Economic Assessment of Tolls on Freight Transportation in the Hampton Roads Region

Final Report

prepared for

Freight Transportation Advisory Committee

prepared by

Cambridge Systematics, Inc.

with

Parsons
Transystems
Cheng Solutions

Cambridge Systematics

October, 2015

technical report

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Table of Contents

List of Tables

List of Figures

1.0 Introduction

The economy of Hampton Roads has always been influenced by the Port and the surrounding freight companies that support the movements of goods within area, state, and nation. However, in the last two decades the precision of global supply chains has reached the point where "local" policy decisions that impact port landside access can being tracked and evaluated by international steamship lines and third party logisticians when planning routing and investment decisions. International trade impacts every economy, yet for economies centered on maritime trade, policy decisions that impact trading competitiveness can be felt directly and immediately. It is crucial for ports and metro areas to fully understand how policy changes that impact the cost of shipping goods can ripple throughout the local economy and to carefully weigh the competing needs of additional mobility for people and goods with the short and long term impacts that can emerge from the pricing of existing infrastructure.

The regional, interstate, and international movements of goods directly impacts long-term economic vitality. Nowhere is this more evident than in areas that are home to major global gateways, including in the Hampton Roads region. The region's multimodal transportation system, which includes the Port terminals, serves key industries and economic development assets in the region and throughout the state, provides for emergency evacuation routing, serves as everyday local commute routes for the urban area, serves strategic military bases and uses and provides mobility for millions of visitors each year. Recognizing the significance of a robust transportation to all of its users, including the Port, the Hampton Roads Transportation Planning Organization (HRTPO) and Virginia Department of Transportation (VDOT) have identified a program of improvements to maintain and enhance the performance and integrity of the region's highway network over the coming decades to include more traditional projects included in the draft 2040 Long Range Transportation Plan along with major regional enhancement associated within the Hampton Roads Transportation Accountability Commission initiative. However, the issue of how the improvements may be funded has raised concern among many stakeholders, leading to the call for a study of how tolling will impact the competitiveness of the region's freight industries.

1.1 Study Overview

The objective of the study is to analyze the economic trade-offs of the benefits of transportation infrastructure investments and tolls as a way to pay for the investments. The introduction of tolls on several major water/tunnel crossings that are daily commuter facilities for freight destined traffic to and from the port has increased concern about the impact of tolls on the cost of doing business in the region. These tolled facilities are also heavily used by manufacturers and distributors. With the deployment of tolls, many regional freight constituents raised questions about the economic impact of tolling on freight competitiveness. In response to these concerns, the Freight Transportation Advisory Committee (FTAC) with support from the Virginia Department of Transportation commissioned a study to examine the economic implications of proposed highway improvements and the use of tolls to fund those improvements. The Economic Assessment answers the following questions:

- How do truck freight costs change if additional capacity is not added to the roadway network?
- How do truck freight costs change if capacity is added to the roadwork network and tolls are used to pay for the improvements?
- How do changes in truck freight costs compare across these two scenarios?

The study region, shown in Figure 1.1, is the Virginia portion of the Virginia Beach-Norfolk-Newport News Metropolitan Statistical Area (MSA). This area includes Gloucester County, Isle of Wight County, James City County, York County, City of Chesapeake, City of Hampton, City of Newport News, City of Norfolk, City of Poquoson, City of Portsmouth, City of Suffolk, City of Virginia Beach, City of Williamsburg, Mathews County, and Surry County. The study also examined freight rate data specific to the Port of Virginia port terminals including Norfolk International Terminals (NIT), Portsmouth Marine Terminals, Newport News and Virginia International Gateway Terminals.

Figure 1.1 Study Area

Source: Virginia Economic Development Partnership

The approach to the study includes three key components:

- Stakeholder interviews- Shippers, carriers, economic developers and real estate developers were interviewed throughout the region to gain insight into their operations, cost structures, the role of the region's transportation network and overall regional strengths and weaknesses from a freight perspective.
- Benchmark analysis – Key inland markets and competing ports were identified based on the Federal Highway Administration's (FHWA) Freight Analysis Framework (FAF) commodity flow data and the port provided data. Once identified, Parson's exclusive Real Time Freight Intelligence (RTFI) data was used to compare actual freight rates to and from competing regions to the study region.
- Freight Cost Analysis –Freight costs were broken down into four primary types and were used to assess two scenarios:

- Scenario One evaluated a Business as Usual (BAU) future condition without any transportation capacity investments.

- Scenario Two assessed the future conditions with major regional transportation improvements funded by tolls (Build with Tolls). The truck demand for both of the scenarios was estimated using the Hampton Roads Transportation Planning Organization's (HRTPO) regional travel demand data.

1.2 Stakeholder Engagement

A series of stakeholder interviews were conducted throughout the region during the early stages of the study (between September 2014 and October 2014) and the insights from those interviews informed the study methodology as well as the findings. Interviewees included a mixture of industrial and retail shippers, local and national motor carriers, freight facility operators and economic development agencies. Table 1.1 displays the organizations interviewed as part of the study effort.

Table 1.1 Organizations Interviewed for the Study

Organization	Organization	Organization
Audax Transportation	GTL Transport	Target
Continental Terminals	Hooker Furniture	Virginia Maritime Association
CrossGlobe Transport, Inc.	Lumber Liquidators	Greater Richmond Partnership
California Cartage Company (CCC)	Massimo Zanetti Beverage	Norfolk Department of Development
Givens Logistics, LC	Mead Westvaco	Virginia Chamber of Commerce
Hampton Road Economic Development Alliance	Roanoke Regional Chamber of Commerce	Roanoke Regional Partnership

Key findings from the shipper and carrier interviews include:

- Prior to port side delays arising from operational changes implemented at the port as well as the arrival of larger ships, drayage truckers were getting between 3 and 4 turns per day. Due to congestion and operational delays at the port, that has been reduced to 1 to 2 turns per day.

- Average local dray rates have held steady for the past 4 to 5 years but have started to increase within the last 12 months.

- Driver shortage remains the primary issue facing carriers and shippers in the region. Anything that impacts the ability of a trucker to make more turns and thus more money, impacts driver availability.

- In terms of transportation infrastructure, the biggest need is the Third Crossing[1] (commonly referred to as Patriot's Crossing). Other key roadway facilities for trucking include Interstates 64, 264 and 464 and U.S. 58 and 460.

- The majority of companies are furnishing toll transponders to drivers or providing reimbursements and the cost of tolls are currently being passed onto shippers.

Key findings from the economic development representatives include:

- Regarding the importance of transportation to businesses compared with taxes, energy costs, real estate costs and availability and quality of labor pool, in general, all respondents ranked qualified labor pool the most important factor unanimously; transportation was ranked the 2nd or 3rd. The remaining three factors were clustered as less important for the business community.

- Congestion came up as the most frequently mentioned key transportation issues of concern. Transportation funding and the Third Crossing/Patriots Crossing were also noted as needed investments.

- Interviewees were asked about large parcels available for development, road connectors to access these parcels, and whether there were any threats of these parcels being rezoned for non-industrial uses.

  - In the Hampton Roads region:

    - There are large parcels mainly in western part of the region, which is more rural. Green Mountain Coffee and CenterPoint among others have developed in the western area. The main road connectors are I-64, 264, 664, Highway 58 and Highway 460. It is acknowledged that the region's future is tied to the port, so there is not much pressure for rezoning the land for other uses.

    - Specifically in Norfolk, about 95% of the land is developed, so there are not large parcels available for development. Therefore, Norfolk aims to

[1] The Third crossing consists of 2 segments from the larger Hampton Roads crossing project- 1) a new four-lane roadway and bridge facility from near the southern end of the MMBT to the planned I-564 Intermodal Connector near Naval Station Norfolk and 2) a new four-lane roadway and bridge running from the previous segment to State Route 164 near the port facilities adjacent to Craney Island.

attract businesses that can be vertical. Rezoning is not much of an issue for Norfolk, because their economic development strategy aligns with their master plan (Norfolk 2030), which is required by the Commonwealth of Virginia to be updated every five years. The master plan guides their business attraction efforts.

  - The Greater Richmond Area presents opportunities for a logistic hub and large green field sites.

    - Logistic hub: The area around the port, which is about one square mile, is designated by the city as a logistic hub (inland port). There are many underutilized zones and buildings that are not leased. About eight million square feet of assets are estimated as underperforming assets, which could be used for warehouse and manufacturing. For example, Philip Morris uses one million square feet under roof warehouse (climate-controlled but antiquated space) in this zone out of 115 acres in total (including parking, etc.). The facility, located on I-95, belongs to a third party and Philip Morris is a long-term tenant.

    - Green field sites: They are available in the counties of Chesterfield, Hanover, and Henrico. For example, Shandong Tranlin bought 900 acres of green field sites for their industrial park. There are a million square feet of warehouses for liquid and lumber in Henrico. Amazon's fulfillment center takes a little over one million square feet.

- Congestion is identified as the number one challenge for port-business expansion at the state level. One of the priorities for the state is to improve the I-64 Corridor and interstate facilities connecting to the port.

- In the Richmond region, economic development officials' perceptions are that frequency of the barge service which is less than daily is a challenge, because container shipping is time-sensitive. The officials also expressed concern regarding the access to the port of Hampton Roads. Both the rail and road accesses are slow and congested. One respondent commented "If there is no alternative to I-64 that would be an issue, because of the congestion of 64. Either tolling or public private partnership solution is needed to provide relief to the I-64 Corridor." "For I-64, tolling new capacity would be an alternative option. Those who choose to use it will pay for new lanes on I-64, but not for the existing lanes on I-64."

- Specific to tolling, the economic development representatives generally felt that transportation funding needs to be comprehensive and not implemented in a way that impacts only a specific region or jurisdiction. To date, many felt that the tolls impact to workers and commercial and retail developments was larger than impacts to industrial developments.

1.3 Organization of Report

The remainder of the report is organized as follows:

- Section 2 provides a summary of current and future regional freight flows based on FHWA FAF data.
- Section 3 details the benchmarking analysis comparing freight rates in the study region to New York/New Jersey, Baltimore, Charleston and Savannah port regions.
- Section 4 presents the analysis of the impact of tolls and congestion on current and future freight costs. The analysis includes travel demand modeling of future truck trips and the estimation of associated changes in truck operating costs under the two future Scenarios: Business as Usual (BAU) or no-build and Build with tolls.
- Section 5 provides a brief summary of the findings and policy considerations.

2.0 Regional Freight Flows

This section describes and analyzes the amount and types of commodities moving across the Virginia Beach-Norfolk-Newport News VA Metropolitan Statistical Area's transportation system. This profile focuses on the two primary measures of freight activity, tonnage, and value. Tonnage is an indicator of the demand that freight movement places on the transportation infrastructure while value is an indicator of the economic activity associated with freight.

First, data sources and methodology are discussed followed by a description of existing and future freight demand. The data are analyzed by direction, by mode, by commodity, and by trading partner for both current (2012 base year) and future (2040 forecast data) freight flows.

