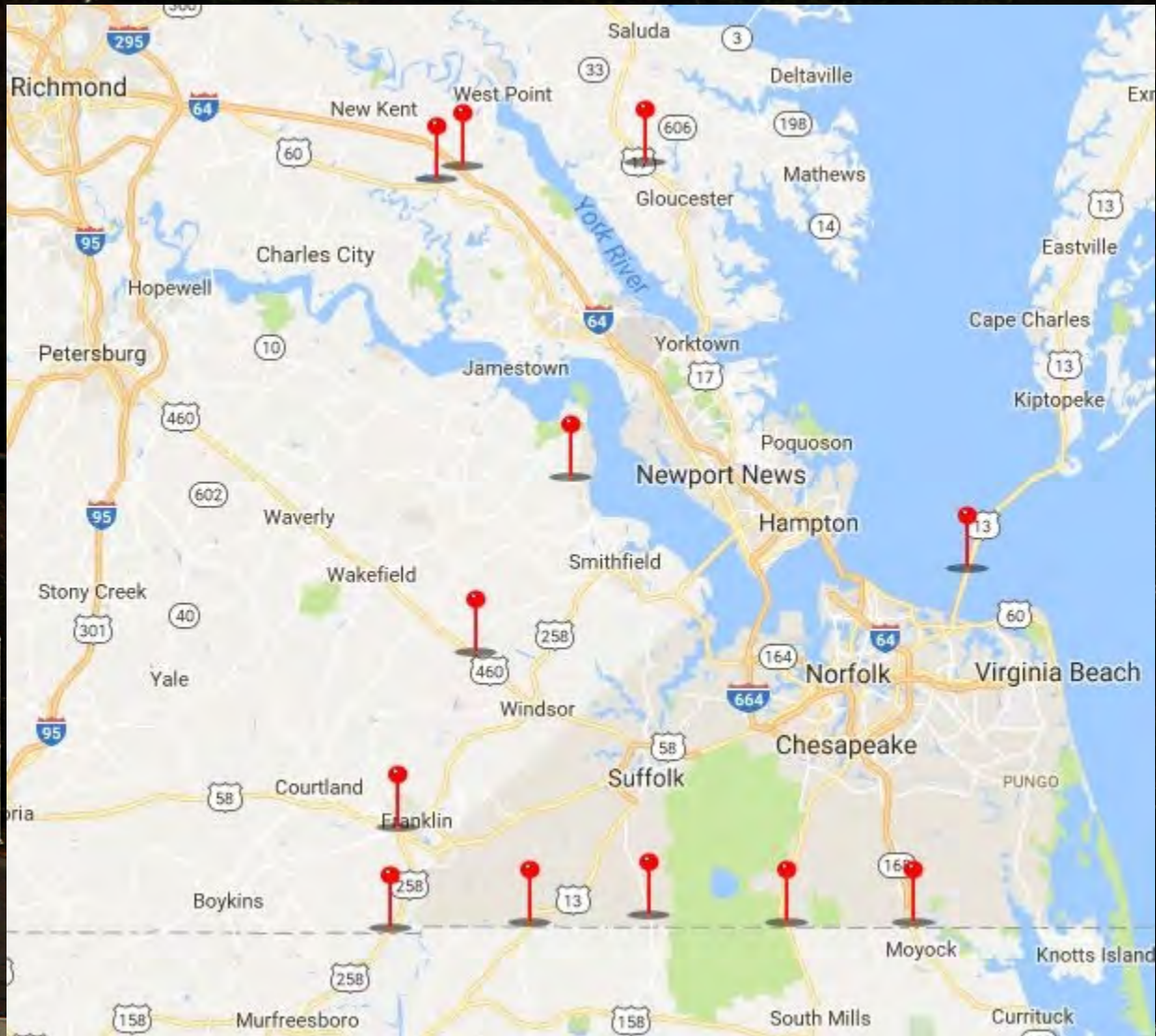


# Highway Gateways Used by Port Trucks

March 2018



T 18-01

the heartbeat of  
**HAMPTON  
ROADS**  
TRANSPORTATION PLANNING ORGANIZATION

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## **REPORT DOCUMENTATION**

### **TITLE**

Highway Gateways Used by Port Trucks

### **ORGANIZATION**

Hampton Roads Transportation Planning Org.  
723 Woodlake Drive  
Chesapeake, Virginia 23320  
<http://www.hrtpo.org>

