ANALYZING THE IMPACT OF IMPLEMENTING NEW TOLLS ON EXISTING ROADWAY FACILITIES – THE HAMPTON ROADS EXPERIENCE

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ABSTRACT

The Midtown and Downtown Tunnels have been two of the most congested facilities in the Hampton Roads area of Virginia. Traffic queues nearly four miles long were daily occurrences at both facilities during the peak travel periods. To relieve this congestion, construction began in 2012 of an additional two-lane tube at the Midtown Tunnel, rehabilitation of the Downtown Tunnel and the original Midtown Tunnel, and an extension to the MLK Freeway. In order to finance the project – which is expected to be completed in 2018 – tolling began at the Midtown and Downtown Tunnels on February 1, 2014.

In response to this project, Hampton Roads Transportation Planning Organization (HRTPO) staff studied the impact of tolling on the regional transportation system by comparing the traffic and transit conditions prior to tolls being implemented at the Midtown and Downtown Tunnels with post-tolling conditions. This research will assist local decision-makers as they determine whether tolls should be included as a funding source for candidate major highway projects. Further, it will provide other planning agencies with information regarding the regional travel impacts of tolling since tolls were implemented on existing facilities prior to capacity improvements being completed.

This study includes an analysis of changes in traffic volumes, queues, delays, and transit conditions, and highlights a survey funded by the HRTPO to assess the public's views of the project. Among the findings are that peak period delays decreased by 32% at four river crossing corridors after tolls were implemented.

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INTRODUCTION

The Hampton Roads region of Southeastern Virginia is an area that thrives on its greatest natural asset – water. The region is adjacent to the Atlantic Ocean and the Chesapeake Bay and is split into two subareas – the Peninsula and the Southside – by the Hampton Roads Harbor. The Southside is also split into eastern and western sections by the Southern Branch of the Elizabeth River.

These subareas of Hampton Roads are connected by a number of bridges and tunnels. Two tunnels and three bridges span the Southern Branch of the Elizabeth River (Figure 1). Each of these bridges and tunnels – except for the South Norfolk Jordan Bridge – has been toll-free since 1986 (*1*).

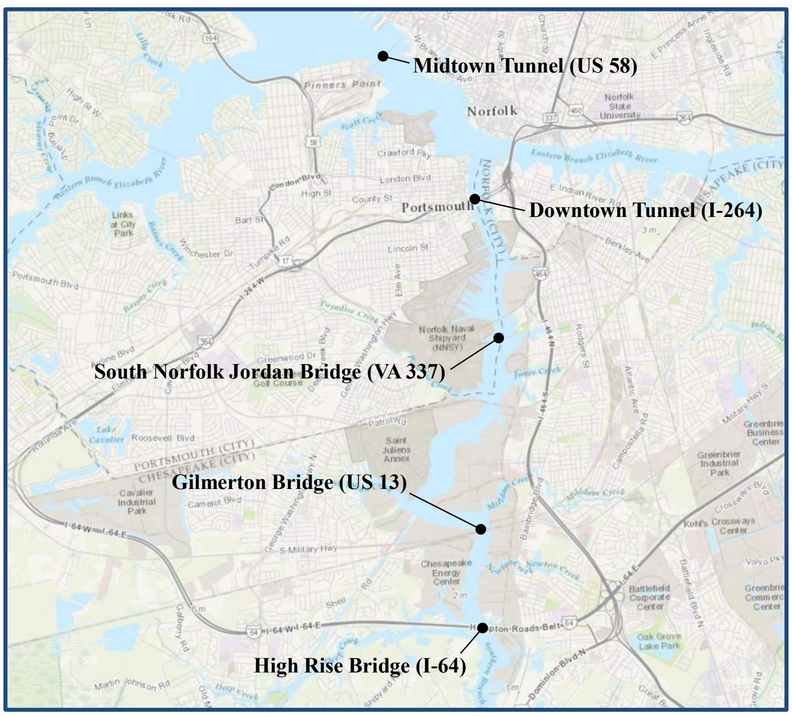

FIGURE 1 – Bridges and Tunnels Spanning the Southern Branch of the Elizabeth River

The Midtown Tunnel (US 58) and Downtown Tunnel (I-264), which connect the cities of Norfolk and Portsmouth, have been two of the most congested facilities in the Commonwealth of Virginia. A study by the Hampton Roads Transportation Planning Organization (HRTPO) indicated that the Downtown Tunnel had the most delay of any freeway corridor in the region, and the Midtown Tunnel had the most delay of any arterial corridor (*2*). Traffic queues nearly four miles long were regular occurrences at both facilities during the peak travel periods. Congestion was also common on the High Rise Bridge (I-64) and to a lesser extent the Gilmerton Bridge (US 13).

To relieve this congestion, construction began in 2012 on an additional two-lane tube at the Midtown Tunnel, rehabilitation of the Downtown Tunnel and the original Midtown Tunnel tube, and an extension to the MLK Freeway. The completion of the additional Midtown Tunnel tube, rehabilitation of the Downtown Tunnel, and extension to the MLK Freeway are expected to be completed in 2016, and the rehabilitation of the original Midtown Tunnel is expected to be completed in 2018.