2.1 Data Methodology

The main data source for this commodity flow analysis was the Freight Analysis Framework version 3.4 (FAF3.4). Developed and provided by the Federal Highway Administration (FHWA), FAF3.4 provides tonnage estimates by commodity type and mode for 123 U.S. regions or FAF zones that consist of major metropolitan areas, state remainders, and 16 entire states. The primary basis for FAF3.4 is a 2007 survey of the shipping behavior of 100,000 U.S. manufacturers and wholesalers (i.e., the Commodity Flow Survey), supplemented by the Journal of Commerce's Port Import Export Reporting System (PIERS), the U.S. Army Corps of Engineers' Waterborne Commerce Database, and the Surface Transportation Board's (STB) Carload Waybill Sample Public Use File for rail. The forecast incorporated into FAF version 3.4 was produced by IHS using Q2 2012 as the base period and includes projected volumes for 2040, as well as the intermediate years of 2015, 2020, 2025, 2030 and 2035. FAF3.4 also includes a 2012 provisional data that is synthesized from the 2007 base year data.

Cambridge Systematics developed a method to disaggregate the FAF3.4 truck data from FAF zones to the county/city level. Using employment by industry at the county/city level and a series of regression equations developed for FHWA, the FAF zones corresponding to the Commonwealth of Virginia were disaggregated to the county/city level for a detailed analysis of the truck flows in the Hampton Roads region. The truck flows that were disaggregated include domestic trucks, domestic trucks from international imports and exports by water, and domestic trucks from international imports and exports by truck.

It is important to note that the Freight Analysis Framework data used for this analysis do not include any data on through flows, it only includes traffic that either originates or terminates within the region. Hence, the statistics presented understate the total volume and value of goods moving in the region. For example, truck traffic originating and terminating outside of Virginia but traveling on I-81, I-95 or other Virginia highways are not included in the FAF data. However, the region's travel demand model which was used for the freight costs analysis does include through trips.

The study area is comprised of the fifteen counties and independent cities included in the Virginia Beach-Norfolk-Newport News VA Metropolitan Statistical Area (MSA). Throughout the remainder of this report the words "region" or "regional" will refer to this fifteen-county/city study area.

2.2 Overview of Regional Freight Volumes

In 2012, 141 million tons of freight valued at $146 billion moved into, out of and within the study area's transportation system. By 2040, it is projected that the region's transportation system will carry more than 251 million tons of freight annually, valued at $322 billion, an increase of 78 percent by tonnage and 120 percent by value.

Directional Analysis

Table 2.1 displays the tonnage and value of the regional freight flows by direction in 2012 and 2040. Figures 2.1 and 2.2 graphically display the growth of freight tonnage and value, respectively, by direction for 2012 and 2040.

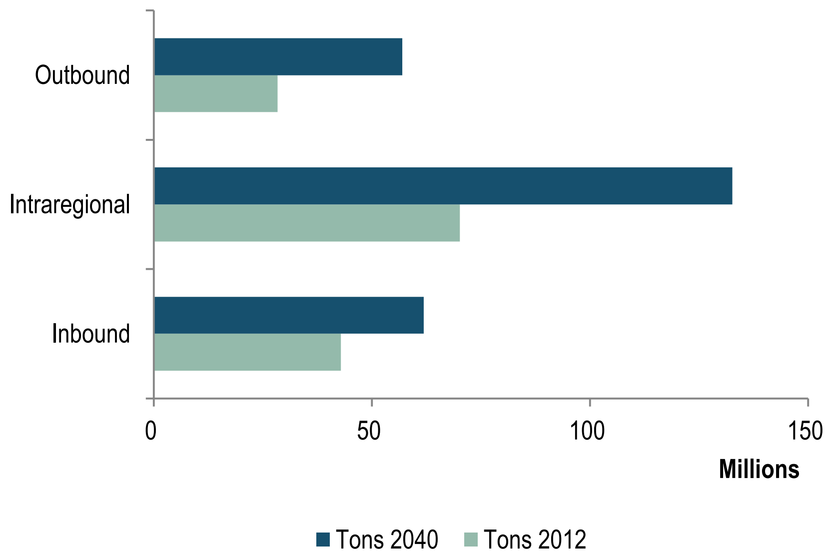
The largest component of total regional freight tonnage was intraregional traffic, and is expected to continue to account for the largest share over the next thirty years, from 70.2 million tons (50 percent) of the total tonnage in 2012 to 132.6 million tons (53 percent) in 2040 – exhibiting an 89 percent increase. Inbound freight was the second largest component with 42.9 million tons (30 percent) in 2012, and by 2040 is expected to increase 44 percent to 61.9 million tons (25 percent). Outbound freight accounted for 28.4 million tons (20 percent) in 2012, and is projected to double to nearly 57 million tons (23 percent) over the next thirty years.

Table 2.1 Total Regional Freight by Volume, 2012-2040 Tons and Value (in thousands)

Direction	Tons 2012	Tons 2040	% Change (2012 to 2040)	Value 2012	Value 2040	% Change (2012 to 2040)
Inbound	42,862	61,853	44%	52,615,677	100,942,511	92%
Intraregional	70,190	132,628	89%	41,963,183	68,555,524	63%
Outbound	28,375	56,963	101%	51,588,941	152,648,724	196%
Total	**141,427**	**251,444**	**78%**	**146,167,801**	**322,146,759**	**120%**

Source: FHWA's Freight Analysis Framework version 3.4.

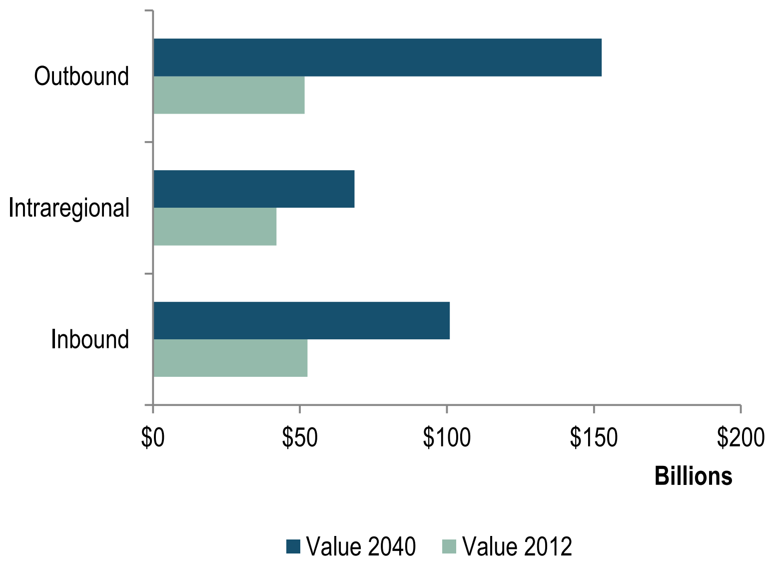
Figure 2.1 Direction of Total Freight Flows by Weight, 2012 and 2040



Source: FHWA's Freight Analysis Framework version 3.4.

When measured by value (see Figure 2.2), inbound and outbound traffic represented the largest shares of the regional freight flows. In 2012, $52.6 billion (36 percent) moved inbound to the region and by 2040 inbound freight is expected to grow 92 percent to $100.9 billion (31 percent). Outbound freight accounted for $51.6 billion (35 percent) in 2012, and it is expected to significantly increase 196 percent to $152.6 billion (47 percent) of the 2040 total. In the region in 2012, $42 billion dollars originated and terminated and by 2040 intraregional freight is projected to grow 63 percent to $68.5 billion. When measured in value, intraregional freight accounted for 29 percent of the 2012 total, compared to 50 percent when measured in tonnage. This is due to heavy low-value commodities that are moving intraregionally, such as rail shipments of coal which account for 43 percent of the intraregional tonnage and 6 percent of the intraregional value.

Figure 2.2 Direction of Total Freight Flows by Value, 2012 and 2040



Source: FHWA's Freight Analysis Framework version 3.4.

2.3 Modal Split of Regional Freight Flows

Freight utilizes different modes of transportation. This section will analyze the current and future trends of the regional movement of freight via the roadways, railways, water, air and pipeline (excluding through moves). Table 2.2 and Figures 2.3 and 2.4 display the current and future mode breakdown of total freight tonnage and value. When measured by weight, in 2012 most of the freight moved by truck (52 percent) and rail (35 percent). By 2040, rail moves are expected to grow faster than truck moves and the rail share of the 2040 tonnage is expected to grow to 49 percent, while the truck share is expected to decrease to 37 percent. Multiple modes and mail represented 8 percent of the 2012 tonnage. By 2040, this share is expected to increase to 11 percent. Domestic water and air shipments account for less than 1 percent.

When measured by value, truck shipments are the dominant mode accounting for 68 percent of the 2012 regional freight and expected to account for 59 percent of the 2040 total. Multiple modes and mail follow, representing 23 percent of the 2012 total freight. This share is expected to grow significantly to 32 percent over the next thirty years. The remaining modes account for 9 percent of the 2012 and 2040 totals.

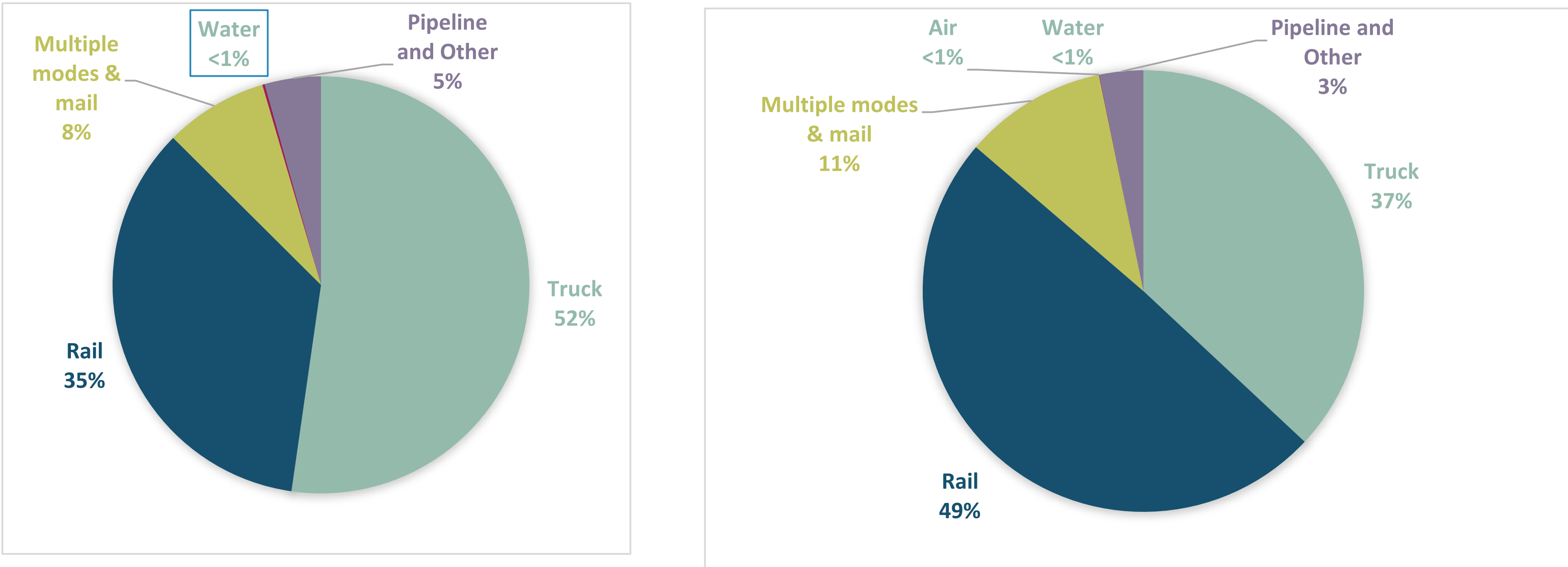
Table 2.2 Total Regional Freight by Mode, 2012 and 2040 Tons and Value (in thousands)