### **AUTHOR**

Robert B. Case, PE, PhD

**REPORT DATE**            March 2018

### **ABSTRACT**

HRTPO staff prepared this study to inform the HRTPO Board which highway routes port-related trucks primarily use to enter and exit Hampton Roads. HRTPO staff plans to use the study results to inform the scoring of candidate projects under the HRTPO Project Prioritization Tool, and to provide the study results as input for major regional studies currently being conducted by HRTPO and VDOT.

### **ACKNOWLEDGMENTS**

This document was prepared by the Hampton Roads Transportation Planning Organization (HRTPO) in cooperation with the Port of Virginia Port (POV) using the StreetLight Data system, access to which was provided by the Virginia Department of Transportation (VDOT). The contents of this report reflect the views of the HRTPO. The HRTPO staff is responsible for the facts and the accuracy of the data presented herein. This document does not constitute a standard, specification, or regulation. The contents do not necessarily reflect the official views or policies of the FHWA, FTA, VDOT or DRPT. FHWA, FTA, VDOT or DRPT acceptance of this report as evidence of fulfillment of the objectives of this program does not constitute endorsement/approval of the need for any recommended improvements nor does it constitute approval of their location and design or a commitment to fund any such improvements. Additional project level environmental impact assessments and/or studies of alternatives may be necessary.

### **NON-DISCRIMINATION**

The HRTPO assures that no person shall, on the ground of race, color, national origin, handicap, sex, age, or income status as provided by Title VI of the Civil Rights Act of 1964 and subsequent authorities, be excluded from participation in, be denied the benefits of, or be otherwise subject to discrimination under any program or activity. The HRTPO Title VI Plan provides this assurance, information about HRTPO responsibilities, and a Discrimination Complaint Form.

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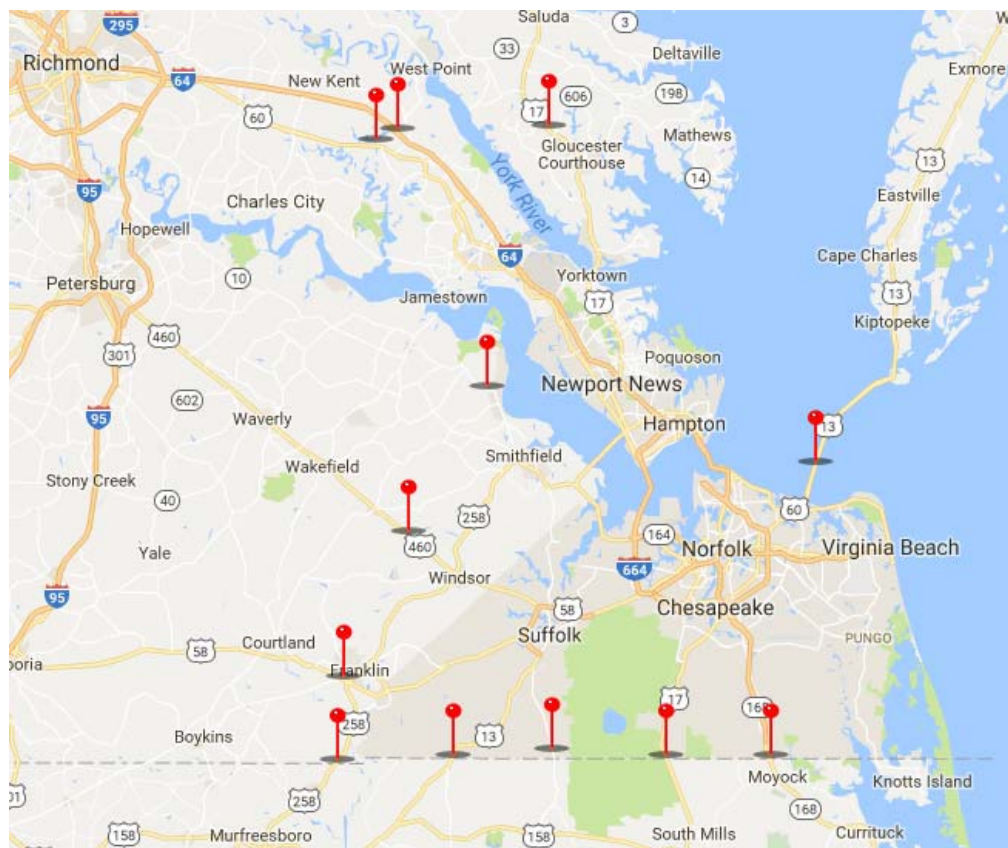