With limited funding available for transportation improvements, tolls have recently been reintroduced as a method for constructing new capacity and upgrading transportation facilities, both in the Commonwealth of Virginia and throughout the United States. Public-private partnerships, which are contractual agreements for projects that are funded and operated through a partnership formed between a public agency and a private sector entity, have also become a more popular mechanism to fund and construct these improvements. In order to finance this project, it is being constructed as a public-private partnership between VDOT and Elizabeth River Crossings OpCo, LLC (ERC), and ERC began collecting tolls at the Midtown and Downtown Tunnels on February 1, 2014.

The Midtown and Downtown Tunnels maintain all-electronic tolling, with discounts applied for vehicles with EZ-Pass transponders. Toll rates throughout 2014 were initially set at $1.00 during peak periods (which ERC established as 5:30-9:00 am and 2:30-7:00 pm Monday through Friday) for passenger cars using EZ-Pass and $0.75 during off-peak periods. Tolls for passenger cars without EZ-Pass were $0.75 to $1.50 higher depending whether their license plate was registered for tolling discount purposes. Tolls will increase for passenger cars at the Midtown and Downtown Tunnels by $0.25 annually until the Midtown Tunnel project is substantially complete, at which time ERC can increase tolls annually by a factor equal to the greater of the change in the consumer price index or 3.5%.

In response to this project, HRTPO staff began a multi-year study to discover the impact of tolling on the regional transportation system by comparing the traffic and transit conditions prior to tolls being implemented with conditions after tolls were implemented. As part of this effort, HRTPO staff conducted an online review of previous toll impact studies. Upon review, most studies were related to construction of new roads, reconstruction or rehabilitation of existing toll roads, and converting toll-free roadways into toll roads as part of a project that provides additional capacity. There are a couple of notable examples – two bridges in Lee County, Florida, and SR-520 in Seattle, Washington. In August 1998, Lee County implemented a value pricing strategy on two toll bridges between the cities of Fort Myers and Cape Coral that was successful in inducing significant shifts in traffic out of the peak congestion period. In December 2011, variable tolling was reintroduced on SR-520 (after being removed in 1979 when the bridge was paid off) to fund the construction of a new bridge. According to the Seattle Times, the SR-520 tolls "reduced traffic across the bridge by about 30% and have not (yet) had inverse effects on traffic on parallel route I-90." (*3*)

This case study for the Midtown and Downtown Tunnels will provide other planning agencies with research regarding the regional travel impacts of tolling since tolls were implemented on existing facilities prior to capacity improvements being in place. This presented the HRTPO with the opportunity to measure the true impact of implementing tolls without the additional impacts of changing the roadway characteristics.

ANALYSIS

The goal of this study was to compare traffic and transit conditions before and after tolls were implemented at the Midtown and Downtown Tunnels to discover the impact of tolling these facilities on the regional transportation system. In order to achieve this goal, HRTPO staff analyzed:

- Projected traffic impacts (via the Hampton Roads Travel Demand Model)
- Traffic volume impacts
- Impacts on traffic queues and queue clearance times
- Impacts on segment travel times and speeds
- Public transportation impacts

Projected Traffic Impacts

At the beginning of this study, HRTPO staff ran the Hampton Roads Travel Demand Model in order to determine potential impacts along tolled corridors and other study area roadways as a result of the planned tolls on the Midtown and Downtown Tunnels. The purpose was to identify roadways projected to experience changes in traffic volumes and congestion as a result of the upcoming tolling.

Upon running the regional travel demand model, HRTPO staff found that tolling at the Midtown and Downtown Tunnels was projected to decrease weekday volumes at the facilities by 20% and 43%, respectively. Other roadways in the area, particularly the three alternate crossings of the Southern Branch of the Elizabeth River and their approaches, were expected to see increases in volumes. It should be noted, however, that toll levels modeled by HRTPO staff were higher than the actual initial toll rates due to a reduction announced by the Governor of Virginia two weeks prior to the implementation of tolls.

HRTPO staff used this list of roadways as a baseline for collecting and analyzing pre-tolling and post-tolling data, photos, and videos.

Traffic Volume Impacts

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 continuous count station locations include each of the three other alternate river crossings – the South Norfolk Jordan Bridge (SNJB), Gilmerton Bridge (US 13), and High Rise Bridge (I-64) – and eight other locations throughout the study area.

HRTPO staff obtained traffic volume data that was collected and analyzed for data quality by VDOT and the SNJB for 13 months prior to tolls being implemented at the Midtown and Downtown Tunnels (January 1, 2013, to January 31, 2014), and for 10 months after tolls were implemented (February 1, 2014, to November 30, 2014). Staff, however, analyzed the seven month period of May-November 2013 to determine pre-tolling conditions, and the seven month period of May-November 2014 to determine post-tolling conditions. One exception was at the High Rise Bridge, which used the September-November periods in 2013 and 2014 due to a lack of available data prior to September 2013. These time periods allow for an appropriate time of year comparison, produce a period long enough to smooth out monthly fluctuations in volumes, and allow for a three month period after tolls were implemented for traffic patterns to stabilize.

