus on a project-level (site-specific) analysis within the Tier 1 Selected Corridor Alternative (Corridor 7). The Tier 2 NEPA process was initiated formally with publication of a Notice of Intent (NOI) to prepare an EIS in the Federal Register on November 15, 2024.

This technical report describes the traffic analyses performed for the Tier 2 Study. It includes a description of the data collection effort, the methodologies used for analysis of existing conditions and the results of that analysis, the methodologies used to forecast future traffic volumes, and the results of the analyses of those volumes.

2 BACKGROUND

The Chesapeake Bay is one of Maryland's most important natural, economic, and cultural resources and the largest estuary in the United States. The 64,000-square-mile watershed that flows into the Chesapeake Bay spans six states and the District of Columbia and includes 150 major rivers and over 100,000 tributaries. The Chesapeake Bay has historically shaped the region's identity, culture, and traditions.

The Bay Bridge is a two-span structure that crosses the Chesapeake Bay from Anne Arundel County on the Western Shore to Queen Anne's County on the Eastern Shore. The original span opened in 1952, and the second span opened in 1973. Today, the two-lane original span typically carries eastbound traffic, and the three-lane second span typically carries westbound traffic. However, lanes on the bridge can be reversed to accommodate periods of heavy traffic. The approaches along U.S. 50/301 on each shore have six lanes (three lanes for each travel direction). The Bay Bridge has become one of Maryland's most iconic and recognizable landmarks, used by millions of Maryland residents and other travelers every year.

2.1 The Tiered NEPA Process

To study possible solutions that could address transportation issues, specifically as they relate to congestion, the MDTA and the FHWA are conducting the Bay Crossing Study as a tiered NEPA study. The tiered approach to NEPA has allowed the MDTA and the FHWA to focus on broader, planning-level decisions related to the preferred location of a potential new Bay crossing in the Tier 1 Study EIS. In the subsequent Tier 2 Study EIS, the MDTA and FHWA analyzed more specific, project-level alternatives and potential impacts.

The Tier 1 Study evaluated 14 possible alternative corridor locations over a broad geographic area that spanned nearly 100 miles of the Chesapeake Bay between Harford and Cecil counties to the north and St. Mary's and Somerset counties to the south. The Tier 1 Study identified Corridor 7 as the Selected Corridor Alternative, which is a two-mile-wide and approximately 22-mile-long corridor that follows existing U.S. 50/301 and includes the location of the existing Bay Bridge.

The Tier 2 Study involves a project-level (site-specific) alternatives analysis within the Tier 1 Selected Corridor Alternative (Corridor 7). The focus of the Tier 2 Study is to identify the environmental impacts associated with alternatives to address the Tier 2 Study's Purpose and Need. This technical report supports the evaluation presented in the EIS.

2.2 Study Limits

The MDTA analyzed the traffic volumes along Corridor 7 and its interchanges to determine appropriate study limits for the Tier 2 Study. The Tier 2 western study limit has been identified as the MD 2/MD 450 interchange just east of the Severn River Bridge, and the Tier 2 eastern study limit has been identified as the U.S. 50/301 split.

2.3 Purpose and Need

The purpose of the Tier 2 Study is to address existing and future transportation capacity needs and access across the Chesapeake Bay and at the Chesapeake Bay Bridge approaches along the U.S. 50/301 corridor. The Tier 2 Study is evaluating measures to reduce congestion, improve travel times and reliability, mobility, and roadway deficiencies, and accommodate maintenance activities and navigation, while minimizing impacts to local communities and the environment. Five needs have been identified:

- **Adequate Capacity and Reliable Travel Times** – Capacity of the Bay Bridge and its approaches on U.S. 50/301 are not sufficient to accommodate existing and anticipated traffic demand, resulting in traffic congestion on the Bay Bridge and adjacent roadway network.

- **Mobility** – Congestion at the Bay Bridge and its approaches and subsequent spillover effects on local roadways limit the movement of people, goods, and services across the Chesapeake Bay and in adjacent communities.

- **Roadway Deficiencies** – The bridge does not meet current design standards for design or traffic operations because of the existing narrow lane widths, lack of shoulders, and other factors.

- **Existing and Future Maintenance Needs** – Due to the age and design life of the existing Bay Bridge, substantial maintenance of the facility will be needed, leading to lane closures that make incident management more difficult and cause increased traffic and congestion delays.

- **Navigation** – The existing Bay Bridge is a key constraint for the height of ships that travel the Chesapeake Bay, including to the Port of Baltimore.

The MDTA has also identified two study objectives:

- **Environmental Responsibility** – Project alternatives will be developed to avoid and minimize impacts to communities and sensitive environmental resources.

- **Cost and Financial Responsibility** – Cost and financial responsibility will be a factor when analyzing and evaluating potential solutions, with regard to the means of paying for the development, operation, and maintenance of all proposed facilities.

3 ALTERNATIVES

The MDTA identified the Alternatives Retained for Detailed Study (ARDS), which are the NEPA range of reasonable alternatives for evaluation in the Tier 2 Study EIS. The ARDS include the No-Build Alternative and six build alternatives, (**Figure 3-1)**. Each build alternative includes removing the existing eastbound and westbound Bay Bridge spans and replacing them with two new bridge spans constructed near the location of the existing Bay Bridge. The ARDS are differentiated by the number of lanes provided across the new bridge and on the approaches as well as the bridge location and consist of:

- **Alternative A - No-Build**: retains the existing Bay Bridge, the U.S. 50/301 alignment, and the existing number of lanes: 6 lanes along U.S. 50/301 on the Western Shore, 5 lanes across the Chesapeake Bay on the existing Bay Bridge, and 6 lanes along U.S. 50/301 on the Eastern Shore;

- **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 with one span to the north of the existing spans and one span in-between the existing spans, 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 with one span to the south of the existing spans and one span in-between the existing spans, 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 with one span to the north of the existing spans and one span in-between the existing spans, and 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 with one span to the south of the existing spans and one span in-between the existing spans, and 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 with one span to the north of the existing spans and one span in-between the existing spans, and 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 with one span to the south of the existing spans and one span in-between the existing spans, and 8 lanes along U.S. 50/301 on the Eastern Shore.

Each of the ARDS will also include an optional pedestrian / bicycle shared use path, tolling, transit-related improvements, Transportation Systems Management (TSM)/Transportation Demand Management (TDM), stormwater management, utilities, and truck weigh and inspection stations. These common items, in addition to the improvements associated with each build alternative, informed the development of the limit of disturbance (LOD) for each build alternative. Additional detail on the ARDS can be found in the Tier 2 Study Draft EIS.

3.1 Alternative A: No-Build

Alternative A (6-5-6), the No-Build Alternative, would retain the existing Bay Bridge, the U.S. 50/301 alignment, and the existing number of lanes. This alternative would retain six lanes on the approaches on the Eastern and Western Shores and five lanes on the two-span Bay Bridge. The No-Build Alternative will include regular maintenance of the Bay Bridge and U.S. 50/301, but no capital improvements other than currently planned and programmed projects.

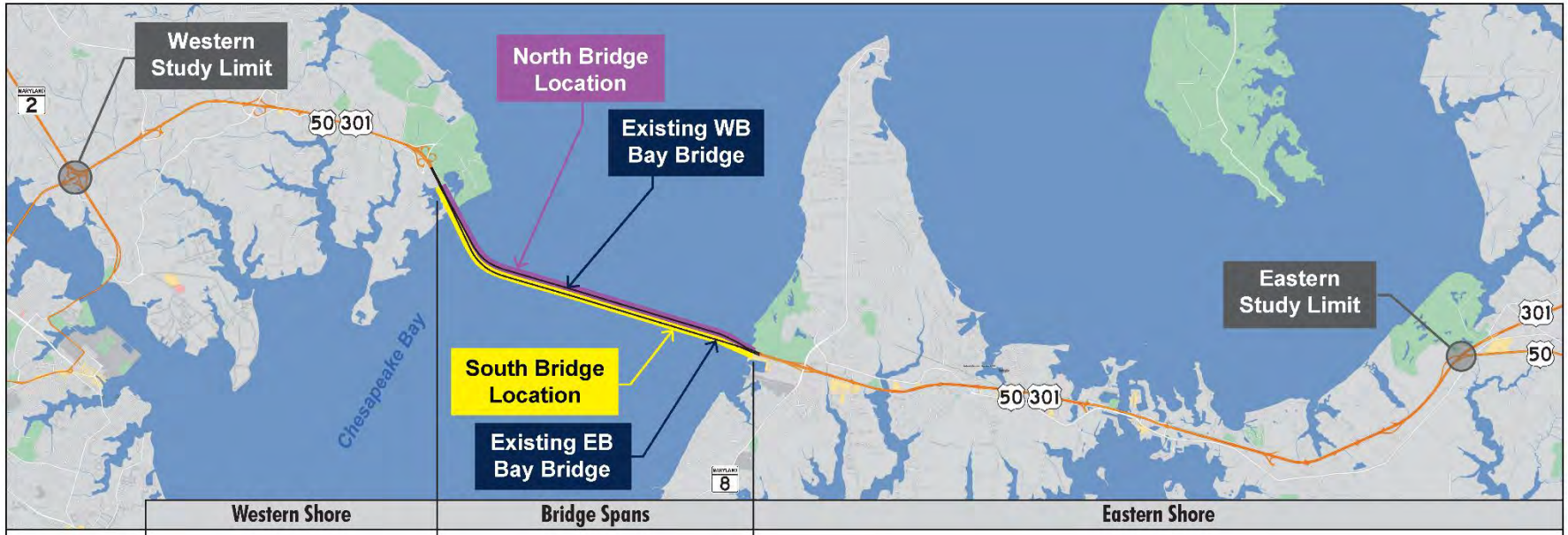
3.2 Alternative B: 6-8-6 North

Alternative B (6-8-6 North) would replace the existing Bay Bridge spans with two new bridge spans and would consist of six lanes along U.S. 50/301 on the Western Shore (three per direction), eight lanes on a new bridge (four per direction), and six lanes along U.S. 50/301 on the Eastern Shore (three per direction). The two new bridge spans would consist of one span to the north and one span in between the location of the existing bridge spans. The approach roadways would remain on the existing roadway alignment, except where necessary to connect to the new bridge spans. Thus, with Alternative B, 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 and would remain at six total travel lanes beyond the immediate tie-ins to the new bridge spans.

3.3 Alternative C: 6-8-6 South

Alternative C (6-8-6 South) would replace the existing Bay Bridge spans with two new bridge spans and would consist of six lanes along U.S. 50/301 on the Western Shore (three per direction), eight lanes on a new bridge (four per direction), and six lanes along U.S. 50/301 on the Eastern Shore (three per direction). The two new bridge spans would include one span to the south and one span in between the location of the existing bridge spans. The approach roadways would remain on the existing roadway alignment, except where necessary to connect to the new bridge spans. Thus, with Alternative C, 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 and would remain at six total travel lanes beyond the immediate tie-ins to the new bridge spans.

Figure 3-1: Alternatives Summary



	Western Shore	Bridge Spans	Eastern Shore
Alternative A: No-Build	6 Lanes	5 Lanes	6 Lanes
Alternative B	6 Lanes	8 Lanes NORTH	6 Lanes
Alternative C	6 Lanes	8 Lanes SOUTH	6 Lanes
Alternative D	8 Lanes	8 Lanes NORTH	8 Lanes
Alternative E	8 Lanes	8 Lanes SOUTH	8 Lanes
Alternative F	8 Lanes	10 Lanes NORTH	8 Lanes
Alternative G	8 Lanes	10 Lanes SOUTH	8 Lanes

3.4 Alternative D: 8-8-8 North

Alternative D (8-8-8 North) would replace the existing Bay Bridge spans with two new bridge spans and would consist of eight lanes along U.S. 50/301 on the Western Shore (four per direction), eight lanes on a new bridge (four per direction), and eight lanes along U.S. 50/301 on the Eastern Shore (four per direction). The two new bridge spans would include one span to the north and one span in between the location of the existing bridge spans. Alternative D would increase the number of lanes along the U.S. 50/301 approaches to eight lanes from the MD 2/MD 450 interchange on the Western Shore to the U.S. 50/301 split on the Eastern Shore and would generally remain on the existing roadway alignment except where necessary to connect to the new bridge spans. Thus, with Alternative D, the five existing bridge lanes would be increased to eight bridge lanes and the number of lanes on the Western Shore and Eastern Shore would increase from six total travel lanes to eight total travel lanes.

3.5 Alternative E: 8-8-8 South

Alternative E (8-8-8 South) would replace the existing Bay Bridge spans with two new bridge spans and would consist of eight lanes along U.S. 50/301 on the Western Shore (four per direction), eight lanes on a new bridge (four per direction), and eight lanes along U.S. 50/301 on the Eastern Shore (four per direction). The two new bridge spans would include one span to the south and one span in between the location of the existing bridge spans. Alternative E would increase the number of lanes along the U.S. 50/301 roadway approaches to eight lanes from the MD 2/MD 450 interchange on the Western Shore to the U.S. 50/301 split on the Eastern Shore and would generally remain on the existing roadway alignment except where necessary to connect to the new bridge spans. Thus, with Alternative E, the five existing bridge lanes would be increased to eight bridge lanes and the number of lanes on the Western Shore and Eastern Shore would increase from six total travel lanes to eight total travel lanes.

3.6 Alternative F: 8-10-8 North

Alternative F (8-10-8 North) would replace the existing Bay Bridge spans with two new bridge spans and would consist of eight lanes along U.S. 50/301 on the Western Shore (four per direction), ten lanes on a new bridge (five per direction), and eight lanes along U.S. 50/301 on the Eastern Shore (four per direction). The two new bridge spans would include one span to the north and one span in between the location of the existing bridge spans. Alternative F would increase the number of lanes along the U.S. 50/301 approach roadway to eight lanes from the MD 2/MD 450 interchange on the Western Shore to the U.S. 50/301 split on the Eastern Shore and would generally remain on the existing roadway alignment except where necessary to connect to the new bridge spans. Thus, with Alternative F, the five existing bridge lanes would be increased to ten bridge lanes and the number of lanes on the Western Shore and Eastern Shore would increase from six total travel lanes to eight total travel lanes.

3.7 Alternative G: 8-10-8 South

Alternative G (8-10-8 South) would replace the existing Bay Bridge spans with two new bridge spans and would consist of eight lanes along U.S. 50/301 on the Western Shore (four per direction), ten lanes on a new bridge (five per direction), and eight lanes along U.S. 50/301 on the Eastern Shore (four per direction). The two new bridge spans would include one span to the south and one span in between the location of the existing bridge spans. Alternative G would increase the number of lanes along the U.S. 50/301 approach roadway to eight lanes from the MD 2/MD 450 interchange on the Western Shore to the U.S. 50/301 split on the Eastern Shore

and would generally remain on the existing roadway alignment except where necessary to connect to the new bridge spans. Thus, with Alternative G, the five existing bridge lanes would be increased to ten bridge lanes and the number of lanes on the Western Shore and Eastern Shore would increase from six total travel lanes to eight total travel lanes.

3.8 Other Components of the Build Alternatives

3.8.1 Optional Pedestrian / Bicycle Shared Use Path

All proposed build alternatives include the option for the safe inclusion of a pedestrian/bicycle shared use path (SUP) along a new bridge. The MDTA has identified connections to existing and proposed trails and recreational facilities on the Eastern Shore and Western Shore.

3.8.2 Tolling

The MDTA owns and operates the Bay Bridge and uses tolls from its eight facilities to maintain and operate all their facilities. The Bay Bridge will continue to be a tolled facility and the MDTA will continue to manage it and the toll to address the current and future traffic and the associated congestion.

3.8.3 Transit-related Improvements

Transit-related improvements would be made through a financial commitment from the MDTA that would focus on providing a one-time investment for local transit agencies near the Bay Bridge. The same commitment would be made for all alternatives and would not be used to differentiate between alternatives.

All transit-related opportunities would be determined in the future, closer to the time of construction. The MDTA would coordinate with the Maryland Transit Administration (MTA), local governments, and local transit agencies to help determine the opportunities. However, these agencies would determine the transit-related improvements that would be most beneficial for them at that time and they would be separate and distinct projects from the Bay Crossing.

3.8.4 TSM TDM Considerations

Two TSM/TDM improvements were considered with the retained build alternatives for potential implementation: congestion pricing and part-time shoulder use (PTSU) lanes.

The Bay Bridge will continue to be a tolled facility. If a build alternative is selected, congestion pricing could be used in the future to provide flexibility for toll management strategies that the MDTA could use to further reduce congestion and achieve transportation goals.

The shoulders on the bridge would be full width (12 feet wide) to accommodate future maintenance needs and incident management, therefore, they would also be wide enough to accommodate a PTSU lane. Although the build alternatives have been developed to accommodate PTSU, the operation of PTSU lanes is not being included as part of the alternatives. Future implementation of PTSU is not precluded.

3.8.5 Stormwater Management (SWM)

A planning-level, conceptual SWM analysis was completed that identified the stormwater needs and potential treatment locations throughout the study area for each build alternative.

3.8.6 Utilities

The study area along U.S. 50/301 contains public utilities including: potable water, sanitary sewer, natural gas, electric power/distribution, communications, and cable television. The build alternatives would impact some of these utilities that are in close proximity to U.S. 50/301, and the impacts to these utilities and associated replacements have been included in the build alternatives.

3.8.7 Truck Weigh and Inspection Station

There are two existing Truck Weigh and Inspection Stations (TWIS) along U.S. 50/301 between Oceanic Drive and the Bay Bridge, one in each direction. As part of the build alternatives, these facilities would be upgraded and relocated where necessary.

3.8.8 Limits of Disturbance (LOD)

The LOD is the proposed boundary that would include all construction, erosion and sediment control, SWM, and right-of-way offsets. The LODs for the alternatives were developed from the proposed horizontal and vertical geometry, typical sections, roadside design, and proposed interchange modifications. For Alternatives B and C, the number of lanes on the Western Shore and Eastern Shore would not change and would remain at six total travel lanes beyond the immediate tie-ins to the new bridge spans. This would mean the limits of roadway improvements associated with Alternatives B and C would end at the immediate tie-ins to the new bridge spans, compared with the limits of roadway improvements for Alternatives D through G, which would end at the study limits (MD 2/MD 450 and the U.S. 50/301 Split). Due to the shorter distance of proposed roadway modifications associated with Alternatives B and C, the LODs associated with these two build alternatives are smaller than the LODs associated with the other build alternatives.

4 TRAFFIC ANALYSIS METHODOLOGIES

4.1 Introduction

This chapter describes how the study area limits were identified, the existing traffic volumes in the study area, the process used to forecast future volumes, and the procedures used to analyze those volumes.

4.2 Study Area Limits for Traffic Analyses

The Selected Corridor Alternative (Corridor 7) identified in the Tier 1 Study FEIS/ROD (**Figure 4-1**) was used as the basis to evaluate 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 locations of the traffic counts can be seen in **Figure 4-2**. Traffic counts were also collected beyond the limits of Corridor 7 and were used to assist with the identification of appropriate endpoints.

Typically, in a study of this sort, traffic data is collected on “normal” weekdays; that is, days with typical commuting/school/shopping activities. While the Bay Bridge does experience “normal” weekday traffic, it also experiences high summer traffic volumes due to its role as a key connection to beach and seasonal recreational destinations. Traffic volumes on weekends, particularly summer weekends, which often exceed weekday volumes. Thus, the Tier 1 Study involved a traffic analysis of both conditions. This was continued in the Tier 2 Study, with the traffic volume data collection effort including both non-summer weekdays (NSWD) (Tuesday and Wednesday) and summer weekends (Thursday through Sunday).

The discussion below (in Sections 4.1.1 and 4.1.2) explain how the detailed traffic data was used to identify appropriate study area limits for the traffic analyses.

Figure 4-1: Tier 1 Study Selected Corridor Alternative

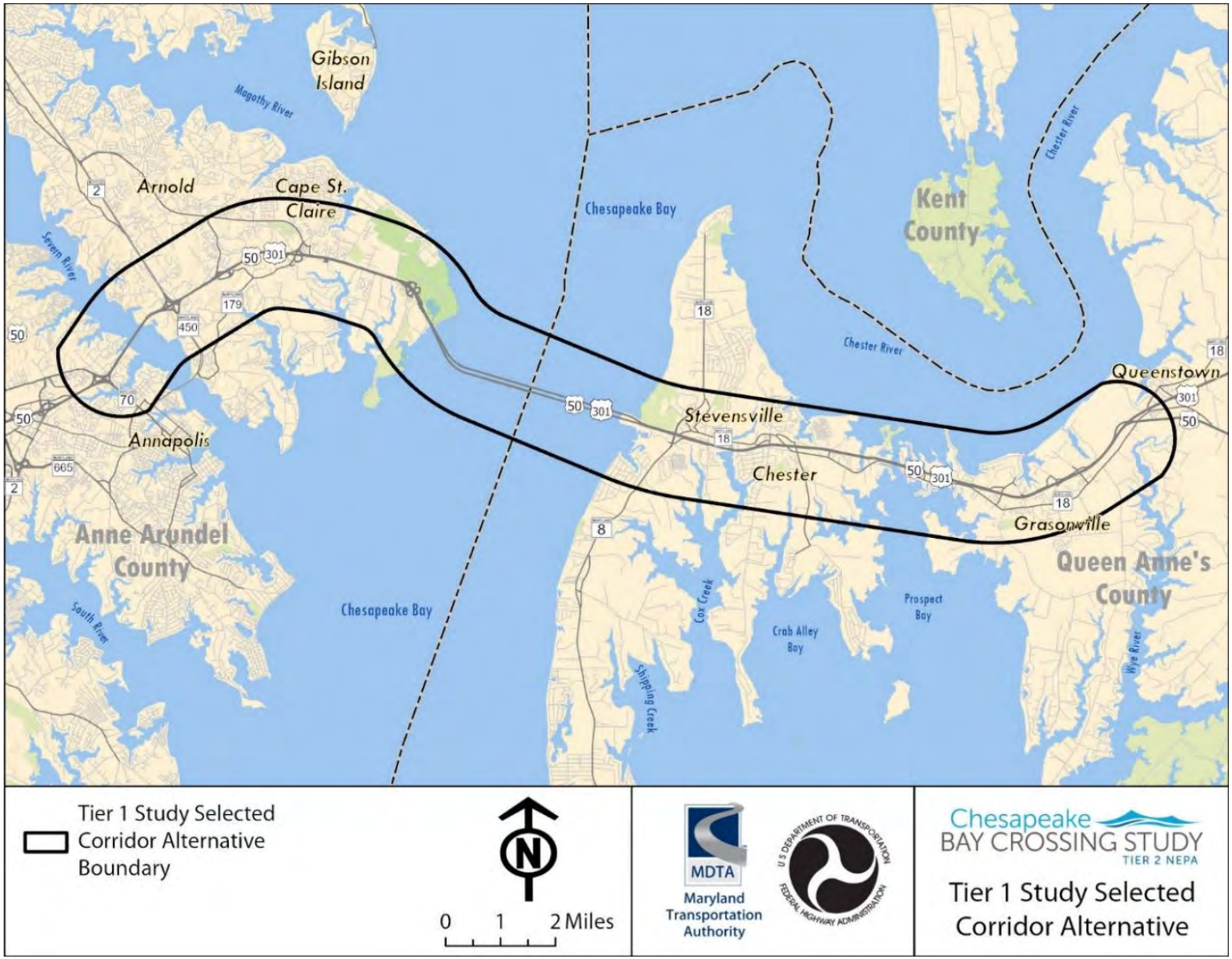
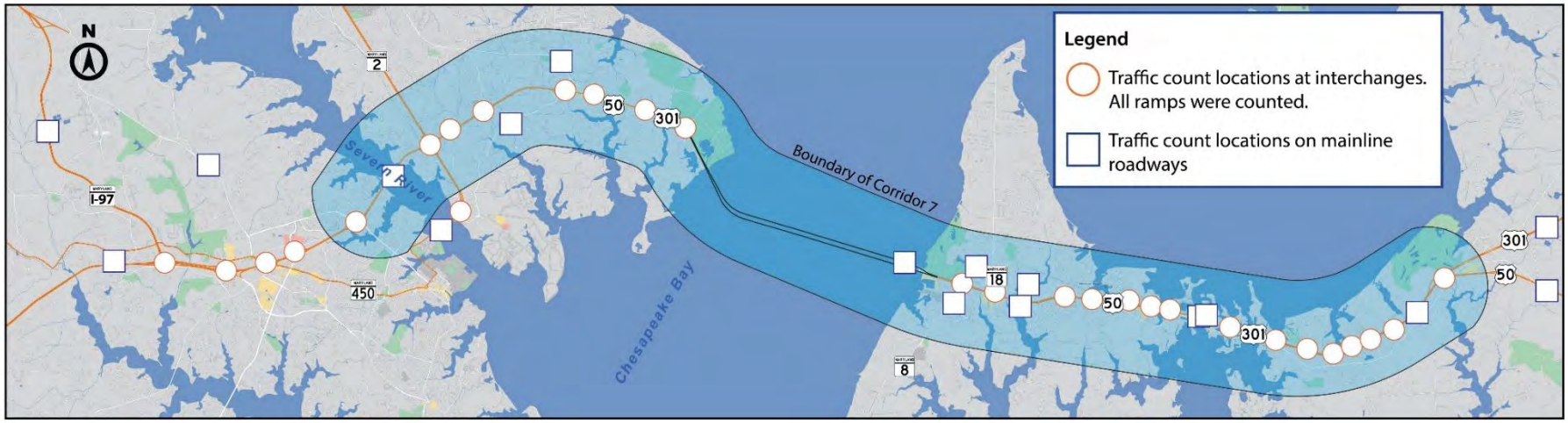


Figure 4-2: Traffic Count Locations



4.2.1 Existing Volumes Crossing the Bay

Hourly traffic volume data for the Bay Bridge itself was obtained from MDTA for the period starting on April 1, 2022 and ending on December 31, 2022. Data was not obtained from January 1, 2022 through March 31, 2022, to minimize the influence of the COVID-19 pandemic and the gradual resumption of everyday activities following the pandemic on the data set. Eastbound data came from the toll collection system equipment; westbound data was provided by automatic traffic recorders (ATRs) installed and maintained by MDTA. (The westbound ATRs are located on US 50/301, between the MD 8 on-ramp and the cross-over. In this way, only westbound traffic is captured, regardless of the lane configuration in use on the spans at any given time.) The traffic count data was compiled and reviewed to identify appropriate groupings of data to be used in the study to reflect distinct seasonal operating characteristics.

Historically, the Bay Bridge has carried more traffic on summer weekends than on any day of the week at other times of the year. This attribute was noted in the 2022 data as well. For the purposes of data analyses, "summer" was defined to begin on Thursday May 26, 2022 (the Thursday before Memorial Day) and end on Labor Day (Monday September 5, 2022). "Non-summer" was defined as the remainder of the year.

In-depth review of the data revealed the following:

1. Summer Fridays generally had the highest daily volumes for the eastbound direction. Westbound, summer Sundays were generally the highest volume days.
2. On most days of the week, even during Non-summer months, there was a directional imbalance in volumes on the Bay Bridge. Typically, Thursdays/Fridays/Saturdays had higher eastbound volumes (although Saturdays were closer to being balanced than the other two days). Sundays and Mondays had higher westbound volumes.
3. The weekdays with the closest directional balance were generally Tuesdays and Wednesdays.
4. Weekends beyond the start and end of summer (sometimes referred to as the "shoulder season") often experienced higher volumes than weekends in the winter months.

Based on these results, the following decisions were made regarding development of existing volumes for the study:

1. Two groups of traffic data scenarios would be analyzed.
2. The first group would consist of volumes on Non-summer Tuesdays and Wednesdays, which is also referred to as Non-summer weekdays. This scenario represented the lower end of recurring volumes crossing the Bay.
3. The second scenario would consist of Summer weekends, with eastbound volumes taken from summer Fridays and westbound volumes taken from summer Sundays. This scenario represented the higher end of recurring volumes crossing the Bay.

Use of these two scenarios allowed for analysis of a wide range of recurring conditions.

A small number of days were removed from the data set prior to the development of "typical" daily volumes crossing the Bridge. These removals consisted of days generally known to be atypical during each year. No other days were removed, even if their volumes appeared to be unusually high or unusually low. The removed days were:

- Non-summer weekdays:
  - Both directions: the Tuesday and Wednesday before Thanksgiving. On these days, traffic was atypical, due to schools generally not being in session and a noticeable increase in recreational/holiday travel.
- Summer weekends:
  - Eastbound: the Friday of Memorial Day, Fourth of July, and Labor Day weekends. These three days, which were the start of holiday (three-day) weekends, had unusually high traffic volumes, even by summer weekend standards.
  - Westbound: the Sunday of Memorial Day, Fourth of July, and Labor Day weekends. These three days, which were in the middle of holiday (three-day) weekends, had unusually low traffic volumes. (Mondays on these weekends had unusually high traffic volumes.)

4.2.2 Existing Ramp Volumes

Beginning in the summer of 2022, traffic data was collected along U.S. 50/301 ramps from just west of I-97 to just east of the U.S. 50/301 split. Traffic volume data was collected on summer Thursdays/Fridays/Saturdays/Sundays from Memorial Day through Labor Day and on non-summer Tuesdays/Wednesdays/Thursdays between Labor Day and Memorial Day. The volumes on each ramp to/from U.S. 50/301 were counted during these periods using temporary traffic counting equipment.

4.2.3 Other Existing Volumes

In addition, several mainline locations along U.S. 50/301 (such as the Severn River Bridge and the Kent Narrows Bridge) and key locations near U.S. 50/301 (such as MD 179) were counted on both NSWDs and on summer weekends. The locations of the counts are shown in **Figure 4-2** above.

The data collected was summarized and presented to the agencies and the public in 2023 in a series of graphics shown in **Figures 4-3 through 4-8**.

4.2.4 Analysis of Existing Volumes

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 4-3** 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 4-4** shows that approximately 55 to 71 percent of the traffic crossing the Severn River exits from 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 NSWD and 23 percent on a summer Friday. Overall, there is a net decrease in traffic from the Severn River Bridge to the Bay Bridge.

Figure 4-3: Westbound Daily Traffic Volumes between the Severn River Bridge and the Bay Bridge

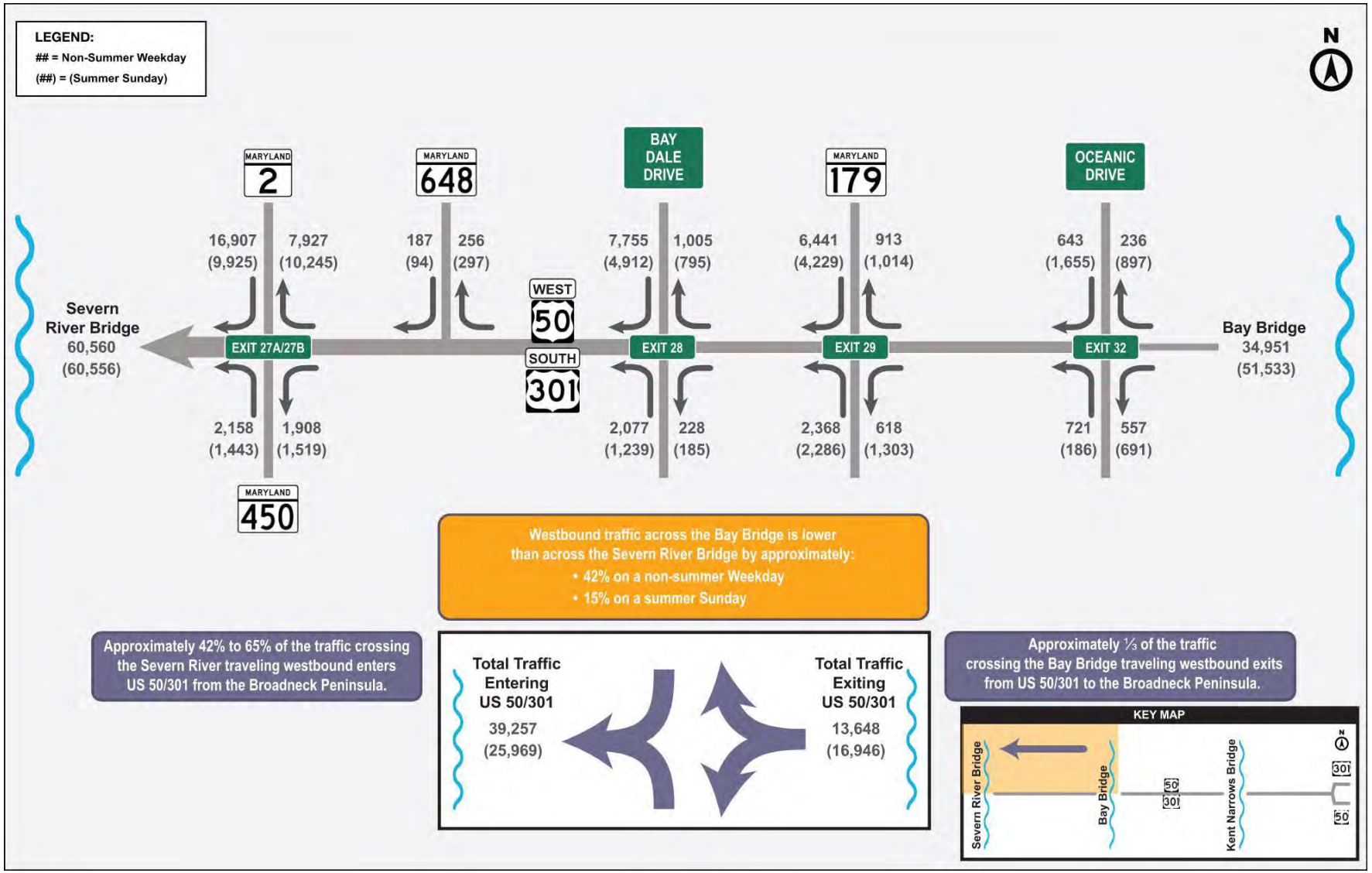


Figure 4-4: Eastbound Daily Traffic Volumes between the Severn River Bridge and the Bay Bridge

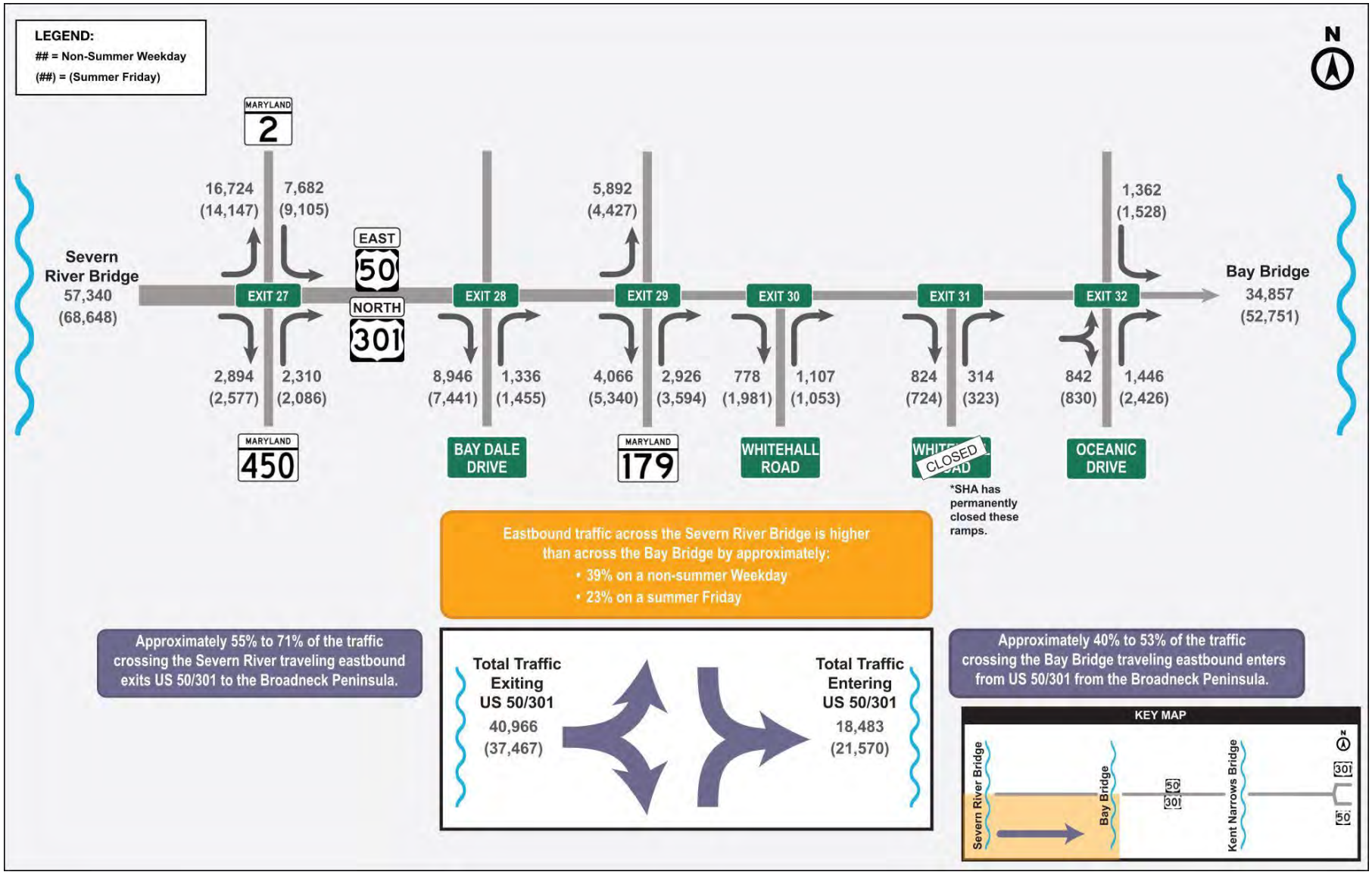


Figure 4-5: Westbound Daily Traffic Volumes between the Kent Narrows Bridge and the U.S. 50/301 Split

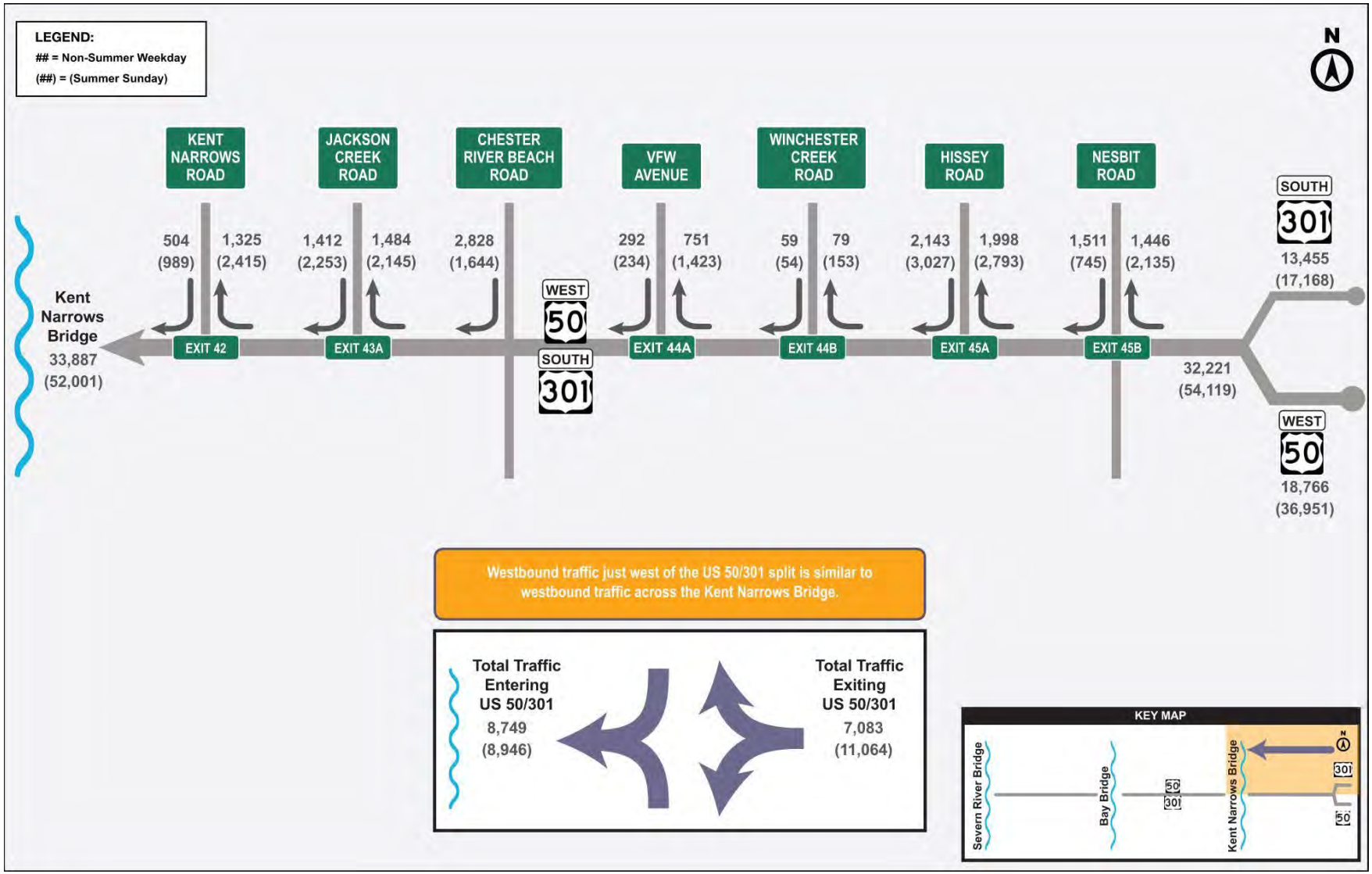


Figure 4-6 Westbound Daily Traffic Volumes between the Bay Bridge and the Kent Narrows Bridge

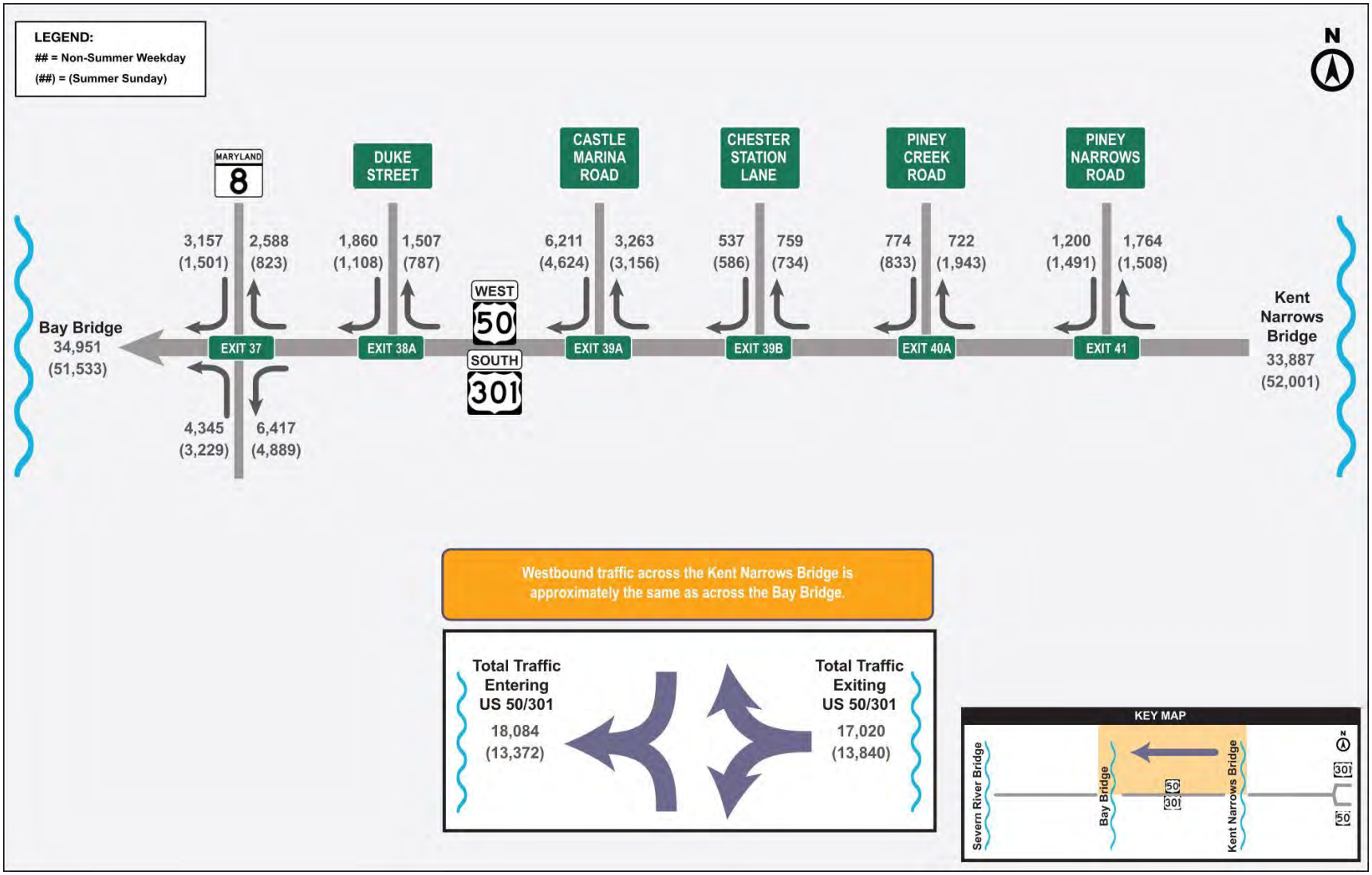


Figure 4-7: Eastbound Daily Traffic Volumes between the Bay Bridge and the Kent Narrows Bridge

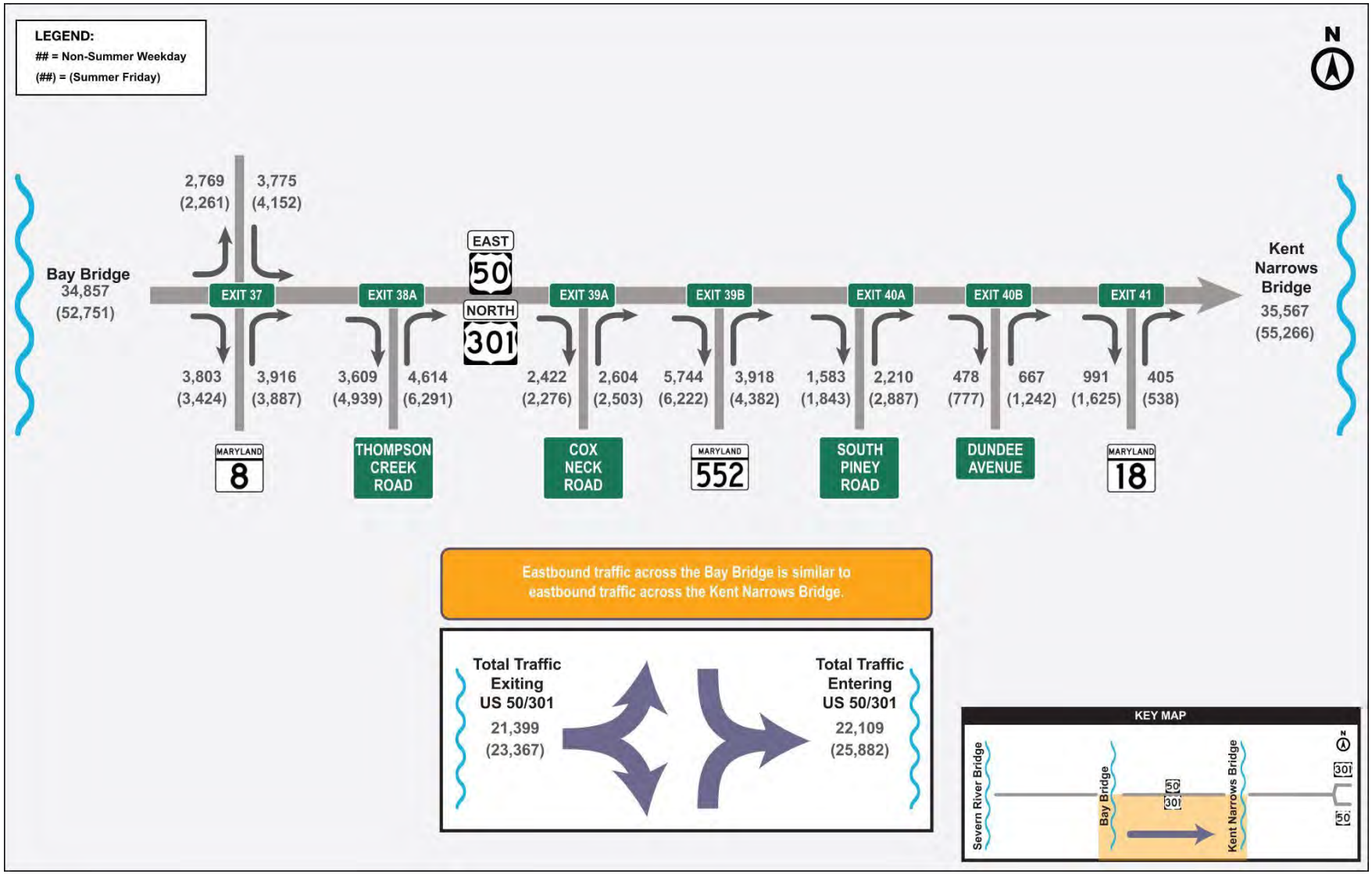
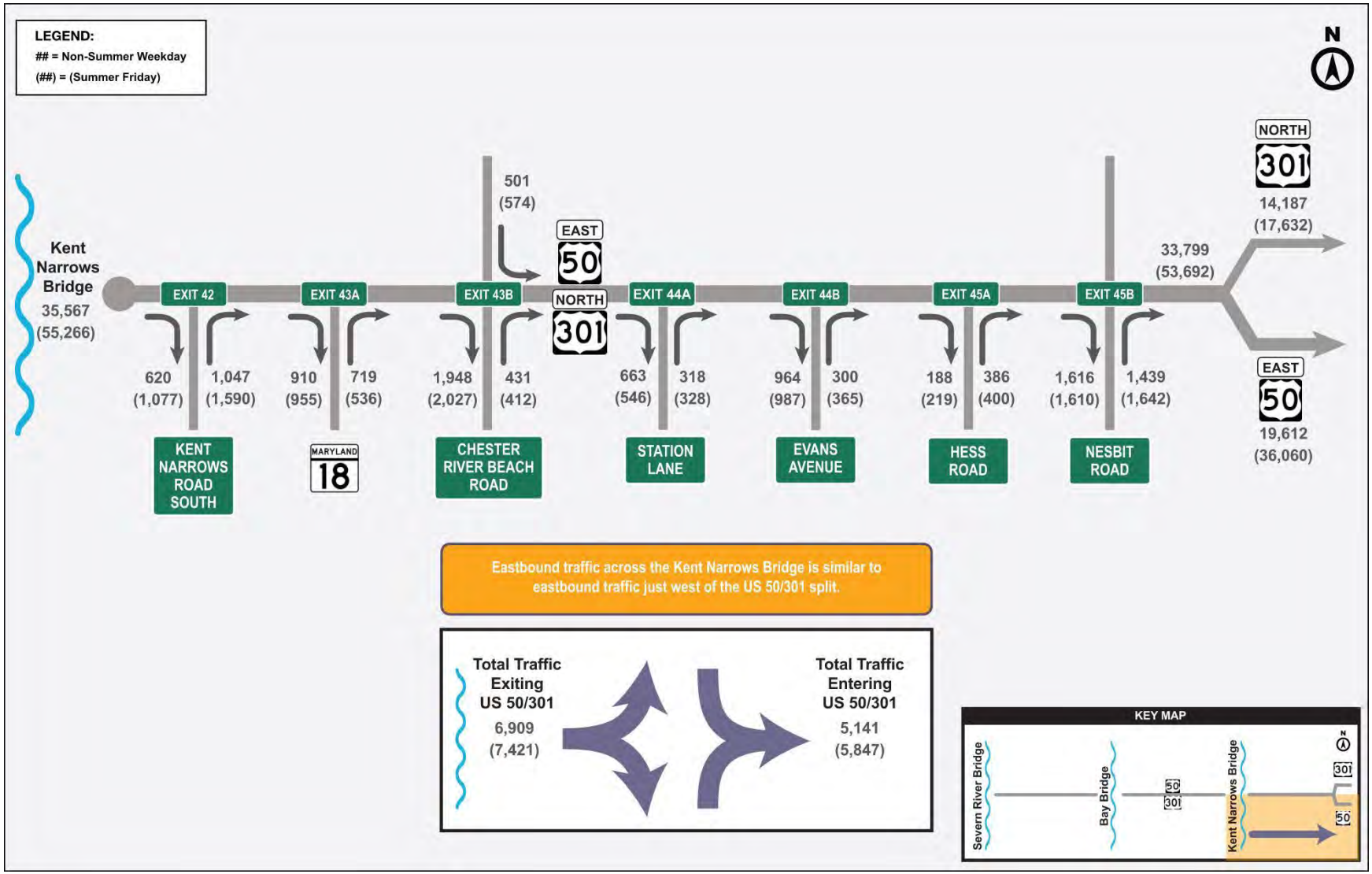


Figure 4-8: Eastbound Daily Traffic Volumes between the Kent Narrows Bridge and the U.S. 50/301 Split



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 4-5 and 4-6**. 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 4-7 and 4-8**. 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 NSWDs. On summer weekends, the traffic split is approximately 70 percent using U.S. 50 and approximately 30 percent using U.S. 301.