## INTRODUCTION

The purpose of this study is to find which highway gateways to Hampton Roads are most used by trucks going to/from the local Port of Virginia port facilities.

The HRTPO can use this information as input to its decisions when planning and funding highway improvements with an eye to helping port operations. Specifically, HRTPO staff intends to:

- Employ the study's measurement of highway gateway usage by port-related trucks in scoring candidate projects with the HRTPO Prioritization Tool (tool component: "increase access to port facilities", 10 points for highway projects)
- Provide the study's measurement of highway gateway usage by port-related trucks to the consultants preparing the US 58 Arterial Management Plan
- Provide the study's measurement of highway gateway usage by port-related trucks to the consultants preparing the Regional Connectors Study.



**FIGURE 1 12 Highway Gateways for Hampton Roads**

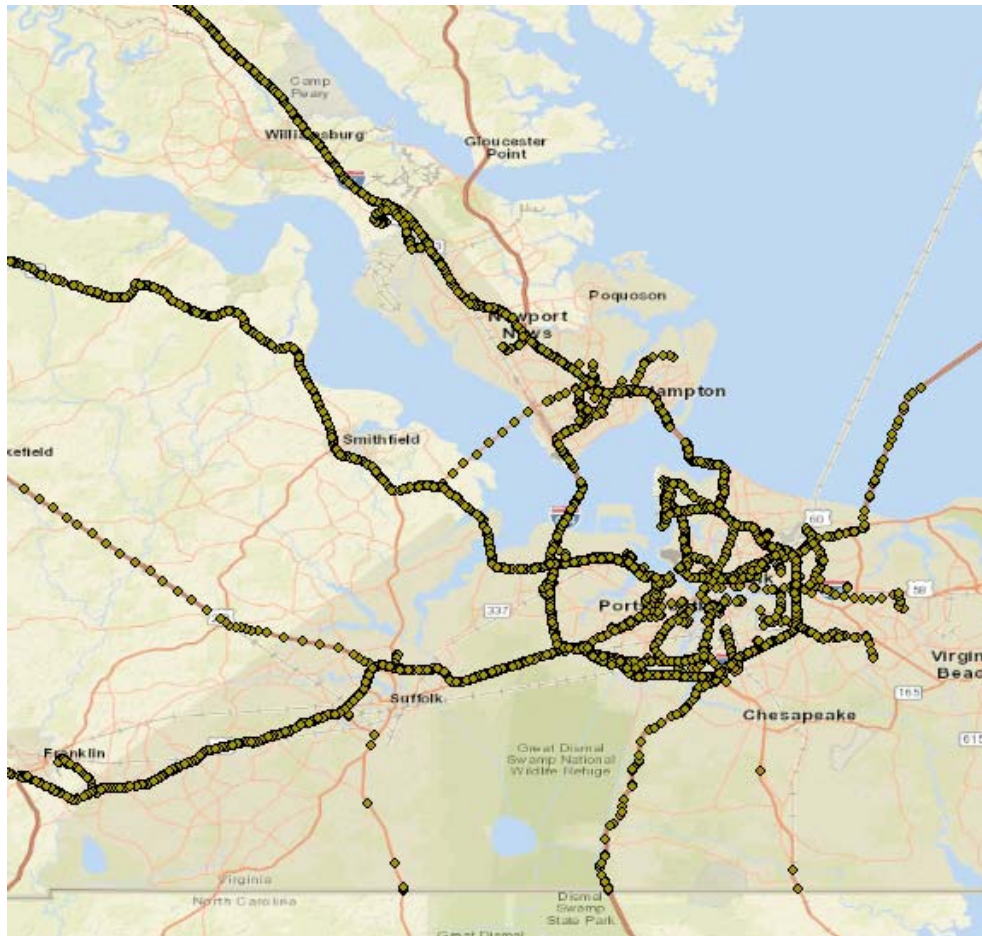
Source: HRTPO staff via [insight.streetlightdata.com](https://insight.streetlightdata.com)

