

Analyzing and Mitigating the Impact of Tolls at the Midtown and Downtown Tunnels



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ANALYZING AND MITIGATING THE IMPACT OF TOLLS AT THE MIDTOWN AND DOWNTOWN TUNNELS

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Analyzing and Mitigating the Impact of Tolls
at the Midtown and Downtown Tunnels

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ABSTRACT

On December 5, 2011, VDOT signed a comprehensive agreement with Elizabeth River Crossings (ERC) for construction of an additional two-lane tube at the Midtown Tunnel, rehabilitation of the Downtown Tunnel, and extension of the MLK Freeway. As part of the agreement, ERC is permitted to collect tolls on these three facilities, and tolling began at the Downtown and Midtown Tunnels on February 1, 2014.

In response, Hampton Roads Transportation Planning Organization (HRTPO) staff began a multi-year study in Fiscal Year (FY) 2013 comparing the “before” and “after” traffic conditions to discover the impact of tolling. Goals of this study are to analyze “before” and “after” traffic and transit conditions resulting from tolling at the Midtown and Downtown Tunnels, gain insight into toll sensitivity in the region, and to develop congestion mitigation strategies for impacted corridors.

This report provides background information on the project and the comprehensive agreement, examines the projected traffic impacts using the travel demand model, analyzes traffic and transit conditions before and after toll implementation, and makes recommendations to mitigate these impacts.

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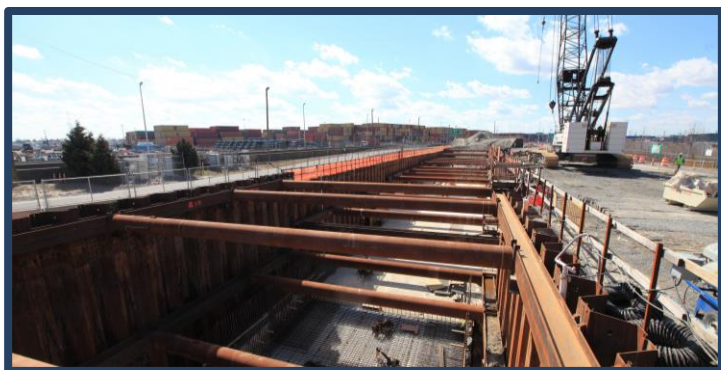
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EXECUTIVE SUMMARY

On December 5, 2011, VDOT signed a comprehensive agreement with Elizabeth River Crossings (ERC) for construction of an additional two-lane tube at the Midtown Tunnel, rehabilitation of the Downtown Tunnel, and extension of the Martin Luther King, Jr. (MLK) Freeway to I-264 (scheduled to be completed in 2016/2017). As part of the agreement, ERC is permitted to collect tolls on the Midtown Tunnel (MTT), Downtown Tunnel (DTT), and MLK Freeway extension, and tolling began at the DTT and MTT on February 1, 2014.



Midtown Tunnel Construction

Source: VDOT

In response, Hampton Roads Transportation Planning Organization (HRTPO) staff began a multi-year study in Fiscal Year (FY) 2013 comparing the “before” and “after” traffic conditions to discover the impact of tolling. Goals of this study are to analyze “before” and “after” traffic and transit conditions resulting from tolling at the Midtown and Downtown Tunnels, gain insight into toll sensitivity in the region, and to develop congestion mitigation strategies for impacted corridors.

In FY 2013 and FY 2014 staff videotaped, photographed, and collected travel time data to document “before” traffic conditions at locations where traffic volumes were projected to change based on tolling at the Midtown and Downtown Tunnels. These same locations were documented in FY 2015 “after” tolls were implemented. In addition, HRTPO staff obtained traffic count data from locations throughout the study area where volumes are collected on a continuous basis and segment travel time and speed data collected by INRIX.

KEY FINDINGS

The following is a summary of the major findings of this study:

Traffic volumes

As expected, traffic volumes decreased at the Midtown and Downtown Tunnels after tolls were implemented there. Weekday volumes decreased by 8% at the Midtown Tunnel and 20% at the Downtown Tunnel. Decreases in volumes during the peak travel periods, however, were much lower than those during the off peak midday and weekend periods, as shown in the table below.

Parallel crossings of the Southern Branch of the Elizabeth River – the South Norfolk Jordan Bridge, Gilmerton Bridge, and High Rise Bridge – saw increases in volumes once tolls were imposed at the Midtown and Downtown Tunnels. Weekday volumes increased by 49% at the South Norfolk Jordan Bridge, 53% at the Gilmerton Bridge, and 7% at the High Rise Bridge. The increases in volume at these three facilities were also much lower during the AM and PM peak travel periods than they were during the off peak midday and weekend periods. Additionally, increases in volumes were larger at the Gilmerton Bridge than they were at the High Rise Bridge, regardless of the time of day or day of the week.

Change in Volumes at Five Crossings of the Southern Branch of the Elizabeth River, Pre-Tolling (May-November 2013) versus Post-Tolling (May-November 2014) Conditions

Facility	Change in Volumes, May-November 2013 to May-November 2014					
	Weekday	AM Peak Period	PM Peak Period	Off Peak (Midday)	Weekend	Weekday Trucks
Midtown Tunnel	-3,166 -8%	-714 -7%	-901 -8%	-1,996 -15%	-1,296 -5%	-52 -3%
Downtown Tunnel	-18,726 -20%	-2,696 -12%	-1,863 -8%	-6,575 -22%	-20,930 -29%	N/A N/A
Jordan Bridge	+3,221 +49%	+615 +36%	+353 +14%	+694 +48%	+2,136 +104%	+211 +74%
Gilmerton Bridge	+10,138 +53%	+2,641 +53%	+3,678 +53%	+3,087 +50%	+8,611 +67%	+307 +55%
High Rise Bridge ¹	+6,117 +7%	+964 +5%	-1,062 -4%	+2,808 +11%	+6,814 +11%	N/A N/A

Source: HRTPO analysis of VDOT and SNJB data.

Traffic Queues and Queue Clearance Times

Based on travel time runs collected by HRTPO staff, peak period traffic queues improved – but did not go away – for nearly all of the Midtown Tunnel and Downtown Tunnel approaches after tolls were implemented there. As shown in the tables below, peak period traffic queues for alternate routes, such as the I-64 High Rise Bridge, Military Highway/Gilmerton Bridge, George Washington Highway, and South Norfolk Jordan Bridge, worsened after the tolls were implemented.

Comparison of Traffic Queue Lengths and Queue Clearance Times along Key Roadways Before and After Tolls

AM Peak (7:00am-8:30am)

Queue Improved
Queue Worsened

Roadway Segment	"Before" (Pre-Toll)	"After" (Post-Toll)	% Change	"Before" (Pre-Toll)	"After" (Post-Toll)	% Change
	Traffic Queue Length (mi)	Traffic Queue Length (mi)		Queue Clearance Time (min)	Queue Clearance Time (min)	
Midtown Tunnel (EB Western Fwy)	2.2	1.9	-14%	27	21	-22%
Midtown Tunnel (NB MLK Fwy)	1.0	0.6	-40%	14	8	-43%
Downtown Tunnel (EB I-264)	2.0	2.1	+5%	18	13	-28%
Downtown Tunnel (WB I-264)	0.8	0.1	-88%	4	2	-50%
Downtown Tunnel (NB I-464)	2.1	2.0	-5%	7	7	0%
I-64/HR Bridge (to Va Beach)	3.3	5.6	+70%	7	14	+100%
Jordan Bridge (WB)	NA	0.8	NA	NA	8	NA

PM Peak (4:00pm-6:00pm)

Roadway Segment	"Before" (Pre-Toll)	"After" (Post-Toll)	% Change	"Before" (Pre-Toll)	"After" (Post-Toll)	% Change
	Traffic Queue Length (mi)	Traffic Queue Length (mi)		Queue Clearance Time (min)	Queue Clearance Time (min)	
Midtown Tunnel (NB MLK Fwy)	0.6	0.0	-100%	8	2	-75%
Midtown Tunnel (SB Hampton Blvd)	1.0	0.9	-10%	19	11	-42%
Midtown Tunnel (WB Brambleton Ave)	1.0	0.9	-10%	19	11	-42%
Downtown Tunnel (EB I-264)	1.2	0.2	-83%	9	3	-67%
Downtown Tunnel (WB I-264)	1.4	1.1	-21%	12	6	-50%
Downtown Tunnel (NB I-464)	0.6	0.1	-83%	8	2	-75%
I-64/HR Bridge (to Va Beach)	3.2	5.8	+81%	7	14	+100%
I-64/HR Bridge (to Suffolk)	1.6	2.2	+38%	4	9	+125%
WB Military Hwy to Gilmerton Bridge	0.0	1.8	NA	5	10	+100%
WB Military Hwy to Canal Dr	0.0	1.5	NA	2	4	+100%
SB GW Hwy to Military Hwy	0.0	1.0	NA	3	8	+167%

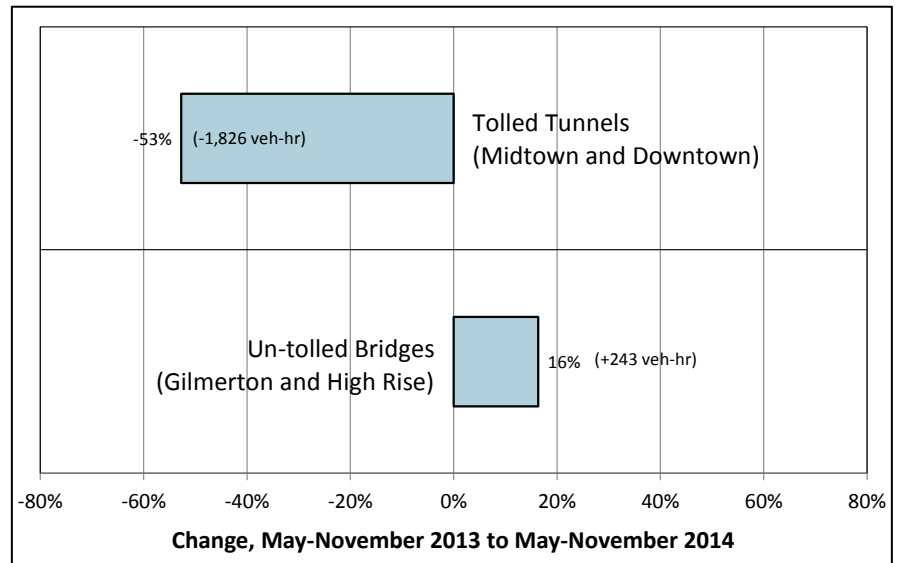
Note: For Post-toll, EB I-264 towards the Downtown Tunnel was under construction (MLK Fwy extension) and was reduced to 2 lanes. The Gilmerton Bridge was 2 lanes pre-toll and 4 lanes post-toll.

Segment Travel Times and Speeds

HRTPO staff used travel time and speed data collected by INRIX to determine congestion levels and total delay for roadways impacted by tolling at the Midtown and Downtown Tunnels. In general, as expected because of the shift in vehicles from tolled facilities to un-tolled ones, delay decreased at tolled facilities and increased at the parallel free routes. Peak period delays decreased greatly (-65%) at the Downtown Tunnel after tolls were implemented there, and delays increased greatly (+90%) at the un-tolled Gilmerton Bridge.

Overall, as shown in the figure below, total peak period delay decreased at the tolled tunnels by 1,826 vehicle-hours per weekday (-53%), and increased at the non-tolled bridges by 243 vehicle-hours per weekday (+16%). Combined, total peak period delay at these four crossing corridors decreased by 1,583 vehicle-hours each weekday after tolls were imposed at the Midtown and Downtown Tunnels.

Change in Weekday Peak Period Total Delays at Tolled and Un-tolled Crossings, May-November 2013 versus May-November 2014



Source: HRTPO analysis of VDOT and INRIX data.

Transit Ridership

An analysis of average weekday transit ridership for the five bus routes and one ferry route most likely impacted by tolling shows that most bus transit routes crossing the Southern Branch of the Elizabeth River experienced a small increase in ridership during the first month “after” tolls were implemented on February 1, 2014, but returned to prior levels afterwards. However, ridership for bus routes 45 and 47 increased in July 2014, which coincided with HRT increasing service frequencies and hours of operation using funding provided under the ERC comprehensive agreement. In other words, expansion of transit availability and service times had a greater impact on ridership than tolling did.

STRATEGIES

A number of strategies should be considered to improve traffic conditions due to the impacts of tolling at the Midtown and Downtown Tunnels, including:

- **Roadway Improvements** – With volumes increasing at and on approaches to alternate crossings of the Southern Branch of the Elizabeth River, widening George Washington Highway from 2 to 4 lanes between Canal Dr and Military Hwy should be considered.
- **Intersection Improvements** – With increased volumes in the Military Hwy/Gilmerton Bridge corridor, intersection improvements should be considered at Military Hwy’s intersection with Campostella Road and Shell Rd. In addition, intersection improvements at Elm Ave/Victory Blvd/Williams Ave in Portsmouth should be considered due to increased volumes on the South Norfolk Jordan Bridge.
- **Enhance Public Transportation** – As mentioned previously, expansion of transit availability and service times had a greater impact on ridership than tolling did.
- **Promote TRAFFIX/Transportation Alternatives** – TRAFFIX aims to decrease traffic congestion by reducing the number of Single Occupancy Vehicles (SOVs) by encouraging ridesharing and other alternatives to driving such as public transportation, teleworking, biking, and walking.

- **Increase Public Awareness of Tolls and E-ZPass** – Results from Christopher Newport University’s South Hampton Roads Midtown and Downtown Tunnel Tolls Survey indicated that users overestimate the cost of the existing toll rates, and may users do not understand the benefits of E-ZPass or how to open an account.

INTRODUCTION

On December 5, 2011, VDOT signed a comprehensive agreement with Elizabeth River Crossings¹ (ERC) for construction of an additional two-lane tube at the Midtown Tunnel, rehabilitation of the Downtown Tunnel, and extension of the Martin Luther King, Jr. (MLK) Freeway to I-264 (scheduled to be completed in 2016/2017). As part of the agreement, ERC is permitted to collect tolls on the Midtown Tunnel (MTT), Downtown Tunnel (DTT), and MLK Freeway extension, and tolling began at the DTT and MTT on February 1, 2014.

In response, Hampton Roads Transportation Planning Organization (HRTPO) staff began a multi-year study in Fiscal Year (FY) 2013 comparing the “before” and “after” traffic conditions to discover the impact of tolling. Goals of this study are to analyze “before” and “after” traffic and transit conditions resulting from tolling at the Midtown and Downtown Tunnels, gain insight into toll sensitivity in the region, and to develop congestion mitigation strategies for impacted corridors.

In September 2012, HRTPO staff ran the Hampton Roads travel demand forecast model and found that MTT/DTT tolling would likely:

- Cause traffic volumes to decrease at the tolled tunnels and their approaches
- Cause traffic volumes to increase at other crossings and their approaches (e.g. I-64 High-Rise Bridge and Military Highway including the Gilmerton Bridge)

In FY 2013 and FY 2014 staff videotaped, photographed, and collected travel time data to document “before” traffic conditions at these locations, to be juxtaposed in FY 2015 to “after” (i.e. post-toll) conditions.

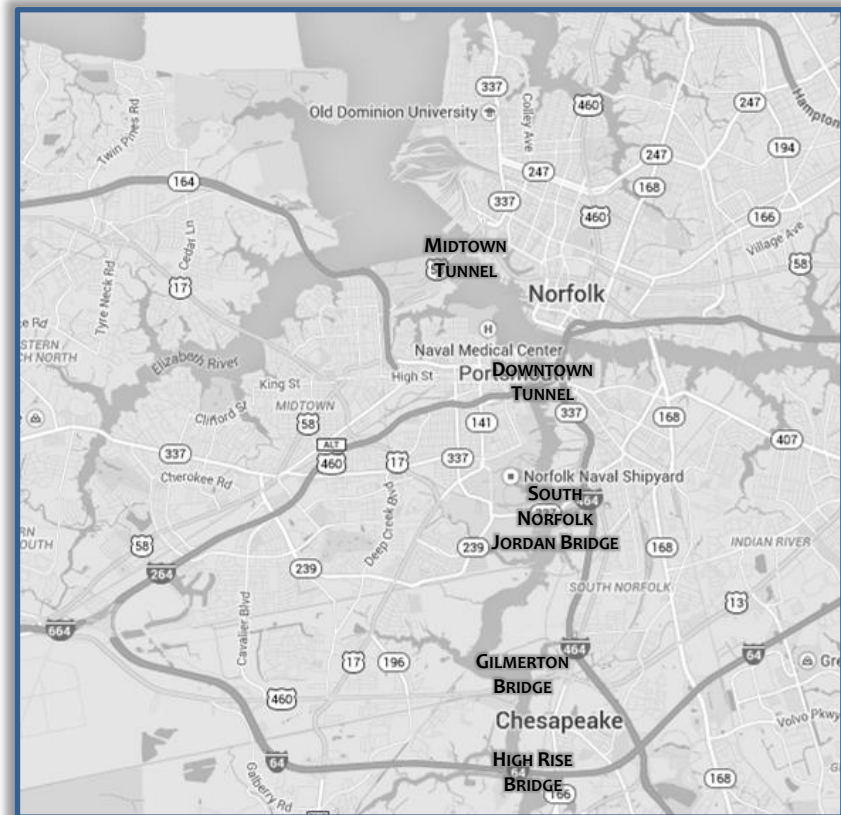
This report provides background information on tolling at the Midtown and Downtown tunnels, analyzes the impacts to the transportation network resulting from tolling, and makes recommendations to mitigate those impacts. It is important to note that this study only analyzes traffic

¹Elizabeth River Crossings (ERC) is a sole-purpose company created to finance, deliver, operate and maintain the Elizabeth River Tunnels Project. For more information on ERC, visit: www.driveert.com

STUDY PURPOSE

- To document and analyze “before” and “after” traffic and transit conditions resulting from tolling at the Midtown & Downtown tunnels
- Toll sensitivity – correlation between traffic volumes, queues, and tolls
- To develop congestion mitigation strategies for the impacted corridors.

Map 1 – Study Area Map



Background Map Source: Google.

conditions “before” and “after” tolling for the existing roadway and tunnel capacities. Upon opening of the new two-lane tube at the Midtown Tunnel and the extension of MLK Freeway to I-264, the overall roadway capacity across the Elizabeth River will increase, resulting in another set of impacts.

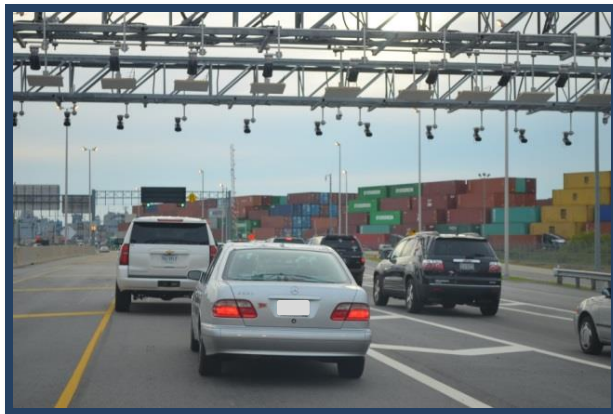
A list of sections contained in this study is provided below:

- I. Introduction**
 - a. Comprehensive Agreement and Tolls
 - b. Hampton Roads Transit Partnership
 - c. Project Descriptions – Midtown Tunnel, Downtown Tunnel, and MLK Extension
 - d. Project Descriptions – Alternate Routes
 - e. South Hampton Roads MTT and DTT Tolls Survey
- II. Projected Traffic Impacts Using the Travel Demand Model**
- III. Traffic Conditions: Before and After Toll Implementation**
 - a. Traffic Volumes – provides an analysis of traffic volumes using traffic counts collected by VDOT and the South Norfolk Jordan Bridge.
 - b. Traffic Queues and Queue Clearance Times – includes analyses of videos, photos, and traffic queues which were collected by HRTPO staff during peak hours using in-vehicle travel runs and from roadside locations near tunnel facilities.
 - c. Segment Travel Times and Speeds – provides an analysis of roadway travel times, speeds, and congestion levels in the study area during peak travel periods.
- IV. Transit Conditions: Before and After Toll Implementation**
- V. Recommendations**
- VI. Appendices**

COMPREHENSIVE AGREEMENT AND TOLLS

Tolling at the MTT, DTT, and MLK Freeway is part of a 58-year "Comprehensive Agreement" between VDOT and Elizabeth River Crossings (ERC) for construction of an additional two-lane tube at the Midtown Tunnel, rehabilitation of the Downtown Tunnel, and extension of the Martin Luther King, Jr. (MLK) Freeway to I-264 for an advertised total cost of \$2.16 billion. This agreement was made possible as part of the Public-Private Transportation Act (PPTA) of 1995 in Virginia, which authorizes state agencies and local governments to execute agreements with private firms to develop, construct and/or operate transportation facilities.

The Comprehensive Agreement between ERC and VDOT took effect in 2012 and was amended to lower the initial toll rates (beginning on February 1, 2014). The original toll was to be \$1.84 for passenger cars and \$7.36 for trucks with an E-ZPass transponder during peak travel periods. This toll, however, was lowered to \$1.00 for passenger cars and \$4.00 for trucks under a deal struck by Governor Terry McAuliffe in which the Commonwealth of Virginia agreed to reimburse ERC \$82.5 million to reduce the tolls until the new Midtown Tunnel tube is completed. Toll rates will increase each year through 2017 as shown to the right and on the following page. Beginning on January 1, 2017, or upon substantial completion of the new Midtown Tunnel in accordance with the Comprehensive Agreement, passenger cars with E-ZPass will pay \$1.84 during peak travel periods and trucks with E-ZPass will pay \$7.36. MLK Freeway tolls will be \$0.50 for tunnel users and \$1.00 for non-tunnel users. Vehicles without E-ZPass will pay double or triple these amounts, depending on whether the user has registered their license plate with ERC.



Downtown Tunnel and Midtown Tunnel Toll Rates

2014 Toll Rates (February 1, 2014 – December 31, 2014):

2014 Toll Rates

Passenger Vehicles (Two-axes, includes motorcycles)

	E-ZPass	Registered/Pre-paid* Pay BY PLATE	Unregistered** Pay BY PLATE
Monday - Friday			
12:00 a.m. to 5:30 a.m.	\$0.75	\$1.50	\$2.25
5:30 a.m. to 9:00 a.m. (PEAK)	\$1.00	\$1.75	\$2.50
9:00 a.m. to 2:30 p.m.	\$0.75	\$1.50	\$2.25
2:30 p.m. to 7:00 p.m. (PEAK)	\$1.00	\$1.75	\$2.50
7:00 p.m. to 12:00 a.m.	\$0.75	\$1.50	\$2.25

Heavy Vehicles (Three or more axes, includes cars with trailers)

	E-ZPass	Registered/Pre-paid* Pay BY PLATE	Unregistered** Pay BY PLATE
Monday - Friday			
12:00 a.m. to 5:30 a.m.	\$2.25	\$3.00	\$3.75
5:30 a.m. to 9:00 a.m. (PEAK)	\$4.00	\$4.75	\$5.50
9:00 a.m. to 2:30 p.m.	\$2.25	\$3.00	\$3.75
2:30 p.m. to 7:00 p.m. (PEAK)	\$4.00	\$4.75	\$5.50
7:00 p.m. to 12:00 a.m.	\$2.25	\$3.00	\$3.75

Off-peak rates apply on weekends and holidays.

*Registered/Pre-paid Pay by Plate rates include a \$0.75 processing fee.

**Unregistered or Post-paid Pay by Plate rates include a \$1.50 processing fee.

Source: www.driveert.com.

2015 Toll Rates² (January 1, 2015 – December 31, 2015):

- Passenger Vehicles (E-ZPass)
 - Off-peak \$1.00
 - Peak \$1.25
- Heavy Vehicles (E-ZPass)
 - Off-peak \$3.00
 - Peak \$5.00

2016 Toll Rates² (January 1, 2016 – December 31, 2016):

- Passenger Vehicles (E-ZPass)
 - Off-peak \$1.25
 - Peak \$1.50
- Heavy Vehicles (E-ZPass)
 - Off-peak \$3.75
 - Peak \$6.00

2017 Toll Rates² (effective January 1, 2017 or upon substantial completion of the new Midtown Tunnel):

- Passenger Vehicles (E-ZPass)
 - Off-peak \$1.59
 - Peak \$1.84
- Heavy Vehicles (E-ZPass)
 - Off-peak \$4.77
 - Peak \$7.36

MLK Freeway Toll Rates

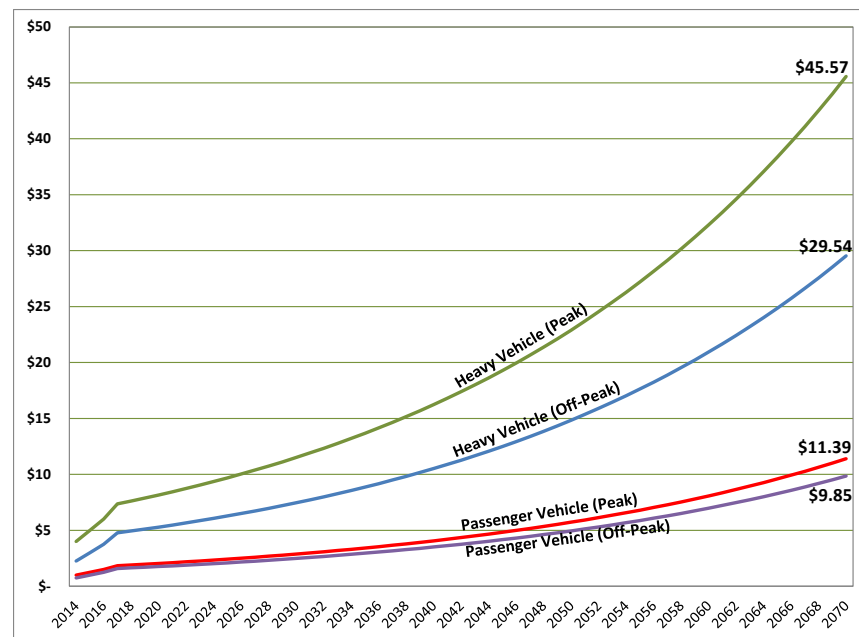
Toll Rates (effective upon completion of the new MLK Freeway extension):

- Passenger & Heavy Vehicles
 - DTT/MTT Tunnel Users (E-ZPass) \$0.50
 - Non-Tunnel Users (E-ZPass) \$1.00

According to the Comprehensive Agreement after 2017 and thru 2070, tolls will escalate annually by a factor equal to the greater of the change in the consumer price index (CPI) or 3.5%. **Figure 1** shows the minimum toll rates at the MTT and DTT for users with E-ZPass through the year 2070, using the 2017 toll rates above and growing the toll by 3.5% annually.

According to Old Dominion University's The State of the Region report (October 2014), ERC carries full traffic, revenue and toll collection risk and there is no guaranteed profit. ERC is authorized to earn a maximum of 13.5% on its invested capital. If ERC earns less than this due to the construction of other competing facilities by VDOT, then the Commonwealth of Virginia must compensate ERC for the shortfall, subject to contract stipulations. If ERC's revenues exceed 13.5%, then ERC will share a portion of the excess revenue with VDOT. VDOT's share of

Figure 1 - Minimum Toll Rates at MTT & DTT through 2070*



Prepared by: HRTPO Staff

*Assumes an increase of 3.5% annually.

excess gross revenues would increase as a percentage along with the increase of ERC's gross revenues³. If VDOT collects gross revenues, it is required by law to use it on transportation improvements in those corridors.

² Drivers without E-ZPass transponders will pay double or triple these amounts.

³ If gross revenues exceed the forecasted 13.5% rate of return by 5-10%, 10-20%, 20-30%, and in excess of 30%, then VDOT will share 5%, 15%, 30%, and 60%, respectively. ERC may earn gross revenues up to 5% in excess of forecasts before VDOT shares in profits.

HAMPTON ROADS TRANSIT PARTNERSHIP⁴

As part of the Comprehensive Agreement, Elizabeth River Crossings (ERC) – in partnership with VDOT – will provide an annual subsidy to Hampton Roads Transit (HRT) for 58 years to increase bus and ferry service between Norfolk and Portsmouth – providing improved interconnectivity and low-cost, convenient alternatives to driving. The annual subsidy will start at approximately \$2.1 million and (similar to the annual toll increase) will annually increase by 3.5% or the consumer price index (CPI), whichever is greater. This annual subsidy will expand both bus and ferry services between Norfolk and Portsmouth.

HRT Bus Service Improvements

As part of the subsidy, seven new 40-foot buses have been purchased and incorporated into HRT service. Improvements have also been made to three HRT bus routes between Norfolk and Portsmouth—Routes 44, 45, and 47 (effective July 6, 2014):

- Routes 44⁵ and 47 – operational hours extended from 7 pm to 10 pm
- Route 47 – Sunday service was added (7 am to 7 pm)
- Routes 45 and 47 – Weekday frequencies improved to 15-minute intervals between 6-9 am and 4-7 pm from the previous 30 to 60-minute intervals.

HRT Ferry Service Improvements

HRT operates three 150-passenger ferries across the Elizabeth River between North Landing and High Street in Portsmouth and the Waterside area in downtown Norfolk. Ferries are operated every 30 minutes with 15-minute service during the summer at peak times on weekends. As part of the subsidy, the Elizabeth River Ferry's weekday hours were extended (effective February 1, 2014) to depart 60 minutes earlier, now beginning at 5:30 am.

⁴ HRT Partnership brochure, <https://www.driveert.com/about-the-project/resources/>

⁵ Service to Fort Norfolk light rail station and Downtown Norfolk Transit Center was discontinued and Route 44 now operates between Starmount Parkway (Chesapeake) and Norfolk General Hospital with stops at Victory Crossing and High Street/Florida Avenue. Route 44 also now services Tidewater Community College (Portsmouth Campus) Monday through Saturday after 7:00 pm.



One of the New Buses Purchased by ERC in Partnership with Hampton Roads Transit



Elizabeth River Ferry

PROJECT DESCRIPTION – MIDTOWN TUNNEL, DOWNTOWN TUNNEL, AND MLK EXTENSION

This section provides the construction schedules and descriptions for projects included within ERC and VDOT's Comprehensive Agreement⁶. The location of ERC's improvements is shown in **Map 2** on page 7.

Midtown Tunnel

Construction (November 2013 – December 2016), Rehabilitation (Existing MTT – 2017)

Project Summary:

The new Midtown Tunnel will increase capacity and reduce congestion on US 58 between Norfolk and Portsmouth. The project includes:

- A new 2-lane tunnel under the Elizabeth River adjacent to the existing US 58 Midtown Tunnel. Bi-directional traffic in the existing Midtown Tunnel will be converted to one-way. The new tunnel will carry westbound traffic from Norfolk to Portsmouth. Eastbound traffic will use the existing tunnel.
- Interchange improvements in Norfolk at Brambleton Avenue/Hampton Boulevard to enhance traffic flow.
- Rehabilitation of the existing Midtown Tunnel tube. This consists of structural, fire, and safety improvements including: Tunnel fireproofing for structural protection, a new jet fan ventilation system, LED tunnel lighting which provides brighter lighting and uses less energy, tile and concrete repair, and exit and safety signage. The improvements being made will extend the life of the facilities as well as improve its safety and energy efficiency.

Downtown Tunnel

Rehabilitation (westbound DTT – August 2013 – Summer 2014, eastbound DTT begins Summer 2014)

Project Summary:

Rehabilitation of the existing Downtown Tunnel tubes consists of structural, fire, and safety improvements including:

- Tunnel fireproofing for structural protection

- A new jet fan ventilation system
- LED tunnel lighting (brighter and more energy-efficient)
- Tile and concrete repair
- Exit and safety signage

The improvements being made will extend the life of the facilities as well as improve its safety and energy efficiency.

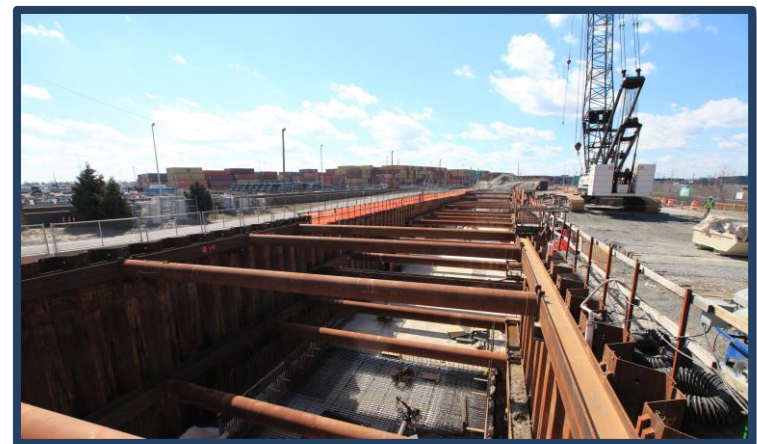
Martin Luther King (MLK) Freeway Extension

Construction (November 2013 – December 2016)

Project Summary:

Extending the MLK Freeway from London Blvd. to I-264 with a partial interchange at High St. will:

- Provide more direct access between the Midtown and Downtown tunnels.
- Add a faster route to and from both tunnels.
- Allow motorists to easily choose between the Midtown or Downtown tunnels.
- Better communicate traffic conditions via changeable message signs on the MLK Freeway.
- Help reduce traffic volumes on surface streets in Portsmouth.

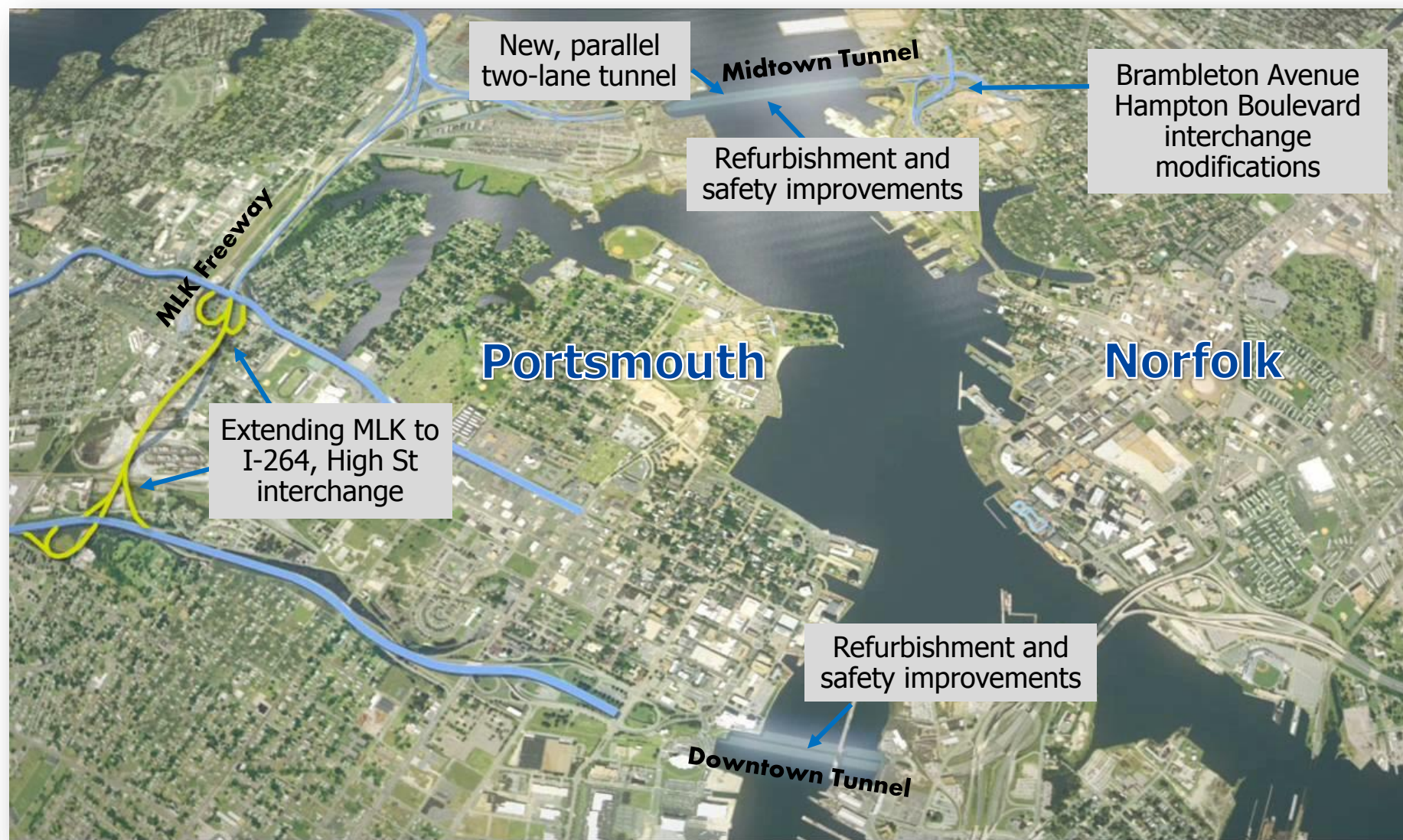


Midtown Tunnel Construction

Source: VDOT

⁶ Project descriptions were obtained from the Elizabeth River Tunnels website (www.driveert.com).

Map 2 – Midtown Tunnel, Downtown Tunnel, and MLK Freeway Extension Project Improvements



Source: Elizabeth River Crossings (ERC)

PROJECT DESCRIPTION – ALTERNATE ROUTES

The Gilmerton Bridge, South Norfolk Jordan Bridge, and the I-64/High Rise Bridge are three of the major alternates to the Midtown and Downtown Tunnels for crossing the Southern Branch of the Elizabeth River. This section provides the construction schedules and descriptions of these facilities.