4.2.5 Other Factors Related to Study Area Limits

Truck traffic in the corridor does not influence the location of the study area limits (or logical termini) because there are no major generators of truck traffic within the study area and truck volumes are relatively consistent across the corridor. Trucks comprise approximately 5.4 percent of the NSWD traffic on the Bay Bridge, and approximately 3.9 percent of the summer weekend day (SWED) traffic. The corridor is on the National Network and provides an important link in regional truck travel. There were no specific truck or freight-related concerns identified during the Tier 1 Study which would affect the study area limits.

Transit does not influence the location of logical termini because the corridor has relatively low-density land use and existing transit options across the Bay are minimal with low ridership. There are no existing ferry or high-capacity transit options, and bus service is limited with one deviated fixed bus route that crosses the Bay Bridge three times in each direction per day (operated by Queen Anne's County (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 Maryland Transit Administration. Transit was identified as a potential solution to address the study need of improving mobility during the Tier 1 Study and has been considered in the development of Tier 2 Study alternatives.

As noted above, there is no existing ferry service across the Bay. A passenger-only ferry service has been proposed and is under evaluation by the Chesapeake Bay Ferry Consortium.

4.2.6 Identification of Study Area Limits

4.2.6.1 Western Terminus

As noted, the traffic volumes across the Bay Bridge are lower than volumes across the Severn River Bridge on both NSWDs 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, as shown in **Figure 4-9**, 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 MD 2/MD 450 interchange 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. The tie-in of the proposed improvements with the existing U.S. 50/301 configuration at this interchange would not preclude any future improvements by the State Highway Administration (SHA) along U.S. 50/301, MD 2/MD 450, or to the west, including the Severn River Bridge.

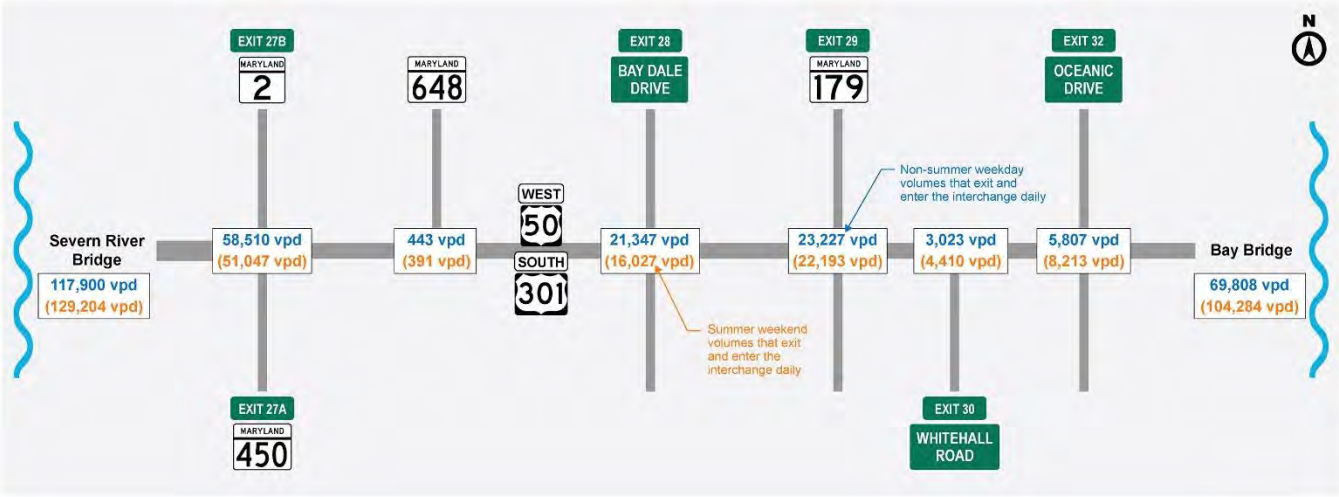
The MD 2/MD 450 interchange was therefore selected as the western logical terminus given the possible extent of potential transportation improvements.

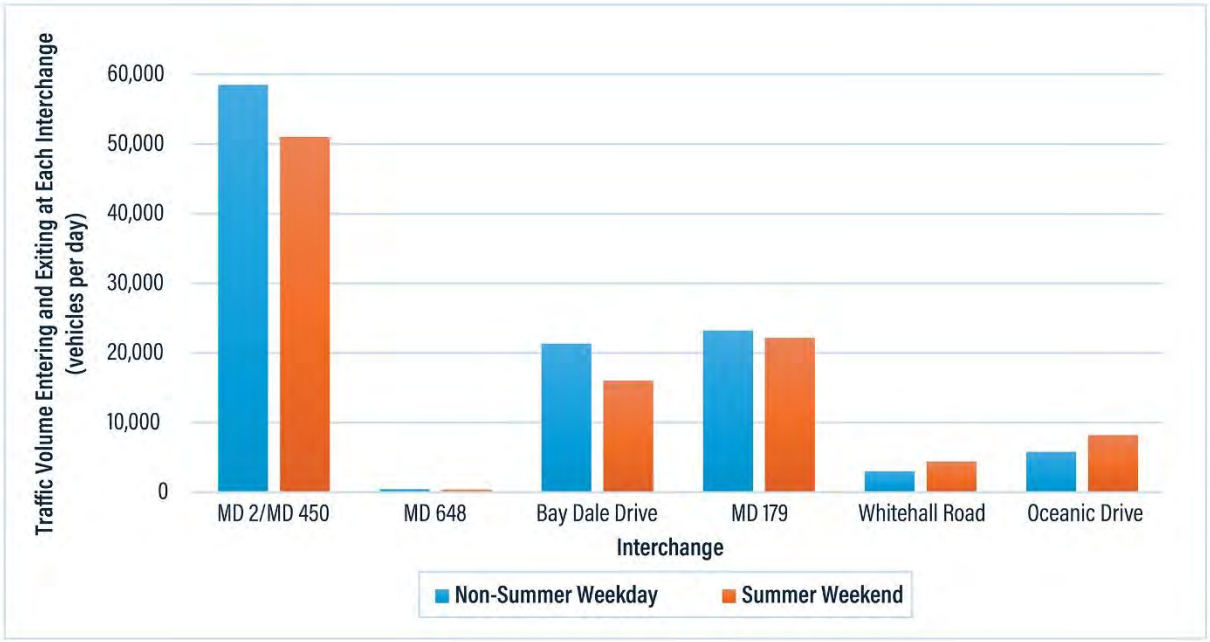
4.2.6.2 Eastern Terminus

As noted in Section 4.1.4, traffic volumes are relatively consistent between the Bay Bridge and the U.S. 50/301 Split. At the Split, a major change in volume occurs, with traffic being divided between U.S. 50 and 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, such improvements as part of the Tier 2 study would not preclude any future improvements by SHA along either roadway.

The U.S. 50/301 split is therefore selected as the eastern logical terminus given the possible extent of potential transportation improvements.

Figure 4-9: Total Daily Traffic Volumes Entering and Exiting at Each Interchange on the Western Shore





4.2.6.3 Interchanges within the Study Area

The study area described above includes the interchanges shown in **Table 4-1**:

Table 4-1: Interchanging Roadways

U.S. 50/301		Interchanging Roadway(s)
Eastbound	Westbound	
X	X	MD 2/MD 450
	X	MD 648
X	X	Bay Dale Drive
X	X	MD 179
X		Whitehall Road (Exit 30)
X	X	Oceanic Drive
X	X	MD 8
X		Thompson Creek Road
	X	Duke Street
X		Cox Neck Road
	X	Castle Marina Road
X		MD 522
	X	Chester Station Lane
X		South Piney Road
	X	Piney Creek Road
X		Dundee Avenue
X		MD 18 (Exit 41)
	X	Piney Narrows Road
X		Kent Narrows Road South
	X	Kent Narrows Road
X		MD 18 (Exit 43A)
	X	Jackson Creek Road
X	X	Chester River Beach Road
X		Station Lane
	X	VFW Avenue
X		Evans Avenue
	X	Winchester Creek Road
X		Hess Road
	X	Hissey Road
X	X	Nesbit Road
X	X	U.S. 50/301 Split

As **Table 4-1** shows, there are 20 interchanges on eastbound U.S. 50/301 and 19 interchanges on westbound U.S. 50/301 within the study area. Only eight of those interchanges allow traffic to directly cross over/under U.S. 50/301.

4.3 Traffic Analysis Methodologies for Existing Conditions

4.3.1 Overview

The purpose of these analyses was to identify current operating conditions along U.S. 50/301 within the study area, including the Bay Bridge itself, the U.S. 50/301 approaches to the Bridge on both sides, and each ramp entering/exiting U.S. 50/301. This provided a baseline against which alternative improvement strategies could be evaluated, so future conditions could be compared.

The first stages of the existing conditions analyses focused on the Bay Bridge itself and the U.S. 50/301 approaches in close proximity to the Bridge since the Bridge is the bottleneck in the study area.

The tools which were used in the initial evaluation of existing conditions are listed immediately below, along with a very brief description of their use. Additional detail regarding each tool's use is provided in the following sections.

- Highway Capacity Manual (HCM)[1]: The HCM was used to compute levels of service (LOS) at the Bay Bridge and on segments of U.S. 50/301 within the study area, including weaving sections and ramps at their junctions with U.S. 50/301.
- Queuing Spreadsheet: This tool (developed by the BCST2 Team expressly for this project, based upon HCM parameters) was used to compute queue lengths and durations at the Bay Bridge and was calibrated based on observations of existing conditions.

The two tools identified above provided performance measures at multiple individual locations within the study area. These initial results were used to help identify and define a number of potential improvement strategies for further analysis.

Each of the HCM analyses identified LOS at a single specific segment and did not consider external factors that could and would affect traffic operations. Such external factors include queues from downstream segments, such as the Bay Bridge. Thus, the HCM analyses represented a best-case condition. The queuing spreadsheet described above was used to supplement the HCM analyses, to address this limitation, and to provide additional depth for the initial evaluation.

VISSIM, a microsimulation model, was then used to perform detailed analyses of the corridor, assessing measures such as throughput, queuing, and travel time/speed. The VISSIM model used the results of the HCM and queuing analyses described above as a starting point.

4.3.2 HCM Analysis of Bay Crossing and Approaches/Departures

U.S. 50/301 within the traffic study area is classified as an urban freeway/expressway with three lanes in each direction on both approaches to the Bay Bridge. The Bay Bridge has a total of five lanes, with three lanes typically available for westbound traffic and two lanes typically available

[1] National Academies of Sciences, Engineering, and Medicine. 2022. *Highway Capacity Manual 7th Edition: A Guide for Multimodal Mobility Analysis*. Washington, DC: The National Academies Press. https://doi.org/10.17226/26432.

for eastbound traffic. During peak periods for eastbound traffic, one of the westbound lanes can be operated as an eastbound contra-flow lane.

In a study like the Tier 2 Study, the HCM is normally used to evaluate traffic operations in terms of LOS. LOS, as defined by the HCM, "is a quantitative stratification of a performance measure or measures that represents quality of service, measured on an A through F scale, with LOS A representing the best operating conditions from the traveler's perspective and LOS F the worst."

At LOS D, traffic flow is still stable, and travel times are relatively predictable. At LOS E, traffic flow is volatile, and travel times can vary widely. Capacity is the breakpoint between LOS E and LOS F. Accepted transportation planning and traffic engineering expertise and practice suggest that achieving at least a LOS D is preferred, but LOS E or even LOS F may be all that is possible for some facilities.

The HCM uses density, measured in passenger cars per mile per lane (pc/mi/ln), to assess LOS. The range of densities for each LOS are shown in **Table 4-2**. The capacity of a roadway is the upper limit of the density for LOS E, or 45 pc/mi/ln.

Table 4-2: LOS Criteria for Basic Freeway and Multilane Highway Segments

LOS	Density (pc/mi/ln)	HCM Description of This LOS
A	≤11	• Free-flow operations • Vehicles are almost completely unimpeded
B	>11–18	• Reasonably free-flow operations • Ability to maneuver within the traffic stream is only slightly restricted
C	>18–26	• Flow with speeds near the free-flow speed • Freedom to maneuver within the traffic stream is noticeably restricted
D	>26–35	• Speeds begin to decline with increasing flows • Freedom to maneuver within the traffic stream is seriously limited
E	>35–45	• Operation at or near capacity • Operations are highly volatile because there are virtually no usable gaps within the traffic stream
F	Demand exceeds capacity OR density > 45	• Unstable flow

4.3.3 HCM Capacity Analysis for the Bay Bridge

Traditional capacity analyses performed by MDTA have consistently recognized that the Bay Bridge, even under ideal operating conditions, has a lower capacity than what would otherwise be anticipated considering the number of lanes and the operation of those lanes on the Bridge. A number of factors contribute to the Bay Bridge having a lower capacity than would otherwise be expected. These factors include:

1. Absence of shoulders.

2. Uphill grade.

3. Horizontal curve.

4. Physical environment. This includes the Bay itself, the expansive views from the Bridge under clear weather conditions (which can lead some drivers to slow down to look at the viewshed of the Bay and/or ships on the Bay), the lack of any roadside view under inclement weather conditions (which can lead some drivers to slow down due to uncertainty regarding what is present just beyond the Bridge parapet), the movement of the Bridge (particularly in windy conditions), and the presence of the Bridge towers (which are physically striking in their appearance and can lead some drivers to slow down to look at them).

5. Lane restrictions for vehicles exceeding five tons gross vehicle weight/gross vehicle weight rating. Such vehicles are restricted to the right lane on both spans and are prohibited in the two-way lane. (The two-way lane is sometimes referred to as the contra-flow lane.)

6. Speed limits, which vary by span and by location on the span. On the southern bridge (which is normally used for eastbound traffic), the speed limit is 40 miles per hour (mph) at the beginning of the span, increasing to 50 mph partway across. When two-way traffic is in effect on the southern span, westbound traffic has a speed limit of 40 mph through the entire length. On the northern span (which is normally used for westbound traffic), the speed limit is 50 mph through the entire length. When two-way traffic is in effect on the northern span, eastbound traffic has a speed limit of 40 mph through the entire length.

In addition, when either structure is accommodating traffic in both directions, there is a reduction in capacity, due to the lack of a divider between the directions of travel.

An extensive analysis was performed on the hourly data for both directions on the Bay Bridge to estimate the actual capacity of the Bridge and the maximum volumes that could be accommodated at each LOS. That analysis is described in a project document titled, "Development of Proposed Level of Service Breakpoints for the Bay Bridge, Version 3.4" (**Appendix A**). The results of that analysis were used in the Study and are summarized in **Table 4-3**.

Table 4-3: Best-Case Condition LOS Breakpoints for Bay Bridge (Maximum Hourly Volumes)

LOS	Maximum Density (pc/mi/ln)	Vehicles per Lane (1)	Vehicles in 3 Lanes
A	11	398	1,194
B	18	651	1,952
C	26	938	2,814
D	35	1,246	3,737
E	45	1,517	4,551
F	>45	Not Applicable	Not Applicable

(1) Vehicles Per Lane are rounded to the nearest whole number.

4.3.4 HCM Capacity Analysis for Approach/Departure Roadways

The study also involves analyses of the approach and departure roadways serving the Bridge. Thus, the capacity and LOS breakpoints for these approach roadways also needed to be determined.

Traditional HCM analyses were performed for the approach and departure roadways in the immediate vicinity of the Bay Bridge. Impacts of interchange ramps were not considered at this stage of the analysis. The results of that analysis, and a comparison of the capacity of the Bay Bridge to the capacity of its approach roadways, are summarized in **Table 4-4**.

Table 4-4: LOS Breakpoints for Approach/Departure Roadways

LOS	Volume (in 1 lane) for this LOS (vehicles)		Ratio of Approaches/ Bridge	Volume (in 3 lanes) for this LOS (vehicles)		Ratio of Approaches/ Bridge
	Bridge	Approaches		Bridge	Approaches	
A	398	510	1.28	1194	1530	1.28
B	651	833	1.28	1952	2500	1.28
C	938	1202	1.28	2814	3606	1.28
D	1246	1618	1.30	3737	4854	1.30
E	1517	1979	1.30	4551	5938	1.30

For any level of service, the volume that can be accommodated on the approach roadways, is approximately 28-30 percent higher than the volume which can be accommodated on the Bay Bridge itself (**Table 4-4**).

4.3.5 Queuing Analysis on U.S. 50/301

Observations of traffic operations at the Bay Bridge have shown that queues begin to develop at a traffic volume level well below the capacity of the Bridge. Comparisons of volume data and queue lengths reported by MDTA have shown that queues begin to form when those volumes reach approximately 1,150 vehicles per hour per lane (vphpl). That analysis is described in a project document titled, "Derivation of 'Queue Start Volume' on the Approaches to the Bay Bridge, Version 1.1" (**Appendix B).**

The volume-to-capacity ratio at the point at which queuing begins was calculated to be 0.758 (1,150 vphpl/1,517 vphpl). Per **Table 4-3**, this volume corresponds to LOS D. This value is consistent with the HCM, which states (on page 670):

> "LOS D is the level at which speeds begin to decline with increasing flows, with density increasing more quickly. Freedom to maneuver within the traffic stream is seriously limited, and drivers experience reduced physical and psychological comfort levels. Even minor incidents can be expected to create queuing because the traffic stream has little space to absorb disruptions."

In essence, the transition from the approach roadway to the Bay Bridge, and the corresponding reduction in the capacity per lane, results in a permanent "minor incident", or in this case a bottleneck, at the start of the Bridge, with queues extending back onto the approach roadways. Queues get longer when volumes exceed 1,150 vphpl and begin to diminish when approach volumes drop below that level.

An Excel spreadsheet was developed to compute the length and duration of queues for combinations of hourly approach volumes and number of lanes on both the Bridge and its approach roadways.

4.3.6 VISSIM Analyses

The primary purpose of developing a VISSIM microsimulation model of existing conditions within the study area was to allow assessment of system-wide performance measures, including travel times/speeds, throughput, and queuing. Once calibrated to existing conditions, the model was then used for detailed analysis of future conditions, for the No-Build and range of alternatives, and for the same performance measures that were measured for the existing conditions. "VISSIM Modeling Guidance," a document produced by the SHA, was used in the development and calibration of the VISSIM model. Additional information may be found in the VISSIM Calibration and Methodologies Memorandum prepared for the Tier 2 Study.

As noted above, the HCM analyses were preliminary, and provided a starting point for the detailed VISSIM analyses. The HCM analyses provide performance metrics which do not necessarily provide the same level of detail as VISSIM. The VISSIM outputs will be the primary data used for analysis.

4.3.7 Diversion to Local Roads

Diversion to local roads was addressed at a qualitative level. If there are no queues on U.S. 50/301, traffic does not divert to the local roads. However, when there is a queue on U.S. 50/301, there is likely to be diversion if a driver anticipates that they will have a shorter travel time on a roadway other than on U.S. 50/301. The extent of the diversion and the locations at which the diversion from U.S. 50/301 starts varies with the length of the queue on U.S. 50/301, and is thus variable not only from day-to-day, but from hour-to-hour.

It should be noted that the qualitative analyses reported in this document do not account for operational changes to U.S. 50/301 or its ramps which could be made in an effort to discourage diversion. Some of these operational changes are already being implemented. Starting in summer 2022, SHA and the Counties have attempted to discourage diversion to local roads by temporarily closing key entrance ramps approaching the Bay Bridge and close to the Bridge during summer peak periods. Traffic that would attempt to divert to local roads would not be able to get back onto U.S. 50/301 close to the bridge, thus discouraging traffic from diverting in the first place.

These operational changes are likely to continue in the future, and perhaps be modified to address growth in traffic volumes in the Study Area. However, in order to provide a consistent basis of analysis across all of the alternatives, these operational changes were not factored into the qualitative analyses.

4.4 Traffic Analysis Methodologies for Future Conditions

4.4.1 Development of Future Traffic Volumes

In the DC-MD-VA region, two Metropolitan Planning Organizations (MPOs) have historically developed and produced travel demand forecasts – the Baltimore Metropolitan Council (BMC) and the Metropolitan Washington Council of Governments (MWCOG). These MPO models are detailed and appropriate for their intended purpose of travel forecasting and environmental analysis in their respective jurisdictions but are of limited use in transportation planning efforts that cross their jurisdictional boundaries or impact areas that are not within the geographic areas covered by their models or at the outer edges of the model area. There are large areas of the State of Maryland that are not within the jurisdictional reach of either BMC or MWCOG, particularly Western Maryland and most of the Eastern Shore. Specifically, the Bay Bridge itself is at the geographic limit of the MWCOG model, and the BMC model extends only to the border of QAC. This precludes each model from assessing, in detail, demands on the bridge from the Eastern Shore and beyond.

To address areas outside the MPO jurisdictions, multistate travel, and travel on the boundaries of the two MPO areas, SHA began developing the Maryland Statewide Transportation Model (MSTM), the State's first statewide modeling tool, in 2006. The MSTM represents a new generation of model that provides greater geographical reach than the previous MPO models. The increased geographical reach in the MSTM is enabled by means of Traffic Analysis Zones that are larger in size compared to those in the two MPO models.

SHA has been maintaining and refining the MSTM over eighteen years. Key model inputs such as socioeconomic assumptions and future highway and transit projects are coded into the model to ensure consistency with BMC, MWCOG, and Wilmington Area Planning Council MPOs. This state-of-the-art model allows SHA to estimate how different growth and development patterns influence key measures of transportation performance. (The current version of the MSTM forecasts 2045 conditions. The BMC model has been updated to 2050, while the current version of the MWCOG model uses 2045.) MSTM is a planning tool that guides SHA policies and construction priorities and is used to develop the State's annual Consolidated Transportation Program and to support SHA's project-based scoring system. The MSTM offers MDTA the best option to perform the travel demand forecasting required for the Tier 2 Study and was the most appropriate option given the geographic limitations of the regional MPO models.

After examining these available options and consulting with the SHA Travel Forecasting and Analysis Division, MDTA chose the Maryland Statewide Transportation Model (MSTM) to develop travel demand forecasts for the Tier 2 Study. The MSTM was also used in the Tier 1 Study. MDTA conducted travel demand forecasting to assess existing traffic volumes and conditions, and to estimate future traffic volumes and conditions in 2045 for the No-Build alternative and several build alternatives.

Traffic volume forecasts from the MSTM were developed for conditions anticipated in the year 2045 for a "No-Build" scenario. The No-Build scenario assumes that no new crossings of the Bay are constructed, and that the existing Bay Bridge remains as it is today, providing five lanes of traffic. Forecasts were also developed for a number of "Build" scenarios, each providing one or more additional lanes across the Bay at the approximate location of the existing Bay Bridge. The "per lane" capacity of the existing Bay Bridge was used for each additional lane considered. Some

of the Build scenarios also assumed that additional lanes were provided on U.S. 50/301 on its approaches/departures to the Bridge. The forecasts made no distinction between the existing Bay Bridge and any potential new Bay Bridge at the same approximate location as the existing Bay Bridge. For example, for scenarios involving eight total lanes crossing the Bay, the forecasts did not distinguish between the existing Bay Bridge plus a new three-lane crossing versus a new eight-lane bridge crossing.

These volume forecasts were developed over a number of months in 2023-2024. Additional information about the traffic volume forecast performed for the project may be found in the *Bay Crossing Study Tier 2 Travel Demand Forecasting Technical Report*. Additional information about the MSTM is available at https://roads.maryland.gov/mdotsha/pages/Index.aspx?PageId=254

4.4.2 HCM Analyses, Queuing Analyses and VISSIM Analyses for Future Conditions

The procedures described above for Existing Conditions were used in the assessment of future conditions within the study area. That is, HCM analyses were used for preliminary assessments of alternatives and detailed analyses were performed using VISSIM.

As discussed above, the Bay Bridge has a documented capacity that is lower than would be expected on the basis of HCM analyses; the adjustment factors for grade and shoulder width that are included in the HCM do not fully capture the unique capacity-reducing factors that exist on the Bay Bridge. Some of the factors leading to this reduced capacity are physical (such as the lack of full shoulders) and some appear to be related to human factors.

It is likely that any new crossing of the Bay would address at least some of the physical factors. However, the ability of a new crossing to address any one or more of the human factors is difficult to predict at this time. Therefore, the capacity analyses for future conditions were based on the premise that a new crossing would have the same capacity per lane as existing conditions. That is, a lane approaching the new crossing was analyzed with a capacity per lane of 1.30 times the capacity of a lane on the new crossing itself.

A sensitivity analysis addressing this topic was performed, and is discussed in Chapter 7.1.

4.4.3 Diversion to Local Roads for Future Conditions

The qualitative assessment described for existing conditions was performed for future conditions as well.

5 TRAFFIC ANALYSIS OF EXISTING CONDITIONS

5.1 HCM Analysis and Queuing Analysis of the Bay Bridge

Using the 2022 data, HCM and queuing analyses were performed for the Bay Bridge for both NSWD and SWED conditions. The results of these analyses are shown in **Table 5-1**.

Table 5-1 shows the following conditions would occur:

1. Under NSWD conditions, with two-way operation in effect to allow the peak direction to operate with three lanes, queues do not typically form in either direction.
2. On summer Fridays, even with two-way operations allowing for three lanes eastbound, eastbound queues of one mile or longer typically exist for eight hours, with a maximum length of 3.2 miles. In the westbound direction, with only two lanes available, queues of one mile or longer typically exist for seven hours, with a maximum length of 3.1 miles.
3. On summer Sundays, when three westbound lanes are provided throughout the day, westbound queues of one mile or longer typically exist for eight hours, with a maximum length of 3.5 miles. In the eastbound direction, with only two lanes available, queues of one mile or longer typically exist for ten hours, with a maximum length of 4.9 miles.
4. For seven hours on summer Fridays and for eight hours on summer Sundays, queues longer than one mile exist in both directions. Five lanes, even with two-way operation, do not provide sufficient capacity to prevent queuing.

If there was no two-way operation, there would always be three lanes westbound and two lanes eastbound (**Table 5-2**). Per **Table 5-2**, without two-way operation:

1. In the eastbound direction, queues of one mile or longer would typically exist for six hours on NSWDs, with the longest queue reaching 5.6 miles. (It should be noted that these conditions sometimes actually occur, due to weather restrictions or other factors which prevent MDTA from implementing two-way operation during the eastbound peak period.)
2. On summer Fridays, eastbound queues of greater than 10.0 miles would exist through much of the day.

On summer Sundays, westbound queues would be the same without two-way operation as they would be with two-way operation. This is because two-way operation is typically not implemented on summer Sundays, leaving three westbound lanes under both conditions.

Table 5-1: Existing Hourly Levels of Service and Queue Lengths across the Bay Bridge

Time	Typical Non-Summer Weekday						Typical Summer Friday						Typical Summer Sunday**					
	Eastbound			Westbound			Eastbound			Westbound			Eastbound			Westbound		
	LOS	Queue (miles)	Queue Longer Than 1 Mile	LOS	Queue (miles)	Queue Longer Than 1 Mile	LOS	Queue (miles)	Queue Longer Than 1 Mile	LOS	Queue (miles)	Queue Longer Than 1 Mile	LOS	Queue (miles)	Queue Longer Than 1 Mile	LOS	Queue (miles)	Queue Longer Than 1 Mile
12-1AM	A	0.0		A	0.0		A	0.0		A	0.0		A	0.0		A	0.0	
1-2AM	A	0.0		A	0.0		A	0.0		A	0.0		A	0.0		A	0.0	
2-3AM	A	0.0		A	0.0		A	0.0		A	0.0		A	0.0		A	0.0	
3-4AM	A	0.0		A	0.0		A	0.0		A	0.0		A	0.0		A	0.0	
4-5AM	A	0.0		A	0.0		A	0.0		A	0.0		A	0.0		A	0.0	
5-6AM	A	0.0		B	0.0		A	0.0		B	0.0		A	0.0		A	0.0	
6-7AM	B	0.0		C	0.0		C	0.0		C	0.0		B	0.0		A	0.0	
7-8AM	C	0.0		D	0.0		D	0.0		C	0.0		C	0.0		A	0.0	
8-9AM	C	0.0		C	0.0		C*	0.0		D	0.0		C	0.0		B	0.0	
9-10AM	C	0.0		C	0.0		C*	0.0		D	0.0		D	0.0		C	0.0	
10-11AM	C	0.0		C	0.0		D*	0.0		D	0.0		E	0.6		D	0.0	
11AM-12PM	D	0.0		B	0.0		E*	0.5		D	0.3		E	1.4	✓	D	0.2	
12-1PM	D	0.0		B	0.0		E*	1.1	✓	E	0.8		E	2.2	✓	E	0.9	
1-2PM	D	0.0		C	0.0		E*	1.5	✓	E	1.5	✓	E	3.0	✓	E	1.6	✓
2-3PM	C*	0.0		D	0.0		D*	1.9	✓	E	2.1	✓	E	3.8	✓	E	2.1	✓
3-4PM	D*	0.0		D	0.0		D*	2.2	✓	E	2.4	✓	E	4.4	✓	D	2.5	✓
4-5PM	D*	0.0		D	0.0		E*	2.7	✓	E	2.9	✓	E	4.9	✓	D	2.8	✓
5-6PM	D*	0.0		D	0.0		E*	3.2	✓	D	3.1	✓	D	4.9	✓	D	3.3	✓
6-7PM	C*	0.0		C	0.0		D*	2.9	✓	D	2.8	✓	D	4.4	✓	D	3.5	✓
7-8PM	B*	0.0		B	0.0		C* (1)	1.8	✓	D	2.1	✓	C (1)	3.2	✓	D	3.4	✓
8-9PM	B	0.0		A	0.0		C* (1)	0.5		C	0.9		B (1)	1.4	✓	D	2.6	✓
9-10PM	B	0.0		A	0.0		B*	0.0		B	0.0		B	0.0		C (1)	0.7	
10-11PM	A	0.0		A	0.0		B	0.0		A	0.0		A	0.0		B	0.0	
11PM-12AM	A	0.0		A	0.0		A	0.0		A	0.0		A	0.0		A	0.0	
Max. Queue		**0.0**			**0.0**			**3.2**			**3.1**			**4.9**			**3.5**	
Hours with Queue > 1.0 Mile			**0**			**0**			**8**			**7**			**10**			**8**

***** Assuming two-way operation on the westbound bridge, providing a third eastbound lane.
****** Assuming 3 lanes in the westbound peak-flow direction, this never overlaps the eastbound peak-flow.

(1) Computed LOS based on approach volume. LOS is actually D or E due to the queue (the unserved demand) from the preceding hour.

Table 5-2: Existing Hourly Levels of Service and Queue Lengths across the Bay Bridge without Two-Way Operation

Time	Typical Non-Summer Weekday						Typical Summer Friday						Typical Summer Sunday					
	Eastbound			Westbound			Eastbound			Westbound			Eastbound			Westbound		
	LOS	Queue (miles)	Queue Longer Than 1 Mile	LOS	Queue (miles)	Queue Longer Than 1 mile	LOS	Queue (miles)	Queue Longer Than 1 Mile	LOS	Queue (miles)	Queue Longer Than 1 Mile	LOS	Queue (miles)	Queue Longer Than 1 Mile	LOS	Queue (miles)	Queue Longer Than 1 Mile
12-1AM	A	0.0		A	0.0		A	0.0		A	0.0		A	0.0		A	0.0	
1-2AM	A	0.0		A	0.0		A	0.0		A	0.0		A	0.0		A	0.0	
2-3AM	A	0.0		A	0.0		A	0.0		A	0.0		A	0.0		A	0.0	
3-4AM	A	0.0		A	0.0		A	0.0		A	0.0		A	0.0		A	0.0	
4-5AM	A	0.0		A	0.0		A	0.0		A	0.0		A	0.0		A	0.0	
5-6AM	A	0.0		B	0.0		A	0.0		B	0.0		A	0.0		A	0.0	
6-7AM	B	0.0		C	0.0		C	0.0		C	0.0		B	0.0		A	0.0	
7-8AM	C	0.0		D	0.0		D	0.0		C	0.0		C	0.0		A	0.0	
8-9AM	C	0.0		C	0.0		D	0.1		C	0.0		C	0.0		B	0.0	
9-10AM	C	0.0		C	0.0		E	0.8		C	0.0		D	0.0		C	0.0	
10-11AM	C	0.0		C	0.0		F	2.9	✓	C	0.0		E	0.6		D	0.0	
11AM-12PM	D	0.0		B	0.0		F	5.5	✓	C	0.0		E	1.4	✓	D	0.2	
12-1PM	D	0.0		B	0.0		F	8.4	✓	C	0.0		E	2.2	✓	E	0.9	
1-2PM	D	0.0		C	0.0		F	>10.0	✓	C	0.0		E	3.0	✓	E	1.6	✓
2-3PM	E	0.7		C	0.0		F	>10.0	✓	C	0.0		E	3.8	✓	E	2.1	✓
3-4PM	F	2.2	✓	C	0.0		F	>10.0	✓	C	0.0		E	4.4	✓	D	2.5	✓
4-5PM	F	4.2	✓	C	0.0		F	>10.0	✓	C	0.0		E	4.9	✓	D	2.8	✓
5-6PM	F	5.6	✓	B	0.0		F	>10.0	✓	C	0.0		D	4.9	✓	D	3.3	✓
6-7PM	D (1)	5.4	✓	B	0.0		F	>10.0	✓	C	0.0		D	4.4	✓	D	3.5	✓
7-8PM	C (1)	4.1	✓	A	0.0		E	>10.0	✓	B	0.0		C (1)	3.2	✓	D	3.4	✓
8-9PM	B (1)	2.1	✓	A	0.0		D	>10.0	✓	B	0.0		B (1)	1.4	✓	D	2.6	✓
9-10PM	B	0.0		A	0.0		C (1)	>10.0	✓	B	0.0		B	0.0		C (1)	0.7	
10-11PM	A	0.0		A	0.0		B (1)	>10.0	✓	A	0.0		A	0.0		B	0.0	
11PM-12AM	A	0.0		A	0.0		A (1)	>10.0	✓	A	0.0		A	0.0		A	0.0	
					0.0													
Max. Queue		**5.6**			**0.0**			**>10.0**			**0.0**			**4.9**			**3.5**	
Hours with Queue > 1.0 Mile			**6**			**0**			**14**			**0**			**10**			**8**

(1) Computed LOS based on approach volume. LOS is actually D or E due to the queue from the preceding hour.

5.2 HCM Analysis of U.S. 50/301 in the Remainder of the Study Area

HCM analyses of peak hour volumes on the other individual segments of U.S. 50/301, including weaving sections and ramp junctions with U.S. 50/301, were performed and are summarized in **Tables 5-3 and 5-4**. On NSWDs, the AM peak hour occurs in the westbound direction and the PM peak hour occurs in the eastbound direction. Under SWED conditions, the Friday peak hour occurs in the eastbound direction and the Sunday peak hour occurs in the westbound direction. As noted previously, the HCM analyses represent a best-case condition and do not consider external factors such as queuing from the Bay Bridge.

In these tables, with regard to the "Segment Type" column:

- A "basic freeway" segment or "basic highway" segment is one in which there are no ramps, and no lane additions/lane drops occur.
- In a "merge" segment, a ramp enters U.S. 50/301 without adding a mainline lane.
- In a "diverge" segment, a ramp exits U.S. 50/301 without subtracting a mainline lane.
- A "weaving" segment is one in which an auxiliary lane is added to the mainline between an entrance ramp and the next exit ramp.

In the eastbound direction of travel:

1. In the absence of external factors (such as queuing from the Bay Bridge), most of the elements of U.S. 50/301 operate at an acceptable LOS (that is, LOS "D" or better). The exceptions occur at the Bay Bridge itself under SWED conditions and at the western end of the study area under both NSWD and SWED conditions.
2. Generally, densities are higher under SWED conditions than NSWD conditions. The exceptions occur at the western end of the study area.

In the westbound direction:

1. Conditions are similar to those noted for the eastbound direction.
2. The Bay Bridge operates at LOS "E" under SWED conditions; some elements of U.S. 50/301 operate at LOS "E" approaching the Severn River Bridge under both NSWD and SWED conditions.
3. Densities are generally higher under SWED conditions than NSWD conditions, except in the western end of the study area.

Table 5-3: Highway Capacity Manual Computations: Eastbound U.S. 50/301 Existing Conditions

Segment Name	Segment Type	SWED (Friday Peak Hour)		NSWD (PM Peak Hour)	
		Density (pc/lane/mile)	LOS	Density (pc/lane/mile)	LOS
Off Ramp to MD 2/MD 450*	Diverge	29.5	D	32.9	D
Inside MD 2/MD 450 Interchange	Basic Freeway	29.0	D	32.4	D
On Ramp from MD 2/MD 450	Merge	27.2	C	30.5	D
East of MD 2/MD 450	Basic Freeway	35.9	E	41.1	E
Ferguson Rd Off Ramp	Diverge	24.8	C	26.1	C
Inside Ferguson Rd Interchange	Basic Freeway	32.5	D	32.9	D
On Ramp from Ferguson Rd	Merge	21.7	C	21.4	C
East of Ferguson Rd	Basic Freeway	33.3	D	33.1	D
Off Ramp to Buschs Frontage Rd	Diverge	23.8	C	23.6	C
Inside Buschs Frontage Rd Interchange	Basic Freeway	30.9	D	30.5	D
Weave from Buschs Frontage Rd to MD 179	Weaving	30.5	D	29.7	D
East of MD 179	Basic Freeway	29.1	D	25.9	C
Off Ramp to Whitehall Rd (Exit 30)	Diverge	25.9	C	23.0	C
Inside Whitehall Rd (Exit 30) Interchange	Basic Freeway	28.5	D	25.5	C
On Ramp to Whitehall Rd (Exit 30)	Merge	22.7	C	20.4	C
Whitehall Rd (Exit 30) to Whitehall Rd (Exit 31)	Basic Freeway	29.2	D	26.0	C
Off Ramp to Whitehall Rd (Exit 31)	Diverge	24.2	C	21.9	C
Inside Whitehall Rd (Exit 31) Interchange	Basic Freeway	28.9	D	25.5	C
On Ramp from Whitehall Rd (Exit 31)	Merge	24.4	C	22.1	C
Whitehall Rd (Exit 31) to Oceanic Dr	Basic Freeway	29.1	D	25.7	C
Off Ramp to Oceanic Dr	Diverge	27.2	C	24.9	C
Inside Oceanic Dr Interchange	Basic Freeway	28.6	D	25.4	C
On Ramp from Oceanic Dr	Merge	25.3	C	22.4	C
Western Side of Bay Bridge	Basic Highway	40.2	E	33.6	D
Eastern Side of Bay Bridge	Basic Highway	35.4	E	30.5	D
Off Ramp to MD 8	Diverge	22.4	C	18.7	B
Inside MD 8 Interchange	Basic Freeway	26.1	D	20.1	C

Segment Name	Segment Type	SWED (Friday Peak Hour)		NSWD (PM Peak Hour)	
		Density (pc/lane/mile)	LOS	Density (pc/lane/mile)	LOS
Weave from MD 8 to Thompson Creek Rd	Weaving	31.2	D	25.1	C
Inside Thompson Creek Rd Interchange	Basic Freeway	28.0	D	23.2	C
On Ramp from Thompson Creek Rd	Merge	24.9	C	20.9	C
East of Thompson Creek Rd	Basic Freeway	32.1	D	26.7	D
Off Ramp to Cox Neck Rd	Diverge	27.2	C	23.2	C
Inside Cox Neck Rd Interchange	Basic Freeway	30.8	D	24.9	C
Weave from Cox Neck Rd to Dominion Rd	Weaving	31.2	D	25.0	C
Inside Dominion Rd Interchange	Basic Freeway	28.1	D	22.4	C
On Ramp from Dominion Rd	Merge	22.2	C	19.1	B
East of Dominion Rd	Basic Freeway	30.9	D	25.2	C
Off Ramp to S Piney Rd	Diverge	22.2	C	18.3	B
Inside S Piney Rd Interchange	Basic Freeway	29.5	D	23.9	C
Weave from S Piney Rd to Dundee Ave	Weaving	28.5	D	22.4	C
Inside Dundee Ave Interchange	Basic Freeway	31.0	D	25.5	C
Weave from Dundee Ave to Main St/MD18 (Exit 41)	Weaving	28.4	D	22.0	C
Inside Main St/MD18 (Exit 41) Interchange	Basic Freeway	30.7	D	25.5	C
On Ramp from Main St/MD18 (Exit 41)	Merge	24.4	C	20.6	C
R Clayton Mitchell Jr Bridge	Basic Freeway	31.1	D	25.7	C
Off Ramp to Kent Narrows Rd	Diverge	20.5	C	17.0	B
Inside Kent Narrows Rd Interchange	Basic Freeway	30.2	D	25.4	C
On Ramp from Kent Narrows Rd	Merge	20.5	C	17.2	B
East of Kent Narrows Rd	Basic Freeway	31.0	D	26.2	D
Off Ramp to Main St/MD18 (Exit 43A)	Diverge	21.9	C	18.3	B
Inside Main St/MD 18 (Exit 43A) Interchange	Basic Freeway	30.5	D	25.5	C
Weave from Exit 43A to Chester River Beach Rd	Weaving	26.8	C	22.8	C
Inside Chester River Beach Rd Interchange	Basic Freeway	29.6	D	24.6	C
Weave from Chester River Beach Rd to Station Ln	Weaving	25.9	C	21.5	C
Inside Station Ln Interchange	Basic Freeway	29.9	D	24.8	C

Segment Name	Segment Type	SWED (Friday Peak Hour)		NSWD (PM Peak Hour)	
		Density (pc/lane/mile)	LOS	Density (pc/lane/mile)	LOS
Weave from Station Ln to Evans Ave	Weaving	25.7	C	21.2	C
Inside Evans Ave Interchange	Basic Freeway	29.5	D	24.1	C
Weave from Evans Ave to Hess Rd	Weaving	25.2	C	20.2	C
Inside Hess Rd Interchange	Basic Freeway	29.6	D	24.2	C
Weave from Hess Rd to Nesbit Rd	Weaving	25.8	C	20.8	C
Inside Nesbit Rd Interchange	Basic Freeway	28.9	D	23.3	C
On Ramp from Nesbit Rd	Merge	22.5	C	17.4	B
East of Nesbit Rd	Basic Freeway	29.7	D	24.4	C
US 50/US 301 Split	Diverge	14.4	B	14.3	B
US 50 East of US 50/US 301 Split	Basic Highway	25.1	C	18.1	C
US 301 East of US 50/US 301 Split	Basic Highway	14.9	B	14.9	B

*A diverge segment with a lane drop that has a deceleration length of greater than 1,500 feet was analyzed as a basic freeway section immediately upstream of the off-ramp.