## METHODOLOGY

### Initial Data Set: ATRI

HRTPO staff initially tried to enumerate port truck usage of regional highway gateways using one month of truck location data from the American Trucking Research Institute (ATRI).

Today, many trucks in the US are equipped with GPS units that periodically (e.g. once per minute) record the location of the truck (latitude and longitude), primarily for the benefit of the trucking company. Participating companies send this data to ATRI for research purposes. ATRI gave HRTPO staff an electronic file containing the minute-by-minute location of ATRI-participating trucks in Hampton Roads for the month of September 2014.



**FIGURE 2 Trucks Visiting Norfolk International Terminals (NIT) Sept. 30, 2014**

Source: HRTPO staff processing of ATRI data via ESRI GIS

HRTPO staff processed these 7.5m records, identifying those trucks that entered one of the four POV facilities (Norfolk International Terminals [NIT], Portsmouth Marine Terminal [PMT], Newport News Marine Terminal [NNMT], and the Virginia International Gateway [VIG]), and then finding which highway gateway they used if entering/leaving Hampton Roads.

Unfortunately, this analysis rendered illogical results (e.g. high usage of US 17 in North Carolina and low usage of US 460), apparently as a result of the non-random group of trucking companies providing GPS data to ATRI. Consequently, HRTPO staff pursued the analysis of another truck-location data set.



## Final Data Set: StreetLight

HRTPO staff successfully enumerated the relative usage of regional highway gateways by port trucks (i.e. which highway gateways are used the most) using StreetLight, a travel data firm. StreetLight collects travel data from several sources including:

- For personal travel: connected cars and smart phones
- For truck travel: GPS-based fleet management

“As of December 2016, StreetLight’s data repositories process analytics for nearly 35M users, or about 10% of the population and about 12% of commercial truck trips.”<sup>1</sup> From this location data, StreetLight estimates origins and destinations of trips. To make this data usable, StreetLight developed a web-based analytical tool InSight, accessible for paying customers. Fortunately, VDOT has contracted with StreetLight, and has made the service available to HRTPO staff.



### Location-Based Services Data

Our Location-Based Services data comes from smartphone apps that track devices' locations to provide specific services. These services include weather forecasts, shopping deals, restaurant reviews, etc. We use this type of data for Metrics that describe activities and travel patterns around and between locations.

### Navigation-GPS Data

Our navigation-GPS data comes from devices that help people navigate, such as connected cars and trucks, turn-by-turn route guidance apps, and commercial fleet management systems. We use this type of data for Metrics that describe trips and routes with extremely high spatial precision.