Domestic Mode	Tons 2012	Tons 2040	% Change 2012-2040	Value 2012	Value 2040	% Change 2012-2040
Truck	73,922	92,929	26%	98,972,639	191,337,890	93%
Rail	49,758	124,067	149%	4,650,036	12,481,606	168%
Multiple modes & mail	11,319	26,307	132%	33,186,214	102,509,296	209%
Water	277	106	-62%	54,534	52,189	-4%
Air	31	45	48%	2,143,824	2,079,366	-3%
Pipeline and Other	6,121	7,988	31%	7,160,554	13,686,413	91%
Total	**141,427**	**251,444**	**78%**	146,167,801	322,146,759	**120%**

Source: FHWA Freight Analysis Framework Version 3.4

Figure 2.3 Regional Mode Share by Weight

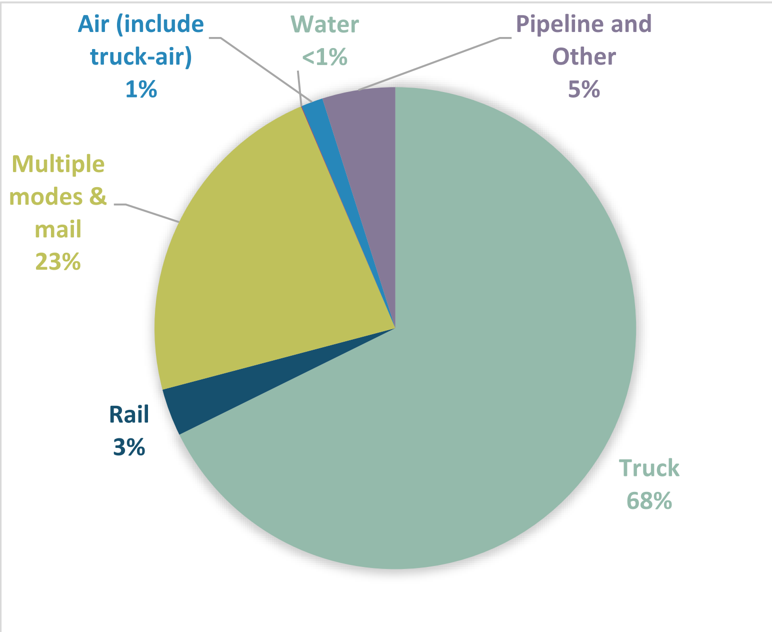
2012 (left) and 2040 (right)



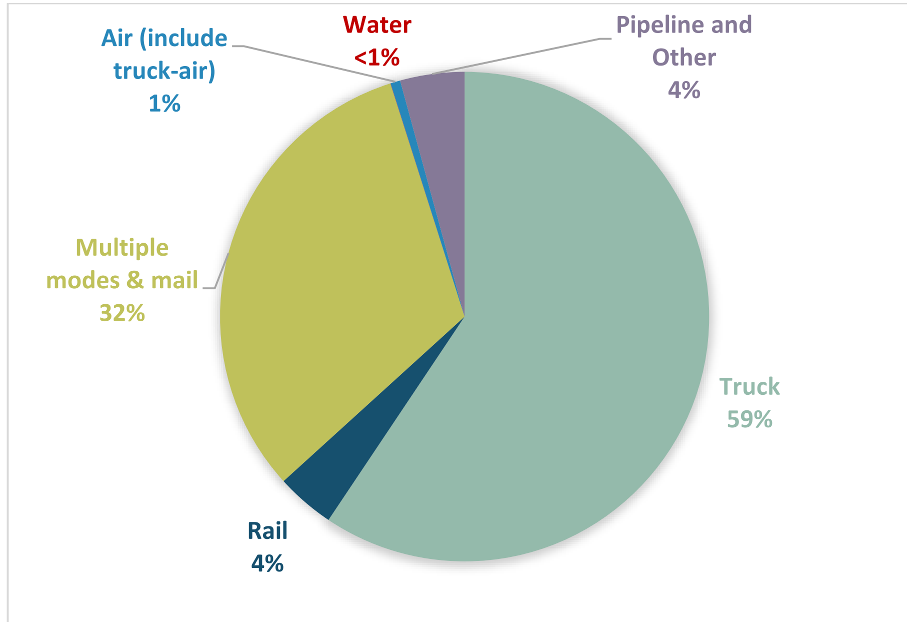
2012 2040

Figure 2.4 Regional Mode Share by Value

2012 (left) and 2040 (right)



2012



2040

3.0 Benchmarking Freight Rates in the Hampton Roads Region Against Competing Port Regions

3.1 Introduction

A key component of the analysis was the examination of freight transport costs to and from the Norfolk area terminals as compared to those for significant competitor ports along the East Coast of the US. For this benchmarking analysis, four other ports were identified during the initial stakeholder outreach:

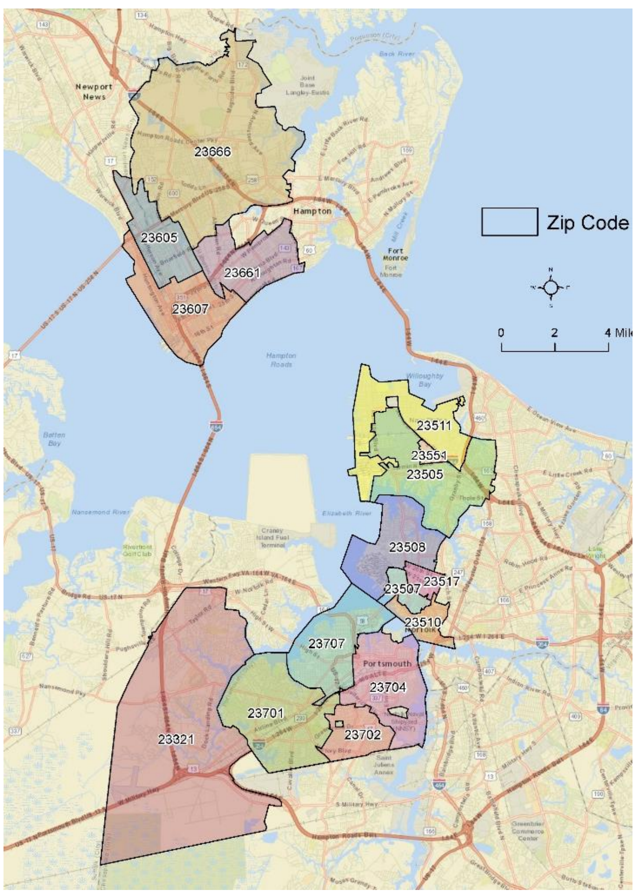
- New York/New Jersey
- Baltimore
- Charleston
- Savannah, GA

3.2 Data Used

The study team used Parsons' Real-Time Freight Intelligence (RTFI) dataset for this component of the study. Details of the data used are described in the results of the tolling study. For the benchmarking, Parsons used data for the 2013 calendar year. In all, 91,704 shipment records were used for the analysis. The team extracted data by identifying all of the zip codes in each port location where port facilities are located. These zip codes are identified in Table 3.1 and the accompanying map.

Table 3.1 Zip Codes Used in the Analysis, by Region

Norfolk, VA	Baltimore, MD	Charleston, SC	NY/NJ	Savannah, GA
23703	21222	29401	07114	31404
23321	21224	29464	07201	31401
23607	21226	29406	10303	31421
23605	21227	29403	07002	31415
23661	21230	29405	07305	31408
23666		29440	11231	31407
23707				
23704				
23702				
23701				
23505				
23511				
23551				
23508				
23507				
23517				
23510				



Source: Parsons

Each of the terminal-based geographic designations was defined analytically by examining the facilities using overhead images in Google Maps, and superimposing zip codes onto the terminal facilities themselves, and on immediately surrounding freight facilities, such as nearby industrial parks. The team then used these groups of zip codes as origins or destinations in the analysis.

The shipments included in the analysis were limited to truckload (TL). Less-than-truckload (LTL) moves were not included based on input from FTAC members. The team did not include over-dimensional loads in the analysis. Table 3.2 offers a review of the amount of data extracted for each grouping. The data do not represent the full volume of movements at the ports, but rather the number of movements in the payment database. There are numerous freight payment services and the lower number for Norfolk could be due to Port of Norfolk shippers using payment systems other the one available for the this analysis.

Table 3.2 Benchmarking Data Volumes, by Region

Port	Inbound TL	Outbound TL
Norfolk	2,275	766
Baltimore	9,021	12,321
Charleston	5,482	8,463
NY/NJ	6,494	13,807
Savannah	7,260	7,457

Source: Parsons

Finally, in order to minimize potential inconsistencies in the dataset, the shipments used for this analysis were limited to those that were for commodities in the manufacturing categories, represented by NAICS codes beginning with the two digit designation of 31, 32 or 33. These include the individual industries in Table 3.3.

Table 3.3 North American Industry Codes (NAICS) Commodities Included in the Benchmarking Analysis

Code	Description
311	Food manufacturing
312	Beverage and tobacco product manufacturing
313	Textile mills
314	Textile product mills
315	Apparel manufacturing
316	Leather and allied product manufacturing
321	Wood product manufacturing
322	Paper manufacturing
323	Printing and related support activities
324	Petroleum and coal products manufacturing
325	Chemical manufacturing
326	Plastics and rubber products manufacturing
327	Nonmetallic mineral product manufacturing
331	Primary metal manufacturing
332	Fabricated metal product manufacturing
333	Machinery manufacturing
334	Computer and electronic product manufacturing
335	Electrical equipment, appliance, and component manufacturing
336	Transportation equipment manufacturing
337	Furniture and related product manufacturing
339	Miscellaneous manufacturing

Source: Parsons

3.3 Analytical Process

Once the team extracted the data, the next step in the process was to calculate the per ton-mile costs for all shipments, segregating them into truckload and LTL. Then these values were plotted against the actual distance each shipment was transported. In addition to plotting the entire dataset, the team generated additional plots to drill down on shipments that traveled less than 250 miles to or from the terminals. This was done to provide comparable datasets for the benchmarking. The team then analyzed the resulting data plots to formulate the tolling cost assessment.

Shipments possessing the following characteristics were excluded from the analysis:

- a trip distance of 0 miles;
- a shipment weight equal to or less than 1 pound; or
- a calculated cost per ton-mile less than $0.01 or greater than $30.

Finally, the shipments were segregated into three weight categories:

- Shipment Weight < 5,000 lbs.
- 5,000 lbs. ≤ Shipment Weight < 15,000 lbs.

- 15,000 lbs. ≤ Shipment Weight

This allowed for a comparison of results on a per-mile basis (as opposed to per ton-mile). The different weight categories were used to segregate both very light and very heavy shipments from those that are the most common, thereby isolating the effects on cost that result from either condition. Based on input from the FTAC committee, the tolling analysis focused on the data for shipments between 5,000 and 15,000 lbs. which represent the primary type of loads within the region.