Table 5-4: Highway Capacity Manual Computations: Westbound U.S. 50/301 Existing Conditions

Segment Name	Segment Type	SWED (Sunday Peak)		NSWD (AM Peak)	
		Density (pc/lane/mile)	LOS	Density (pc/lane/mile)	LOS
US 50 East of US 50/US 301 Merge	Basic Highway	20.4	C	14.3	B
US 301 East of US 50/US 301 Merge	Basic Highway	19.5	C	12.4	B
US 50/US 301 Merge*	Merge	29.7	D	19.9	C
West of US 50/US 301 Merge	Basic Freeway	29.7	D	19.9	C
Off Ramp to Blackbeard Rd	Diverge	20.1	C	12.9	B
Under Nesbit Rd	Basic Freeway	28.8	D	19.3	C
Weave from Winchester Creek to Hissey Rd	Weaving	25.7	C	17.6	B
Inside Hissey Rd Interchange	Basic Freeway	28.0	D	19.2	C
Weave from Hissy Rd to Winchester Creek	Weaving	25.5	C	17.1	B
Evans Ave	Basic Freeway	29.3	D	20.5	C
Weave from Evans Ave to VFW Ave	Weaving	24.8	C	16.8	B
Inside VFW Ave Interchange	Basic Freeway	29.0	D	20.0	C
On Ramp from VFW Ave	Merge	17.5	B	11.5	B
West of VFW Ave	Basic Freeway	29.1	D	20.1	C
Weave from Exit 43A to Chester River Beach Rd	Weaving	27.0	C	19.7	B
Jackson Creek Rd	Basic Freeway	28.7	D	21.7	C
On Ramp from Jackson Creek Rd	Merge	21.2	C	15.9	B
West of Jackson Creek Rd	Basic Freeway	29.9	D	22.5	C
Off Ramp to Kent Narrows Rd	Diverge	20.0	B	15.1	B
Kent Narrows Rd	Basic Freeway	28.4	D	22.0	C
On Ramp from Kent Narrows Rd	Merge	22.7	C	17.7	B
R Clayton Mitchell Jr Bridge	Basic Freeway	29.1	D	22.1	C
Off Ramp to Piney Narrows Rd	Diverge	21.0	C	15.9	B
Piney Narrows Rd	Basic Freeway	28.2	D	21.3	C
On Ramp from Piney Narrows Rd	Merge	18.5	B	13.5	B
West of Piney Narrows Rd	Basic Freeway	28.7	D	21.8	C
Off Ramp to Piney Creek Rd	Diverge	22.1	C	17.0	B

Segment Name	Segment Type	SWED (Sunday Peak)		NSWD (AM Peak)	
		Density (pc/lane/mile)	LOS	Density (pc/lane/mile)	LOS
Piney Creek Rd	Basic Freeway	28.2	D	21.4	C
On Ramp from Piney Creek Rd	Merge	18.0	B	13.4	B
West of Piney Creek Rd	Basic Freeway	28.7	D	22.1	C
Off Ramp to Chester Station Ln	Diverge	21.2	C	16.4	B
Chester Station Ln	Basic Freeway	28.3	D	21.8	C
Weave from Chester Station Ln to Castle Marina Rd	Weaving	25.1	C	18.9	B
Castle Marina Rd	Basic Freeway	27.0	D	20.4	C
On Ramp from Castle Marina Rd	Merge	23.5	C	19.9	B
West of Castle Marina Rd	Basic Freeway	30.0	D	24.3	C
Off Ramp to Duke St	Diverge	21.0	C	16.4	B
Duke St	Basic Freeway	29.5	D	22.9	C
Weave from Duke St to MD 8	Weaving	28.2	C	23.0	C
Inside MD 8 Interchange	Basic Freeway	26.1	D	17.1	B
On Ramp from MD 8	Merge	20.1	C	17.6	B
Eastern Side of Bay Bridge	Basic Highway	38.7	E	30.4	D
Western Side of Bay Bridge	Basic Highway	34.2	D	27.6	D
Off Ramp to Oceanic Dr	Diverge	23.0	C	18.9	B
Inside Oceanic Dr Interchange	Basic Freeway	26.8	D	21.5	C
On Ramp from Oceanic Dr	Merge	23.4	C	19.1	B
West of Oceanic Dr	Basic Freeway	27.6	D	21.9	C
Off Ramp to MD 179	Diverge	23.9	C	19.7	B
Inside MD 179 Interchange	Basic Freeway	27.5	D	22.0	C
On Ramp from MD 179	Merge	23.3	C	21.9	C
West of MD 179	Basic Freeway	31.6	D	28.9	D
Off Ramp to Bay Dale Dr	Diverge	25.0	C	22.5	C
Inside Bay Dale Dr Interchange	Basic Freeway	31.0	D	28.2	D
On Ramp from Bay Dale Dr	Merge	29.3	D	32.0	D

Segment Name	Segment Type	SWED (Sunday Peak)		NSWD (AM Peak)	
		Density (pc/lane/mile)	LOS	Density (pc/lane/mile)	LOS
West of Bay Dale Dr	Basic Freeway	35.7	E	37.7	E
Off Ramp to MD 648	Diverge	28.3	D	29.2	D
Inside MD 648 Interchange	Basic Freeway	35.5	E	37.6	E
On Ramp from MD 648	Merge	30.6	D	31.6	D
West of MD 648	Basic Freeway	35.6	E	37.7	E
Off Ramp to MD 2	Diverge	27.5	C	28.4	D
Inside MD 2/MD 450 Interchange	Basic Freeway	30.1	D	31.4	D
Off Ramp to MD 450	Diverge	27.2	C	28.0	C
Over Boulters Way	Basic Freeway	28.8	D	29.8	D
On Ramp from MD 2	Merge	28.3	D	N/A	F

*A merge segment with a lane addition was analyzed as a basic freeway section immediately downstream of the on-ramp.

5.3 VISSIM Analysis

The HCM analyses described in **Tables 5-3 and 5-4** address the peak hour of traffic volumes for NSWD and SWED conditions without consideration of the highway as a continuous network. However, as noted in **Tables 5-1 and 5-2**, queuing occurs at the Bay Bridge under SWED conditions today, with those queues extending for several hours. One of the advantages of VISSIM is that it allows a multi-hour analysis of a study area more easily than HCM. In addition, it bears repeating that the HCM analyses were preliminary and provided a starting point for the detailed VISSIM analyses. The HCM analyses provide performance metrics which do not necessarily provide the same level of detail as VISSIM. The VISSIM outputs will be the primary data used for analysis.

The HCM analyses were performed, both with and without two-way operation, in order to demonstrate the importance of two-way operation under existing conditions. The VISSIM analyses considered "with two-way operation" only, since two-way operation represents the best case scenario for existing conditions. This approach provided the best basis of comparison for existing conditions against the Alternatives.

The results of the Existing Conditions VISSIM analyses are shown in **Tables 5-5 through 5-12**. Delay, LOS, and speeds along U.S. 50/301 throughout the corridor during the peak volume hour at the Bay Bridge are shown in **Tables 5-5 and 5-6** for SWED conditions and **Tables 5-9 and 5-10** for NSWD conditions.

The results produced by VISSIM for freeway segments were evaluated by considering LOS classifications presented in the HCM. It should be noted that the density calculations provided by VISSIM do not exactly replicate the density calculations provided by the HCM, however they are similar. For VISSIM, density is measured in vehicles per lane per mile. The HCM LOS letter gradations are applied to the VISSIM density values to provide a qualitative point of reference.

These tables also show:

- Volume Expected: the hourly volume of vehicles wishing to use this segment.
- Throughput: the number of vehicles in the Volume Expected which actually use the segment.
- Unmet Demand: Volume Expected minus Throughput.
- Throughput Percentage: Throughput divided by Volume Expected, expressed as a percentage.

This additional data provides an indication of how well the VISSIM model replicates actual field conditions. Typically, throughput % values of 90% to 110% are accepted as reasonable for calibration, although individual segments may have values outside this range.

For future conditions, this additional data also provides important information about conditions beyond the Study Limits, where "metering" may be occurring, and thus restricting traffic flow into or out of the Study Limits. The Unmet Demand is an indication of the extent of that metering.

Queue lengths and durations, at the Bay Bridge and within the overall study area, are shown in **Table 5-7** for SWED conditions and **Table 5-11** for NSWD conditions. (It should be noted that the VISSIM analyses replicate observed existing conditions within calibration limits, but do not precisely match those observed conditions.) A bottleneck diagram, visually summarizing the results of the analyses, is shown in **Figure 5-1** for SWED conditions and **Figure 5-2** for NSWD conditions. In each bottleneck diagram, red shading is used to identify the presence and length of a queue on a particular segment. A queue longer than 0.1 mile begins at a bottleneck (a maroon rectangle in the bottleneck diagram) and ends where the red shading changes to green or hatched green. For the purposes of the analyses, vehicles were defined as being in a queue if their average speeds were 25 miles per hour or lower on a particular segment.

A summary of travel times and speeds is shown in **Table 5-8** for SWED conditions and in **Table 5-12** for NSWD conditions.

Table 5-5: VISSIM Eastbound US 50/301 Segment Results:
Existing Conditions Summer Weekend, Peak Hour of Volume with Three Eastbound Lanes

Eastbound Segment Name	Segment Type	SWED (Friday Peak Hour)						
		Density (veh/ln/mi)	LOS	Speed (mph)	Volume Expected	Throughput	Unmet Demand	Through-put %
MD 2/MD 450 to Ferguson Rd	Freeway	23.7	C	61.6	4547	4389	-158	97%
Ferguson Rd to MD 179	Freeway	21.7	C	62.2	4116	4041	-75	98%
MD 179 to Whitehall Rd (Exit 30)	Freeway	19.4	C	63.0	3754	3660	-94	97%
Whitehall Rd (Exit 30) to Oceanic Dr	Freeway	20.1	C	61.2	3833	3679	-154	96%
Oceanic Dr to Bay Bridge	Freeway	54.9	F	19.2	3955	3579	-376	90%
William Preston Lane Jr. Bay Bridge	Freeway	31.6	D	36.8	3955	3577	-378	90%
Bay Bridge to MD 8	Freeway	25.6	C	46.5	3955	3578	-377	90%
Weave from MD 8 to Thompson Creek Rd	Weave	17.8	B	51.8	4134	3685	-449	89%
Thompson Creek Rd to Cox Neck Rd	Freeway	21.5	C	60.1	4283	3877	-406	91%
Weave from Cox Neck Rd to Dominion Rd	Weave	15.9	B	61.5	4301	3899	-402	91%
Dominion Rd to S Piney Rd	Freeway	20.2	C	61.4	4122	3720	-402	90%
Weave from S Piney Rd to Dundee Ave	Weave	15.7	B	61.4	4214	3850	-364	91%
Weave from Dundee Ave to Main St/MD 18 (Exit 41)	Weave	17.1	B	56.8	4247	3875	-372	91%
R Clayton Mitchell Jr Bridge	Freeway	20.4	C	62.2	4143	3804	-339	92%
Kent Narrows Rd to Main St/MD 18 (Exit 43A)	Freeway	20.2	C	62.2	4133	3771	-362	91%
Weave from Exit 43A to Chester River Beach Rd	Weave	15.0	B	62.3	4103	3744	-359	91%
Weave from Chester River Beach Rd to Station Ln	Weave	14.7	B	62.6	4028	3691	-337	92%
Weave from Station Ln to Evans Ave	Weave	14.8	B	62.1	4011	3672	-339	92%
Weave from Evans Ave to Hess Rd	Weave	14.6	B	62.0	3965	3629	-336	92%
Weave from Hess Rd to Nesbit Rd	Weave	14.7	B	61.9	3977	3631	-346	91%
U.S. 50/U.S. 301 Split	Merge/Diverge	20.0	C	61.0	3956	3663	-293	93%
U.S. 50 East of U.S. 50/U.S. 301 Split	Freeway	19.2	C	59.6	2490	2285	-205	92%
U.S. 301 East of U.S. 50/U.S. 301 Split	Freeway	10.7	A	63.2	1466	1371	-95	94%

Table 5-6: VISSIM Westbound US 50/301 Segment Results:
Existing Conditions Summer Weekend, Peak Hour of Volume with Three Westbound Lanes

Westbound Segment Name	Segment Type	SWED (Sunday Peak Hour						
		Density (veh/ln/mi)	LOS	Speed (mph)	Volume Expected	Through-put	Unmet Demand	Through-put %
U.S. 301 East of U.S. 50/U.S. 301 Split	Freeway	16.5	B	58.3	1935	1921	-14	99%
U.S. 50 East of U.S. 50/U.S. 301 Split	Freeway	17.3	B	58.6	2045	2031	-14	99%
U.S. 50/U.S. 301 Split	Merge/Diverge	20.9	C	62.4	3980	3921	-59	99%
Weave from Nesbit Rd to Hissey Rd	Weave	15.6	B	61.7	3924	3861	-63	98%
Weave from Hissey Rd to Winchester Creek Rd	Weave	15.7	B	62.1	3933	3891	-42	99%
Weave from Winchester Creek Rd to Vfw Ave	Weave	15.5	B	62.7	3930	3890	-40	99%
Vfw Ave to Chester River Beach Rd	Freeway	20.4	C	62.6	3899	3841	-58	99%
Weave from Chester River Beach Rd to Jackson Creek Rd	Weave	16.2	B	62.2	4040	4018	-22	99%
Jackson Creek Rd to Kent Narrows Rd	Freeway	21.3	C	62.4	4003	3980	-23	99%
R Clayton Mitchell Jr. Bridge	Freeway	20.6	C	62.5	3891	3866	-25	99%
Piney Narrows Rd to Piney Creek Rd	Freeway	20.2	C	62.6	3846	3798	-48	99%
Piney Creek Rd to Chester Station Ln	Freeway	20.2	C	62.5	3846	3786	-60	98%
Weave from Chester Station Ln to Castle Marina Rd	Weave	15.3	B	62.0	3838	3805	-33	99%
Castle Marina Rd to Duke St	Freeway	21.4	C	61.6	4018	3960	-58	99%
Weave from Duke St to MD 8	Weave	25.7	C	40.1	4035	3947	-88	98%
MD 8 to Bay Bridge	Freeway	72.4	F	16.2	3841	3515	-326	92%
William Preston Lane Jr. Bay Bridge	Freeway	32.2	D	36.4	3841	3516	-325	92%
Bay Bridge to Oceanic Dr	Freeway	18.8	C	62.1	3841	3497	-344	91%
Oceanic Dr to MD 179	Freeway	19.3	C	62.6	3921	3616	-305	92%
MD 179 to Bay Dale Dr	Freeway	21.4	C	62.2	4307	3989	-318	93%
Bay Dale Dr to MD 2/MD 450	Freeway	28.6	D	52.0	4777	447	-318	93%

Table 5-7: VISSIM Queuing Results: Existing Conditions Summer Weekend, with Three Eastbound Lanes on Friday and Three Westbound Lanes on Sunday

Time	Typical Summer Friday			Typical Summer Sunday		
	Eastbound Maximum Queue (miles)			Westbound Maximum Queue (miles)		
	Between U.S. 50/301 Split & Start of Bay Bridge (1)	From Start of Bay Bridge to End of Queue	Total	Between Start of Queue at Bay Dale Drive and Start of Bay Bridge (2)	From Start of Bay Bridge to End of Queue	Total
10-11 AM	0.0	0.3	n/a (3)	0.0	0.3	n/a (3)
11 AM – 12 PM	0.0	0.7	n/a (3)	0.0	0.7	n/a (3)
12-1 PM	0.0	1.3	n/a (3)	0.0	1.5	n/a (3)
1-2 PM	0.0	1.9	n/a (3)	0.0	2.3	n/a (3)
2-3 PM	0.0	2.3	n/a (3)	0.0	2.7	n/a (3)
3-4 PM	0.0	2.6	n/a (3)	0.0	3.1	n/a (3)
4-5 PM	0.0	3.1	n/a (3)	0.0	3.3	n/a (3)
5-6 PM	0.0	4.0	n/a (3)	0.0	3.7	n/a (3)
6-7 PM	0.0	4.1	n/a (3)	0.0	3.8	n/a (3)
7-8 PM	0.0	3.6	n/a (3)	0.0	3.5	n/a (3)
8-9 PM	0.0	2.0	n/a (3)	0.0	2.0	n/a (3)
9-10 PM	0.0	0.2	n/a (3)	0.0	0.0	n/a (3)
10-11 PM	0.0	0.0	n/a (3)	0.0	0.0	n/a (3)
Max. Queue	**0.0**	**4.1**	n/a (3)	**0.0**	**3.8**	n/a (3)
Hours with Queue > 1 Mile	**0**	**9**	n/a (3)	**0**	**9**	n/a (3)

(3) Queues from end of study area do not extend to the start of the Bay Bridge.

Figure 5-1: Bottleneck Diagram: Existing Conditions Summer Weekend Scenario, Peak Hour of Queueing (Eastbound Friday and Westbound Sunday)

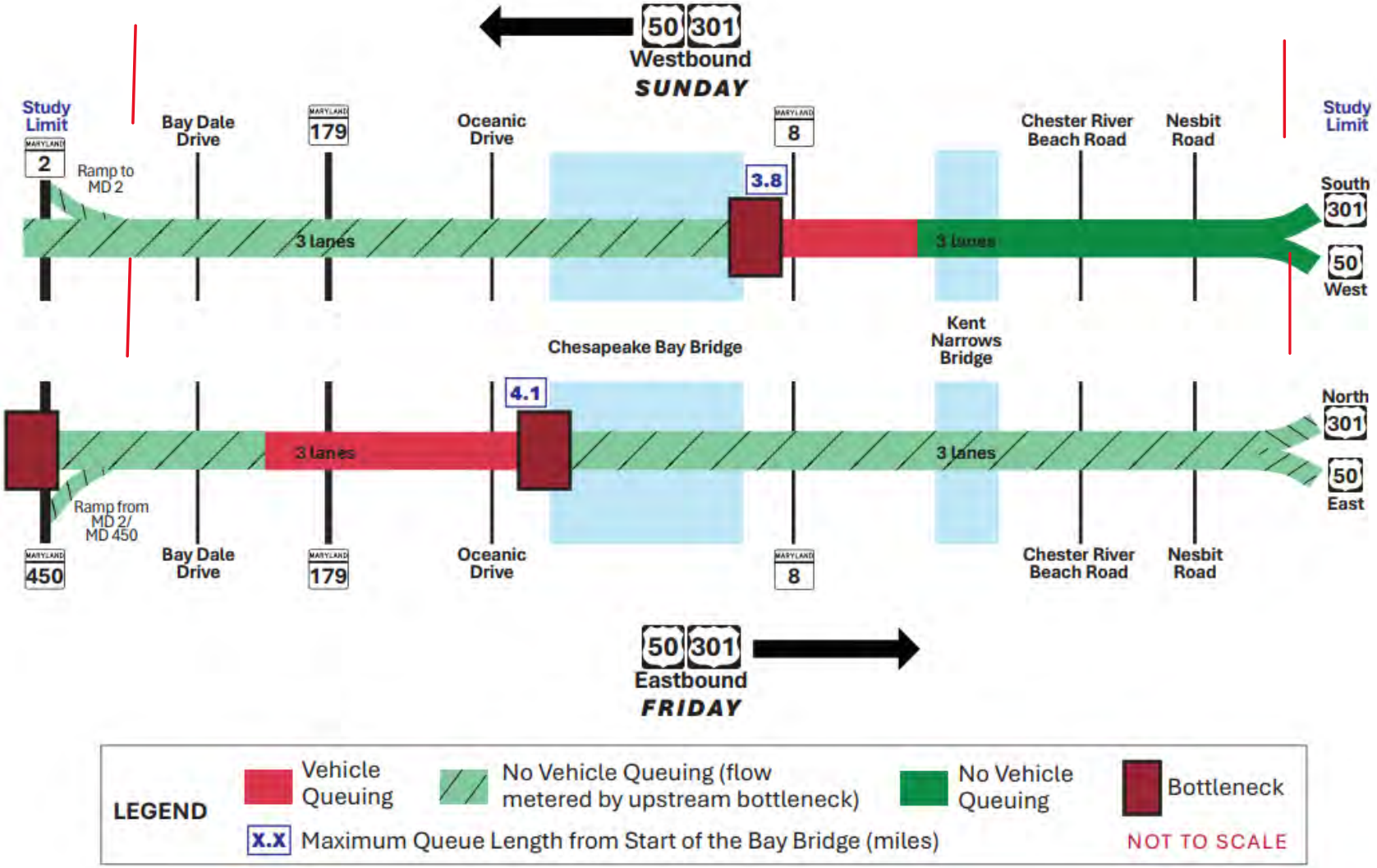


Table 5-8: Travel Time Results for Existing Conditions during SWED, Peak Hour of Queuing

Existing Conditions	Eastbound US 50/301	Westbound U.S. 50/301

		MD 2/MD 450 to Start of Bay Bridge	Start of Bay Bridge to US 50 301 Split	US 50/301 Split to Start of Bay Bridge	Start of Bay Bridge to MD 2/ MD 450
Summer Weekend	Max Travel Time (min)	32	16	30	13
	Speed at Max Travel Time (mph)	9.4	55.9	17.2	49.1

Table 5-9: VISSIM Eastbound US 50/301 Segment Results:
Existing Conditions Non-Summer Weekday, Peak Hour of Volume, with Three Lanes in Eastbound Direction

Eastbound Segment Name	Segment Type	NSWD (PM Peak Hour)						
		Density (veh/ln/mi)	LOS	Speed (mph)	Volume Expected	Through-put	Unmet Demand	Through-put %
MD 2/MD 450 to Ferguson Rd	Freeway	25.5	C	60.6	4661	4634	-28	99%
Ferguson Rd to MD 179	Freeway	20.9	C	62.2	3910	3892	-18	100%
MD 179 to Whitehall Rd (Exit 30)	Freeway	16.8	B	63.1	3118	3184	66	102%
Whitehall Rd (Exit 30) to Oceanic Dr	Freeway	17.1	B	63.0	3248	3224	-23	99%
Oceanic Dr to Bay Bridge	Freeway	23.7	C	35.4	3442	3407	-35	99%
William Preston Lane Jr. Bay Bridge	Freeway	21.7	C	38.2	3442	3395	-47	99%
Bay Bridge to MD 8	Freeway	17.7	B	46.5	3442	3385	-58	98%
Weave from MD 8 to Thompson Creek Rd	Weave	15.8	B	52.4	3553	3312	-240	93%
Thompson Creek Rd to Cox Neck Rd	Freeway	18.9	C	61.0	3652	3459	-193	95%
Weave from Cox Neck Rd to Dominion Rd	Weave	14.1	B	61.9	3670	3477	-193	95%
Dominion Rd to S Piney Rd	Freeway	17.7	B	62.3	3489	3317	-173	95%
Weave from S Piney Rd to Dundee Ave	Weave	13.7	B	62.0	3551	3405	-147	96%
Weave from Dundee Ave to Main St/MD 18 (Exit 41)	Weave	14.4	B	59.4	3570	3418	-153	96%
R Clayton Mitchell Jr Bridge	Freeway	18.1	C	62.5	3512	3398	-115	97%
Kent Narrows Rd to Main St/MD 18 (Exit 43A)	Freeway	18.3	C	62.4	3554	3423	-131	96%
Weave from Exit 43A to Chester River Beach Rd	Weave	13.6	B	62.5	3535	3390	-146	96%
Weave from Chester River Beach Rd to Station Ln	Weave	13.2	B	62.8	3435	3304	-132	96%
Weave from Station Ln to Evans Ave	Weave	13.1	B	62.5	3401	3264	-137	96%
Weave from Evans Ave to Hess Rd	Weave	12.8	B	62.4	3336	3201	-135	96%
Weave from Hess Rd to Nesbit Rd	Weave	12.9	B	62.0	3355	3209	-146	96%
U.S. 50/U.S. 301 Split	Merge/Diverge	17.4	B	61.8	3338	3229	-108	97%
U.S. 50 East of U.S. 50/U.S. 301 Split	Freeway	15.1	B	61.8	1937	1868	-69	96%
U.S. 301 East of U.S. 50/U.S. 301 Split	Freeway	10.6	A	63.0	1401	1342	-59	96%

Table 5-10: VISSIM Westbound US 50/301 Segment Results: Existing Conditions NSWD, Peak Hour of Volume, with Three Lanes in Westbound Direction

Westbound Segment Name	Segment Type	NSWD (AM Peak Hour)						
		Density (veh/ln/mi)	LOS	Speed (mph)	Volume Expected	Through-put	Unmet Demand	Through-put %
U.S. 301 East of U.S. 50/U.S. 301 Split	Freeway	9.9	A	62.1	1206	1232	26	102%
U.S. 50 East of U.S. 50/U.S. 301 Split	Freeway	14.1	B	59.1	1668	1665	-3	100%
U.S. 50/U.S. 301 Split	Merge/Diverge	15.3	B	63.1	2874	2889	15	101%
Weave from Nesbit Rd to Hissey Rd	Weave	11.5	B	62.6	2880	2886	7	100%
Weave from Hissey Rd to Winchester Creek Rd	Weave	11.6	B	62.6	2893	2895	3	100%
Weave from Winchester Creek Rd to Vfw Ave	Weave	11.4	B	63.3	2891	2885	-6	100%
Vfw Ave to Chester River Beach Rd	Freeway	14.9	B	63.5	2850	2831	-18	99%
Weave from Chester River Beach Rd to Jackson Creek Rd	Weave	12.2	B	63.0	3104	3062	-42	99%
Jackson Creek Rd to Kent Narrows Rd	Freeway	16.1	B	63.3	3097	3051	-46	99%
R Clayton Mitchell Jr. Bridge	Freeway	15.7	B	63.2	3023	2974	-49	98%
Piney Narrows Rd to Piney Creek Rd	Freeway	15.3	B	63.5	2973	2911	-61	98%
Piney Creek Rd to Chester Station Ln	Freeway	15.3	B	63.3	2978	2904	-73	98%
Weave from Chester Station Ln to Castle Marina Rd	Weave	11.6	B	62.6	2958	2903	-54	98%
Castle Marina Rd to Duke St	Freeway	16.9	B	62.4	3222	3173	-49	98%
Weave from Duke St to MD 8	Weave	16.2	B	49.3	3254	3201	-53	98%
MD 8 to Bay Bridge	Freeway	24.7	C	42.3	3119	3130	11	100%
William Preston Lane Jr. Bay Bridge	Freeway	26.2	D	39.4	3119	3094	-25	99%
Bay Bridge to Oceanic Dr	Freeway	16.2	B	62.4	3119	3023	-96	97%
Oceanic Dr to MD 179	Freeway	16.4	B	62.9	3170	3096	-75	98%
MD 179 to Bay Dale Dr	Freeway	19.9	C	62.4	3824	3719	-105	97%
Bay Dale Dr to MD 2/MD 450	Freeway	32.6	D	45.5	4596	4409	-187	96%

Table 5-11: VISSIM Queuing Results: Existing Conditions NSWD, with Three Lanes Eastbound in PM and Three Lanes Westbound in AM

Time	Typical PM			Time	Typical AM		
	Eastbound Maximum Queue (miles)				Westbound Maximum Queue (miles)		
	Between U.S. 50/301 Split & Start of Bay Bridge (1)	From Start of Bay Bridge to End of Queue	Total		Between Start of Queue at Bay Dale Drive & Start of Bay Bridge (2)	From Start of Bay Bridge to End of Queue	Total
2-3 PM	0.0	0.1	n/a (3)	5-6 AM	0.0	0.0	n/a (3)
3-4 PM	0.0	0.2	n/a (3)	6-7 AM	0.0	0.0	n/a (3)
4-5 PM	0.0	0.3	n/a (3)	7-8 AM	0.0	0.1	n/a (3)
5-6 PM	0.0	0.2	n/a (3)	8-9 AM	0.0	0.1	n/a (3)
6-7 PM	0.0	0.0	n/a (3)	9-10 AM	0.0	0.0	n/a (3)
7-8 PM	0.0	0.0	n/a (3)	10-11 AM	0.0	0.0	n/a (3)
8-9 PM	0.0	0.0	n/a (3)	11-12 PM	0.0	0.0	n/a (3)
9-10 PM	0.0	0.0	n/a (3)	12-1 PM	0.0	0.0	n/a (3)
10-11 PM	0.0	0.0	n/a (3)	1-2 PM	0.0	0.0	n/a (3)
11-12 AM	0.0	0.0	n/a (3)	2-3 PM	0.0	0.0	n/a (3)
Max. Queue	**0.0**	**0.3**	n/a (3)	**Max. Queue**	**0.0**	**0.1**	n/a (3)
Hours with Queue > 1 Mile	**0**	**0**	n/a (3)	**Hours with Queue > 1 Mile**	**0**	**0**	n/a (3)

(1) 13.8 miles from U.S. 50/301 Split to start of eastbound Bay Bridge (9.6 miles on Eastern Shore and 4.2 miles on Bay Bridge)

(2) 8.7 miles from Bay Dale Drive merge point to start of westbound Bay Bridge: (4.5 miles on Western Shore and 4.2 miles on Bay Bridge).

(3) Queues from end of study area do not extend to the start of the Bay Bridge.

Figure 5-2: Bottleneck Diagram, Existing Conditions NSWD Scenario, Peak Hour of Queuing (Eastbound PM, Westbound AM)

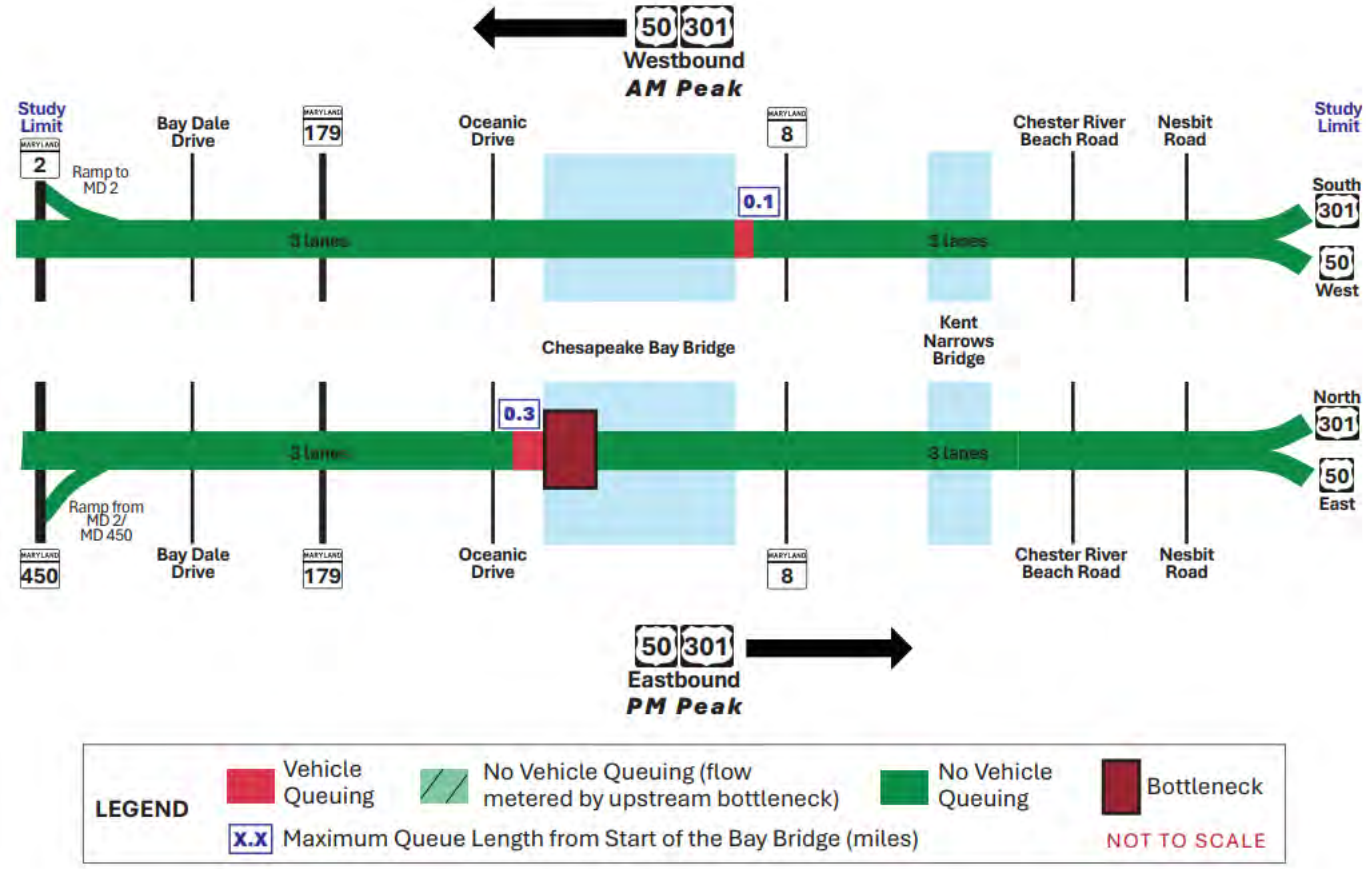


Table 5-12: Travel Time Results for Existing Conditions during NSWD, Peak Hour of Queuing

Existing Conditions		Eastbound US 50/301		Westbound U.S. 50/301	
		MD 2/MD 450 to Start of Bay Bridge	Start of Bay Bridge to US 50 301 Split	US 50/301 Split to Start of Bay Bridge	Start of Bay Bridge to MD 2/ MD 450
Non-Summer Weekday	Max Travel Time (min)	6	16	9	15
	Speed at Max Travel Time (mph)	50.0	55.9	57.3	44.5

Tables 5-5 through 5-8 and **Figure 5-1** present the following summer weekend existing conditions results:

1. During the peak volume hour, the segment results for eastbound U.S. 50/301 on the Western Shore as it approached the bridge showed LOS F operations and reduced speeds because of a bottleneck at the Bay Bridge. Queues later in the day reach approximately four miles.
2. The segment results for westbound U.S. 50/301 on the Eastern Shore as it approached the Bay Bridge were similar to the eastbound results, with LOS F operations and reduced speeds on the Bay Bridge during the peak volume hour and queues later in the day reaching approximately four miles.
3. During the peak volume hour, the bottleneck at the Bay Bridge in each direction reduced the volumes able to cross the bridge. With the reduced volumes on the bridge and downstream of the bridge, traffic operations were shown as improved and speeds increased in the model results.
4. Speeds downstream of the Bay Bridge are noticeably greater than speeds approaching the Bay Bridge. This is due to the queuing on the approaches to the Bay Bridge. Due to this queuing, there are diversions to the local roadway network. These diversions occur on roads such as Whitehall Road on the Western Shore and MD 18 on the Eastern Shore.

Tables 5-9 through 5-12 and **Figure 5-2** present the following for the NSWD existing conditions results:

1. No operational concerns were identified for eastbound U.S. 50/301, with all segments operating at LOS D or better and queues at the start of the Bay Bridge, not extending beyond one mile. The VISSIM analyses show a short queue, of approximately a quarter mile, during one hour.
2. No operational concerns were identified for westbound U.S. 50/301, with all segments operating at LOS D or better and queues at the start of the Bay Bridge, not extending beyond one mile. The VISSIM analyses show a short queue, of approximately one tenth of a mile, during one hour.
3. Speeds are above 44 mph, and generally at or above 50 mph. With no significant queuing occurring at the Bay Bridge nor at any other locations within the study area, there is no significant diversion to local roads.

6 TRAFFIC ANALYSIS OF FUTURE (2045) CONDITIONS

6.1 Introduction

As discussed in Chapter 3, a number of alternatives, including the No-Build Alternative, are being considered in the Tier 2 Study. During early development of these alternatives, the preliminary traffic analyses treated the Bay Bridge as a free-standing element of the transportation system. The analyses determined how the Bay Bridge would operate in the absence of any external factors, such as bottlenecks either upstream or downstream of the Bridge. The analysis and results were beneficial as a comparison or base line to the analysis that is required to take into consideration those external factors. If the bottlenecks at the limits or within the study area were to be removed, the Bay Bridge itself would operate as shown in **Table 6-1** and described below.

- Under No-Build, queues of at least 4 miles would be expected in both directions during NSWDs. On SWEDs, queues greater than 10 miles would be expected.
- Queuing would be eliminated in all of the build alternatives during NSWDs.
- Under SWED conditions, the 6-8-6 and 8-8-8 scenarios would have shorter queues than those expected under No-Build, but those queues would be at least seven miles long.
- Under the SWED conditions, queues would be eliminated in the 8-10-8 scenario.

Table 6-1: Results of Preliminary Traffic Analyses for the Bay Bridge and Its Approaches

Direction	Location	Metric	Existing Conditions	Alternative A (No-Build)	Alternative B/C (6-8-6)	Alternative D/E (8-8-8)	Alternative F/G (8-10-8)
Non-Summer Weekday (NSDW)	Eastbound on U.S. 50/301	Maximum Queue (miles)	0	4.1	0	0.1	0
		Duration of Queues > 1 mile (hours)	0	4	0	0	0
	Westbound on U.S. 50/301	Maximum Queue (miles)	0	4.9	0	0	0
		Duration of Queues > 1 mile (hours)	0	11	0	0	0
Summer Weekend Day (SWED)	Eastbound on U.S. 50/301	Maximum Queue (miles)	4.8	>10	7.3	7.5	0
		Duration of Queues > 1 mile (hours)	8	14	10	11	0
	Westbound on U.S. 50/301	Maximum Queue (miles)	3.5	>10	8.0	8.4	0
		Duration of Queues > 1 mile (hours)	8	14	10	11	0

Following the detailed development of the alternatives, the detailed traffic analyses of the Bay Bridge and its approach roadways were conducted. These detailed analyses did not evaluate the Bay Bridge as a free-standing element of the transportation system; they took into consideration the external factors throughout the study area, including the bottlenecks both upstream and downstream of the Bay Bridge, that did have an impact on the traffic operations of the Bridge. These detailed analyses are described in the remainder of this Traffic Analysis Technical Report.

The methodologies described in the HCM and queuing spreadsheet described in Chapter 4 of this document were used for development and initial evaluation of alternatives for the Bay Crossing itself and for the approach/departure roadways on U.S. 50/301. These analyses are provided in Appendix C. Following the identification of appropriate alternatives to be brought forward for more detailed analysis, a VISSIM microsimulation model of the study area was developed, calibrated, and used to evaluate and compare alternatives. VISSIM provides the opportunity to assess system-level impacts (such as queuing and volume throughput), which are useful for comparing alternatives, and for assisting in the assessment of the locations at which build alternatives can effectively be transitioned back into the existing roadway.

Note that the HCM, used in the initial evaluation, provides performance metrics which do not necessarily provide the same level of detail as VISSIM. The VISSIM outputs will be the primary data for analysis and alternative comparisons.

Travel demand forecasts and VISSIM analyses for the alternatives are described in the following subsections.

6.2 Reliable Travel Times

One of the elements of the Purpose and Need for the Bay Crossing Study Tier 2 NEPA is Reliable Travel Times. It is highly desirable for a traveler to know how long their trip is going to take, with some degree of certainty.

Today, the Bay Bridge presents challenges in identifying Reliable Travel Times. Those challenges are caused by the factors discussed below.

6.2.1 Contraflow (Two-Way) Operations

All five lanes on the Bridge are capable of being reversed (that is, being operated in contraflow fashion) in order to accommodate the broadest possible range of conditions, including: peak eastbound flow during the weekday PM peak period; peak eastbound flow on Fridays and Saturdays during the summer; and lane closures due to incidents or maintenance operations. The most frequent departure from normal operation is a reversal of the southernmost lane on the three-lane span to provide a third eastbound lane. This condition is known locally as “two-way traffic”.

While contraflow provides great flexibility for MDTA, and allows the agency to respond quickly to rapidly-changing conditions, it also limits Reliable Travel Times to a great extent. Simply stated, a traveler doesn’t always know whether 1, 2 or 3 lanes will be open for their direction of travel. Among the reasons for this are:

Inclement weather: Contraflow is not operated during inclement weather.

Traffic volumes: MDTA endeavors to balance the extent of queuing on the eastbound and westbound approaches, to the extent practical. This can lead to the reversal of the contraflow lane multiple times during a single day.

6.2.2 Lack of Shoulders

The absence of shoulders diminishes reliability for the following reasons:

Maintenance: With no shoulders on the existing Bridge, virtually any maintenance activity, including removing debris from the Bridge, requires the closure of at least one lane.

Minor incidents: A stalled vehicle or a vehicle with a flat tire closes a lane on the existing Bridge, because there are no shoulders to which that vehicle can be moved.

All of these factors are addressed by any of the Build alternatives.

Inclement weather: There will typically be no need for contraflow, so inclement weather will not affect the number of lanes available.

Traffic volumes: Without contraflow, there will be no need (for any reasonable means) for MDTA to balance the extent of queuing on the eastbound and westbound approaches.

Maintenance: With shoulders on a new Bridge, at least some maintenance will be possible from the shoulder.

Minor incidents: With shoulders on a new Bridge, a stalled vehicle or a vehicle with a flat tire can typically be moved to a shoulder, minimizing the possibility of a lane closure.

6.3 VISSIM Analyses of 2045 Scenarios

As discussed in Chapter 4, VISSIM microsimulation modeling software was utilized for the purposes of assessing system-wide performance measures, including volume throughput and queuing. A VISSIM model was developed for each of the pairs of 2045 alternatives that were initially analyzed by HCM and the queuing spreadsheet: Alternative A – No-Build, Alternatives B/C: 6-8-6, Alternatives D/E: 8-8-8, and Alternatives F/G: 8-10-8. Two scenarios were developed for each of these alternative pairs: summer weekend and non-summer weekday. Each of the eight 2045 scenarios is described individually in Sections 6.3 through 6.8. For each of the scenarios, balanced volumes were converted into vehicle inputs for the VISSIM model by using the diurnal distribution of traffic volumes identified by the travel demand forecasts. The measures of effectiveness (MOE) utilized for the VISSIM analysis were density, LOS, average speed, throughput, and maximum queue lengths. Density, LOS, and speed MOE were analyzed on a segment-by-segment basis for the peak hour of each scenario, while queue lengths were analyzed both at the start of the Bay Bridge and at the start of any other location in the study area where queues began to form. Each direction of U.S. 50/301 was analyzed for each hour of the VISSIM analysis. Summary tables of these MOE results are provided for each scenario below.

In addition to MOE results tables, “bottleneck diagrams” were developed for each of the scenarios, to aid in the visualization of the effects of queuing throughout the Tier 2 Study Limits, for both eastbound and westbound U.S. 50/301. These bottleneck diagrams are also provided below.

For all SWED scenarios, the eastbound model represented 10:00 AM to 11:00 PM on a typical summer Friday, while the westbound model represented 10:00 AM to 11:00 PM on a typical summer Sunday. The peak hour of volume for each direction was 12:00 PM to 1:00 PM.

It should be noted that the peak hour of queuing typically occurred later than the peak hour of volume. Through many of the PM hours, volumes were lower than in the peak hour, but they were still greater than the volume at which queues begin to form (or continue to grow). The bottleneck diagrams approximate conditions during the hour during which the longest queues first occurred. Depending upon the alternative, this hour varied, from the late afternoon into the evening.

For all NSWD scenarios, the AM peak period model represented 5:00 AM to 12:00 PM in both directions of travel; the peak hour for the peak direction (westbound) was 8:00 AM to 9:00 AM. The bottleneck diagrams approximate conditions at 10:00 AM, which was at or near the hour during which the longest queues occurred in the westbound direction, unless otherwise noted.

For all NSWD scenarios, the PM peak period model represented 2:00 PM to 9:00 PM in both directions of travel; the peak hour for the peak direction (eastbound) was 5:00 PM to 6:00 PM. The bottleneck diagrams approximate conditions at 6:00 PM, which was at or near the hour during which the longest queues occurred in the eastbound direction, unless otherwise noted.

6.4 2045 Alternative A (No-Build)

6.4.1 Development of Traffic Volumes

As noted in Chapter 4, the MSTM was used to develop 2045 traffic volume forecasts for Alternative A (No-Build), for both average NSWD conditions and average SWED conditions. The transportation network, land use data, and relevant functionalities in the model were carefully updated to represent 2022 travel patterns, in accordance with the established travel demand forecasting practice. The updated model was then calibrated using the best and most comprehensive data sources available at the time to ensure that it sufficiently represented observed traffic conditions, for both NSWD and SWED conditions. Thus, a Tier 2 Study version of MSTM was prepared. The volumes obtained from these efforts were used in the analyses and are summarized in **Table 6-2**.

Table 6-2: Daily Trips Across the Bay Bridge (vehicles per day)

Day Type	Existing (2022)	2045 No-Build	Percent Change (%)
Typical NSWD	69,588	91,150	31
Typical Summer Weekend Day	104,284	130,500	25

Comparison of the Existing Volumes to 2045 Alternative A (No-Build) volumes shows that, on a daily basis, volumes are forecasted to increase by about 31 percent on typical NSWDs, and by about 25 percent on typical summer weekends. Over the 23 years between 2022 and 2045, this is an annual growth rate of approximately 1.2 percent for typical NSWDs and an annual growth rate of approximately 1.0 percent for typical summer weekends. These forecasts are within the range of annual growth that is typical for this region.

Daily NSWD and SWED volumes for Alternative A (No-Build), including each interchange in the Tier 2 Study Limits, are shown in **Figures 6-1 through 6-6**.