## FIGURE 3 StreetLight Data Sources

Source: <https://www.streetlightdata.com/population-mobility-technology>

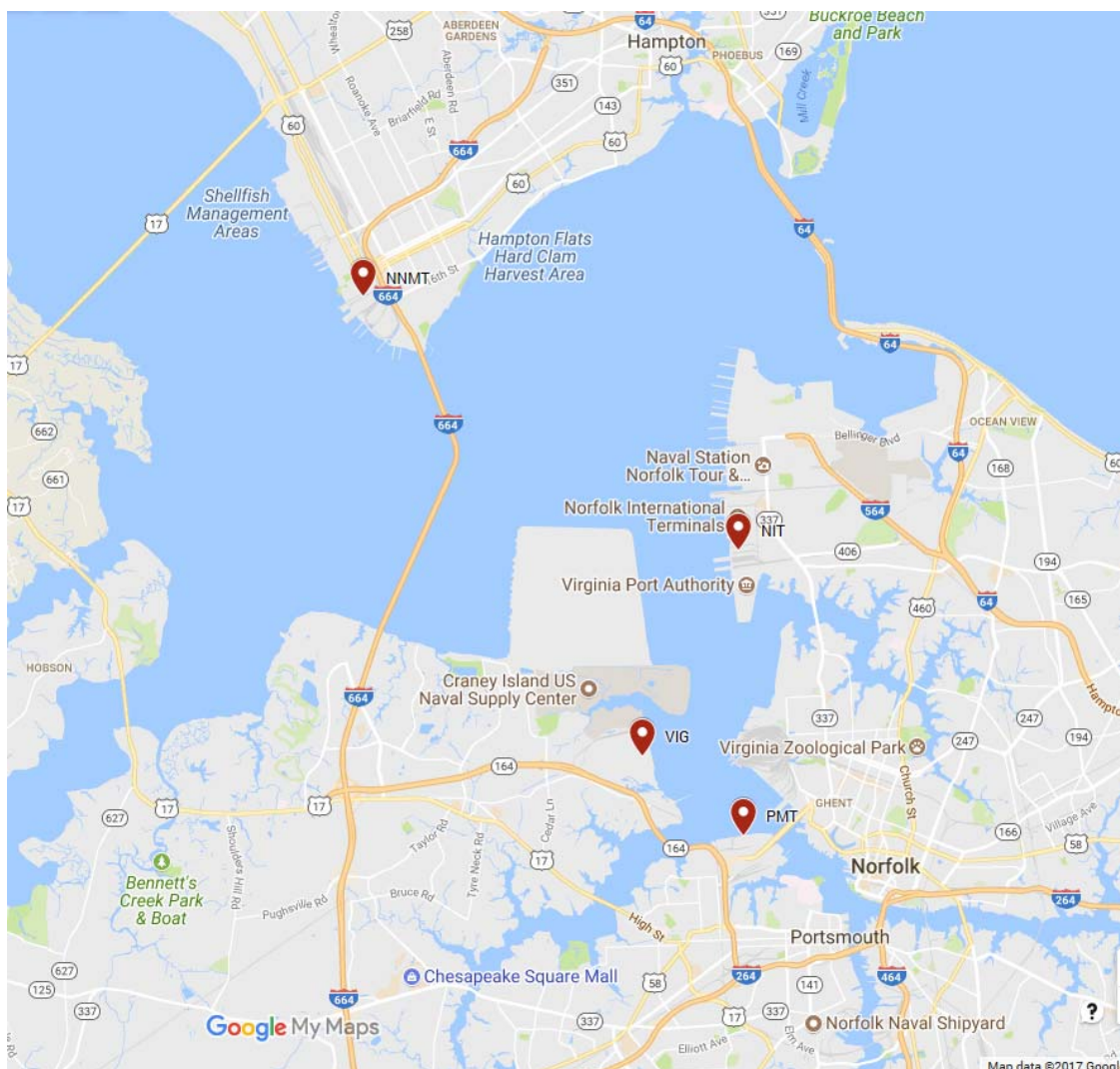
<sup>1</sup> StreetLight slides attached to 9-26-16 email from Darrel Johnson (VDOT)

## *Trips Between Port Facilities and Gateways*

Initially, HRTPO staff used StreetLight to enumerate trips between local container port facilities and regional highway gateways.