3.4 Analytical Results

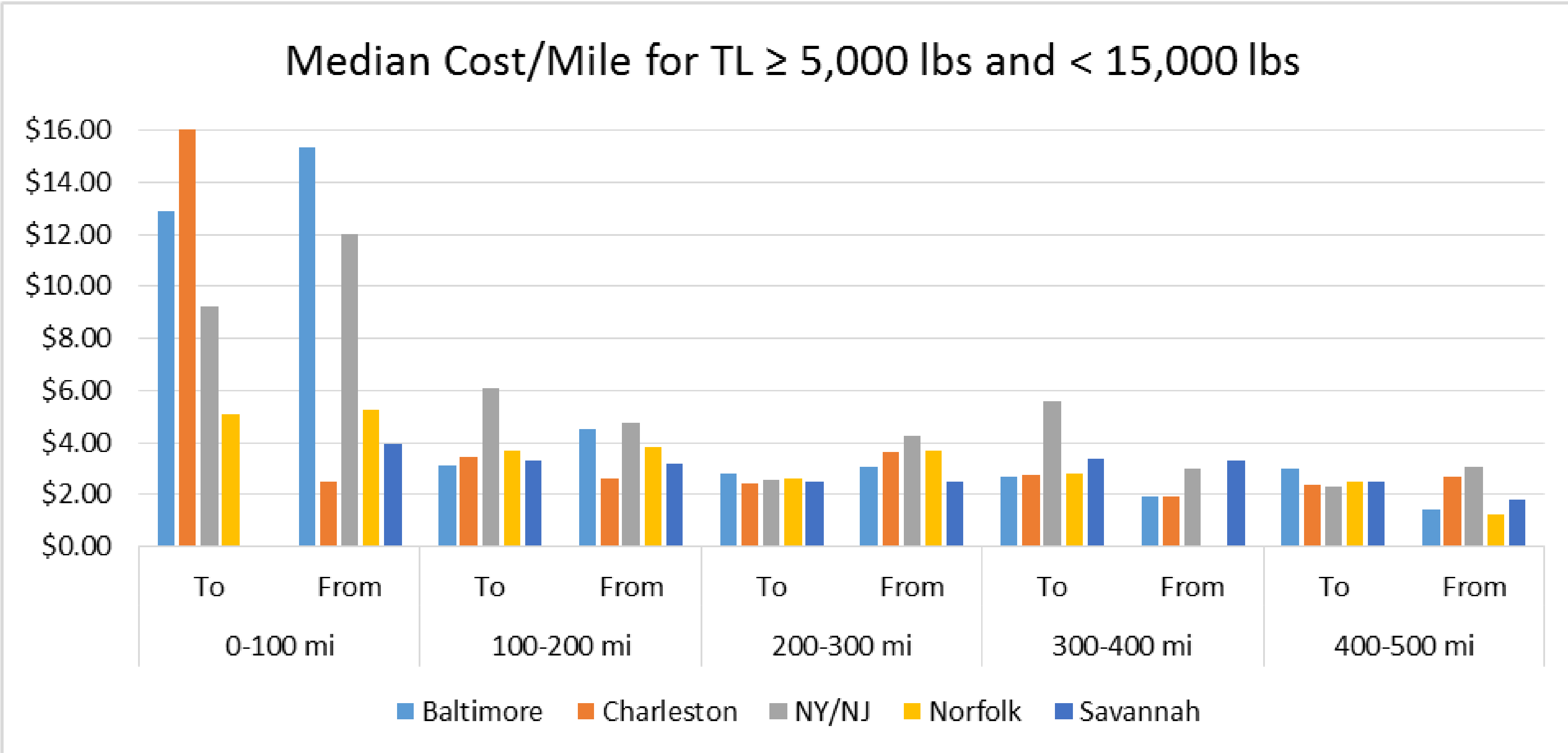
The results of the analysis are illustrated in the figures below. It should be noted that values for shipments originating and terminating at the HR Port of Virginia are for moves to and from all four port facilities in the region. The cost association with these trips includes the cost associated with tolls currently in place at the Downtown Tunnel, Midtown Tunnel, South Norfolk Jordan Bridge, Coleman Bridge, Chesapeake Bay Bridge Tunnel and Chesapeake Expressway, which for this analysis was the EZPass price for travel during peak periods. Toll costs also show up on the freight bills for the other ports used in the analysis.

Figure 3.1 shows the median cost per mile for all truckload (TL) shipments between 5,000 pounds and 15,000 pounds to and from each of the ports. Short haul shipments, generally under 100 miles from the port in either direction, have more variation in cost per-ton-mile than do those traveling greater distances. Because carriers typically apply a minimum charge regardless of the length of the trip, values within this range tend to skew cost per mile calculations.

Norfolk is competitive in this truck load weight range, especially for long distance hauls. The higher cost per ton-mile to the Port of NY/NJ in the 300 to 400 mileage range is due to the smaller number of shipments in this weight range and the mix of commodities being shipped.

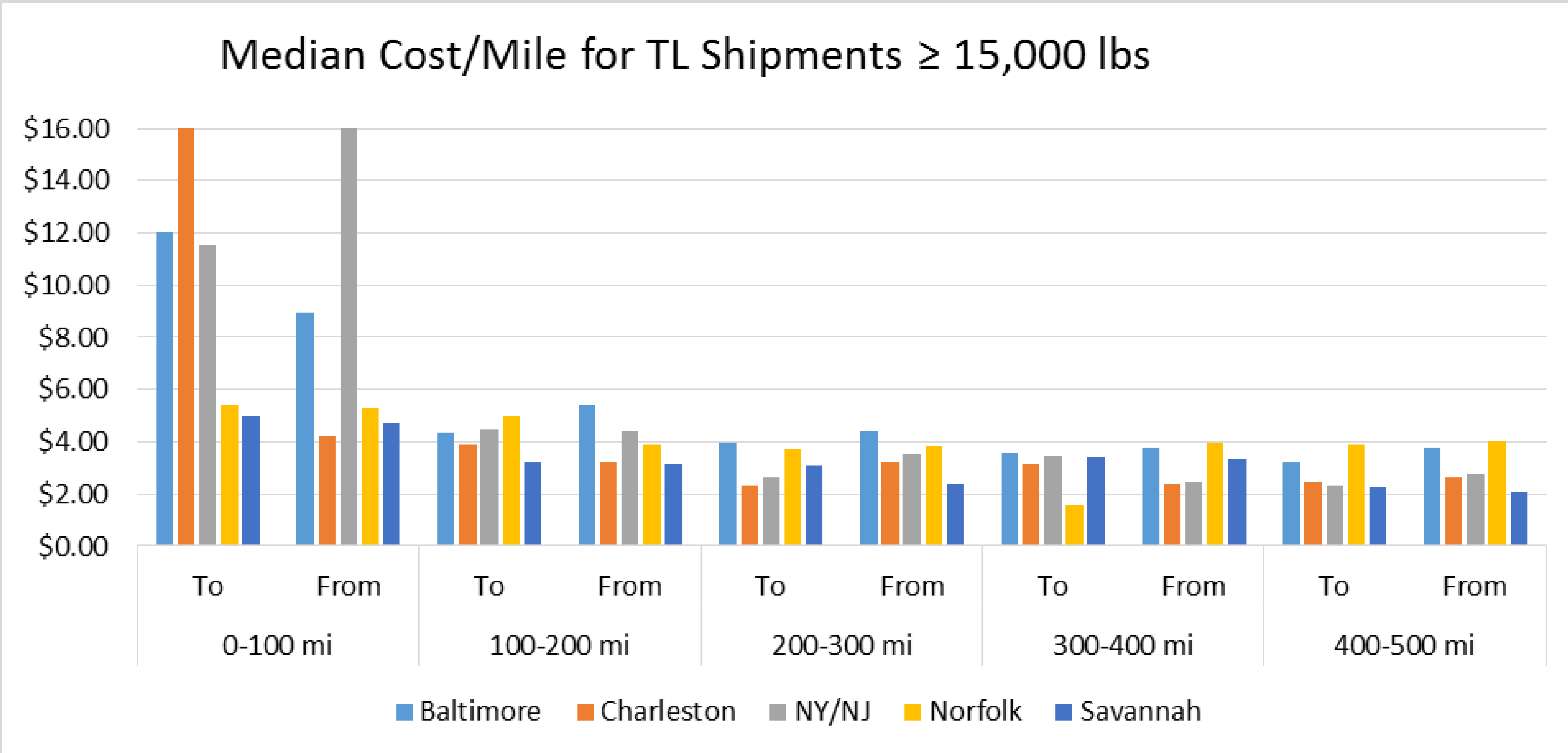
Figure 3.2 shows the median cost per mile for all truckload shipments greater than or equal to 15,000 pounds to and from each of the ports. Again, the same kinds of anomalies appear in the short distance mileage band. Norfolk does not perform as well in moving heavier shipments as it does with shipment weights below 15,000 lbs.

Figure 3.1 Median Cost per Mile for Truckload Weighing Between 5,000 and 15,000 Pounds



Source: Parsons

Figure 3.2 Median Cost per Mile for TL Shipments Weighing More than 15,000 Pounds



Source: Parsons

The results of the transportation cost benchmarking offer additional insights when viewed with the cost figures superimposed on a map graphic, as shown in the Figures 3.3 to 3.6. In each figure, concentric rings are placed at travel distance intervals from the ports included in the benchmarking analysis, and compared with similar information for the Norfolk ports. This allows for a comparison of travel costs to or from common points of interest, such as significant markets.

In these figures, only travel cost information (in median $ per ton-mile) for trips less than 500 miles is included. The team chose to focus on this maximum travel distance since the analysis indicated that comparisons become less reliable at longer distances due to such factors as low data volume.[2] Additionally, the mileage bands in the figures are spaced more closely to allow for a finer level of analysis.

Figure 3.3 illustrates the mileage bands for shipments originating or terminating at the Norfolk ports vs. those the same distances to and from the Port of New York/New Jersey. Figure 3.4 -3.6 illustrates the mileage bands for shipments originating or terminating at the Norfolk ports vs. those the same distances to and from the Port of Charleston, Port of Baltimore and the Port of Savannah, respectively.