Figure 6-1: Westbound Daily Traffic Volumes between the Severn River Bridge and the Bay Bridge: Alternative A: No-Build in 2045

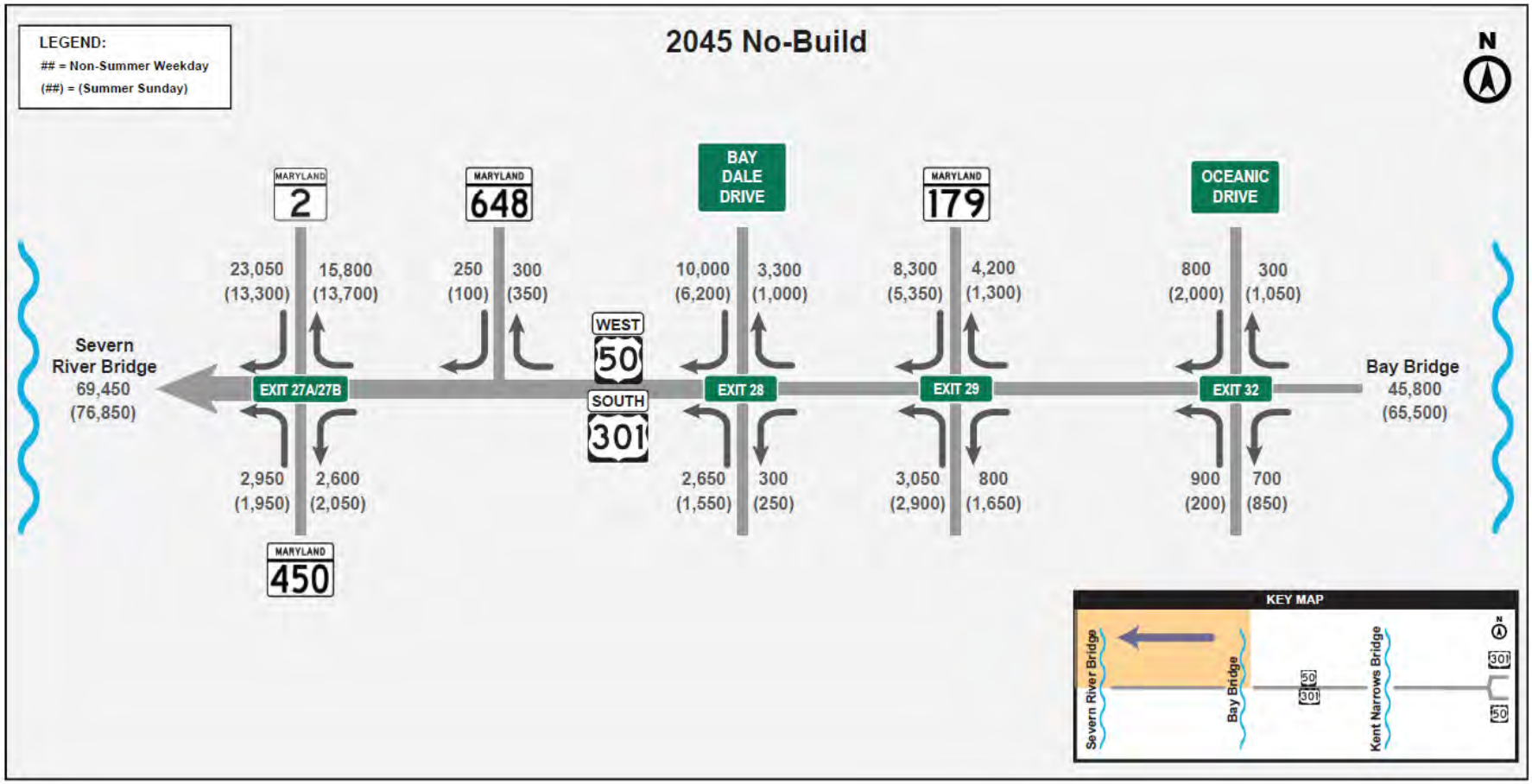


Figure 6-2: Eastbound Daily Traffic Volumes between the Severn River Bridge and the Bay Bridge: Alternative A: No-Build in 2045

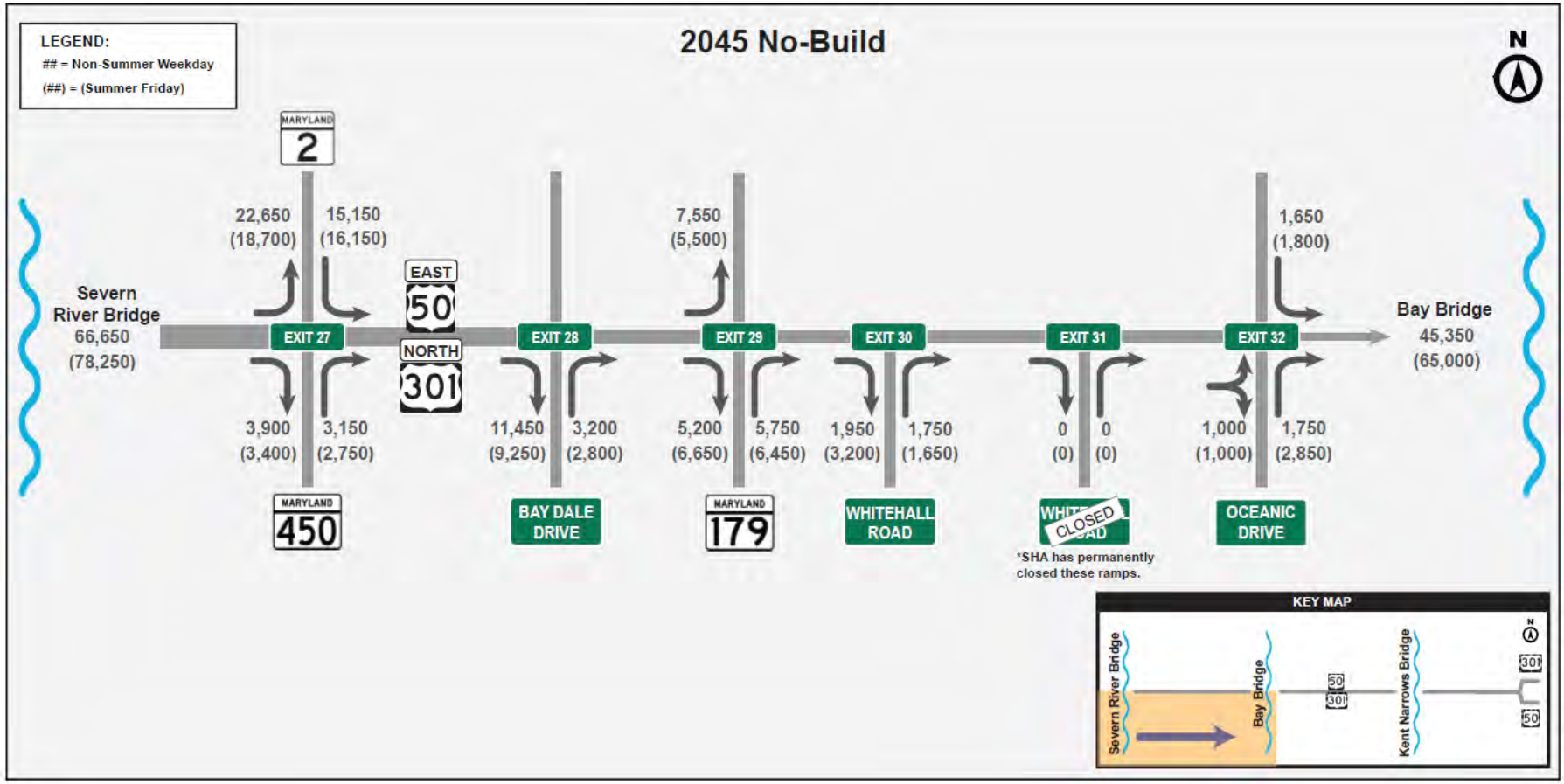


Figure 6-3: Westbound Daily Traffic Volumes between the Kent Narrows Bridge and the U.S. 50/301 Split: Alternative A: No-Build in 2045

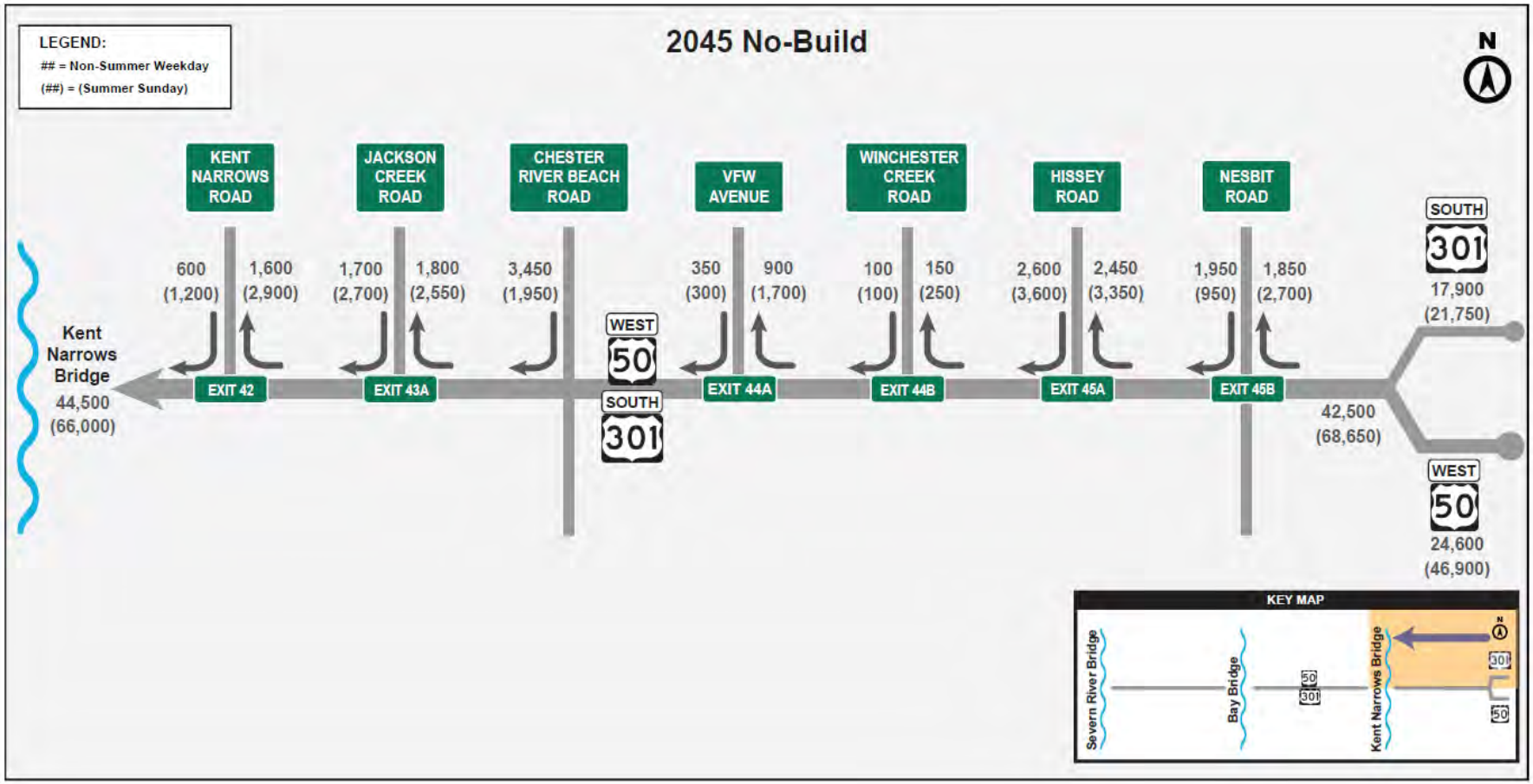


Figure 6-4: Westbound Daily Traffic Volumes between the Bay Bridge and the Kent Narrows Bridge: Alternative A: No-Build in 2045

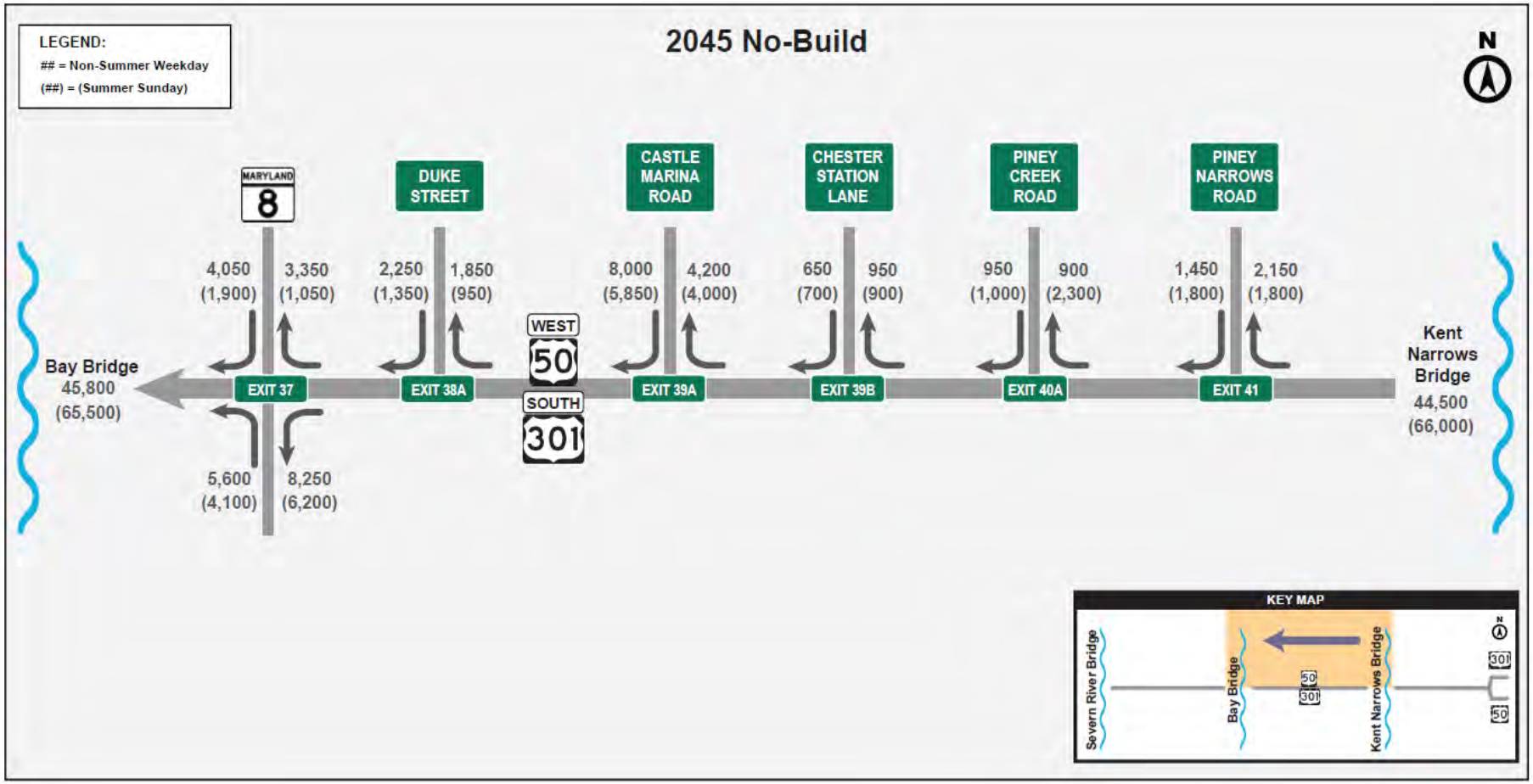


Figure 6-5: Eastbound Daily Traffic Volumes between the Bay Bridge and the Kent Narrows Bridge: Alternative A: No-Build in 2045

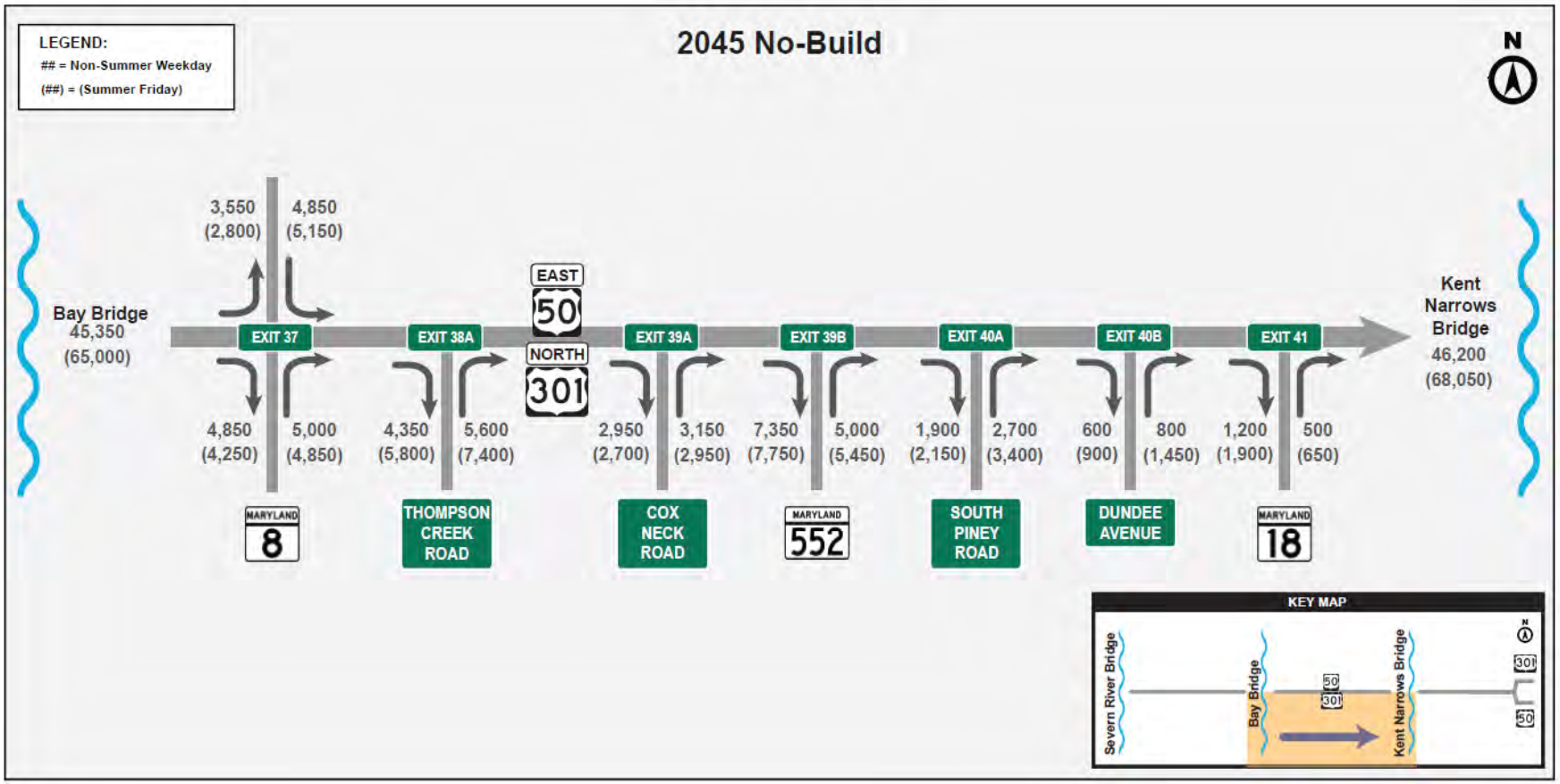
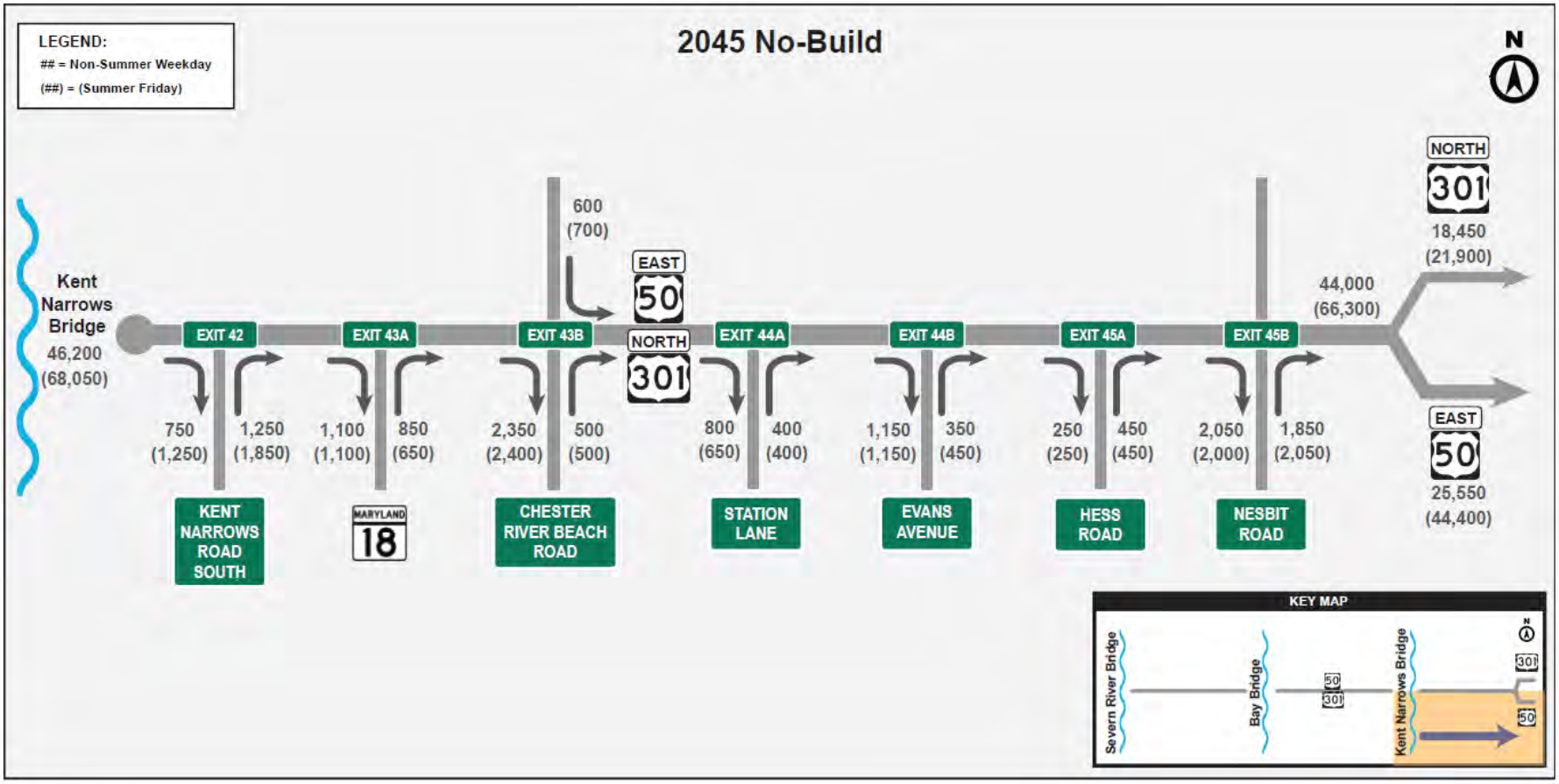


Figure 6-6: Eastbound Daily Traffic Volumes between the Kent Narrows Bridge and the U.S. 50/301 Split: Alternative A: No-Build in 2045



6.4.2 Alternative A No-Build Summer Weekend Scenario

The No-Build model matches the geometry of the existing conditions model with one exception. After the collection of existing conditions traffic volume data in 2022, Exit 31 along eastbound U.S. 50/301 was closed by the State Highway Administration, for operational and safety reasons. Thus, Exit 31 has been removed from the model for analysis of 2045 conditions, as this is an alteration which occurred after the collection of existing conditions data in 2022.

The results of the No-Build Summer Weekend VISSIM analyses are shown in **Tables 6-3 through 6-7**. Delay, LOS, and speeds along U.S. 50/301 throughout the corridor during the peak volume hour at the Bay Bridge are shown in **Table 6-3 and Table 6-4**. Queue lengths and durations at the Bay Bridge are shown in **Table 6-5**. A bottleneck diagram, visually summarizing the results of the analyses, is shown in **Figure 6-7**. A summary of travel times and speeds is shown in **Table 6-6**. Throughput is shown in **Table 6-7**.

Table 6-3: VISSIM Eastbound U.S. 50/301 Segment Results - No-Build Summer Weekend, Peak Hour of Volume

Eastbound Segment Name	Segment Type	SWED (Friday Peak Hour)						
		Density (veh/ln/mi)	LOS	Speed (mph)	Volume Expected	Volume Actual	Unmet Demand	Throughput %
MD 2/MD 450 to Ferguson Rd	Freeway	158.0	F	6.8	5600	3209	-2391	57%
Ferguson Rd to MD 179	Freeway	147.6	F	6.8	5119	3004	-2115	59%
MD 179 to Whitehall Rd (Exit 30)	Freeway	175.5	F	5.7	4455	2983	-1472	67%
Whitehall Rd (Exit 30) to Oceanic Dr	Freeway	177.2	F	5.6	4578	2994	-1584	65%
Oceanic Dr to Bay Bridge	Freeway	57.5	F	25.8	4850	3261	-1589	67%
William Preston Lane Jr. Bay Bridge	Freeway	29.1	D	38.2	4850	3272	-1578	67%
Bay Bridge to MD 8	Freeway	23.5	C	46.6	4850	3283	-1567	68%
Weave from MD 8 to Thompson Creek Rd	Weave	17.0	B	51.9	5070	3526	-1544	70%
Thompson Creek Rd to Cox Neck Rd	Freeway	21.1	C	60.1	5189	3796	-1393	73%
Weave from Cox Neck Rd to Dominion Rd	Weave	15.7	B	61.5	5208	3858	-1350	74%
Dominion Rd to S Piney Rd	Freeway	20.8	C	61.2	5037	3821	-1216	76%
Weave from S Piney Rd to Dundee Ave	Weave	16.2	B	61.1	5131	3966	-1165	77%
Weave from Dundee Ave to Main St/MD 18 (Exit 41)	Weave	17.6	B	57.1	5172	4010	-1162	78%
R Clayton Mitchell Jr Bridge	Freeway	21.4	C	61.8	5079	3973	-1106	78%
Kent Narrows Rd to Main St/MD 18 (Exit 43A)	Freeway	21.6	C	61.9	5124	4018	-1106	78%
Weave from Exit 43A to Chester River Beach Rd	Weave	16.1	B	61.9	5091	3995	-1096	78%
Weave from Chester River Beach Rd to Station Ln	Weave	16.0	B	62.0	5001	3961	-1040	79%
Weave from Station Ln to Evans Ave	Weave	16.2	B	61.1	4982	3950	-1032	79%
Weave from Evans Ave to Hess Rd	Weave	16.1	B	61.0	4930	3924	-1006	80%
Weave from Hess Rd to Nesbit Rd	Weave	16.2	B	60.6	4945	3926	-1019	79%
U.S. 50/U.S. 301 Split	Merge/Diverge	22.5	C	59.1	4949	3990	-959	81%
U.S. 50 East of U.S. 50/U.S. 301 Split	Freeway	25.0	C	53.4	3315	2669	-646	81%
U.S. 301 East of U.S. 50/U.S. 301 Split	Freeway	10.4	A	62.8	1634	1302	-332	80%

Table 6-4: VISSIM Westbound U.S. 50/301 Segment Results – No-Build Summer Weekend, Peak Hour of Volume

Westbound Segment Name	Segment Type	SWED (Sunday Peak Hour)						
		Density (veh/ln/mi)	LOS	Speed (mph)	Volume Expected	Volume Actual	Unmet Demand	Through-put %
U.S. 301 East of U.S. 50/U.S. 301 Split	Freeway	13.5	B	60.6	1627	1634	7	100%
U.S. 50 East of U.S. 50/U.S. 301 Split	Freeway	26.9	D	57.8	3510	3106	-404	88%
U.S. 50/U.S. 301 Split	Merge/Diverge	25.3	C	62.3	5137	4726	-411	92%
Weave from Nesbit Rd to Hissey Rd	Weave	22.8	C	51.7	5006	4578	-428	91%
Weave from Hissey Rd to Winchester Creek Rd	Weave	34.3	D	36.0	5024	4512	-512	90%
Weave from Winchester Creek Rd to Vfw Ave	Weave	46.0	F	28.6	5012	4354	-658	87%
Vfw Ave to Chester River Beach Rd	Freeway	66.5	F	21.6	4907	4024	-883	82%
Weave from Chester River Beach Rd to Jackson Creek Rd	Weave	87.3	F	12.2	5053	4027	-1026	80%
Main St/MD 18 (Exit 43A) to Kent Narrows Rd	Freeway	107.2	F	12.1	5064	3775	-1289	75%
R Clayton Mitchell Jr. Bridge	Freeway	140.9	F	8.1	4937	3366	-1571	68%
Piney Narrows Rd to Piney Creek Rd	Freeway	139.8	F	7.7	4937	3233	-1704	65%
Piney Creek Rd to Chester Station Ln	Freeway	141.4	F	7.5	4840	3183	-1657	66%
Weave from Chester Station Ln to Castle Marina Rd	Weave	150.7	F	5.3	4825	3210	-1615	67%
Castle Marina Rd to Duke St	Freeway	148.1	F	7.8	4964	3452	-1512	70%
Weave from Duke St to MD 8	Weave	89.4	F	9.8	4994	3512	-1482	70%
MD 8 to Bay Bridge	Freeway	74.1	F	15.8	4900	3521	-1379	72%
William Preston Lane Jr. Bay Bridge	Freeway	32.2	D	36.4	4900	3518	-1382	72%
Bay Bridge to Oceanic Dr	Freeway	18.7	C	62.3	4900	3501	-1399	71%
Oceanic Dr to MD 179	Freeway	19.1	C	62.7	4922	3591	-1331	73%
MD 179 to Bay Dale Dr	Freeway	21.0	C	62.3	5319	3932	-1387	74%
Bay Dale Dr to MD 2/MD 450	Freeway	30.8	D	48.2	5805	4450	-1355	77%

Table 6-5: VISSIM Queuing Results – No-Build Summer Weekend

Time	Typical Summer Friday			Typical Summer Sunday		
	Eastbound Maximum Queue (miles)			Westbound Maximum Queue (miles)		
	Between U.S. 50/301 Split & Start of Bay Bridge (1)	From Start of Bay Bridge to End of Queue	Total	Between Start of Queue at Bay Dale Dr & Start of Bay Bridge (2)	From Start of Bay Bridge to End of Queue	Total
10-11 AM	0.1	3.3	n/a (3)	0.0	1.6	n/a (3)
11 AM-12 PM	0.0	>7.1 (4)	n/a (3)	0.0	4.7	n/a (3)
12-1 PM	0.1	>7.1 (4)	n/a (3)	0.0	8.3	n/a (3)
1-2 PM	0.1	>7.1 (4)	n/a (3)	0.0	10.9	n/a (3)
2-3 PM	0.1	>7.1 (4)	n/a (3)	0.0	>11.0 (4)	n/a (3)
3-4 PM	0.1	>7.1 (4)	n/a (3)	0.0	>11.0 (4)	n/a (3)
4-5 PM	0.0	>7.1 (4)	n/a (3)	0.0	>11.0 (4)	n/a (3)
5-6 PM	0.0	>7.1 (4)	n/a (3)	0.0	>11.0 (4)	n/a (3)
6-7 PM	0.1	>7.1 (4)	n/a (3)	0.0	>11.0 (4)	n/a (3)
7-8 PM	0.0	>7.1 (4)	n/a (3)	0.0	>11.0 (4)	n/a (3)
8-9 PM	0.0	>7.1 (4)	n/a (3)	0.0	>11.0 (4)	n/a (3)
9-10 PM	0.0	>7.1 (4)	n/a (3)	0.0	>11.0 (4)	n/a (3)
10-11 PM	0.0	>7.1 (4)	n/a (3)	0.0	>11.0 (4)	n/a (3)
Max. Queue	**0.1**	>7.1 (4)	n/a (3)	**0.0**	>11.0 (4)	n/a (3)
Hours with Queue > 1 Mile	**0**	**13**	n/a (3)	**0**	**13**	n/a (3)

(1) 13.8 miles from U.S. 50/301 Split to start of eastbound Bay Bridge (9.6 miles on Eastern Shore and 4.2 miles on Bay Bridge)

(2) 8.7 miles from Bay Dale Drive merge point to start of westbound Bay Bridge: (4.5 miles on Western Shore and 4.2 miles on Bay Bridge).

(3) Queues from end of study area do not extend to start of the Bay Bridge.

(4) Queues extend beyond the end of the study area.

Figure 6-7: Bottleneck Diagram: No-Build Summer Weekend Scenario, Peak Hour of Queuing

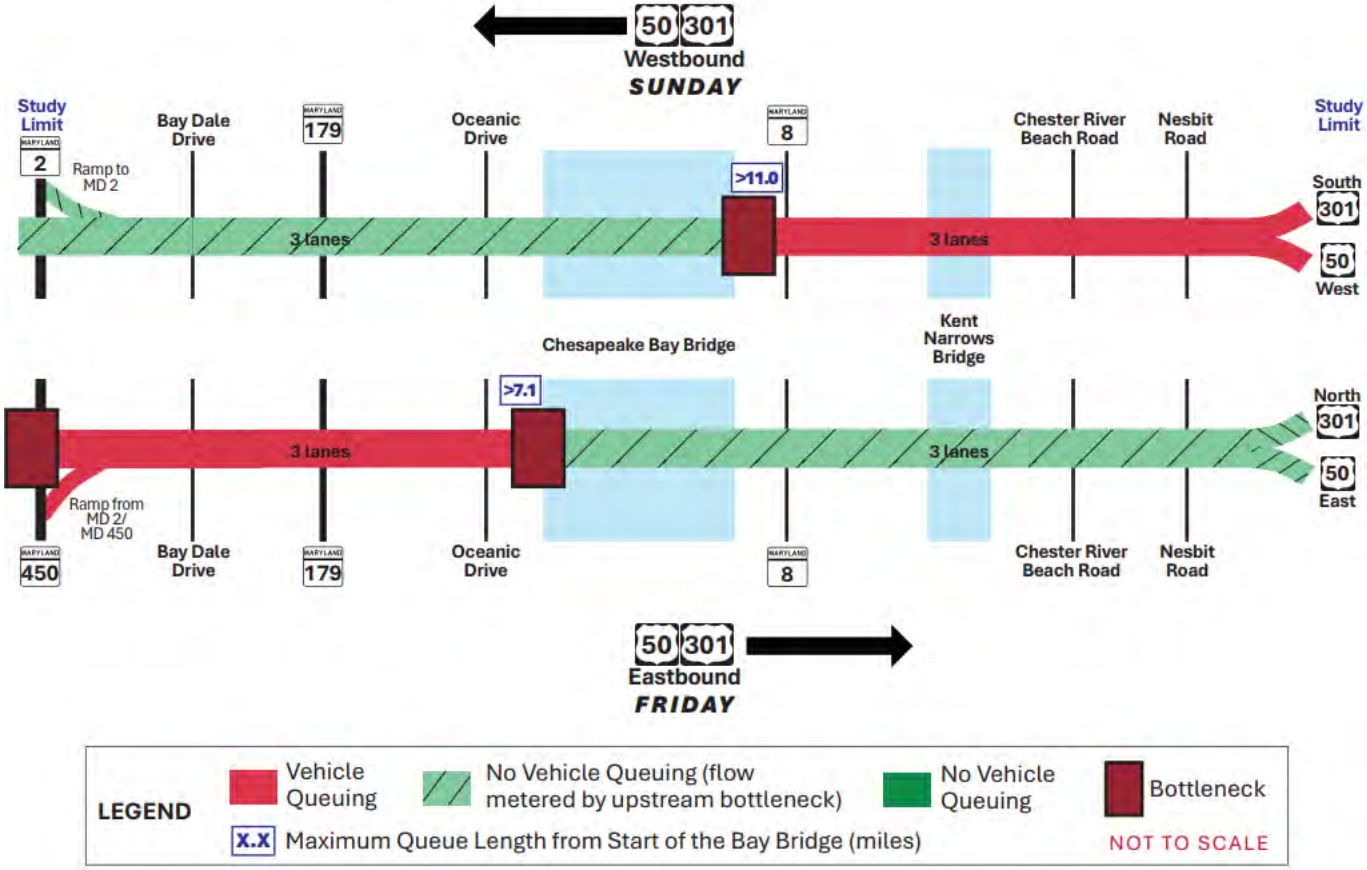


Table 6-6: Travel Time Results for Alternative A (No-Build) during SWED, Peak Hour of Queuing

Existing Conditions		Eastbound US 50/301		Westbound U.S. 50/301	
		MD 2/MD 450 to Start of Bay Bridge	Start of Bay Bridge to US 50 301 Split	US 50/301 Split to Start of Bay Bridge	Start of Bay Bridge to MD 2/ MD 450
Summer Weekend	Max Travel Time (min)	54	16	79	13
	Speed at Max Travel Time (mph)	5.6	55.9	6.5	49.1

Table 6-7: SWED Throughput at Bay Bridge in Peak Hour of Volume

Alternative	SWED					
	Eastbound			Westbound		
	Forecast Peak Hour Volume (12:00 - 1:00 PM)	Peak Hour Volume Able to Cross the Bay Bridge (Throughput)	Throughput Percentage	Forecast Peak Hour Volume (12:00 - 1:00 PM)	Peak Hour Volume Able to Cross the Bay Bridge (Throughput)	Throughput Percentage
No-Build	4,850	3272	67%	4,900	3518	72%

Tables 6-3 through 6-7 and **Figure 6-7** show the following results.

1. During the peak volume hour, the segment results for eastbound U.S. 50/301 on the Western Shore as it approaches the bridge show LOS F operations and very low speeds because of the bottleneck at the Bay Bridge. The segment results for westbound U.S. 50/301 on the Eastern Shore as it approaches the Bay Bridge are similar, with LOS F and very low speeds.
2. During the peak volume hour, the bottleneck at the Bay Bridge in each direction reduces the volumes (throughput) able to cross the bridge. With the reduced volumes able to cross the bridge, the traffic operations downstream of the bridge improve and speeds increase.
3. These conditions noted for the peak volume hour would extend for multiple hours. Queues from the starting points of the bottleneck at the Bay Bridge were greater than one mile for the duration of the run, and extended beyond the limits of the Tier 2 Study Limits for most hours of the model run.
4. In the eastbound direction, traffic flow is metered by conditions beyond the Study Limits. Less than 60 percent of forecast traffic volumes can be accommodated at the western Study Limit. At the Bay Bridge, approximately two-thirds of the desired volume can be accommodated.
5. In the westbound direction, conditions are better at the eastern Study Limits. At the Bay Bridge, over 1,300 vehicles cannot be accommodated.
6. Speeds would be significantly lower downstream of the Bay Bridge than on the approaches to the Bay Bridge. Throughput would range from 67% to 72%. The

queues at the Bay Bridge would lead to diversion to local roads on the approaches to the Bay Bridge. Queues would be longer than under existing conditions; as a result, diversion would also be expected to be more extensive.

6.4.3 Alternative A: No-Build Non-Summer Weekday (NSWD) Scenario

Roadway geometry in Alternative A: No-Build NSWD model matches that of the No-Build SWED model. The results of the Alternative A: No-Build NSWD VISSIM analyses are shown in **Tables 6-8 through 6-12**. Delay, LOS, and speeds along U.S. 50/301 throughout the corridor, during the peak volume hour at the Bay Bridge, are shown in **Tables 6-8 and 6-9**. Queue lengths and durations at the Bay Bridge are shown in **Table 6-7**. A bottleneck diagram, visually summarizing the results of the analyses, is shown in **Figure 6-8**.

Table 6-8: VISSIM Eastbound U.S. 50/301 Segment Results: No-Build NSWD, Peak Hour of Volume

Eastbound Segment Name	Segment Type	NSWD (PM Peak Hour)						
		Density (veh/ln/mi)	LOS	Speed (mph)	Volume Expected	Volume Actual	Unmet Demand	Throughput %
MD 2/MD 450 to Ferguson Rd	Freeway	27.1	D	59.1	5795	4810	-985	83%
Ferguson Rd to MD 179	Freeway	22.9	C	61.5	4976	4220	-756	85%
MD 179 to Whitehall Rd (Exit 30)	Freeway	19.9	C	62.3	4067	3711	-357	91%
Whitehall Rd (Exit 30) to Oceanic Dr	Freeway	25.5	C	51.5	4262	3732	-530	88%
Oceanic Dr to Bay Bridge	Freeway	63.5	F	23.5	4500	3612	-888	80%
William Preston Lane Jr. Bay Bridge	Freeway	31.5	D	38.4	4500	3608	-892	80%
Bay Bridge to MD 8	Freeway	25.6	C	47.1	4500	3620	-880	80%
Weave from MD 8 to Thompson Creek Rd	Weave	16.8	B	52.5	4644	3521	-1123	76%
Thompson Creek Rd to Cox Neck Rd	Freeway	20.6	C	61.1	4768	3765	-1003	79%
Weave from Cox Neck Rd to Dominion Rd	Weave	15.5	B	61.8	4788	3844	-944	80%
Dominion Rd to S Piney Rd	Freeway	20.2	C	61.7	4555	3739	-816	82%
Weave from S Piney Rd to Dundee Ave	Weave	15.7	B	61.6	4634	3872	-761	84%
Weave from Dundee Ave to Main St/MD 18 (Exit 41)	Weave	16.7	B	58.1	4654	3885	-769	83%
R Clayton Mitchell Jr Bridge	Freeway	20.6	C	62.5	4584	3863	-722	84%
Kent Narrows Rd to Main St/MD 18 (Exit 43A)	Freeway	20.8	C	62.5	4634	3909	-725	84%
Weave from Exit 43A to Chester River Beach Rd	Weave	15.7	B	62.1	4609	3896	-713	85%
Weave from Chester River Beach Rd to Station Ln	Weave	15.3	B	62.6	4485	3822	-663	85%
Weave from Station Ln to Evans Ave	Weave	15.3	B	32.1	4445	3789	-657	85%
Weave from Evans Ave to Hess Rd	Weave	15.0	B	62.1	4366	3735	-631	86%
Weave from Hess Rd to Nesbit Rd	Weave	15.2	B	61.7	4386	3743	-642	85%
U.S. 50/U.S. 301 Split	Merge/Diverge	20.6	C	61.4	4366	3789	-577	87%
U.S. 50 East of U.S. 50/U.S. 301 Split	Freeway	18.3	C	60.1	2535	2203	-332	87%
U.S. 301 East of U.S. 50/U.S. 301 Split	Freeway	12.4	B	63.1	1831	1568	-263	86%

Table 6-9: VISSIM Westbound U.S. 50/301 Segment Results: No-Build NSWD, Peak Hour of Volume

Westbound Segment Name	Segment Type	NSWD (AM Peak Hour)						
		Density (veh/ln/mi)	LOS	Speed (mph)	Volume Expected	Volume Actual	Unmet Demand	Throughput %
U.S. 301 East of U.S. 50/U.S. 301 Split	Freeway	13.2	B	60.7	1583	1604	21	101%

Westbound Segment Name	Segment Type	NSWD (AM Peak Hour)						
		Density (veh/ln/mi)	LOS	Speed (mph)	Volume Expected	Volume Actual	Unmet Demand	Throughput %
U.S. 50 East of U.S. 50/U.S. 301 Split	Freeway	17.6	B	58.8	2175	2072	-103	95%
U.S. 50/U.S. 301 Split	Merge/Diverge	19.5	B	62.8	3758	3662	-96	97%
Weave from Nesbit Rd to Hissey Rd	Weave	14.8	B	61.9	3767	3656	-112	97%
Weave from Hissey Rd to Winchester Creek Rd	Weave	14.8	B	62.1	3780	3681	-99	97%
Weave from Winchester Creek Rd to Vfw Ave	Weave	14.6	B	62.8	3776	3670	-106	97%
Vfw Ave to Chester River Beach Rd	Freeway	19.1	C	62.8	3727	3603	-124	97%
Weave from Chester River Beach Rd to Jackson Creek Rd	Weave	15.7	B	62.3	4032	3925	-108	97%
Main St/MD 18 (Exit 43A) to Kent Narrows Rd	Freeway	20.9	C	62.6	4023	3922	-101	97%
R Clayton Mitchell Jr. Bridge	Freeway	20.4	C	62.7	3935	3845	-90	98%
Piney Narrows Rd to Piney Creek Rd	Freeway	20.1	C	62.8	3873	3782	-91	98%
Piney Creek Rd to Chester Station Ln	Freeway	20.0	C	62.7	3878	3767	-110	97%
Weave from Chester Station Ln to Castle Marina Rd	Weave	15.2	B	61.8	3851	3758	-93	98%
Castle Marina Rd to Duke St	Freeway	22.4	C	60.9	4187	4096	-91	98%
Weave from Duke St to MD 8	Weave	24.0	C	43.9	4222	4100	-123	97%
MD 8 to Bay Bridge	Freeway	67.8	F	17.4	4050	3537	-513	87%
William Preston Lane Jr. Bay Bridge	Freeway	31.5	D	37.1	4050	3511	-539	87%
Bay Bridge to Oceanic Dr	Freeway	18.7	C	62.2	4050	3486	-564	86%
Oceanic Dr to MD 179	Freeway	18.9	C	62.5	4112	3549	-563	86%
MD 179 to Bay Dale Dr	Freeway	63.6	F	20.7	4673	3923	-750	84%
Bay Dale Dr to MD 2/MD 450	Freeway	43.1	E	64.2	5474	4421	-1053	81%

Table 6-10: VISSIM Queuing Results: No-Build NSWD

Time	Typical PM			Time	Typical AM		
	Eastbound Maximum Queue (miles)				Westbound Maximum Queue (miles)		
	Between U.S. 50/301 Split & Start of Bay Bridge (1)	From Start of Bay Bridge to End of Queue	Total		Between Start of Queue at Bay Dale Dr & Start of Bay Bridge (2)	From Start of Bay Bridge to End of Queue	Total
2-3 PM	0.0	0.8	n/a (3)	5-6 AM	0.0	0.0	n/a (3)
3-4 PM	0.0	1.1	n/a (3)	6-7 AM	0.1	0.3	n/a (3)
4-5 PM	0.0	1.6	n/a (3)	7-8 AM	1.5	1.4	n/a (3)
5-6 PM	0.0	1.7	n/a (3)	8-9 AM	2.8	2.2	n/a (3)
6-7 PM	0.0	1.7	n/a (3)	9-10 AM	3.6	2.4	n/a (3)
7-8 PM	0.0	1.0	n/a (3)	10-11 AM	3.9	0.9	n/a (3)
8-9 PM	0.0	0.0	n/a (3)	11-12 PM	3.4	0.1	n/a (3)
9-10 PM	0.0	0.0	n/a (3)	12-1 PM	2.2	0.0	n/a (3)
10-11 PM	0.0	0.0	n/a (3)	1-2 PM	1.5	0.0	n/a (3)
11-12 AM	0.0	0.0	n/a (3)	2-3 PM	0.0	0.0	n/a (3)
Max. Queue	**0.0**	**1.7**	**n/a (3)**	**Max. Queue**	**3.9**	**2.4**	**n/a (3)**
Hours with Queue > 1 Mile	**0**	**5**	**0**	**Hours with Queue > 1 Mile**	**7**	**5**	**0**

(1) 13.8 miles from U.S. 50/301 Split to start of eastbound Bay Bridge (9.6 miles on Eastern Shore and 4.2 miles on Bay Bridge)

(2) 8.7 miles from Bay Dale Drive merge point to start of westbound Bay Bridge: (4.5 miles on Western Shore and 4.2 miles on Bay Bridge).

(3) Queues from end of study area do not extend to the start of the Bay Bridge.