Gilmerton Bridge

Construction (November 2009 – Winter 2015)

Project Summary:

Bridge replacement project on Military Highway/Route 13 in Chesapeake that replaces the original twin bascule bridge with a vertical lift bridge spanning the Southern Branch of the Elizabeth River. Four lanes were opened to traffic on November 14, 2013, with continued bridge work completed in Winter 2015. Project benefits include:

- Increased horizontal and vertical clearance to accommodate marine and motorist traffic with fewer bridge openings.
- Increased lane width to improve traffic flow and accommodate future widening of Military Highway.

This project was constructed using public funds at a cost of \$140 million and does not contain tolls.

South Norfolk Jordan Bridge

The new 2-lane bridge opened in 2012

Project Summary:

- On October 14, 2008, Chesapeake City Council voted to shut down the original Jordan Bridge due to structural deterioration and lack of funding for repairs.
- Figg Bridge Developers submitted plans for a new privately-funded South Norfolk Jordan Bridge, including the removal of the closed bridge. The new 2-lane bridge was approved by Chesapeake City Council on January 27, 2009.
- The South Norfolk Jordan Bridge opened to traffic on October 27, 2012.
- The SNJB is a fixed span with a vertical clearance of 145' and a horizontal clearance of 270'.

The SNJB uses similar automated technologies (E-ZPass and license plate readers) for toll collection as used at the Midtown and Downtown Tunnels. Existing toll rates for the new bridge are shown on the following page.



Construction of the Gilmerton Bridge in Chesapeake, VA



South Norfolk Jordan Bridge in Chesapeake, VA

South Norfolk Jordan Bridge Toll Rates

(effective June 17, 2013 through December 31, 2014)⁷

Vehicle Type	 Discount Rate	 Discount Rate	 Pay by Mail
Passenger Vehicles, Motorcycles and Mopeds/Scooters (2 axles)	\$1.50	\$3.00	\$4.00
3 axles	\$2.50	\$4.00	\$5.00
4 axles	\$3.50	\$5.00	\$6.00
5 or more axles	\$4.50	\$6.00	\$7.00

⁷New base travel fees of \$1.75 (E-ZPass), \$3.25 (Pay by Plate) and \$4.25 (Pay by Mail) were implemented on Thursday, January 1, 2015. Source: www.snjb.net

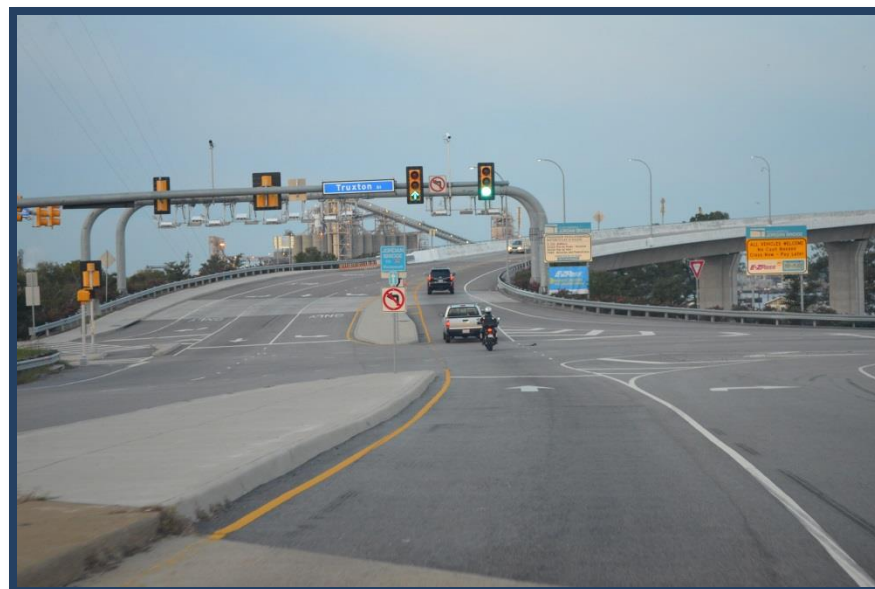
I-64 Southside Widening (including High Rise Bridge)

Draft Environmental Assessment October 3, 2014

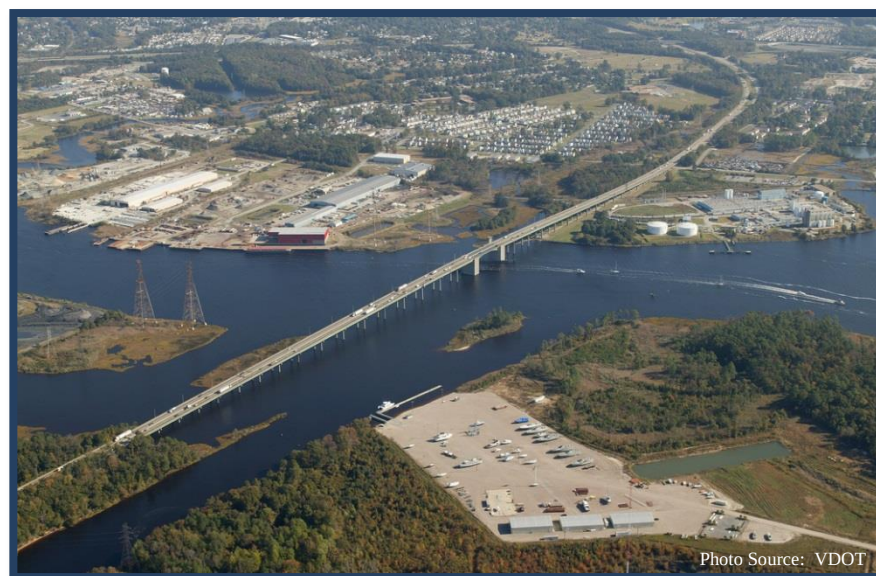
Project Summary:

This project will widen the existing highway from I-464 to I-64/I-264/I-664 at Bowers Hill, and may replace the High Rise Bridge.

- Included as a Hampton Roads Transportation Fund (HRTF) candidate project adopted by the HRTPO Board resolution on October 17, 2013.
- HRTPO Board amended the 2034 Long-Range Transportation Plan to include this project on September 18, 2014.
- Location public hearing was held on November 6, 2014.
- Multiple alternatives are currently being considered, including options for various High Rise Bridge heights and whether the project will include HOV or HOT lanes.
- Most recent VDOT cost estimate – \$1.86 to \$2.30 Billion (including replacing the existing High Rise Bridge).



Automated Toll Collection at the South Norfolk Jordan Bridge (Eastbound)



Existing I-64 High-Rise Bridge over the Southern Branch of the Elizabeth River in Chesapeake, Virginia

SOUTH HAMPTON ROADS MTT AND DTT TOLLS SURVEY

The HRTPO Board requested in January 2014 that Christopher Newport University's Judy Ford Wason Center for Public Policy conduct the South Hampton Roads Midtown and Downtown Tunnels Tolls Survey. The goal of this study was to assess the public's views and anticipated behavior in light of the implementation of tolling on the Midtown and Downtown tunnels. The data and analysis focused on commuting experiences, knowledge and views of tolls on the Midtown and Downtown tunnels, anticipated changes to commuting patterns, and knowledge and use of the EZ Pass system. This survey was conducted in two parts:

- Part I⁷: Pre-Tolling Report and Findings (March 2014)
- Part II⁸: Post-Tolling Report and Findings (March 2015)

Summaries of key findings from the survey are provided to the right.

1. Commuting Experiences

- Vast majority of residents drive; a third commute through one or both tunnels, and nearly two-thirds of them do so during Peak hours.

2. Views on Tolls

- Residents are slightly more supportive of tolls than opposed; tolling most popular option for paying for transportation improvements in Hampton Roads.

3. Knowledge of Tolls

- Residents think a reasonable toll for cars and light trucks is \$.77, and for commercial heavy trucks is \$1.75; split on whether current toll for cars and lights trucks is too high.

4. Anticipated Changes to Driving Habits

- Few say they will change where they live to avoid tolls, but majority say they will change their commute or where they travel to avoid them.

5. Issues Related to EZ Pass

- Most residents have heard about EZ Pass; majority have opened an account or say they don't need one. Most employers not helping with toll costs.

Part I: Summary of Key Findings (Pre-Toll)

1. Progress on Traffic Management

- Residents report fewer delays.
- Increase in daily tunnel usage and decrease in occasional tunnel usage.

2. Views on Tolls Mixed

- Support for tolls has dropped while opposition has increased.
- Tolls remain preferred method for paying for transportation.
- More residents think \$1.00 tolls is reasonable.

3. Knowledge of Tolls

- Residents are largely unaware of the actual toll rates.
- Residents report average Off-Peak and Peak toll rates higher than they are.

4. Some Behavioral Changes, but less than predicted

- Some changes in commuting habits, routes, and methods, but not as much as residents anticipated making in January.

5. Issues Related to EZ Pass

- A persistent pocket of residents have not opened EZ Pass accounts for financial or knowledge/understanding reasons.

Part II: Summary of Key Findings (Post-Toll)

⁷ Available at <http://www.hrtpo.org/uploads/docs/032014TPO-Enclosure%209-Southampton%20Roads%20Midtown%20and%20Downtown%20Tolls%20Survey-Part%20I.pdf>

⁸ Available at <http://www.hrtpo.org/uploads/docs/031915TPO-Enclosure%2015D-South%20Hampton%20Roads%20Midtown%20and%20Downtown%20Tunnels%20Tolls%20Survey-Part%20II.pdf>

PROJECTED TRAFFIC IMPACTS USING THE TRAVEL DEMAND MODEL

In September 2012, HRTPO staff ran the Hampton Roads travel demand model to determine potential impacts along tolled corridors and alternate roadways in the study area as a result of upcoming tolls planned on the Midtown and Downtown Tunnels. The purpose was to identify roadways that may experience changes in traffic as a result of MTT/DTT tolls, roadways with significant increases or decreases in traffic congestion during peak hours.

As of September 2012, tolls on the MTT/DTT were set to begin on February 1, 2014, at \$1.84 for passenger cars and \$7.36 for heavy vehicles during peak hours and \$1.59 for passenger cars and \$4.77 for heavy vehicles during off-peak hours. On January 15, 2014, Governor Terry McAuliffe announced that initial tolls would be lowered by nearly half during construction after a deal was reached with ERC. On February 1, 2014, tolls for passenger cars with E-ZPass began at \$1.00 during peak hours and \$4.00 for trucks with E-ZPass.

Staff ran the travel demand model with the full toll rates as initially planned. As a result, **Map 3** on the following page generally shows higher changes in 24-hour traffic volumes than what actually occurred after lower tolls were implemented on February 1, 2014.

Listed below are the toll assumptions used in the travel demand model analysis performed in September 2012:

Assumptions - “Before” Tolls at Midtown/Downtown Tunnels

- New Gilmerton Bridge complete (4 lanes)
- South Norfolk Jordan Bridge open with tolling (2 lanes)
 - Auto/Light Vehicles (2 axles): \$2.00 (AM/PM peak), \$2.00 (Off-peak)
 - Heavy Vehicles (3+ axles): \$6.49 (AM/PM peak), \$4.49 (Off-peak)
- No tolls at Midtown/Downtown Tunnels

Assumptions - “After” Tolls at Midtown/Downtown Tunnels

- New Gilmerton Bridge complete (4 lanes)
- South Norfolk Jordan Bridge open with variable tolling (2 lanes)
 - Auto/Light Vehicles (2 axles): \$2.00 (AM/PM peak), \$2.00 (Off-peak)
 - Heavy Vehicles (3+ axles):⁹ \$6.49 (AM/PM peak), \$4.49 (Off-peak)
- Variable tolling at Midtown/Downtown Tunnels

- Auto/Light Vehicles (2 axles): \$1.84 (AM/PM peak), \$1.59 (Off-peak)
- Heavy Vehicles (3+ axles): \$7.36 (AM/PM peak), \$4.77 (Off-peak)

Key Roadways with Forecasted Changes in Traffic Volumes Due to Midtown/Downtown Tunnel Tolling (see Map 3, page 12)

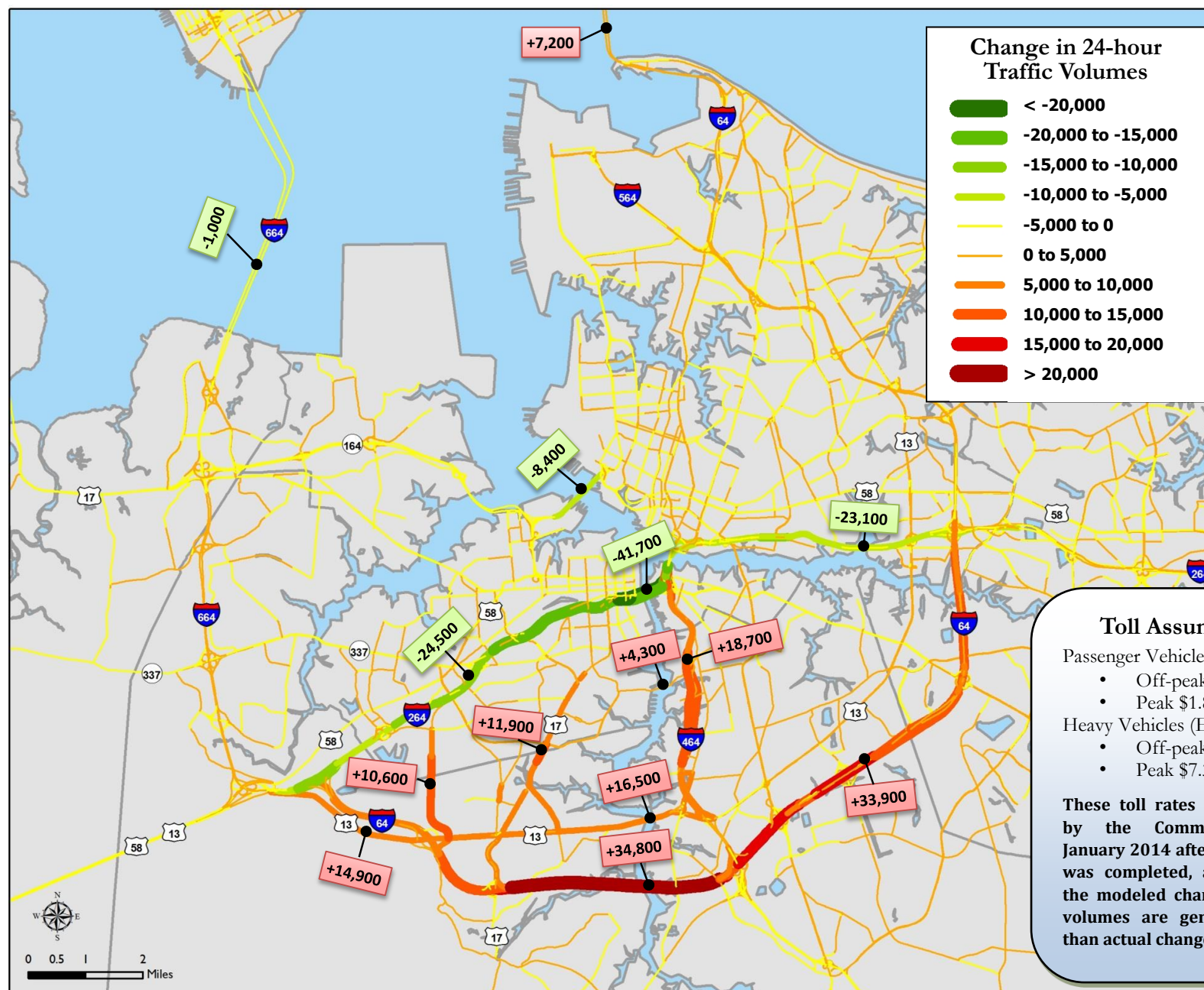
Upon running the regional travel demand model, HRTPO staff found that MTT/DTT tolling would likely:

- Cause traffic volumes to decrease at the tolled tunnels and their approaches:
 - Midtown Tunnel (including Western Fwy, MLK Fwy, Hampton Blvd and Brambleton Ave)
 - Downtown Tunnel (including Berkley Bridge and I-464)
- Cause traffic volumes to increase at other crossings and their approaches:
 - I-64 Southside/High-Rise Bridge
 - Military Highway, including the Gilmerton Bridge
 - George Washington Hwy (I-64 to Victory Blvd)
 - South Norfolk Jordan Bridge
 - Cavalier Blvd (Military Hwy to Victory Blvd)
 - Canal Dr (Shell Rd to George Washington Hwy)
 - Shell Rd (Canal Dr to George Washington Hwy)
 - Hampton Roads Bridge-Tunnel

HRTPO staff used this list of roadways as a baseline for collecting and analyzing pre-toll and post-toll traffic conditions – traffic volumes, traffic queues using photos/videos, and segment travel time/speed data – which are provided in subsequent sections of this report.

⁹ A weighted average toll was used for heavy vehicles based on VDOT 2010 truck classification data in Hampton Roads. Model inputs cannot vary toll amounts based on the number of axles.

Map 3 – Forecasted* Change in 24-hour Traffic Volumes Before and After Midtown/Downtown Tunnel Tolls



*This analysis was conducted by HRTPO staff in September 2012 using the regional travel demand model and the original comprehensive agreement terms for tolls. At that time, tolls were set to begin on February 1, 2014 at \$1.84 for passenger cars and \$7.36 for heavy vehicles during peak hours and \$1.59 for passenger cars and \$4.77 for heavy vehicles during off-peak hours.

TRAFFIC CONDITIONS: BEFORE AND AFTER TOLL IMPLEMENTATION

The following three parts of this section analyze traffic conditions along key roadways “before” and “after” toll implementation at the Midtown and Downtown Tunnels. Many of the roadways included in this analysis were identified in the previous section of this report from the travel demand model analysis, where traffic volumes were expected to increase or decrease.

1. **Traffic Volumes** – An analysis of traffic volumes using traffic counts collected by VDOT and the South Norfolk Jordan Bridge.
2. **Traffic Queues and Queue Clearance Times** – Analyses of videos, photos, and traffic queue data collected by HRTPO staff during peak hours using in-vehicle travel runs and from roadside locations near tunnel facilities.
3. **Segment Travel Times and Speeds** – An analysis of roadway travel times, speeds, and congestion levels in the study area during peak travel periods.

TRAFFIC VOLUMES

This section provides an analysis of traffic volumes “before” and “after” tolls were implemented at the Midtown and Downtown Tunnels.

Traffic volumes were analyzed not only at the Midtown and Downtown Tunnels but also at select locations throughout the study area where traffic volume data is collected continuously throughout the year. These 13 continuous count station locations¹⁰ are shown in **Map 4**.

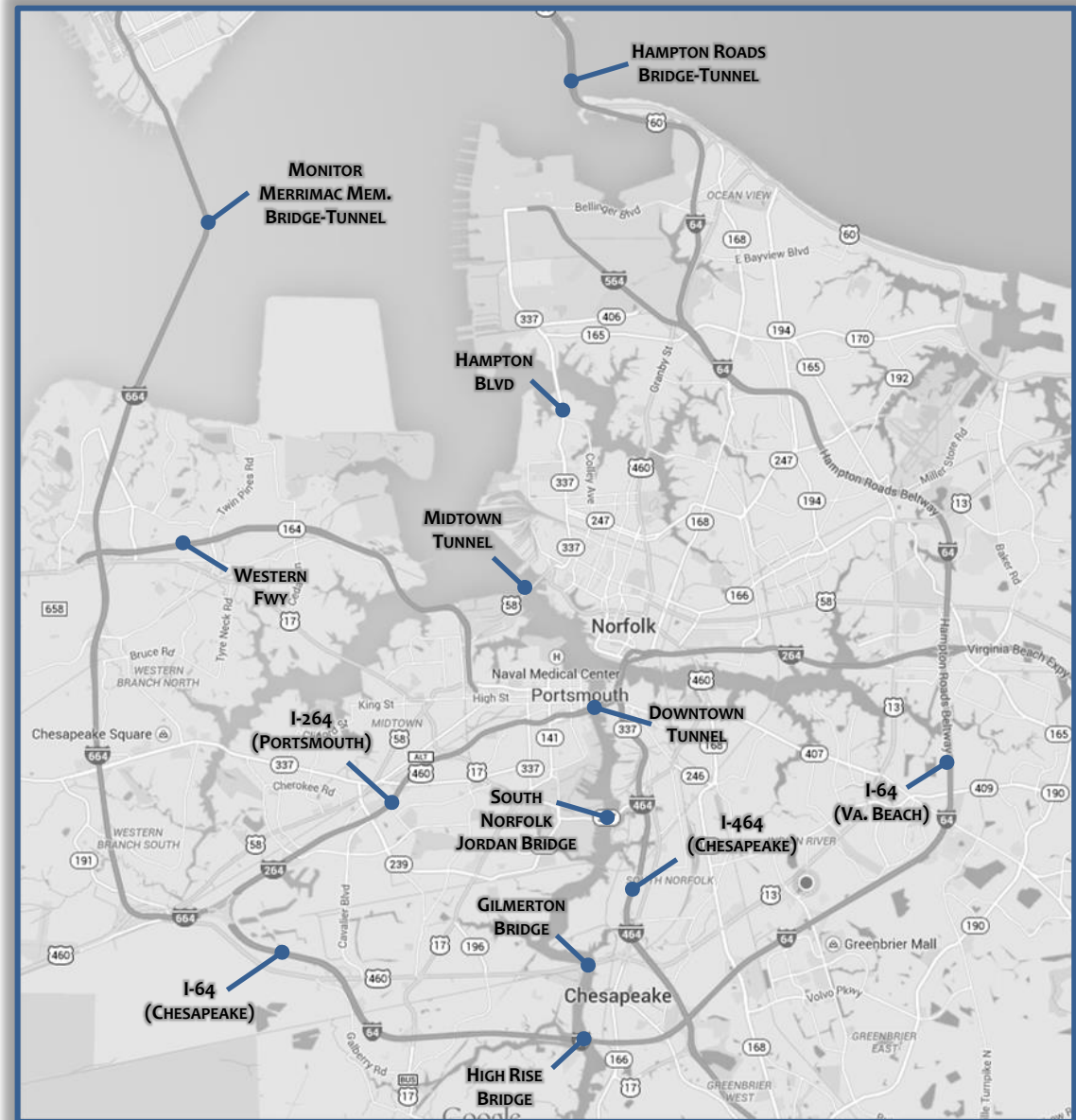
The traffic volume data that HRTPO staff analyzed for this study was collected by the Virginia Department of Transportation (VDOT) for 13 months during the pre-tolling period from January 1, 2013, to January 31, 2014, and for 10 months during the post-tolling period from February 1, 2014, to November 30, 2014.

This section examines the following traffic volume characteristics “before” and “after” toll implementation, both at the Midtown and Downtown Tunnels and at adjacent and alternate facilities in the study area:

1. Weekday Volumes
2. Peak vs. Non-Peak Volumes
3. Weekend Volumes
4. Truck Volumes

¹⁰ HRTPO staff intended to include the Dominion Boulevard Steel Bridge (now replaced by the Veterans Bridge) in Chesapeake in the analysis for this study. However, due to construction of the new bridge, the continuous count station at this location was taken out of service in September 2013.

Map 4 – Continuous Count Stations Included in this Study



Background Map Source: Google.

WEEKDAY VOLUMES

As shown in the “Projected Traffic Impacts Using the Travel Demand Model” section of this report, big changes in regional traffic patterns were projected to occur when tolls were implemented at the Midtown and Downtown Tunnel. This section includes an analysis of the changes that actually occurred in weekday volumes (defined in this study as volumes on Tuesdays, Wednesdays, and Thursdays) at the Midtown and Downtown Tunnels and other select locations throughout the study area.

Midtown and Downtown Tunnel

Prior to the implementation of tolls, weekday traffic volumes were consistently in the 40,000 vehicles per day range at the Midtown Tunnel (**Figure 2**). Weekday volumes at the Downtown Tunnel, however, were decreasing in the months prior to the implementation of tolls. Weekday volumes at the Downtown Tunnel decreased from 98,500 vehicles per weekday in June 2013 down to 78,700 vehicles per weekday in November 2013, before increasing back up to 85,200 vehicles in December. Some of this decrease in volumes was due to closures of the westbound direction of the Downtown Tunnel due to construction. The tunnel closures covered entire weekends starting in August 2013, but were changed to nightly closures in November 2013. These nightly closures continued at times throughout the remainder of the study period.

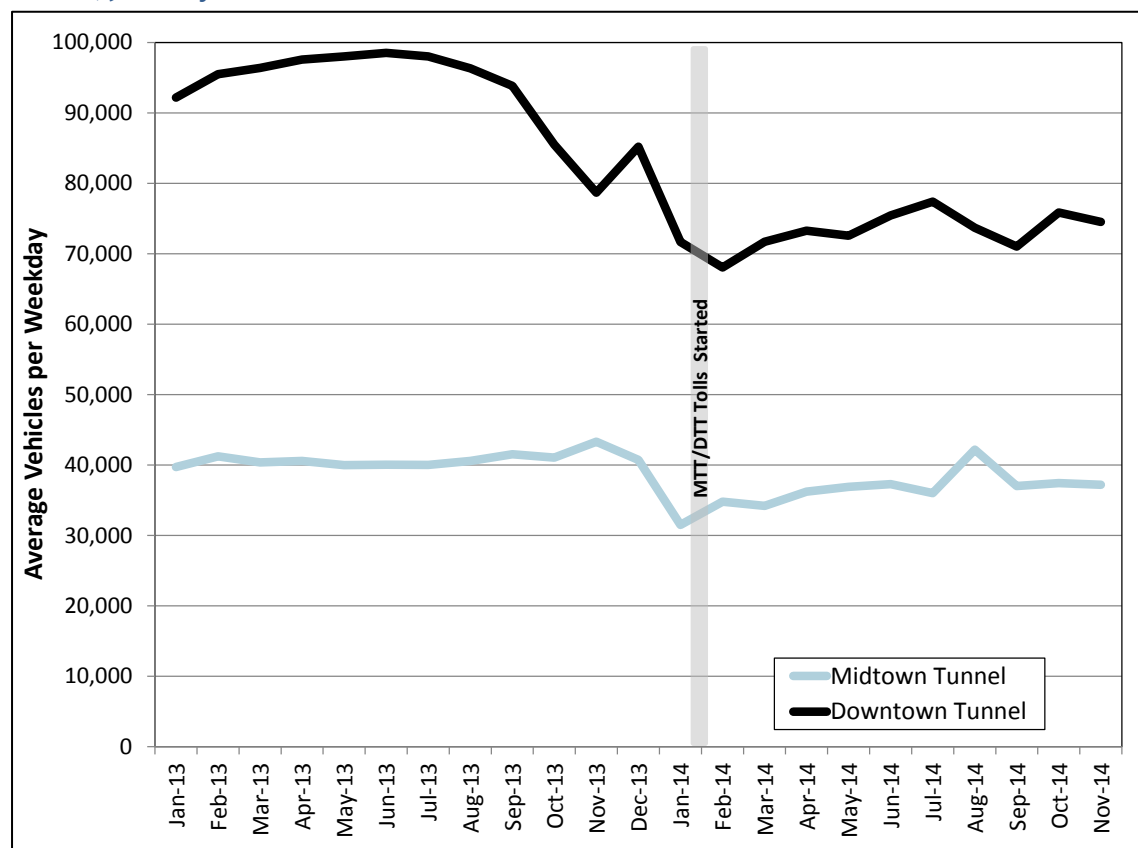
In addition, bad weather in January 2014 – the month before tolls were implemented – greatly impacted traffic volumes, not only at the Midtown and Downtown Tunnels but throughout the region.

As expected, volumes decreased at the Midtown and Downtown Tunnels after tolls were implemented on February 1, 2014. A Special Report produced by HRTPO titled “Tolls Reduce Tunnel Traffic, but Where Did Everybody Go” noted that weekday volumes for the first week of tolling were down 6,300 vehicles (or

16%) at the Midtown Tunnel and 19,600 vehicles (or 23%) at the Downtown Tunnel from the middle of January (when weather conditions did not impact travel).

Further analysis by HRTPO staff noted that by the last week of February, some of the volumes had returned to the tunnels. Weekday volumes the last week of February 2014 were 900 vehicles higher at the Midtown Tunnel and 5,400 vehicles higher at the Downtown Tunnel than they were during the first week of the month.

Figure 2 – Average Weekday Volumes at the Midtown and Downtown Tunnel by Month, January 2013–November 2014



Source: HRTPO analysis of VDOT data. Notes: Weekday volumes are impacted by Downtown Tunnel overnight closures starting in November 2013, and winter weather days impacted volumes in January 2014.

Weekday volumes at the Midtown and Downtown Tunnels continued to increase throughout the spring and early summer of 2014. By November 2014 – the last month of data analyzed for this study – average volumes were 2,400 vehicles per weekday higher at the Midtown Tunnel than in February 2014, and 6,500 vehicles per weekday higher at the Downtown Tunnel. They were, however, still significantly lower than pre-tolling volumes.

Figure 3 shows the volumes at the Midtown Tunnel and Downtown Tunnel for pre-tolling and post-tolling conditions. Throughout this study, staff generally used the period of May-November 2013 to analyze pre-tolling conditions, and the period of May-November 2014 to analyze post-tolling conditions. These time periods allow for a three month period after tolls were in place for traffic patterns to stabilize, and provide a period long enough to smooth out monthly fluctuations in volumes.

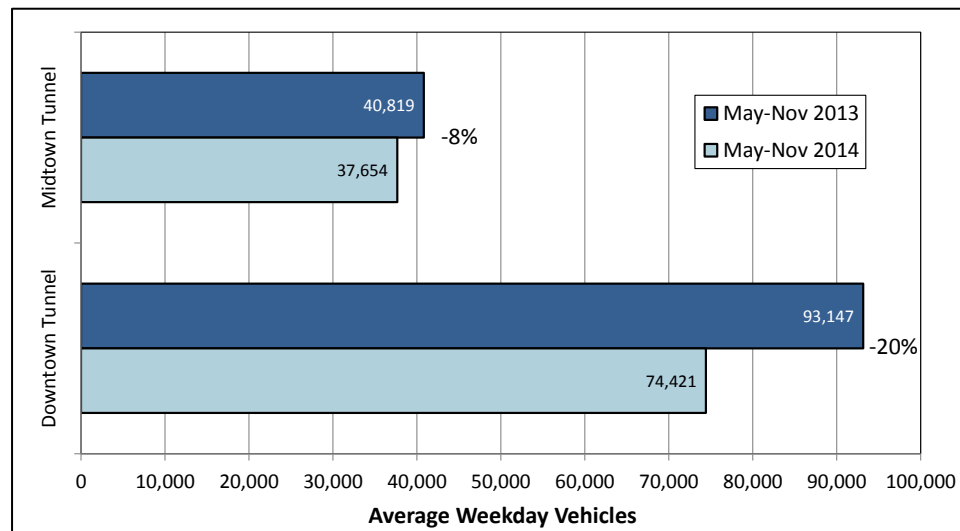
Between May-November 2013 and May-November 2014, volumes decreased from 40,819 vehicles per weekday at the Midtown Tunnel down to 37,654 vehicles per weekday. This was a decrease of nearly 3,200 vehicles, or 8%. At the Downtown Tunnel, volumes decreased from 93,147 vehicles per weekday in May-November 2013 down to 74,421 vehicles per weekday in May-November 2014. This was a decrease of 18,700 vehicles per weekday, or 20%.

River Crossings

While volumes decreased at the Midtown and Downtown Tunnels after tolls were implemented, volumes increased at three other crossings of the Southern Branch of the Elizabeth River – the South Norfolk Jordan Bridge (SNJB), the Gilmerton Bridge, and the I-64 High Rise Bridge. **Figure 4** on page 17 shows how these weekday volumes changed at the five river crossings (and other locations in the study area) from the pre-tolling May-November 2013 period to the post-tolling May-November 2014 period.

The crossing that saw the largest increase in volumes after tolls were implemented was the Gilmerton Bridge. Volumes at the Gilmerton Bridge increased by 10,100 vehicles per weekday after tolls were implemented, a 53% increase. By comparison, the High Rise Bridge saw an increase of

Figure 3 – Average Weekday Volumes at the Midtown and Downtown Tunnel, May-November 2013 versus May-November 2014



Source: HRTPO analysis of VDOT data.

6,100 vehicles per weekday (+7%), and the South Norfolk Jordan Bridge saw an increase of 3,200 vehicles per weekday (+49%).

Figure 5 on page 18 shows the total number of vehicles that cross the Southern Branch of the Elizabeth River at these five locations combined. Traffic volumes crossing the river in February 2014 – the first month tolls were in place – were 232,300 vehicles each weekday, which is less than the 240,500 vehicles crossing each weekday in December 2013.

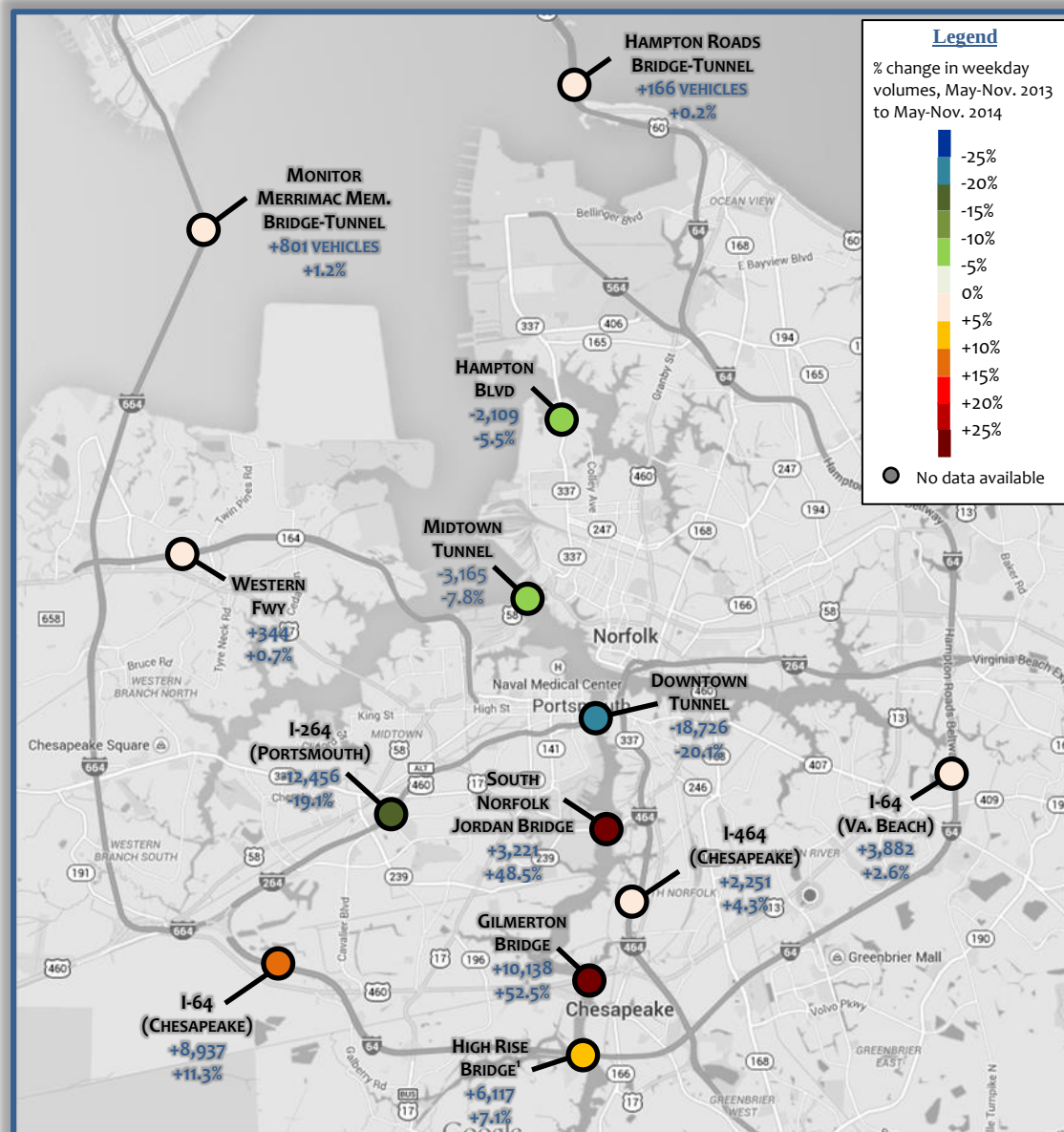
However, looking at the period from September-November 2013 versus the same months in 2014 (data prior to September 2013 is unavailable for the High Rise Bridge), the number of vehicles crossing the river at these five locations increased slightly after tolls were put in place, from 241,800 vehicles per weekday in 2013 to 242,600 vehicles in 2014.

Study Area

Figure 4 shows how these weekday volumes changed at the 13 locations from the pre-tolling May-November 2013 period to the post-tolling May-November 2014 period.

As part of this study, HRTPO staff examined whether tolling had an impact on volumes at two of the Hampton Roads Harbor crossings – the Hampton Roads Bridge-Tunnel (HRBT) and the Monitor-Merrimac Memorial Bridge-Tunnel (MMMBT). Looking at the two facilities for the May-November 2013 period, 57.9% of weekday volumes used the HRBT while 42.1% used the MMMBT. By the May-November 2014 period, volumes slightly shifted to the MMMBT, as 57.6% of weekday volumes used the HRBT and 42.4% used the MMMBT.