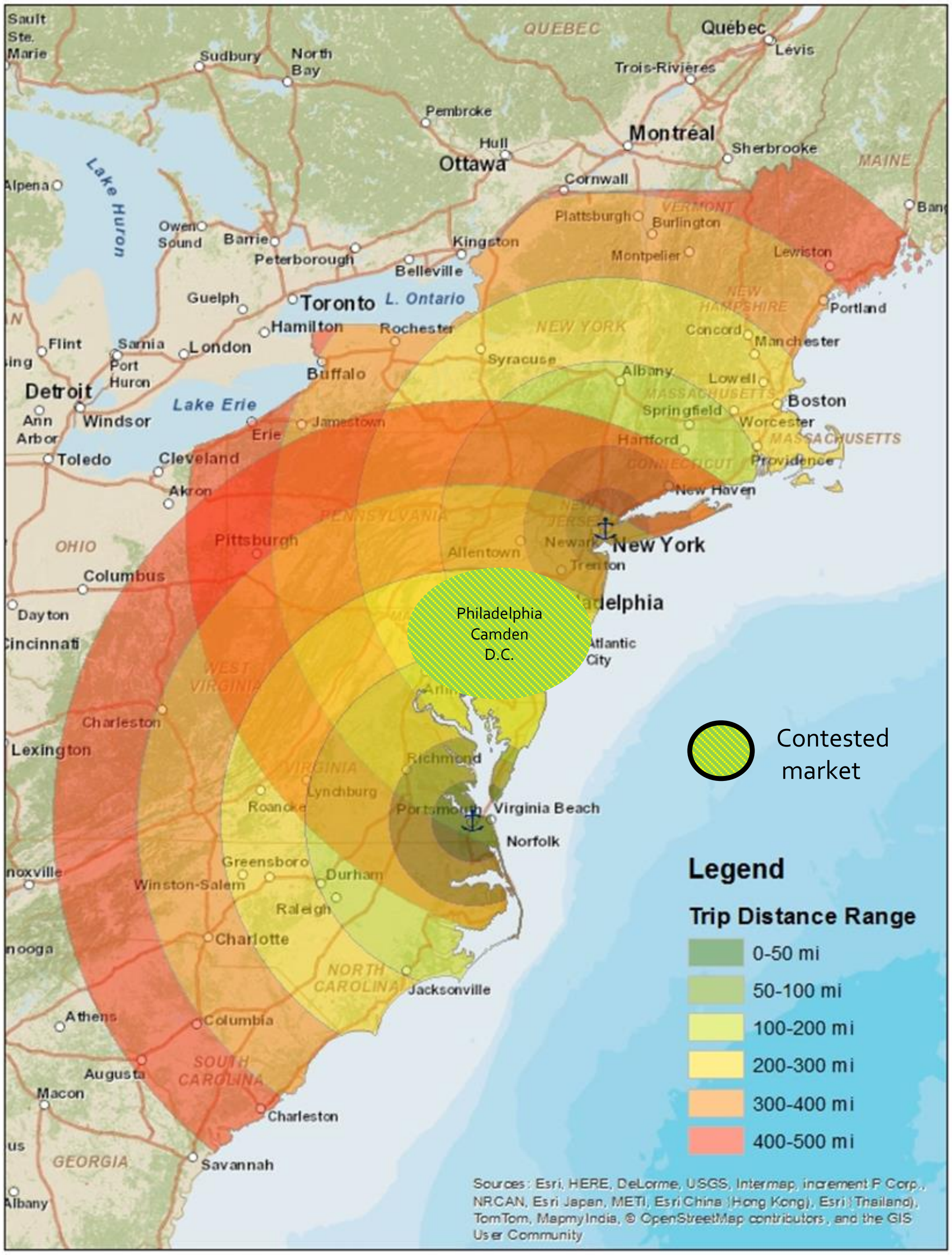
The inland markets where the color bands overlap represent the inland markets where there exists the most competitive pressures since they have choices in port gateways. Based on these maps, stakeholder input, and analysis of the FHWA FAF data, primary competitive inland markets were identified as:

- Philadelphia, PA - Camden, NJ (Port of NY/NJ);
- Washington D.C. - Front Royal, VA (Baltimore and NY/NJ) ; and
- Greensboro and Raleigh, NC. (Charleston and Savannah Ports)

These regions are considered contested regions since they have choices of multiple gateways within an equal distance. There are also other contested regions but these rose to the top due to current and projected volumes of freight. Therefore, in order for the Port of Virginia to compete for traffic coming from or going to these regions, it is vital that the surface transportation network be efficient. Investments, such as the proposed I-44 corridor connecting Norfolk to Raleigh could be significant in giving the Port of Virginia an advantage over competing gateways.

[2] It is important to note that this is largely due to the fact that shipments moving directly to or from ports are typically short-distance trips as opposed to any notable shortcomings in the dataset.

Figure 3.3 Trip Distance Bands for Trips To/From Norfolk vs New York/New Jersey



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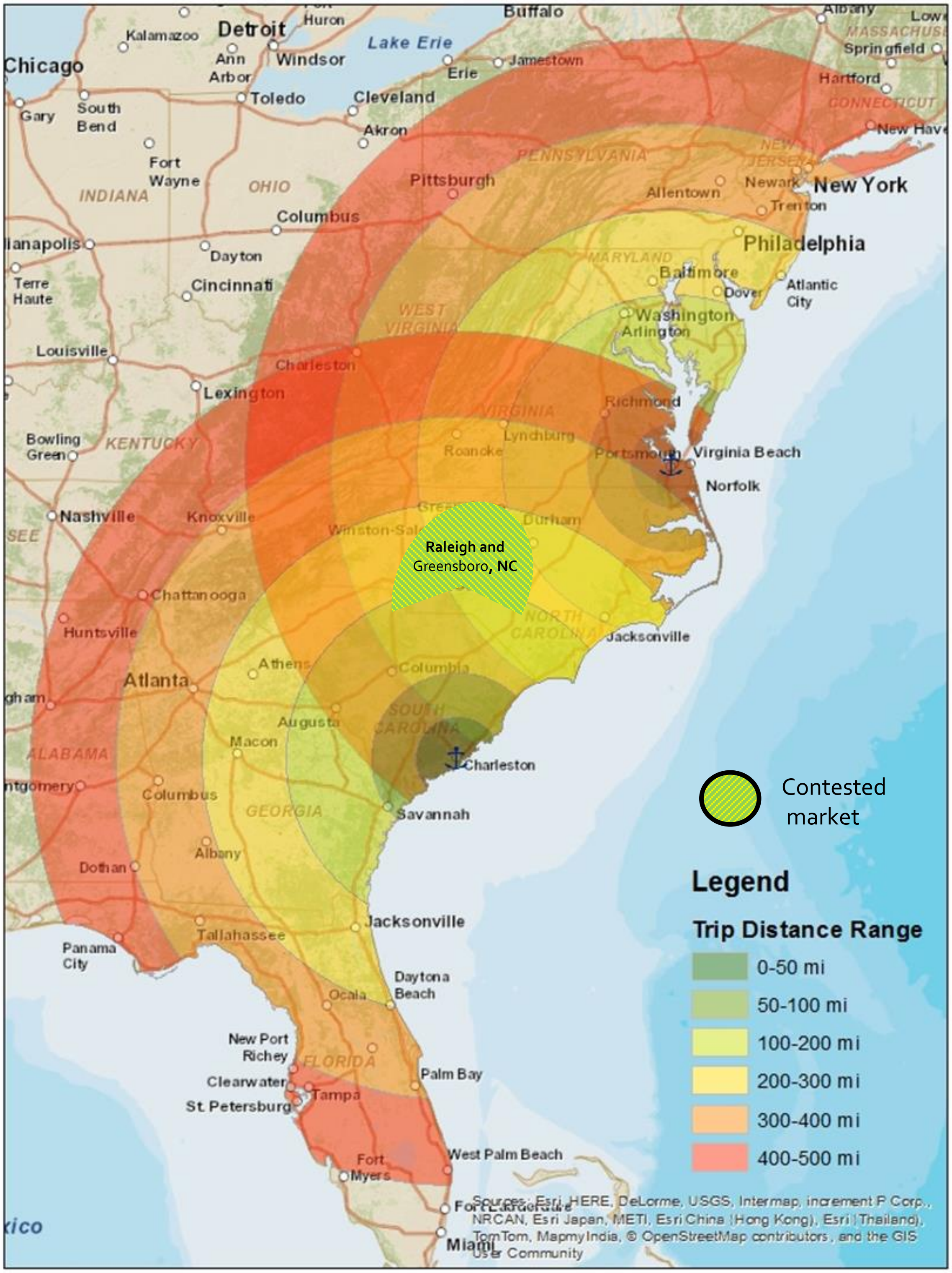
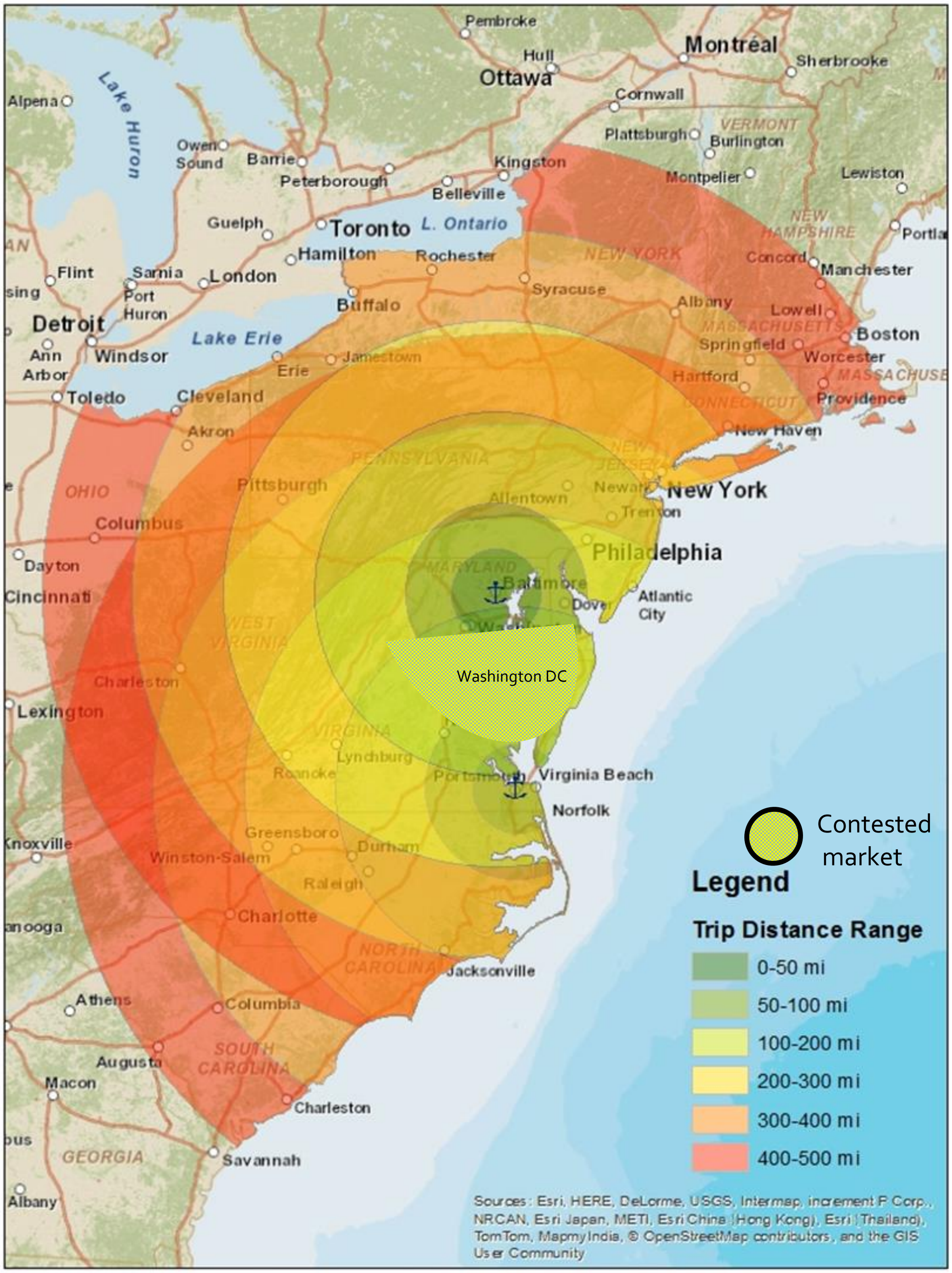
Source: Parsons