Figure 6-8: Bottleneck Diagram: No-Build NSWD Scenario, Peak Hour of Queuing (Eastbound PM, Westbound AM)

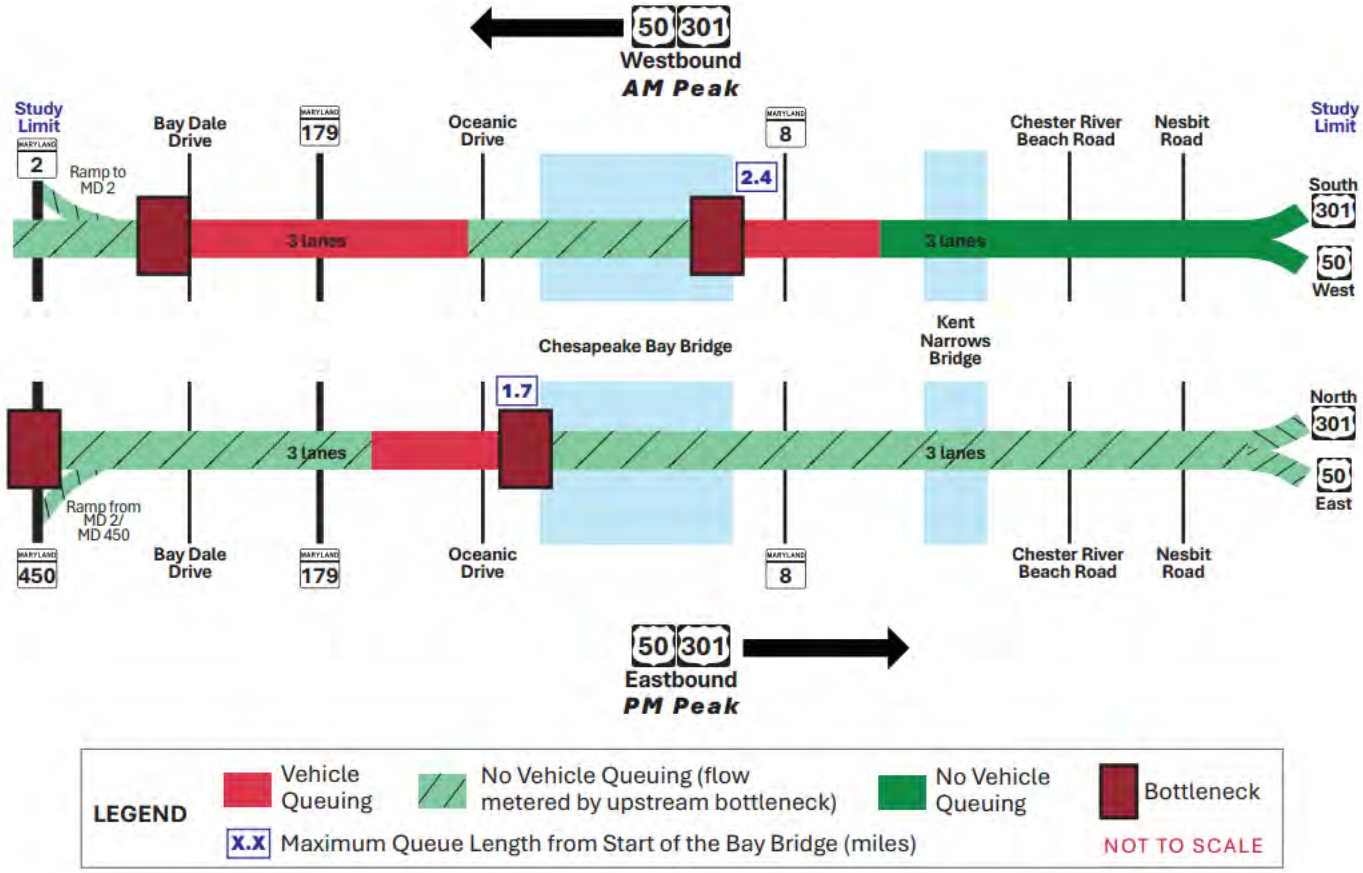


Table 6-11: Travel Time Results for Alternative A (No-Build) during NSWD, Peak Hour of Queuing

Existing Conditions		Eastbound US 50/301		Westbound U.S. 50/301	
		MD 2/MD 450 to Start of Bay Bridge	Start of Bay Bridge to US 50 301 Split	US 50/301 Split to Start of Bay Bridge	Start of Bay Bridge to MD 2/ MD 450
Non-Summer Weekday	Max Travel Time (min)	17	16	20	33
	Speed at Max Travel Time (mph)	17.6	55.9	25.8	29.5

Table 6-12: NSWD Throughput in Peak Hour of Volume

Alternative	NSWD					
	Eastbound			Westbound		
	Forecast Peak Hour Volume (4:00 - 5:00 PM)	Peak Hour Volume Able to Cross the Bay Bridge (Throughput)	Throughput Percentage	Forecast Peak Hour Volume (7:00 - 8:00 AM)	Peak Hour Volume Able to Cross the Bay Bridge (Throughput)	Throughput Percentage
No-Build	4,500	3608	80%	4,050	3511	87%

Tables 6-8 through 6-12 and **Figure 6-8** reveal the following results for Alternative A: No-Build.

1. During the PM peak volume hour, eastbound U.S. 50/301 shows LOS D or better conditions for the entire Tier 2 Study Limits, with the exception of the Bay Bridge that operated at LOS F in the model runs. However, there is a bottleneck to the west of the Tier 2 Study Limits that meters flow into the Study Area and toward the Bay Bridge.
2. During the AM peak volume hour, westbound U.S. 50/301 shows LOS D or better conditions except for two locations which operated at LOS F in the model runs. One location is the Bay Bridge, and the other is the segment between the MD 179 interchange and the Bay Dale Drive interchange. Even with traffic flow and volumes metered by the bottleneck at the Bay Bridge, there will still be a bottleneck at Bay Dale Drive. The queues at Bay Dale Drive could lead to some diversion of traffic wishing to travel northbound on MD 2 to College Parkway; diversion of traffic wishing to travel over the Severn River Bridge would be unlikely, due to the circuitousness of the likely diversion route.
3. Queues at the start of the eastbound Bay Bridge range from approximately one to two miles in length during the PM study period, until dissipating by 8:00 PM. During this period, some diversion to local roads, such as Whitehall Road, would be expected.
4. Queues at the start of the westbound Bay Bridge range from approximately two to three miles in length during the AM study period. During this period, some diversion to MD 18 would be expected.
5. In the eastbound direction, speeds approaching the Bay Bridge are substantially lower than speeds downstream of the Bay Bridge. In the westbound direction, speeds are much closer together but are still lower on the approach than downstream. Throughputs are below 90% in each direction, reflecting the results of the queuing and travel time analyses.

6.5 2045 Build Alternatives

4In addition to Alternative A (No-Build), six build alternatives were developed:

- Alternative B: 6-8-6 North
- Alternative C: 6-8-6 South
- Alternative D: 8-8-8 North
- Alternative E: 8-8-8 South
- Alternative F: 8-10-8 North
- Alternative G: 8-10-8 South

A description of each of these build alternatives is provided in Chapter 3.

The physical location of the new spans across the Bay, as described in Chapter 3, has no impact on the traffic analysis. So, if a new span carrying four lanes across the Bay was to be constructed, its ability to carry traffic would be the same, regardless of whether it was built just south of the existing Bay Bridge or just north of the existing Bay Bridge. This simplified the traffic analysis and allowed for consideration of the following build configurations:

- Alternatives B/C: 6-8-6
- Alternatives D/E: 8-8-8
- Alternatives F/G: 8-10-8

Each of the alternatives being considered for a new Bay Bridge include a lower grade than the existing Bay Bridge and full shoulders on both sides of the travel lanes. These changes would likely increase the capacity-per-lane on the Bridge; however, the extent of that increase is uncertain. The ability of a new crossing to address any one or more of the human factors which currently reduce capacity is difficult to predict at this time. For example, a new bridge will still have views of the Bay and is likely to have one or more towers in the middle of the span. The extent to which factors such as these will be different for drivers on a new bridge is unknown. Therefore, the capacity analyses for future conditions were based on the conservative premise that a new crossing would have the same capacity per lane as existing conditions. That is, a lane approaching the new crossing was analyzed with a capacity per lane of 1.30 times the capacity of a lane on the new crossing itself.

6.6 Travel Demand Forecasts for Year 2045 Build Alternatives

The travel demand forecasts for each of the alternatives is summarized in **Table 6-13**.

Table 6-13: Daily Trips Across the Bay Bridge (vehicles per day), 2045

Parameter	Day Type	Alternative A No-Build	Alternatives B/C: 6-8-6	Alternatives D/E: 8-8-8	Alternatives F/G: 8-10-8
Daily Trips	Typical NSWD	91,150	92,600	93,450	93,850
	Typical SWED	130,500	143,150	148,600	148,650
Percentage Change from No-Build	Typical NSWD	0.0	1.6	2.5	3.0
	Typical SWED	0.0	9.7	13.9	13.9

Per **Table 6-13**:

1. For NSWD, the growth in daily volumes for each of the Build Alternatives is relatively small, reaching a maximum of 3.0 percent higher for Alternatives F/G: 8-10-8.

2. SWED volumes are expected to grow at a higher rate than NSWD volumes for each of the build Alternatives. Alternatives D/E: 8-8-8 and Alternatives F/G: 8-10-8 are expected to see a 13.9 percent increase over No-Build.

6.7 Analysis of Alternatives B/C: 6-8-6

6.7.1 Daily Volumes

Daily NSWD and SWED volumes for Alternatives B/C: 6-8-6, including each interchange in the Tier 2 Study Limits, are shown in **Figures 6-9 through 6-14**.

Figure 6-9: Westbound Daily Traffic Volumes between the Severn River Bridge and the Bay Bridge: 2045 Alternatives B and C (6-8-6)

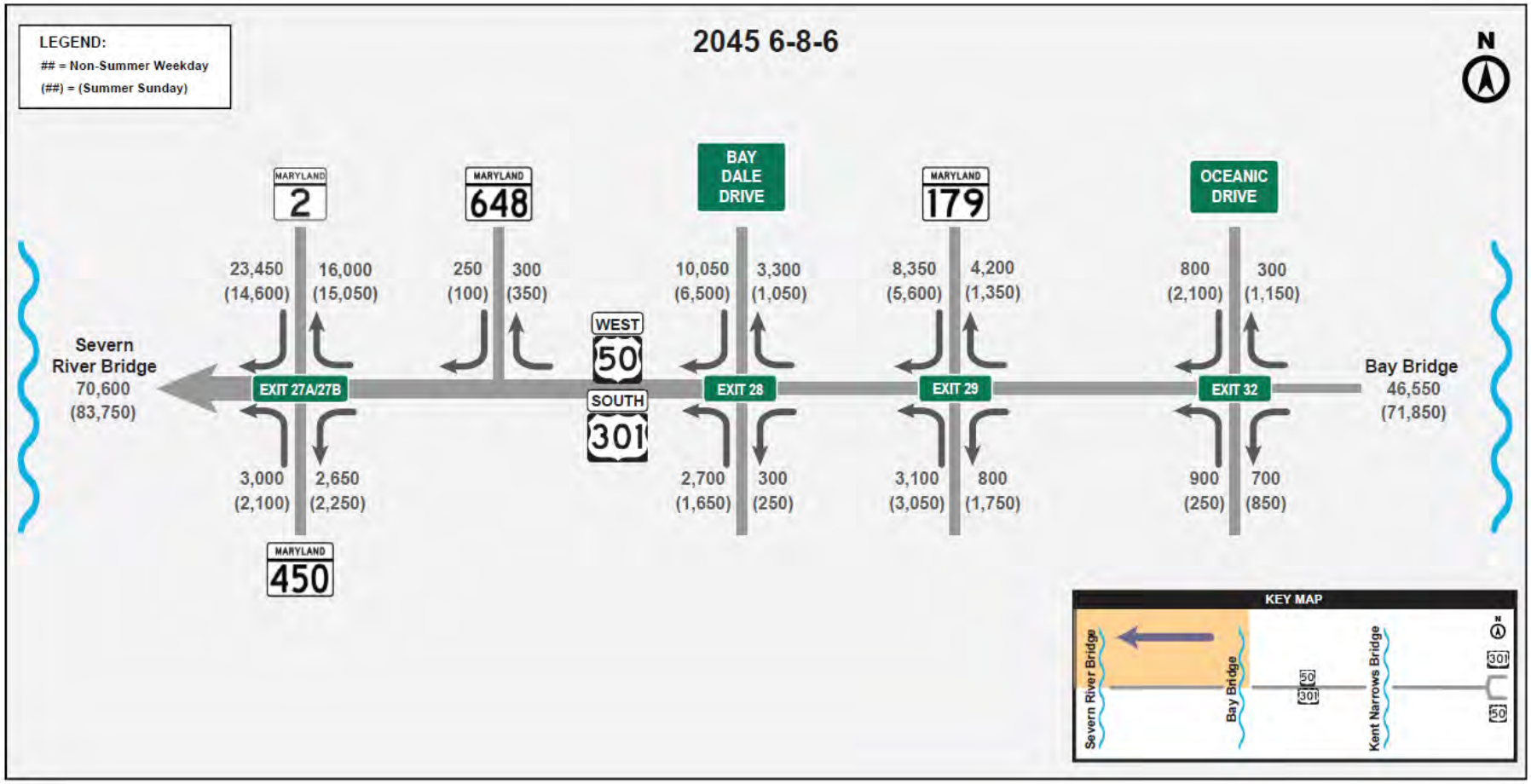


Figure 6-10: Eastbound Daily Traffic Volumes between the Severn River Bridge and the Bay Bridge: 2045 Alternatives B and C (6-8-6)

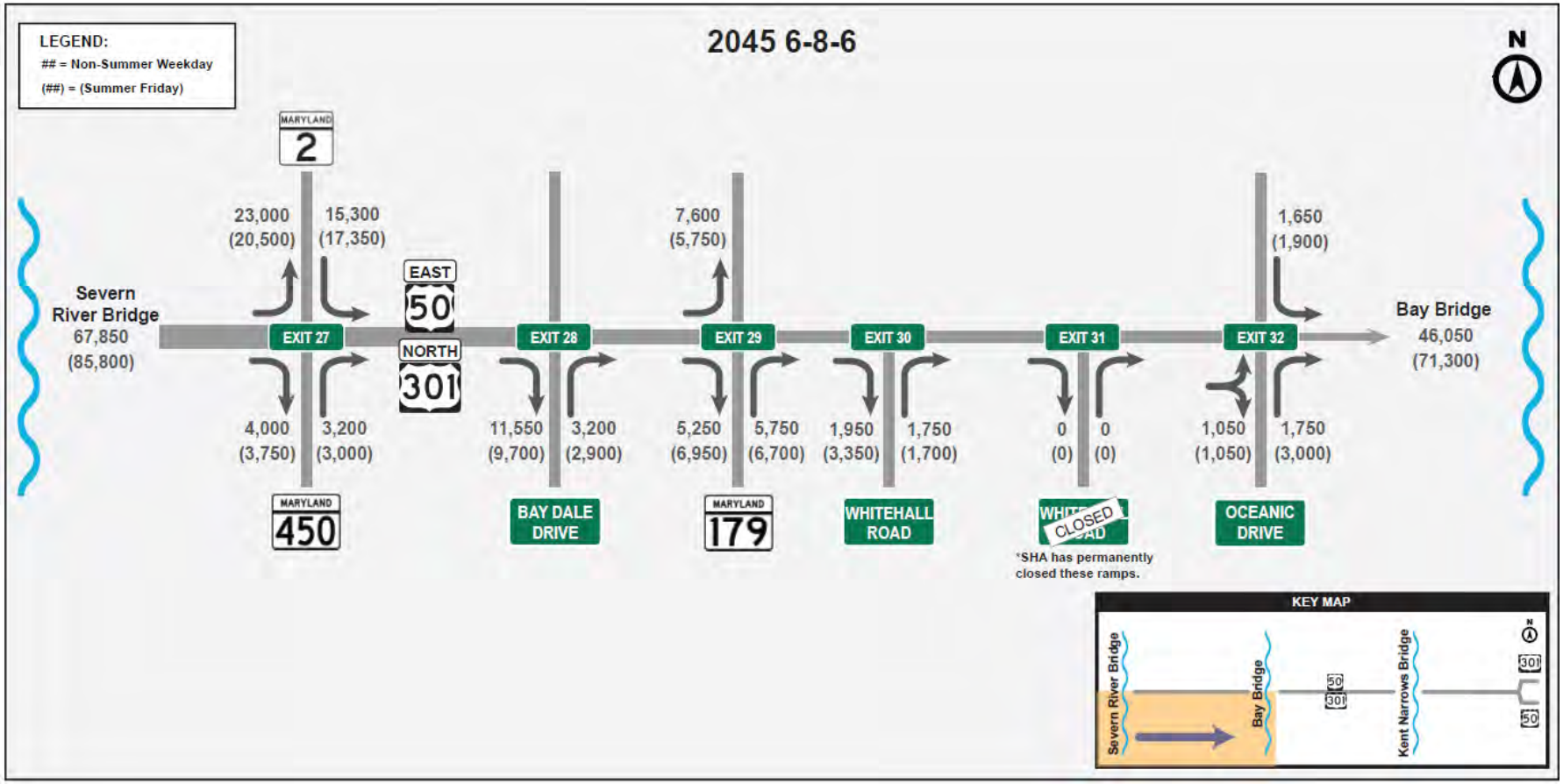


Figure 6-11: Westbound Daily Traffic Volumes between the Kent Narrows Bridge and the U.S. 50/301 Split: 2045 Alternatives B and C (6-8-6)

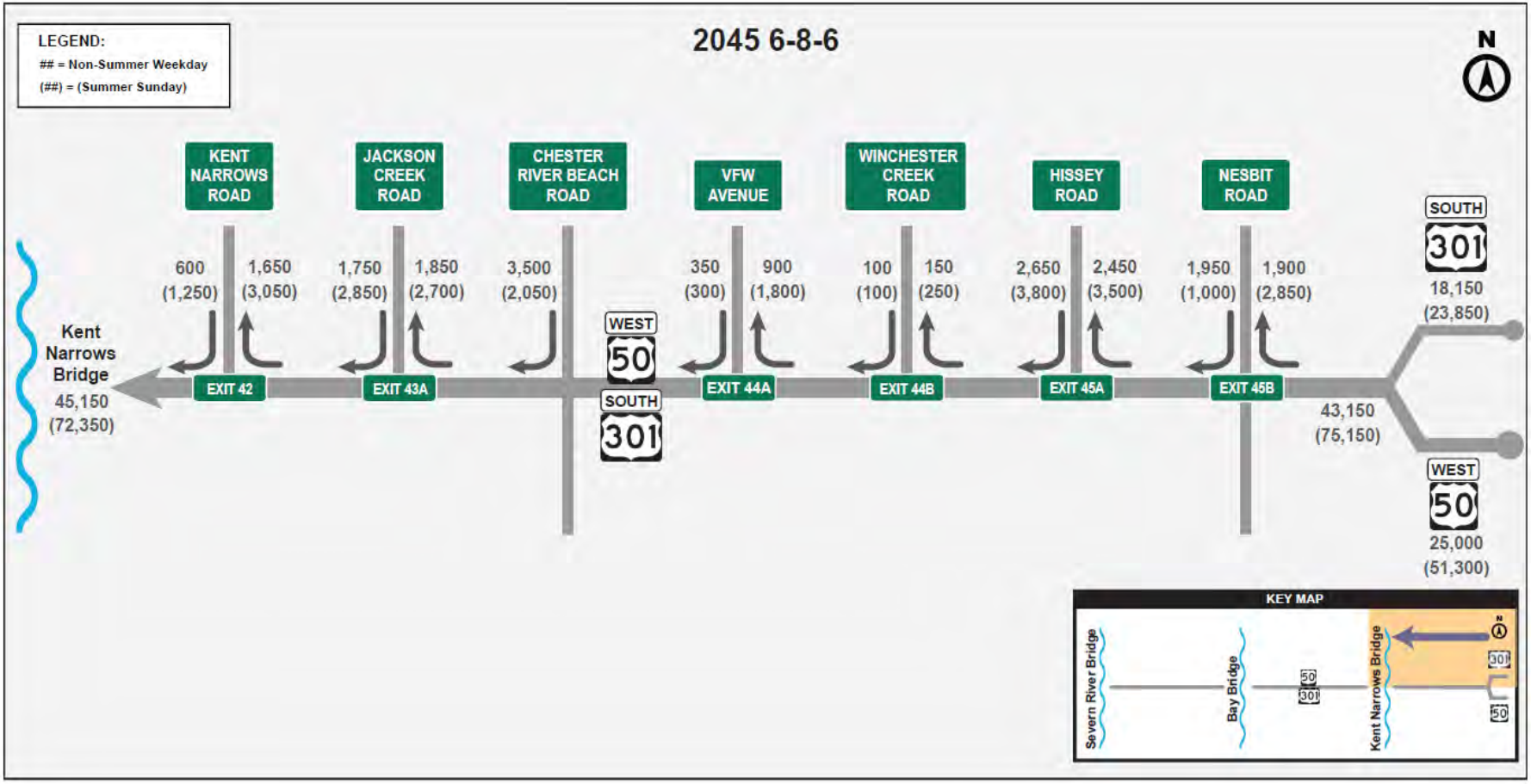


Figure 6-12: Westbound Daily Traffic Volumes between the Bay Bridge and the Kent Narrows Bridge: 2045 Alternatives B and C (6-8-6)

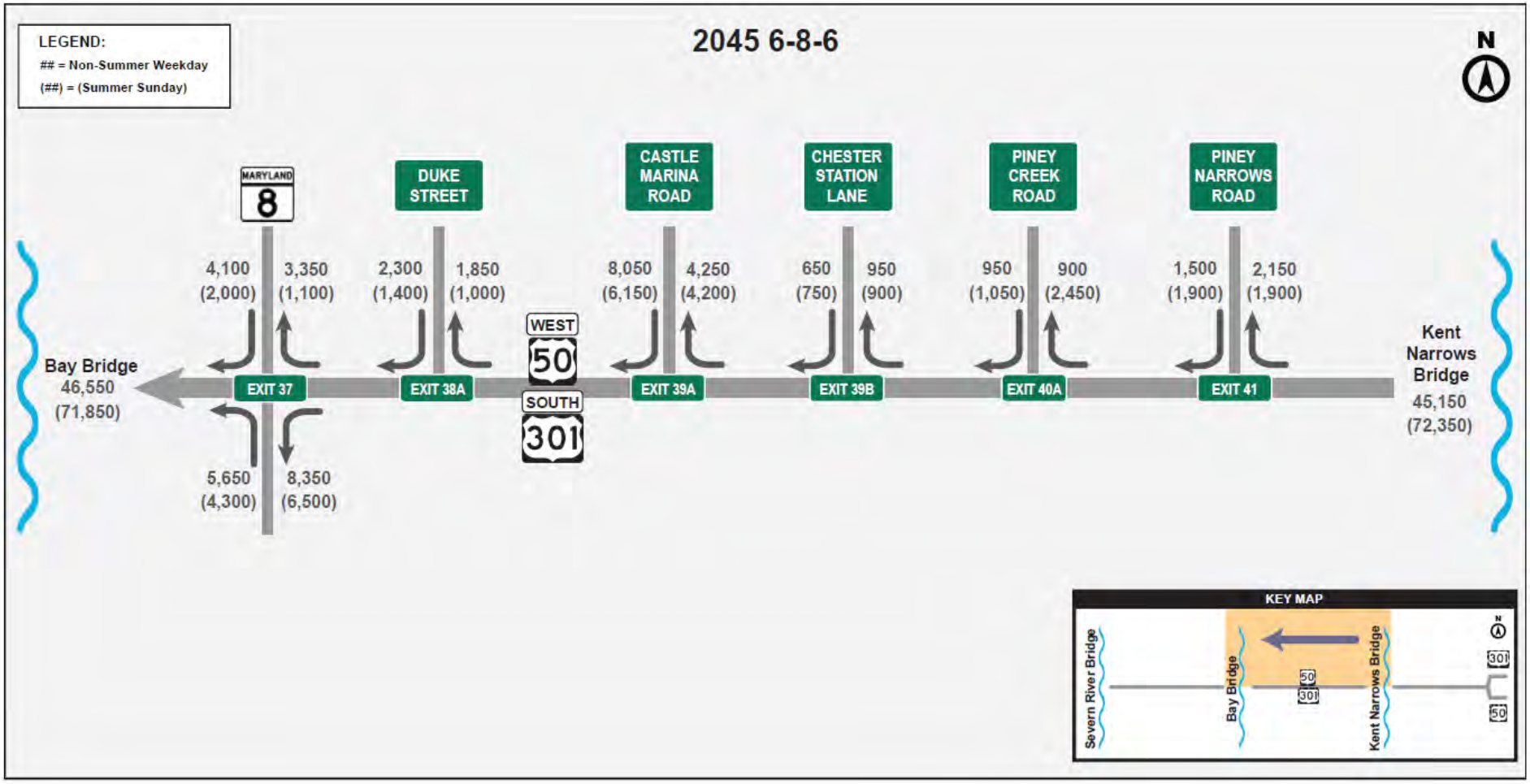


Figure 6-13: Eastbound Daily Traffic Volumes between the Bay Bridge and the Kent Narrows Bridge: 2045 Alternatives B and C (6-8-6)

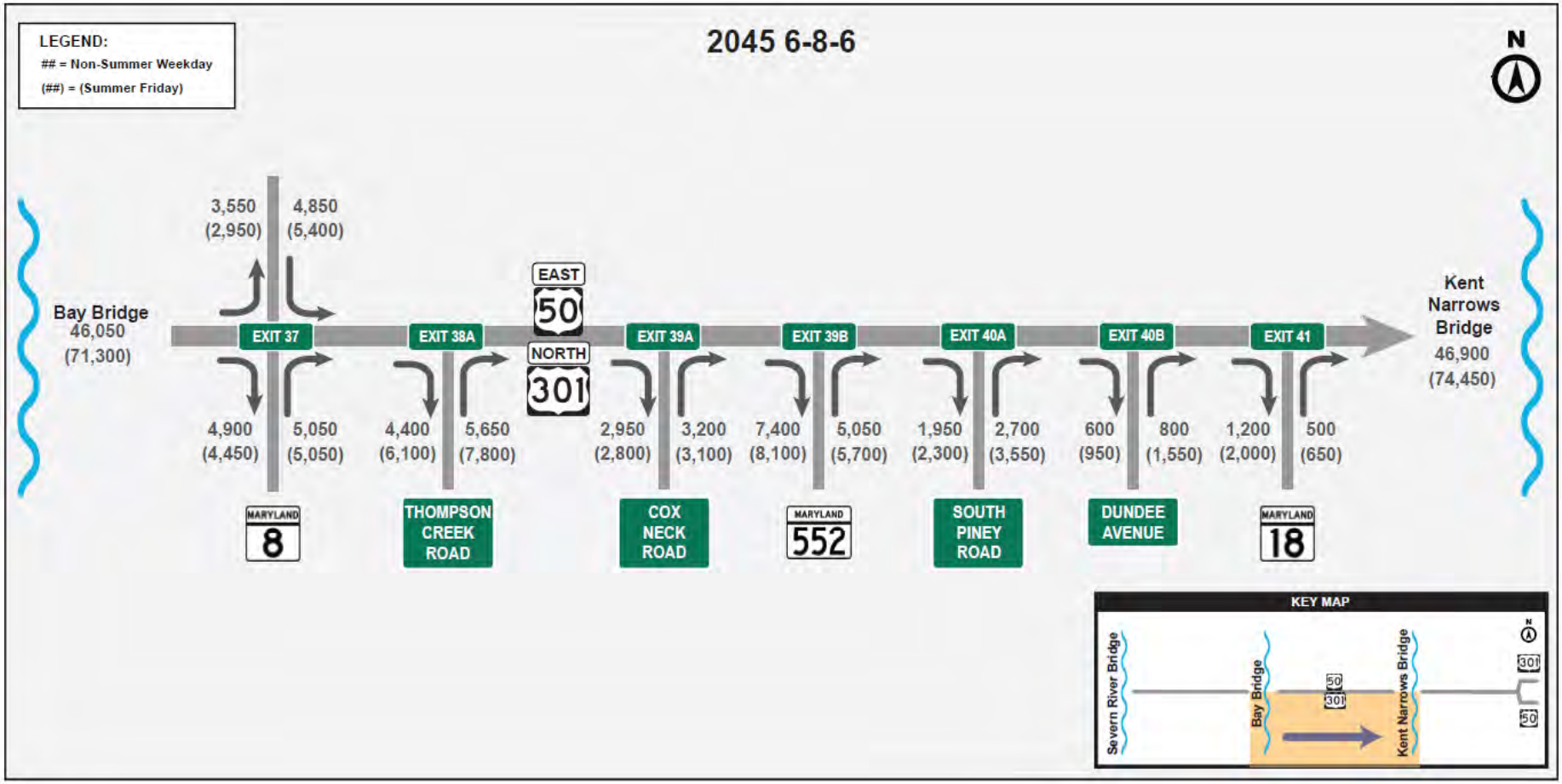
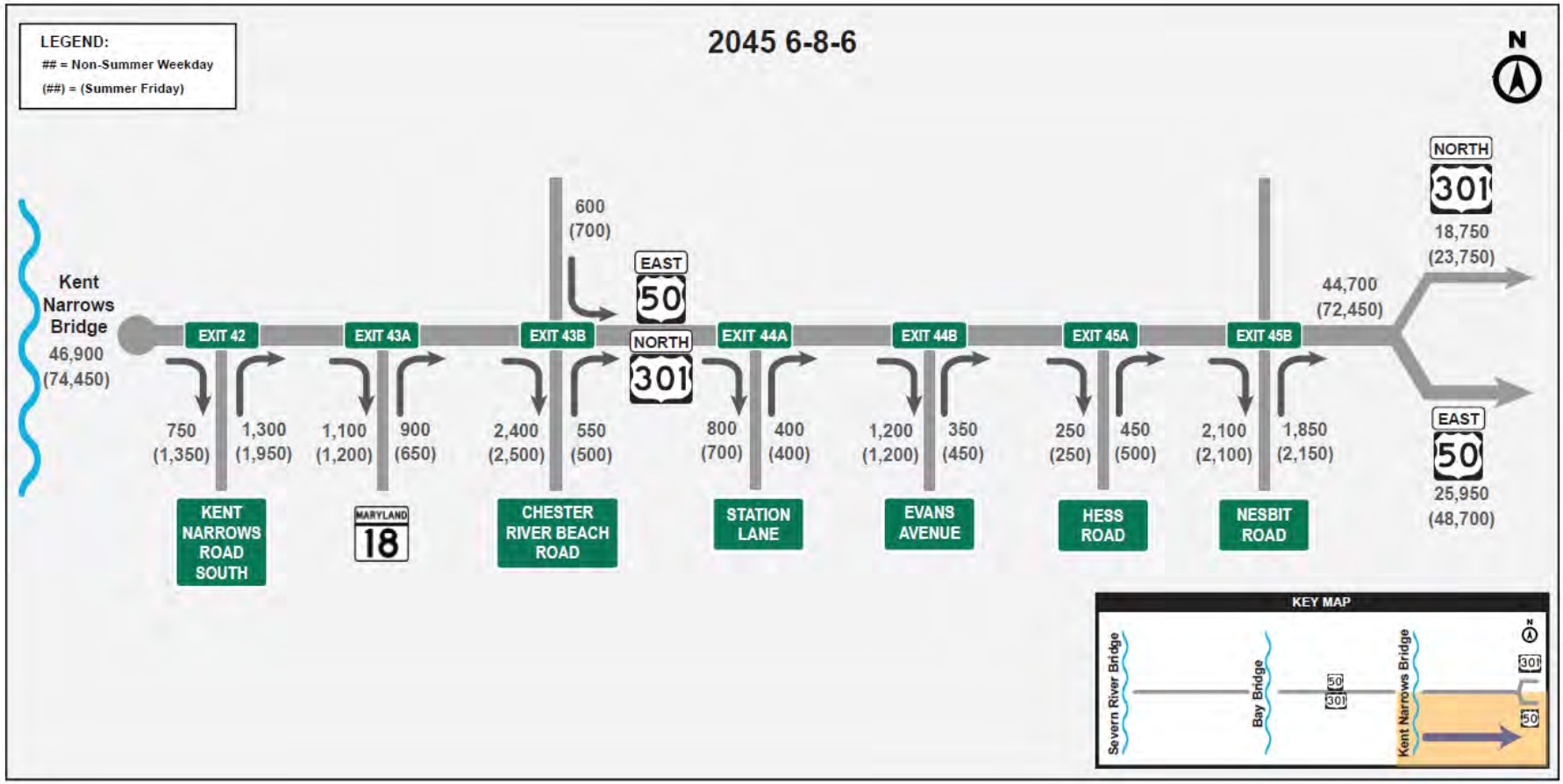


Figure 6-14: Eastbound Daily Traffic Volumes between the Kent Narrows Bridge and the U.S. 50/301 Split: 2045 Alternatives B and C (6-8-6)



6.7.2 Alternatives B/C: 6-8-6 Summer Weekend Scenario

In the Alternative B/C: 6-8-6 model, U.S. 50/301 includes eight-lane roadway approaches and an eight-lane section on the Bay Bridge that ties into the existing roadway configuration within approximately two miles of the limits of the bridge. No reversible lanes are present in this model. The Alternative B/C: 6-8-6 model matches the geometry of the No-Build model outside these limits.

The results of the Alternative B/C: 6-8-6 Summer Weekend VISSIM analyses are shown in **Tables 6-14 through 6-18**. Delay, LOS, and speeds along U.S. 50/301 throughout the corridor, during the peak volume hour at the Bay Bridge, are shown in **Tables 6-14 and 6-15**. Queue lengths and durations at the Bay Bridge are shown in **Table 6-16**. A bottleneck diagram, visually summarizing the results of the analyses, is shown in **Figure 6-15**. A summary of travel times and speeds is shown in **Table 6-17**. Throughput is shown in **Table 6-18.**

Table 6-14: VISSIM Eastbound US 50/301 Segment Results: Alternatives B and C (6-8-6) Summer Weekend Scenario

Eastbound Segment Name	Segment Type	SWED (Friday Peak Hour)						
		Density (veh/ln/mi)	LOS	Speed (mph)	Volume Expected	Throughput	Unmet Demand	Throughput %
MD 2/MD 450 to Ferguson Rd	Freeway	27.2	D	59.7	6143	4867	-1276	79%
Ferguson Rd to MD 179	Freeway	24.4	C	61.5	5633	4507	-1126	80%
MD 179 to Whitehall Rd (Exit 30)	Freeway	22.8	C	62.1	4912	4244	-668	86%
Whitehall Rd (Exit 30) to Oceanic Dr	Freeway	22.4	C	62.2	5061	4176	-885	83%
Oceanic Dr to Bay Bridge	Freeway	27.1	D	37.4	5350	4460	-890	83%
William Preston Lane Jr. Bay Bridge	Freeway	30.3	D	33.7	5350	4446	-904	83%
Bay Bridge to MD 8	Freeway	26.6	D	37.9	5350	4432	-918	83%
Weave from MD 8 to Thompson Creek Rd	Weave	22.0	C	51.9	5579	4572	-1007	82%
Thompson Creek Rd to Cox Neck Rd	Freeway	40.1	E	41.0	5706	4699	-1007	82%
Weave from Cox Neck Rd to Dominion Rd	Weave	20.3	C	59.0	5729	4783	-946	83%
Dominion Rd to S Piney Rd	Freeway	33.5	D	46.7	5549	4694	-855	85%
Weave from S Piney Rd to Dundee Ave	Weave	24.8	C	49.5	5642	4807	-835	85%
Weave from Dundee Ave to Main St/MD 18 (Exit 41)	Weave	26.2	C	46.7	5687	4866	-821	86%
R Clayton Mitchell Jr Bridge	Freeway	29.7	D	54.2	5586	4823	-763	86%
Kent Narrows Rd to Main St/MD 18 (Exit 43A)	Freeway	33.2	D	49.4	5631	4844	-787	86%
Weave from Exit 43A to Chester River Beach Rd	Weave	20.1	C	59.0	5590	4744	-846	85%
Weave from Chester River Beach Rd to Station Ln	Weave	20.4	C	57.6	5493	4688	-805	85%
Weave from Station Ln to Evans Ave	Weave	20.4	C	57.1	5470	4655	-815	85%
Weave from Evans Ave to Hess Rd	Weave	20.4	C	57.1	5414	4648	-766	86%
Weave from Hess Rd to Nesbit Rd	Weave	20.8	C	55.9	5433	4646	-787	86%
U.S. 50/U.S. 301 Split	Merge/Diverge	40.2	E	41.4	5436	4717	-719	87%
U.S. 50 East of U.S. 50/U.S. 301 Split	Freeway	86.3	F	18.4	3654	3094	-560	85%
U.S. 301 East of U.S. 50/U.S. 301 Split	Freeway	12.6	B	60.5	1782	1525	-257	86%

Table 6-15: VISSIM Westbound US 50/301 Segment Results: Alternatives B and C (6-8-6) Summer Weekend Scenario

Westbound Segment Name	Segment Type	SWED (Sunday Peak Hour)						
		Density (veh/ln/mi)	LOS	Speed (mph)	Volume Expected	Throughput	Unmet Demand	Throughput %
U.S. 301 East of U.S. 50/U.S. 301 Split	Freeway	17.9	B	50.9	1776	1773	-3	100%
U.S. 50 East of U.S. 50/U.S. 301 Split	Freeway	35.9	E	50.0	3821	3326	-495	87%
U.S. 50/U.S. 301 Split	Merge/Diverge	60.7	F	33.6	5597	5026	-571	90%
Weave from Nesbit Rd to Hissey Rd	Weave	55.2	F	36.0	5459	4839	-620	89%
Weave from Hissey Rd to Winchester Creek Rd	Weave	64.4	F	31.0	5481	4857	-624	89%
Weave from Winchester Creek Rd to Vfw Ave	Weave	26.8	C	50.9	5469	4842	-627	89%
Vfw Ave to Chester River Beach Rd	Freeway	25.2	C	62.8	5357	4738	-619	88%
Weave from Chester River Beach Rd to Jackson Creek Rd	Weave	27.3	C	48.0	5510	4918	-592	89%
Main St/MD 18 (Exit 43A) to Kent Narrows Rd	Freeway	34.6	D	51.4	5521	4944	-577	90%
R Clayton Mitchell Jr. Bridge	Freeway	26.1	D	61.4	5387	4799	-588	89%
Piney Narrows Rd to Piney Creek Rd	Freeway	27.8	D	57.7	5387	4797	-590	89%
Piney Creek Rd to Chester Station Ln	Freeway	27.5	D	57.2	5283	4687	-596	89%
Weave from Chester Station Ln to Castle Marina Rd	Weave	20.2	C	58.8	5272	4741	-531	90%
Castle Marina Rd to Duke St	Freeway	28.8	D	56.8	5417	4898	-519	90%
Weave from Duke St to MD 8	Weave	25.1	C	49.2	5447	4947	-500	91%
MD 8 to Bay Bridge	Freeway	69.8	F	16.8	5350	4669	-681	87%
William Preston Lane Jr. Bay Bridge	Freeway	31.3	D	37.4	5350	4677	-673	87%
Bay Bridge to Oceanic Dr	Freeway	58.1	F	19.1	5350	4280	-1070	80%
Oceanic Dr to MD 179	Freeway	138.8	F	9.2	5376	3813	-1563	71%
MD 179 to Bay Dale Dr	Freeway	126.4	F	11.2	5789	4233	-1556	73%
Bay Dale Dr to MD 2/MD 450	Freeway	32.9	D	47.7	6299	4714	-1585	75%

Table 6-16: VISSIM Queuing Results: Alternatives B and C (6-8-6) Summer Weekend Scenario

Time	Typical Summer Friday			Typical Summer Sunday		
	Eastbound Maximum Queue (miles)			Westbound Maximum Queue (miles)		
	Between U.S. 50/301 Split and Start of Bay Bridge (1)	From Start of Bay Bridge to End of Queue	Total	Between Start of Queue at Bay Dale Dr & Start of Bay Bridge (2)	From Start of Bay Bridge to End of Queue	Total
10-11 AM	0.1	0.0	n/a (3)	1.0	0.1	n/a (4)
11 AM – 12 PM	0.1	0.0	n/a (3)	3.4	0.5	n/a (4)
12-1 PM	0.5	0.0	n/a (3)	5.9	0.8	n/a (4)
1-2 PM	1.1	0.0	n/a (3)	8.7	1.5	10.2
2-3 PM	2.2	0.0	n/a (3)	8.7	4.2	12.9
3-4 PM	2.6	0.0	n/a (3)	8.7	8.4	17.1
4-5 PM	3.4	0.0	n/a (3)	8.7	>11.0 (5)	>19.7 (5)
5-6 PM	4.1	0.0	n/a (3)	8.7	>11.0 (5)	>19.7 (5)
6-7 PM	4.3	0.0	n/a (3)	8.7	>11.0 (5)	>19.7 (5)
7-8 PM	4.4	0.0	n/a (3)	8.7	>11.0 (5)	>19.7 (5)
8-9 PM	3.1	0.0	n/a (3)	8.7	>11.0 (5)	>19.7 (5)
9-10 PM	0.6	0.0	n/a (3)	8.7	>11.0 (5)	>19.7 (5)
10-11 PM	0.0	0.0	n/a (3)	8.7	>11.0 (5)	>19.7 (5)
Max. Queue	**4.4**	**0.0**	n/a (3)	**8.7**	**>11.0 (5)**	**>19.7 (5)**
Hours with Queue > 1 Mi	**8**	**0**	n/a (3)	**13**	**10**	**13**

(1) 13.8 miles from U.S. 50/301 Split to start of eastbound Bay Bridge (9.6 miles on Eastern Shore and 4.2 miles on Bay Bridge).

(2) 8.7 miles from Bay Dale Drive merge point to start of westbound Bay Bridge: (4.5 miles on Western Shore and 4.2 miles on Bay Bridge).

(3) Queues from end of study area do not extend to the start of the Bay Bridge.

(4) Queues from Bay Dale Drive do not extend to the Bay Bridge.

(5) Queues extend beyond the end of the study area.

Figure 6-15: Bottleneck Diagram: Alternatives B and C (6-8-6) Summer Weekend Scenario

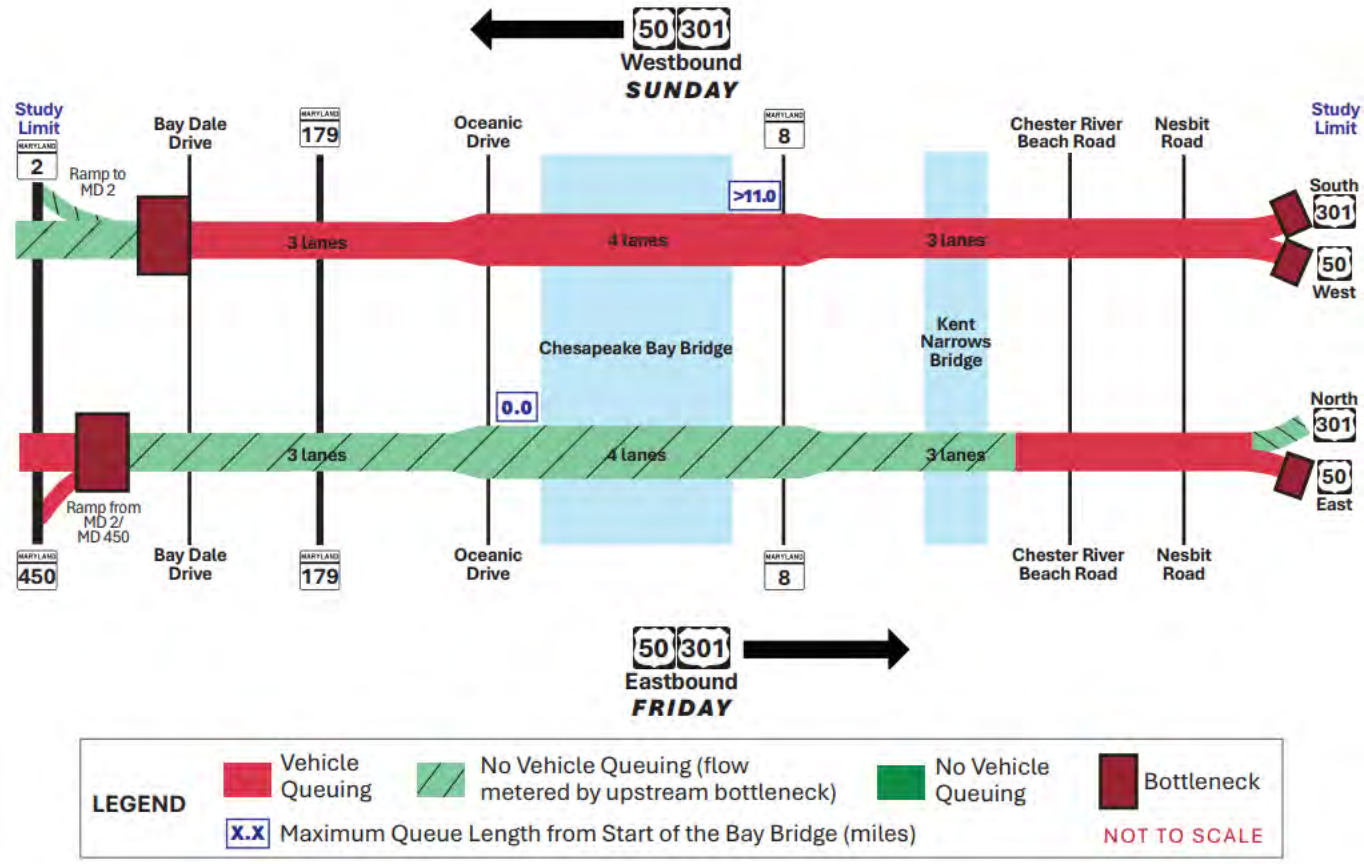


Table 6-17: Travel Time Results for Alternatives B and C: 6-8-6 during SWED, Peak Hour of Queuing

Alternatives B/C: 6-8-6 Conditions		Eastbound US 50/301		Westbound U.S. 50/301	
		MD 2/MD 450 to Start of Bay Bridge	Start of Bay Bridge to US 50 301 Split	US 50/301 Split to Start of Bay Bridge	Start of Bay Bridge to MD 2/ MD 450
Summer Weekend	Max Travel Time (min)	9	31	75	51
	Speed at Max Travel Time (mph)	33.3	32.1	6.9	13.5

Table 6-18: SWED Throughput at Bay Bridge in Peak Hour of Volume

Alternative	SWED					
	Eastbound			Westbound		
	Forecast Peak Hour Volume (12:00 - 1:00 PM)	Peak Hour Volume Able to Cross the Bay Bridge (Throughput)	Throughput Percentage	Forecast Peak Hour Volume (12:00 - 1:00 PM)	Peak Hour Volume Able to Cross the Bay Bridge (Throughput)	Throughput Percentage
6-8-6	5,350	4460	83%	5,350	4677	87%

Tables 6-14 through 6-18 and **Figure 6-15** show the results for Alternative B/C: 6-8-6:

1. During the peak volume hour, while the speed was lower on the eastbound Bay Bridge than on its approach or departure, the lower speed did not result in queuing.
2. On westbound U.S. 50/301 during the peak volume hour, conditions were different. While the Bay Bridge itself did not operate at speeds that would lead to queues, there was a bottleneck at the Bay Dale Drive interchange, leading to very low speeds and queuing approaching that interchange.
3. Almost no queuing was observed at the start of the Bay Bridge for eastbound U.S. 50/301 during the model run. As a result, no significant diversion to local roads is expected on the eastbound approach to the Bay Bridge.
4. During the peak volume hour, the westbound queues did not extend to the Bay Bridge. However, the westbound direction experienced queuing in the later hours of the day. By 7:00 PM, this queue would extend across the Bay Bridge and onto the Eastern Shore, to the eastern Study Limit. Thus, the westbound queues presented for this scenario are not caused by the Bay Bridge itself but do extend across the bridge. On the Western Shore, these queues could lead to diversion to College Parkway for traffic wishing to travel on northbound MD 2. Diversion of traffic wishing to travel over the Severn River would also be likely, despite to the circuitousness of the likely diversion route, due to the extent of the queues on U.S. 50/301. Diversion to westbound MD 18 on the Eastern Shore would be expected.
5. Due to a bottleneck located to the west of the Study Area, there is generally no queuing on eastbound U.S. 50/301 on the Western Shore. This bottleneck meters flow into the

Study Area, and results in reduced volumes on eastbound U.S. 50/301; consequently, queuing does not occur at the Bay Bridge. Over the course of the VISSIM runs, an average of 4,460 vehicles were able to cross the Bay Bridge during the peak volume hour, but 5,350 vehicles desired to cross based on the forecasted volumes.