Figure 4 – Total and Percentage Change in Weekday Volumes at Continuous Count Station Locations in the Study Area, May-November 2013 to May-November 2014



Source: HRTPO analysis of VDOT and SNJB data. Background Map Source: Google.

1 – Continuous count data was unavailable at the High Rise Bridge prior to September 2013. The High Rise Bridge data reflects the September-November period for 2013 and 2014.

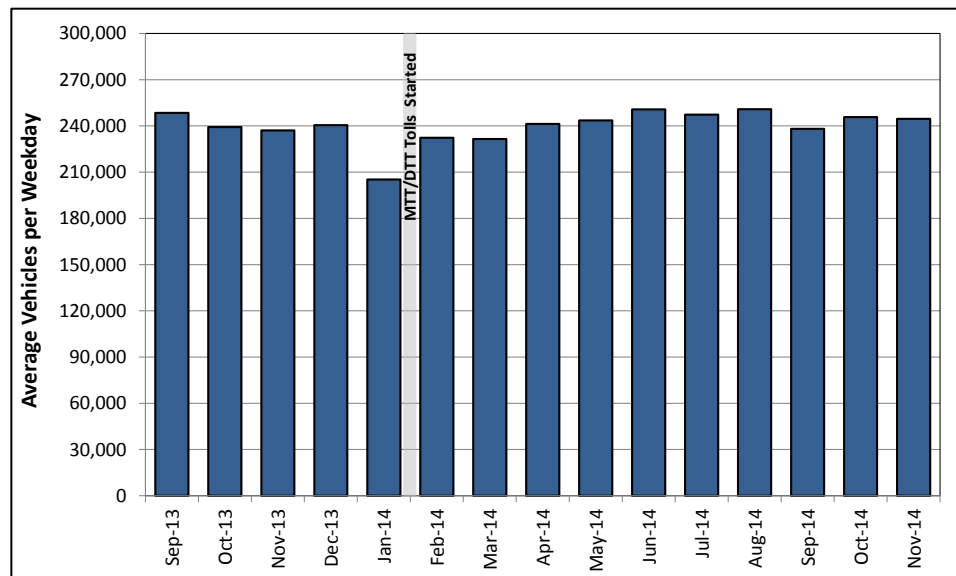
However, volumes have been shifting for years from the HRBT towards the MMMBT. As shown in **Table 1**, the share of volume at the HRBT has steadily decreased, from 63.4% in 2002 down to below 58% in 2013 and 2014. Based on this data, it appears tolling at the Midtown and Downtown Tunnels had little to no impact on travel patterns across the Hampton Roads Harbor.

Table 1 – Share of Weekday Volumes at the HRBT and MMMBT

Year	Hampton Roads Bridge-Tunnel	Monitor-Merrimac Mem. Bridge-Tunnel
2002	63.4%	36.6%
2004	63.3%	36.7%
2006	61.8%	38.2%
2008	61.0%	39.0%
2010	58.8%	41.2%
2012	58.9%	41.1%
May-Nov. 2013	57.9%	42.1%
May-Nov. 2014	57.6%	42.4%

Source: HRTPO analysis of VDOT data.

Figure 5 – Average Weekday Volumes at the Five River Crossings by Month, September 2013–November 2014



Source: HRTPO analysis of VDOT and SNJB data. Crossings include the Midtown Tunnel, Downtown Tunnel, South Norfolk Jordan Bridge (SNJB), Gilmerton Bridge, and High Rise Bridge. Notes: Winter weather days impacted volumes in January 2014, and continuous count data was unavailable at the High Rise Bridge prior to September 2013.

PEAK VS NON-PEAK VOLUMES

The preceding section examined the changes in 24-hour weekday traffic volumes throughout the region due to the implementation of tolls at the Midtown and Downtown Tunnels. However, travel characteristics vary greatly throughout the day. Congestion is much more prevalent during the morning and afternoon peak travel periods, when a majority of trips are made by people commuting to or from work. During non-peak travel periods, trips are more likely to be discretionary, in terms of the time the trip is taken, the route of the trip, or whether the trip is even made. In addition, the toll rates established by Elizabeth River Crossings (ERC) are slightly higher during peak travel periods than they are during off peak periods (\$1.00 vs. \$0.75 in 2014).

This section examines the changes that occurred in peak period volumes as compared to non-peak period volumes on weekdays at the Midtown and Downtown Tunnels and other select locations throughout the study area. For this section, time periods are defined as the AM Peak Period (5 am – 9 am), Midday Period (9 am – 3 pm), PM Peak Period (3 pm – 7 pm), and Overnight (7 pm – 5 am). Although these time period definitions differ slightly from ERC's tolling periods, they are the same as used in other HRTPO planning efforts.

Midtown and Downtown Tunnel

Figure 6 shows the average weekday volumes at the Midtown Tunnel during the AM Peak, Midday, PM Peak, and Overnight time periods, and **Figure 7** shows the same data for the Downtown Tunnel. While Midtown Tunnel volumes were largely constant during the AM Peak, Midday, and PM Peak Periods in 2013 before the tolls were implemented, volumes were already decreasing at the Downtown Tunnel. AM Peak Period (-5.3%), PM Peak Period (-4.5%), and especially Midday volumes (-10.5%) all decreased at the Downtown Tunnel from Summer 2013 to December 2013. January 2014 volumes were low at both facilities but as mentioned previously in this report this was largely due to bad weather the last two weeks of the month.

Figure 6 – Average Weekday Volumes by Time of Day at the Midtown Tunnel by Month, January 2013-November 2014

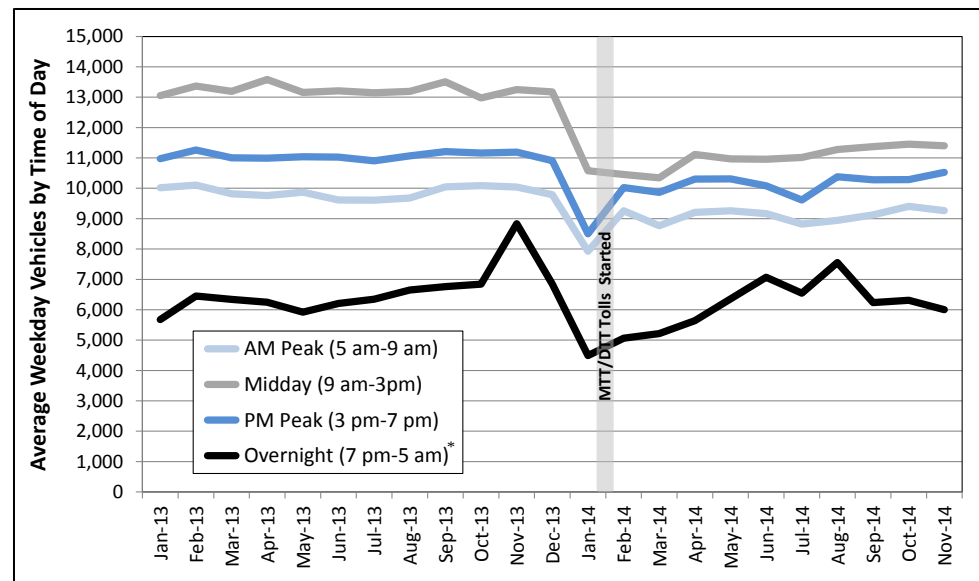
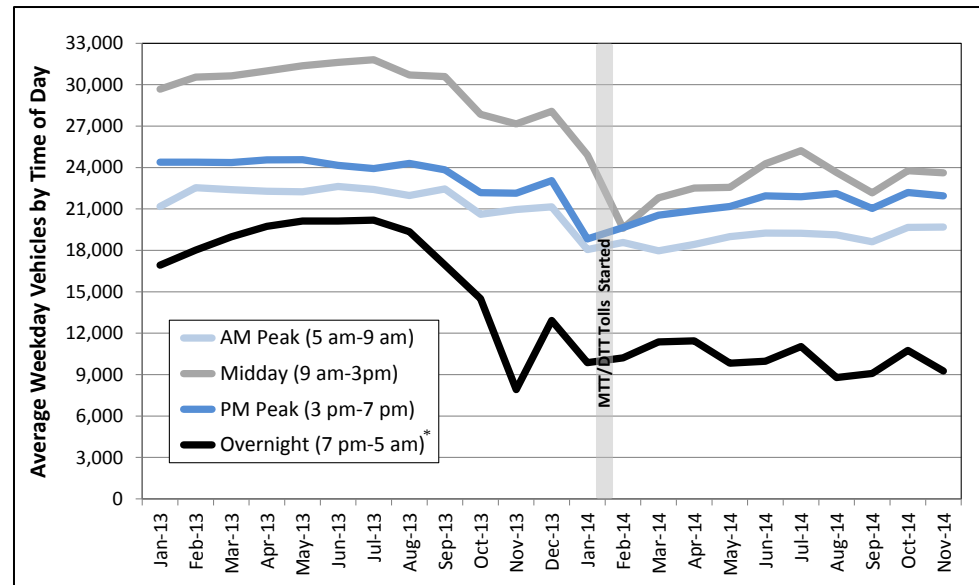


Figure 7 – Average Weekday Volumes by Time of Day at the Downtown Tunnel by Month, January 2013-November 2014



Source: HRTPO analysis of VDOT data. Winter weather days impacted volumes in January 2014.

* Overnight volumes were impacted by Downtown Tunnel closures starting in November 2013.

Once tolls were implemented on February 1, 2014, volumes dropped during all four time periods at both the Midtown Tunnel and Downtown Tunnel. In data included with HRTPO's "Tolls Reduce Tunnel Traffic, but Where Did Everybody Go?" Special Report, it was shown that volumes during the off peak travel periods decreased more than the volumes did during the peak travel periods. At the Midtown Tunnel, volumes the first week after tolls were in place compared to the middle of January (when weather conditions did not impact travel) were down 10% during the AM Peak Period, 12% during the PM Peak Period, and 21% during the off peak periods. At the Downtown Tunnel, volumes were down 12% during the AM Peak Period, 20% during the PM Peak Period, and 31% during the off peak periods.

Further analysis by HRTPO Staff determined that by the last week of February, some of the diverted volumes had returned, particularly at the Downtown Tunnel. Weekday peak period volumes during the last week of February 2014 were 250 vehicles higher at the Midtown Tunnel than they were during the first week of the month, and 2,400 vehicles higher at the Downtown Tunnel. During off peak periods, volumes during the last week of February were 670 vehicles per weekday higher at the Midtown Tunnel and 2,960 vehicles per weekday higher at the Downtown Tunnel than during the first week of February. This trend continued throughout 2014, as volumes continued to grow at the Midtown Tunnel and Downtown Tunnel during the AM Peak, PM Peak, and Midday periods.

It should be noted that the overnight data at both the Midtown and Downtown Tunnels were impacted by nightly directional closures at the Downtown Tunnel. Overnight closures also occurred regularly at the Gilmerton Bridge. Due to these numerous closures, the trends in overnight volumes were not further analyzed in this report.

Figures 8 and 9 compare Midtown and Downtown Tunnel volumes by time of day from May-November 2013 to the same months in 2014. At the Midtown Tunnel, volumes decreased by 714 vehicles (-7%) during the AM Peak Period and 902 vehicles (-8%) during the PM Peak Period from May-November 2013 to May-November 2014. Midday volumes at the Midtown Tunnel, however, decreased by a much larger amount – 1,996 vehicles per day (-15%).

Figure 8 – Average Weekday Volumes at the Midtown Tunnel by Time of Day, May-November 2013 versus May-November 2014

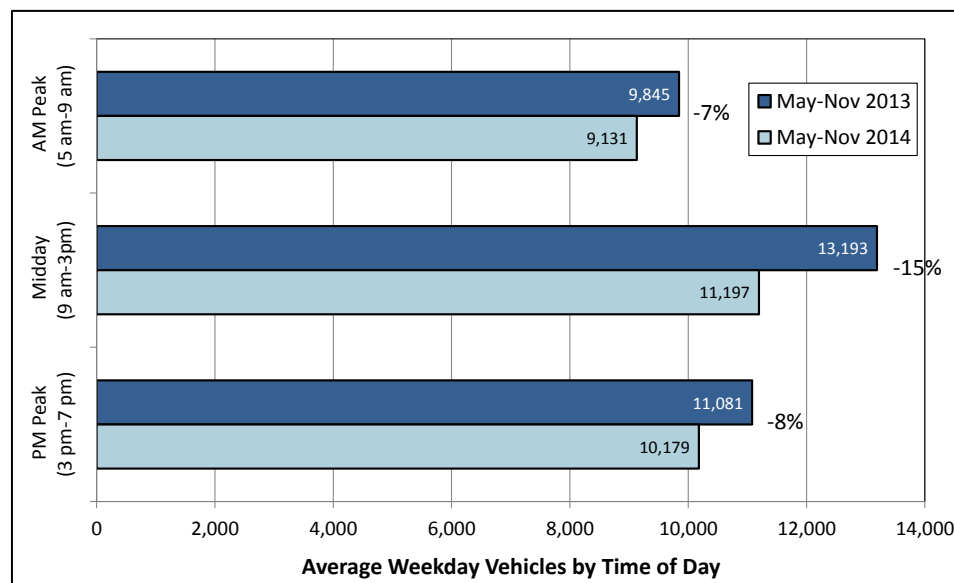
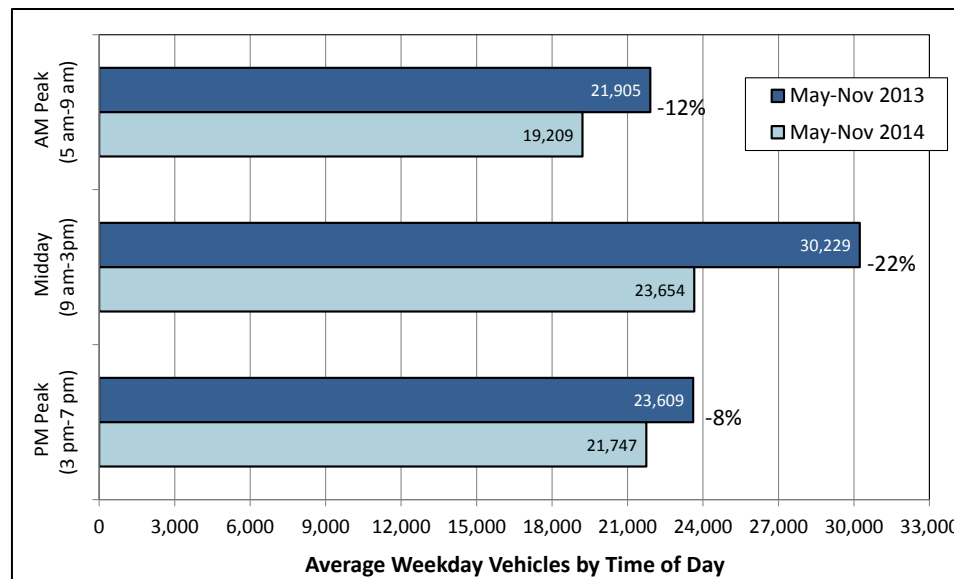


Figure 9 – Average Weekday Volumes at the Downtown Tunnel by Time of Day, May-November 2013 versus May-November 2014



Source: HRTPO analysis of VDOT data. Overnight volumes are not included due to the impacts of numerous nightly closures at the Downtown Tunnel.

Although the decreases in volumes were larger at the Downtown Tunnel than at the Midtown Tunnel, the same relationship between peak period and off peak period volumes can be seen. Volumes at the Downtown Tunnel decreased by 2,696 vehicles (-12%) during the AM Peak Period and 1,862 vehicles (-8%) during the PM Peak Period from May-November 2013 to May-November 2014. During the Midday period, however, volumes at the Downtown Tunnel decreased by 6,575 vehicles (-22%).

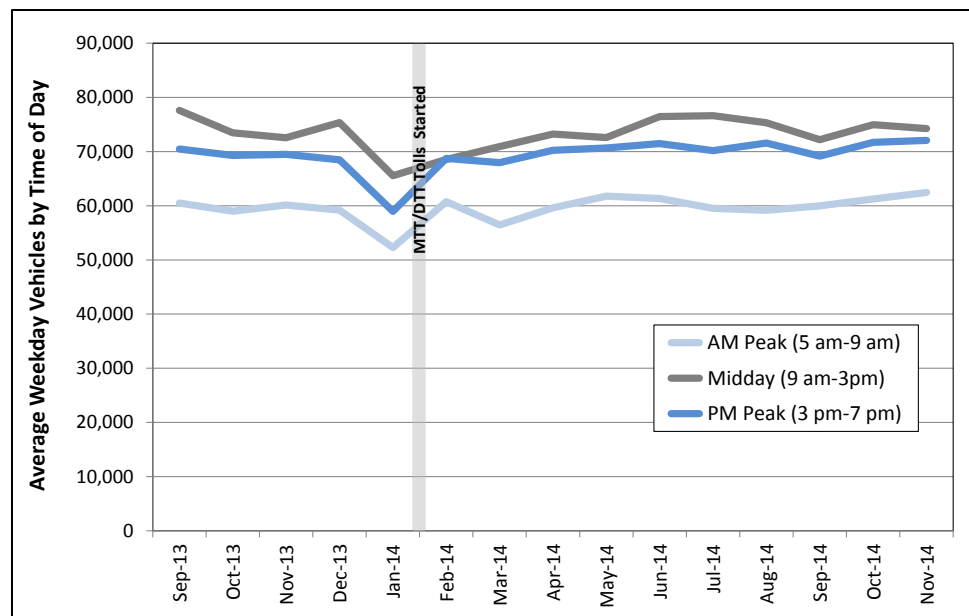
River Crossings and the Study Area

After tolls were implemented, volumes shifted from the Midtown and Downtown Tunnels to other crossings of the Southern Branch of the Elizabeth River, at all time periods throughout the day. **Figure 11** on pages 22-23 shows the change in average weekday volumes by time of day at the continuous count station locations in the study area from May-November 2013 to the same months in 2014.

The Gilmerton Bridge experienced the largest increase in both total volume and percent increase in volume during both peak periods and the midday period, with approximately 50% increases during each time period. The South Norfolk Jordan Bridge also saw large percentage increases in volumes during the AM Peak Period (+36%) and the Midday Period (+48%). Notably, the High Rise Bridge saw a large increase in volumes during the Midday Period (+11%), but saw a smaller increase during the AM Peak Period (+5%) and actually saw a decrease in volumes during the PM Peak Period (-4%).

Figure 10 shows the total number of vehicles that crossed the Southern Branch of the Elizabeth River at these five locations combined. Looking at the period from September-November 2013 versus the same months in 2014 (data prior to September 2013 is unavailable for the High Rise Bridge), the total number of vehicles crossing the river at these five locations actually increased during peak periods after tolls were put in place. Volumes during the AM Peak Period increased by 1,279 vehicles per weekday (+2%) from September-November 2013 to September-November 2014, and volumes during the PM Peak Period increased by 1,105 vehicles per weekday (+2%). Midday volumes, however, decreased by 844 vehicles per weekday (-1%).

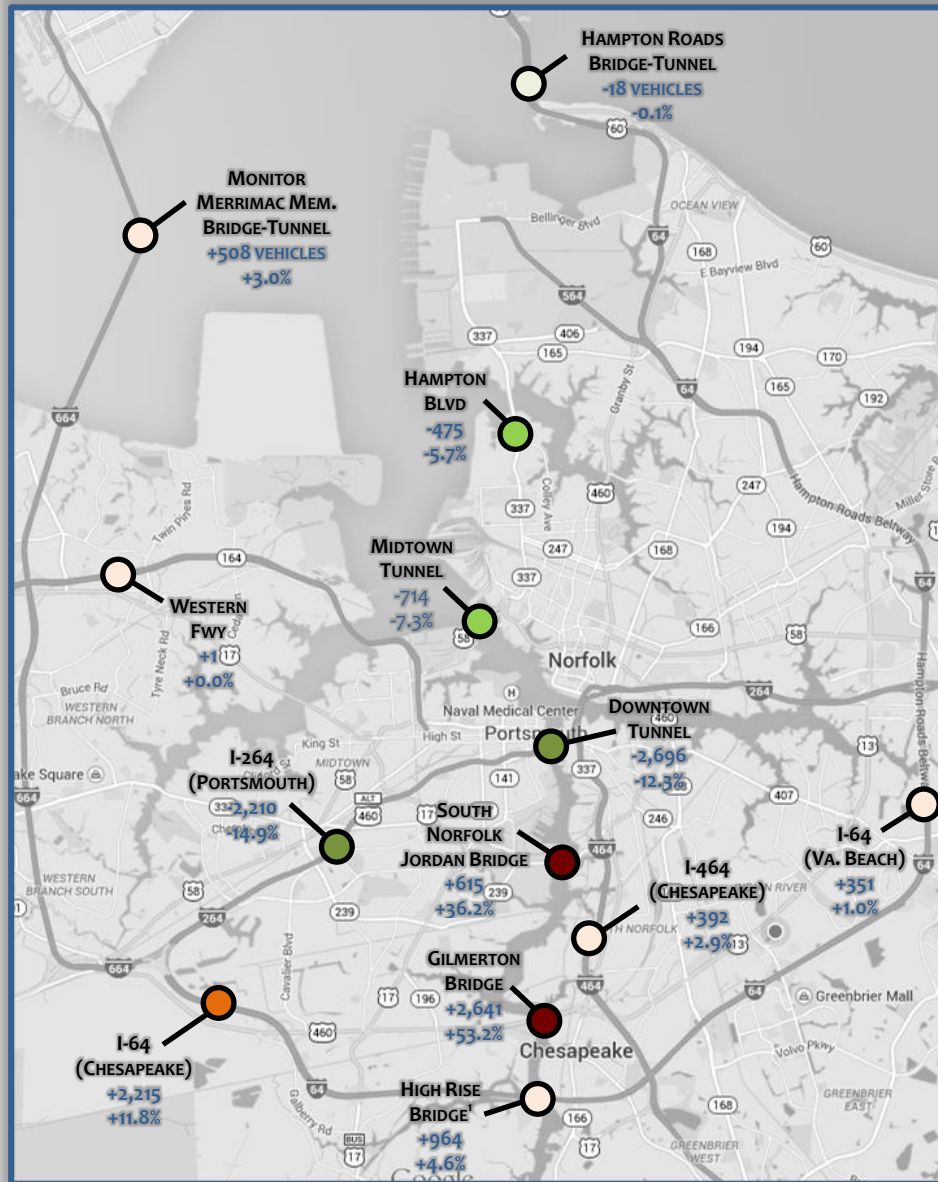
Figure 10 – Average Weekday Volumes at the Five River Crossings by Month by Time of Day, September 2013-November 2014



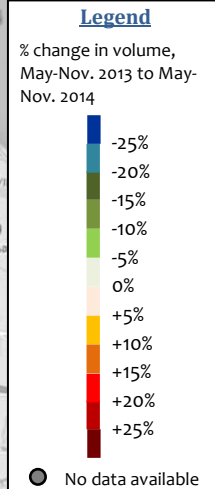
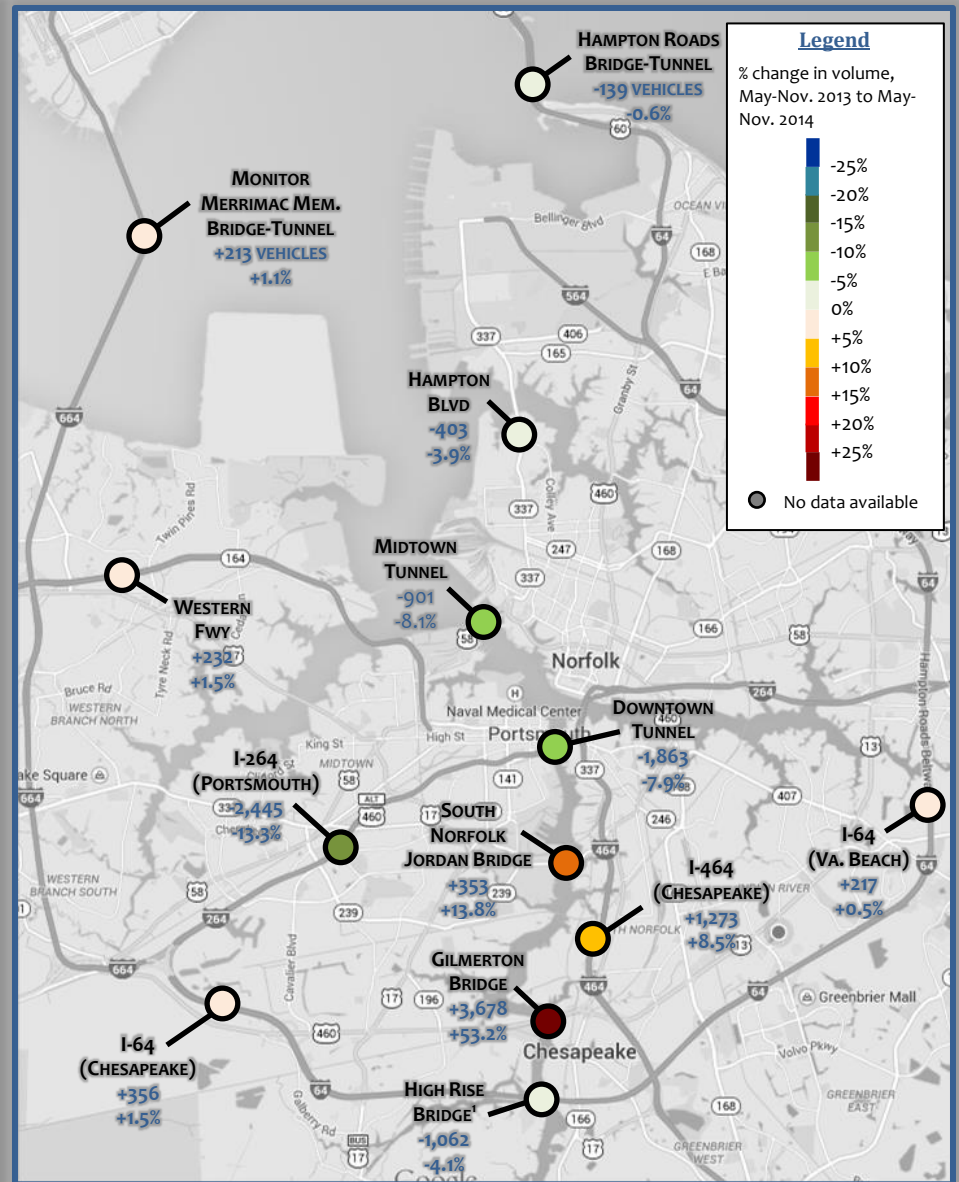
Source: HRTPO analysis of VDOT and SNJB data. Crossings include the Midtown Tunnel, Downtown Tunnel, South Norfolk Jordan Bridge (SNJB), Gilmerton Bridge, and High Rise Bridge. Notes: Winter weather days impacted volumes in January 2014, and continuous count data was unavailable at the High Rise Bridge prior to September 2013.

Figure 11 – Total and Percentage Change in Weekday Volumes at Continuous Count Station Locations in the Study Area by Time of Day, May-November 2013 to May-November 2014

AM Peak Period (5 am – 9 am)



PM Peak Period (3 pm – 7 pm)

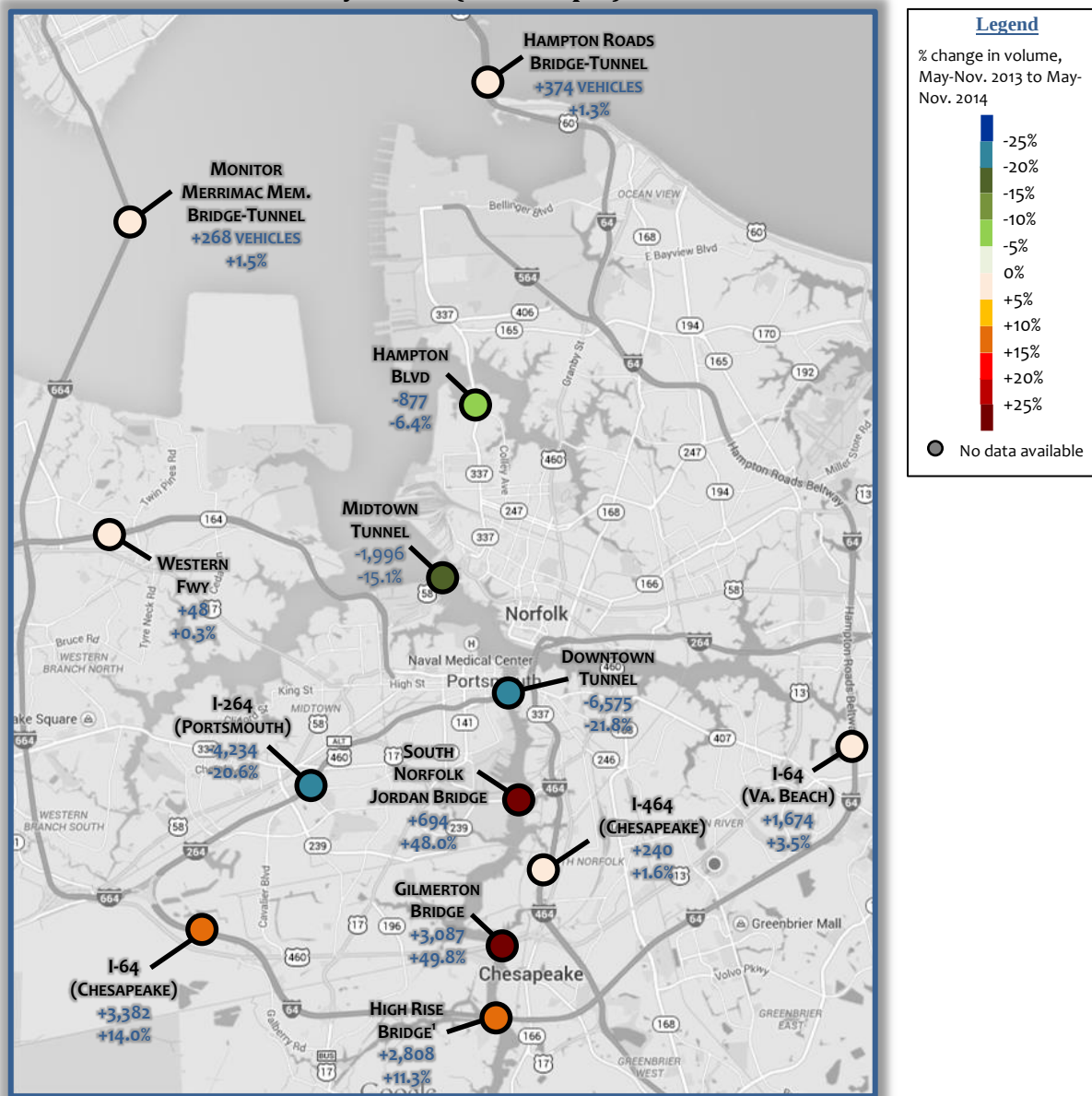


Source: HRTPO analysis of VDOT and SNJB data. Background Map Source: Google.

1 – Continuous count data was unavailable at the High Rise Bridge prior to September 2013. The High Rise Bridge data reflects the September-November period for 2013 and 2014.

Figure 11 (continued) - Total and Percentage Change in Weekday Volumes at Continuous Count Station Locations in the Study Area by Time of Day, May-November 2013 to May-November 2014

Midday Period (9 am – 3 pm)



Source: HRTPO analysis of VDOT and SNJB data. Background Map Source: Google.

1 – Continuous count data was unavailable at the High Rise Bridge prior to September 2013. The High Rise Bridge data reflects the September-November period for 2013 and 2014.

WEEKEND VOLUMES

This section examines the changes that occurred in weekend volumes at the Midtown and Downtown Tunnels and other select locations throughout the study area. For this analysis, weekend data includes a combination of both Saturday and Sunday volumes.

Midtown and Downtown Tunnel

Figure 12 shows the average weekday and weekend volumes at the Midtown Tunnel between January 2013 and November 2014, and **Figure 13** shows the same data for the Downtown Tunnel.

As can be seen in Figures 13 and 14, weekend volumes at the Midtown and Downtown Tunnels were impacted by construction closures at the Downtown Tunnel. The westbound Downtown Tunnel was closed each weekend starting in August 2013, but was changed to nightly closures by ERC in October 2013. Additionally, the eastbound Downtown Tunnel was closed for construction on select weekends in the summer and fall of 2014. Dates of weekend closures of the Downtown Tunnel are shown in **Table 2** below. Because of the large impacts of these temporary closures, this analysis examines only those weekends when Downtown Tunnel closures were not in place.

Table 2 - Weekend Closure Dates at the Downtown Tunnel, January 2013 - November 2014

Westbound	Eastbound
8/10 - 8/11/2013	7/26 - 7/27/2014
8/17 - 8/18/2013	8/2 - 8/3/2014
8/24 - 8/25/2013	8/9 - 8/10/2014
9/7 - 9/8/2013	8/16 - 8/17/2014
9/14 - 9/15/2013	9/20 - 9/21/2014
9/21 - 9/22/2013	10/25 - 10/26/2014
9/28 - 9/29/2013	11/1 - 11/2/2014
10/5 - 10/6/2013	

Source: HRTPO analysis of VDOT Downtown Tunnel counts.

Figure 12 - Average Weekday and Weekend Volumes at the Midtown Tunnel by Month, January 2013-November 2014

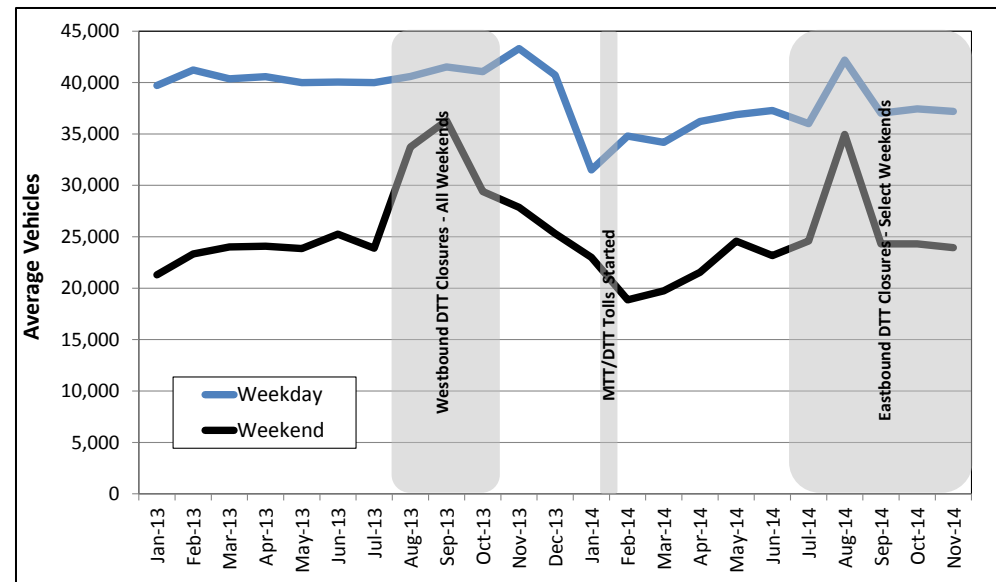
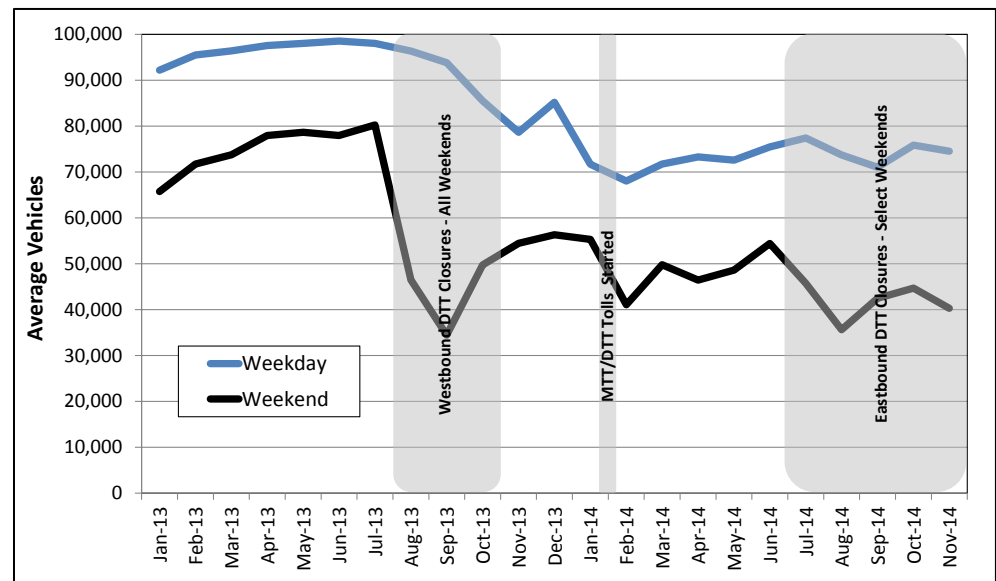


Figure 13 - Average Weekday and Weekend Volumes at the Downtown Tunnel by Month, January 2013-November 2014



Source: HRTPO analysis of VDOT data.

Figure 14 shows the changes in Midtown and Downtown Tunnel weekend volumes from May-November 2013 to the same months in 2014. At the Midtown Tunnel, weekend volumes decreased from 25,436 vehicles per day in May-November 2013 to 24,140 vehicles per day in May-November 2014, a 5% drop. The decrease in weekend volumes at the Downtown Tunnel was much larger, from 71,117 vehicles per day in May-November 2013 down to 50,187 vehicles per day in May-November 2014, a 29% drop.