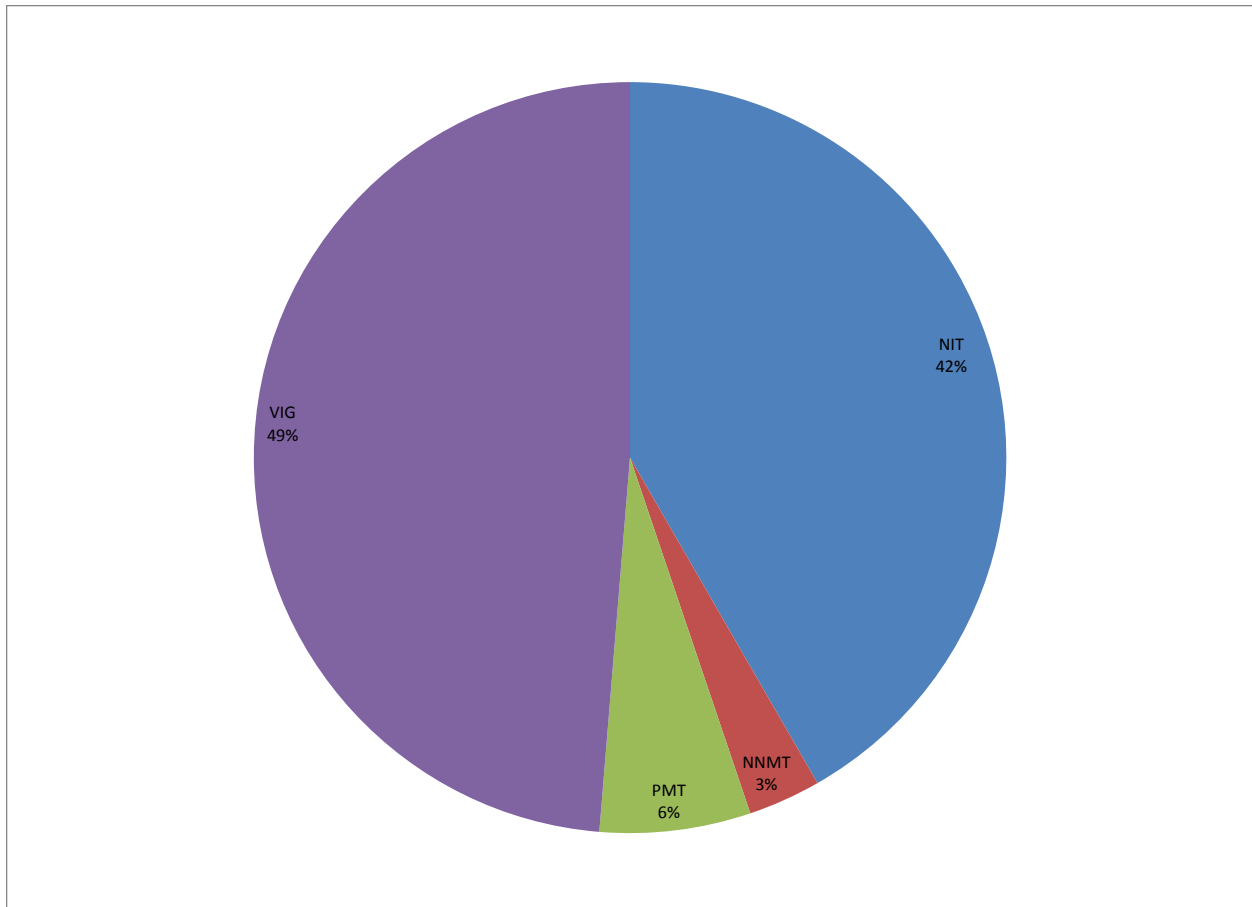
### Container Ports

- Newport News Marine Terminal (NNMT)
- Norfolk International Terminals (NIT)
- Portsmouth Marine Terminals (PMT)
- Virginia International Gateway (VIG)