6. On the Eastern Shore, in the eastbound direction, there will be a bottleneck at the eastern end of the study area, as the increased volumes crossing the Bay Bridge attempt to merge into two lanes on eastbound U.S. 50 at the Split. The queuing from this bottleneck would be expected to result in diversion to eastbound MD 18.

7. In the westbound direction, the bottleneck at Bay Dale Drive similarly reduces traffic flow through the Study Area. Over the course of the VISSIM runs, and average of 4,677 vehicles were able to cross the Bay Bridge during the peak volume hour, but 5,350 vehicles desired to cross the bridge based on the forecasted volumes.

8. Westbound speeds, both upstream and downstream of the Bay Bridge, would be lower than eastbound speeds. Throughput would be below 90% in both directions.

6.7.3 Alternatives B/C: 6-8-6 Non-Summer Weekday (NSWD) Scenario

Roadway geometry in Alternative B/C: 6-8-6 NSWD model matches that of the 6-8-6 Summer Weekend model. The results of the Alternative B/C: 6-8-6 NSWD VISSIM analyses are shown in **Tables 6-19 through 6-23**. Delay, LOS, and speeds along U.S. 50/301 throughout the corridor, during the peak volume hour at the Bay Bridge, are shown in **Tables 6-19 and 6-20**. Queue lengths and durations at the Bay Bridge are shown in **Table 6-21**. A bottleneck diagram, visually summarizing the results of the analyses, is shown in **Figure 6-16**. A summary of travel times and speeds is shown in **Table 6-22**. Throughput is shown in **Table 6-23.**

Table 6-19: VISSIM Eastbound U.S. 50/301 Segment Results: Alternatives B and C (6-8-6) NSWD Scenario

Eastbound Segment Name	Segment Type	NSWD (PM Peak Hour)						
		Density (veh/ln/mi)	LOS	Speed (mph)	Volume Expected	Throughput	Unmet Demand	Throughput %
MD 2/MD 450 to Ferguson Rd	Freeway	27.6	D	58.9	5950	4867	-1083	82%
Ferguson Rd to MD 179	Freeway	22.8	C	61.7	5115	4219	-897	82%
MD 179 to Whitehall Rd (Exit 30)	Freeway	21.4	C	61.9	4190	3985	-206	95%
Whitehall Rd (Exit 30) to Oceanic Dr	Freeway	21.6	C	62.1	4365	4027	-338	92%
Oceanic Dr to Bay Bridge	Freeway	22.7	C	31.2	4600	4257	-343	93%
William Preston Lane Jr. Bay Bridge	Freeway	25.8	C	27.4	4600	4255	-345	92%
Bay Bridge to MD 8	Freeway	22.4	C	31.5	4600	4236	-364	92%
Weave from MD 8 to Thompson Creek Rd	Weave	19.2	B	52.5	4745	4033	-712	85%
Thompson Creek Rd to Cox Neck Rd	Freeway	23.3	C	59.5	4870	4160	-709	85%
Weave from Cox Neck Rd to Dominion Rd	Weave	17.8	B	59.9	4895	4267	-628	87%
Dominion Rd to S Piney Rd	Freeway	23.3	C	58.9	4660	4118	-542	88%
Weave from S Piney Rd to Dundee Ave	Weave	17.5	B	60.2	4735	4215	-520	89%
Weave from Dundee Ave to Main St/MD 18 (Exit 41)	Weave	19.7	B	53.8	4755	4239	-516	89%
R Clayton Mitchell Jr Bridge	Freeway	23.0	C	61.1	4685	4210	-475	90%
Kent Narrows Rd to Main St/MD 18 (Exit 43A)	Freeway	23.0	C	61.2	4740	4218	-522	89%
Weave from Exit 43A to Chester River Beach Rd	Weave	17.2	B	60.6	4720	4170	-550	88%
Weave from Chester River Beach Rd to Station Ln	Weave	16.6	B	61.5	4595	4092	-503	89%
Weave from Station Ln to Evans Ave	Weave	16.7	B	60.5	4555	4049	-506	89%
Weave from Evans Ave to Hess Rd	Weave	16.5	B	60.7	4470	4006	-464	90%
Weave from Hess Rd to Nesbit Rd	Weave	16.6	B	60.0	4490	3991	-499	89%
U.S. 50/U.S. 301 Split	Merge/Diverge	22.5	C	60.0	4465	4043	-422	91%
U.S. 50 East of U.S. 50/U.S. 301 Split	Freeway	20.8	C	57.0	2592	2370	-223	91%
U.S. 301 East of U.S. 50/U.S. 301 Split	Freeway	13.3	B	62.4	1873	1661	-212	89%

Table 6-20: VISSIM Westbound U.S. 50/301 Segment Results: Alternatives B and C (6-8-6) NSWD Scenario

Westbound Segment Name	Segment Type	NSWD (AM Peak Hour)						
		Density (veh/ln/mi)	LOS	Speed (mph)	Volume Expected	Throughput		
U.S. 301 East of U.S. 50/U.S. 301 Split	Freeway	13.3	B	60.9	1618	1618	0	100%
U.S. 50 East of U.S. 50/U.S. 301 Split	Freeway	18.9	C	58.8	2229	2220	-9	100%
U.S. 50/U.S. 301 Split	Merge/Diverge	20.3	C	62.9	3847	3820	-27	99%
Weave from Nesbit Rd to Hissey Rd	Weave	15.3	B	62.1	3851	3799	-53	99%
Weave from Hissey Rd to Winchester Creek Rd	Weave	15.3	B	62.2	3869	3811	-58	98%
Weave from Winchester Creek Rd to Vfw Ave	Weave	15.2	B	62.5	3865	3806	-59	98%
Vfw Ave to Chester River Beach Rd	Freeway	19.8	C	63.1	3816	3758	-58	98%
Weave from Chester River Beach Rd to Jackson Creek Rd	Weave	16.5	B	61.9	4128	4079	-49	99%
Main St/MD 18 (Exit 43A) to Kent Narrows Rd	Freeway	21.8	C	62.5	4119	4082	-37	99%
R Clayton Mitchell Jr. Bridge	Freeway	21.2	C	62.7	4025	3980	-46	99%
Piney Narrows Rd to Piney Creek Rd	Freeway	20.7	C	62.8	3967	3901	-67	98%
Piney Creek Rd to Chester Station Ln	Freeway	20.7	C	62.4	3972	3882	-90	98%
Weave from Chester Station Ln to Castle Marina Rd	Weave	15.8	B	61.7	3945	3899	-46	99%
Castle Marina Rd to Duke St	Freeway	23.9	C	59.2	4284	4248	-36	99%
Weave from Duke St to MD 8	Weave	23.5	C	45.8	4324	4259	-65	98%
MD 8 to Bay Bridge	Freeway	21.9	C	45.8	4150	4004	-146	96%
William Preston Lane Jr. Bay Bridge	Freeway	24.3	C	41.1	4150	3999	-151	96%
Bay Bridge to Oceanic Dr	Freeway	15.6	B	63.0	4150	3926	-224	95%
Oceanic Dr to MD 179	Freeway	21.2	C	61.9	4212	3942	-270	94%
MD 179 to Bay Dale Dr	Freeway	56.3	F	24.9	4787	4139	-649	86%
Bay Dale Dr to MD 2/MD 450	Freeway	34.2	D	45.0	5603	4617	-986	82%

Table 6-21: VISSIM Queuing Results: Alternatives B and C (6-8-6) NSWD Scenario

Time	Typical PM			Time	Typical AM		
	Eastbound Maximum Queue (miles)				Westbound Maximum Queue (miles)		
	Between U.S. 50/301 Split & Start of Bay Bridge (1)	From Start of Bay Bridge to End of Queue	Total		Between Start of Queue at Bay Dale Dr & Start of Bay Bridge (2)	From Start of Bay Bridge to End of Queue	Total
2-3 PM	0.0	0.0	n/a (3)	5-6 AM	0.0	0.0	n/a (3)
3-4 PM	0.1	0.0	n/a (3)	6-7 AM	0.1	0.0	n/a (3)
4-5 PM	0.1	0.0	n/a (3)	7-8 AM	1.5	0.0	n/a (3)
5-6 PM	0.1	0.0	n/a (3)	8-9 AM	2.6	0.1	n/a (3)
6-7 PM	0.0	0.0	n/a (3)	9-10 AM	2.8	0.0	n/a (3)
7-8 PM	0.0	0.0	n/a (3)	10-11 AM	2.7	0.0	n/a (3)
8-9 PM	0.0	0.0	n/a (3)	11-12 PM	2.4	0.0	n/a (3)
9-10 PM	0.0	0.0	n/a (3)	12-1 PM	2.1	0.0	n/a (3)
10-11 PM	0.0	0.0	n/a (3)	1-2 PM	2.0	0.0	n/a (3)
11-12 AM	0.0	0.0	n/a (3)	2-3 PM	0.0	0.0	n/a (3)
Max. Queue	**0.1**	**0.0**	n/a (3)	**Max. Queue**	**2.8**	**0.1**	n/a (3)
Hours with Queue > 1 Mile	**0**	**0**	n/a (3)	**Hours with Queue > 1 Mile**	**7**	**0**	n/a (3)

(1) 13.8 miles from U.S. 50/301 Split to start of eastbound Bay Bridge (9.6 miles on Eastern Shore and 4.2 miles on Bay Bridge).

(2) 8.7 miles from Bay Dale Drive merge point to start of westbound Bay Bridge: (4.5 miles on Western Shore and 4.2 miles on Bay Bridge).

(3) Queues from end of study area do not extend to the start of the Bay Bridge.

Figure 6-16: Bottleneck Diagram: Alternatives B and C (6-8-6) NSWD Scenario (Eastbound PM, Westbound AM)

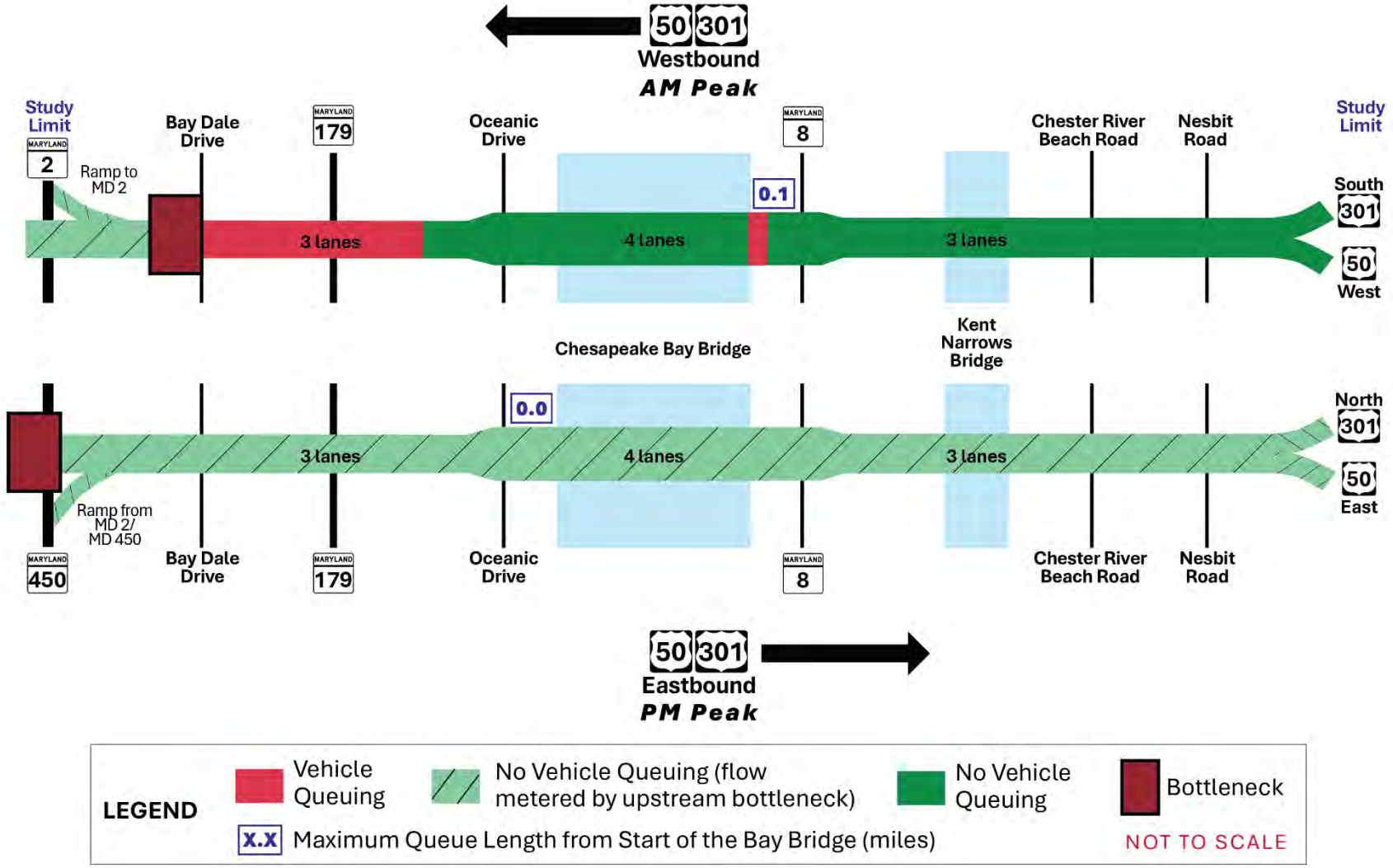


Table 6-22: Travel Time Results for Alternatives B and C: 6-8-6 during NSWD, Peak Hour of Queuing

Alternatives B/C: 6-8-6 Conditions		Eastbound US 50/301		Westbound U.S. 50/301	
		MD 2/MD 450 to Start of Bay Bridge	Start of Bay Bridge to US 50 301 Split	US 50/301 Split to Start of Bay Bridge	Start of Bay Bridge to MD 2/ MD 450
Non-Summer Weekday	Max Travel Time (min)	8	17	9	27
	Speed at Max Travel Time (mph)	37.5	52.1	57.3	34.8

Table 6-23: NSWD Throughput in Peak Hour of Volume

Alternative	NSWD					
	Eastbound			Westbound		
	Forecast Peak Hour Volume (4:00 - 5:00 PM)	Peak Hour Volume Able to Cross the Bay Bridge (Throughput)	Throughput Percentage	Forecast Peak Hour Volume (7:00 - 8:00 AM)	Peak Hour Volume Able to Cross the Bay Bridge (Throughput)	Throughput Percentage
6-8-6	4,600	4255	92%	4,150	3999	96%

Tables 6-19 through 6-23 and **Figure 6-16** show the following results for Alternative B/C: 6-8-6.

1. No operational deficiencies were identified for eastbound U.S. 50/301 in the PM NSWD analysis. The segments all operated at LOS D or better during the PM volume peak hour and no queueing was observed at the start of the Bay Bridge throughout the PM period. Thus, no diversion from eastbound U.S. 50/301 would be anticipated. However, flow was metered through the entire Tier 2 Study Limits by a bottleneck located west of the study limits.
2. During the AM peak volume hour, westbound U.S. 50/301 shows LOS D or better conditions except for the segment between the MD 179 interchange and the Bay Dale Drive interchange, which operates at LOS F in the model runs. The removal of the bottleneck at the Bay Bridge results in greater traffic flow reaching the bottleneck at Bay Dale Drive, thus leading to a longer queue than in Alternative A: No-Build. These queues could lead to some diversion to College Parkway of traffic wishing to travel northbound on MD 2. Diversion of traffic wishing to travel over the Severn River Bridge would be less likely, due to the circuitousness of the likely diversion route, but still could occur.
3. Speeds would be higher downstream of the Bay Bridge than on the approaches to the Bay Bridge, for both directions. Throughput would be above 90%, for both directions.

6.8 Analysis of Alternatives D/E: 8-8-8

6.8.1 Daily Volumes

Daily NSWD and SWED volumes for Alternative D/E: 8-8-8, including each interchange in the Tier 2 Study Limits, are shown in **Figures 6-17 through 6-22**.

Figure 6-17: Westbound Daily Traffic Volumes between the Severn River Bridge and the Bay Bridge: 2045 Alternatives D and E (8-8-8)

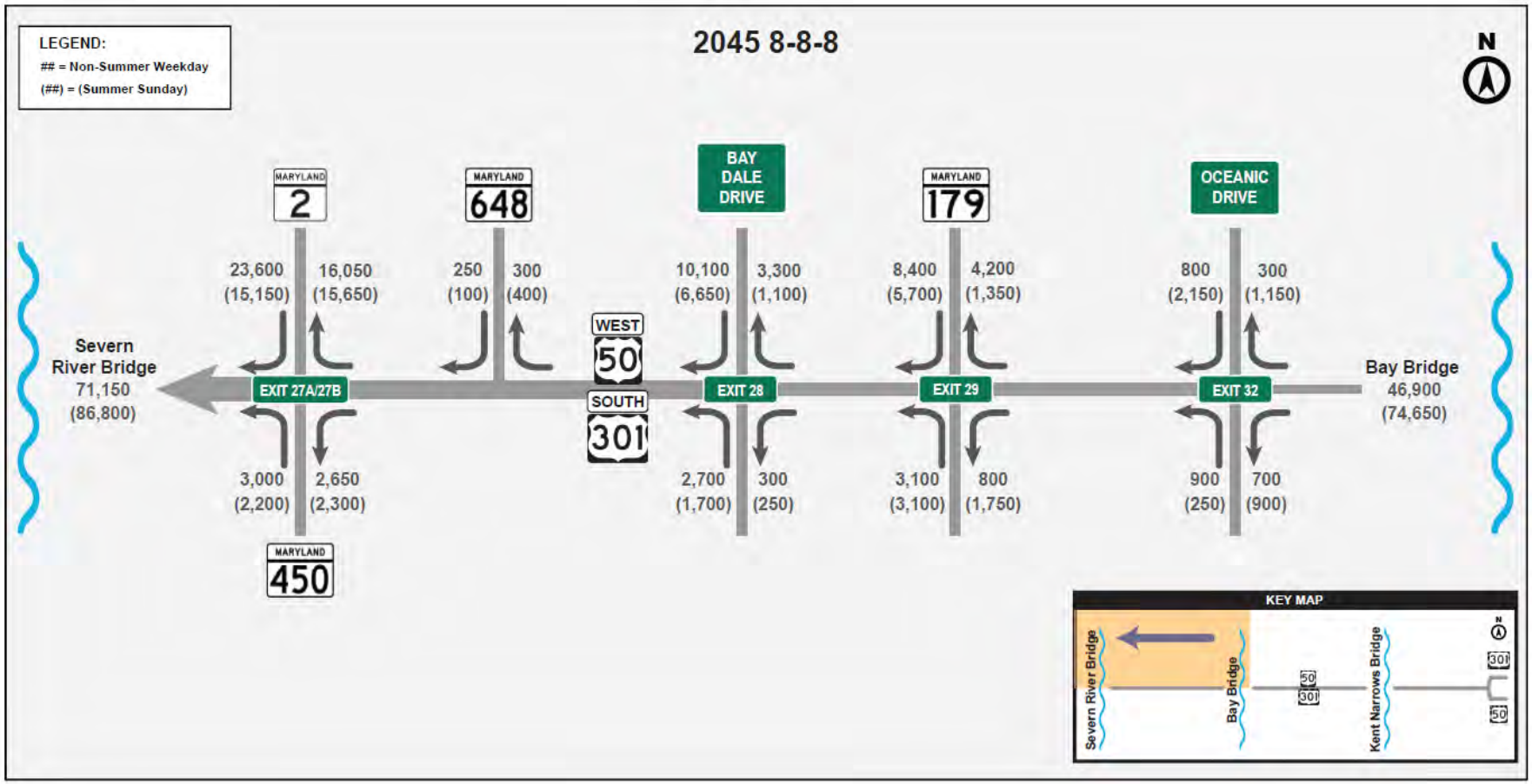


Figure 6-18: Eastbound Daily Traffic Volumes between the Severn River Bridge and the Bay Bridge: 2045 Alternatives D and E (8-8-8)

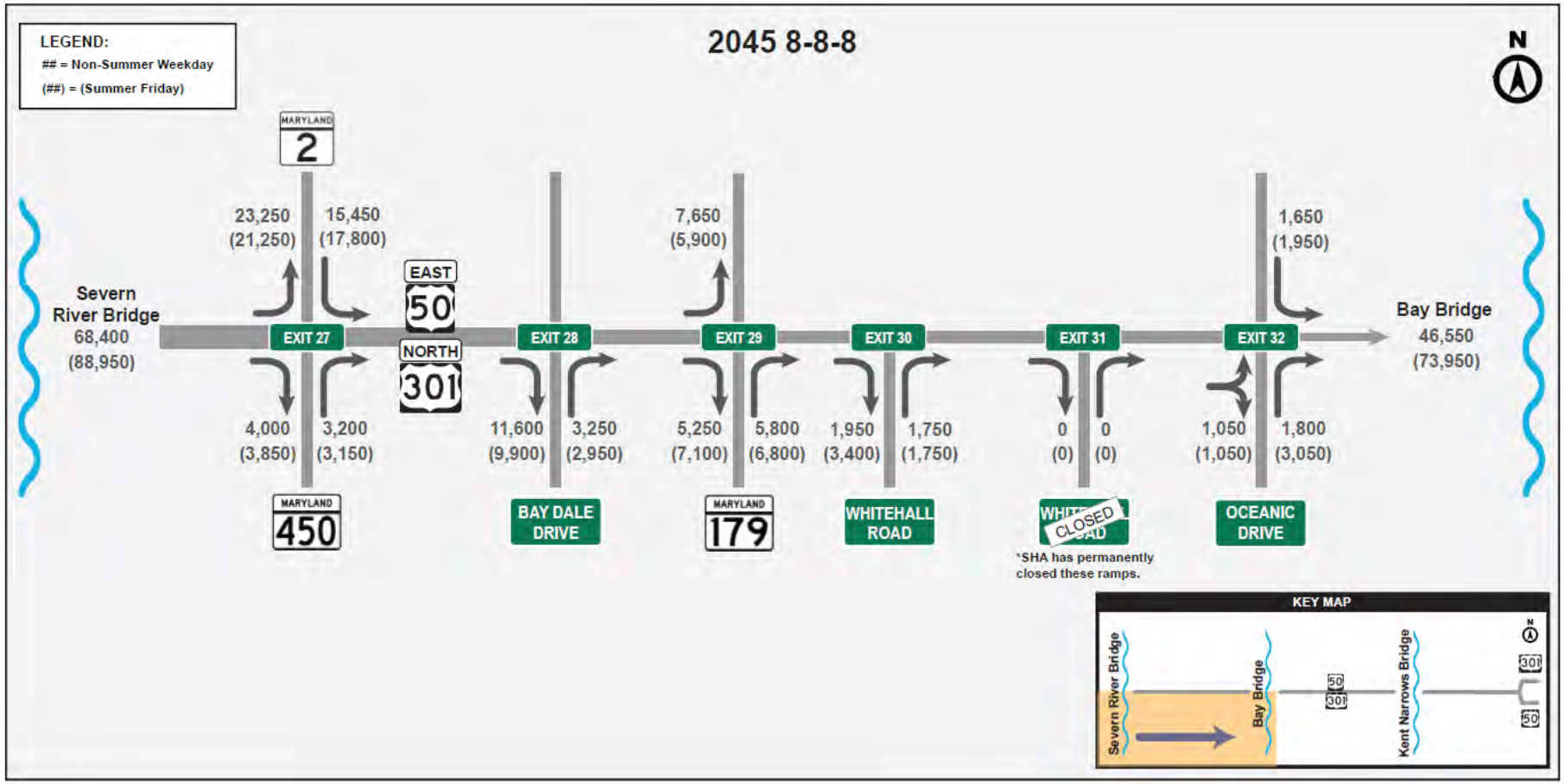


Figure 6-19: Westbound Daily Traffic Volumes between the Kent Narrows Bridge and the U.S. 50/301 Split: 2045 Alternatives D and E (8-8-8)

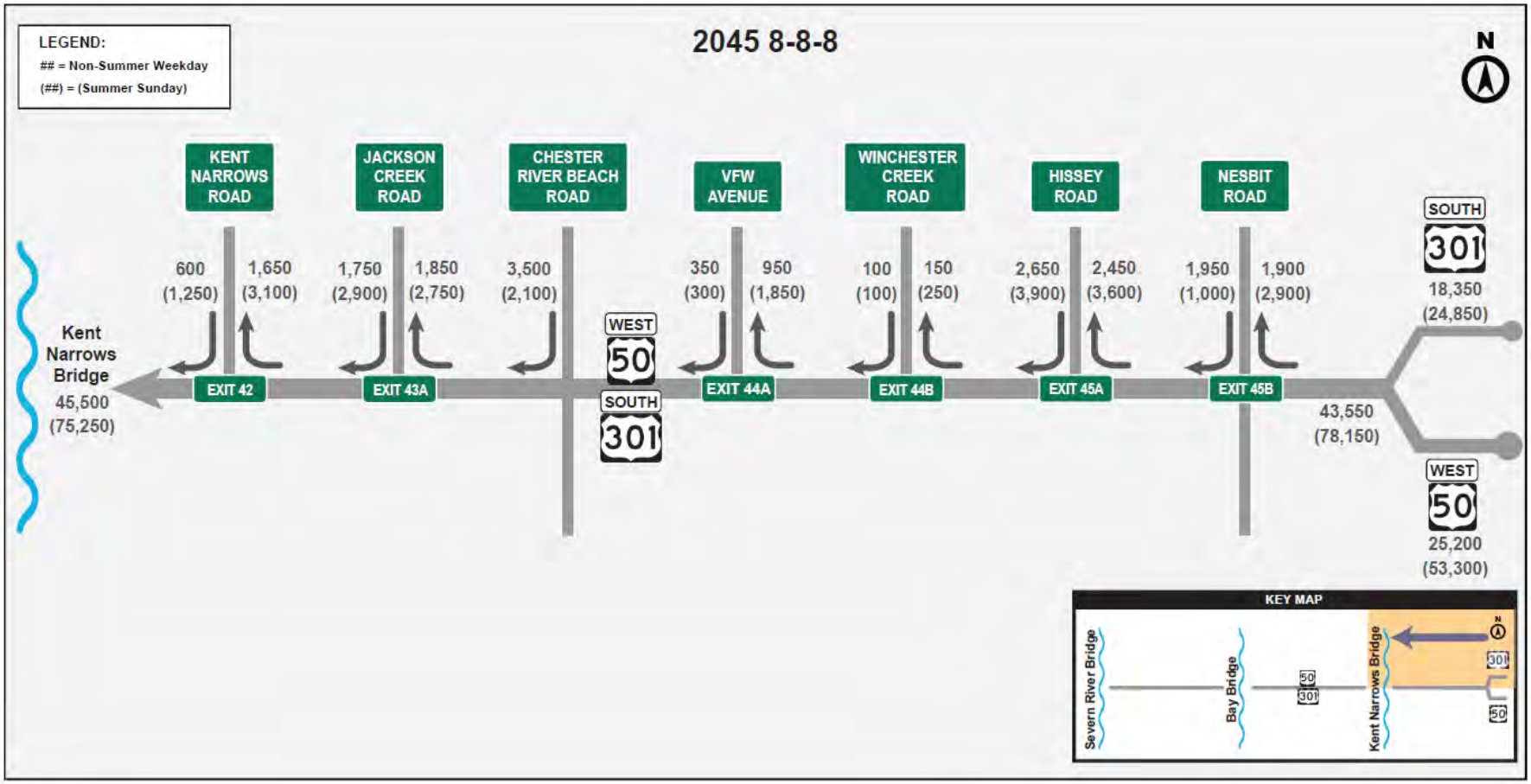


Figure 6-20: Westbound Daily Traffic Volumes between the Bay Bridge and the Kent Narrows Bridge: 2045 Alternatives D and E (8-8-8)

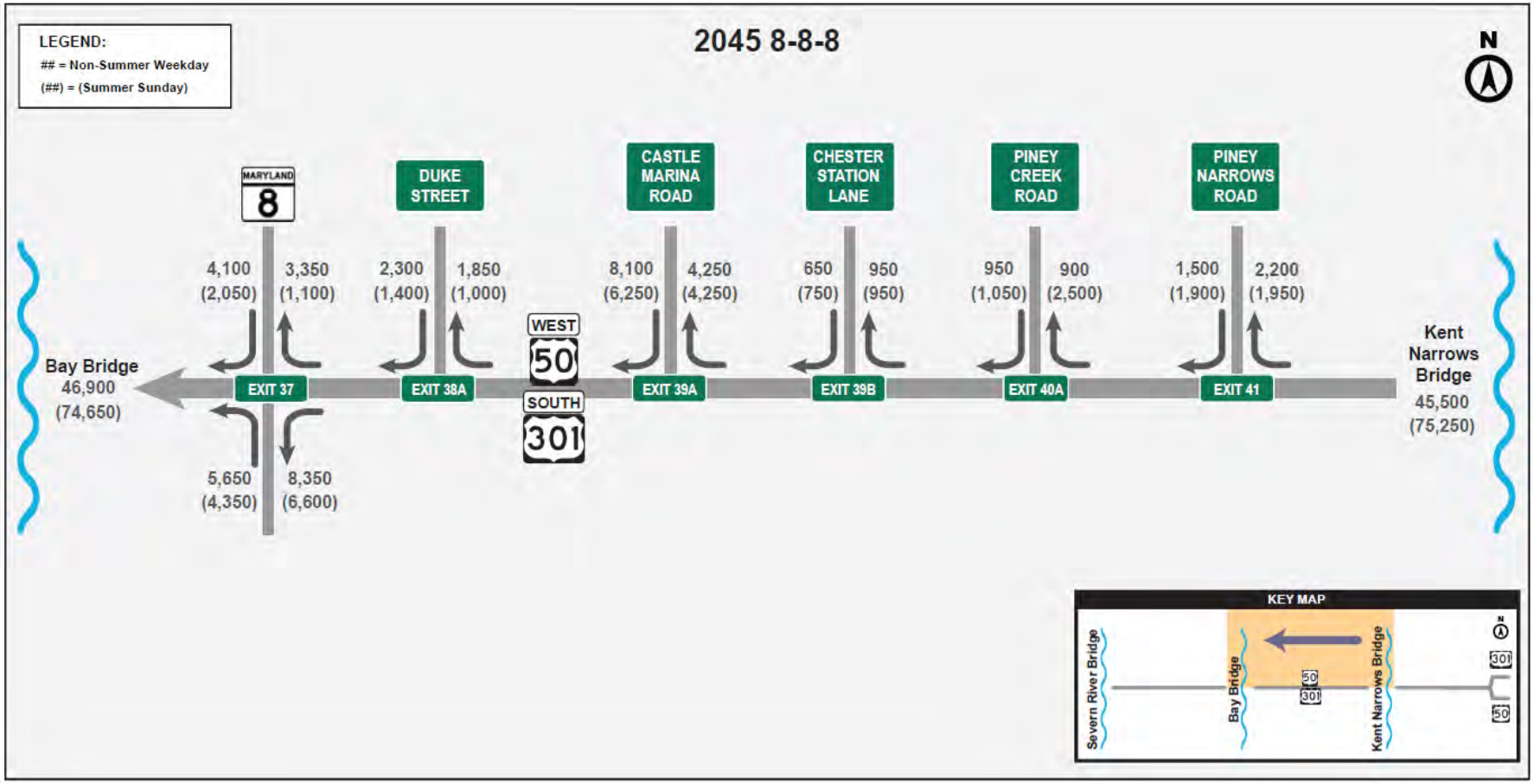


Figure 6-21: Eastbound Daily Traffic Volumes between the Bay Bridge and the Kent Narrows Bridge: 2045 Alternatives D and E (8-8-8)

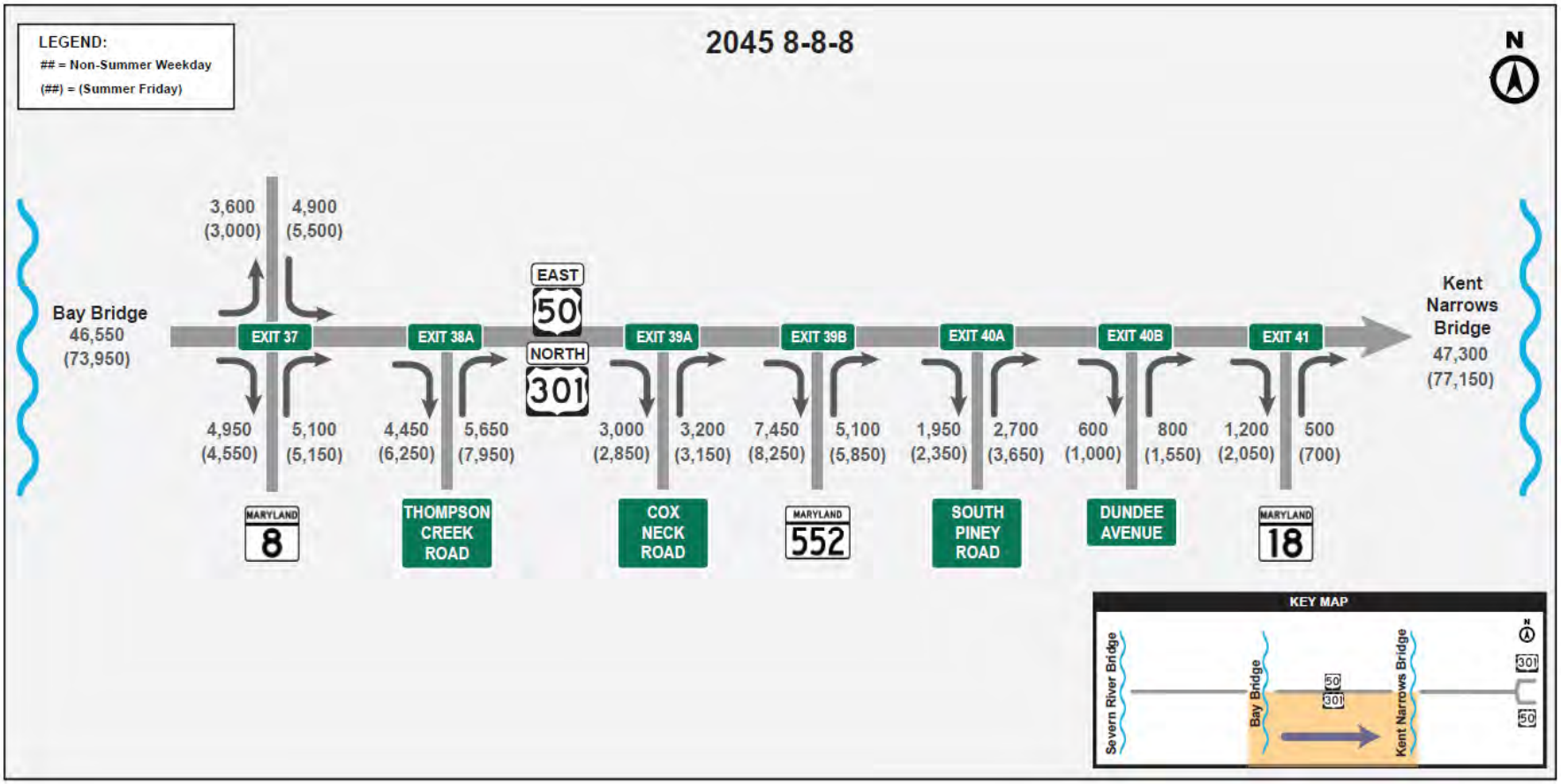
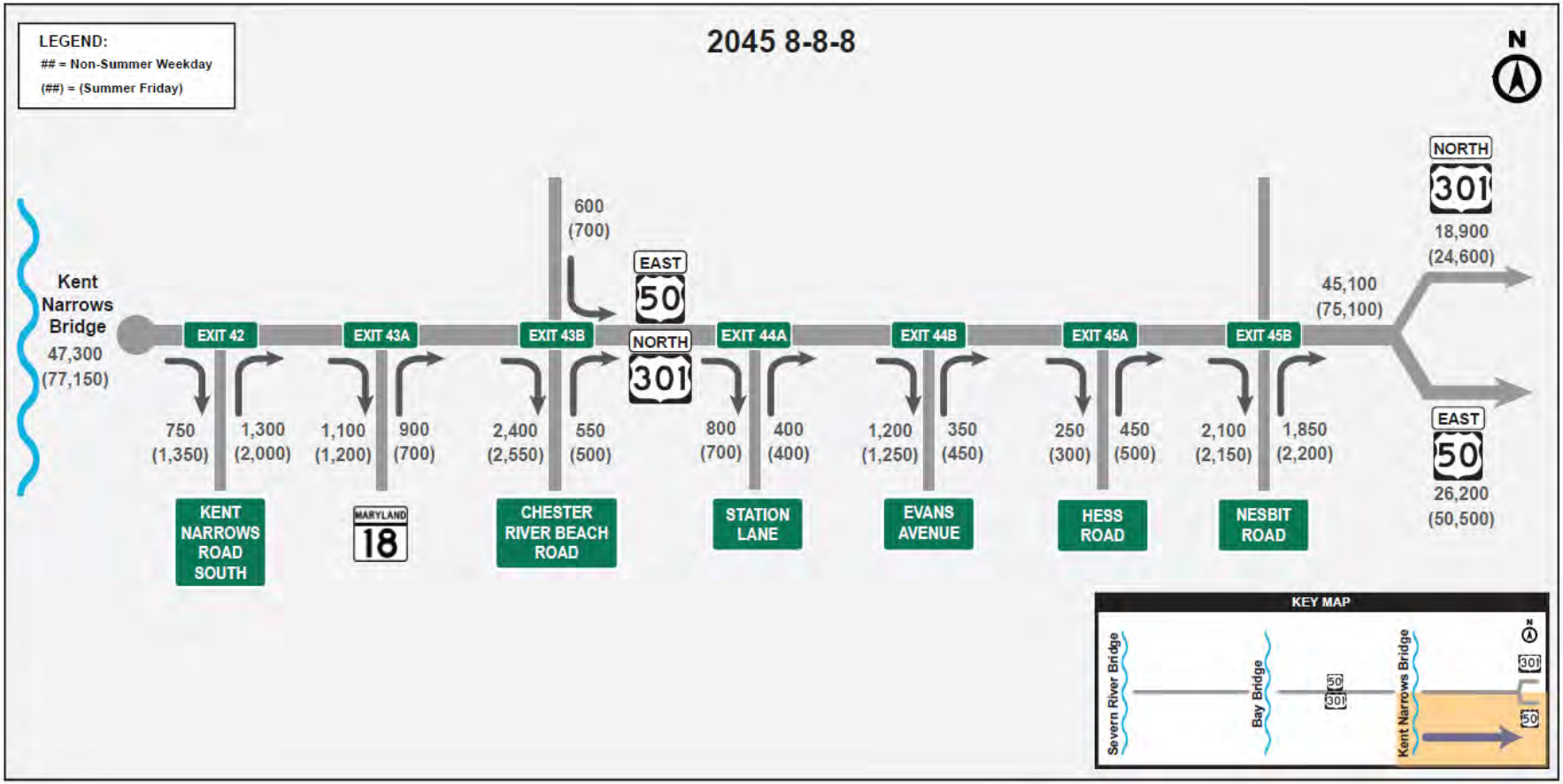


Figure 6-22: Eastbound Daily Traffic Volumes between the Kent Narrows Bridge and the U.S. 50/301 Split: 2045 Alternatives D and E (8-8-8)



6.8.2 Alternative D/E: 8-8-8 Summer Weekend Scenario

In the Alternative D/E: 8-8-8 model, U.S. 50/301 includes eight-lane roadway approaches and an eight-lane section on the Bay Bridge that tie into the existing roadway configuration near the limits of the Tier 2 Study Limits. On the Western Shore, the tie-in occurs on the eastern side of the MD 2/MD 450 interchange. In the eastbound direction, the ramp from MD 2/MD 450 becomes the fourth lane on U.S. 50/301. In the westbound direction, the fourth lane is dropped as an "exit only" lane to MD 2.

On the Eastern Shore, the tie-in occurs for westbound traffic on the ramp from U.S. 301 before the merge. U.S. 50 and U.S. 301 meet at the merge with two lanes on each roadway, forming four lanes. For eastbound traffic at the U.S. 301 split, U.S. 301 continues as two lanes and U.S. 50 has three lanes that extend to the east of the traffic signal at the Queenstown Premium Outlets. No reversible lanes are present in this model. Several interchange ramps have been realigned to accommodate the eight-lane roadway section, but none of those realignments affected the intersection of the ramps at the local roadways.

The results of the Alternative D/E: 8-8-8 Summer Weekend VISSIM analyses are shown in **Tables 6-24 through 6-28**. Delay, LOS and speeds along U.S. 50/301 throughout the corridor, during the peak volume hour at the Bay Bridge, are shown in **Tables 6-24 and 6-25**. Queue lengths and durations at the Bay Bridge are shown in **Table 6-26**. A bottleneck diagram, visually summarizing the results of the analyses, is shown in **Figure 6-23**. A summary of travel times and speeds is shown in **Table 6-27**. Throughput is shown in **Table 6-28.**

Table 6-24: VISSIM Eastbound US 50/301 Segment Results: Alternatives D and E (8-8-8) Summer Weekend Scenario

Eastbound Segment Name	Segment Type	SWED (Friday Peak Hour)						
		Density (veh/ln/mi)	LOS	Speed (mph)	Volume Expected	Volume Actual	Unmet Demand	Throughput %
MD 2/MD 450 to Ferguson Rd	Freeway	24.9	C	62.0	6364	6181	-184	97%
Ferguson Rd to MD 179	Freeway	22.9	C	62.2	5843	5689	-153	97%
MD 179 to Whitehall Rd (Exit 30)	Freeway	20.9	C	62.6	5101	5233	132	103%
Whitehall Rd (Exit 30) to Oceanic Dr	Freeway	20.2	C	62.9	5254	5086	-167	97%
Oceanic Dr to Bay Bridge	Freeway	72.5	F	11.9	5550	5189	-361	94%
William Preston Lane Jr. Bay Bridge	Freeway	34.0	D	25.3	5550	5155	-395	93%
Bay Bridge to MD 8	Freeway	27.5	D	31.1	5550	5144	-406	93%
Weave from MD 8 to Thompson Creek Rd	Weave	20.2	C	51.6	5783	5218	-564	90%
Thompson Creek Rd to Cox Neck Rd	Freeway	22.2	C	60.2	5910	5337	-573	90%
Weave from Cox Neck Rd to Dominion Rd	Weave	17.9	B	60.5	5933	5402	-531	91%
Dominion Rd to S Piney Rd	Freeway	21.4	C	61.1	5753	5238	-514	91%
Weave from S Piney Rd to Dundee Ave	Weave	17.7	B	60.9	5850	5386	-464	92%
Weave from Dundee Ave to Main St/MD 18 (Exit 41)	Weave	19.5	B	55.6	5891	5410	-482	92%
R Clayton Mitchell Jr Bridge	Freeway	21.4	C	62.5	5790	5362	-428	93%
Kent Narrows Rd to Main St/MD 18 (Exit 43A)	Freeway	21.6	C	62.5	5839	5400	-439	92%
Weave from Exit 43A to Chester River Beach Rd	Weave	17.4	B	61.8	5801	5362	-439	92%
Weave from Chester River Beach Rd to Station Ln	Weave	16.9	B	62.4	5700	5273	-427	93%
Weave from Station Ln to Evans Ave	Weave	17.1	B	61.5	5678	5250	-428	92%
Weave from Evans Ave to Hess Rd	Weave	16.8	B	62.0	5618	5207	-411	93%
Weave from Hess Rd to Nesbit Rd	Weave	17.1	B	60.8	5633	5201	-432	92%
U.S. 50/U.S. 301 Split	Merge/Diverge	58.6	F	23.6	5636	5078	-558	90%
U.S. 50 East of U.S. 50/U.S. 301 Split	Freeway	119.2	F	9.2	3790	3178	-612	84%
U.S. 301 East of U.S. 50/U.S. 301 Split	Freeway	13.5	B	61.1	1846	1647	-200	89%

Table 6-25: VISSIM Westbound US 50/301 Segment Results: Alternatives D and E (8-8-8) Summer Weekend Scenario

Westbound Segment Name	Segment Type	SWED (Sunday Peak Hour)						
		Density (veh/ln/mi)	LOS	Speed (mph)	Volume Expected	Volume Actual	Unmet Demand	Throughput %
U.S. 301 East of U.S. 50/U.S. 301 Split	Freeway	14.7	B	62.9	1848	1845	-3	100%
U.S. 50 East of U.S. 50/U.S. 301 Split	Freeway	26.9	D	57.6	3963	3094	-869	78%
U.S. 50/U.S. 301 Split	Merge/Diverge	19.5	B	63.1	5810	4918	-893	85%
Weave from Nesbit Rd to Hissey Rd	Weave	15.5	B	62.1	5669	4816	-853	85%
Weave from Hissey Rd to Winchester Creek Rd	Weave	15.7	B	62.2	5691	4897	-794	86%
Weave from Winchester Creek Rd to Vfw Ave	Weave	15.6	B	62.7	5680	4878	-802	86%
Vfw Ave to Chester River Beach Rd	Freeway	18.7	C	63.4	5565	4737	-828	85%
Weave from Chester River Beach Rd to Jackson Creek Rd	Weave	15.7	B	62.8	5721	4931	-790	86%
Main St/MD 18 (Exit 43A) to Kent Narrows Rd	Freeway	19.6	C	63.1	5732	4957	-775	86%
R Clayton Mitchell Jr. Bridge	Freeway	19.3	C	63.0	5595	4854	-741	87%
Piney Narrows Rd to Piney Creek Rd	Freeway	19.2	C	63.1	5591	4853	-738	87%
Piney Creek Rd to Chester Station Ln	Freeway	18.8	C	63.1	5483	4756	-727	87%
Weave from Chester Station Ln to Castle Marina Rd	Weave	15.4	B	61.9	5468	4775	-693	87%
Castle Marina Rd to Duke St	Freeway	20.1	C	61.6	5617	4959	-658	88%
Weave from Duke St to MD 8	Weave	20.5	C	48.8	5647	5008	-639	89%
MD 8 to Bay Bridge	Freeway	70.5	F	16.6	5550	4663	-887	84%
William Preston Lane Jr. Bay Bridge	Freeway	31.3	D	37.3	5550	4671	-879	84%
Bay Bridge to Oceanic Dr	Freeway	18.6	C	62.3	5550	4627	-923	83%
Oceanic Dr to MD 179	Freeway	35.0	E	33.8	5576	4599	-977	82%
MD 179 to Bay Dale Dr	Freeway	152.4	F	6.9	6000	4208	-1792	70%
Bay Dale Dr to MD 2/MD 450	Freeway	64.2	F	18.4	6520	4702	-1819	72%

Table 6-26: VISSIM Queuing Results: Alternatives D and E (8-8-8) Summer Weekend Scenario

Time	Typical Summer Friday			Typical Summer Sunday		
	Eastbound Maximum Queue (miles)			Westbound Maximum Queue (miles)		
	Between U.S. 50/301 Split & Start of Bay Bridge (1)	From Start of Bay Bridge to End of Queue	Total	Between Start of Queue at MD 2 & Start of Bay Bridge (2)	From Start of Bay Bridge to End of Queue	Total
10-11 AM	0.0	0.1	n/a (3)	0.1	0.2	n/a (3)
11 AM – 12 PM	0.0	0.4	n/a (3)	1.7	0.6	n/a (3)
12-1 PM	0.8	0.8	n/a (3)	3.4	1.0	n/a (3)
1-2 PM	2.1	1.1	n/a (3)	5.5	1.3	n/a (3)
2-3 PM	4.4	1.3	n/a (3)	9.2	1.8	10.9
3-4 PM	4.6	1.5	n/a (3)	9.3	3.6	12.8
4-5 PM	5.9	1.7	n/a (3)	9.3	5.7	15.0
5-6 PM	7.3	1.9	n/a (3)	9.3	7.7	17.0
6-7 PM	8.3	1.9	n/a (3)	9.3	9.1	18.4
7-8 PM	11.1	1.4	n/a (3)	9.3	>11.0 (4)	>20.3 (4)
8-9 PM	10.7	0.0	n/a (3)	9.3	>11.0 (4)	>20.3 (4)
9-10 PM	7.2	0.0	n/a (3)	8.5	>11.0 (4)	n/a (3)
10-11 PM	3.0	0.0	n/a (3)	4.7	>11.0 (4)	n/a (3)
Max. Queue	**11.1**	**1.9**	n/a (3)	**9.3**	>11.0 (4)	>20.3 (4)
Hours with Queue > 1 Mile	**10**	**7**	n/a (3)	**12**	**11**	**7**

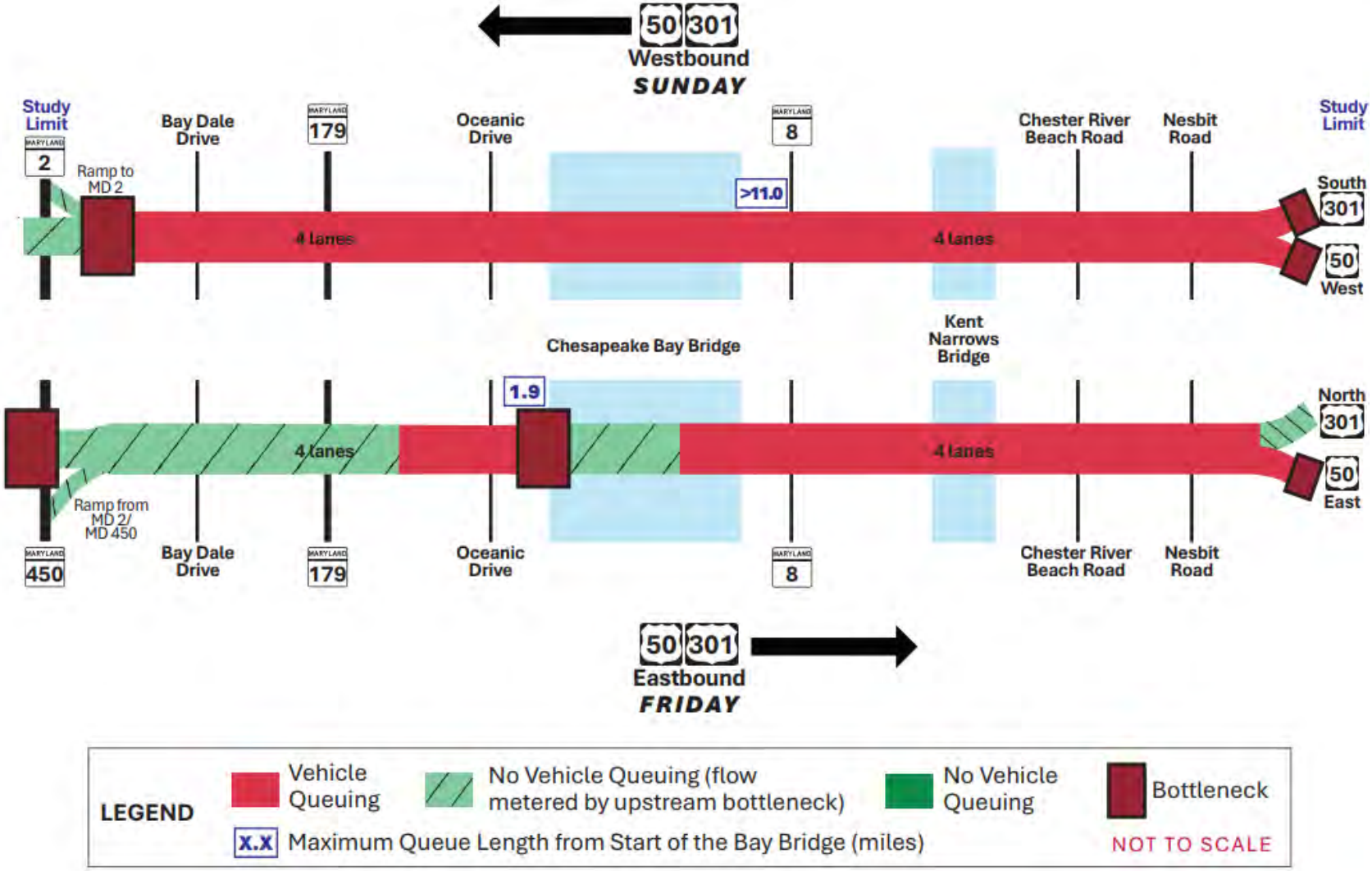
(1) 13.8 miles from U.S. 50/301 Split to start of eastbound Bay Bridge (9.6 miles on Eastern Shore and 4.2 miles on Bay Bridge)

(2) 9.3 miles from MD 2 merge point to start of westbound Bay Bridge: (5.1 miles on Western Shore and 4.2 miles on Bay Bridge).