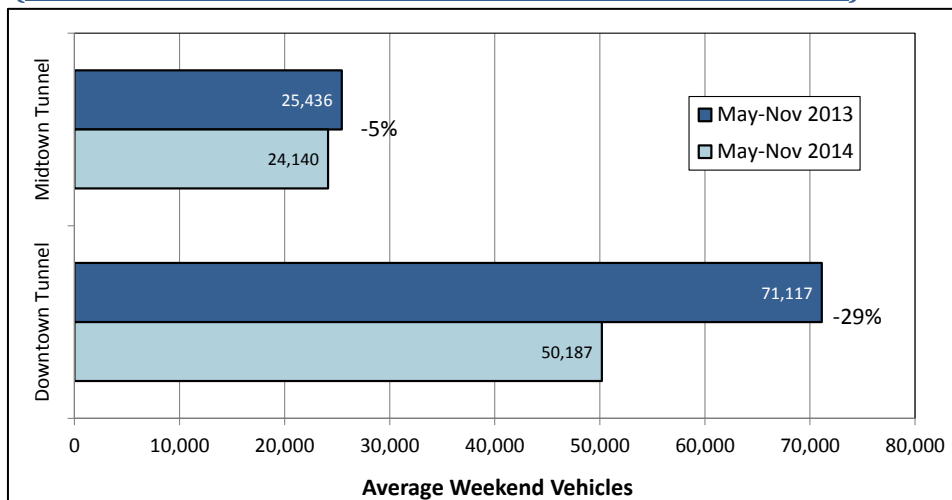
River Crossings and the Study Area

As with weekday volumes, weekend volumes also shifted from the Midtown and Downtown Tunnels toward other crossings of the Southern Branch of the Elizabeth River. **Figure 16** on page 26 shows the change in average weekend volumes at these crossings and the other continuous count station locations in the study area from May-November 2013 to the same months in 2014.

The Gilmerton Bridge experienced the largest increase in weekend volumes among the crossings of the Southern Branch of the Elizabeth River, with an increase of 8,611 vehicles on weekend days after tolls were implemented at the Downtown and Midtown Tunnels. This is an increase of 67% from pre-tolling to post-tolling conditions. The High Rise Bridge (+6,814 vehicles/+11%) and the South Norfolk Jordan Bridge (+2,136 vehicles/+104%) also saw large increases in weekend volumes after tolls were implemented at the Downtown and Midtown Tunnels.

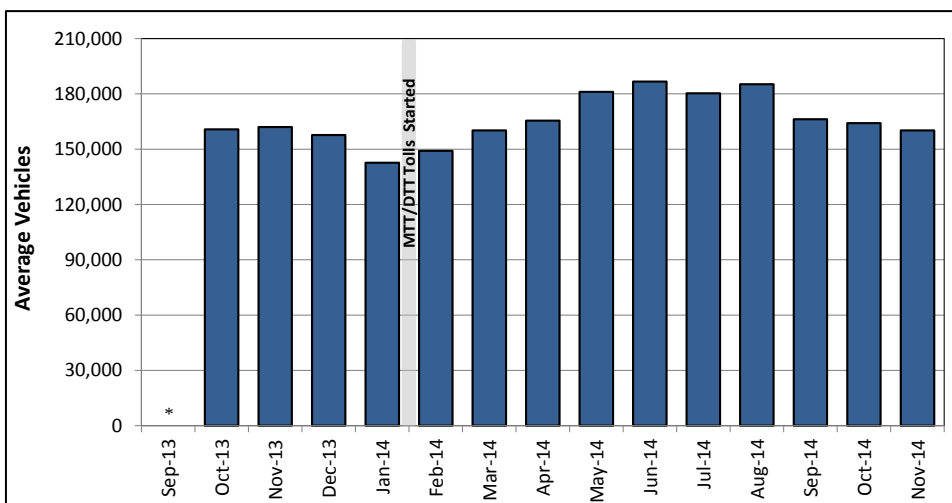
Figure 15 shows the average weekend volumes that crossed the Southern Branch of the Elizabeth River at the five locations combined. Data is not shown for September 2013 due to a lack of non-holiday weekends where the westbound Downtown Tunnel was open to traffic. Instead, comparing weekends in October-November 2013 where the Downtown Tunnel was open with the same months in 2014, the number of vehicles crossing the river at these five locations decreased by 1,424 vehicles per day (-1%).

Figure 14 – Average Weekend Volumes at the Midtown and Downtown Tunnel, May-November 2013 versus May-November 2014
(EXCLUDING WEEKENDS WITH DOWNTOWN TUNNEL CLOSURES)



Source: HRTPO analysis of VDOT data.

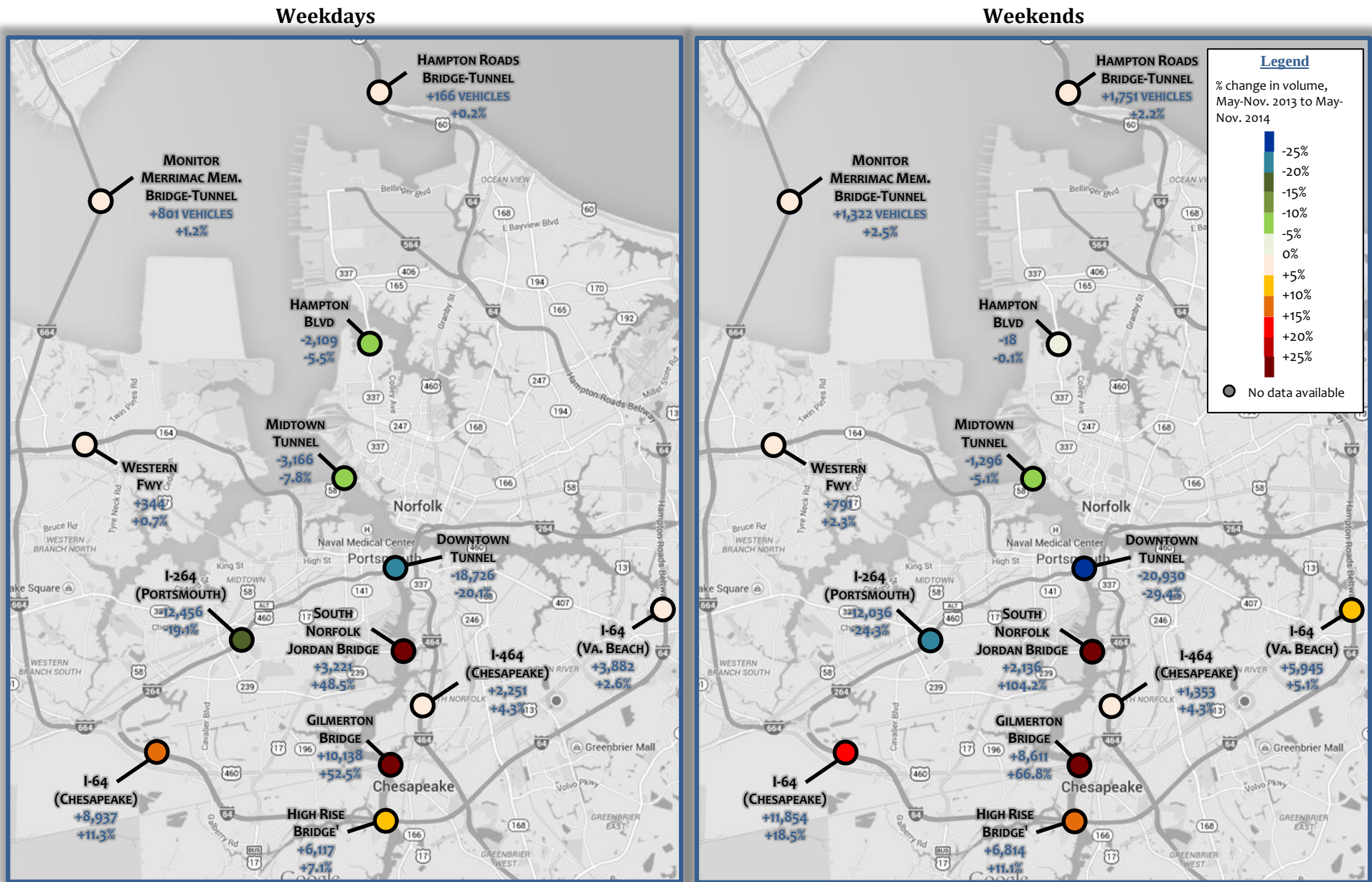
Figure 15 – Average Weekend Volumes at the Five River Crossings by Month, September 2013-November 2014
(EXCLUDING WEEKENDS WITH DOWNTOWN TUNNEL CLOSURES)



Source: HRTPO analysis of VDOT and SNJB data. Crossings include the Midtown Tunnel, Downtown Tunnel, South Norfolk Jordan Bridge (SNJB), Gilmerton Bridge, and High Rise Bridge.

* September 2013 volumes are not included due to the lack of non-holiday weekends where the WB Downtown Tunnel was open to traffic. Notes: Winter weather days impacted volumes in January 2014, and continuous count data was unavailable at the High Rise Bridge prior to September 2013.

Figure 16 – Total and Percentage Change in Weekday and Weekend Volumes at Continuous Count Station Locations in the Study Area, (EXCLUDING WEEKENDS WITH DOWNTOWN TUNNEL CLOSURES), May-November 2013 to May-November 2014



Source: HRTPO analysis of VDOT and SNJB data. Background Map Source: Google.

1 – Continuous count data was unavailable at the High Rise Bridge prior to September 2013. The High Rise Bridge data reflects the September-November period for 2013 and 2014.

TRUCK VOLUMES

As the home of the third largest container port on the East Coast, the efficient movement of freight is critically important to Hampton Roads. The implementation of tolls at the Midtown and Downtown Tunnels – which in 2014 ranged from \$2.25 for trucks with E-ZPass during non-peak travel periods to \$5.50 during peak periods for trucks without E-ZPass or a license plate registered with ERC – was expected to impact regional truck travel patterns. HRTPO staff analyzed the changes in truck travel patterns due to the implementation of tolls using vehicle classification data collected by VDOT and the South Norfolk Jordan Bridge at the continuous count stations in the study area.

It should be noted that vehicle classification data is not collected by VDOT at every continuous count station site. Vehicle classification data is available at 10 of the 13 continuous count stations in the study area, but is unavailable at the Downtown Tunnel, High Rise Bridge, and the I-64 location in Virginia Beach.

Only weekday volumes were analyzed for this truck volume analysis, since truck volumes are much higher on weekdays than on weekends. At the continuous count station locations in the study area, weekday truck volumes are nearly five times higher than the truck volumes seen on weekends.

Figure 17 on page 28 shows the average weekday truck volumes by month at the continuous count stations where vehicle classification data is collected. **Figure 18** on page 29 shows the change in average weekday truck volumes at these locations between pre-tolling conditions in May-November 2013 and post-tolling conditions in May-November 2014.

As expected, truck volumes decreased at the Midtown Tunnel after tolling was implemented, although it was not a large decrease. There was an average of 1,909 trucks at the Midtown Tunnel each weekday during the pre-tolling May-November 2013 period. In the post-tolling May-November 2014 period, this average dropped to 1,857 trucks per weekday, a decrease of 52 trucks per day (-3%).

Although vehicle classification data is not collected at the Downtown Tunnel, there is a continuous count station with vehicle classification data on I-264 between Victory Boulevard and Portsmouth Boulevard in



Trucks at the Midtown Tunnel Entrance

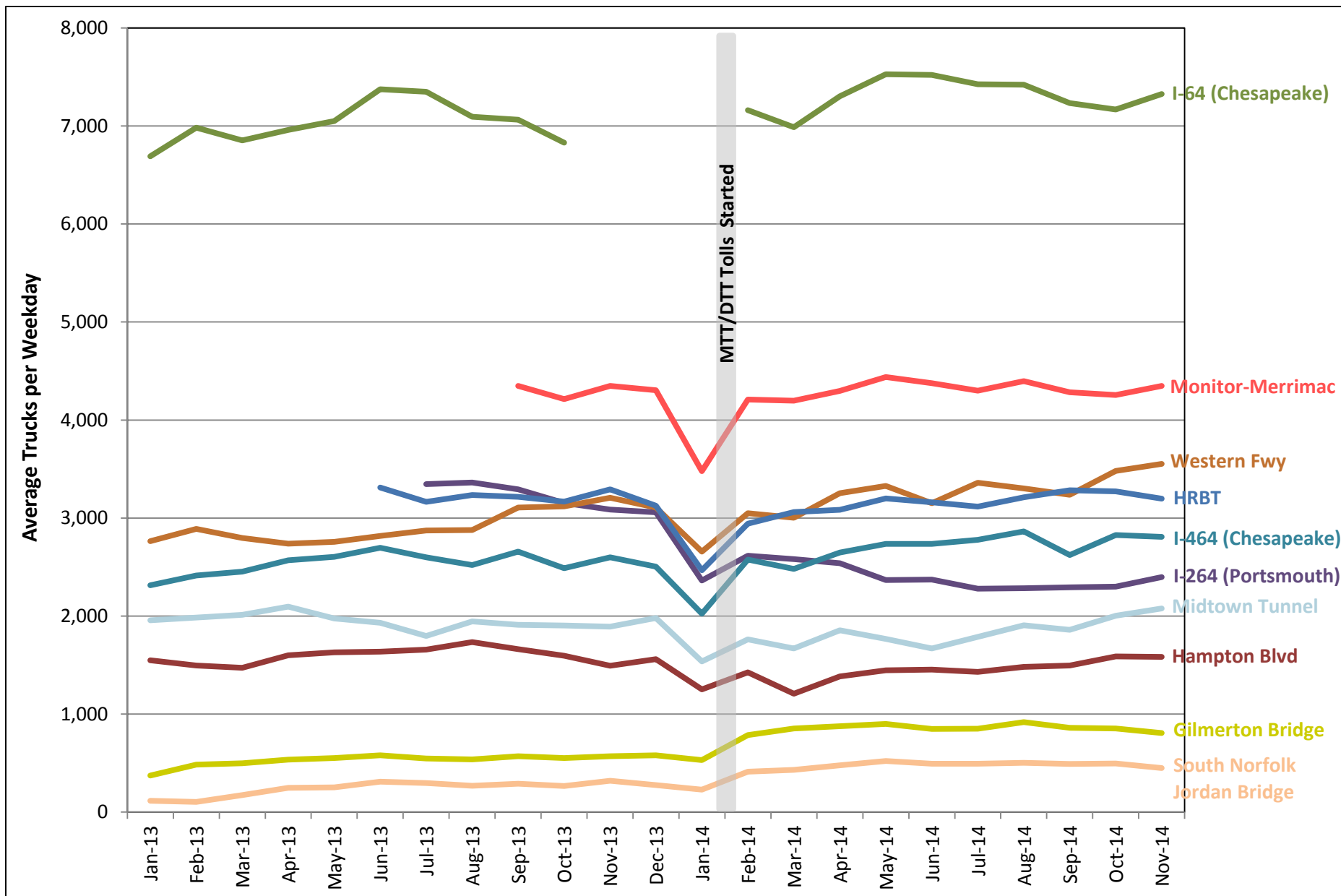


Figure 17 – Average Truck Volumes per Weekday at Continuous Count Stations in the Study Area, January 2013 – November 2014

Source: HRTPO analysis of VDOT and SNJB data. Vehicle classification data is not available 11/13 to 1/14 at the I-64 Chesapeake location, 1/13 to 8/13 at the Monitor-Merrimac Memorial Bridge-Tunnel, 1/13 to 6/13 at the I-264 Portsmouth location, and 1/13 to 5/13 at the Hampton Roads Bridge-Tunnel.

Portsmouth. Truck volumes decreased at this location after tolling was implemented. There was an average of 3,238 trucks on I-264 each weekday during the pre-tolling May-November 2013 period. In the post-tolling May-November 2014 period, this average dropped to 2,307 trucks, a decrease of 931 trucks per weekday (-29%).

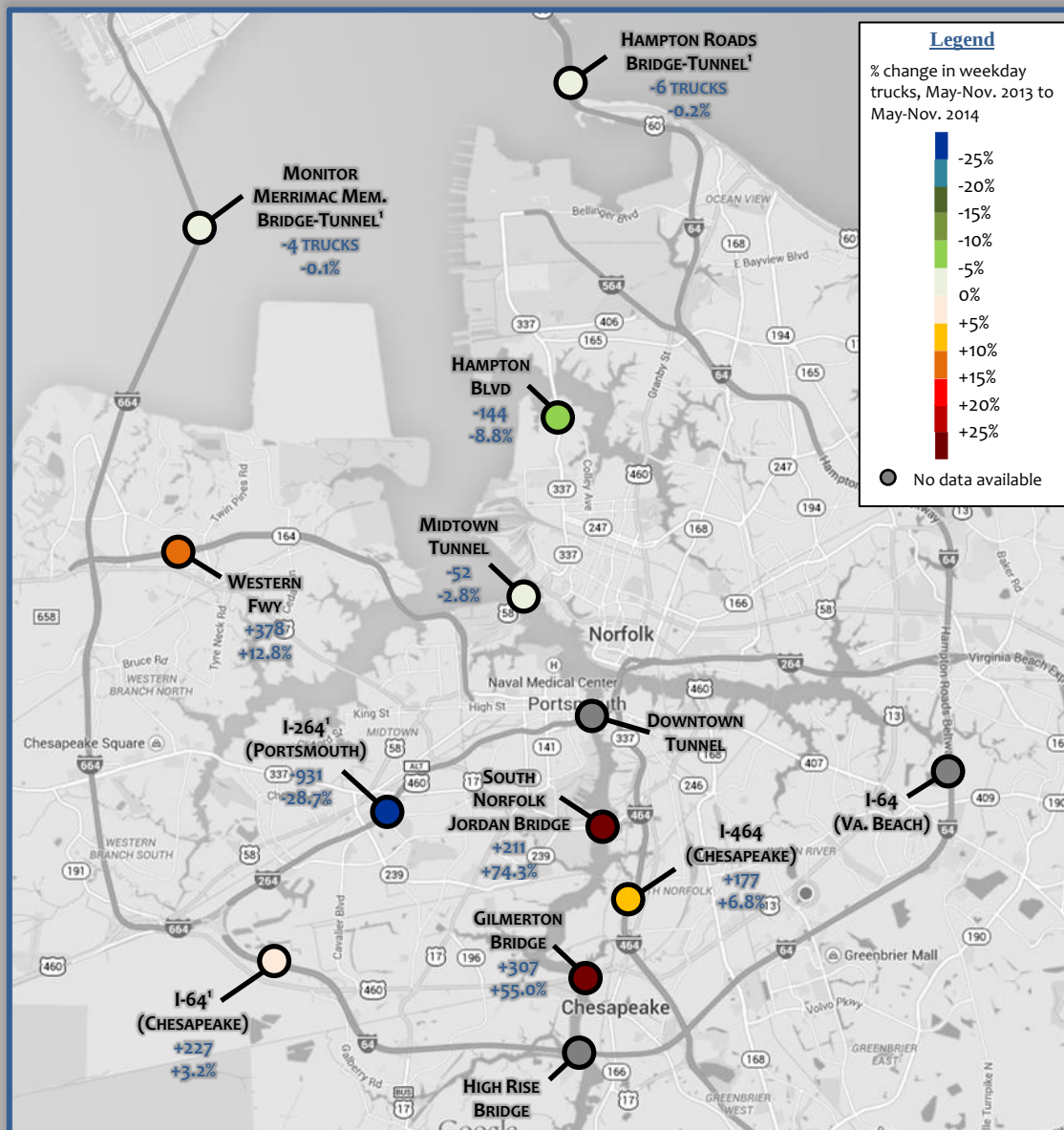
Many of these trucks diverted to the free crossings of the Southern Branch of the Elizabeth River. The Gilmerton Bridge carried 557 trucks per weekday in May-November 2013, prior to tolling at the Midtown and Downtown Tunnels. After tolling was implemented, the number of trucks increased to 864 trucks per weekday in May-November 2014, a 55% increase.

I-64 in Chesapeake also saw an increase in trucks. At the continuous count station located near Bowers Hill, the number of trucks increased 3%, from 7,142 trucks per weekday prior to tolls in May-November 2013 up to 7,369 trucks in May-November 2014 after tolls were implemented.

In spite of the decrease in trucks at the Midtown Tunnel, there was a large increase in trucks on the Western Freeway between pre-tolling and post-tolling conditions. This is likely due to more trucks accessing the Virginia International Gateway (formerly known as APM Terminals Virginia) due to an increase in general cargo passing through the Port of Virginia. According to the Port of Virginia, the port moved 76,699 containers by truck in November 2014, 6,505 more (9% higher) than was moved by truck by the Port in November 2013.

Tolling at the Midtown and Downtown Tunnels appears to have had little impact on truck travel patterns at the Hampton Roads Harbor crossings. The average number of trucks using the Hampton Roads Bridge-Tunnel and Monitor-Merrimac Memorial Bridge-Tunnel was largely unchanged between pre-tolling and post-tolling conditions.

Figure 18 – Total and Percentage Change in Truck Volumes at Continuous Count Station Locations in the Study Area, May-November 2013 to May-November 2014



Source: HRTPO analysis of VDOT and SNJB data. Background Map Source: Google.

¹ – Vehicle classification data was unavailable at these locations at times during the study period. The HRBT data reflects the June-November period, the MMBBT reflects the September-November period, the I-64 Chesapeake location reflects the May-October period, and the I-264 Portsmouth location reflects the July-November period.

TRAFFIC QUEUES AND QUEUE CLEARANCE TIMES

This section provides an analysis of traffic queues and queue clearance times during peak hours along the Midtown and Downtown Tunnel approaches and alternate routes using photos and videos collected by HRTPO staff. Photos and videos were collected to visualize and document peak traffic conditions “before” and “after” tolls were initiated on February 1, 2014.

METHODOLOGY

HRTPO staff identified a list of roadways where traffic volumes were expected to increase or decrease as a result of tolling at the MTT/DTT using the travel demand model analysis (see page 11). For these roadways, staff photographed and videotaped traffic conditions “before” and “after” toll implementation for the following peak hour time periods:

	"Before" Traffic Conditions (Pre-Toll)		"After" Traffic Conditions (Post-Toll)
	Oct '12	Sep '13 - Oct '13	Sep '14 - Oct '14
Weekdays (Mon - Thu)			
Morning Peak Hours: 7:00am-8:30am	Photo	Photo	Photo
Afternoon Peak Hours: 4:00pm-6:00pm	Photo & Video	Photo	Photo & Video

HRTPO staff typically performed two to four in-vehicle travel runs per direction during morning and afternoon peak hours (approximately 120 runs) for each roadway of interest, tunnels and alternative routes. Using a combination of photos and videos, HRTPO staff measured traffic queues and queues clearance times. For this study traffic queues and queue clearance times are defined as:

- **Traffic Queue** – distance from the back of the traffic queue to the bridge/tunnel entrance (Miles)
- **Queue Clearance Time** – time to travel from the back of the traffic queue to the bridge/tunnel exit (Minutes)

For each in-vehicle run, staff took photographs at continuous intervals along the roadway using the time stamp for each photo to determine queue clearance times. Photos were collected for several weekdays for each

direction in order to determine regular congestion patterns and travel times. Traffic queues were measured using photos and the distance measuring tool feature on Google maps. Staff collected over 3,500 photographs along these selected routes — over 1,000 before toll implementation and over 2,500 afterwards.

In addition to photos, staff collected continuous in-vehicle video footage for afternoon peak hours “before” and “after” tolls using a tripod inside of a van, which were also used to measure traffic queues and queue clearance times. Approximately 470 minutes of video footage were captured and archived into digital format.

From all of the travel runs, staff selected one run for each roadway approach that best represented typical congestion patterns to determine traffic queues and queue clearance times “before” and “after” toll implementation. Some travel runs were omitted due to irregular causes of congestion, such as traffic incidents and broken down vehicles. The goal was to capture “recurring” traffic congestion—congestion experienced by commuters every day.

A summary of in-vehicle travel runs for the AM and PM peak hours are provided in **Tables 3 and 4** on the following page. Travel runs that were selected for the traffic queue analysis are shown in green.

It is important to note that the Gilmerton Bridge in Chesapeake was under construction during the “before” (pre-toll) in-vehicle travel runs with a reduced capacity of one lane in each direction. For post-toll conditions, the new Gilmerton Bridge was open to traffic with two lanes in each direction. Also, eastbound I-264 towards the Downtown Tunnel was under construction (MLK Freeway Extension) and was reduced from three lanes to two lanes during post-toll conditions.

Table 3 - In-vehicle Travel Runs – AM Peak (7:00am-8:30am)

Roadway Segment	"Before" (Pre-Toll)			"After" (Post-Toll)		
	Date	Start Time (End of Traffic Queue)	End Time (Bridge/Tunnel Exit)	Date	Start Time (End of Traffic Queue)	End Time (Bridge/Tunnel Exit)
Midtown Tunnel (EB Western Fwy)	10/17/2013 (Thu)	7:27	7:54	9/16/14 (Tue)	7:21	7:44
				9/23/14 (Tue)	7:34	7:55
Midtown Tunnel (NB MLK Fwy)	10/16/2013 (Wed)	7:46	8:00	9/23/14 (Tue)	8:05	8:18
				9/25/14 (Thu)	7:49	7:57
Downtown Tunnel (EB I-264)	9/25/2013 (Wed)	7:48	8:06	9/17/14 (Wed)	7:22	7:26
				9/17/14 (Wed)	7:47	8:00
				9/24/14 (Wed)	8:20	8:35
				10/2/14 (Thu)	7:51	8:05
Downtown Tunnel (WB I-264)	10/16/2013 (Wed)	7:35	7:39	9/17/14 (Wed)	7:39	7:41
				9/30/14 (Tue)	7:57	7:59
				10-2-14 (Thu)	8:12	8:14
Downtown Tunnel (NB I-464)	10/16/2013 (Wed)	8:15	8:22	9/17/14 (Wed)	8:04	8:11
				9/24/14 (Wed)	8:07	8:14
I-64/HR Bridge (to Va Beach)	10/16/2013 (Wed)	7:00	7:07	9/16/14 (Tue)	8:10	8:23
				9/24/14 (Wed)	7:43	8:00
				10/2/2014 (Thu)	8:21	8:35
Jordan Bridge (WB)	NA	NA	NA	10-7-14 (Tue)	7:23	7:27
				10-9-14 (Thu)	7:09	7:17

Travel runs that were selected for the traffic queue analysis are shown in green.

Table 4 - In-vehicle Travel Runs – PM Peak (4:00pm-6:00pm)

Roadway Segment	"Before" (Pre-Toll)			"After" (Post-Toll)		
	Date	Start Time (End of Traffic Queue)	End Time (Bridge/Tunnel Exit)	Date	Start Time (End of Traffic Queue)	End Time (Bridge/Tunnel Exit)
Midtown Tunnel (NB MLK Fwy)	10-16-12 (Tue)	5:04	5:08	9-16-14 (Tue)	4:52	4:54
	10-22-13 (Tue)	5:13	5:21	9-23-14 (Tue)	5:21	5:23
Midtown Tunnel (SB Hampton Blvd)	10-16-12 (Tue)	4:40	4:59	9-16-14 (Tue)	4:57	5:06
				9-23-14 (Tue)	5:06	5:17
Midtown Tunnel (WB Brambleton Ave)	10-22-13 (Tue)	4:50	5:09	9-16-14 (Tue)	5:17	5:28
				9-23-14 (Tue)	5:24	5:34
Downtown Tunnel (EB I-264)	10-16-12 (Tue)	4:18	4:27	9-16-14 (Tue)	4:33	4:35
	10-30-13 (Wed)	4:30	4:38	9-17-14 (Wed)	4:49	4:52
	10-22-13 (Tue)	4:37	4:42	10-2-14 (Thu)	5:12	5:20
Downtown Tunnel (WB I-264)	10-16-12 (Tue)	3:52	4:04	9-16-14 (Tue)	4:40	4:43
	10-22-12 (Mon)	4:40	4:52	9-16-14 (Tue)	5:46	5:52
				9-17-14 (Wed)	4:31	4:40
				10-2-14 (Thu)	5:02	5:06
Downtown Tunnel (NB I-464)	10-30-13 (Wed)	4:44	4:52	9-17-14 (Wed)	5:00	5:02
				9-18-14 (Thu)	4:35	4:40
				10-2-14 (Thu)	5:27	5:29
I-64/HR Bridge (to Va Beach)	10-17-12 (Wed)	5:01	5:08	9-17-14 (Wed)	5:10	5:16
				9-17-14 (Wed)	5:35	5:39
				9-18-14 (Thu)	4:15	4:28
				9-18-14 (Thu)	4:46	5:00
				10-9-14 (Thu)	5:07	5:18
I-64/HR Bridge (to Suffolk)	9/25/2013 (Wed)	4:09	4:20	9-17-14 (Wed)	5:23	5:32
	10-17-12 (Wed)	4:44	4:48	9-24-14 (Wed)	4:28	4:42
				10-9-14 (Thu)	4:51	4:56
				10-16-14 (Thu)	5:14	5:22
WB Military Hwy to Gilmerton Bridge	10-15-12 (Mon)	4:28	4:33	9-29-14 (Mon)	4:33	4:43
WB Military Hwy to Canal Dr	10-15-12 (Mon)	4:33	4:35	9-29-14 (Mon)	4:43	4:47
SB GW Hwy to Military Hwy	10-24-12 (Wed)	4:53	4:56	9-25-14 (Thu)	4:51	4:59

Additional Photo and Video Collection

In order to further visualize the toll impacts, staff obtained permission and collected photos and videos from two parking decks near the MTT and DTT, which provided a “bird’s-eye view” perspective. Photos/videos for the MTT were collected from the CHKD/Sentara Hospital parking deck along Hampton Boulevard for the southbound/westbound approach. Photos/videos for the DTT were collected from the Dominion Tower parking deck in Norfolk along I-264/Berkley Bridge for the westbound approach.

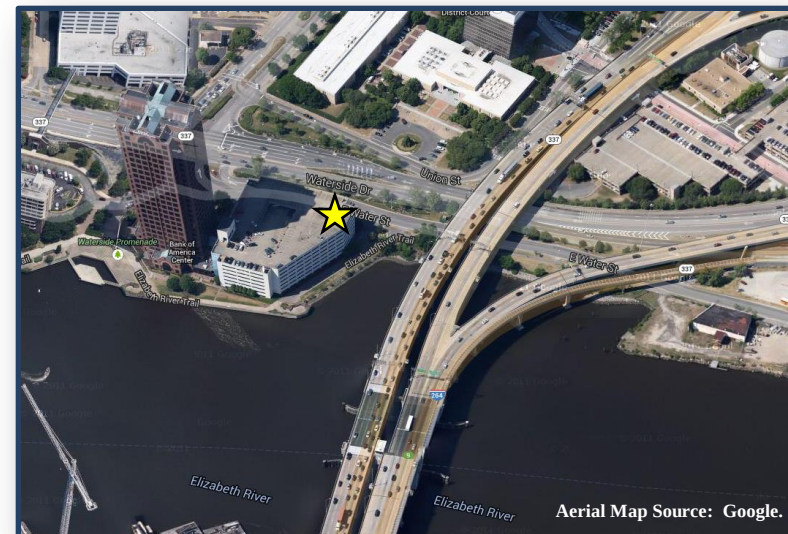
The aerial images on this page show the two parking deck locations. Sample video screenshots showing traffic conditions from these two locations “before” and “after” toll implementation are provided on the following page. As shown, traffic congestion at both locations—CHKD/Sentara Hospital and Dominion Tower parking decks—improved overall “after” tolls were implemented on February 1, 2014. Traffic queues and queue clearance times for these locations are discussed further in remaining pages of this section.

Videos were also edited and used for this study in PowerPoint technical presentations to the Transportation Technical Advisory Committee and the HRTPO Board to show examples of traffic conditions “before” and “after” toll implementation.

Additional video screenshots showing in-vehicle traffic conditions before and after toll implementation are provided in **Appendix A**.



**Westbound Midtown Tunnel Photo/Video Location –
CHKD/ Sentara Hospital Parking Deck**



**Westbound Downtown Tunnel Photo/Video Location –
Dominion Tower Parking Deck**

Westbound Midtown Tunnel along Hampton Blvd (CHKD/ Sentara Hospital Parking

Westbound Downtown Tunnel along I-264/ Berkley Bridge (Dominion Tower Parking Deck)

VIDEO SCREENSHOT: PM PEAK – BEFORE TOLLS



Thu 10/18/12

VIDEO SCREENSHOT: PM PEAK – AFTER TOLLS



Tue 9/23/14



Thu 10/25/12



Thu 10/2/14

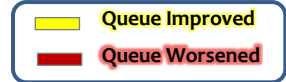
TRAFFIC QUEUES AND QUEUE CLEARANCE TIMES

As discussed above, HRTPO staff calculated traffic queues and queue clearance times during peak hours for each roadway approach “before” and “after” tolling at the Midtown and Downtown Tunnels based on the in-vehicle travel runs. Although staff conducted approximately two to four travel runs, more runs (beyond the scope of this study) would be required to get an accurate measure at each facility by peak/direction.

Results are summarized in **Table 5** and in **Figures 19 and 20** on pages 35-36. End of traffic queue photos “before” and “after” toll implementation for the selected AM and PM peak travel runs—conducted by staff—are provided on the nine pages following Figures 19 and 20.

Based on staff’s photo and video observations, overall traffic congestion decreased along tolled approaches to the Midtown and Downtown Tunnels and increased along alternate routes/crossings as expected from the travel demand model forecast. For some MTT and DTT approaches, traffic queues were similar or were only slightly reduced “after” toll implementation, however queue clearance times improved significantly. At these locations, staff observed lighter side street and ramp traffic, which improved travel speeds and reduced queue clearance times. For alternate routes, such as the I-64/High Rise Bridge and the Gilmerton Bridge/Military Highway, traffic queues nearly doubled in length and queue clearance times doubled.

Table 5 - Comparison of Traffic Queue Lengths and Queue Clearance Times along Key Roadways Before and After Tolls



AM Peak (7:00am-8:30am)

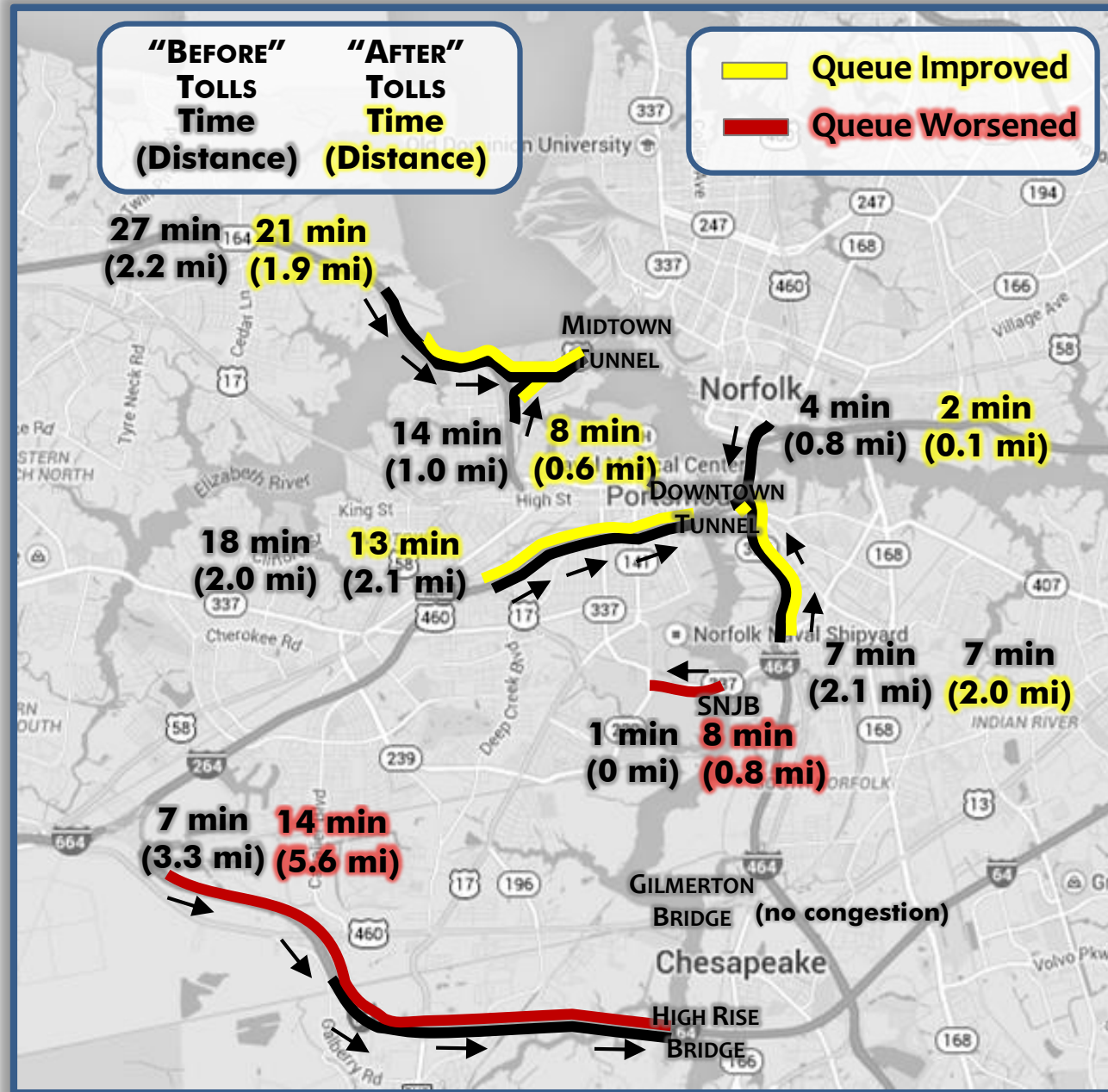
Roadway Segment	"Before" (Pre-Toll)	"After" (Post-Toll)	% Change	"Before" (Pre-Toll)	"After" (Post-Toll)	% Change
	Traffic Queue Length (mi)	Traffic Queue Length (mi)		Queue Clearance Time (min)	Queue Clearance Time (min)	
Midtown Tunnel (EB Western Fwy)	2.2	1.9	-14%	27	21	-22%
Midtown Tunnel (NB MLK Fwy)	1.0	0.6	-40%	14	8	-43%
Downtown Tunnel (EB I-264)	2.0	2.1	+5%	18	13	-28%
Downtown Tunnel (WB I-264)	0.8	0.1	-88%	4	2	-50%
Downtown Tunnel (NB I-464)	2.1	2.0	-5%	7	7	0%
I-64/HR Bridge (to Va Beach)	3.3	5.6	+70%	7	14	+100%
Jordan Bridge (WB)	NA	0.8	NA	NA	8	NA

PM Peak (4:00pm-6:00pm)

Roadway Segment	"Before" (Pre-Toll)	"After" (Post-Toll)	% Change	"Before" (Pre-Toll)	"After" (Post-Toll)	% Change
	Traffic Queue Length (mi)	Traffic Queue Length (mi)		Queue Clearance Time (min)	Queue Clearance Time (min)	
Midtown Tunnel (NB MLK Fwy)	0.6	0.0	-100%	8	2	-75%
Midtown Tunnel (SB Hampton Blvd)	1.0	0.9	-10%	19	11	-42%
Midtown Tunnel (WB Brambleton Ave)	1.0	0.9	-10%	19	11	-42%
Downtown Tunnel (EB I-264)	1.2	0.2	-83%	9	3	-67%
Downtown Tunnel (WB I-264)	1.4	1.1	-21%	12	6	-50%
Downtown Tunnel (NB I-464)	0.6	0.1	-83%	8	2	-75%
I-64/HR Bridge (to Va Beach)	3.2	5.8	+81%	7	14	+100%
I-64/HR Bridge (to Suffolk)	1.6	2.2	+38%	4	9	+125%
WB Military Hwy to Gilmerton Bridge	0.0	1.8	NA	5	10	+100%
WB Military Hwy to Canal Dr	0.0	1.5	NA	2	4	+100%
SB GW Hwy to Military Hwy	0.0	1.0	NA	3	8	+167%

Note: For Post-toll, eastbound I-264 towards the Downtown Tunnel was under construction (MLK Fwy extension) and was reduced from 3 to 2 lanes. The Gilmerton Bridge was 2 lanes pre-toll and 4 lanes post-toll.