Figure 3.4 Trip Distance Bands for Shipments to/from Norfolk vs. Charleston



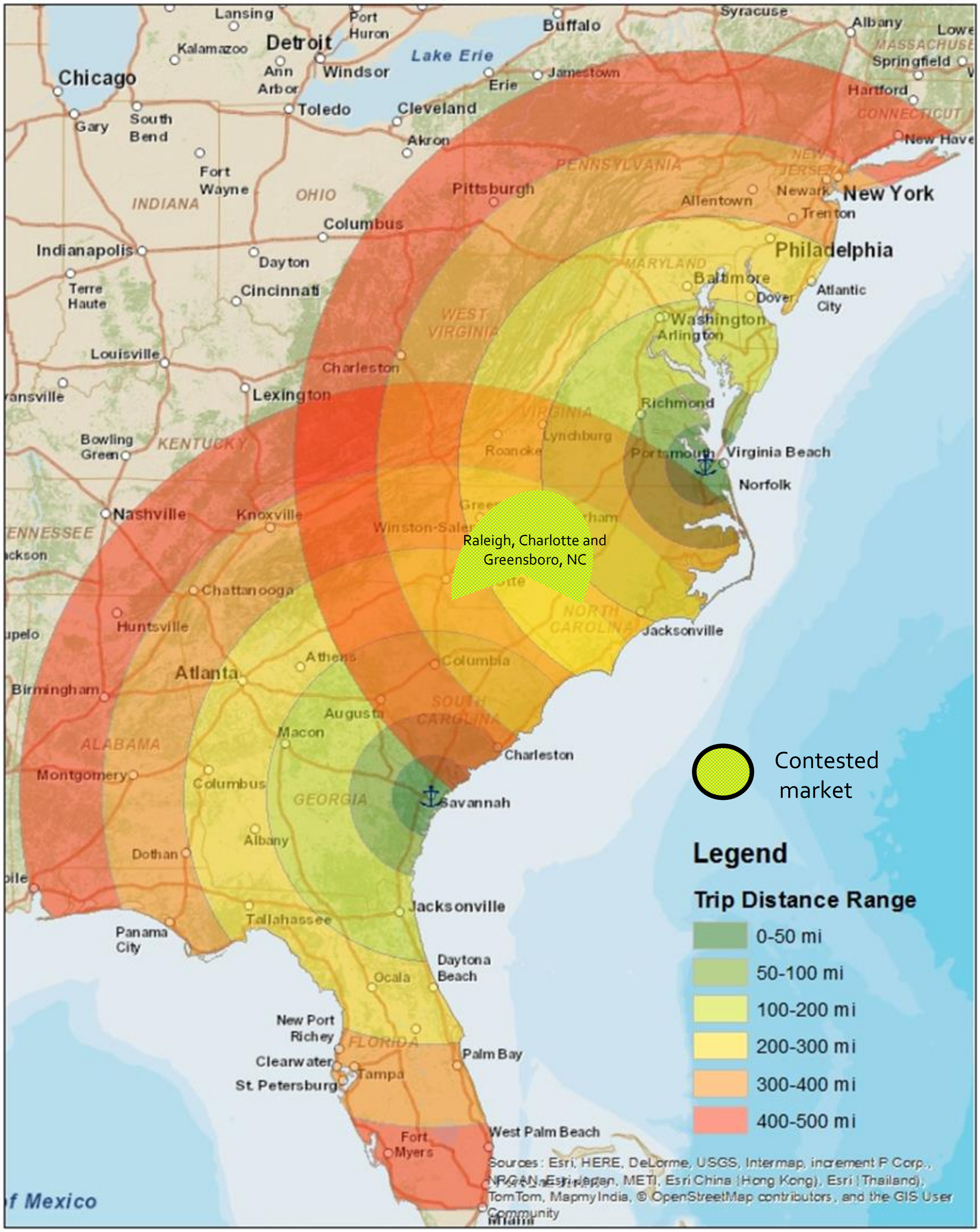
Source: Parsons

Figure 3.5 Trip Distance Bands for Shipments to/from Norfolk vs. Baltimore



Source: Parsons

Figure 3.6 Trip Distance Bands for Shipments to/from Norfolk vs. Savannah



Source: Parsons

3.5 Limitations of the Analysis Based on RTFI Data

Based on the composition of the dataset, caution should be exercised when using some of the results. Two characteristics were evident in the dataset. First, for some of the combinations of direction and distance, the number of individual shipment records was small. Second, the analysis was confined to manufacturing goods which represent a small portion of the total goods being transported into, out of and throughout the study region.

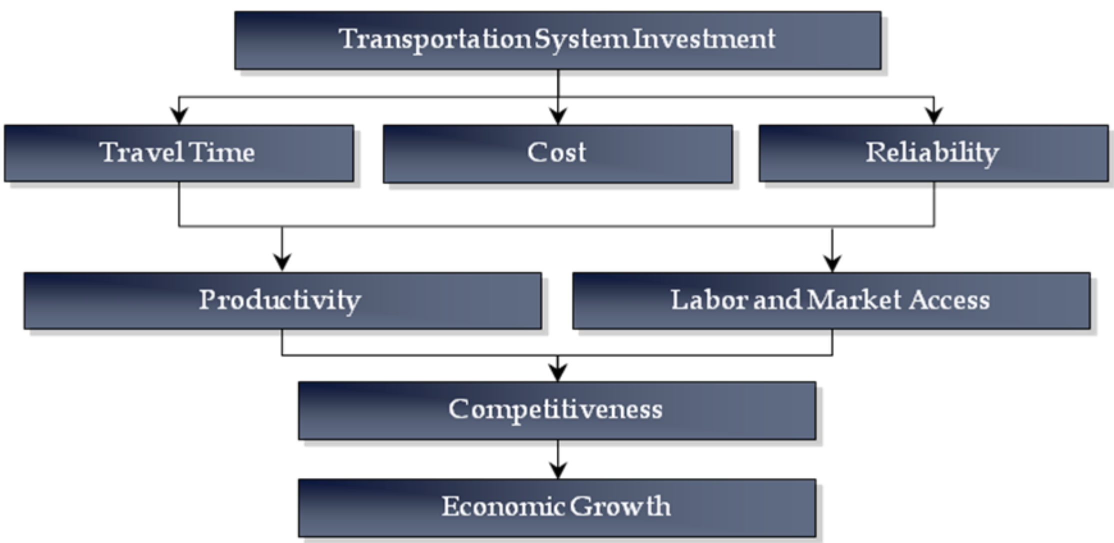
So, while caution should be exercised in computing direct comparison figures at the aggregate levels, the dataset used for the analysis offers enough detail to formulate explanations for some of the specific differences.

4.0 Impact of Congestion and Tolls on Regional Freight Costs

4.1 Overview

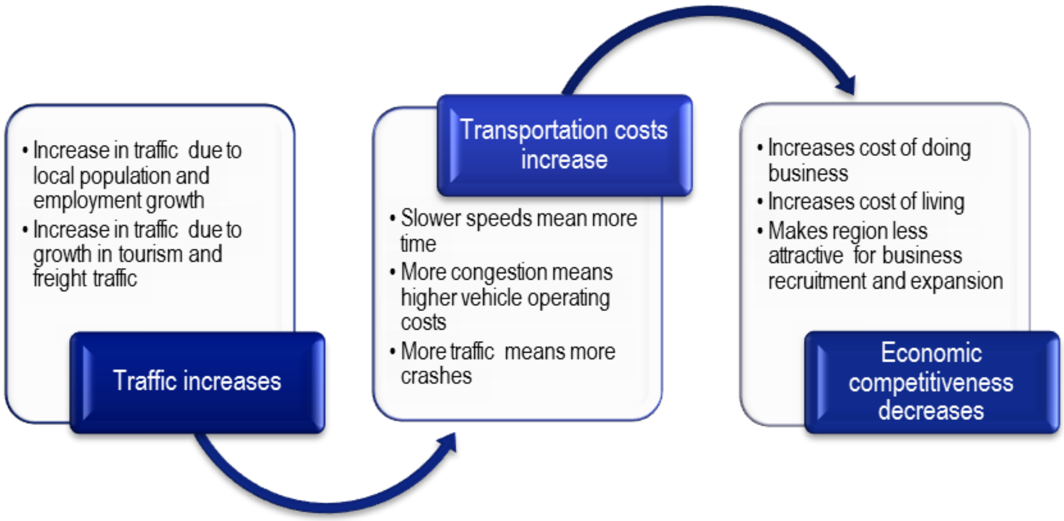
The Hampton Roads region is home to key industries and economic development assets in the state. The region's transportation network serves as local commuter routes for the urban area, the gateway into the state for millions of tons of freight and millions of visitors each year and emergency and military routing. As shown in Figure 4.1, good roads are vital to the economy because the quality of transportation impacts the cost of doing business through travel times, reliability of travel times, and overall transportation costs. These factors directly impact productivity, as well as access to markets and labor, which impact the region's and state's economic competitiveness and overall growth.

Figure 4.1 Linkage between Transportation and Economic Development



Likewise, failure to maintain the transportation system's ability to provide safe, efficient mobility of goods and people can lead to lost economic activity and opportunities. As shown in Figure 4.2, lack of investment can lead to worsening conditions, including increased traffic congestion and increases in crashes. In turn, this leads to increases in travel times and overall transportation costs for residents and businesses. As transportation costs increase, the region may become less attractive in terms of business expansion, retention and recruitment.

Figure 4.2 Impact of Deteriorating Transportation Infrastructure



4.2 Setting Up the Analysis

The Economic Assessment for this study evaluates the economic implications of the construction (with tolls) of major roadway capacity projects identified by the state in its September 29, 2014 "HRTAC Initial Financial Plan". The specific projects analyzed were coordinated with the HRTPO and include:

- Widening I-64 on the Peninsula from 4 to 6 lanes from exit 255 to exit 234
- Widening I-664 from 4 to 8 lanes from I-64 at Hampton Coliseum to the MMMBT
- Widening I-664 from 4 to 6 lanes from MMMBT to I-64 at Bowers Hill
- Addition of Patriot's Crossing with Craney Island Connector
- Widening of I-64 on the Southside by 2 lanes from Bowers Hill to I-464 including the High Rise Bridge
- Interchange improvements at I-64 & I-264 in Norfolk (no tolls on this improvement)

Two alternative scenarios were evaluated including:

- Scenario 1 - Business As Usual (BAU): Defined as ongoing maintenance and operations with no capacity expansion, this scenario would result in worsening traffic conditions leading to increased transportation costs in the region. Traditionally, a base case scenario is compared to an improved network scenario, but in this study, an examination of how transportation costs are likely to change without the proposed capacity improvements was needed. Thus, the team developed a BAU scenario to estimate the increase in trucking costs without the investments.

- Scenario 2 - Build - Fund via Tolls: Defined as the implementation of the proposed major capacity improvements based on the HRTPO model and includes modeling the impacts of tolling.

A regional travel demand model (TDM) developed and maintained by the Virginia DOT for the HRTPO was used to forecast regional truck traffic for the two scenarios. The TDM includes projecting the number of truck trips by origin and destination based on socioeconomic forecasts such as employment and population at a small geographic scale. This step is referred to as the trip generation. The truck trips are then routed on the regional roadway network through an assignment process that uses factors such as functional class of road, travel time and travel distance. For the BAU scenario, future trips were projected and assigned to the region's existing plus committed network which includes only projects that are already committed with an identified funding source. None of the HRTAC projects were included in the existing plus committed network. The results from the 2040 BAU or no build will be compared to the base year data to examine how truck trip distance, travel time and costs will change without the proposed HRTAC capacity projects.