(3) Queues from end of study area do not extend to the start of the Bay Bridge.

(4) Queues extend beyond the end of the study area.

Figure 6-23: Bottleneck Diagram: Alternatives D and E (8-8-8) Summer Weekend Scenario



Note: In the eastbound direction, at the eastern end of the Tier 2 Study Limits, the bottleneck will actually occur on U.S. 50, just east of the Queenstown Premium Outlets, where the three lanes on eastbound U.S. 50 will be reduced to the existing two lanes. For simplicity and for consistency with the other bottleneck diagrams, the bottleneck is shown at the U.S. 301 split.

Table 6-27: Travel Time Results for Alternatives D and E: 8-8-8 during SWED, Peak Hour of Queuing

Alternatives D/E: 8-8-8 Conditions		Eastbound US 50/301		Westbound U.S. 50/301	
		MD 2/MD 450 to Start of Bay Bridge	Start of Bay Bridge to US 50 301 Split	US 50/301 Split to Start of Bay Bridge	Start of Bay Bridge to MD 2/ MD 450
Summer Weekend	Max Travel Time (min)	10	67	92	62
	Speed at Max Travel Time (mph)	30.0	21.4	5.6	11.9

Table 6-28: SWED Throughput at Bay Bridge in Peak Hour of Volume

Alternative	SWED					
	Eastbound			Westbound		
	Forecast Peak Hour Volume (12:00 - 1:00 PM)	Peak Hour Volume Able to Cross the Bay Bridge (Throughput)	Throughput Percentage	Forecast Peak Hour Volume (12:00 - 1:00 PM)	Peak Hour Volume Able to Cross the Bay Bridge (Throughput)	Throughput Percentage
8-8-8	5,550	5155	93%	5,550	4671	84%

Tables 6-24 through 6-28 and **Figure 6-23** show the following results for Alternative D/E: 8-8-8:

1. Eastbound traffic flow entering the Tier 2 Study Limits is metered by a bottleneck to the west of the Study Area. With four lanes on eastbound U.S. 50/301, starting at the western end of the Tier 2 Study Limits, flow is still metered to a slight extent. Sufficient traffic flow is able to reach the bridge to result in queues. Some diversion to Whitehall Road would be expected during these periods of queuing.
2. Steady queues of one to two miles were observed at the start of the Bay Bridge for eastbound U.S. 50/301 during middle hours of the model run.
3. At the U.S. 50/301 split near the eastern limit of the Study Area, queues form in the eastbound direction due to a lane drop on U.S. 50 past the U.S. 301 split. These queues extended approximately to the Bay Bridge in the model runs. This would lead to diversion to eastbound MD 18. The 6-8-6 model did not exhibit queues of this length due to the traffic being metered on the Western Shore, thus reducing the volume throughput on the Bay Bridge, and thus allowing fewer vehicles to reach the U.S. 301 split.
4. Westbound queues from a bottleneck at the western limit of the study area would begin to extend past the Bay Bridge in the peak hour. This bottleneck is not caused by the ramp to MD 2, but rather by the U.S. 50/301 mainline, where the cross-section returns to the existing three lanes. The westbound direction experiences more significant queuing in the later hours of the day that extends back onto the Eastern Shore, and to the eastern limit of the Study Area. Thus, the westbound queues presented for this scenario are not caused by the Bay Bridge itself. On the Western Shore, these queues

could lead to diversion to College Parkway for traffic wishing to travel on northbound MD 2. Diversion of traffic wishing to travel over the Severn River would also be likely, despite to the circuitousness of the likely diversion route, due to the extent of the queues on U.S. 50/301. Diversion to westbound MD 18 on the Eastern Shore would be expected.

5. Speeds would be a maximum of 30 mph and would be higher in the eastbound direction than in the westbound direction. Throughput would be above 90% for the eastbound direction, and below 85% for the westbound direction.

6.8.3 Alternative D/E: 8-8-8 Non-Summer Weekday (NSWD) Scenario

Roadway geometry in Alternative D/E: 8-8-8 NSWD model matches that of the 8-8-8 Summer Weekend model. The results of Alternative D/E: 8-8-8 NSWD VISSIM analyses are shown in **Tables 6-29 through 6-33**. Delay, LOS, and speeds along U.S. 50/301 throughout the corridor, during the peak volume hour at the Bay Bridge, are shown in **Tables 6-29 and 6-30**. Queue lengths and durations at the Bay Bridge are shown in **Table 6-31**. A bottleneck diagram, visually summarizing the results of the analyses, is shown in **Figure 6-24**. A summary of travel times and speeds is shown in **Table 6-32**. Throughput is shown in **Table 6-33**.

Table 6-29: VISSIM Eastbound U.S. 50/301 Segment Results: Alternatives D and E (8-8-8) NSWD Scenario

Eastbound Segment Name	Segment Type	NSWD (PM Peak Hour)						
		Density (veh/ln/mi)	LOS	Speed (mph)	Volume Expected	Volume Actual	Unmet Demand	Throughput %
MD 2/MD 450 to Ferguson Rd	Freeway	23.5	C	61.7	5974	5807	-166	97%
Ferguson Rd to MD 179	Freeway	20.2	C	62.3	5139	5043	-96	98%
MD 179 to Whitehall Rd (Exit 30)	Freeway	17.2	B	62.9	4214	4331	116	103%
Whitehall Rd (Exit 30) to Oceanic Dr	Freeway	17.1	B	63.2	4410	4312	-98	98%
Oceanic Dr to Bay Bridge	Freeway	24.8	C	30.7	4650	4578	-72	98%
William Preston Lane Jr. Bay Bridge	Freeway	28.1	D	27.1	4650	4568	-82	98%
Bay Bridge to MD 8	Freeway	24.1	C	31.5	4650	4548	-102	98%
Weave from MD 8 to Thompson Creek Rd	Weave	17.2	B	49.7	4795	4268	-527	89%
Thompson Creek Rd to Cox Neck Rd	Freeway	20.3	C	54.2	4915	4400	-515	90%
Weave from Cox Neck Rd to Dominion Rd	Weave	16.2	B	55.3	4935	4474	-461	91%
Dominion Rd to S Piney Rd	Freeway	18.9	C	56.7	4700	4296	-404	91%
Weave from S Piney Rd to Dundee Ave	Weave	15.6	B	56.5	4775	4413	-362	92%
Weave from Dundee Ave to Main St/MD 18 (Exit 41)	Weave	16.6	B	53.1	4795	4420	-375	92%
R Clayton Mitchell Jr Bridge	Freeway	19.4	C	56.7	4725	4388	-337	93%
Kent Narrows Rd to Main St/MD 18 (Exit 43A)	Freeway	19.5	C	56.7	4780	4410	-370	92%
Weave from Exit 43A to Chester River Beach Rd	Weave	15.5	B	56.6	4760	4399	-361	92%
Weave from Chester River Beach Rd to Station Ln	Weave	15.1	B	57.1	4635	4305	-330	93%
Weave from Station Ln to Evans Ave	Weave	15.0	B	56.7	4595	4264	-331	93%
Weave from Evans Ave to Hess Rd	Weave	14.7	B	57.1	4510	4193	-317	93%
Weave from Hess Rd to Nesbit Rd	Weave	14.9	B	56.6	4530	4200	-330	93%
U.S. 50/U.S. 301 Split	Merge/Diverge	19.1	B	55.6	4505	4237	-269	94%
U.S. 50 East of U.S. 50/U.S. 301 Split	Freeway	14.5	B	57.0	2617	2474	-143	95%
U.S. 301 East of U.S. 50/U.S. 301 Split	Freeway	15.6	B	56.1	1888	1754	-134	93%

Table 6-30: VISSIM Westbound U.S. 50/301 Segment Results: Alternatives D and E (8-8-8) NSWD Scenario

Westbound Segment Name	Segment Type	NSWD (AM Peak Hour)						
		Density (veh/ln/mi)	LOS	Speed (mph)	Volume Expected	Volume Actual	Unmet Demand	Throughput %
U.S. 301 East of U.S. 50/U.S. 301 Split	Freeway	12.9	B	63.2	1624	1634	10	101%
U.S. 50 East of U.S. 50/U.S. 301 Split	Freeway	17.8	B	58.7	2230	2093	-137	94%
U.S. 50/U.S. 301 Split	Merge/Diverge	14.7	B	63.3	3854	3717	-137	96%
Weave from Nesbit Rd to Hissey Rd	Weave	11.8	B	62.6	3858	3704	-154	96%
Weave from Hissey Rd to Winchester Creek Rd	Weave	12.4	B	60.5	3876	3739	-136	96%
Weave from Winchester Creek Rd to Vfw Ave	Weave	12.4	B	60.0	3871	3724	-147	96%
Vfw Ave to Chester River Beach Rd	Freeway	15.1	B	60.5	3818	3645	-173	95%
Weave from Chester River Beach Rd to Jackson Creek Rd	Weave	13.2	B	60.2	4128	3982	-145	96%
Main St/MD 18 (Exit 43A) to Kent Narrows Rd	Freeway	16.5	B	60.3	4119	3980	-139	97%
R Clayton Mitchell Jr. Bridge	Freeway	16.3	B	59.6	4026	3896	-130	97%
Piney Narrows Rd to Piney Creek Rd	Freeway	16.0	B	59.8	3964	3835	-129	97%
Piney Creek Rd to Chester Station Ln	Freeway	16.0	B	59.8	3969	3827	-141	96%
Weave from Chester Station Ln to Castle Marina Rd	Weave	13.0	B	58.8	3942	3822	-120	97%
Castle Marina Rd to Duke St	Freeway	17.7	B	58.7	4283	4163	-120	97%
Weave from Duke St to MD 8	Weave	17.8	B	47.1	4323	4187	-135	97%
MD 8 to Bay Bridge	Freeway	22.8	C	42.8	4150	3895	-255	94%
William Preston Lane Jr. Bay Bridge	Freeway	23.5	C	41.3	4150	3877	-273	93%
Bay Bridge to Oceanic Dr	Freeway	15.1	B	63.0	4150	3812	-338	92%
Oceanic Dr to MD 179	Freeway	15.3	B	63.1	4212	3865	-347	92%
MD 179 to Bay Dale Dr	Freeway	17.5	B	63.0	4787	4412	-375	92%
Bay Dale Dr to MD 2/MD 450	Freeway	29.7	D	44.0	5601	5139	-462	92%

Table 6-31: VISSIM Queuing Results: Alternatives D and E (8-8-8) NSWD Scenario

Time	Typical PM			Time	Typical AM		
	Eastbound Maximum Queue (miles)				Westbound Maximum Queue (miles)		
	Between U.S. 50/301 Split & Start of Bay Bridge (1)	From Start of Bay Bridge to End of Queue	Total		Between Start of Queue at MD 2 & Start of Bay Bridge (2)	From Start of Bay Bridge to End of Queue	Total
2-3 PM	0.0	0.0	n/a (3)	5-6 AM	0.0	0.0	n/a (3)
3-4 PM	0.0	0.0	n/a (3)	6-7 AM	0.1	0.0	n/a (3)
4-5 PM	0.0	0.0	n/a (3)	7-8 AM	0.6	0.1	n/a (3)
5-6 PM	0.0	0.0	n/a (3)	8-9 AM	0.9	0.0	n/a (3)
6-7 PM	0.0	0.0	n/a (3)	9-10 AM	0.9	0.0	n/a (3)
7-8 PM	0.0	0.0	n/a (3)	10-11 AM	0.6	0.0	n/a (3)
8-9 PM	0.0	0.0	n/a (3)	11-12 PM	0.3	0.0	n/a (3)
9-10 PM	0.0	0.0	n/a (3)	12-1 PM	0.1	0.0	n/a (3)
10-11 PM	0.0	0.0	n/a (3)	1-2 PM	0.0	0.0	n/a (3)
11-12 AM	0.0	0.0	n/a (3)	2-3 PM	0.1	0.0	n/a (3)
Max. Queue	**0.0**	**0.0**	n/a (3)	**Max. Queue**	**0.9**	**0.1**	n/a (3)
Hours with Queue > 1 Mile	**0**	**0**	n/a (3)	**Hours with Queue > 1 Mile**	**0**	**0**	n/a (3)

(1) 13.8 miles from U.S. 50/301 Split to start of eastbound Bay Bridge (9.6 miles on Eastern Shore and 4.2 miles on Bay Bridge).

(2) 9.3 miles from MD 2 merge point to start of westbound Bay Bridge: (5.1 miles on Western Shore and 4.2 miles on Bay Bridge).

(3) Queues from end of study area do not extend to the start of the Bay Bridge.

Figure 6-24: Bottleneck Diagram: Alternatives D and E (8-8-8) NSWD Scenario (Eastbound PM, Westbound AM)

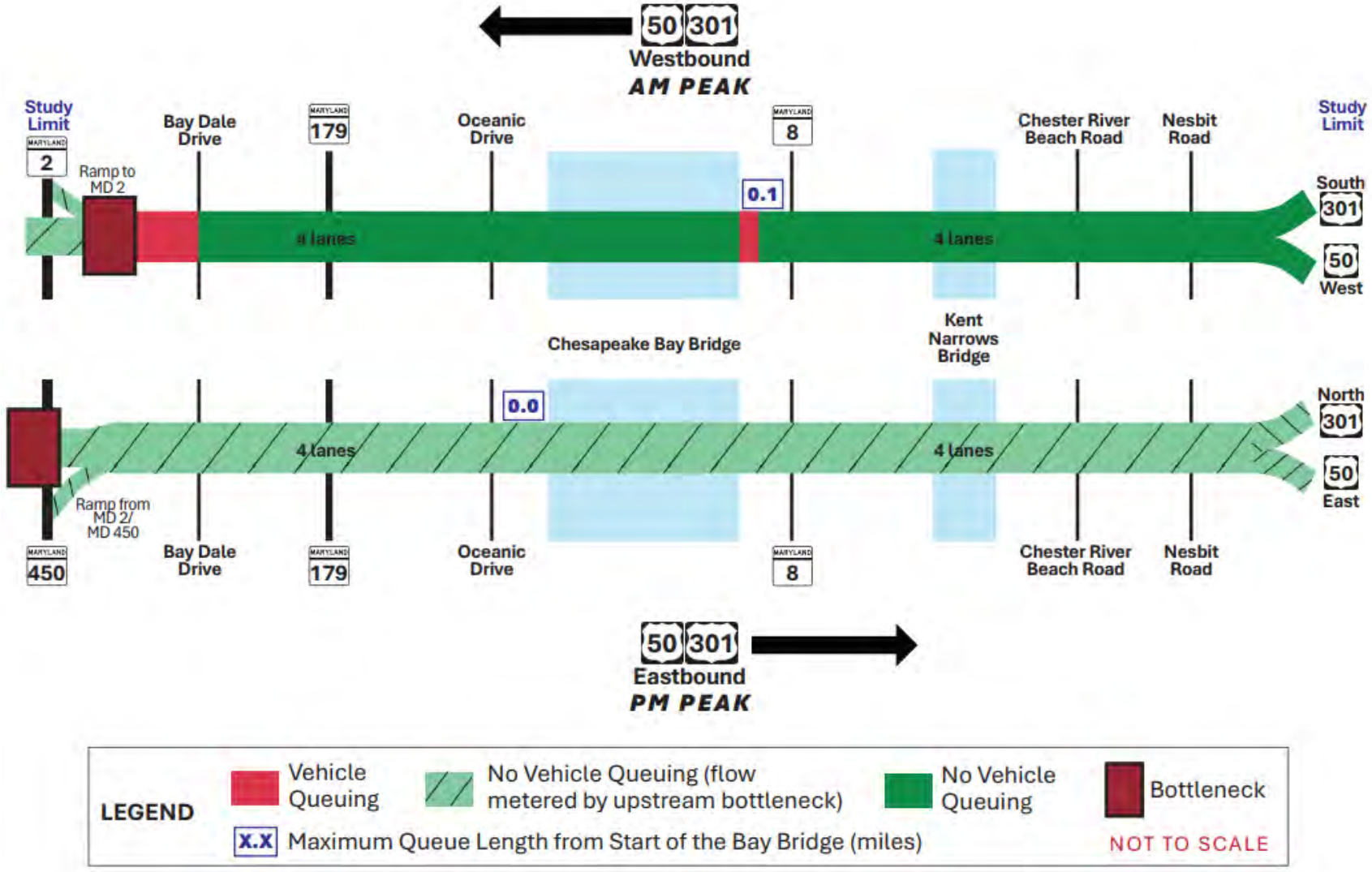


Table 6-32: Travel Time Results for Alternatives D and E: 8-8-8 during NSWD, Peak Hour of Queuing

Alternatives D/E: 8-8-8 Conditions		Eastbound US 50/301		Westbound U.S. 50/301	
		MD 2/MD 450 to Start of Bay Bridge	Start of Bay Bridge to US 50 301 Split	US 50/301 Split to Start of Bay Bridge	Start of Bay Bridge to MD 2/ MD 450
Non-Summer Weekday	Max Travel Time (min)	6	17	10	16
	Speed at Max Travel Time (mph)	50.0	52.1	51.6	42.8

Table 6-33: NSWD Throughput in Peak Hour of Volume

Alternative	NSWD					
	Eastbound			Westbound		
	Forecast Peak Hour Volume (4:00 - 5:00 PM)	Peak Hour Volume Able to Cross the Bay Bridge (Throughput)	Throughput Percentage	Forecast Peak Hour Volume (7:00 - 8:00 AM)	Peak Hour Volume Able to Cross the Bay Bridge (Throughput)	Throughput Percentage
8-8-8	4,650	4568	98%	4,150	3877	93%

Tables 6-29 through **6-33** and **Figure 6-24** show the following results for Alternative D/E: 8-8-8.

1. No operational deficiencies were identified for eastbound U.S. 50/301 in the PM NSWD analysis. Segments all operated at LOS C or better during the PM volume peak hour and no queueing was observed at the start of the Bay Bridge throughout the PM period. Thus, no diversion to local roads would be expected. There was a bottleneck located to the west of the Tier 2 Study Limits, but the addition of a fourth lane at the MD 2/MD 450 interchange eliminated the effects of that bottleneck.
2. No operational deficiencies were identified for westbound U.S. 50/301 in the AM NSWD analysis, except near the western Study Limit. Segments all operated at LOS D or better during the AM volume peak hour and no queuing was observed at the start of the Bay Bridge throughout the AM period. There was a bottleneck located to the west of the Tier 2 Study Limits, which would cause some limited queuing to develop in the Tier 2 Study Limits. Diversion from these queues would be expected to be minimal, but could still occur, particularly for traffic wishing to travel northbound on MD 2.
3. Speeds would generally be 50 mph or higher. The exception to this would be westbound, downstream of the Bay Bridge, where speeds would be below 45 mph. Throughput would be above 90%, for both directions.

6.9 Analysis of Alternatives F/G: 8-10-8

6.9.1 Daily Volumes

Daily NSWD and SWED volumes for Alternatives F/G: 8-10-8, including each interchange in the Tier 2 Study Limits, are shown in **Figures 6-25 through 6-30**.

Figure 6-25: Westbound Daily Traffic Volumes between the Severn River Bridge and the Bay Bridge: 2045 Alternatives F and G (8-10-8)

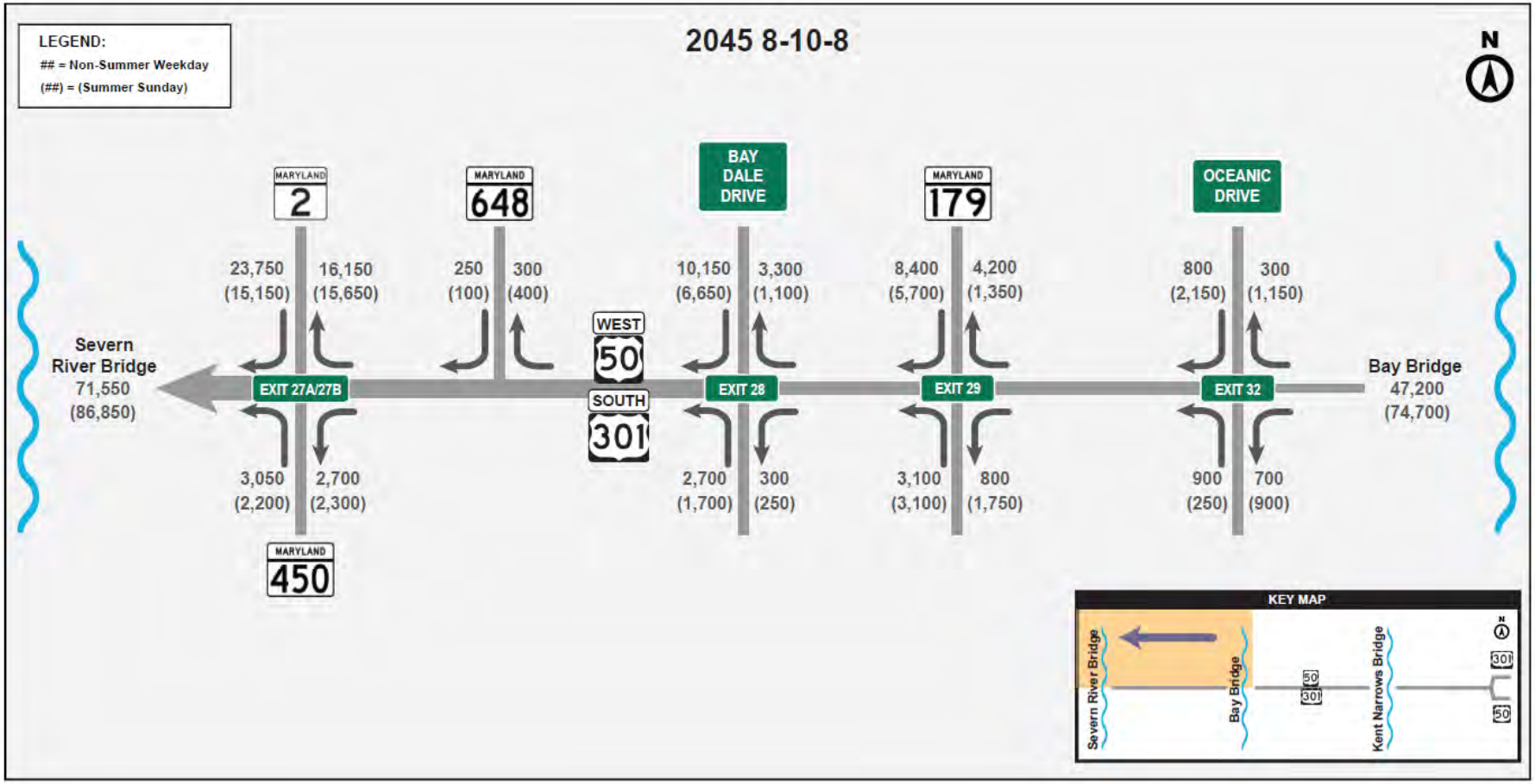


Figure 6-26: Eastbound Daily Traffic Volumes between the Severn River Bridge and the Bay Bridge: 2045 Alternatives F and G (8-10-8)

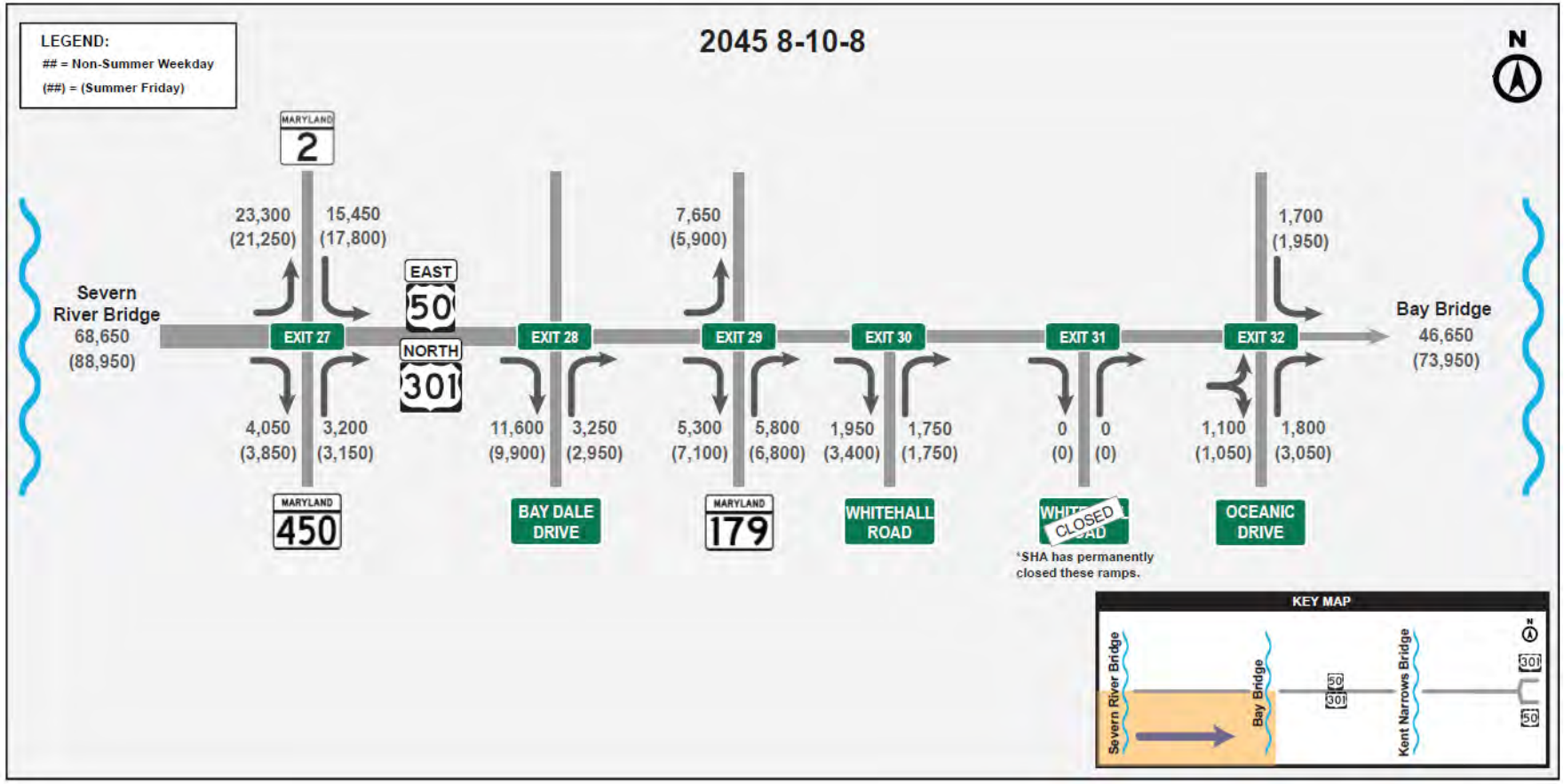


Figure 6-27: Westbound Daily Traffic Volumes between the Kent Narrows Bridge and the U.S. 50/301 Split: 2045 Alternatives F and G (8-10-8)

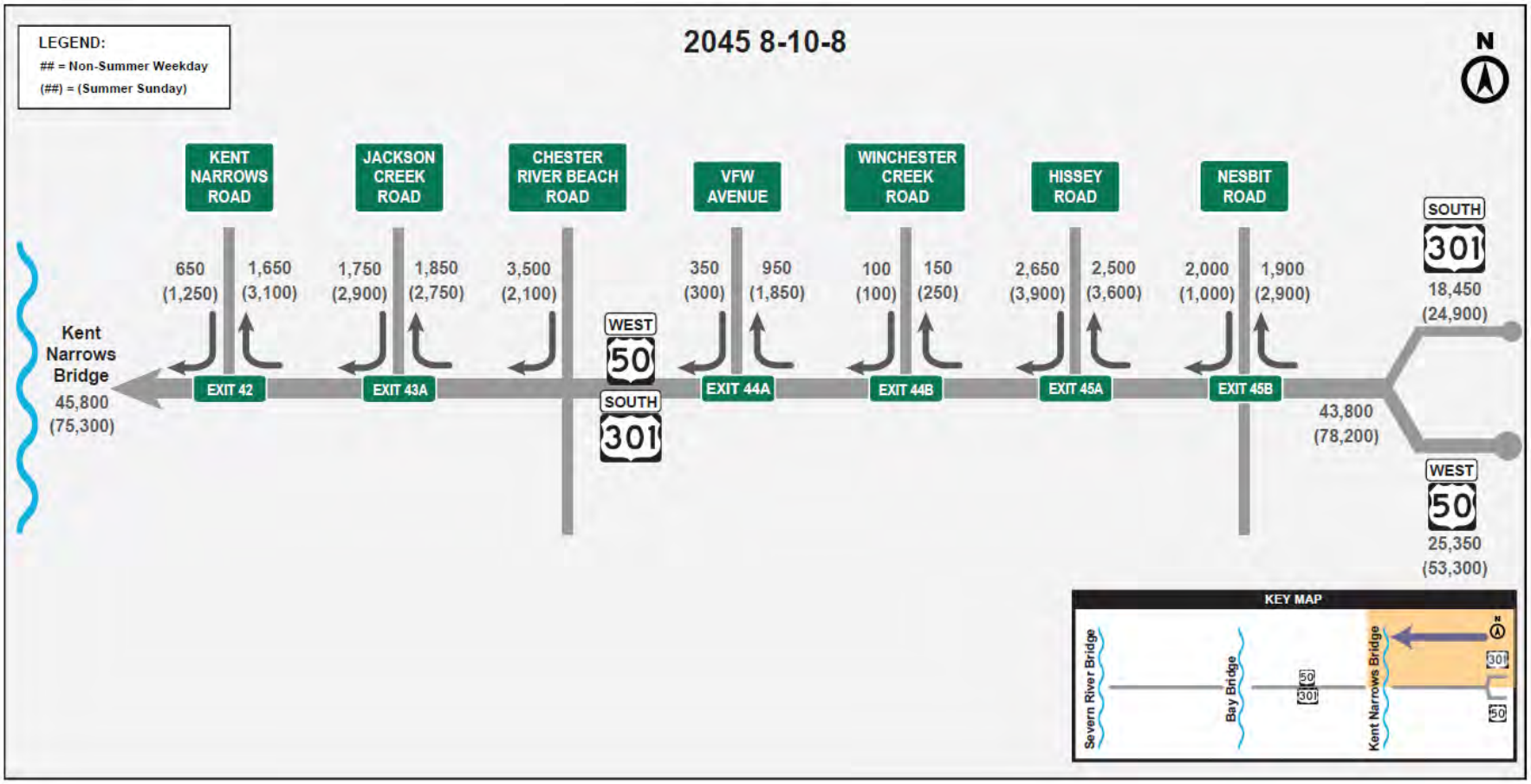


Figure 6-28: Westbound Daily Traffic Volumes between the Bay Bridge and the Kent Narrows Bridge: 2045 Alternatives F and G (8-10-8)

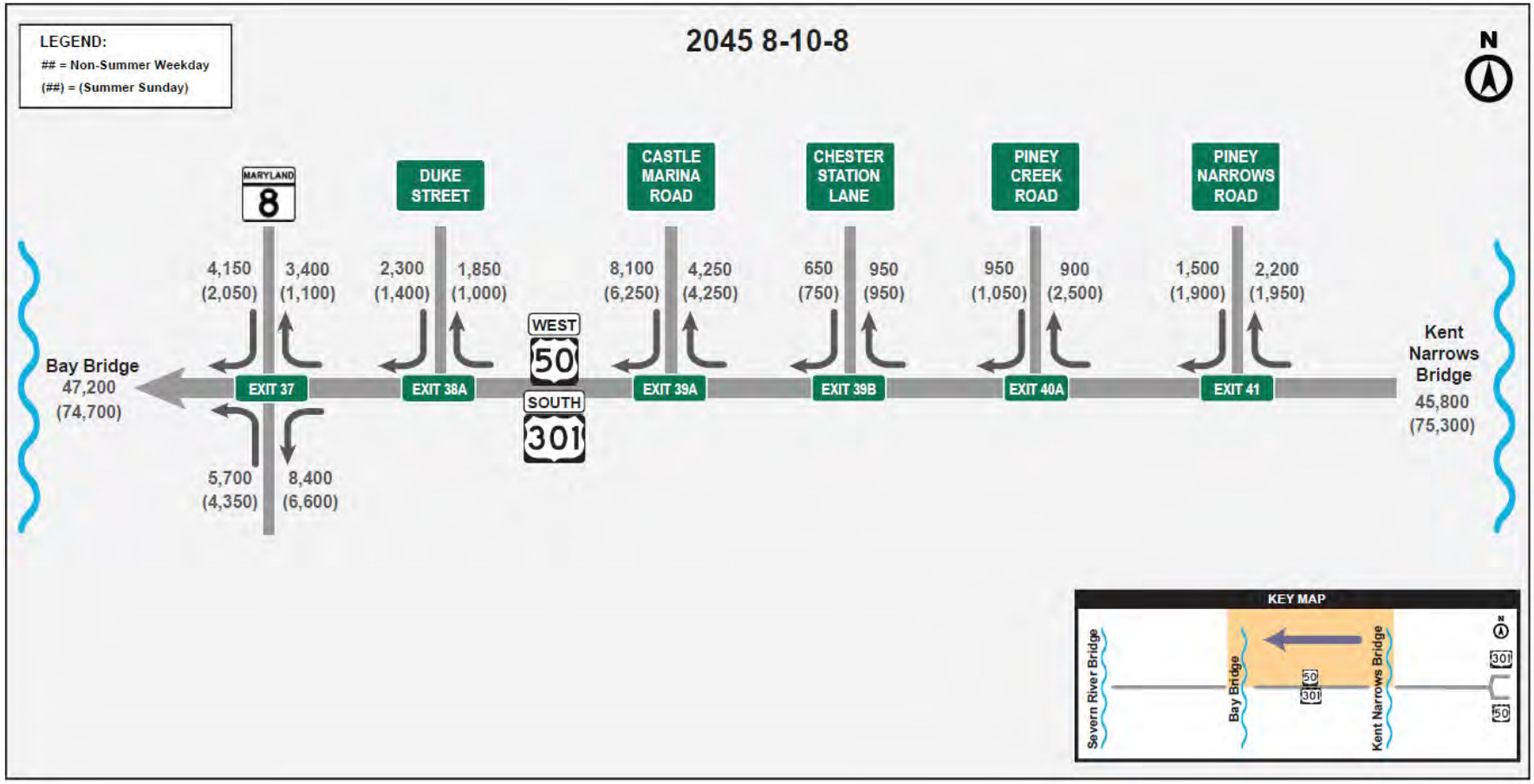


Figure 6-29: Eastbound Daily Traffic Volumes between the Bay Bridge and the Kent Narrows Bridge: 2045 Alternatives F and G (8-10-8)

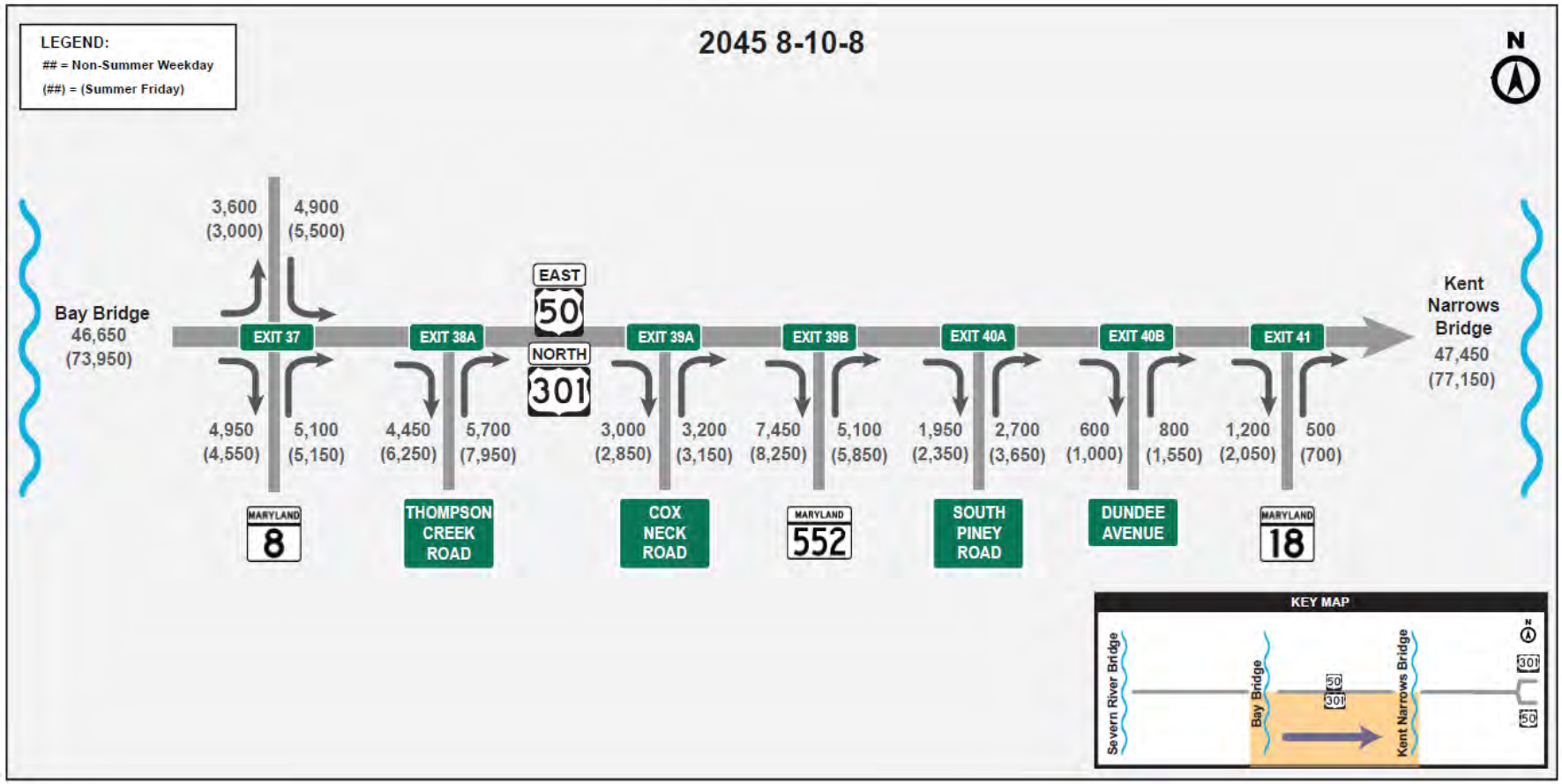
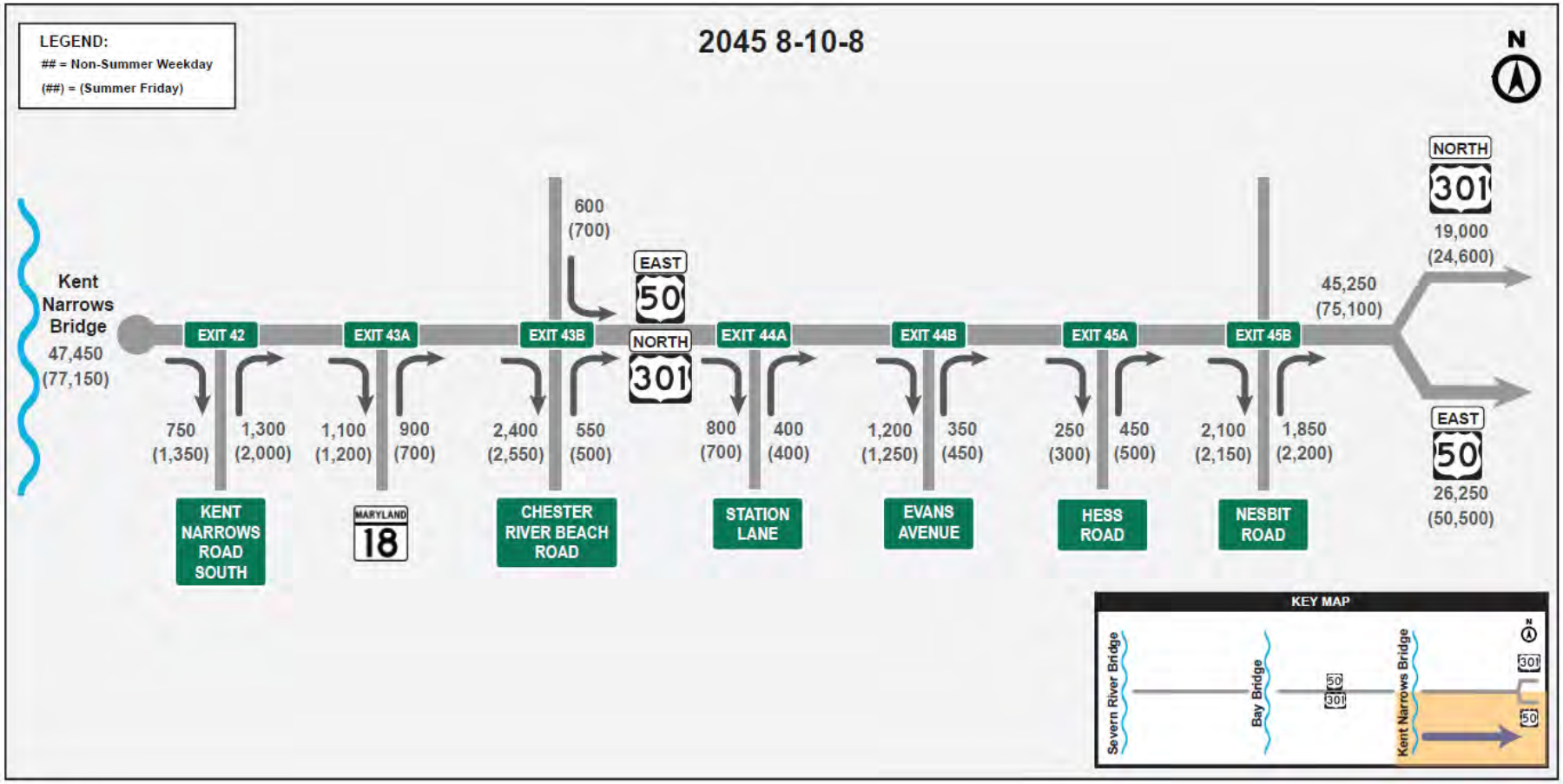


Figure 6-30: Eastbound Daily Traffic Volumes between the Kent Narrows Bridge and the U.S. 50/301 Split: 2045 Alternatives F and G (8-10-8)



6.9.2 Alternative F/G: 8-10-8 Summer Weekend Scenario

In the Alternative F/G: 8-10-8 model, U.S. 50/301 includes ten-lane roadway approaches and a ten-lane section on the Bay Bridge. Approximately two miles from the Bridge, the ten-lane roadway ties into an eight-lane roadway configuration. The eight-lane roadway sections tie into the existing roadway configuration near the limits of the Tier 2 Study Limits similar to the Alternative D/E: 8-8-8 model.