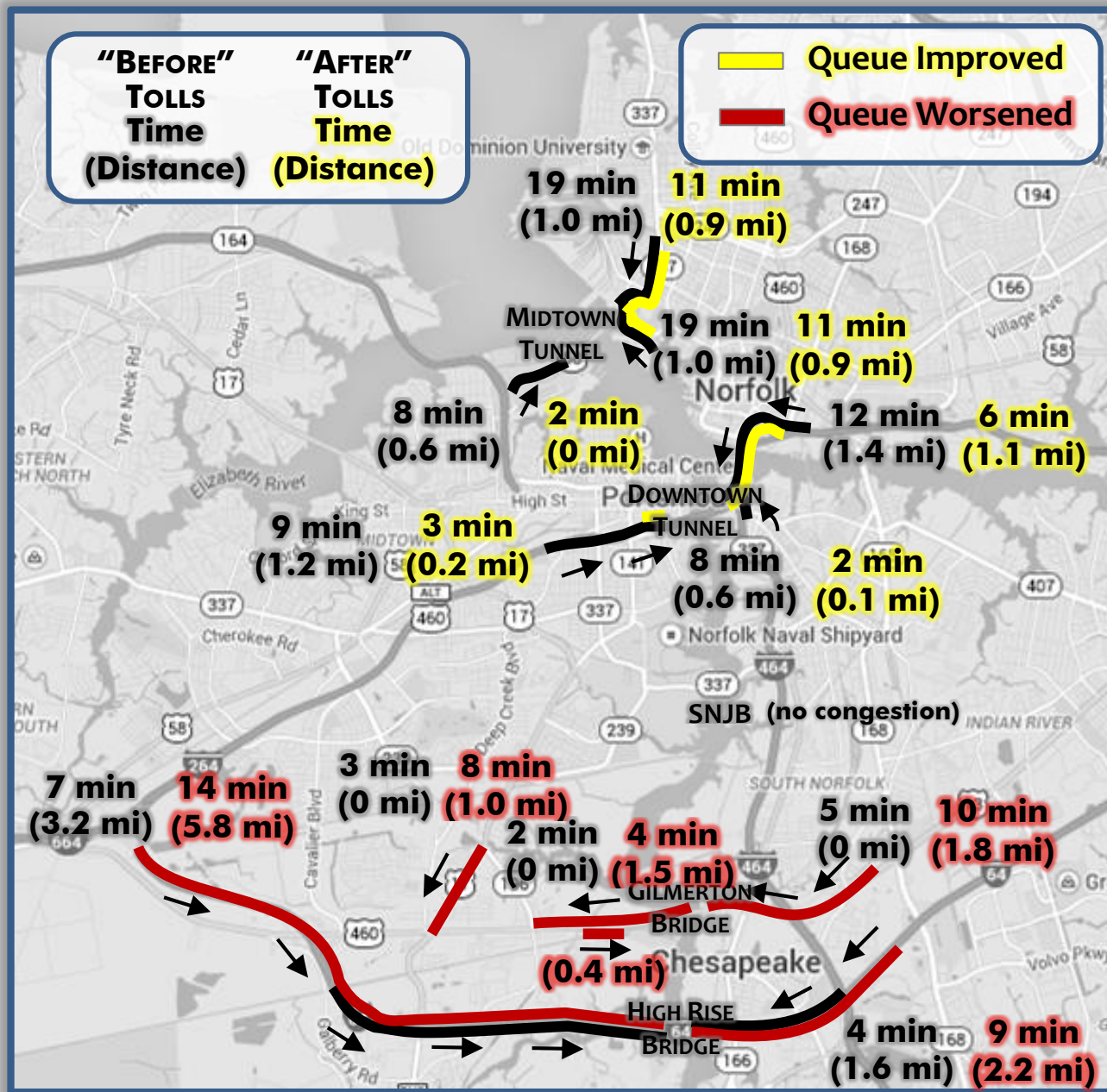
Figure 19 – Traffic Queue Lengths and Queue Clearance Times – AM Peak (7:00am-8:30am)



Note: For Post-toll, eastbound I-264 towards the Downtown Tunnel was under construction (MLK Fwy extension) and was reduced from 3 to 2 lanes. The Gilmerton Bridge was 2 lanes pre-toll and 4 lanes post-toll.

*Midtown and Downtown Tunnel toll rates for passenger cars with E-ZPass were \$1.00 and \$4.00 for heavy vehicles (3+ axles) with E-ZPass during peak hours (implemented February 1, 2014)

Figure 20 - Traffic Queue Lengths and Queue Clearance Times - PM Peak (4:00pm-6:00pm)



*Midtown and Downtown Tunnel toll rates for passenger cars with E-ZPass were \$1.00 and \$4.00 for heavy vehicles (3+ axles) with E-ZPass during peak hours (implemented February 1, 2014)

Note: For Post-toll, eastbound I-264 towards the Downtown Tunnel was under construction (MLK Fwy extension) and was reduced from 3 to 2 lanes. The Gilmerton Bridge was 2 lanes pre-toll and 4 lanes post-toll.

AM PEAK – BEFORE TOLLS



Traffic Queue: 2.2 mi, Queue Clearance Time: 27 min.

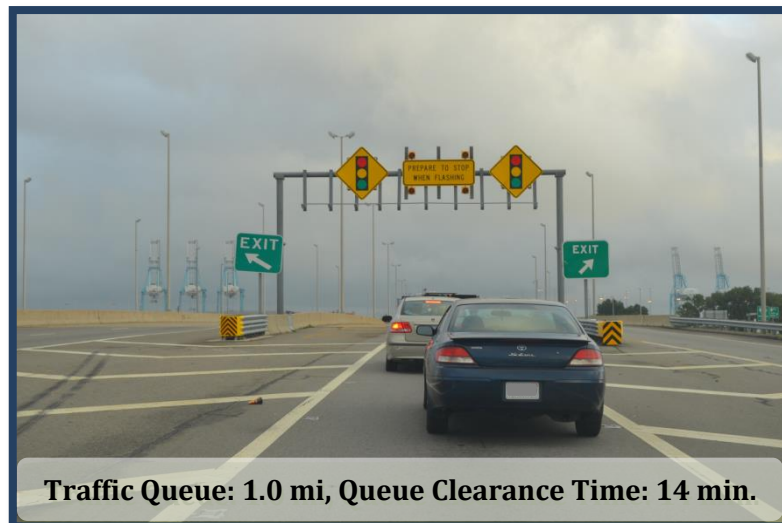
(@ West Norfolk Rd) Thu 10/17/13

AM PEAK – AFTER TOLLS



Traffic Queue: 1.9 mi, Queue Clearance Time: 21 min.

(@ West Norfolk Bridge) Tue 9/23/14



Traffic Queue: 1.0 mi, Queue Clearance Time: 14 min.

(@ Rte 58 East exit) Wed 10/16/13



Traffic Queue: 0.6 mi, Queue Clearance Time: 8 min.

(@ Rte 58 East exit) Thu 9/25/14

AM PEAK – BEFORE TOLLS



Traffic Queue: 2.0 mi, Queue Clearance Time: 18 min.

(@ Frederick Blvd) Wed 9/25/13

AM PEAK – AFTER TOLLS



Traffic Queue: 2.1 mi, Queue Clearance Time: 13 min.

(@ Frederick Blvd) Wed 9/17/14



Traffic Queue: 0.8 mi, Queue Clearance Time: 4 min.

(@ Market St underpass) Wed 10/16/13



Traffic Queue: 0.1 mi, Queue Clearance Time: 2 min.

(just past Berkley Bridge) Tue 9/30/14

AM PEAK – BEFORE TOLLS



Traffic Queue: 2.1 mi, Queue Clearance Time: 7 min.

(@ Poindexter St) Wed 10/16/13

AM PEAK – AFTER TOLLS



Traffic Queue: 2.0 mi, Queue Clearance Time: 7 min.

(@ Poindexter St merge) Wed 9/17/14



Traffic Queue: 3.3 mi, Queue Clearance Time: 7 min.

(@ Yadkin Rd.) Wed 10/16/13



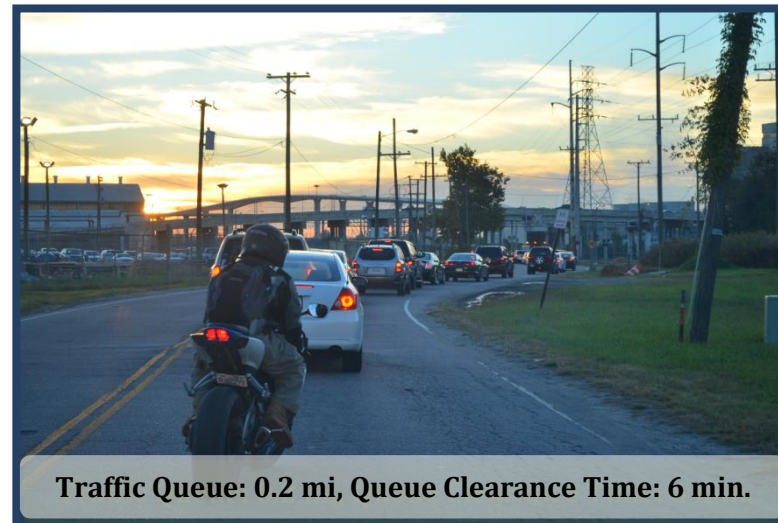
Traffic Queue: 5.6 mi, Queue Clearance Time: 14 min.

(@ Bowers Hill) Thu 10/2/14

AM PEAK – BEFORE TOLLS



AM PEAK – AFTER TOLLS



Thu 10/9/14



Thu 10/9/14

PM PEAK – BEFORE TOLLS



Traffic Queue: 0.6 mi, Queue Clearance Time: 8 min.

(@ Rte 58 East exit) Tue 10/22/13

PM PEAK – AFTER TOLLS



Traffic Queue: 0 mi, Queue Clearance Time: 2 min.

(@ Rte 58 East exit) Tue 9/16/14



Traffic Queue: 1.0 mi, Queue Clearance Time: 19 min.

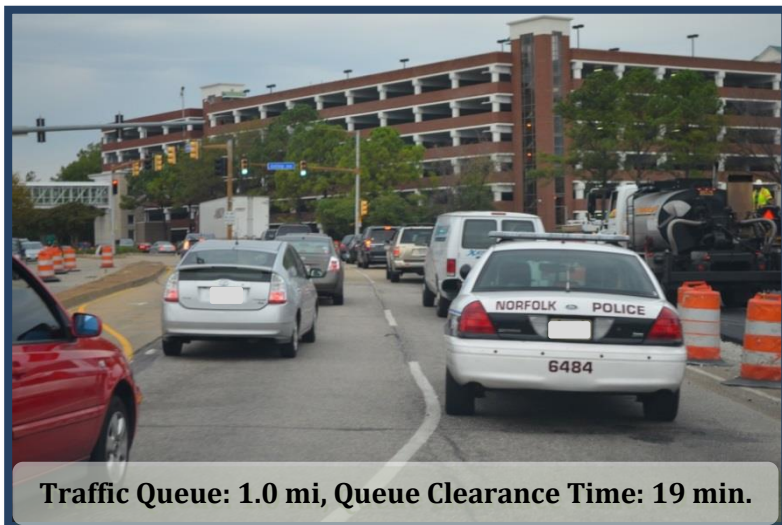
(@ Woodrow Ave) Tue 10/16/12



Traffic Queue: 0.9 mi, Queue Clearance Time: 11 min.

(@ Gates Ave) Tue 9/23/14

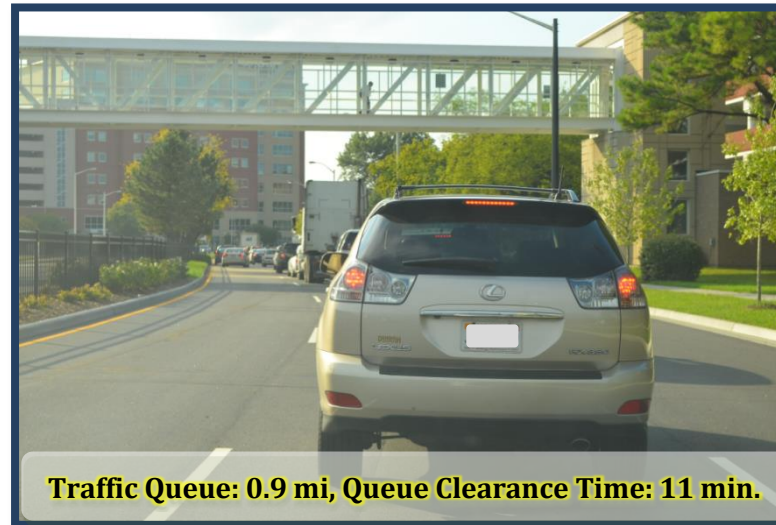
PM PEAK – BEFORE TOLLS



Traffic Queue: 1.0 mi, Queue Clearance Time: 19 min.

(just east of Colley Ave) Tue 10/22/13

PM PEAK – AFTER TOLLS



Traffic Queue: 0.9 mi, Queue Clearance Time: 11 min.

(just west of Colley Ave) Tue 9/16/14



Traffic Queue: 1.2 mi, Queue Clearance Time: 9 min.

(@ Des Moines Ave exit) Tue 10/16/12



Traffic Queue: 0.2 mi, Queue Clearance Time: 3 min.

(near tunnel entrance) Wed 9/17/14

Westbound I-264 towards Downtown Tunnel

PM PEAK – BEFORE TOLLS



Traffic Queue: 1.4 mi, Queue Clearance Time: 12 min.

(east of City Hall Ave exit) Tue 10/16/12

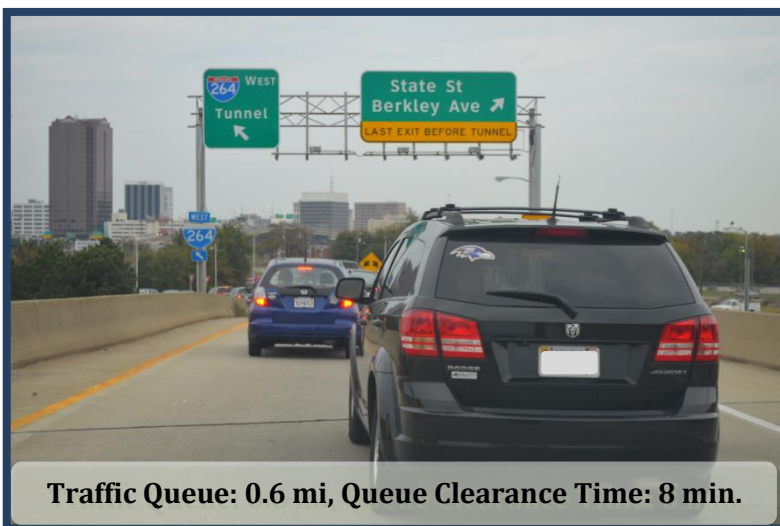
PM PEAK – AFTER TOLLS



Traffic Queue: 1.1 mi, Queue Clearance Time: 6 min.

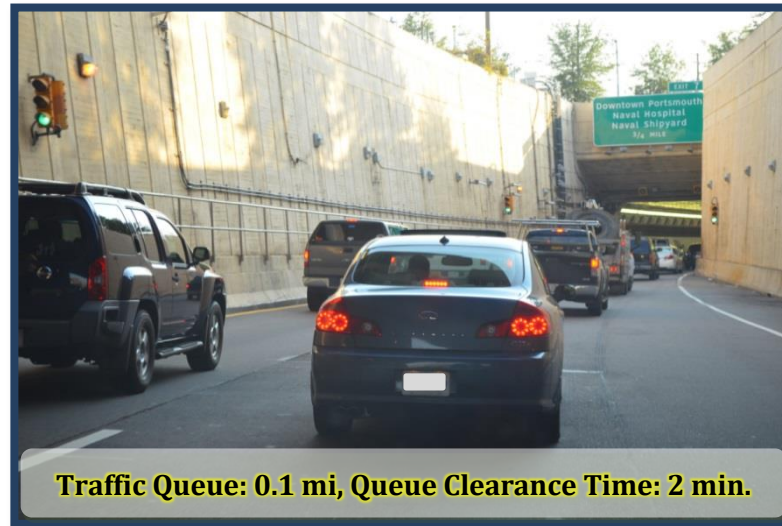
(@ City Hall Ave exit) Tue 9/16/14

Northbound I-464 towards Downtown Tunnel



Traffic Queue: 0.6 mi, Queue Clearance Time: 8 min.

Wed 10/30/13



Traffic Queue: 0.1 mi, Queue Clearance Time: 2 min.

Thu 10/2/14

PM PEAK – BEFORE TOLLS



Traffic Queue: 3.2 mi, Queue Clearance Time: 7 min.

(@ George Washington Hwy exit) Wed 10/17/12

PM PEAK – AFTER TOLLS



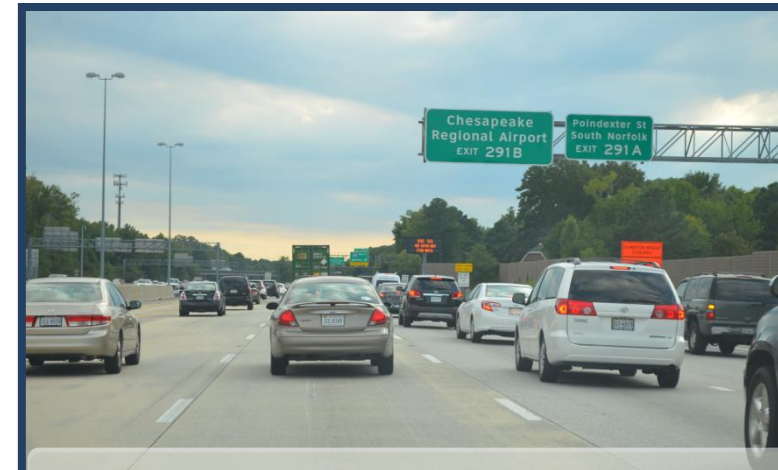
Traffic Queue: 5.8 mi, Queue Clearance Time: 14 min.

(@ Bowers Hill) Thu 9/18/14



Traffic Queue: 1.6 mi, Queue Clearance Time: 4 min.

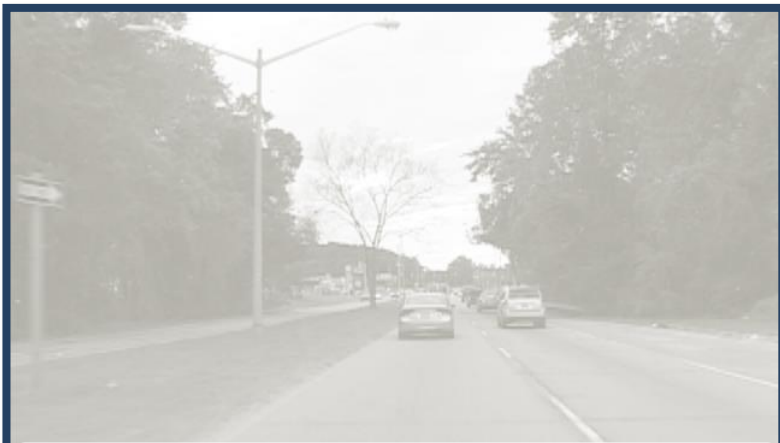
(@ I-464) Wed 10/17/12



Traffic Queue: 2.2 mi, Queue Clearance Time: 9 min.

(west of Battlefield Blvd) Wed 9/17/14

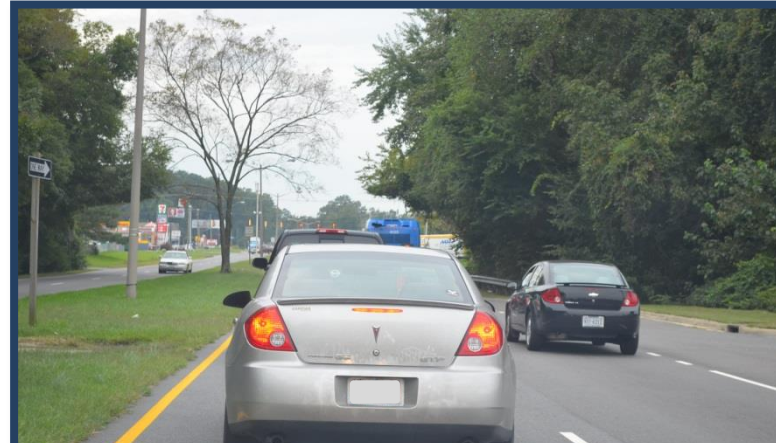
PM PEAK – BEFORE TOLLS



Traffic Queue: 0 mi, Queue Clearance Time: 5 min.

(0.3 mi west of Battlefield Blvd) Mon 10/15/12

PM PEAK – AFTER TOLLS



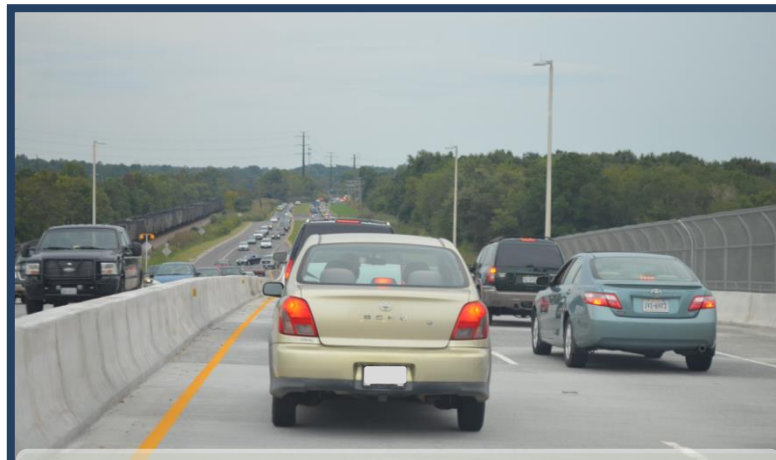
Traffic Queue: 1.8 mi, Queue Clearance Time: 10 min.

(0.3 mi west of Battlefield Blvd) Mon 9/29/14



Traffic Queue: 0 mi, Queue Clearance Time: 2 min.

Mon 10/15/12



Traffic Queue: 1.5 mi, Queue Clearance Time: 4 min.

Mon 9/29/14

Observations – AM Peak

Based on photos and videos collected by HRTPO staff during morning peak hours on key roadways “before” and “after” MTT/DTT toll implementation, a summary of observations and traffic conditions is provided below:

Midtown Tunnel: Conditions Improved

- Traffic queues along eastbound Western Freeway decreased from 2.2 miles before tolls to 1.9 miles “after” tolls. Queue clearance times reduced from 27 to 21 minutes.
- Traffic queues along northbound MLK Freeway toward eastbound MTT decreased from 1.0 miles “before” tolls to 0.6 miles “after” tolls. Queue clearance times were reduced nearly in half from 14 to 8 minutes.

Downtown Tunnel: Conditions Improved

- Traffic queues were similar along eastbound I-264 towards DTT approach “before” (2.0 miles) and “after” (2.1 miles) toll implementation (extending to Frederick Blvd). Even though roadway capacity for eastbound I-264 was reduced from 3 to 2 lanes “after” tolls due to construction of the MLK Freeway Extension, queue clearance times for this eastbound I-264 approach were reduced from 18 to 13 minutes.
- Before tolls, traffic queues were approximately 0.8 miles along I-264 westbound toward the DTT. “After” tolls, traffic queues were nearly gone (0.1 miles). Queue clearance times were cut in half from 4 to 2 minutes.
- Traffic queues for northbound I-464 toward westbound DTT were similar “before” (2.1 miles) and “after” tolls (2.0 miles). Queue clearance times stayed the same at 7 minutes. Traffic queues were on the Berkley Bridge towards Norfolk and not towards the westbound DTT/Portsmouth.

I-64 Southside/High Rise Bridge: Conditions Worsened

- Traffic queues and queue clearance times for I-64 towards Virginia Beach nearly doubled from “before” to “after” toll implementation from 3.3 to 5.6 miles and from 7 to 14 minutes, respectively. Severe congestion was concentrated near interchanges.
- No traffic queues or congestion along I-64 towards Suffolk.

Military Highway/Gilmerton Bridge: No Change

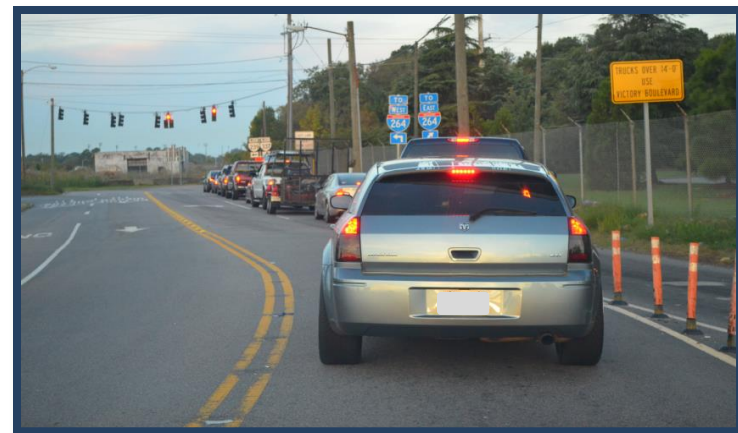
- No traffic queues or congestion “before” or “after” toll implementation.

George Washington Highway: No Change

- No traffic queues or congestion “before” or “after” toll implementation.

South Norfolk Jordan Bridge: Conditions Worsened

- Travel runs were not performed along eastbound Elm Ave towards Norfolk Naval Shipyard/Jordan Bridge “before” tolls because there was no existing traffic congestion at the Jordan Bridge. “After” tolls, 0.2 mile traffic queue was present along eastbound Elm Ave towards Norfolk Naval Shipyard with queue clearance time of 6 minutes. Elm Ave is a two-lane roadway (one lane in each direction) so traffic continuing onto Elm Ave towards the Jordan Bridge is using the shoulder to bypass gate traffic in the morning.
- No traffic queues were observed during the morning peak “before” toll implementation. “After” tolls, there was a 0.8 mile traffic queue along westbound Jordan Bridge to the signalized intersection at Victory Blvd/Elm Ave/Williams Ave with a queue clearance time of 8 minutes. The westbound green phase only allows approximately 10-12 vehicles per cycle for the single through/right turn lane (see photo below).



Morning traffic congestion along westbound Jordan Bridge at the signalized intersection at Victory Blvd/Elm Ave/Williams Ave towards Norfolk Naval Shipyard

Observations – PM Peak

Based on photos and videos collected by HRTPO staff during afternoon peak hours on key roadways “before” and “after” MTT/DTT toll implementation, a summary of observations and traffic conditions is provided below:

Midtown Tunnel: Conditions Improved

- 0.6 mile traffic queue for northbound MLK Freeway toward eastbound MTT “before” tolls. “After” tolls, there was no traffic congestion for this approach.
- Traffic queues were slightly reduced from 1.0 miles to 0.9 miles along southbound Hampton Blvd and westbound Brambleton Ave toward westbound MTT. Queue clearance times, however, decreased from 19 minutes to 11 minutes for Hampton Blvd and Brambleton Ave. Travel speeds were much slower “before” tolls due to higher side street traffic, particularly near the CHKD/Eastern Virginia Medical School area. Opposing congestion was also heavier “before” tolls, which reduced travel speeds. For westbound Brambleton Ave, “before” traffic queues were 1.0 miles, extending beyond Colley Ave. “After” tolls, the queue was comparable (0.9 miles), but the queue clearance time also decreased from 19 minutes to 11 minutes.

Downtown Tunnel: Conditions Improved

- Traffic backups regularly extended over a mile past Des Moines Ave for the eastbound DTT approach “before” tolls and were nearly gone “after” toll implementation.
- “After” toll implementation, traffic queues were reduced from 1.4 miles to 1.1 miles along I-264 westbound toward the DTT. Queue clearance times were cut in half from 12 to 6 minutes.
- Small traffic queues (0.6 miles) for northbound I-464 toward westbound DTT “before” tolls. “After” tolls, there was only slight congestion at the DTT entrance. Queue clearance times were reduced from 8 to 2 minutes.
- “Before” toll implementation, severe traffic congestion was observed along southbound St Pauls Blvd from Brambleton Ave and along northbound St Pauls Blvd from Waterside Dr toward Market St/City Hall Ave/I-264/DTT ramps. “After” toll implementation, light to moderate congestion levels were observed along St Pauls Blvd.

I-64 Southside/High Rise Bridge: Conditions Worsened

- Traffic queues (3.2 to 5.8 miles) and queue clearance times (7 to 14 minutes) for I-64 towards Virginia Beach nearly doubled from “before” to “after” toll implementation. Severe congestion was concentrated near interchanges.
- Traffic queues (1.6 miles) for I-64 towards Suffolk from I-464 to the High Rise Bridge “before” toll implementation. “After” tolls, traffic queues (2.2 miles) increased almost to Battlefield Blvd with queue clearance times more than doubling (4 to 9 minutes).

Military Highway/Gilmerton Bridge: Conditions Worsened

- No traffic queues or congestion “before” toll implementation. (Note: Gilmerton Bridge was under construction with a reduced capacity to 2 lanes)
- “After” toll implementation, there was severe congestion along westbound Military Hwy/Gilmerton Bridge from about 0.3 miles west of Battlefield Blvd to Canal Dr (1.8 miles). “After” tolls travel times between Battlefield Blvd and Canal Dr doubled from 5 to 10 minutes. Traffic backups were observed for left-turning vehicles along westbound Military Hwy at Campostella Rd and Shell Rd (the new Gilmerton Bridge was opened with 4 lanes of capacity).
- “After” toll implementation, small traffic queues (approximately 0.4 miles) were observed along eastbound Military Hwy at Shell Rd.

George Washington Highway: Conditions Worsened

- No traffic queues or congestion “before” toll implementation.
- “After” toll implementation, severe traffic congestion and queues (1.0 miles) were observed along southbound George Washington Hwy between Canal Dr and Military Hwy. Queue clearance times for this section of southbound George Washington Hwy more than doubled from 3 to 8 minutes. (Note: George Washington Hwy between Canal Dr and Military Hwy is 2 lanes, but 4 lanes north of Canal Dr and south of Military Hwy.)

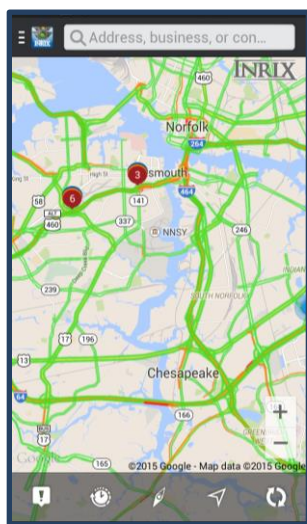
South Norfolk Jordan Bridge: No Change

- No backups or congestion was observed “before” and “after” toll implementation at the MTT/DTT, however, “after” video footage showed more vehicles using the corridor.

SEGMENT TRAVEL TIMES AND SPEEDS

This section provides an analysis of roadway travel times, speeds, and congestion levels in the study area during peak travel periods “before” and “after” tolls were implemented at the Midtown and Downtown Tunnels.

HRTPO staff has access to historical travel time and speed data collected by INRIX. INRIX collects travel time and speed data on a continuous basis, using millions of GPS-enabled fleet vehicles (taxis, airport shuttles, service vehicles, and long haul trucks), mobile devices that have INRIX’s applications installed, traditional road sensors, and other sources.



INRIX Travel Time Data Phone App

VDOT has purchased real-time and archived travel time and speed data from INRIX, which HRTPO staff can access through the Regional Integrated Transportation Information System (RITIS). RITIS is maintained by the University of Maryland’s Center for Advanced Transportation Technology Laboratory. INRIX data is available for 1,100 miles of roadways in Hampton Roads, including nearly all freeways and many principal and minor arterials. Roadways with INRIX data that were analyzed as part of this study include:

- Midtown Tunnel
 - Both directions of the Midtown Tunnel between MLK Freeway and Brambleton Ave
 - Westbound Brambleton Ave between Boush St and Hampton Blvd
 - Southbound Hampton Blvd between 38th St and Brambleton Ave
 - Northbound MLK Freeway between London Blvd and Western Freeway
 - Eastbound Western Freeway between I-664 and MLK Freeway
- Downtown Tunnel
 - Eastbound I-264 between the I-64/I-664 interchange at Bowers Hill and Waterside Dr
 - Westbound I-264 between Military Hwy and Effingham St
- I-64 (Chesapeake) including the High Rise Bridge
 - Eastbound I-64 (towards Suffolk) between Indian River Rd and George Washington Hwy
 - Westbound I-64 (towards Virginia Beach) between the I-264/I-664 interchange at Bowers Hill and I-464
- Military Highway including the Gilmerton Bridge
 - Eastbound Military Hwy between I-64 and I-464
 - Westbound Military Hwy between Battlefield Blvd and George Washington Hwy
- George Washington Highway
 - Northbound George Washington Hwy between I-64 and Frederick Blvd
 - Southbound George Washington Hwy between Frederick Blvd and I-64
- Canal Drive
 - Northbound Canal Dr between Military Hwy and George Washington Hwy
 - Southbound Canal Dr between George Washington Hwy and Military Hwy

HRTPO staff downloaded INRIX data for these roadways for pre-tolling conditions from May 1, 2013, to November 1, 2013, and for post-tolling conditions from May 1, 2014, to November 30, 2014. These time periods match the periods used in the traffic volume analysis shown previously in this report. Data was downloaded by direction for every 15-minute period during the morning (AM) peak period (5:00 am – 9:00 am) and the afternoon (PM) peak period (3:00 pm – 7:00 pm) for Tuesdays, Wednesdays, and Thursdays.

Using this data, HRTPO staff calculated an average travel time and an average travel speed for each roadway segment that comprises the above corridors. These average travel times and speeds were calculated for each peak period 15-minute interval in order to determine the change in travel times and speeds from pre-tolling conditions to post-tolling conditions by time of the day.

Roadway congestion levels were measured in this study using the travel time index. The travel time index compares typical travel conditions during a particular time of day to the travel conditions during uncongested, free-flow conditions. As an example, if it takes one minute to travel the length of a roadway segment during uncongested, free-flow conditions but it takes two minutes on average during congested conditions, the travel time index during those congested conditions would be 2 minutes/1 minute = 2.0. The higher the travel time index, the more congested the roadway segment is.

For each of the six corridors listed on the previous page, HRTPO staff produced maps showing roadway congestion levels by direction and time of day “before” tolls were implemented (an average of May-November 2013 weekdays) and “after” tolls were in place (an average of May-November 2014 weekdays). These congestion maps are included in **Appendix C**. An example showing the Eastbound Downtown Tunnel during the AM Peak Period is shown to the right in **Figure 21**.