HRTPO staff analyzed the impacts of tolling on the following traffic volume characteristics as part of this study:

- Weekday volumes
- Peak and off-peak period volumes
- Weekend volumes
- Truck volumes

Weekday Volumes

As expected, volumes decreased at the Midtown and Downtown Tunnels immediately after tolls were implemented on February 1, 2014. In the first week after tolls were implemented, weekday volumes decreased by 6,342 vehicles (-16%) at the Midtown Tunnel and by 19,557 vehicles (-23%) at the Downtown Tunnel from the levels seen during the middle of January 2014 (winter weather conditions greatly impacted regional travel levels during the last two weeks of January). 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 (+3%) at the Midtown Tunnel and 5,400 vehicles higher (+8%) at the Downtown Tunnel than they were during the first week of the month.

Weekday volumes at the Midtown and Downtown Tunnels continued to increase throughout the spring and summer of 2014. They were, however, still significantly lower than pre-tolling volumes.

Using the May-November 2013 period to represent pre-tolling conditions and the May-November 2014 period to represent post-tolling conditions, volumes decreased from 40,819 vehicles per weekday at the Midtown Tunnel prior to the implementation of tolls down to 37,654 vehicles per weekday after tolls were implemented. This was a decrease of 3,165 vehicles per weekday, or 8%. At the Downtown Tunnel, volumes decreased from 93,147 vehicles per weekday prior to tolls down to 74,421 vehicles per weekday after tolls were imposed. This was a decrease of 18,726 vehicles per weekday, or 20%.

While volumes decreased at the Midtown and Downtown Tunnels after tolls were implemented, volumes increased at the three alternate crossings of the Southern Branch of the Elizabeth River (Figure 2). The crossing that saw the largest increase in volumes after tolls were implemented was the Gilmerton Bridge. Volumes at the Gilmerton Bridge increased by 10,138 vehicles per weekday after tolls were implemented, a 53% increase. By comparison, the High Rise Bridge saw an increase of 6,117 vehicles per weekday (+7%), and the South Norfolk Jordan Bridge saw an increase of 3,221 vehicles per weekday (+49%).

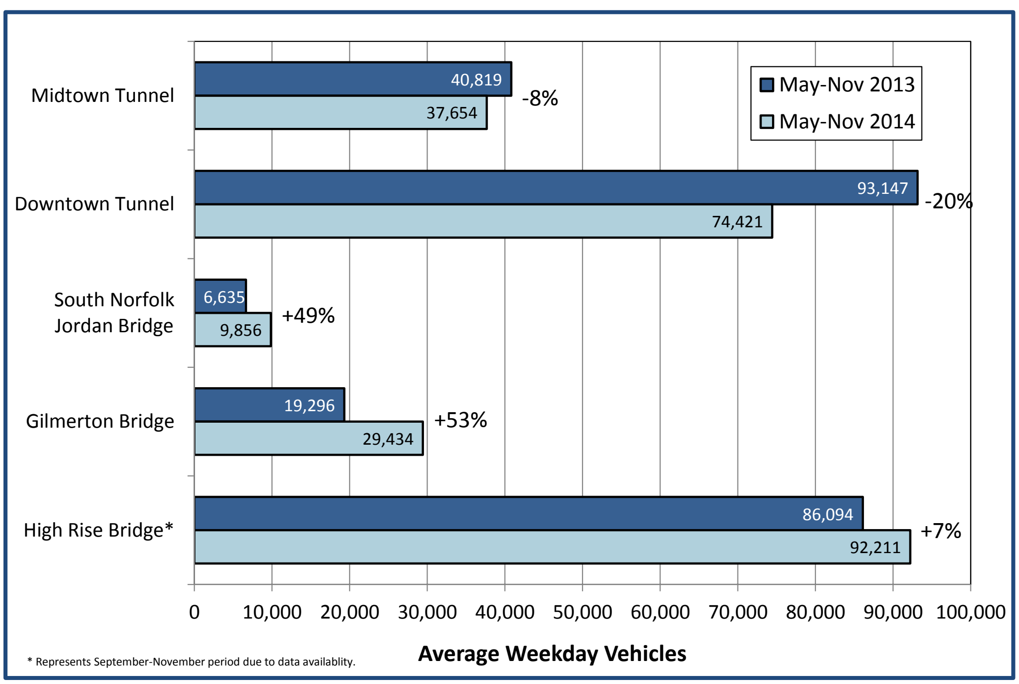

FIGURE 2 – Average Weekday Volumes at Southern Branch of the Elizabeth River Crossings – Pre-Tolling (May-Nov. 2013) and Post-Tolling (May-Nov. 2014) Conditions

Peak and Off-Peak Period Volumes

Although examining the changes in weekday volumes provides a good overview on the impact that implementing tolls at the Midtown and Downtown Tunnels had on regional travel, 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 made. In addition, the toll rates at the tunnels are slightly higher during peak travel periods ($1.00 in 2014) than they are during off-peak periods ($0.75).

HRTPO staff examined the changes that occurred due to the tolls implemented at the Midtown and Downtown Tunnels in weekday peak period volumes as compared to weekday off-peak period volumes. 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 Period (7 pm – 5 am). Although these time period definitions differ slightly from the peak tolling periods charged at each tunnel, they reflect the time periods used in HRTPO's transportation planning efforts. The overnight data at both the Midtown and Downtown Tunnels were impacted by nightly directional closures at the Downtown Tunnel and recurring overnight closures at the Gilmerton Bridge. Due to these numerous closures, the trends in overnight volumes were not further analyzed.