**FIGURE 4 Container Ports in Hampton Roads**

Source: HRTPO staff via ESRI



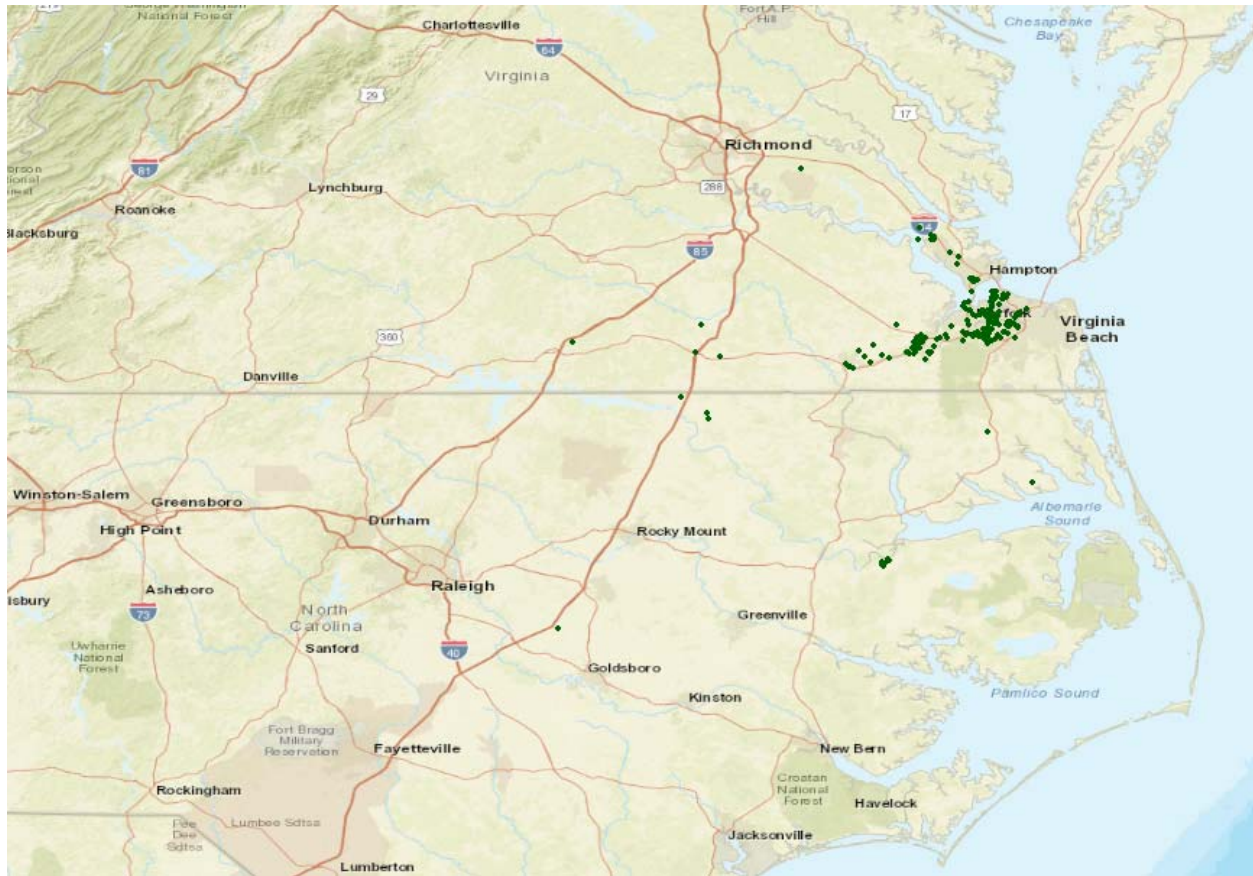
**FIGURE 5 Truck Traffic using Highway Gateways, by Port Origin, Jul'16-Jun'17**

Source: HRTPO staff calculation using HRTPO staff programming of StreetLight (4\_Ports\_and\_12\_1402\_od\_commercial.xlsx)

Of the four ports in Hampton Roads, VIG and NIT were dominant during the study period.

Unfortunately, as with the ATRI data, we got unreasonable results when using StreetLight to measure trips between port facilities and highway gateways, i.e. US 17 in Chesapeake showing high usage, and US 460 showing low usage. Upon further examination, HRTPO staff found that StreetLight data indicates that only a small portion of truck trips originating at port facilities have destinations outside of Hampton Roads<sup>2</sup>, as shown on the figure on following page. Fortunately, we realized that StreetLight's "trip" definition—StreetLight terminates a trip when the traveler is stationary for 5 minutes—was likely "ending" trips within Hampton Roads even though the actual trip continued outside the region. In fact, many of the "trips" ended near the port facility, apparently due to stopping at the gate.