For the build scenario, the first steps of truck trip generation is the same. Hence, the same truck trip table is assigned to the region's existing plus committed projects network plus the selected HRTAC projects. In other words, the only difference between the two modeling scenarios is the additional HRTAC projects added to the region's transportation network. Comparing the changes in 2040 truck trip costs in terms of travel time and vehicle operating costs in the build scenario to the base year will allow for the examination of the impacts of the investments. These impacts, plus the estimated toll charges, will then be compared to change in transportation costs arising from the BAU scenario if the benefits of making the investments outweigh the cost of the tolls.

4.3 Methodology

The analysis of freight cost impacts from transportation changes are based on four main categories to include:

- Freight/crew labor costs – value of time (VOT);
- Vehicle operating costs (VOC) ;
- Truck turn buffer time costs (BC); and
- Cost of tolls.

Freight movements in the region, as well as any changes to these movements, affect the vehicle cost, travel time, and travel demand factors of industries dependent upon the highway and bridge and tunnel system. These changes are measured by the changes in vehicle miles traveled (VMT) or distance, and vehicle hours traveled (VHT) or total travel time. Both of these metrics are generated from the travel demand forecast using an industry standard travel demand model developed and maintained by VDOT for the Hampton Roads Transportation Planning Organization (HRTPO). The regional model is able to quantify VMT and VHT by specific roadways along with the characteristic of that facility (tolls or no tolls). With these specific pieces of data the four types of cost can be generated as follows:

User travel cost impacts are estimated as follows:

- Value of time (VOT)

$$VOT_{truck} = VHT_{truck} \times avg\ number\ of\ crew \times \frac{\frac{\$}{hour}}{crewmember}$$

- Vehicle operating cost (VOC)

$$VOC_{truck} = VMT_{truck} \times (\frac{\$}{mile_{fuel\ truck}} + \frac{\$}{mile_{non-fuel\ truck}})$$

- Buffer time costs (BC)

$$BC_{trucks} = Annual\ Trips_{trucks} \times\ Percentage\ local\ trips \times Percent\ of\ Dray\ Trips\ Lost \times Average\ cost\ of\ truck\ dray\ trip$$

- Toll cost = trips * $ per trip

$$Toll_{truck} = trips_{truck} \times \text{\$ per trip}$$

- Change in truck transportation costs in the BAU compared to the base

$$\Delta Truck\ Transportation\ Cost \quad = \Delta VOT_{truck} + \Delta VOC_{truck} + \Delta BC_{truck}$$

- Change in truck transportation costs in the build with tolls compared to BAU

$$\Delta Truck\ Transportation\ Cost = \Delta VOT_{truck} + \Delta VOC_{truck} + \Delta Tolls_{trucks}$$

The VOT encompasses the labor costs associated with transporting goods in the region. Consisting of crew and non-crew costs, the VOT fluctuations are dependent upon changes to VHT. In the BAU scenario, more congestion leads to slower average speeds and increases in the VHT, thereby increasing the VOT above the base year levels. In the build with tolls scenarios, the additional capacity addresses some of the congestion concerns, leading to a slower growth in VHT and VOT as compared to the BAU scenario.

The VOC includes the non-labor cost associated with transporting goods in the region. Any changes in travel miles and travel hours due to changes in average speeds can give rise fuel and non-fuel operation costs. For example, as congestion increases in the region resulting in slower speeds, the VOC would most likely increase as a result of less fuel efficient speeds and increases in congestion-related idling. Under the build with tolls, it is possible that some trucks will drive longer distances to avoid tolls, leading to an increase in VOC. It is expected that this would only occur as long as the increase in VOC is less than the toll.

Buffer time costs take into account the time savings attributed to reliability issues associated with traveling within the region and the longer travel times associated with congestion. For businesses to meet the anticipated delivery requirements, standard procedure is to account for extra time per turn under congestion conditions or add additional vehicles and drivers as more trucks are delayed. If no additional trucks are available, this additional cost may lead to changes in inventory levels and operating costs, leading to an overall increase in production costs. Since this primarily affects local pick-up and delivery trucks trying to get multiple trips completed in a day, buffer time costs were only estimated for intra-regional trips (local truck).

When evaluating the impacts of tolls, it is based on truck trips. As noted in our interview summary, it is likely that carriers will pass this toll onto the shippers. Regardless of who bears the burden of the toll, it still increases the cost of doing business in the region and that is the focus of the analysis.

Key Assumptions

When conducting any economic analysis, assumptions regarding certain aspects of the analysis are required. Key assumptions include crew and non-crew costs of trucking, toll rates and application of rates. Assumptions on trucking costs are drawn from the 2013 Operational Cost of Trucking report produced by the American Transportation Research Institute (ATRI), which is an affiliate of the American Trucking Association.[3] Table 4.1 presents the ATRI cost estimates by category on a per mile and per hour basis.

Table 4.1 Trucking Operational Cost Assumptions

	2013		2040	
Motor Carrier Costs	**Per Mile**	**Per Hour**	**Per Mile**	**Per Hour**
Driver-based Costs (VOT)				
Driver wages	$ 0.440	$ 17.60		
Driver benefits	$ 0.129	$ 5.16		
Subtotal	*$ 0.569*	*$ 22.76*	*$ 1.87*	*$ 74.70*
Vehicle Based (VOC)				
Fuel costs	$ 0.645	$ 25.78		
Equipment lease/purchase payments	$ 0.163	$ 6.52		
Repair and maintenance	$ 0.148	$ 5.92		
Insurance	$ 0.064	$ 2.57		
Permits and licenses	$ 0.026	$ 1.04		
Tires	$ 0.041	$ 1.65		
Sub-total	*$ 1.087*	*$ 43.48*	*$ 3.57*	*$ 142.70*
TOTAL	**$ 1.656**	**$ 66.24**	**$ 5.44**	**$ 217.40**

Source: 2013 values from American Transportation Research Institute, *Operational Cost of Trucking, 2013 Update. 2040 values represent 2013 values with assumed 4.5% average annual inflation rate.*

For the 2040 analysis, the 2013 values listed in Table 4.1 were escalated assuming an annual inflation rate of 4.5%. This inflation rate is based on historical changes in the operational costs of trucking over the past ten years combined with stakeholder input on future trucking costs.

Another set of key assumptions involve estimating the cost of tolls. In Scenario 2 - Build with tolls, key assumptions include:

- All truck trips use a toll facility and pay one toll per trip – to the extent that if some trucks do not have to use a toll facility, the impact of tolls is over-estimated and to the extent that if a trip requires more than one toll, the impact of tolls is under-estimated;
- A round-trip counts as two trips in the TDM so the truck would pay two tolls on a round trip;

[3] http://atri-online.org/2013/09/04/an-analysis-of-the-operational-costs-of-trucking-2013-update/

- All the HRTAC projects modeled with the exception of the interchange improvements at I-64 & I-264 in Norfolk will be tolled under Scenario 2; and

- The current toll rate is assumed to be the peak time registered pay by plate rate of $6 for all trucks. Toll rates are escalated 5% per year to be about $20 per toll in 2040. The higher escalation factor (compared to the Consumer Price Index or CPI) is due to the fact that toll increases are not currently restricted to inflation rates and stakeholder input indicated a perception that toll rates are anticipated to rise faster than inflation. To the extent that trucks use EZPass and/or non-peak times ($3-$5), the toll cost is overestimated. Most carriers interviewed as part of the current study indicated that they provided all drivers, both company and owner/operators, with transponders or reimbursed drivers for tolls. However, this represents a small sample of the total carriers and no additional information regarding the breakout of current truck tolls being paid, therefore, to be conservative a higher cost for trip was used.[4]

4.4 Findings

This section includes the results of the travel demand model for the two scenarios – Scenario 1 – BAU and Scenario 2 - Build with tolls. As discussed in Section 4.2, the TDM consists of generating a truck trip table with origin and destinations based on socioeconomic forecasts and then assigning or routing those trips over the existing network and a network with the additional HRTAC projects included. Key statistics from the travel demand modeling including number of truck trips (interregional and non-local), vehicle hours traveled (VHT) and vehicle miles traveled (VMT) and average trip distance, speed and travel time are shown in Tables. 4.2 through 4.5. The statistics that represent annual numbers are shown for intra-regional or local truck trips and total truck trips.

Table 4.2 Summary of Annual Truck Trips

	Intraregional Trips	Non Regional Trips	Total Truck Trips
2012 Base Year	18,580,693	9,441,452	28,022,145
2040 BAU/No-Build	25,264,628	13,015,112	38,279,740
2040 Build w/Toll	25,264,628	13,015,112	38,279,740

Source: Cambridge Systematics analysis using the HRTPO regional travel demand data.

[4] ERC rates are limited to 3.5% or actual inflation, whichever is higher.

Table 4.3 Summary of Annual Truck Vehicle Hours Traveled (VHT)

	Intraregional Truck VHT	Non Regional VHT	Total Truck VHT
2012 Base Year	5,235,173	4,642,512	9,877,685
2040 BAU/No-Build	9,591,902	8,506,027	18,097,929
2040 Build w/Toll	7,673,968	6,805,217	14,479,185

Source: Cambridge Systematics analysis using the HRTPO travel demand model

Table 4.4 Summary of Annual Truck Vehicle Miles Traveled (VMT)

	Intraregional Truck VMT	Non Regional VMT	Total Truck VMT
2012 Base Year	221,819,070	204,756,065	426,575,135
2040 BAU/No-Build	315,776,194	291,465,546	607,241,740
2040 Build w/Toll	327,873,762	290,755,978	618,629,740

Source: Cambridge Systematics analysis using the HRTPO regional travel demand model.

Table 4.5 Average Truck Speed, Trip Distance and Trip Time

	Avg Speed	Avg trip distance (miles)	Avg trip time (minutes)
2012 Base	43.2	15.2	21.1
2040 BAU (no-build)	33.6	15.9	28.4
2040 Build w/Tolls	42.7	16.2	22.7

Source: Cambridge Systematics analysis of HR travel demand model output.

The results of the TDM are used to calculate the additional delay arising from congestion which is a key metrics used in the analysis. Truck VHT will increase from 2012 base year due to more trips being generated and from reduced speeds due to rising congestion. For the current study, it is important that the VHT increase arising from congestion be isolated. Comparing the time it takes to travel a mile (VHT/VMT) in 2012 to the time it takes to travel a mile in 2040 captures the change in travel time arising from increased travel times, thus isolating the VHT increase due to congestion. . The difference in VHT/VMT between the base year and 2040 BAU scenario is multiplied by the truck VMT in 2040 to derive the additional hours of delay in the future. Similarly, the difference in VHT/VMT between base year and build with tolls is multiplied by truck VMT in the build with toll scenarios to calculate the additional congestion related truck delay in the 2040 build with tolls scenario. The results of this are displayed in Table 4.6.

Table 4.6 Summary of Additional Truck Hours of Delay Compared to 2012 Baseline[1]

Scenario		Intraregional Trips	Non-Regional Trips	Total
2012 Base Year	VHT/VMT - Time to travel a mile			0.0232
2040 BAU (No-Build) compared to Base Year	VHT/VMT - Time to travel a mile			0.0298
	Additional Daily Hours of Truck Delay over 2012	5,751	5,308	11,060
	Additional Annual Hours of Truck Delay	2,099,188	1,937,578	4,036,766
2040 Build with Tolls compared to Base Year	VHT/VMT - Time to travel a mile			0.0234
	Additional Daily Hours of Truck Delay over 2012	224	199	422.81
	Additional Annual Hours of Truck Delay	81,792	72,532	154,324

1. Numbers in the table have been rounded for presentation purposes. The results displayed in the table were calculated with the VHT/VMT numbers carried out 9 digits.