Once tolls were implemented on February 1, 2014, volumes dropped at all time periods of the day at both the Midtown Tunnel and Downtown Tunnel, but 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 by 10% during the AM Peak Period, 12% during the PM Peak Period, and 21% during the off-peak period. 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 period.

By the last week of February, some of the diverted volumes had returned, particularly at the Downtown Tunnel. Peak period volumes (AM and PM combined) during the last week of February 2014 were 250 vehicles per weekday higher (+1%) at the Midtown Tunnel than they were during the first week of the month, and 2,400 vehicles per weekday higher (+6%) at the Downtown Tunnel. During the Midday Period, volumes during the last week of February were 670 vehicles per weekday higher (+4%) at the Midtown Tunnel and 2,960 vehicles per weekday higher (+10%) 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 all time periods of the day.

Comparing the May-November 2013 pre-tolling period with the same post-tolling months in 2014, volumes decreased at the Midtown Tunnel (Figure 3) by 714 vehicles (-7%) during the AM Peak Period and 902 vehicles (-8%) during the PM Peak Period. Midday volumes at the Midtown Tunnel, however, decreased by a much larger amount – 1,996 vehicles per day (-15%).

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 pre-tolling conditions to post-tolling conditions. During the Midday period, however, volumes at the Downtown Tunnel decreased by 6,575 vehicles (-22%).

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. The Gilmerton Bridge experienced the largest increase in both total volume and percent increase in volume during both peak and off-peak periods, 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%).

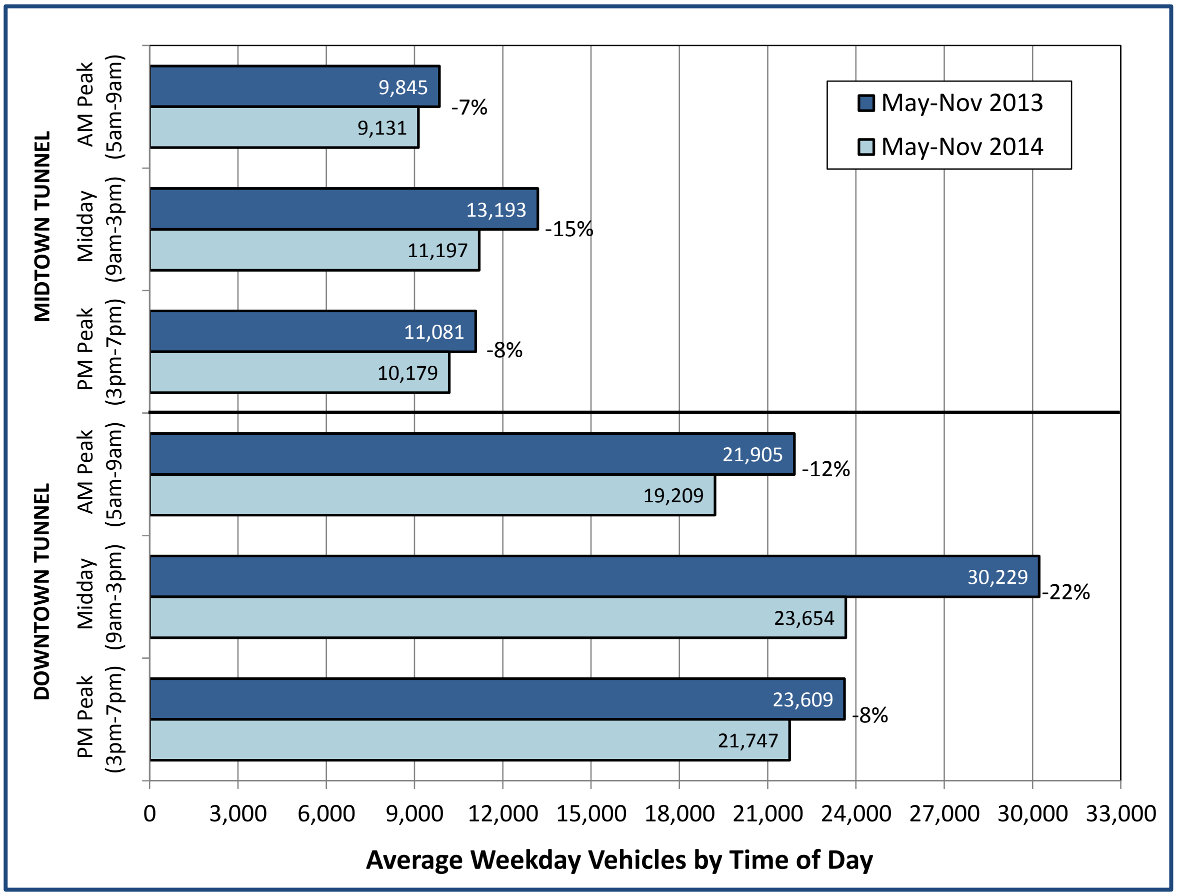

FIGURE 3 – Average Weekday Volumes at the Midtown and Downtwon Tunnels by Time of Day – Pre-Tolling (May-Nov. 2013) and Post-Tolling (May-Nov. 2014) Conditions

Weekend Volumes

Weekend volumes were impacted by recurring closures for the rehabilitation of the Downtown Tunnel. The westbound Downtown Tunnel was closed each weekend starting in August 2013, but these closures were changed to nightly closures in October 2013. Additionally, the eastbound Downtown Tunnel was closed for rehabilitation on select weekends in the summer and fall of 2014. Because of the large impacts of these temporary closures on regional travel, this analysis examines only those weekends when Downtown Tunnel closures were not in place.