In addition to producing congestion level maps, HRTPO staff also calculated total delay for four of these corridors (the Midtown Tunnel, Downtown Tunnel, Gilmerton Bridge, and High Rise Bridge) “before” and “after” tolls were implemented. Total delay was not calculated for the other two corridors (George Washington Hwy and Canal Dr) due to the lack of availability of continuous traffic count data. Total delay not only takes into account the change in travel times but also the impact of changes in travel

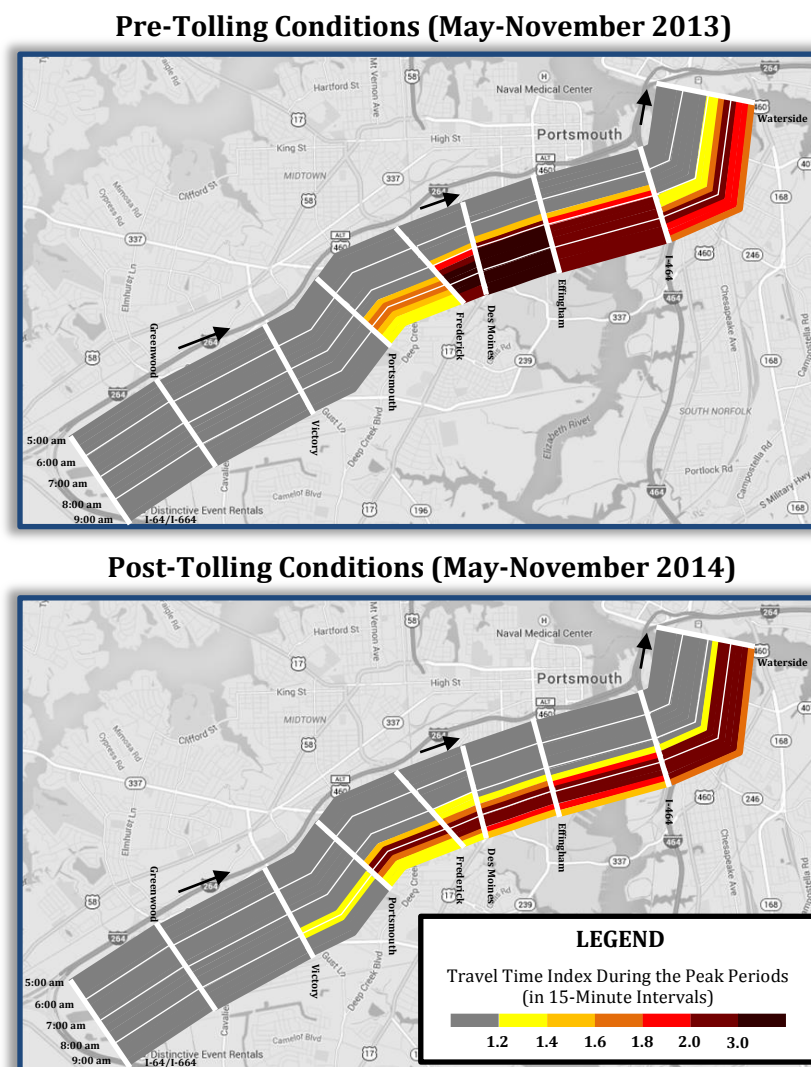


Figure 21 - Congestion Map Example - Eastbound Downtown Tunnel (AM Peak Period)

patterns and traffic volumes. Total delay was calculated using a combination of the INRIX travel time data and the traffic volume data from continuous count stations shown previously in this report.

Total delay was calculated for each corridor for each 15-minute period during the AM Peak Period and the PM Peak Period, using the following formula:

$$\begin{aligned} \text{15-minute period Total Delay} = & \left[\frac{\text{Direction \#1}}{\text{volume}} \times \left(\frac{\text{Direction \#1}}{\text{average travel time}} - \frac{\text{Direction \#1}}{\text{free flow travel time}} \right) \right] \\ & + \left[\frac{\text{Direction \#2}}{\text{volume}} \times \left(\frac{\text{Direction \#2}}{\text{average travel time}} - \frac{\text{Direction \#2}}{\text{free flow travel time}} \right) \right] \end{aligned}$$

These 15-minute period total delays were then summed up to produce total corridor delay values for the AM Peak Period and PM Peak Period for pre-tolling and post-tolling conditions.

Table 6 shows the total delay during both peak periods at the four river crossing corridors during pre-tolling conditions (May-November 2013) and post-tolling conditions (May-November 2014). In general, as expected because of the shift in vehicles from tolled facilities to un-tolled ones, delay decreased at tolled facilities and increased at the parallel free routes. Peak period delays *decreased* greatly (-65%) at the Downtown Tunnel after tolls were implemented there, and delays *increased* greatly (+90%) at the un-tolled Gilmerton Bridge.

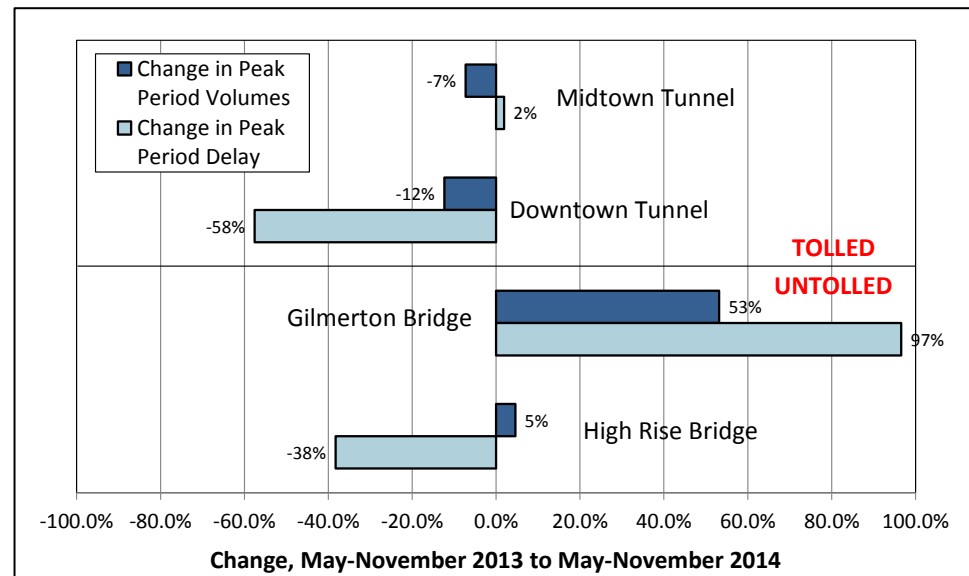
Surprisingly, at those facilities with smaller changes in volumes, delay and volumes changed in opposite directions. **Figure 22** shows the percentage change in volumes and delay from pre-tolling conditions (May-November 2013) to post-tolling conditions (May-November 2014) for the AM Peak Period, and **Figure 23** on page 51 shows the same information for the PM Peak Period. Volumes decreased a small amount at the Midtown Tunnel after tolls were implemented there, yet delay increased (2% in the AM Peak Period and 21% in the PM Peak

Table 6 – Total Weekday Peak Period Delay at the River Crossings, May-November 2013 versus May-November 2014

Crossing	Total Delay (in Vehicle-Hours)								
	AM Peak Period			PM Peak Period			Both Peak Periods Combined		
	Pre-Tolling May-Nov 2013	Post-Tolling May-Nov 2014	Change	Pre-Tolling May-Nov 2013	Post-Tolling May-Nov 2014	Change	Pre-Tolling May-Nov 2013	Post-Tolling May-Nov 2014	Change
Midtown Tunnel	313	319	2%	245	296	21%	559	615	10%
Downtown Tunnel	1,089	462	-58%	1,814	559	-69%	2,904	1,021	-65%
Tunnel Total	1,403	782	-44%	2,060	855	-59%	3,463	1,636	-53%
Gilmerton Bridge	96	188	97%	192	358	87%	287	546	90%
High Rise Bridge	524	324	-38%	676	861	27%	1,200	1,185	-1%
Bridge Total	620	512	-17%	868	1,219	41%	1,487	1,731	16%

Source: HRTPO analysis of VDOT and INRIX data.

Figure 22 – Change in AM Peak Period Volumes and Delay, May-November 2013 versus May-November 2014

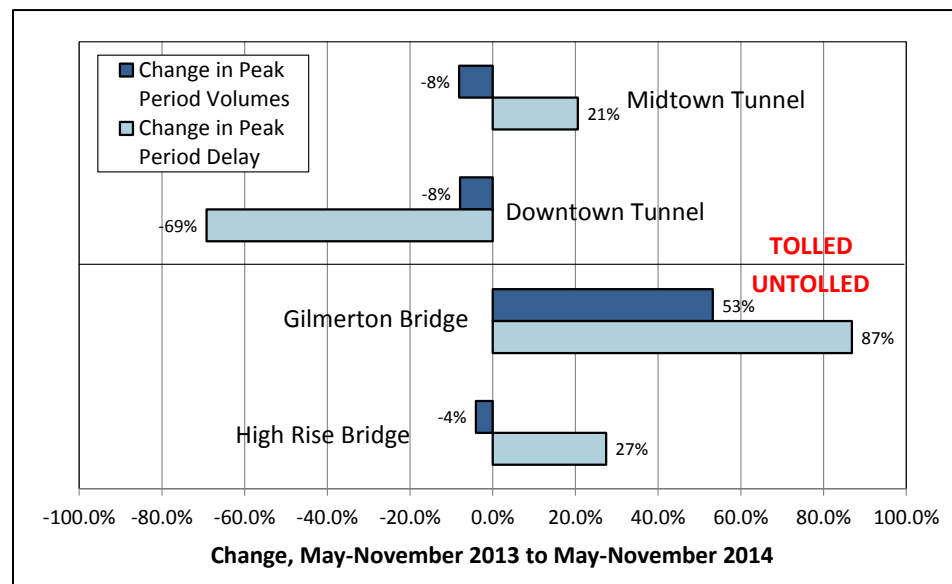


Source: HRTPO analysis of VDOT and INRIX data.

Period) according to the analysis of the INRIX data. Likewise, small changes in volumes at the High Rise Bridge were accompanied with fairly significant changes in delay in the opposite direction (e.g in the PM Peak Period, volume decreased 4% but delay increased 27%). Other factors besides changes in traffic volumes likely influenced the travel times in this corridor, including the number and type of incidents, the impacts of construction on the Gilmerton and Veterans (formerly Steel) Bridges, ramp volumes entering from George Washington Hwy, etc.

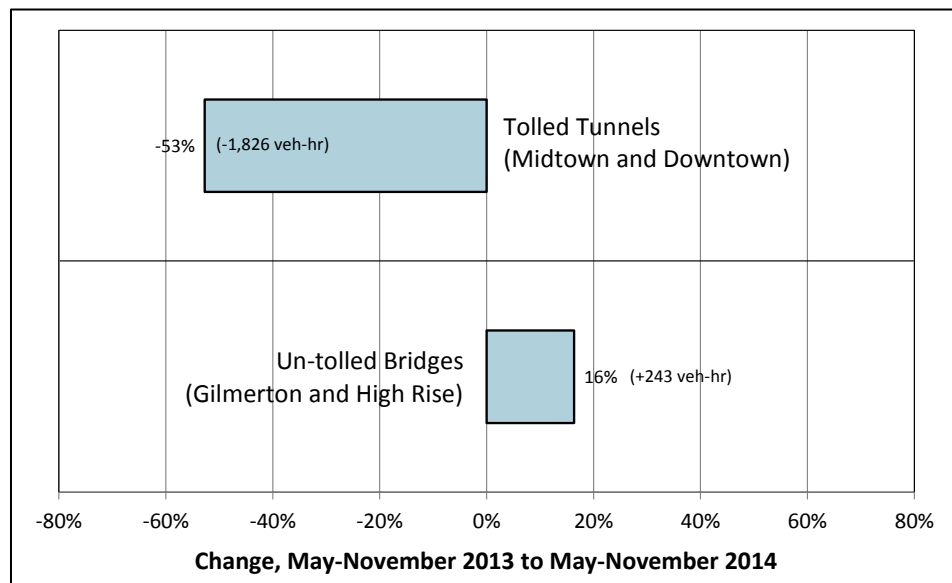
Overall, as shown in **Figure 24**, total peak period delay decreased at the tolled tunnels by 1,826 vehicle-hours per weekday (-53%), and increased at the non-tolled bridges by 243 vehicle-hours per weekday (+16%). Combined, total peak period delay at these four crossing corridors decreased by 1,583 vehicle-hours each weekday after tolls were imposed at the Midtown and Downtown Tunnels.

Figure 23 – Change in PM Peak Period Volumes and Delay, May-November 2013 versus May-November 2014



Source: HRTPO analysis of VDOT and INRIX data.

Figure 24 – Change in Weekday Peak Period Total Delays at Tolled and Un-tolled Crossings, May-November 2013 versus May-November 2014



Source: HRTPO analysis of VDOT and INRIX data.

TRANSIT RIDERSHIP: BEFORE AND AFTER TOLL IMPLEMENTATION

This section provides an analysis of transit ridership along key routes “before” and “after” toll implementation. Average weekday transit ridership was obtained from Hampton Roads Transit (HRT) for five bus routes and one ferry route that were likely to be impacted by the tolls.

As discussed in the Introduction section of this report, on July 6, 2014 HRT increased service frequencies and expanded hours of operation for three bus routes (44, 45, and 47) and the Elizabeth River Ferry using the annual \$2.1 million subsidy from the “Comprehensive Agreement” between VDOT and Elizabeth River Crossings (ERC) for the Midtown and Downtown Tunnel project. This subsidy was put into place to improve connectivity and low-cost alternatives to driving between Norfolk and Portsmouth.

The following routes were analyzed to discover changes in transit ridership after toll implementation. **Map 5** on the following page shows these route locations:

HRT Bus/Ferry Routes Included in the ERC Agreement:

- Bus Route 44: Norfolk General Hospital/Portsmouth (Midtown Tunnel)
- Bus Route 45: Downtown Norfolk/Portsmouth (Downtown Tunnel)
- Bus Route 47: Downtown Portsmouth/Churchland
- Elizabeth River Ferry: North Landing and High St in Portsmouth to the Waterside area in Norfolk

HRT Bus Routes – MTT/DTT Alternate Crossings

- Bus Route 57: Robert Hall Blvd/Airline Blvd (Gilmerton Bridge)
- Metro Area Express (MAX) Route 967: Military Hwy Station to NN Transit Center (I-64/I-664/High Rise Bridge)

An analysis of average weekday transit ridership for the five bus routes and one ferry route “before” and “after” toll implementation is provided in **Figure 25** on page 54. Most bus transit routes experienced a small increase in ridership during the first month “after” tolls were implemented on February 1, 2014, but returned to prior levels afterwards. Ridership for bus routes 45 and 47 increased in July 2014 with the service time and frequency improvements made on July 6, 2014, per the ERC comprehensive agreement. This analysis reveals that expansion of transit availability and service times had a greater impact on ridership than tolling did.

Ridership for route 45 decreased when HRT increased its fares, which began on October 5, 2014 (see fare adjustment schedule on page 55). The MAX 967 bus route nearly doubled its average weekday ridership “after” toll implementation.

Map 5 - Hampton Roads Transit (HRT) Bus and Ferry Routes Included in Toll Impact Analysis (Shaded)



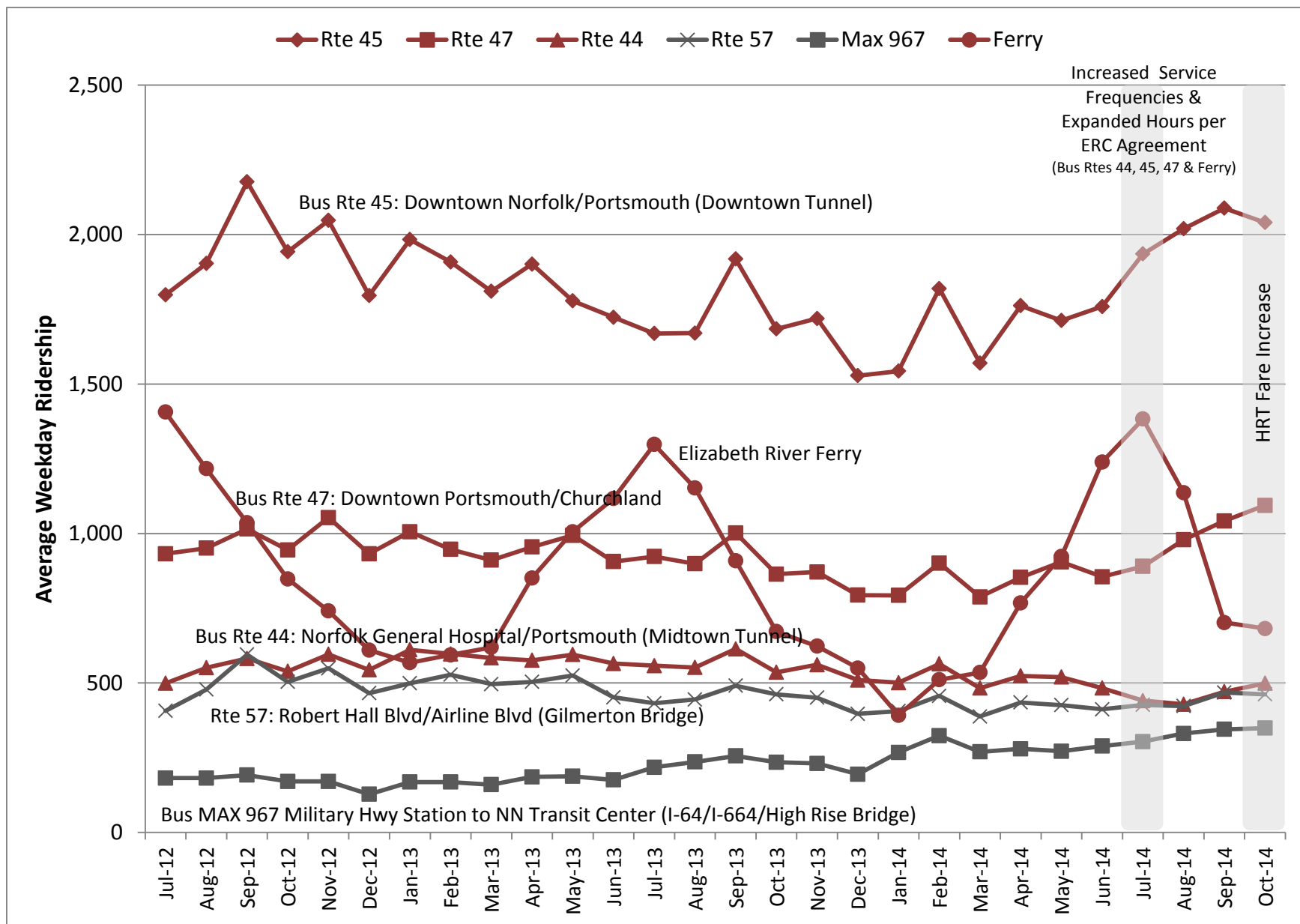


Figure 25 - Hampton Roads Transit (HRT) Ridership for Selected Routes: Before and After Toll Implementation

Data Source: HRT



Fares Adjustment Rate Schedule

October 5, 2014

	FARE MEDIA	CURRENT FARES	NEW FARES 2014	NEW FARES 2016
ADULT FARE				
Local Bus, Light Rail & Ferry	Cash	\$1.50	\$1.75	\$2.00
	1-Day	\$3.50	\$4.00	\$4.50
	1-Day (The Tide only)	\$3.00	eliminate	eliminate
	1-Day (Bundle of 5)	\$16.50	\$19.00	\$21.00
	2-Ride	\$3.00	eliminate	eliminate
	3-Day	n/a	n/a	\$13.00
	7-Day	\$17.00	\$20.00	\$22.00
	30-Day	\$50.00	\$60.00	\$70.00
Shuttle	Cash*	\$1.00	\$2.00	\$2.00
	1-Day**	\$2.00	\$4.00	\$4.50
	3-Day	\$5.00	\$8.00	\$13.00
MAX	Cash	\$3.00	\$3.50	\$4.00
	1-Day	\$5.50	\$6.50	\$7.50
	1-Day (Bundle of 5)	\$24.75	\$30.00	\$35.00
	7-Day	n/a	n/a	n/a
	30-Day	\$95.00	\$110.00	\$125.00
SENIOR/DISABLED/YOUTH/MEDICARE CARD HOLDER				
Local Bus, Light Rail & Ferry	Cash	\$0.75	\$0.75	\$1.00
	1-Day	\$1.75	\$2.00	\$2.25
	1-Day (The Tide Only)	\$1.50	eliminate	eliminate
	1-Day (Bundle of 5)	\$8.75	\$9.50	\$10.50
	2-Day	\$1.50	eliminate	eliminate
	3-Day	n/a	n/a	\$6.50
	30-Day	\$35.00	\$35.00	\$40.00
Shuttle	Cash*	\$0.50	\$1.00	\$1.00
	1-Day**	\$1.00	\$2.00	\$2.25
	3-Day	\$2.50	\$4.00	\$6.50
MAX	Cash	\$1.50	\$1.75	\$2.00
	1-Day	\$5.50	\$6.50	\$7.50
	1-Day (Bundle of 5)	\$24.75	\$30.00	\$35.00
	30-Day	\$95.00	\$110.00	\$125.00
PARATRANSIT				
Clients	Cash	\$3.00	\$3.00	\$4.00
PCA	Cash	\$0.00	\$0.00	\$0.00
Guests	Cash	\$3.00	\$3.00	\$4.00

Source: HRT

*Shuttle Cash Fares will integrate into the Fixed Route Cash Fares in 2016

**The Shuttle 1-Day GoPass will integrate into the Fixed Route 1-Day GoPass in 2014

Hampton Roads Transit (HRT) Fare Adjustment Schedule

SUMMARY & STRATEGIES

The primary goals of this study were to analyze “before” and “after” traffic and transit conditions resulting from tolling at the Midtown & Downtown tunnels, gain insight to toll sensitivity in the region, and to develop congestion mitigation strategies for impacted corridors.

SUMMARY

Provided below is a summary of major findings within this study:

Traffic Conditions: Before and After Toll Implementation

Traffic Volumes

- Volumes decreased at the Midtown Tunnel and Downtown Tunnel after tolls were implemented there. Daily volumes decreased by 8% at the Midtown Tunnel and 20% at the Downtown Tunnel. Midday volumes decreased more (-15% at the Midtown Tunnel, -22% at the Downtown Tunnel) than the AM Peak Period (-7% at the Midtown Tunnel, -12% at the Downtown Tunnel) and PM Peak Period (-8% at the Midtown Tunnel, -8% at the Downtown Tunnel) volumes did.
- Volumes increased at the South Norfolk Jordan Bridge, Gilmerton Bridge, and High Rise Bridge after tolls were implemented at the Midtown and Downtown Tunnels. Daily volumes increased by 49% at the South Norfolk Jordan Bridge, 53% at the Gilmerton Bridge, and 7% at the High Rise Bridge. Midday volumes increased more at these three facilities than they did during the AM Peak Period and PM Peak Period.

Traffic Queues and Queue Clearance Times

- Peak period traffic queues improved, but did not go away, for nearly all Midtown Tunnel and Downtown Tunnel approaches.
- Peak period traffic queues for alternate routes worsened:
 - I-64/High Rise Bridge (AM and PM)
 - Military Hwy (PM)
 - George Washington Hwy (PM)
 - Jordan Bridge (AM)

Segment Travel Times and Speeds

- In general, as expected because of the shift in vehicles from tolled facilities to un-tolled ones, delay decreased at tolled facilities and increased at the parallel free routes. Peak period delays decreased greatly (-65%) at the Downtown Tunnel after tolls were implemented there, and delays increased greatly (+90%) at the un-tolled Gilmerton Bridge.
- Overall, total peak period delay decreased at the tunnels by 1,826 vehicle-hours per day (-53%), and increased at the non-tolled bridges by 243 vehicle-hours per day (+16%), an overall improvement of 1,583 vehicle-hours.

Transit Ridership: Before and After Toll Implementation

- Transit ridership remained relatively constant after tolling began and increased for bus routes 45 and 47 after service time and frequency improvements were made on July 6, 2014, per the ERC comprehensive agreement.

STRATEGIES

Based on the analysis presented in this report, HRTPO staff prepared the following set of mitigation strategies, listed in no particular order:

Arterial Improvements in the City of Chesapeake

- Based on in-vehicle travel runs conducted by HRTPO staff during this study, staff recommends that the City of Chesapeake consider the following alternatives. Additional studies using signal optimization software (e.g. Synchro) and existing traffic/roadway data are recommended prior to implementation:
 - Widen George Washington Hwy from 2 to 4 lanes between Canal Dr and Military Hwy.
 - Extend left turn lane and/or consider providing additional green time on westbound Military Hwy at Campostella Rd during the PM peak hours.
 - Extend left turn lane and/or consider providing additional green time on westbound Military Hwy at Shell Rd during the PM peak hours.

- Optimize signal timings at the signalized intersections of:
 - Military Hwy & George Washington Hwy
 - Military Hwy & Canal Dr
 - George Washington Hwy & Canal Dr
 - Military Hwy & Shell Rd
 - Military Hwy & Campostella Rd

Arterial Improvements in the City of Portsmouth

- Based on in-vehicle travel runs conducted by HRTPO staff during this study, staff recommends that the City of Portsmouth consider the following alternatives. Additional studies using signal optimization software (e.g. Synchro) and existing traffic/roadway data are recommended prior to implementation:
 - Improvements to the intersection of Elm Ave/Victory Blvd/Williams Ave. These improvements could include adding a right turn only lane for the westbound approach, adding a left turn only lane for the eastbound approach, realigning or relocating the intersection to improve access into Gates 29 and 36, and optimize signal timings, particularly for the morning peak hours.

Enhance Public Transportation

- An analysis of transit ridership before and after toll implementation revealed that the expansion of transit availability and service times had a greater impact on ridership than tolling. Ridership for bus routes 45 and 47 increased in July 2014 with the service time and frequency improvements made on July 6, 2014, per the ERC comprehensive agreement.
- Local cities could work with HRT to expand transit availability across the Elizabeth River as well as alternate crossing routes, as demand warrants.

Promote TRAFFIX/Transportation Alternatives

- Cities could work with HRT to promote TRAFFIX (www.gohrt.com/services/traffix), a cooperative public service designed to promote and implement transportation alternatives. TRAFFIX aims to decrease traffic congestion by reducing the number of Single Occupancy Vehicles (SOVs) by encouraging

ridesharing and other alternatives to driving such as public transportation, teleworking, biking, and walking. Below are some transportation demand management (TDM) strategies and programs offered by TRAFFIX that could assist in mitigating traffic congestion across the Elizabeth River:

- Carpool/Vanpool/Van Leasing
- Guaranteed Ride Program
- Transportation Incentive Program (TIP) for Military
- Teleworking
- Go365Pass Program
- Park & Sail
- Park & Ride

Increase Public Awareness of Tolls and E-ZPass

- VDOT/ERC could increase public awareness of existing and future toll rates/periods and E-ZPass benefits.
 - Results from CNU's South Hampton Roads Midtown and Downtown Tunnel Tolls Survey (see page 10) indicated that users overestimate the cost of the existing toll rates. In November 2014, South Hampton Roads residents said, on average, that the off-peak toll rate for cars with EZ-Pass was \$1.15, which was \$0.40 higher than the actual rate (\$0.75). The same survey respondents also thought the peak toll rate for cars with EZ-Pass was, on average, \$1.73, which was \$0.73 higher than the actual rate (\$1.00).
 - Survey results also showed that many users do not understand the benefits of E-ZPass (i.e. ease of use, reduced toll rates) or how to open an account. The survey found that a small but significant percentage (16%) of residents have not opened an E-ZPass account due to financial limitations or a lack of understanding about how to open one.

APPENDICES

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Additional Video Screenshots (PM Peak)59

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APPENDIX A:
ADDITIONAL VIDEO SCREENSHOTS (PM PEAK*)

*In-vehicle video footage was only collected for the PM peak hours.

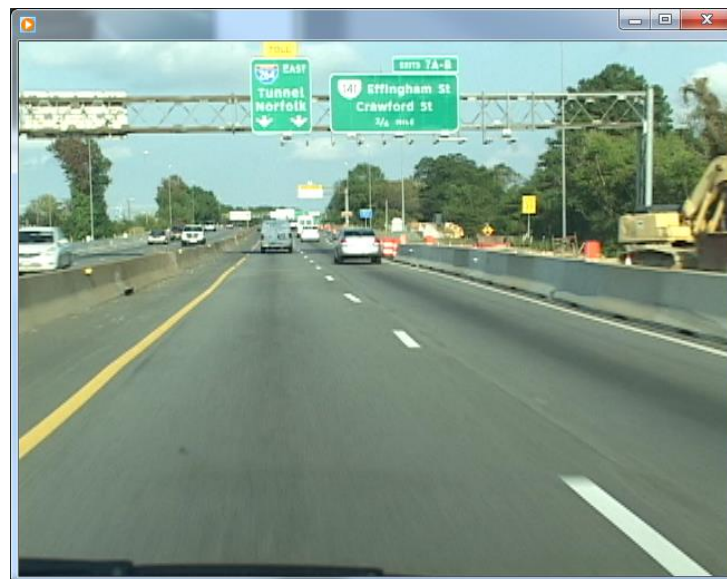
Eastbound Downtown Tunnel along I-264

VIDEO SCREENSHOT: PM PEAK – BEFORE TOLLS



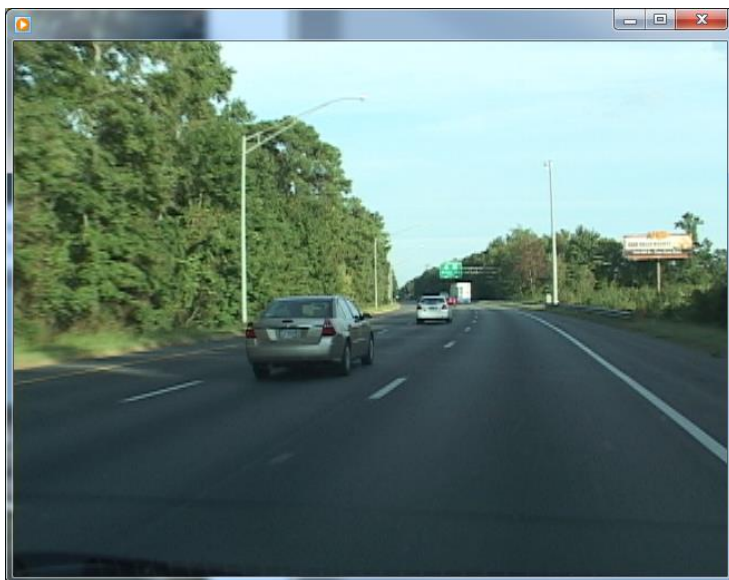
(@ Des Moines Ave exit) Tue 10-16-12

VIDEO SCREENSHOT: PM PEAK – AFTER TOLLS

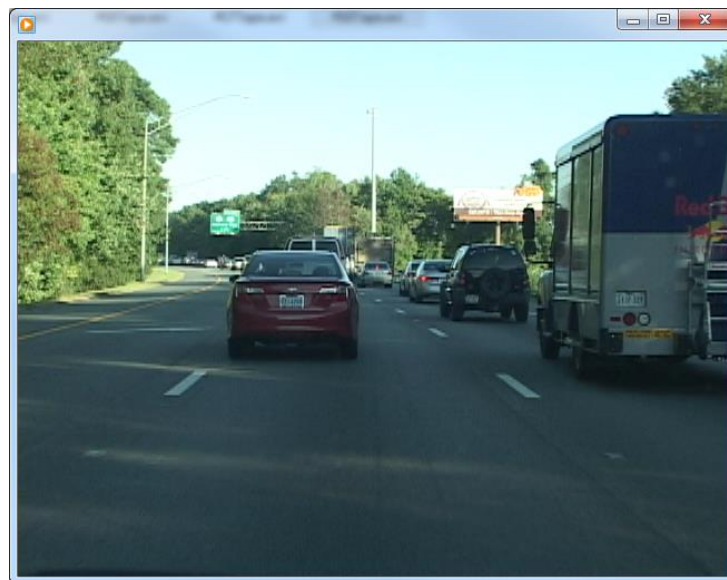


(@ Des Moines Ave exit) Thu 10-2-14

I-64/High Rise Bridge towards Virginia Beach



(0.8 mi east of I-664/I-264) Wed 10-17-12



(0.8 mi east of I-664/I-264) Thu 10-9-14

VIDEO SCREENSHOT: PM PEAK – BEFORE TOLLS

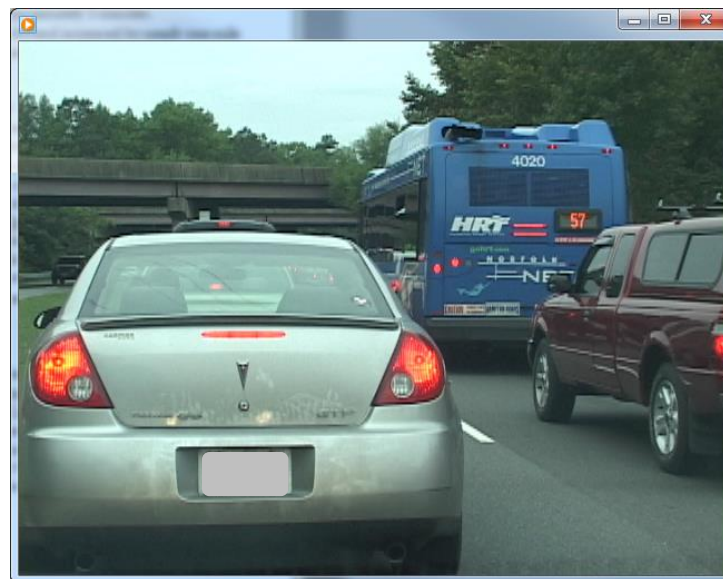
Westbound Military Hwy towards Gilmerton
Bridge



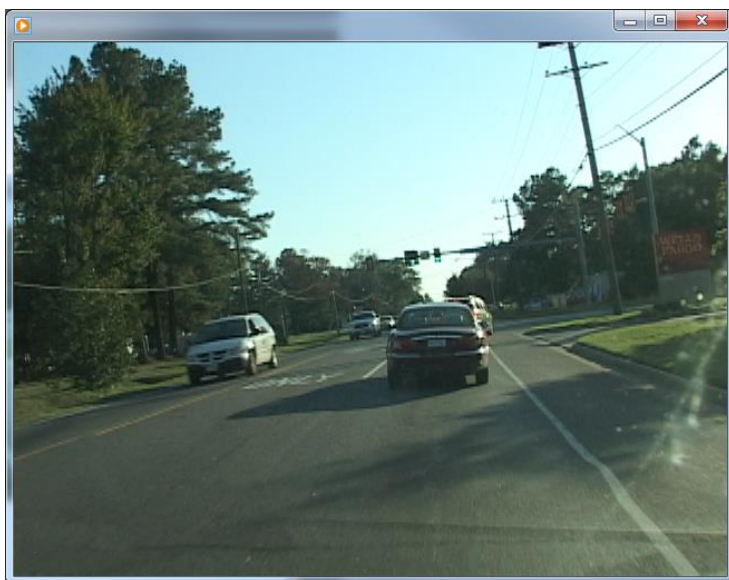
(@I-464) Mon 10-15-12

VIDEO SCREENSHOT: PM PEAK – AFTER TOLLS

(@I-464) Mon 9-29-14



Southbound George Washington Hwy



(@Camelot Blvd) – Wed 10-24-12



(@Camelot Blvd) Thu 9-25-14

APPENDIX B: ASSISTING THE CITY OF CHESAPEAKE WITH POST-TOLLING SIGNAL TIMING PLANS

According to the HRTPO FY 2015 UPWP Task 8.3 work element B.3 (page 58), HRTPO staff planned to conduct the following work:

Analyzing “after” turning movement counts at the adversely affected signalized intersections in Chesapeake (identified in FY 2013) using Synchro software to prepare post-tolling timing plans. These timing plans will be given to Chesapeake for implementation. (Note that Portsmouth has arranged for a consultant to assist that city, as necessary, with any adjustments to traffic signals necessitated by the tolling event.)

Chesapeake staff identified three signalized intersections for further study and evaluation resulting from tolling at the Midtown and Downtown Tunnels:

- Military Hwy & George Washington Hwy
- George Washington Hwy & Canal Dr
- Military Hwy & Canal Dr

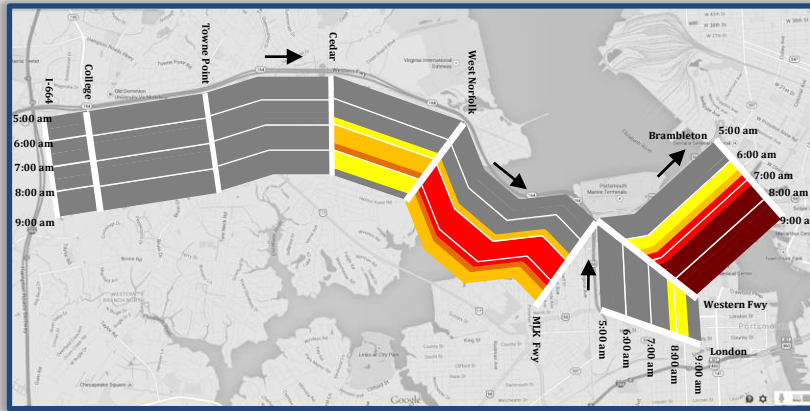
In November 2014, HRTPO staff constructed a triangular network of these intersections and mid-block intersections using Synchro 8.0 Traffic Signal Coordination/Optimization software. Synchro uses Highway Capacity Manual methods to calculate delay and Levels of Service and uses traffic counts and signal data inputs to optimize and coordinate traffic along a network. Chesapeake staff plans to add signal/count data to the Synchro network to retime these signals in the Spring of 2015. Chesapeake staff will finalize signal retimings and consult with HRTPO staff as necessary.