Source: Cambridge Systematics analysis using the HRTPO regional travel demand model. .

For Scenario 1 - BAU or no build scenario, the VOT and VOC are generated from data obtained in the HRTPO TDM combined with the ATRI vehicle cost. It should be noted that methodology is for a regional network and represents system wide metrics and does not reflect any specific roadway. Based on the travel demand model, the additional hours of truck delay is estimated to be 11,060 additional hours daily above the base year. The next step is to then multiply this change by the ATRI cost per hour in 2040 for driver based (VOT) and vehicle based operating costs (VOC) to derive the trucking travel time and vehicle operating cost associated with increased congestion.

The buffer time cost estimates require a few additional calculations. Key assumptions include:

- On average, local trucks get 3 turns per day for intra-regional trips. A turn is comprised of 2 trips (i.e., from port terminal to warehouse and from warehouse back to port terminal). This is based on input from stakeholders and does not account for any reduction in truck turn times due to on-port congestion.

- Based on existing buffer times provided through stakeholder interviews, average trip lengths and changes in average trip times, it is assumed that increased congestion and trip travel times under the BAU scenario would result in a conservative 3.5% of the local drayage trucks "losing" their last turn, resulting in 811 lost trips daily. To the extent that more trips are impacted, the buffer time costs are underestimated.

- Current average cost per drayage trip is assumed to be $200 based on data provided by drayage operators. This cost is inflated to 2040 dollars assuming average annual increase of 4.5%. The result is $650 per drayage trip in 2040.

Table 4.7 summarizes the key inputs, assumptions and findings for estimating buffer time costs under the BAU scenario. It is estimated that the BAU or do nothing will lead to $96.2 million annually in lost revenue for local drayage operators as a result of the buffer time costs.

Table 4.7 Estimation of Increases in Buffer Time Costs in 2040 Arising from Increased Congestion in the Business as Usual Scenario

	Daily	Annual
Total Interegional Truck Trips in 2040 BAU	69,218	25,264,628
Number of Trucks asssuming 3 Turns (or 6 trips) per Truck	11,536	4,210,771
Percent of Turns "Lost"due to Congestion	3.50%	3.50%
Number of Turns "Lost"	404	147,377
Cost of "Lost Turns" ($650 per turn)	$ 262,452	$ 95,795,049

Source: Cambridge Systematics analysis using stakeholder input and the HRTPO regional travel demand model.

The combined results from travel time, vehicle operating and buffer time costs for the business as usual or no-build scenario, presented in Table 4.8., indicate that doing nothing or not building the proposed capacity projects will lead to an additional $973.1 million in trucking costs in the region in 2040. Of this, intraregional truck trips will incur about $552.2 million or 56.7% of the increase in congestion costs.

Table 4.8 Cost of Increased Congestion for Trucks in the Hampton Roads Region in 2040 if HRTAC Capacity Projects are Not Built- Business as Usual

	Intaregional Trips	Non-Regional Trips	Total
Additional Daily Hours of Truck Delay	5,751	5,309	11,060
Additional Annual Hours of Truck Delay	2,099,188	1,937,712	4,036,900
Additional Travel Time Costs	$ 156,809,344	$ 144,747,086	$ 301,556,430
Additional Vehicle Operating Costs	$ 299,554,128	$ 276,511,502	$ 576,065,630
Buffer/Turn Time Costs	$ 95,795,049	NA	$ 95,795,049
Additional Toll Costs	NA	NA	NA
Total Additonal Trucking Costs	**$ 552,158,521**	**$ 421,258,589**	**$ 973,417,109**

Source: Cambridge Systematics analysis using the HRTPO travel demand model and ATRI cost of trucking analysis

For Scenario 2 - Build with no tolls, the change in cost is estimated based on the difference in truck hours traveled compared to the base year and to the 2040 conditions under the no-build scenario. The same ATRI values are used to estimate the cost of the change in truck costs. In the build scenario, it is estimated there will be an additional 423 hours of daily delay compared to the base year, compared to 11,060 in the BAU scenario. Thus, while trucking costs are expected to increase over the 2012 base year, the increase is only a fraction of the BAU scenario. In addition, the significant slowing of truck congestion in the build scenario also results in fewer lost truck turns and a fraction of the buffer time cost increases seen in the BAU scenario. However, in order to pay for this improved capacity, this scenario includes the increased trucking costs arising from tolling. The toll cost is estimated on a per trip basis combined with the rate assumptions presented above led to a toll rate of $20 in 2040 which is applied to the number of truck trips to estimate the toll cost to trucks in 2040. As presented in Table 4.9, the tolls paid by trucks in the

Hampton Roads region is estimated to total about $765.6 million in 2040. Of this, about $505 million, or 66%, will be paid by trucks making regional or local trips. Note that there are no buffer time costs estimated due to the fact that the additional hours of delay is not significant enough to impact the ability to maintain an average of 3 turns per day.

Table 4.9 Increase in Trucking Costs in the Hampton Roads Region in 2040 Arising from the Build with Tolls Scenario

	Intraregional Trips	Non-Regional Trips	Total
Additional Daily Hours of Truck Delay	224	199	423
Additional Annual Hours of Truck Delay	81,829	72,566	154,395
Additional Travel Time Costs	$ 6,112,652	$ 5,420,654	$ 11,533,307
Additional Vehicle Operating Costs	$ 11,677,048	$ 10,355,118	$ 22,032,167
Buffer Costs/Turn Costs	NA	NA	NA
Additional Toll Costs (at $20 toll in 2040)	$ 505,292,568	$ 260,302,232	$ 765,594,800
Total Additonal Trucking Costs	**$ 523,082,269**	**$ 276,078,004**	**$ 799,160,273**

Source: Cambridge Systematics analysis using the HRTPO TDM

Based on the estimation of increased congestion costs if the capacity investments are not built and the increased cost of tolls if they are built and paid for via tolls, trucking costs in the Hampton Roads region will increase less under the "Build with Tolls" scenario than under the no build or BAU scenario (see Table 4.10). In fact, trucking costs are projected to be $174 million less if the projects are built and paid for via tolls than if they are not built.

Table 4.10 Comparison of Increased Trucking Costs in 2040 for the No Build and the Build with Tolls Scenarios

	Intraregional Trips	Non-Regional Trips	Total
BAU or No Build	$ 552,158,521	$ 421,258,589	$ 973,417,109
Build with tolls	$ 523,082,269	$ 276,078,004	$ 799,160,273
Net Change in Cost (BAU - Build with Tolls)	$ 29,076,252	$ 145,180,584	$ 174,256,836

Source: Cambridge Systematics analysis using HRTPO TDM

To help put things into perspective, an average cost per truck trip was calculated for the BAU and Build with Tolls scenario. The difference between the average cost increase under BAU and Build with Tolls scenarios could be interpreted as a "tipping point" or the point at which the toll rate increase exceeds the value of the congestion relief benefit. The results, presented in Table 4.11, indicate that the tipping point for local truck trips is modest while it is significant for non-regional trucks.

Table 4.11 Average Trucking Cost Increase Under the BAU and Build with Tolls Scenarios, 2040

	2040 BAU or No Build			2040 Build with Tolls			Net Difference (Build-BAU)		
	Regional	Non Regional	Total	Regional	Non Regional	Total	Regional	Non Regional	Total
Additional congestion costs	$ 552,158,521	$ 421,258,589	$973,417,109	$ 17,789,701	$ 15,775,772	$ 33,565,473	$ (534,368,820)	$ (405,482,816)	$ (1,006,982,582)
Additional toll costs from new toll facilities				$ 505,292,568	$ 260,302,232	$ 765,594,800	$ 505,292,568	$ 260,302,232	$ 765,594,800
Total Additional Cost Increase	$ 552,158,521	$ 421,258,589	$973,417,109	$ 523,082,269	$ 276,078,004	$ 799,160,273	$ (29,076,252)	$ (145,180,584)	$ (174,256,836)
Number Truck Trips	25,264,628	13,015,112	38,279,740	25,264,628	13,015,112	38,279,740			
Average Additional Cost per Trip	$ 21.86	$ 32.37	$ 25.43	$ 20.70	$ 21.21	$ 20.88	$ (1.15)	$ (11.15)	$ (4.55)

Source: Cambridge Systematics analysis using the HRTPO regional travel demand model. .

5.0 Summary and Considerations

In response to freight industry concerns regarding tolling as a funding mechanism for improving and expanding existing infrastructure, the Freight Transportation Advisory Committee (FTAC) with support from the Virginia Department of Transportation commissioned a study to examine the economic implications of proposed highway improvements and the use of tolls to fund those improvements. The Economic Assessment answers the following questions:

- How do truck freight costs change if additional capacity is not added to the roadway network?
- How do truck freight costs change if capacity is added to the roadwork network and tolls are used to pay for the improvements?
- How do changes in truck freight costs compare across these two scenarios?

The study included stakeholder interviews and input, a benchmarking of freight rates across competing port regions and analysis of future truck travel using the HRTPO regional travel demand model. Four major findings from the analysis include:

- Freight rates in region are generally competitive with peer ports.
- Without the proposed major regional capacity projects there will be an additional 11,060 hours of truck delay daily, translating into more than 4 million additional hours of truck delay in 2040. This increase in truck delay gives rise to significant increases in trucking costs.
- The cost of doing nothing is significant. It is estimated that business as usual will lead to nearly $1 billion increase in trucking costs in 2040. This includes driver and non-driver based costs as well as the cost of reduced number of turns for local drayage operators.
- 57% of the increased cost ($552.2 million) under the BAU usual scenario will be borne by local truck trips.
- Based on current trends in tolling rates, the freight industry will be better off building new capacity on key truck routes with tolls than not making the investment. The net benefit to the freight industry of making the proposed infrastructure investments and using tolls (at the current rate plus inflation) to fund them is about $174 million in 2040.
- Both tolls and congestion costs impact local trips more than trips originating or terminating outside the region. It is estimated that local truck trips will incur about 57%

of the total congestion costs under the BAU and they will pay about 66% of the tolls under the Build with Tolls scenario.

- If tolls rise above $22 per trip in 2040 for local trucks, the costs of tolls start to exceed the congestion relief benefits. That equates to about $7.30 in current dollars.

Given the findings above, there are several points deserving additional consideration such as:

- The region needs to consider the impact on the trucking industry as they evaluate and prioritize capacity expansion projects. The findings presented above rely on averages across the whole regional network. Evaluation of individual projects is required to more completely understand the trade-offs between congestion relief benefits and toll costs accruing to the freight users.

- The tipping point at which the cost of tolls exceeds the congestion relief benefits for local trucks is $2 more than the assumed 2040 toll rate using $2040. This means there is not much room for toll rate increases before the costs exceed the benefits. Also, if trucks are required to pay more than one toll to complete their trip, they will exceed the tipping point.

- The analysis indicates that a significant amount of the toll burden will fall on local truck trips. This has the potential to impact if and where businesses locate in the region. As plans move forward and toll rates are examined for each facility there should be discussion of potential mitigation strategies such as variable toll prices by type of user (local versus non local). These options may consider reduced rates for locally registered trucks, a monthly or annual toll pass that allows trucks to use toll facilities as often as they like for a flat fee, a rebate program or some other program to ease the local burden. A balance is necessary to generate sufficient revenue to fund the investment while easing the burden on local businesses and allow the region to retain existing businesses and attract and capture new business.