At the Midtown Tunnel, weekend volumes (which includes a combination of both Saturday and Sunday volumes) decreased from 25,436 vehicles per day in pre-tolling conditions (May-November 2013) to 24,140 vehicles per day in post-tolling conditions (May-November 2014), a 5% drop. The decrease in weekend volumes at the Downtown Tunnel was much larger, from 71,117 vehicles per day prior to tolling down to 50,187 vehicles per day after tolls were implemented, a 29% decrease.

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. 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.

Truck Volumes

As the home of the third largest container port on the East Coast (*4*), the efficient movement of freight is critically important to the Hampton Roads economy. The implementation of tolls at the Midtown and Downtown Tunnels – which in 2014 ranged from $2.25 for trucks with E-ZPass during off-peak travel periods to $5.50 during peak periods for trucks without E-ZPass – 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.

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 period (May-November 2013). In the post-tolling period (May-November 2014), this average dropped to 1,857 trucks per weekday, a decrease of only 52 trucks per day (-3%).

Although vehicle classification data is not collected at the Downtown Tunnel, there is a continuous count station that collects vehicle classification data on I-264 between Victory Boulevard and Portsmouth Boulevard, approximately three miles to the west of the tunnel. 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 period. In the post-tolling period, this average dropped to 2,307 trucks, a decrease of 931 trucks per weekday (-29%).

Many of these trucks diverted to other crossings of the Southern Branch of the Elizabeth River. The Gilmerton Bridge carried 557 trucks per weekday prior to tolling at the Midtown and Downtown Tunnels. After tolling was implemented, the number of trucks increased to 864 trucks per weekday, a 55% increase. The tolled South Norfolk Jordan Bridge also saw a large increase, from 284 trucks per weekday prior to tolling at the Midtown and Downtown Tunnels to 495 trucks per weekday afterward. Most of this increase is not due to a lower toll (truck tolls with E-ZPass were $4.50 at the South Norfolk Jordan Bridge in 2014), but rather to the fact that the South Norfolk Jordan Bridge is a non-congested crossing that may be more convenient for many truck drivers, especially those travelling to the adjacent Naval Shipyard.

I-64 in Chesapeake also saw a slight increase in trucks. At the continuous count station located on I-64 approximately four miles to the west of the High Rise Bridge, the number of trucks increased 3%, from 7,142 trucks per weekday prior to tolling up to 7,369 trucks per weekday after tolls were implemented.

It should be noted that only weekday truck volumes were analyzed for this study, since truck volumes in Hampton Roads are much higher on weekdays. According to HRTPO staff's analysis, weekday truck volumes are nearly five times higher than the truck volumes seen on weekends at continuous count station locations in the study area.

Summary

A summary of the changes in traffic volumes prior to tolls being implemented at the Midtown and Downtown Tunnels (May-November 2013) to after tolls were implemented (May-November 2014) is shown in Table 1.

TABLE 1 – Changes in Volumes – Pre-Tolling (May-Nov. 2013) to Post-Tolling (May-Nov. 2014) Conditions

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

* Represents September-November period due to data availability.

Traffic Queues and Queue Clearance Times

For each roadway, tunnel, and alternative route in the study area, HRTPO staff photographed and videotaped traffic conditions prior to tolls being implemented (Fall 2012 and Fall 2013) and after tolls were implemented (Fall 2014) to visualize and document changes. Staff performed two to four in-vehicle travel runs per direction during morning and afternoon peak hours (approximately 120 runs) using a "floating car method", traveling at similar speeds of surrounding vehicles. 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. Staff used 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 before and after tolls were implemented using a tripod inside of a van. This video footage was also used to measure traffic queues and queue clearance times. Approximately 470 minutes of video footage were captured and archived into digital format.

HRTPO staff selected travel runs that best represented typical congestion patterns for each roadway approach to determine pre-tolling and post-tolling traffic queues and queue clearance times. The goal was to capture recurring traffic congestion – congestion experienced by commuters every day – so some travel runs were omitted due to irregular causes of congestion, such as traffic incidents.

Videos were edited and used in presentations to the Hampton Roads Transportation Technical Advisory Committee and the HRTPO Board to show examples of traffic conditions before and after toll implementation.

For morning and afternoon peak hours, HRTPO staff produced maps showing where traffic queue lengths and queue clearance times improved or worsened after tolls. An example is shown in Figure 4.