Specifically, on the Western Shore, the tie-in occurs on the eastern side of the MD 2/MD 450 interchange. In the eastbound direction, the ramp from MD 2/MD 450 becomes the fourth lane on U.S. 50/301. In the westbound direction, the fourth lane is dropped as an "exit only" lane to MD 2.

On the Eastern Shore, the tie-in occurs for westbound traffic on the ramp from U.S. 301 before the merge. U.S. 50 and U.S. 301 meet at the merge with two lanes on each roadway, forming four lanes. For eastbound traffic at the U.S. 301 split, U.S. 301 continues as two lanes and U.S. 50 has three lanes that extend to the east of the traffic signal at the Queenstown Premium Outlets.

The results of the Alternative F/G: 8-10-8 Summer Weekend VISSIM analyses are shown in **Tables 6-34 through 6-38**. Delay, LOS and speeds along U.S. 50/301 throughout the corridor, during the peak volume hour at the Bay Bridge, are shown in **Tables 6-34 and 6-35**. Queue lengths and durations at the Bay Bridge are shown in **Table 6-36**. A bottleneck diagram, visually summarizing the results of the analyses, is shown in **Figure 6-31**. A summary of travel times and speeds is shown in **Table 6-37.** Throughput is shown in **Table 6-38.**

Table 6-34: VISSIM Eastbound US 50/301 Segment Results: Alternatives F and G (8-10-8) Summer Weekend Scenario

Eastbound Segment Name	Segment Type	SWED (Friday Peak Hour)						
		Density (veh/ln/mi)	LOS	Speed (mph)	Volume Expected	Volume Actual	Unmet Demand	Throughput %
MD 2/MD 450 to Ferguson Rd	Freeway	24.9	C	62.0	6366	6181	-185	97%
Ferguson Rd to MD 179	Freeway	22.9	C	62.2	5844	5689	-155	97%
MD 179 to Whitehall Rd (Exit 30)	Freeway	20.9	C	62.7	5102	5230	128	103%
Whitehall Rd (Exit 30) to Oceanic Dr	Freeway	20.4	C	62.8	5254	5114	-140	97%
Oceanic Dr to Bay Bridge	Freeway	23.1	C	31.2	5550	5403	-147	97%
William Preston Lane Jr. Bay Bridge	Freeway	26.0	C	27.6	5550	5386	-164	97%
Bay Bridge to MD 8	Freeway	22.6	C	31.7	5550	5376	-174	97%
Weave from MD 8 to Thompson Creek Rd	Weave	17.4	B	51.9	5784	5399	-385	93%
Thompson Creek Rd to Cox Neck Rd	Freeway	23.4	C	59.7	5912	5577	-335	94%
Weave from Cox Neck Rd to Dominion Rd	Weave	19.0	B	58.9	5934	5593	-341	94%
Dominion Rd to S Piney Rd	Freeway	22.9	C	59.1	5754	5405	-349	94%
Weave from S Piney Rd to Dundee Ave	Weave	18.3	B	60.5	5852	5533	-319	95%
Weave from Dundee Ave to Main St/MD 18 (Exit 41)	Weave	21.7	C	51.5	5893	5557	-336	94%
R Clayton Mitchell Jr Bridge	Freeway	22.0	C	62.6	5792	5503	-289	95%
Kent Narrows Rd to Main St/MD 18 (Exit 43A)	Freeway	22.1	C	62.5	5841	5537	-304	95%
Weave from Exit 43A to Chester River Beach Rd	Weave	18.1	B	60.7	5804	5489	-315	95%
Weave from Chester River Beach Rd to Station Ln	Weave	17.3	B	62.6	5704	5402	-302	95%
Weave from Station Ln to Evans Ave	Weave	17.4	B	61.7	5681	5376	-305	95%
Weave from Evans Ave to Hess Rd	Weave	17.3	B	61.8	5621	5331	-290	95%
Weave from Hess Rd to Nesbit Rd	Weave	19.4	B	56.5	5636	5319	-317	94%
U.S. 50/U.S. 301 Split	Merge/Diverge	72.5	F	18.1	5640	5021	-619	89%
U.S. 50 East of U.S. 50/U.S. 301 Split	Freeway	128.1	F	8.3	3794	3150	-644	83%
U.S. 301 East of U.S. 50/U.S. 301 Split	Freeway	13.3	B	60.4	1846	1603	-243	87%

Table 6-35: VISSIM Westbound US 50/301 Segment Results: Alternatives F and G (8-10-8) Summer Weekend Scenario

Westbound Segment Name	Segment Type	SWED (Sunday Peak Hour)						
		Density (veh/ln/mi)	LOS	Speed (mph)	Volume Expected	Volume Actual	Unmet Demand	Throughput %
U.S. 301 East of U.S. 50/U.S. 301 Split	Freeway	14.7	B	62.9	1850	1849	-1	100%
U.S. 50 East of U.S. 50/U.S. 301 Split	Freeway	26.7	D	57.7	3961	3083	-878	78%
U.S. 50/U.S. 301 Split	Merge/Diverge	19.5	B	63.1	5811	4910	-901	84%
Weave from Nesbit Rd to Hissey Rd	Weave	15.6	B	61.8	5670	4816	-854	85%
Weave from Hissey Rd to Winchester Creek Rd	Weave	15.7	B	62.2	5693	4898	-795	86%
Weave from Winchester Creek Rd to Vfw Ave	Weave	15.6	B	62.4	5681	4882	-799	86%
Vfw Ave to Chester River Beach Rd	Freeway	18.7	C	63.4	5566	4747	-819	85%
Weave from Chester River Beach Rd to Jackson Creek Rd	Weave	15.8	B	62.7	5722	4939	-783	86%
Main St/MD 18 (Exit 43A) to Kent Narrows Rd	Freeway	19.6	C	63.1	5733	4948	-785	86%
R Clayton Mitchell Jr. Bridge	Freeway	19.2	C	63.1	5596	4842	-754	87%
Piney Narrows Rd to Piney Creek Rd	Freeway	19.2	C	63.1	5592	4845	-747	87%
Piney Creek Rd to Chester Station Ln	Freeway	18.8	C	63.1	5484	4750	-734	87%
Weave from Chester Station Ln to Castle Marina Rd	Weave	15.4	B	62.1	5469	4778	-691	87%
Castle Marina Rd to Duke St	Freeway	20.0	C	61.9	5617	4957	-660	88%
Weave from Duke St to MD 8	Weave	16.8	B	49.7	5647	5014	-633	89%
MD 8 to Bay Bridge	Freeway	21.0	C	46.4	5550	4876	-674	88%
William Preston Lane Jr. Bay Bridge	Freeway	23.6	C	41.4	5550	4880	-670	88%
Bay Bridge to Oceanic Dr	Freeway	15.4	B	62.9	5550	4844	-706	87%
Oceanic Dr to MD 179	Freeway	67.4	F	17.3	5577	4483	-1094	80%
MD 179 to Bay Dale Dr	Freeway	157.4	F	6.6	6000	4166	-1834	69%
Bay Dale Dr to MD 2/MD 450	Freeway	65.6	F	17.9	6519	4682	-1837	72%

Table 6-36: VISSIM Queuing Results: Alternatives F and G (8-10-8) Summer Weekend Scenario

Time	Typical Summer Friday			Typical Summer Sunday		
	Eastbound Maximum Queue (miles)			Westbound Maximum Queue (miles)		
	Between U.S. 50/301 Split & Start of Bay Bridge (1)	From Start of Bay Bridge to End of Queue	Total	Between Start of Queue at MD 2 & Start of Bay Bridge (2)	From Start of Bay Bridge to End of Queue	Total
10-11 AM	0.0	0.0	n/a (3)	0.1	0.0	n/a (3)
11 AM – 12 PM	0.0	0.0	n/a (3)	2.0	0.0	n/a (3)
12-1 PM	1.1	0.0	n/a (3)	3.9	0.0	n/a (3)
1-2 PM	2.5	0.0	n/a (3)	5.6	0.0	n/a (3)
2-3 PM	5.1	0.0	n/a (3)	7.8	0.0	n/a (3)
3-4 PM	5.7	0.0	n/a (3)	9.2	0.5	9.8
4-5 PM	7.3	0.0	n/a (3)	9.3	1.7	11.0
5-6 PM	8.8	0.0	n/a (3)	9.3	3.2	12.5
6-7 PM	9.4	0.0	n/a (3)	9.3	4.1	13.4
7-8 PM	10.3	0.0	n/a (3)	9.3	6.3	15.6
8-9 PM	9.6	0.0	n/a (3)	9.3	6.9	16.2
9-10 PM	7.7	0.0	n/a (3)	9.3	6.7	16.0
10-11 PM	3.3	0.0	n/a (3)	9.3	4.6	13.9
Max. Queue	**10.3**	**0.0**	n/a (3)	**9.3**	**6.9**	**16.2**
Hours with Queue > 1 Mile	**11**	**0**	n/a (3)	**12**	**7**	**8**

(1) 13.8 miles from U.S. 50/301 Split to start of eastbound Bay Bridge (9.6 miles on Eastern Shore and 4.2 miles on Bay Bridge).

(2) 9.3 miles from MD 2 merge point to start of westbound Bay Bridge: (5.1 miles on Western Shore and 4.2 miles on Bay Bridge).

(3) Queues from end of study area do not extend to the start of the Bay Bridge.

Figure 6-31: Bottleneck Diagram: Alternatives F and G (8-10-8) Summer Weekend Scenario

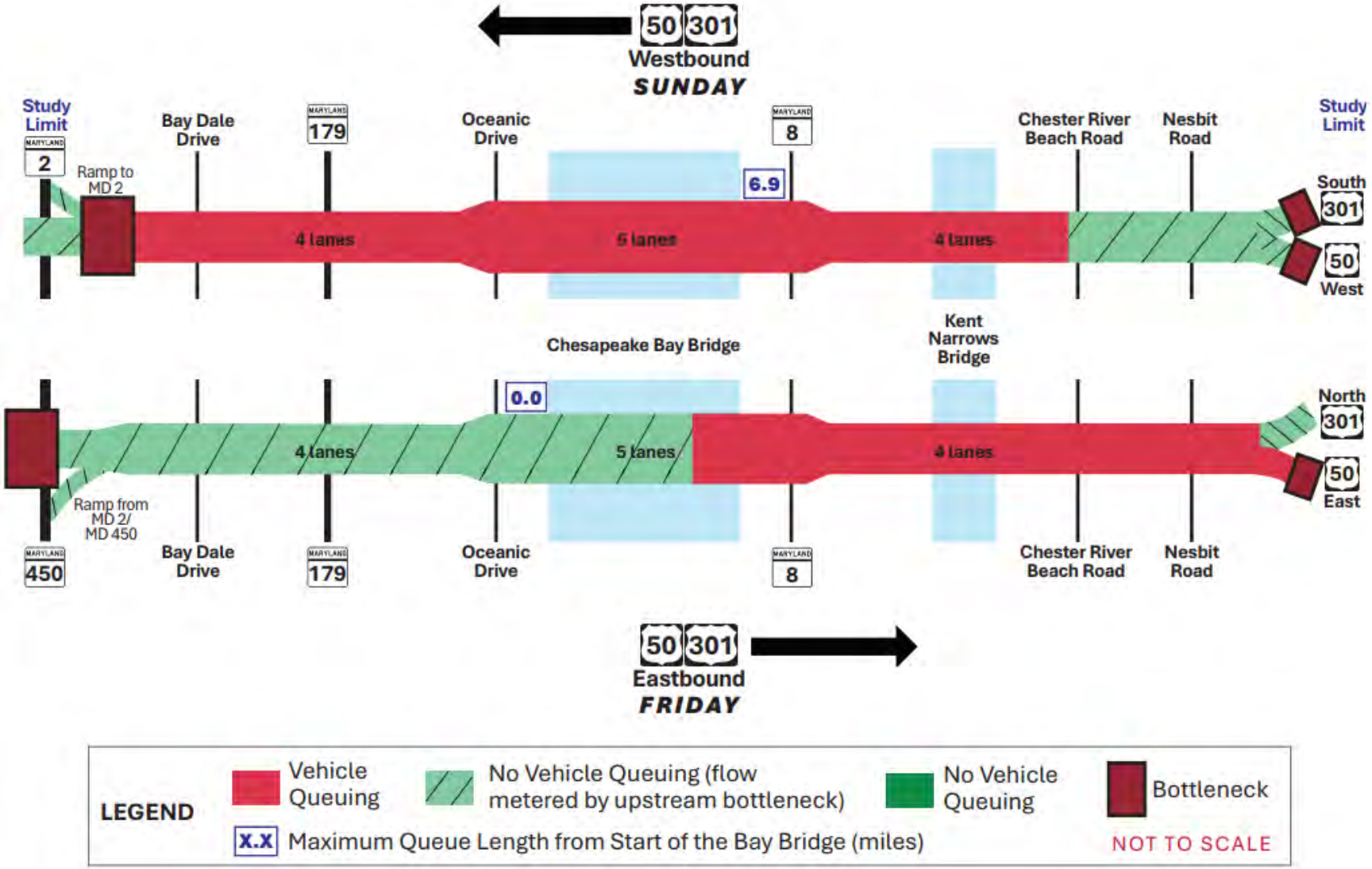


Table 6-37: Travel Time Results for Alternatives F and G: 8-10-8 during SWED, Peak Hour of Queuing

Alternatives F/G: 8-10-8 Conditions		Eastbound US 50/301		Westbound U.S. 50/301	
		MD 2/MD 450 to Start of Bay Bridge	Start of Bay Bridge to US 50 301 Split	US 50/301 Split to Start of Bay Bridge	Start of Bay Bridge to MD 2/ MD 450
Summer Weekend	Max Travel Time (min)	6	79	58	78
	Speed at Max Travel Time (mph)	50.0	17.5	8.9	8.6

Table 6-38: SWED Throughput at Bay Bridge in Peak Hour of Volume

Alternative	SWED					
	Eastbound			Westbound		
	Forecast Peak Hour Volume (12:00 - 1:00 PM)	Peak Hour Volume Able to Cross the Bay Bridge (Throughput)	Throughput Percentage	Forecast Peak Hour Volume (12:00 - 1:00 PM)	Peak Hour Volume Able to Cross the Bay Bridge (Throughput)	Throughput Percentage
8-10-8	5,550	5386	97%	5,550	4880	88%

Tables 6-34 through 6-38 and **Figure 6-31** show the following results for Alternative F/G: 8-10-8:

1. In the eastbound direction, there is no queuing at the Bay Bridge. This is due to the flow being metered by the bottleneck outside the western limit of the Tier 2 Study Limits. Thus, no diversion would be expected on the eastbound approach to the Bay Bridge.
2. In the eastbound direction, there is a bottleneck at the eastern limit of the Tier 2 Study Limits, where the cross section of U.S. 50 returns to its existing two lanes. This is similar to the queues exhibited in the Alternative D/E: 8-8-8 model runs, although the queues in the Alternative F/G: 8-10-8 model runs were longer due to additional forecasted volume. Because of these queues, diversion to eastbound MD 18 would be expected.
3. In the westbound direction, there is a bottleneck at the western limit of the Tier 2 Study Limits. This bottleneck is not caused by the ramp to MD 2, but rather by the U.S. 50/301 mainline, where the cross section returns to the existing three lanes. On the Western Shore, these queues could lead to diversion to College Parkway for traffic wishing to travel on northbound MD 2. Diversion of traffic wishing to travel over the Severn River would also be likely, despite to the circuitousness of the likely diversion route, due to the extent of the queues on U.S. 50/301.
4. There are westbound queues noted in **Table 6-36** for the Bay Bridge. These are not caused by the Bay Bridge itself, but rather by the bottleneck at the western Study Limit that cause the queues to extend across the Bay Bridge and onto the Eastern Shore. Diversion to westbound MD 18 on the Eastern Shore would be expected.

5. There is also a westbound bottleneck to the east of the Tier 2 Study Limits that meters traffic flow into the Study Area and toward the bridge.

6. Speeds would be low, generally below 20 mph. The exception would be eastbound, approaching the Bay Bridge, where speeds of 50 mph are expected. Throughput would be well above 90% for eastbound, and above 85% for westbound traffic.

6.9.3 Alternative F/G: 8-10-8 Non-Summer Weekday (NSWD) Scenario

Roadway geometry in Alternative F/G: 8-10-8 NSWD model matches that of the 8-10-8 Summer Weekend model. The results of Alternative F/G: 8-10-8 NSWD VISSIM analyses are shown in **Tables 6-39 through 6-43**. Delay, LOS, and speeds along U.S. 50/301 throughout the corridor, during the peak volume hour at the Bay Bridge, are shown in **Tables 6-39 and 6-40**. Queue lengths and durations at the Bay Bridge are shown in **Table 6-41**. A bottleneck diagram, visually summarizing the results of the analyses, is shown in **Figure 6-32**. A summary of travel times and speeds is shown in **Table 6-42**. Throughput is shown in **Table 6-43.**

Table 6-39: VISSIM Eastbound U.S. 50/301 Segment Results: Alternatives F and G (8-10-8) NSWD Scenario

Eastbound Segment Name	Segment Type	NSWD (PM Peak Hour						
		Density (veh/ln/mi)	LOS	Speed (mph)	Volume Expected	Volume Actual	Unmet Demand	Throughput %
MD 2/MD 450 to Ferguson Rd	Freeway	23.5	C	61.7	5974	5808	-166	97%
Ferguson Rd to MD 179	Freeway	20.2	C	62.4	5139	5045	-94	98%
MD 179 to Whitehall Rd (Exit 30)	Freeway	17.2	B	62.9	4214	4330	116	103%
Whitehall Rd (Exit 30) to Oceanic Dr	Freeway	17.1	B	63.2	4410	4324	-86	98%
Oceanic Dr to Bay Bridge	Freeway	19.4	C	47.6	4650	4613	-37	99%
William Preston Lane Jr. Bay Bridge	Freeway	21.9	C	42.1	4650	4607	-43	99%
Bay Bridge to MD 8	Freeway	20.4	C	45.5	4650	4587	-63	99%
Weave from MD 8 to Thompson Creek Rd	Weave	13.2	B	53.1	4795	4215	-580	88%
Thompson Creek Rd to Cox Neck Rd	Freeway	17.7	B	61.9	4915	4396	-519	89%
Weave from Cox Neck Rd to Dominion Rd	Weave	14.7	B	60.5	4935	4444	-491	90%
Dominion Rd to S Piney Rd	Freeway	17.0	B	62.6	4700	4259	-441	91%
Weave from S Piney Rd to Dundee Ave	Weave	14.1	B	62.2	4775	4380	-395	92%
Weave from Dundee Ave to Main St/MD 18 (Exit 41)	Weave	14.8	B	59.3	4795	4392	-403	92%
R Clayton Mitchell Jr Bridge	Freeway	17.3	B	63.2	4725	4369	-356	92%
Kent Narrows Rd to Main St/MD 18 (Exit 43A)	Freeway	17.4	B	63.2	4780	4404	-376	92%
Weave from Exit 43A to Chester River Beach Rd	Weave	14.0	B	62.7	4760	4395	-365	92%
Weave from Chester River Beach Rd to Station Ln	Weave	13.6	B	63.2	4635	4304	-331	93%
Weave from Station Ln to Evans Ave	Weave	13.7	B	62.3	4595	4269	-326	93%
Weave from Evans Ave to Hess Rd	Weave	13.3	B	62.9	4510	4196	-314	93%
Weave from Hess Rd to Nesbit Rd	Weave	13.5	B	62.2	4530	4205	-325	93%
U.S. 50/U.S. 301 Split	Merge/Diverge	16.9	B	62.7	4505	4233	-272	94%
U.S. 50 East of U.S. 50/U.S. 301 Split	Freeway	13.0	B	62.9	2617	2456	-161	94%
U.S. 301 East of U.S. 50/U.S. 301 Split	Freeway	13.9	B	62.7	1888	1749	-139	93%

Table 6-40: VISSIM Westbound U.S. 50/301 Segment Results: Alternatives F and G (8-10-8) NSWD Scenario

Westbound Segment Name	Segment Type	NSWD (AM Peak Hour)						
		Density (veh/ln/mi)	LOS	Speed (mph)	Volume Expected	Volume Actual	Unmet Demand	Throughput %
U.S. 301 East of U.S. 50/U.S. 301 Split	Freeway	13.0	B	63.3	1624	1639	15	101%
U.S. 50 East of U.S. 50/U.S. 301 Split	Freeway	17.8	B	58.7	2230	2091	-139	94%
U.S. 50/U.S. 301 Split	Merge/Diverge	14.7	B	63.4	3854	3713	-141	96%
Weave from Nesbit Rd to Hissey Rd	Weave	11.8	B	62.7	3858	3707	-151	96%
Weave from Hissey Rd to Winchester Creek Rd	Weave	11.9	B	62.8	3876	3739	-137	96%
Weave from Winchester Creek Rd to Vfw Ave	Weave	11.7	B	63.4	3871	3721	-150	96%
Vfw Ave to Chester River Beach Rd	Freeway	14.3	B	63.8	3818	3649	-170	96%
Weave from Chester River Beach Rd to Jackson Creek Rd	Weave	12.6	B	63.1	4128	3985	-143	97%
Main St/MD 18 (Exit 43A) to Kent Narrows Rd	Freeway	15.7	B	63.6	4119	3983	-136	97%
R Clayton Mitchell Jr. Bridge	Freeway	15.3	B	63.5	4026	3886	-140	97%
Piney Narrows Rd to Piney Creek Rd	Freeway	15.0	B	63.7	3964	3827	-137	97%
Piney Creek Rd to Chester Station Ln	Freeway	15.0	B	63.7	3969	3818	-151	96%
Weave from Chester Station Ln to Castle Marina Rd	Weave	12.2	B	62.5	3942	3816	-126	97%
Castle Marina Rd to Duke St	Freeway	16.8	B	62.1	4283	4170	-113	97%
Weave from Duke St to MD 8	Weave	14.5	B	48.4	4323	4197	-125	97%
MD 8 to Bay Bridge	Freeway	16.3	B	47.7	4150	3873	-277	93%
William Preston Lane Jr. Bay Bridge	Freeway	18.1	C	42.6	4150	3857	-293	93%
Bay Bridge to Oceanic Dr	Freeway	12.0	B	63.5	4150	3807	-343	92%
Oceanic Dr to MD 179	Freeway	15.3	B	62.9	4212	3851	-360	91%
MD 179 to Bay Dale Dr	Freeway	17.5	B	62.9	4787	4396	-391	92%
Bay Dale Dr to MD 2/MD 450	Freeway	31.8	D	41.6	5601	5120	-481	91%

Table 6-41: VISSIM Queuing Results: Alternatives F and G (8-10-8) NSWD Scenario

Time	Typical PM			Time	Typical AM		
	Eastbound Maximum Queue (miles)				Westbound Maximum Queue (miles)		
	Between U.S. 50/301 Split & Start of Bay Bridge (1)	From Start of Bay Bridge to End of Queue	Total		Between Start of Queue at MD 2 & Start of Bay Bridge (2)	From Start of Bay Bridge to End of Queue	Total
2-3 PM	0.0	0.0	n/a (3)	5-6 AM	0.0	0.0	n/a (3)
3-4 PM	0.0	0.0	n/a (3)	6-7 AM	0.1	0.0	n/a (3)
4-5 PM	0.0	0.0	n/a (3)	7-8 AM	0.6	0.0	n/a (3)
5-6 PM	0.0	0.0	n/a (3)	8-9 AM	0.9	0.0	n/a (3)
6-7 PM	0.0	0.0	n/a (3)	9-10 AM	0.9	0.0	n/a (3)
7-8 PM	0.0	0.0	n/a (3)	10-11 AM	0.6	0.0	n/a (3)
8-9 PM	0.0	0.0	n/a (3)	11-12 PM	0.2	0.0	n/a (3)
9-10 PM	0.0	0.0	n/a (3)	12-1 PM	0.0	0.0	n/a (3)
10-11 PM	0.0	0.0	n/a (3)	1-2 PM	0.1	0.0	n/a (3)
11-12 AM	0.0	0.0	n/a (3)	2-3 PM	0.1	0.0	n/a (3)
Max. Queue	**0.0**	**0.0**	n/a (3)	**Max. Queue**	**0.9**	**0.0**	n/a (3)
Hours with Queue > 1 Mile	**0**	**0**	n/a (3)	**Hours with Queue > 1 Mile**	**0**	**0**	n/a (3)

(1) 13.8 miles from U.S. 50/301 Split to start of eastbound Bay Bridge (9.6 miles on Eastern Shore and 4.2 miles on Bay Bridge)

(2) 9.3 miles from MD 2 merge point to start of westbound Bay Bridge: (5.1 miles on Western Shore and 4.2 miles on Bay Bridge).

(3) Queues from end of study area do not extend to the start of the Bay Bridge.

Figure 6-32: Bottleneck Diagram: Alternatives F and G (8-10-8) NSWD Scenario (Eastbound PM, Westbound AM)

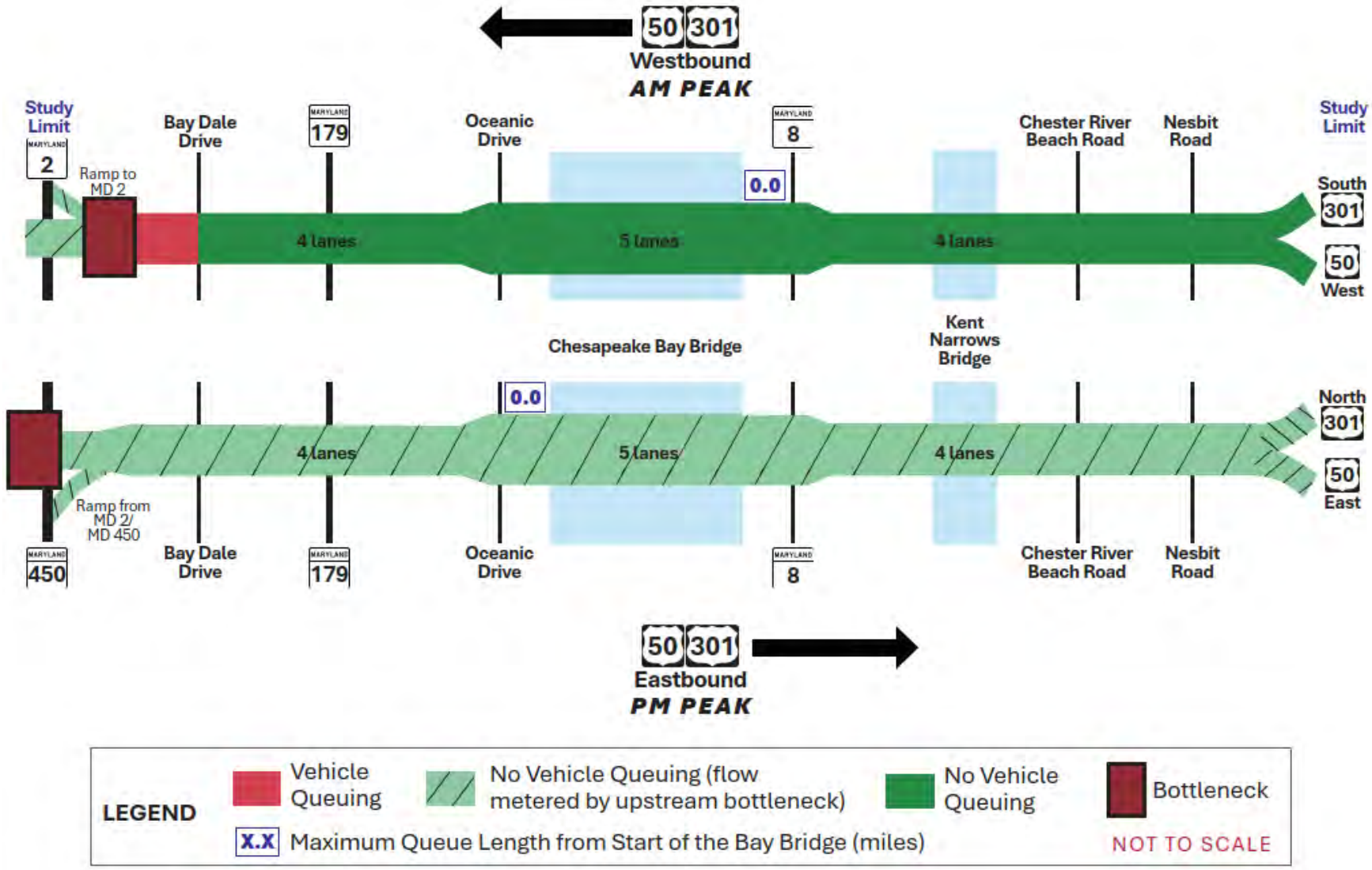


Table 6-42: Travel Time Results for Alternatives F and G: 8-10-8 during NSWD, Peak Hour of Queuing

Alternatives F/G: 8-10-8 Conditions		Eastbound US 50/301		Westbound U.S. 50/301	
		MD 2/MD 450 to Start of Bay Bridge	Start of Bay Bridge to US 50 301 Split	US 50/301 Split to Start of Bay Bridge	Start of Bay Bridge to MD 2/ MD 450
Non-Summer Weekday	Max Travel Time (min)	6	17	9	16
	Speed at Max Travel Time (mph)	50.0	52.1	57.3	42.8

Table 6-43: NSWD Throughput in Peak Hour of Volume

Alternative	NSWD					
	Eastbound			Westbound		
	Forecast Peak Hour Volume (4:00 - 5:00 PM)	Peak Hour Volume Able to Cross the Bay Bridge (Throughput)	Throughput Percentage	Forecast Peak Hour Volume (7:00 - 8:00 AM)	Peak Hour Volume Able to Cross the Bay Bridge (Throughput)	Throughput Percentage
8-10-8	4,650	4607	99%	4,150	3857	93%

Tables 6-39 through 6-43 and **Figure 6-32** reveals the following results for Alternative F/G: 8-10-8.

1. No operational deficiencies were identified for eastbound U.S. 50/301 in the PM NSWD analysis. Segments all operated at LOS C or better during the PM volume peak hour and no queueing was observed at the start of the Bay Bridge throughout the PM period. There was a bottleneck located to the west of the Tier 2 Study Limits, but the addition of a fourth lane at the MD 2/MD 450 interchange eliminated the effects of that bottleneck.
2. No operational deficiencies were identified for most of westbound U.S. 50/301 in the AM NSWD analysis. Most segments operated at LOS D or better during the AM volume peak hour and no queuing was observed at the start of the Bay Bridge throughout the AM period. Thus, there would be no westbound diversion expected on the Eastern Shore. There was a bottleneck located to the west of the Tier 2 Study Limits, which would lead to some limited queues to develop in the Tier 2 Study Limits. Diversion from these queues would be expected to be minimal, but could still occur, particularly for traffic wishing to travel northbound on MD 2.
3. Speeds would generally be above 50 mph. The exception would be westbound, downstream of the Bay Bridge, where speeds would be above 40 mph. Throughput would be above 90%, for both directions.

7 SENSITIVITY ANALYSIS

7.1 HCM Capacity Analysis of New Bridge

As noted above, each of the alternatives being considered for a new Bay Bridge include a less steep roadway grade than the grade on the existing Bay Bridge and full shoulders on both sides of the travel lanes. These improvements are likely to increase the capacity-per-lane on the Bridge; however, the extent of that increase is uncertain. The ability of a new crossing to address any one or more of the human factors which currently reduce capacity is difficult to predict at this time.

Sensitivity analyses were performed for each of the build alternatives, with queue lengths and durations being evaluated for two potential improvements in capacity. These are described below.

- The first level of improvement assumed that standard HCM adjustment factors for the reduced profile grade and the addition of shoulders could be applied to the observed capacity of the existing Bay Bridge. These changes would improve the per-lane capacity of the new bridge from 1,517 vehicles per hour (vph) to 1,608 vph; an increase of approximately six percent.
- The second level of improvement assumed that, in addition to the potential benefits of the first level, at least some of the human factors affecting driver behavior were improved. For the purposes of this analysis, it was assumed that the per-lane capacity of the new bridge would improve by approximately an additional five percent. These changes would raise the capacity of the bridge from 1,517 vph to 1,682 vph, a total increase of nearly eleven percent.

The results of the sensitivity analyses are summarized in **Table 7-1.**

Table 7-1: Sensitivity Analyses of Bay Bridge Per Lane Capacity

							NSWD (1)				SWED (1)			
							Eastbound		Westbound		Eastbound (Friday)		Westbound (Sunday)	
2045 Scenario	With Shoulders and 3.0% Grade?	With Some Level of Improved Driver Reaction to Bridge?	Capacity on Approach (vphpl)	Capacity on Bridge (vphpl)	Bridge Capacity / Approach Capacity	Approach Capacity / Bridge Capacity	Maximum Queue (mi)	Duration of Queues > 1 Mile (hours)	Maximum Queue (mi)	Duration of Queues > 1 Mile (hours)	Maximum Queue (mi)	Duration of Queues > 1 Mile (hours)	Maximum Queue (mi)	Duration of Queues > 1 Mile (hours)
6-8-6	No	No	1979	1517	0.77	1.30	0.0	0	0.0	0	7.3	10	8.0	10
	Yes	No	1979	1608	0.81	1.23	0.0	0	0.0	0	3.7	7	3.8	9
	Yes	Yes	1979	1682	0.85	1.18	0.0	0	0.0	0	0.7	0	1.0	1
8-8-8	No	No	1979	1517	0.77	1.30	0.1	0	0	0	7.5	11	8.4	11
	Yes	No	1979	1608	0.81	1.23	0.0	0	0.0	0	4.6	8	5.0	10
	Yes	Yes	1979	1682	0.85	1.18	0.0	0	0.0	0	2.3	6	2.4	8
8-10-8	No	No	1979	1517	0.77	1.30	0.0	0	0.0	0	0.0	0	0.0	0
	Yes	No	1979	1608	0.81	1.23	0.0	0	0.0	0	0.0	0	0.0	0
	Yes	Yes	1979	1682	0.85	1.18	0.0	0	0.0	0	0.0	0	0.0	0

(1) Based on HCM Computations (See Appendix C.)

The sensitivity analyses show:

1. The potential increase in capacity have almost no effect on the NSWD analyses, because queues are expected to be minimal, even without further improvements.
2. The potential increases in capacity have no effect on the SWED Alternative F/G: 8-10-8 analyses for the same reason.
3. For SWED conditions, for both Alternatives B/C: 6-8-8 and Alternatives D/E: 8-8-8 scenarios:
    a. The addition of shoulders and a lower profile grade could decrease maximum queue lengths by approximately 40 to 60 percent. There could also be reductions in the duration of queues longer than one mile, although those decreases would be more modest.
    b. Assuming some level of improvement in human factors, in addition to the shoulders and lower profile grade, could result in further reductions in queue lengths and durations.

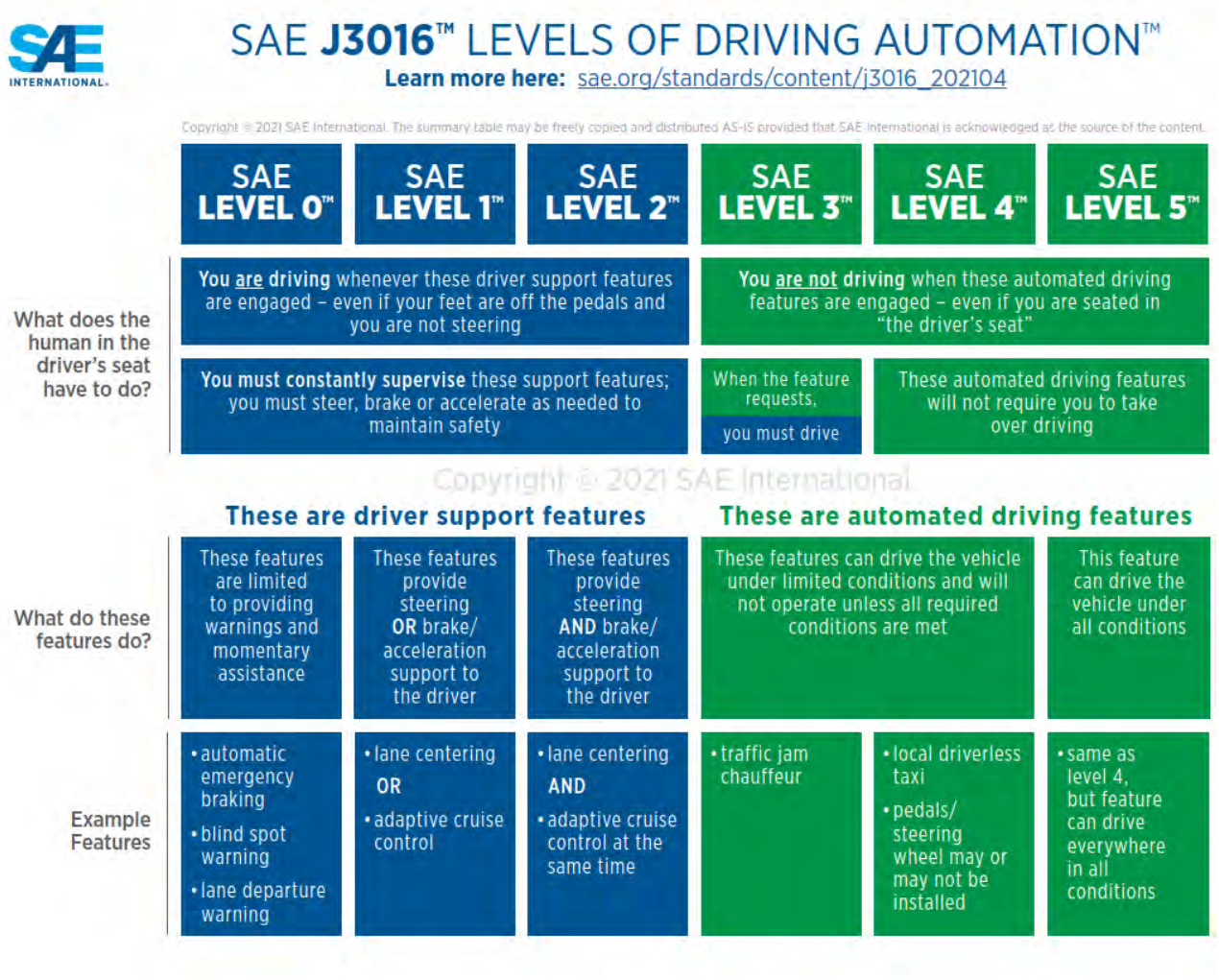
7.2 Connected and Automated Vehicles (CAV)

One of the factors to be considered in the Tier 2 Study is the possible influence of CAVs on traffic operations for both the Bay Bridge and its approach roadways. The analyses performed to address this potential influence are described below.

7.2.1 Society of Automotive Engineers (SAE) Levels of Driving Automation

Figure 7-1 shows the current levels of driving automation and their definitions.

Figure 7-1: SAE Levels of Driving Automation



Source: SAE Website, https://www.sae.org/blog/sae-j3016-update

As of March 2025, there are no Level 4 or Level 5 vehicles available for purchase by the general public in the United States. There is a broad range of opinion in the automotive and engineering communities regarding when Level 4 or Level 5 vehicles will be widely available, how quickly such vehicles will be purchased by the general public, and how quickly those vehicles will become prevalent in the registered vehicle population.

As a result, assessing the potential impacts of CAVs on future traffic operations involves a number of far-reaching assumptions. Because of this, the HCM states that:

> "Because of this uncertainty, it is recommended that the CAV CAFs [Capacity Adjustment Factor] and service volume tables presented in this section be applied to the evaluation of "what if" scenarios, rather than being taken as the final word on what will happen once CAVs become widespread."

7.2.2 Potential Impact on Trip Generation

The MSTM includes an exploratory mechanism for forecasting changes in travel demand based on two different potential levels of CAV use. One of these is referred to as "CAV Slow," and assumes a comparatively low level of CAV use. The other is referred to as "CAV Fast" and assumes a comparatively higher/faster level of CAV use. As noted above, this mechanism is exploratory, and it is included in the model at this time only for sensitivity analysis. It has not been fully validated, and thus is not formally used at this time to develop project-level forecasts.

With that caveat in mind, both of the CAV levels were applied in model runs of the MSTM for each of the 2045 alternatives. The results of the model runs were then qualitatively compared to the base forecasts for the Tier 2 Study Limits described in Chapter 6. This qualitative comparison showed:

1. The percentage change in the daily volume forecasts varied by alternative, and were relatively small—always less than two percent.
2. Some of the changes forecasted were negative, indicating a small drop in traffic on the Bay Bridge. These decreases tended to get slightly more negative as the level of highway/bridge improvements increased.

A decrease in traffic on the Bay Bridge due to implementation of CAVs may appear, at first glance, to be counter-intuitive. However:

1. The total number of regional trips would be expected to remain almost constant, regardless of the level of CAV implementation.
2. As the level of highway/bridge improvements increased in the BCST2 Study Area, some CAV trips might shift to other corridors that are more congested, and thus more able to benefit from the advantages offered by CAVs.

7.2.3 Potential Impacts on Capacity

In theory, widespread implementation of CAVs might be expected to increase capacity of roadways, due to a decrease in headways between vehicles. However, the HCM offers several caveats about this expectation, including the following:

> "…it is not clear how connectivity affects car following and driver behavior and subsequently freeway capacity."
>
> "As a result, for both safety and passenger comfort reasons, current adaptive cruise control systems offer minimum time gaps that are similar to, or longer than, the gaps used by human drivers, and thus may decrease roadway capacity when in widespread use."

With these caveats in mind, use of the CAFs factors shown in Exhibit 26-15 of the HCM indicate that a capacity of as much as 3,200 passenger cars per lane per hour might be possible, if 100 percent of those cars were CAVs. Lower percentages of CAVs in the vehicle fleet would result in lower capacities. As noted in the HCM:

> "Thus, under base conditions, a much greater increase in capacity is seen when the proportion of CAVs on a freeway increases from 80 percent to 100 percent than when it increases from 0 percent to 20 percent."

7.2.4 Discussion

CAVs are not expected to have a substantial impact on the number of vehicular trips in the region as a whole by 2045, and in the BCST2 Study Area in particular. However, they could have a substantial impact on the capacity of the regional roadway network as a whole, and on the Bay Bridge and its approach roadways in particular. However, the actual extent of that improvement cannot be determined with any specificity at this time, due to the factors discussed above. As recommended by the HCM, the Tier 2 Study has assessed these potential impacts in a "what if" manner, rather than depending upon them as part of the evaluation of the various alternatives.

8 SUMMARY

The VISSIM analyses described above show:

8.1 Existing Conditions

8.1.1 Summer Weekends

The Bay Bridge is a bottleneck in the Tier 2 Study Limits, in both directions of travel. Downstream of the Bay Bridge in both directions, congestion is limited due to the reduced number of vehicles which can get through the bottleneck.

8.1.2 Non-Summer Weekdays

The Bay Bridge is not a bottleneck, provided that three lanes can be provided in the eastbound direction during peak periods.

8.2 Alternative A: No-Build in 2045

8.2.1 Summer Weekends

The Bay Bridge will continue to be a bottleneck in the Tier 2 Study Limits in both directions of travel. Queues will be longer than under the Existing Conditions.

8.2.2 Non-Summer Weekdays

The Bay Bridge will be a bottleneck in both directions. In the westbound direction, in addition to the Bay Bridge bottleneck, there will be a bottleneck at Bay Dale Drive due to the increase in traffic volumes between the bridge and Bay Dale Drive.

8.3 Alternative B/C: 6-8-6

8.3.1 Summer Weekends

In the eastbound direction, queues are not anticipated at the Bay Bridge because of the bottleneck located to the west of the Tier 2 Study Limits, which will reduce the volume of traffic able to reach the Bay Bridge. At the eastern limit of the Tier 2 Study Limits (the U.S. 50/301 split), another bottleneck is expected, as U.S. 50 traffic merges into the existing two lanes.

In the westbound direction, two bottlenecks are expected. The first of these, approaching the U.S. 50/301 merge at the eastern limit of the Tier 2 Study Limits, will meter the volume of traffic able to reach the Bay Bridge. The second bottleneck is expected at Bay Dale Drive and it results in queuing over the Bay Bridge and onto the Eastern Shore.

8.3.2 Non-Summer Weekdays:

In the eastbound direction, queues are not anticipated at the Bay Bridge because of the bottleneck located to the west of the Tier 2 Study Limits, which will reduce the volume of traffic able to reach the Bay Bridge.

In the westbound direction, queues longer than 0.1 mile are not anticipated at the Bay Bridge. A bottleneck is expected at Bay Dale Drive, however, queues from that bottleneck should not extend back to the Bay Bridge.

8.4 Alternative D/E: 8-8-8

8.4.1 Summer Weekends

In the eastbound direction, the Bay Bridge is expected to be a bottleneck. Even with traffic volumes being restricted by the bottleneck to the west of the Tier 2 Study Limits, the fourth travel lane added at the MD 2/MD 450 on-ramp will allow enough traffic to reach the Bay Bridge to generate a bottleneck. At the eastern limit of the Tier 2 Study Limits (the U.S. 50/301 split), another bottleneck is expected, as U.S. 50 traffic merges into the existing two lanes.

In the westbound direction, there will be a bottleneck at the western limit of the Tier 2 Study Limits where the fourth mainline lane of U.S. 50/301 is dropped and the highway returns to its existing three lane cross section. This bottleneck will result in extensive queues, extending back over the Bay Bridge and onto the Eastern Shore.

8.4.2 Non-Summer Weekdays:

No bottlenecks are anticipated within the Tier 2 Study Limits.

8.5 Alternative F/G: 8-10-8

8.5.1 Summer Weekends

In the eastbound direction, at the eastern limit of the Tier 2 Study Limits (the U.S. 50/301 split), a bottleneck is expected where the third lane of U.S. 50 is dropped and the traffic merges into the existing two lanes. No bottleneck is expected at the Bay Bridge, nor at the lane drop from five lanes to four lanes. Even if the bottleneck to the west of the Tier 2 Study Limits did not exist, a bottleneck would not be expected at either the Bay Bridge or the lane drop.

In the westbound direction, there will be a bottleneck at the western limit of the Tier 2 Study Limits, where the fourth mainline lane of U.S. 50/301 is dropped and the highway returns to its existing three lane cross section. This bottleneck will result in extensive queues, extending back over the Bay Bridge and onto the Eastern Shore.

8.5.2 Non-Summer Weekdays

No bottlenecks are anticipated within the Tier 2 Study Limits.

8.6 Sensitivity Analysis Considerations

There is a possibility that the capacity of each lane on a new Bay Bridge could be higher than the capacity of each lane on the existing Bridge, due to improved roadway geometry, including the addition of shoulders and a lower/flatter profile grade. Such improvements could reduce queue lengths and durations at the Bay Bridge; however, the extent to which the physical factors that affect driver behavior on the bridge will be reduced is unknown and is difficult to estimate at this time.

CAVs are not expected to have a substantial impact on the number of vehicular trips in 2045 in the BCST2 Study Area. However, even without a change in the number of vehicles on the Bay Bridge, CAVs could operate more efficiently than traditional vehicles. This could have a substantial impact on the capacity of the Bay Bridge and its approach roadways. However, the actual extent of that improvement cannot be determined with any specificity at this time, and will be dependent upon many factors, including the speed with which highly-automated vehicles

become available for purchase and how quickly those vehicles are integrated into the vehicle population. As recommended by the HCM, the Tier 2 Study has assessed these potential impacts in a "what if" manner, rather than depending upon them as part of the evaluation of the various alternatives.