APPENDIX C:
CORRIDOR CONGESTION ANALYSIS

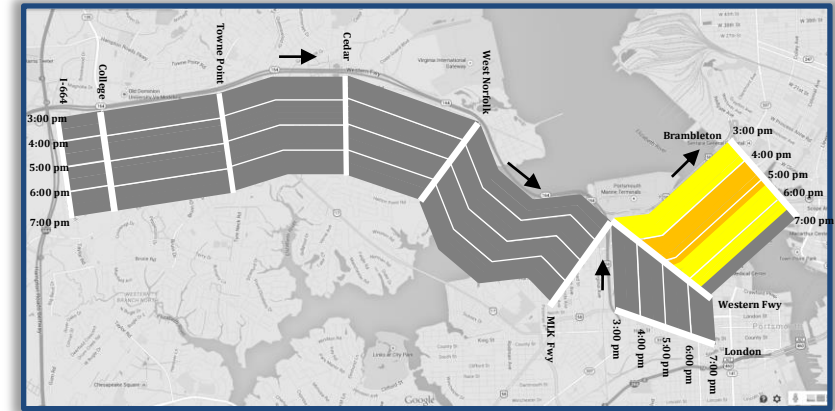
Midtown Tunnel and Approaches – EASTBOUND

AM PEAK PERIOD (5:00 am – 9:00 am)

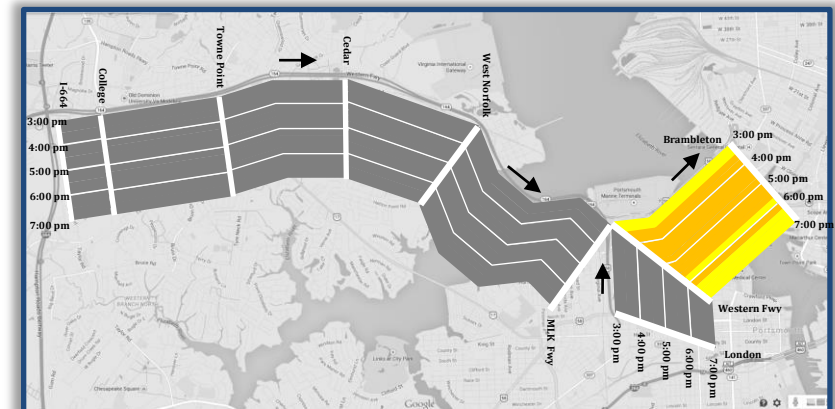
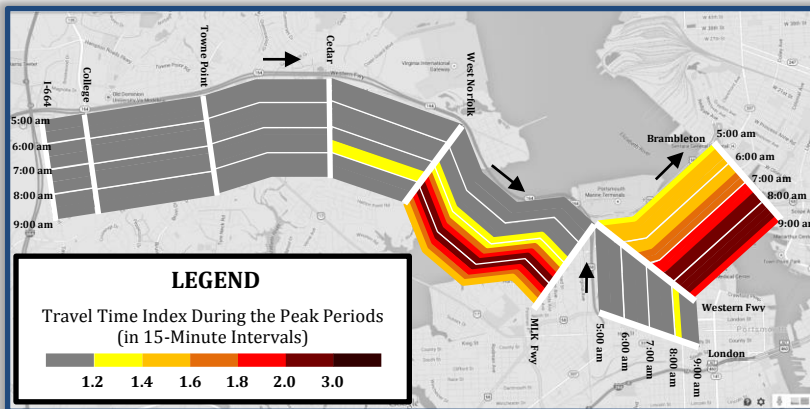
Pre-Tolling Conditions
(May-November 2013)



PM PEAK PERIOD (3:00 pm – 7:00 pm)



Post-Tolling Conditions
(May-November 2014)



CORRIDOR PRE- AND POST-TOLLING TRAVEL TIMES BY TIME OF DAY (minutes)

Via Western Freeway

TOLLING CONDITIONS	5:00	5:15	5:30	5:45	6:00	6:15	6:30	6:45	7:00	7:15	7:30	7:45	8:00	8:15	8:30	8:45
PRE-TOLLING (5/13-11/13)	9.5	9.5	9.6	9.7	10.0	10.4	11.3	13.3	14.0	15.2	15.7	16.3	15.7	15.1	14.5	13.5
POST-TOLLING (5/14-11/14)	10.6	11.0	11.0	11.1	11.1	11.6	12.0	12.9	13.4	14.5	15.8	15.6	15.2	14.5	13.6	
CHANGE	1.1	1.5	1.4	1.4	1.1	0.6	0.4	-1.3	-1.1	-1.9	-1.2	-0.5	-0.2	0.1	0.0	0.1

TOLLING CONDITIONS	15:00	15:15	15:30	15:45	16:00	16:15	16:30	16:45	17:00	17:15	17:30	17:45	18:00	18:15	18:30	18:45
PRE-TOLLING (5/13-11/13)	10.3	10.3	10.4	10.6	11.0	11.0	10.9	11.0	10.7	10.7	10.7	10.4	10.2	10.0	9.8	9.7
POST-TOLLING (5/14-11/14)	10.5	10.5	10.8	11.0	10.9	11.2	11.0	11.3	11.0	10.9	10.9	10.6	10.8	10.4	10.5	10.3
CHANGE	0.2	0.3	0.4	0.4	-0.1	0.2	0.1	0.3	0.3	0.2	0.2	0.2	0.6	0.5	0.7	0.6

Via MLK Freeway

TOLLING CONDITIONS	5:00	5:15	5:30	5:45	6:00	6:15	6:30	6:45	7:00	7:15	7:30	7:45	8:00	8:15	8:30	8:45
PRE-TOLLING (5/13-11/13)	3.4	3.4	3.5	3.6	3.8	4.2	4.7	5.6	5.6	6.4	7.0	7.3	7.3	7.3	6.9	6.2
POST-TOLLING (5/14-11/14)	4.4	4.6	4.6	4.8	4.8	4.8	5.3	5.3	5.8	5.7	6.2	6.9	6.9	6.9	6.8	6.1
CHANGE	1.0	1.2	1.1	1.2	0.9	0.7	0.6	-0.3	0.2	-0.7	-0.8	-0.3	-0.4	-0.4	-0.1	-0.1

TOLLING CONDITIONS	15:00	15:15	15:30	15:45	16:00	16:15	16:30	16:45	17:00	17:15	17:30	17:45	18:00	18:15	18:30	18:45
PRE-TOLLING (5/13-11/13)	4.0	4.0	4.1	4.3	4.7	4.8	4.7	4.7	4.5	4.4	4.3	4.1	3.9	3.8	3.7	3.6
POST-TOLLING (5/14-11/14)	4.2	4.3	4.5	4.7	4.6	4.9	4.7	5.0	4.7	4.5	4.6	4.4	4.5	4.1	4.1	3.9
CHANGE	0.2	0.3	0.4	0.4	-0.1	0.1	0.0	0.3	0.2	0.2	0.3	0.3	0.5	0.2	0.3	0.3

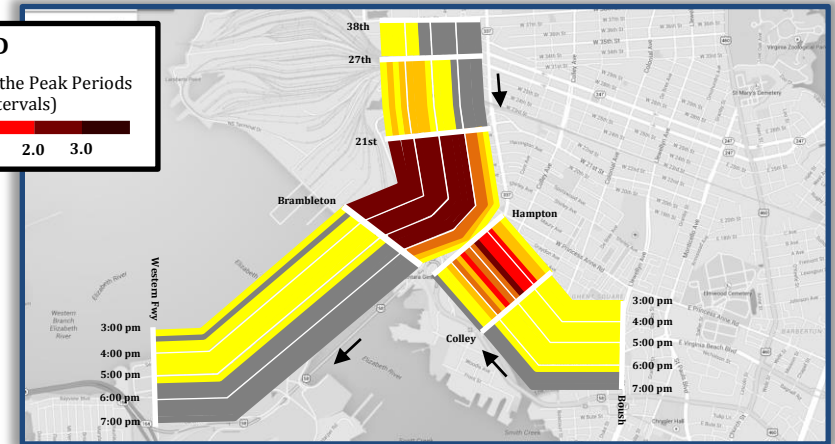
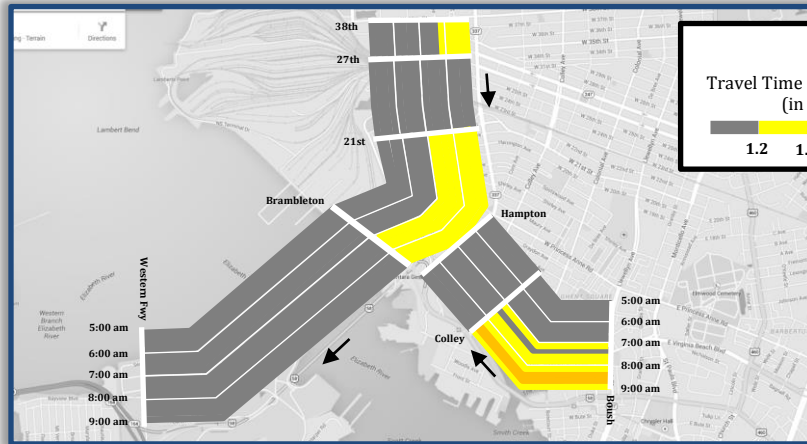
Source: HRTPO analysis of INRIX data. Background Map Source: Google.

Midtown Tunnel and Approaches – WESTBOUND

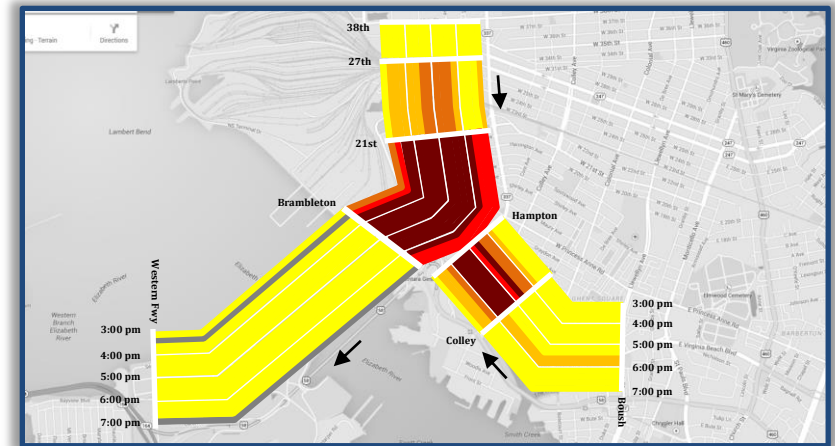
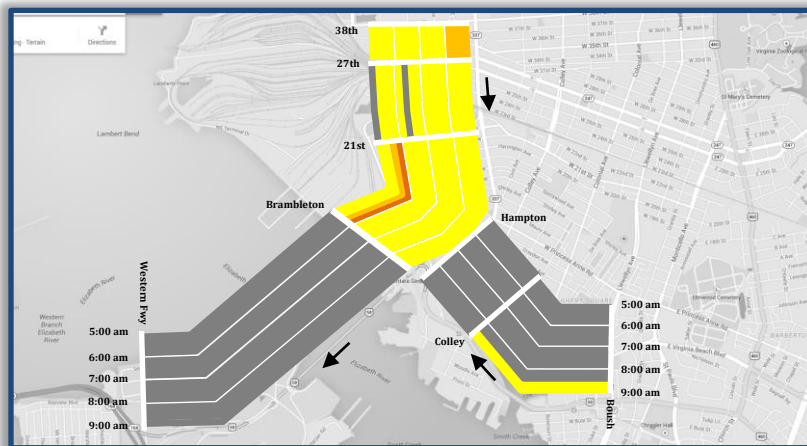
AM PEAK PERIOD (5:00 am – 9:00 am)

PM PEAK PERIOD (3:00 pm – 7:00 pm)

Pre-Tolling Conditions
(May-November 2013)



Post-Tolling Conditions
(May-November 2014)



CORRIDOR PRE- AND POST-TOLLING TRAVEL TIMES BY TIME OF DAY (minutes)

Via Hampton Boulevard

TOLLING CONDITIONS	5:00	5:15	5:30	5:45	6:00	6:15	6:30	6:45	7:00	7:15	7:30	7:45	8:00	8:15	8:30	8:45
PRE-TOLLING (5/13-11/13)	4.0	4.0	4.0	4.1	4.2	4.2	4.3	4.5	4.6	4.6	4.7	4.7	4.6	4.6	4.6	4.6
POST-TOLLING (5/14-11/14)	4.6	4.8	5.1	5.3	4.6	4.6	4.7	4.8	4.7	4.8	4.8	4.8	4.9	4.8	4.8	4.7
CHANGE	0.6	0.8	1.1	1.2	0.4	0.4	0.4	0.3	0.1	0.2	0.1	0.2	0.3	0.2	0.1	0.1

TOLLING CONDITIONS	15:00	15:15	15:30	15:45	16:00	16:15	16:30	16:45	17:00	17:15	17:30	17:45	18:00	18:15	18:30	18:45
PRE-TOLLING (5/13-11/13)	6.5	6.8	6.8	7.1	7.1	7.1	6.9	6.6	6.7	6.5	6.4	6.1	5.7	5.4	5.0	5.0
POST-TOLLING (5/14-11/14)	5.9	6.1	6.7	7.1	7.6	7.6	7.7	7.8	7.9	7.8	8.0	7.5	6.6	6.3	6.1	5.9
CHANGE	-0.6	-0.7	-0.1	0.0	0.5	0.5	0.8	1.2	1.2	1.3	1.6	1.4	0.9	0.9	1.0	0.9

Via Brambleton Avenue

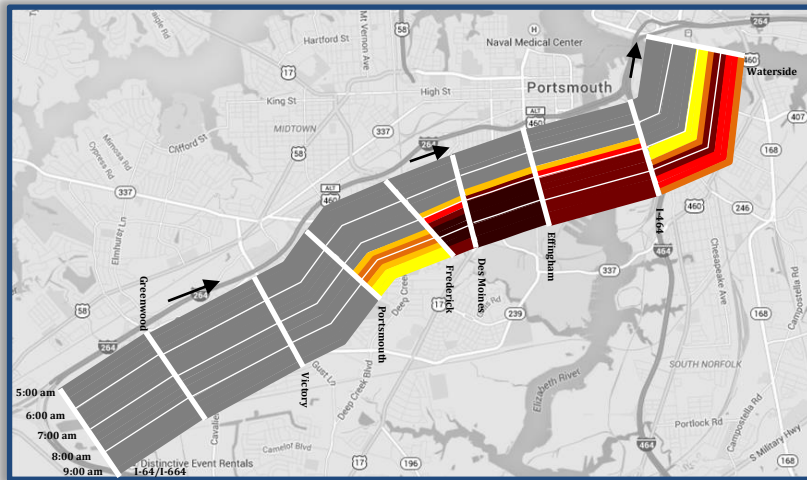
TOLLING CONDITIONS	5:00	5:15	5:30	5:45	6:00	6:15	6:30	6:45	7:00	7:15	7:30	7:45	8:00	8:15	8:30	8:45
PRE-TOLLING (5/13-11/13)	3.7	3.7	3.7	3.8	3.7	3.8	3.9	4.1	4.3	4.2	4.4	4.5	4.4	4.5	4.5	4.4
POST-TOLLING (5/14-11/14)	4.0	4.0	3.9	3.9	3.9	3.9	4.0	4.0	4.0	4.1	4.1	4.2	4.2	4.2	4.2	4.2
CHANGE	0.3	0.3	0.2	0.1	0.2	0.1	0.0	-0.1	-0.3	-0.1	-0.3	-0.3	-0.3	-0.3	-0.3	-0.2

TOLLING CONDITIONS	15:00	15:15	15:30	15:45	16:00	16:15	16:30	16:45	17:00	17:15	17:30	17:45	18:00	18:15	18:30	18:45
PRE-TOLLING (5/13-11/13)	4.6	4.7	4.8	5.0	5.0	5.0	5.1	4.9	4.9	4.8	4.7	4.8	4.6	4.5	4.3	4.3
POST-TOLLING (5/14-11/14)	4.6	4.7	4.9	4.9	5.1	5.0	5.3	5.2	5.5	5.6	5.7	5.4	5.0	5.0	4.8	4.5
CHANGE	0.0	0.0	0.1	-0.1	0.1	0.0	0.2	0.3	0.6	0.7	1.0	0.6	0.4	0.5	0.5	0.2

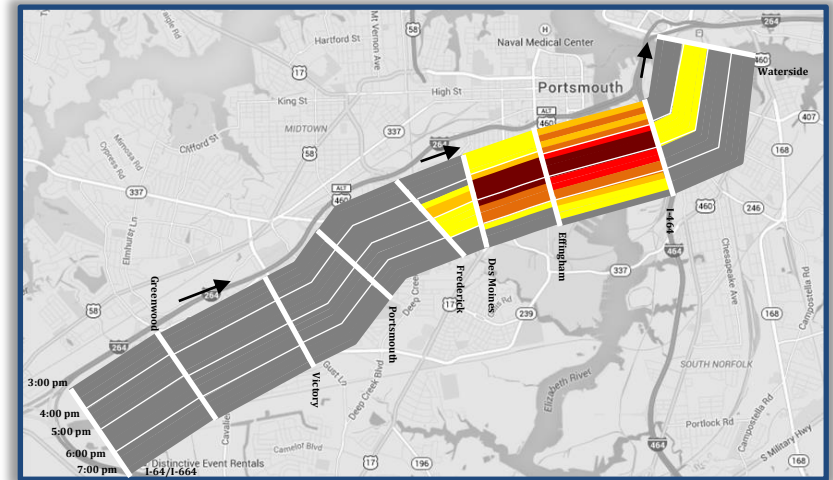
Source: HRTPO analysis of INRIX data. Background Map Source: Google.

I-264 including the Downtown Tunnel – EASTBOUND

AM PEAK PERIOD (5:00 am – 9:00 am)

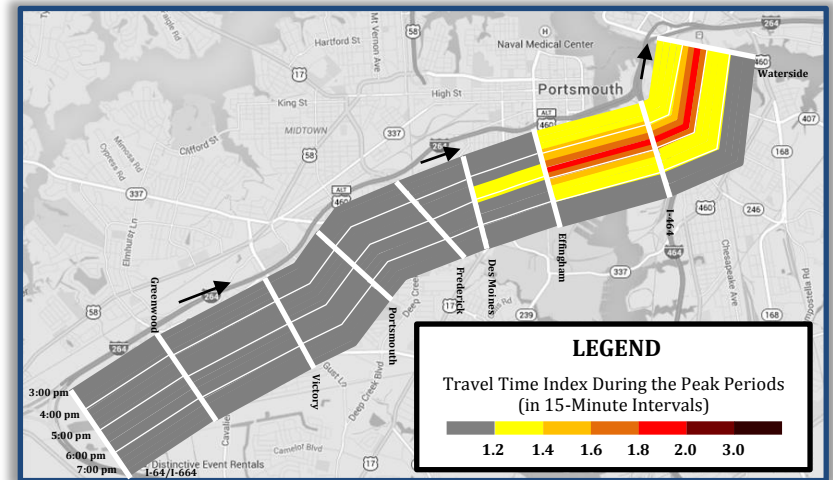
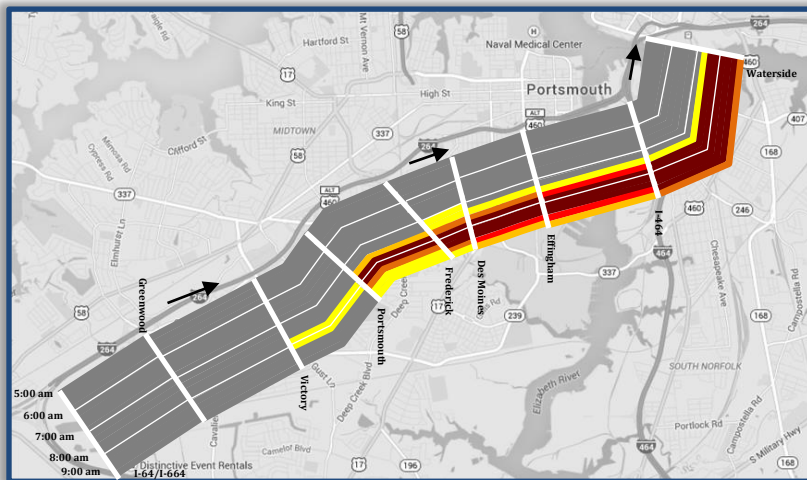


PM PEAK PERIOD (3:00 pm – 7:00 pm)



Pre-Tolling Conditions
(May-November 2013)

Post-Tolling Conditions
(May-November 2014)



LEGEND

Travel Time Index During the Peak Periods
(in 15-Minute Intervals)



CORRIDOR PRE- AND POST-TOLLING TRAVEL TIMES BY TIME OF DAY (minutes)

TOLLING CONDITIONS	5:00	5:15	5:30	5:45	6:00	6:15	6:30	6:45	7:00	7:15	7:30	7:45	8:00	8:15	8:30	8:45
PRE-TOLLING (5/13-11/13)	7.7	7.6	7.5	7.6	7.7	7.9	8.7	10.7	11.9	13.2	16.0	17.4	16.4	15.2	14.2	12.8
POST-TOLLING (5/14-11/14)	7.7	7.8	7.6	7.6	7.7	7.7	7.6	7.9	8.2	8.9	11.1	13.9	14.0	12.3	11.0	9.7
CHANGE	0.0	0.1	0.2	0.0	-0.1	-0.3	-1.1	-2.9	-3.7	-4.3	-4.9	-3.5	-2.5	-2.8	-3.2	-3.1

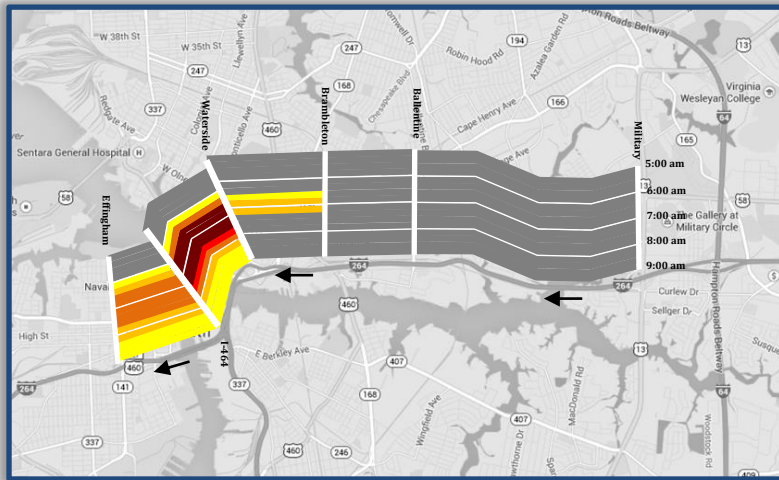
TOLLING CONDITIONS	15:00	15:15	15:30	15:45	16:00	16:15	16:30	16:45	17:00	17:15	17:30	17:45	18:00	18:15	18:30	18:45
PRE-TOLLING (5/13-11/13)	8.8	8.8	8.8	9.3	9.7	10.5	11.3	10.8	10.1	9.8	9.7	9.3	8.5	8.3	8.2	8.0
POST-TOLLING (5/14-11/14)	8.3	8.2	8.3	8.5	8.8	9.2	9.7	9.2	8.7	8.5	8.5	8.3	8.1	7.8	7.7	7.7
CHANGE	-0.5	-0.6	-0.5	-0.8	-0.9	-1.3	-1.6	-1.6	-1.4	-1.2	-1.1	-1.0	-0.5	-0.4	-0.5	-0.3

Source: HRTPO analysis of INRIX data. Background Map Source: Google.

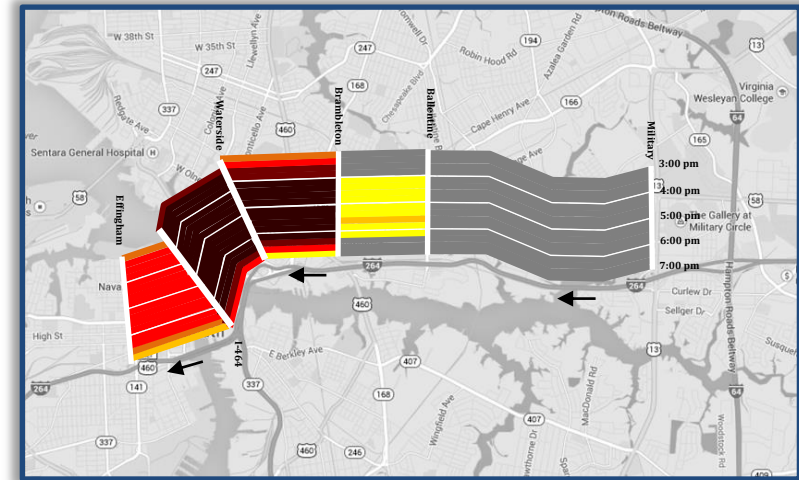
I-264 including the Downtown Tunnel - WESTBOUND

AM PEAK PERIOD (5:00 am – 9:00 am)

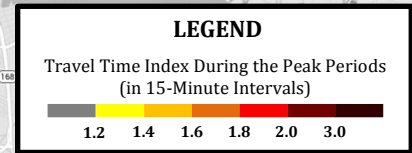
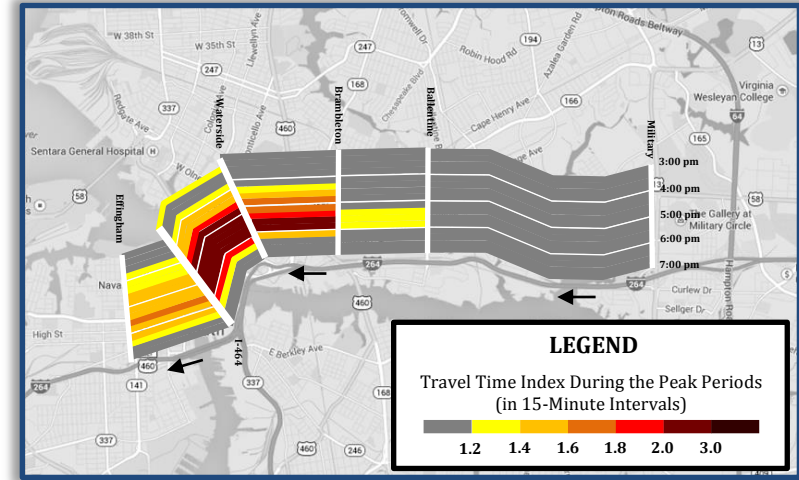
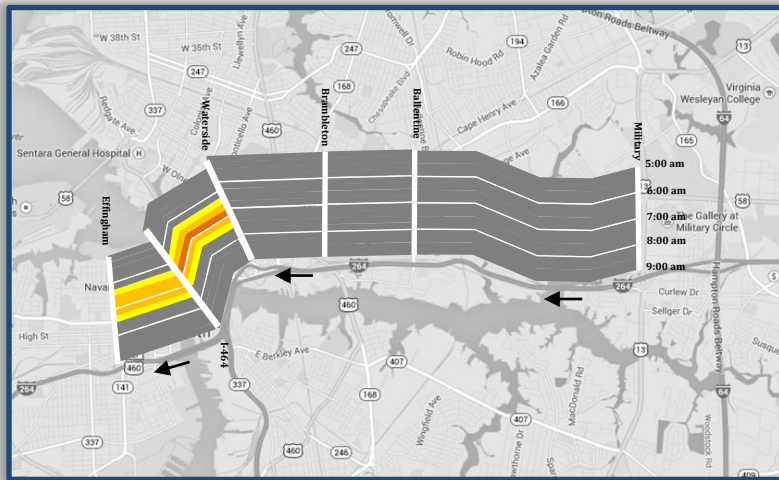
Pre-Tolling Conditions
(May-November 2013)



PM PEAK PERIOD (3:00 pm – 7:00 pm)



Post-Tolling Conditions
(May-November 2014)



CORRIDOR PRE- AND POST-TOLLING TRAVEL TIMES BY TIME OF DAY (minutes)

TOLLING CONDITIONS	5:00	5:15	5:30	5:45	6:00	6:15	6:30	6:45	7:00	7:15	7:30	7:45	8:00	8:15	8:30	8:45
PRE-TOLLING (5/13-11/13)	7.3	7.2	7.3	7.3	7.8	9.0	10.4	10.7	10.7	9.6	9.3	8.9	8.5	8.2	8.0	7.8
POST-TOLLING (5/14-11/14)	7.4	7.2	7.2	7.2	7.4	8.1	8.7	8.9	8.5	8.0	7.6	7.3	7.4	7.3	7.2	7.2
CHANGE	0.1	0.0	-0.1	-0.2	-0.4	-0.8	-1.7	-1.9	-2.2	-1.6	-1.7	-1.5	-1.1	-0.8	-0.8	-0.6

TOLLING CONDITIONS	15:00	15:15	15:30	15:45	16:00	16:15	16:30	16:45	17:00	17:15	17:30	17:45	18:00	18:15	18:30	18:45
PRE-TOLLING (5/13-11/13)	11.3	12.3	13.1	14.2	15.2	15.5	15.7	15.8	15.3	16.1	16.3	16.1	15.1	13.1	11.3	9.3
POST-TOLLING (5/14-11/14)	7.9	7.6	7.6	7.8	8.2	8.6	9.8	9.9	10.1	10.6	12.0	11.4	9.5	8.0	7.6	7.4
CHANGE	-3.4	-4.7	-5.5	-6.4	-7.0	-6.9	-5.9	-5.8	-5.2	-5.5	-4.3	-4.8	-5.7	-5.1	-3.7	-1.9

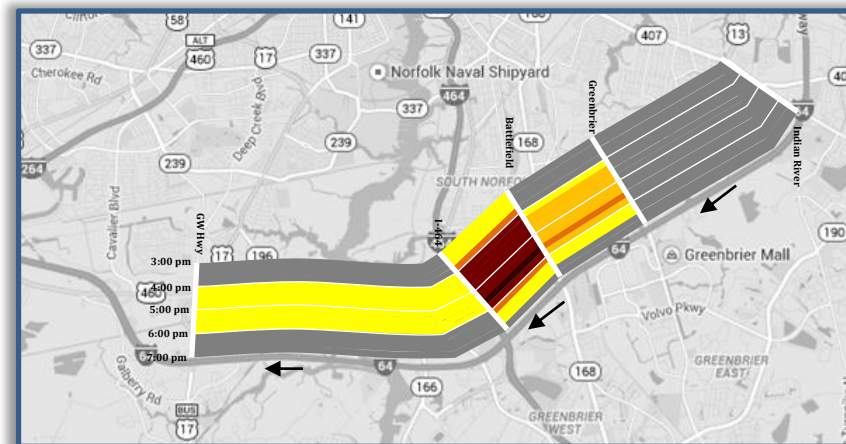
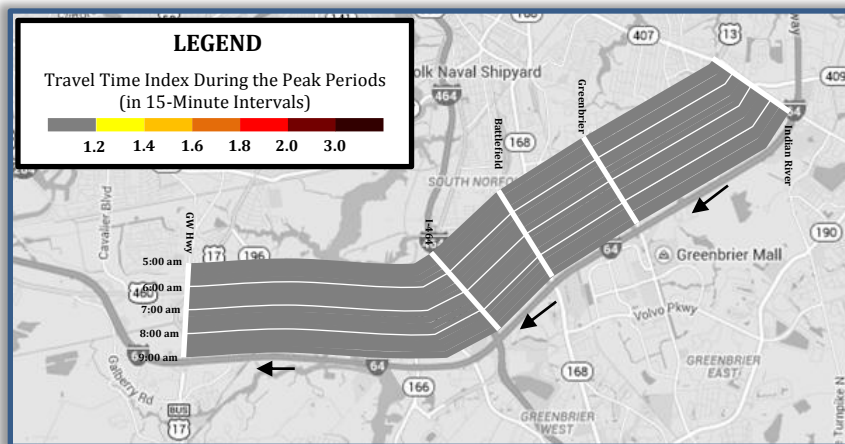
Source: HRTPO analysis of INRIX data. Background Map Source: Google.

I-64 (Chesapeake) including the High Rise Bridge – EASTBOUND

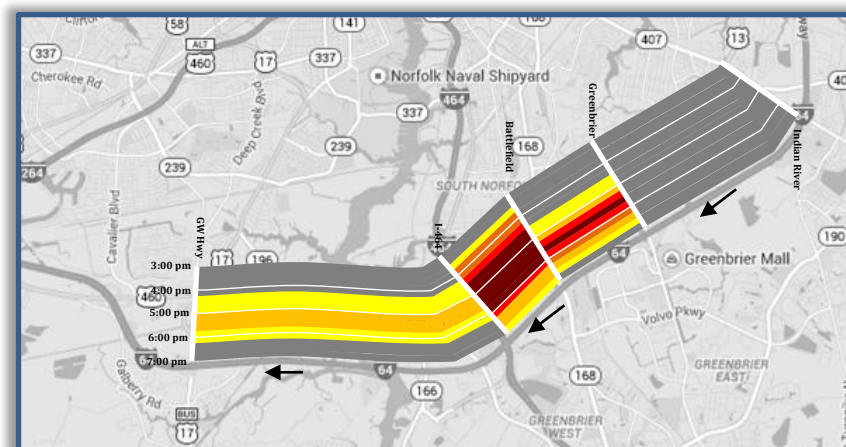
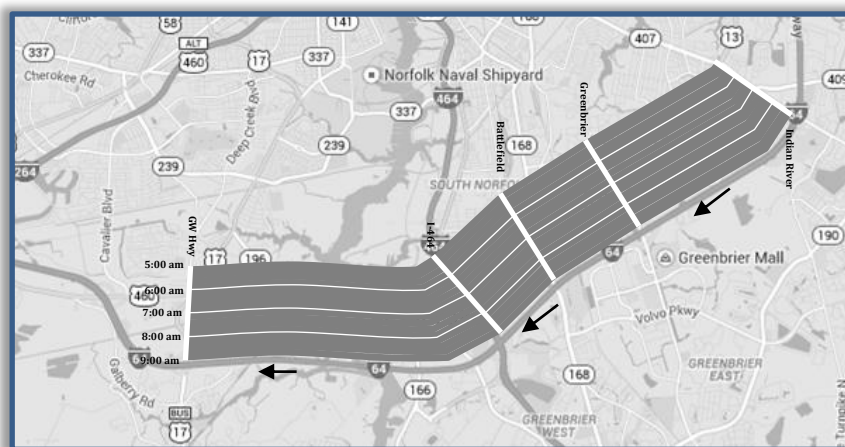
AM PEAK PERIOD (5:00 am – 9:00 am)

PM PEAK PERIOD (3:00 pm – 7:00 pm)

Pre-Tolling Conditions
(May-November 2013)



Post-Tolling Conditions
(May-November 2014)



CORRIDOR PRE- AND POST-TOLLING TRAVEL TIMES BY TIME OF DAY (minutes)

TOLLING CONDITIONS	5:00	5:15	5:30	5:45	6:00	6:15	6:30	6:45	7:00	7:15	7:30	7:45	8:00	8:15	8:30	8:45
PRE-TOLLING (5/13-11/13)	9.2	9.1	9.1	9.0	9.1	9.0	9.1	9.1	9.1	9.1	9.3	9.4	9.4	9.4	9.3	9.2
POST-TOLLING (5/14-11/14)	9.1	9.2	9.1	9.0	9.0	9.0	9.1	9.2	9.3	9.3	9.4	9.4	9.3	9.3	9.2	9.1
CHANGE	-0.1	0.1	0.1	0.0	-0.1	0.0	0.0	0.1	0.2	0.2	0.1	0.0	0.0	-0.1	-0.1	-0.1

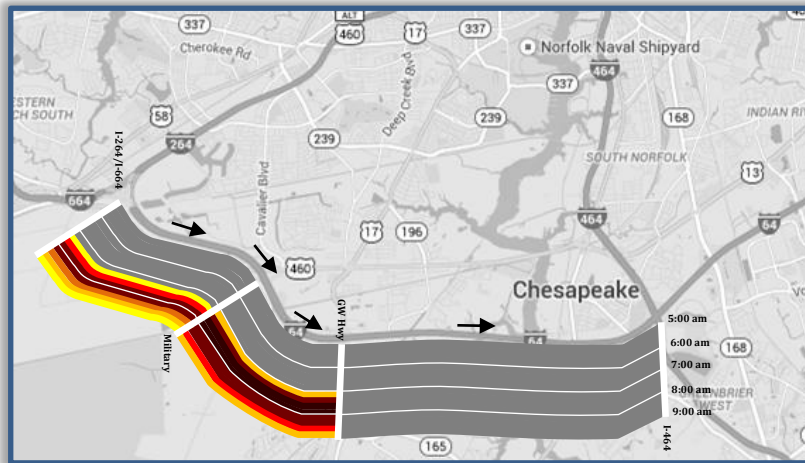
TOLLING CONDITIONS	15:00	15:15	15:30	15:45	16:00	16:15	16:30	16:45	17:00	17:15	17:30	17:45	18:00	18:15	18:30	18:45
PRE-TOLLING (5/13-11/13)	9.9	9.8	10.1	11.0	12.1	12.6	12.8	12.7	12.5	12.9	13.5	12.4	11.1	10.3	9.9	9.5
POST-TOLLING (5/14-11/14)	9.5	9.7	10.0	10.5	10.8	11.4	12.0	12.6	13.9	14.3	14.5	13.7	12.5	11.3	10.7	10.4
CHANGE	-0.3	-0.2	0.0	-0.5	-1.3	-1.2	-0.8	-0.1	1.4	1.4	0.9	1.3	1.4	0.9	0.8	0.9

Source: HRTPO analysis of INRIX data. Background Map Source: Google.