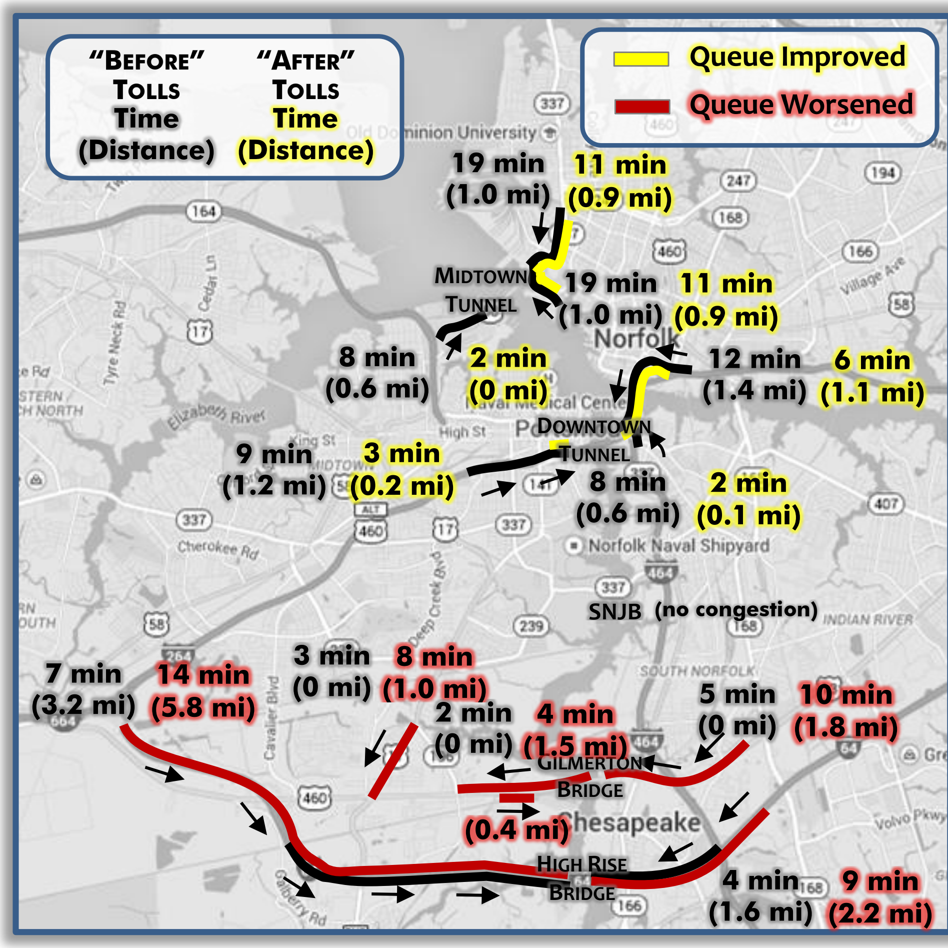

FIGURE 4 – Traffic Queue Lengths and Queue Clearance Times Example – PM Peak (4pm-6pm)

Impacts on Segment Travel Times and Speeds

VDOT has purchased archived travel time 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.

HRTPO staff downloaded travel time data for six corridors from May 1, 2013, to November 1, 2013, for pre-tolling conditions, and from May 1, 2014, to November 30, 2014, for post-tolling conditions. Data was downloaded by direction for every 15-minute period during the AM Peak Period (5:00 am – 9:00 am) and the PM Peak Period (3:00 pm – 7:00 pm) for Tuesdays, Wednesdays, and Thursdays. Using this data, HRTPO staff calculated an average travel time for each roadway segment that comprises the analyzed corridors. These average travel times were calculated for each peak period 15-minute interval.

Roadway congestion levels were measured in this study using the travel time index, which compares travel conditions during a particular time of day to the travel conditions during uncongested, free-flow conditions. The higher the travel time index, the more congested the roadway segment is.

For each of the six corridors, HRTPO staff produced maps showing pre-tolling and post-tolling roadway congestion levels by direction and time of day. An example is shown in Figure 5.

HRTPO staff also calculated total peak period delay before and after tolls were implemented for four of these corridors (the Midtown Tunnel, Downtown Tunnel, Gilmerton Bridge, and High Rise Bridge) where continuous traffic count data was available. Total delay not

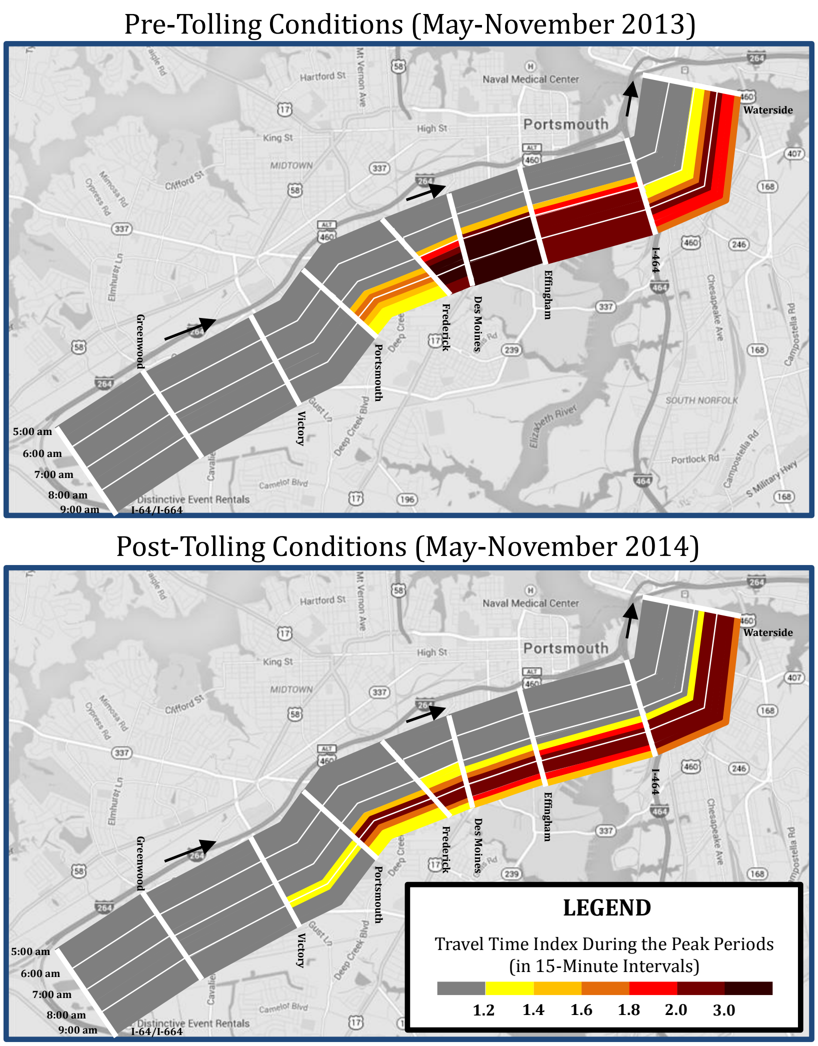

FIGURE 5 – Congestion Map Example – Eastbound Downtown Tunnel (AM Peak Period)

only takes into account the change in travel times (as seen in the INRIX data) but also the impact of changes in travel patterns and traffic volumes (as seen in the traffic volume data from continuous count stations).

Total delay was calculated for each of the four corridors for each 15-minute interval during the morning and afternoon peak periods. These 15-minute interval delays were then summed to produce total corridor delay values for the morning and afternoon peak periods for pre-tolling and post-tolling conditions.

As shown in Figure 6, 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 corridors decreased by 1,583 vehicle-hours each weekday (-32%) after tolls were imposed at the Midtown and Downtown Tunnels.

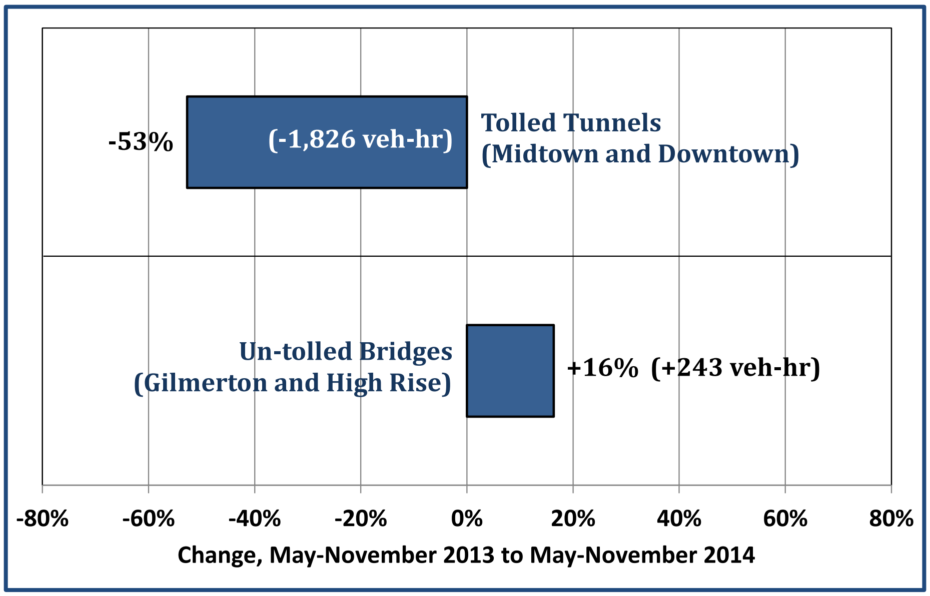

FIGURE 6 – Change in Weekday Peak Period Total Delays at Tolled and Un-tolled Crossings

Public Transportation Impacts

Average weekday transit ridership was obtained from Hampton Roads Transit (HRT) for five bus routes (Routes 44, 45, 47, 57, MAX 967) and one ferry route across the Southern Branch of the Elizabeth River that were impacted by the tolls. An analysis of this data showed that most bus transit routes crossing the Southern Branch of the Elizabeth River experienced an increase in ridership (12%-20%) during the first month after tolls were implemented (February 2014), but returned to prior levels the following month. Elizabeth River Ferry ridership remained mostly unchanged after the tolls were implemented.

ERC is required to provide annual funding – beginning at $2.1 million per year – to HRT for public transportation service improvements in the area. HRT began using this additional funding in July 2014 by providing the following improvements:

- Increasing service frequencies on Routes 45 and 47, from 30 to 60 minute headways down to 15 minute headways during the morning and afternoon peak periods.

- Extending hours of operation at the end of the day from 7 pm to 10 pm six days a week on Routes 44 and 47.
- Extending hours of operation at the beginning of the day by one hour on the ferry route.
- Adding Sunday service on Route 47, from 7 am to 7 pm.