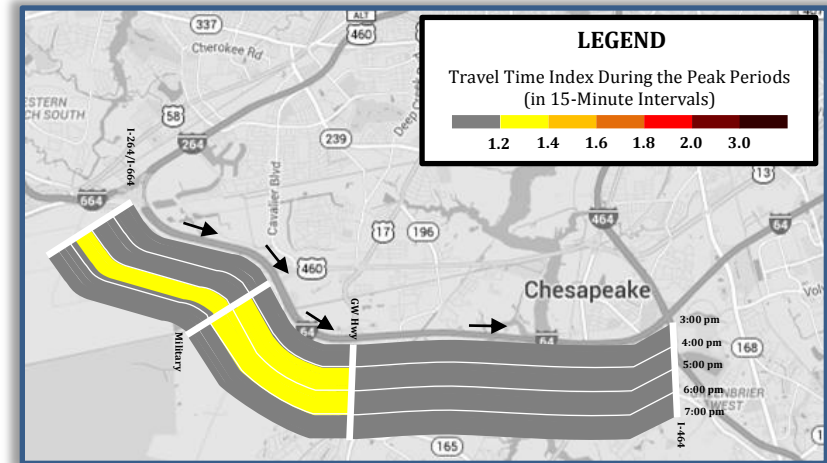
I-64 (Chesapeake) including the High Rise Bridge - WESTBOUND

AM PEAK PERIOD (5:00 am – 9:00 am)

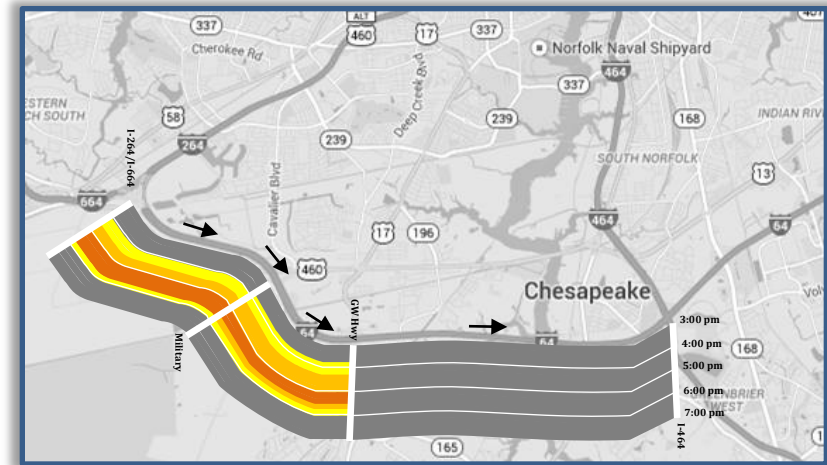
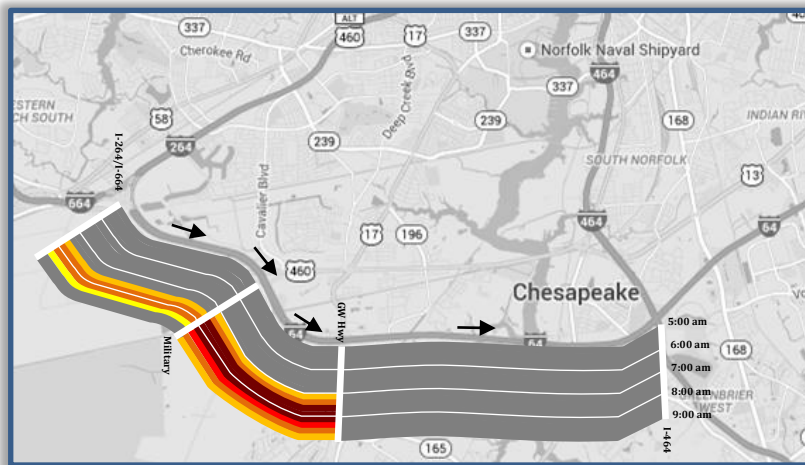
Pre-Tolling Conditions
(May-November 2013)



PM PEAK PERIOD (3:00 pm – 7:00 pm)



Post-Tolling Conditions
(May-November 2014)



CORRIDOR PRE- AND POST-TOLLING TRAVEL TIMES BY TIME OF DAY (minutes)

TOLLING CONDITIONS	5:00	5:15	5:30	5:45	6:00	6:15	6:30	6:45	7:00	7:15	7:30	7:45	8:00	8:15	8:30	8:45
PRE-TOLLING (5/13-11/13)	9.3	9.3	9.2	9.2	9.2	9.2	9.3	9.7	10.4	12.0	15.3	17.5	15.8	14.0	12.5	11.0
POST-TOLLING (5/14-11/14)	9.2	9.3	9.2	9.1	9.0	9.1	9.2	9.6	10.4	11.2	13.2	14.6	13.4	11.7	11.2	10.9
CHANGE	-0.1	0.0	0.0	-0.2	-0.2	-0.1	-0.1	-0.1	0.0	-0.7	-2.2	-2.9	-2.4	-2.3	-1.3	-0.2

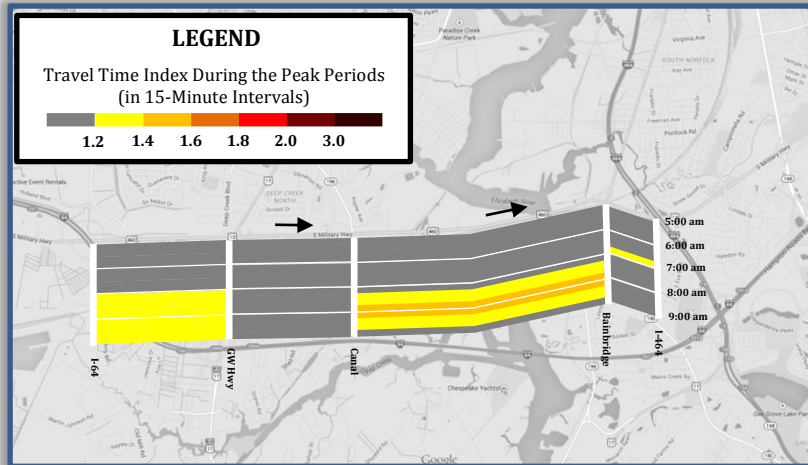
TOLLING CONDITIONS	15:00	15:15	15:30	15:45	16:00	16:15	16:30	16:45	17:00	17:15	17:30	17:45	18:00	18:15	18:30	18:45
PRE-TOLLING (5/13-11/13)	9.3	9.3	9.3	9.8	10.2	10.2	10.3	10.6	10.9	11.0	11.0	10.3	9.8	9.7	9.4	9.4
POST-TOLLING (5/14-11/14)	9.5	9.5	9.8	10.3	11.0	11.3	11.8	12.2	13.0	13.1	12.6	11.3	10.3	9.5	9.3	9.3
CHANGE	0.3	0.1	0.4	0.5	0.8	1.1	1.5	1.7	2.1	2.1	1.6	1.0	0.5	-0.1	-0.2	-0.1

Source: HRTPO analysis of INRIX data. Background Map Source: Google.

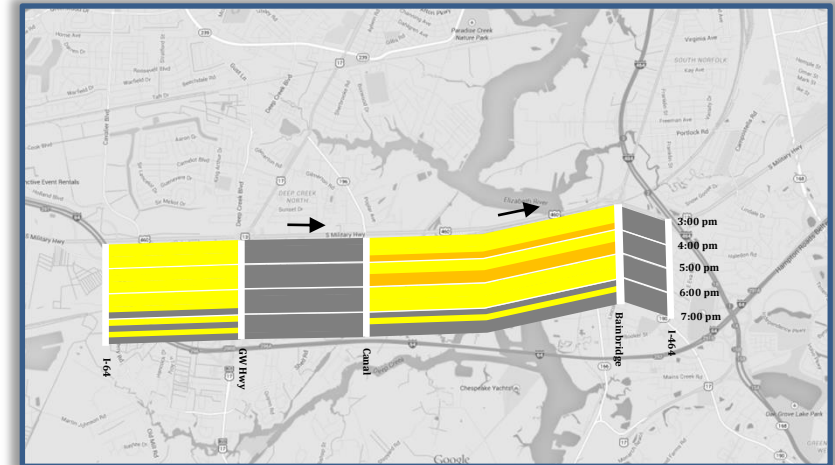
Military Highway including the Gilmerton Bridge - EASTBOUND

AM PEAK PERIOD (5:00 am – 9:00 am)

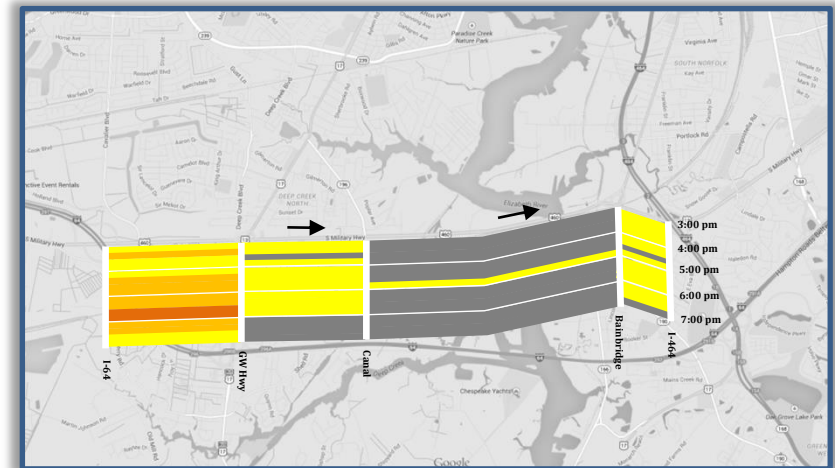
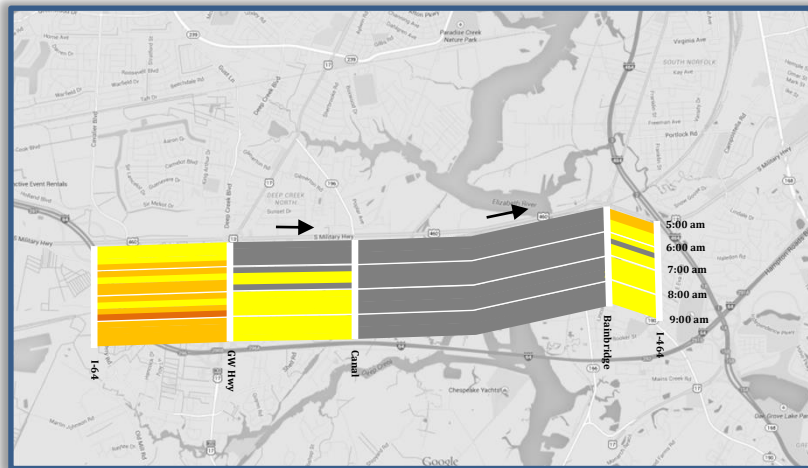
Pre-Tolling Conditions
(May-November 2013)



PM PEAK PERIOD (3:00 pm – 7:00 pm)



Post-Tolling Conditions
(May-November 2014)



CORRIDOR PRE- AND POST-TOLLING TRAVEL TIMES BY TIME OF DAY (minutes)

TOLLING CONDITIONS	5:00	5:15	5:30	5:45	6:00	6:15	6:30	6:45	7:00	7:15	7:30	7:45	8:00	8:15	8:30	8:45
PRE-TOLLING (5/13-11/13)	7.8	7.8	7.8	7.8	7.8	7.9	8.0	8.4	8.5	8.9	9.3	9.8	9.9	9.3	8.9	8.6
POST-TOLLING (5/14-11/14)	9.0	8.7	8.5	8.8	8.7	8.6	8.8	8.7	8.8	8.6	8.8	9.4	9.1	8.9	9.1	9.3
CHANGE	1.2	0.9	0.6	1.0	0.9	0.7	0.8	0.3	0.2	-0.3	-0.4	-0.4	-0.8	-0.4	0.2	0.7

TOLLING CONDITIONS	15:00	15:15	15:30	15:45	16:00	16:15	16:30	16:45	17:00	17:15	17:30	17:45	18:00	18:15	18:30	18:45
PRE-TOLLING (5/13-11/13)	8.8	8.6	8.7	9.3	9.2	9.2	9.6	9.5	9.2	8.7	8.6	8.6	8.3	8.4	8.2	8.2
POST-TOLLING (5/14-11/14)	8.9	9.0	8.9	9.1	9.0	9.0	9.3	9.4	9.3	9.2	9.4	9.5	8.8	8.6	8.5	8.3
CHANGE	0.0	0.4	0.1	-0.3	-0.2	-0.2	-0.3	0.0	0.1	0.5	0.7	0.9	0.4	0.1	0.3	0.1

Source: HRTPO analysis of INRIX data. Background Map Source: Google.

Military Highway including the Gilmerton Bridge – WESTBOUND

AM PEAK PERIOD (5:00 am – 9:00 am)

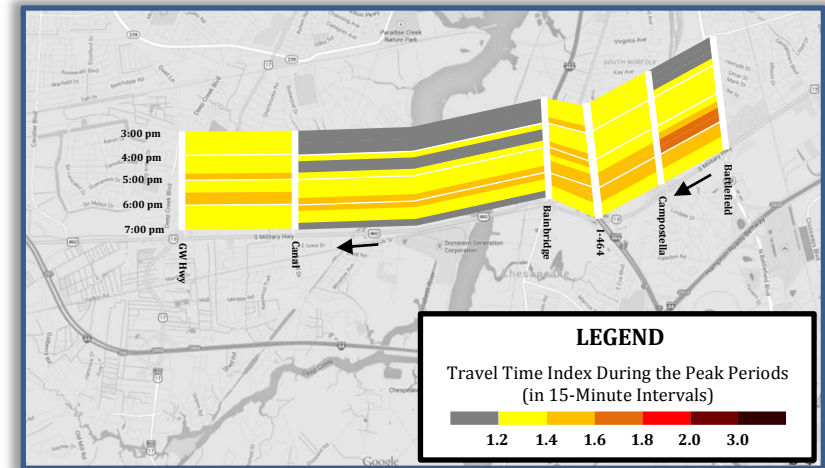
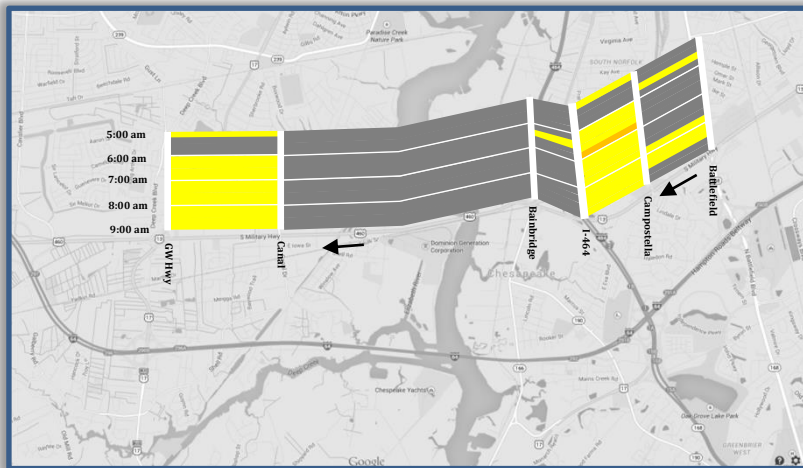
Pre-Tolling Conditions
(May-November 2013)



PM PEAK PERIOD (3:00 pm – 7:00 pm)



Post-Tolling Conditions
(May-November 2014)



LEGEND

Travel Time Index During the Peak Periods
(in 15-Minute Intervals)



CORRIDOR PRE- AND POST-TOLLING TRAVEL TIMES BY TIME OF DAY (minutes)

TOLLING CONDITIONS	5:00	5:15	5:30	5:45	6:00	6:15	6:30	6:45	7:00	7:15	7:30	7:45	8:00	8:15	8:30	8:45
PRE-TOLLING (5/13-11/13)	7.1	7.2	7.0	7.0	7.1	7.5	7.4	7.6	7.5	7.5	7.5	7.5	7.7	7.5	7.5	7.5
POST-TOLLING (5/14-11/14)	7.9	7.8	8.0	7.5	7.9	8.2	7.9	8.2	8.1	7.9	8.2	8.3	8.4	8.2	8.1	8.2
CHANGE	0.8	0.6	0.9	0.5	0.7	0.7	0.5	0.5	0.6	0.5	0.7	0.8	0.7	0.6	0.6	0.7

Source: HRTPO analysis of INRIX data. Background Map Source: Google.

TOLLING CONDITIONS	15:00	15:15	15:30	15:45	16:00	16:15	16:30	16:45	17:00	17:15	17:30	17:45	18:00	18:15	18:30	18:45
PRE-TOLLING (5/13-11/13)	7.9	7.8	8.0	8.4	8.8	8.7	8.8	8.6	8.6	8.7	8.9	8.8	8.2	8.1	7.7	7.7
POST-TOLLING (5/14-11/14)	8.3	8.3	8.2	8.7	8.6	8.7	8.9	9.1	9.0	9.1	9.7	10.2	9.8	9.3	8.8	8.6
CHANGE	0.4	0.4	0.2	0.2	-0.2	0.0	0.0	0.5	0.4	0.5	0.8	1.4	1.6	1.1	1.0	0.8

George Washington Highway - NORTHBOUND

AM PEAK PERIOD (5:00 am – 9:00 am)

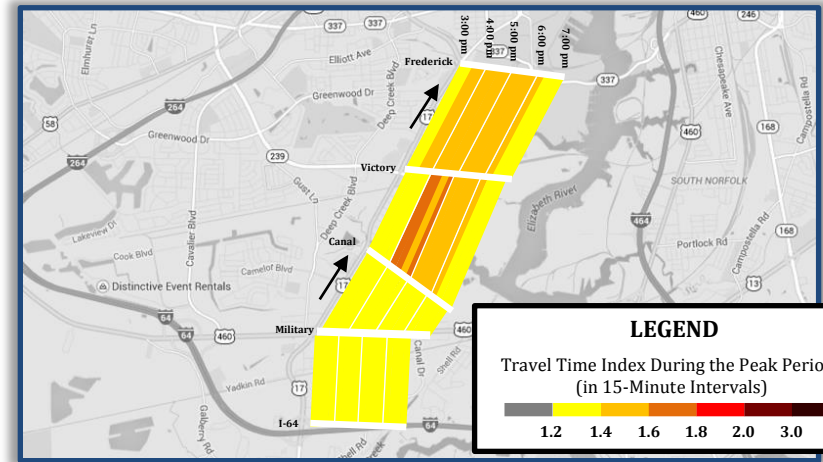
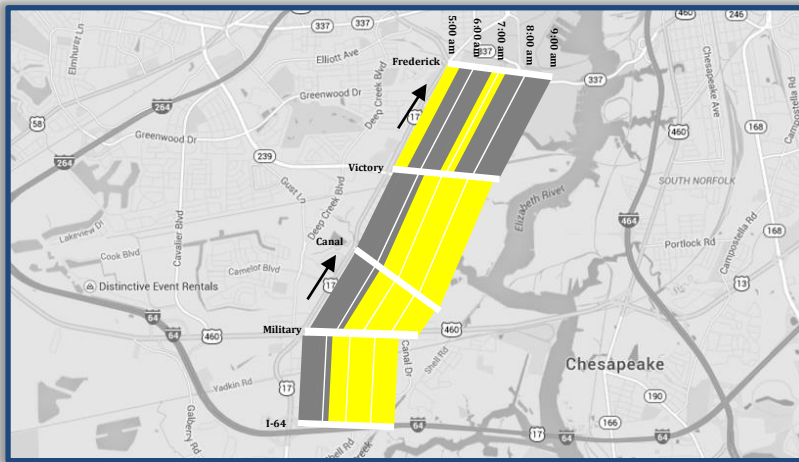


PM PEAK PERIOD (3:00 pm – 7:00 pm)



Pre-Tolling Conditions
(May-November 2013)

Post-Tolling Conditions
(May-November 2014)



LEGEND

Travel Time Index During the Peak Periods
(in 15-Minute Intervals)

1.2 1.4 1.6 1.8 2.0 3.0

CORRIDOR PRE- AND POST-TOLLING TRAVEL TIMES BY TIME OF DAY (minutes)

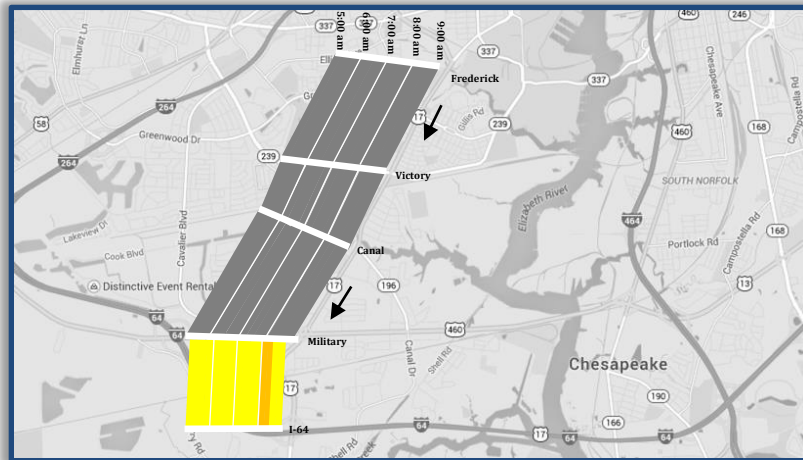
TOLLING CONDITIONS	5:00	5:15	5:30	5:45	6:00	6:15	6:30	6:45	7:00	7:15	7:30	7:45	8:00	8:15	8:30	8:45
PRE-TOLLING (5/13-11/13)	7.0	6.9	7.0	6.9	7.1	7.2	7.3	7.3	7.3	7.3	7.3	7.4	7.3	7.3	7.4	7.3
POST-TOLLING (5/14-11/14)	8.0	7.7	7.7	7.8	7.9	8.2	8.3	8.6	8.4	8.3	8.1	8.1	8.2	8.2	8.2	8.1
CHANGE	1.0	0.8	0.7	0.9	0.8	1.0	1.0	1.3	1.2	0.9	0.7	0.7	0.9	0.8	0.8	0.8

TOLLING CONDITIONS	15:00	15:15	15:30	15:45	16:00	16:15	16:30	16:45	17:00	17:15	17:30	17:45	18:00	18:15	18:30	18:45
PRE-TOLLING (5/13-11/13)	7.7	7.7	7.7	7.8	8.0	7.9	7.7	7.6	7.6	7.6	7.5	7.4	7.4	7.4	7.5	7.3
POST-TOLLING (5/14-11/14)	9.0	9.1	9.2	9.2	9.6	9.9	9.7	9.7	9.6	9.4	9.5	9.4	9.3	8.9	8.6	8.8
CHANGE	1.3	1.4	1.5	1.4	1.7	2.0	2.0	2.1	1.9	1.8	1.9	2.0	1.9	1.4	1.2	1.4

Source: HRTPO analysis of INRIX data. Background Map Source: Google.

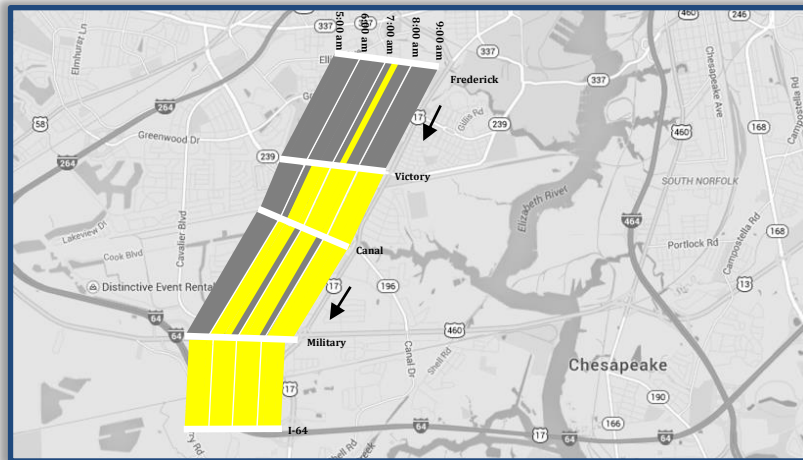
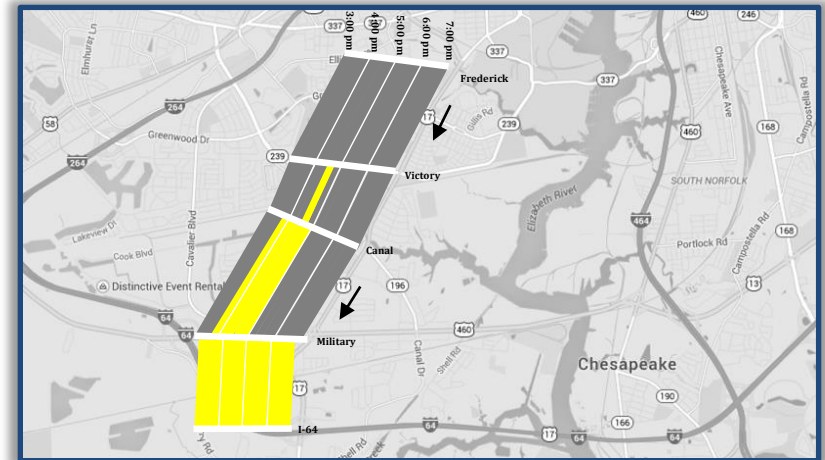
George Washington Highway - SOUTHBOUND

AM PEAK PERIOD (5:00 am – 9:00 am)

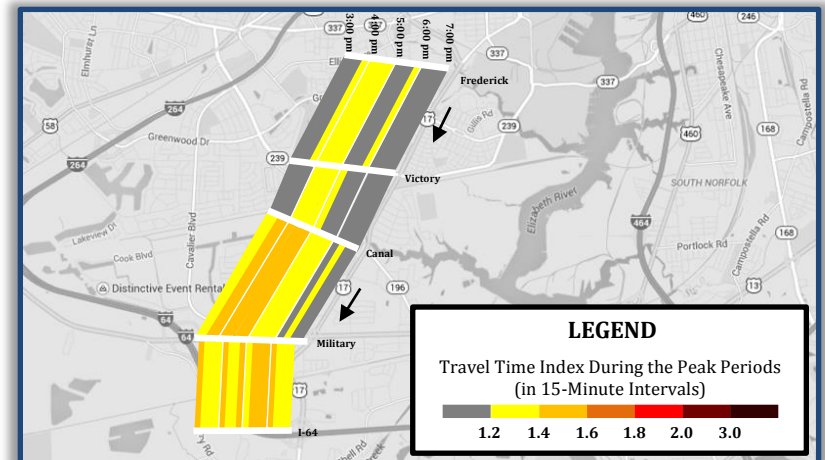


Pre-Tolling Conditions
(May-November 2013)

PM PEAK PERIOD (3:00 pm – 7:00 pm)



Post-Tolling Conditions
(May-November 2014)



LEGEND

Travel Time Index During the Peak Periods
(in 15-Minute Intervals)



CORRIDOR PRE- AND POST-TOLLING TRAVEL TIMES BY TIME OF DAY (minutes)

TOLLING CONDITIONS	5:00	5:15	5:30	5:45	6:00	6:15	6:30	6:45	7:00	7:15	7:30	7:45	8:00	8:15	8:30	8:45
PRE-TOLLING (5/13-11/13)	7.6	7.5	7.5	7.5	7.8	7.8	7.8	7.9	7.8	7.8	8.0	8.0	8.1	8.1	8.1	8.0
POST-TOLLING (5/14-11/14)	8.2	8.0	8.3	8.4	8.7	8.6	8.9	8.7	8.8	9.1	8.7	8.6	8.9	8.9	8.7	8.8
CHANGE	0.6	0.5	0.8	0.9	0.9	0.8	1.1	0.7	0.9	1.3	0.8	0.6	0.9	0.8	0.6	0.8

TOLLING CONDITIONS	15:00	15:15	15:30	15:45	16:00	16:15	16:30	16:45	17:00	17:15	17:30	17:45	18:00	18:15	18:30	18:45
PRE-TOLLING (5/13-11/13)	8.1	8.1	8.1	8.4	8.6	8.8	8.8	8.5	8.2	8.1	8.1	8.0	8.0	7.8	7.7	8.0
POST-TOLLING (5/14-11/14)	8.8	9.0	9.1	9.2	9.3	9.4	9.4	9.3	8.9	8.8	8.8	8.7	8.5	8.6	8.5	8.4
CHANGE	0.8	0.9	0.9	0.9	0.7	0.6	0.6	0.9	0.7	0.7	0.6	0.8	0.6	0.8	0.8	0.4

Source: HRTPO analysis of INRIX data. Background Map Source: Google.

Canal Drive – NORTHBOUND

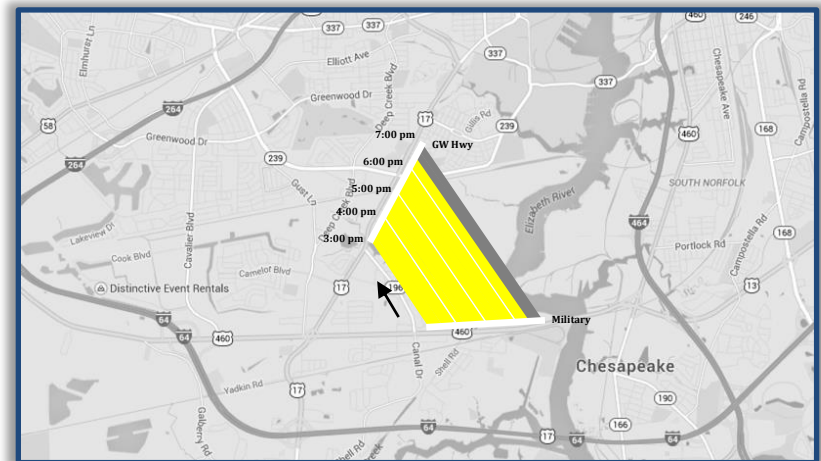
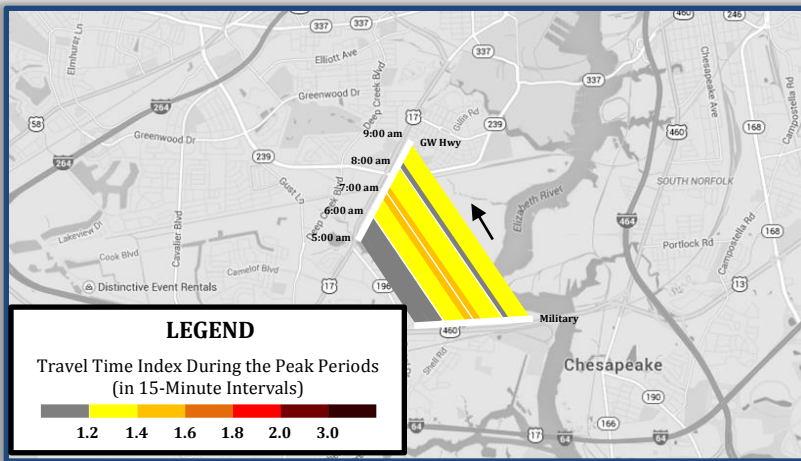
AM PEAK PERIOD (5:00 am – 9:00 am)



PM PEAK PERIOD (3:00 pm – 7:00 pm)



Pre-Tolling Conditions
(May-November 2013)



Post-Tolling Conditions
(May-November 2014)

CORRIDOR PRE- AND POST-TOLLING TRAVEL TIMES BY TIME OF DAY (minutes)

TOLLING CONDITIONS	5:00	5:15	5:30	5:45	6:00	6:15	6:30	6:45	7:00	7:15	7:30	7:45	8:00	8:15	8:30	8:45
PRE-TOLLING (5/13-11/13)	1.8	1.8	1.8	1.8	1.8	1.9	1.8	1.9	1.9	1.9	1.8	1.9	1.9	1.9	1.9	1.9
POST-TOLLING (5/14-11/14)	2.0	2.1	2.1	2.2	2.3	2.3	2.4	2.5	2.6	2.5	2.2	2.2	2.1	2.2	2.2	2.2
CHANGE	0.2	0.2	0.2	0.3	0.4	0.5	0.6	0.6	0.7	0.5	0.4	0.3	0.3	0.3	0.3	0.3

TOLLING CONDITIONS	15:00	15:15	15:30	15:45	16:00	16:15	16:30	16:45	17:00	17:15	17:30	17:45	18:00	18:15	18:30	18:45
PRE-TOLLING (5/13-11/13)	1.8	1.9	1.9	1.9	1.9	1.9	1.8	1.8	1.9	1.9	1.9	1.8	1.9	1.8	1.8	1.8
POST-TOLLING (5/14-11/14)	2.2	2.2	2.3	2.3	2.3	2.2	2.3	2.3	2.3	2.3	2.3	2.2	2.3	2.2	2.1	2.2
CHANGE	0.4	0.3	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.3	0.3	0.3

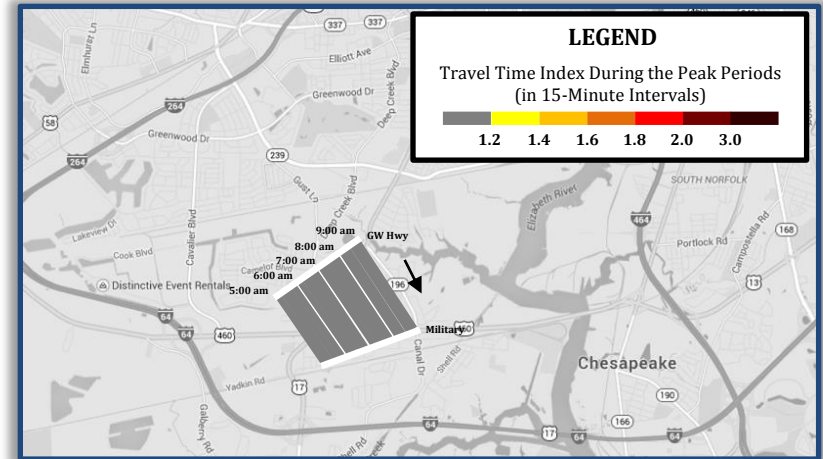
Source: HRTPO analysis of INRIX data. Background Map Source: Google.

Canal Drive – SOUTHBOUND

AM PEAK PERIOD (5:00 am – 9:00 am)



PM PEAK PERIOD (3:00 pm – 7:00 pm)



Pre-Tolling Conditions
(May-November 2013)

Post-Tolling Conditions
(May-November 2014)



CORRIDOR PRE- AND POST-TOLLING TRAVEL TIMES BY TIME OF DAY (minutes)

TOLLING CONDITIONS	5:00	5:15	5:30	5:45	6:00	6:15	6:30	6:45	7:00	7:15	7:30	7:45	8:00	8:15	8:30	8:45
PRE-TOLLING (5/13-11/13)	1.9	1.9	1.9	1.9	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
POST-TOLLING (5/14-11/14)	1.9	1.9	1.9	2.0	1.9	2.0	2.1	2.3	2.1	2.2	2.2	2.2	2.1	2.1	2.1	2.0
CHANGE	0.0	0.0	-0.1	0.1	0.0	0.1	0.1	0.3	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.0

TOLLING CONDITIONS	15:00	15:15	15:30	15:45	16:00	16:15	16:30	16:45	17:00	17:15	17:30	17:45	18:00	18:15	18:30	18:45
PRE-TOLLING (5/13-11/13)	1.9	1.9	2.0	1.9	2.0	2.0	1.9	1.9	1.9	2.0	2.0	2.0	2.0	1.9	2.0	1.9
POST-TOLLING (5/14-11/14)	2.0	2.0	2.0	2.0	2.1	2.1	2.1	2.2	2.1	2.0	2.0	2.0	1.9	1.9	2.0	2.0
CHANGE	0.0	0.0	0.1	0.1	0.1	0.1	0.2	0.2	0.1	0.0	0.1	-0.1	0.0	0.0	0.1	0.1

Source: HRTPO analysis of INRIX data. Background Map Source: Google.

APPENDIX D:
PUBLIC COMMENTS

The Analyzing and Mitigating the Impact of Tolls at the Midtown and Downtown Tunnels report was released for public comment from April 3, 2015 through April 22, 2015. All public comments and HRTPO staff responses are included below.

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**HRTPO Public Comment** (via email)  
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From: Nancy Craft
Sent: Saturday, April 18, 2015
Subject: comments forwarded on the study

I did not see anything surprising - partially based on the traffic reports in the news. However what was not apparent was the confusion relating to paying the tolls and I am wondering how different the report might be if the issue of being billed and paying for the tolls was resolved.

Thank you,

Nancy Craft

HRTPO Staff Response:

Ms. Craft,

Thank you for taking the time to review the Analyzing and Mitigating the Impact of Tolls at the Midtown and Downtown Tunnels study and providing us with your comments. We agree that it is very likely that the EZ Pass billing issue at the Midtown and Downtown Tunnels impacted traffic volumes at those facilities, especially with the attention the issue was given in the media. It is very difficult, unfortunately, for us to determine to what extent though.