Average weekday ridership for Routes 45 and 47 increased by 10% and 4% respectively in the first month after the service improvements were implemented, and ridership continued to grow in the following months. The data suggests that expansion of transit availability and service times had a greater lasting impact on ridership than tolling did.

SURVEY

As part of this effort, HRTPO commissioned a survey to assess the public's views and behavior both before and after tolls were implemented. The South Hampton Roads Midtown and Downtown Tunnels Tolls Survey (*5,6*) – which was conducted by Christopher Newport University's Judy Ford Wason Center for Public Policy – was collected one month prior to the implementation of tolls (January 2014) and ten months after tolls were implemented (November 2014). The survey focused on commuting experiences, knowledge and views of tolls on the tunnels, anticipated changes to commuting patterns, and knowledge and use of the EZ-Pass system.

The random sample telephone survey – which included both landline and cell phones – included residents of the cities of Norfolk, Portsmouth, Chesapeake, Suffolk, and Virginia Beach. The responses were weighted using trip ends in the HRTPO Travel Demand Model to reflect as closely as possible the locality of residence of drivers using the Midtown and Downtown Tunnels. There were 601 respondents included in the pre-tolling survey and 629 respondents in the post-tolling survey.

The primary conclusions of the survey are:

- Prior to tolling, residents were more supportive (44%) than opposed (36%) to using tolls to finance improvements at the Downtown and Midtown Tunnels. Post-tolling, support for the tolls reversed, as more residents were opposed (42%) than supportive (34%) of the tolls. One reason for this is that there were well-publicized issues with erroneous tolling charges to E-ZPass accounts in the months after tolls were implemented.
- In both the pre-tolling and post-tolling surveys, tolling was the most popular option for paying for transportation improvements in Hampton Roads, slightly above raising sales and fuel taxes.
- Prior to tolling, 48% of respondents thought that the proposed toll rate for cars and light trucks was reasonable, and 48% thought the rate was too high. Post-tolling, a majority of survey respondents (60%) said toll rates were reasonable, with 36% saying the rates were too high. Some of this change is likely due to the reduction in toll rates that was announced two weeks prior to the implementation of tolls.
- Many post-tolling survey respondents indicated that they changed their commute (41%) or where they travel (45%) to avoid tolls.
- A small but significant percentage of post-tolling survey respondents (16%) had not opened an EZ-Pass account due to financial limitations or a lack of understanding about how to open one.

SUMMARY

This paper provides the results from a case study in Hampton Roads, Virginia, for analyzing the impact of implementing new tolls on existing roadway facilities. It included an analysis of changes in traffic volumes, queues, delays, and transit conditions as well as the results of a public survey. A summary of major findings are provided below:

Traffic Volume Impacts

- As anticipated, traffic volumes decreased at the Midtown and Downtown Tunnels after tolls were implemented. Decreases in volumes during the peak morning and afternoon travel periods, however, were much lower than those during the midday periods.
- 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.

Traffic Queues

- 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 based on travel time runs collected by HRTPO staff. Peak period queues on alternate routes, including the High Rise Bridge, Gilmerton Bridge, and South Norfolk Jordan Bridge, worsened after the tolls were implemented.

Total Delay

- Overall, total peak period delay decreased at the tolled Midtown and Downtown Tunnels by 53% and increased at the non-tolled Gilmerton and High Rise Bridges by 16%. Combined, total peak period delays at these four crossings decreased by nearly 1,600 vehicle-hours each weekday (-32%) after tolls were imposed at the Midtown and Downtown Tunnels.

Transit Ridership

- Most bus transit routes crossing the Southern Branch of the Elizabeth River experienced an increase in ridership (12%-20%) during the first month after tolls were implemented, but returned to prior levels afterwards. However, ridership for Bus Routes 45 and 47 increased again in July 2014, after HRT increased service frequencies and hours of operation.

Survey

- Prior to tolling, residents were more supportive (44%) than opposed (36%) to using tolls to finance improvements at the Downtown and Midtown Tunnels. Post-tolling, support for the tolls reversed, as more residents were opposed (42%) than supportive (34%) of the tolls.
- Tolling is the most popular option for paying for transportation improvements in Hampton Roads.
- Many have changed their commute (41%) or where they travel (45%) to avoid tolls.
- A small but significant percentage of residents (16%) have not opened an EZ-Pass account due to financial limitations or a lack of understanding about how to open one.

CONCLUSIONS

Variable tolling began at the Midtown and Downtown Tunnels in 2014 to fund tunnel expansion and rehabilitation projects between the cities of Norfolk and Portsmouth, Virginia. HRTPO staff studied traffic patterns before and after toll implementation and found that the total delay during peak periods decreased by 53% at the Midtown and Downtown Tunnels, but increased along parallel routes (Military Highway/Gilmerton Bridge and I-64/High Rise Bridge) by 16%. Combined, total peak period delays at these four crossings decreased by nearly 1,600 vehicle-hours each weekday (-32%).

Even though the original intent of implementing tolling at the Midtown and Downtown tunnels was to fund tunnel improvements, tolling was successful in reducing traffic congestion at the two tunnels during peak periods. The Hampton Roads region is currently considering various funding alternatives, including tolling, for a number of candidate major highway projects. This research will assist local decision-makers as they determine whether tolls should be included as a funding source for these projects.

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