<sup>2</sup> For VIG origins, StreetLight indicates that only 12% of truck trips have destinations beyond the subject 12 highway gateways.



**FIGURE 6 Virginia and North Carolina Trip “Ends” of Trucks from VIG, Jul’16-Jun’17,**  
one dot equals 100 StreetLight Index Trucks

Source: HRTPO mapping via ESRI using HRTPO staff programming of StreetLight (port trucks- StreetLight- VIG as origin.mxd)

The volatility of low sample size renders these few trucks unreliable for estimating highway gateway usage.

### *Trips Between Port-Related Distribution Centers and Gateways*

In order to account for StreetLight's 5-minute-stop trip parameter, instead of examining trips directly from the subject ports, HRTPO staff used StreetLight to enumerate trips between *port-related distribution centers* and regional highway gateways as a measure of the usage of those gateways by port-related trucks.

#### Port-Related Distribution Centers<sup>3</sup>

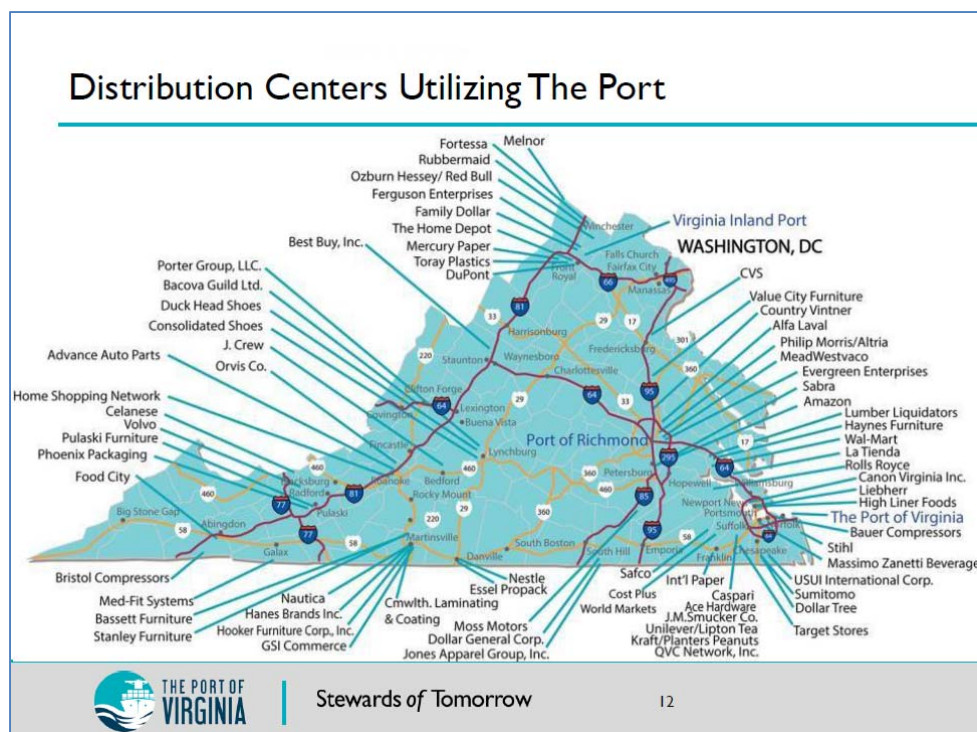
- Canon Virginia
- Liebherr
- High Liner Foods
- Bauer Compressors
- Stihl
- Massimo Zanetti Beverage
- USUI International
- Sumitomo
- Dollar Tree
- Lumber Liquidators
- Haynes Furniture
- Target Stores
- Caspari
- Ace Hardware
- J.M. Smucker
- Unilever / Lipton Tea
- Kraft / Planters Peanuts
- QVC Network
- International Paper
- Cost Plus World Market
- Safco
- Wal-Mart
- La Tienda

HRTPO staff developed this list by identifying which of the distribution centers on the Port of Virginia's "Distribution Centers Utilizing the Port" map (following page) are located within Hampton Roads (i.e. within the gateways listed in the following "Findings" section).

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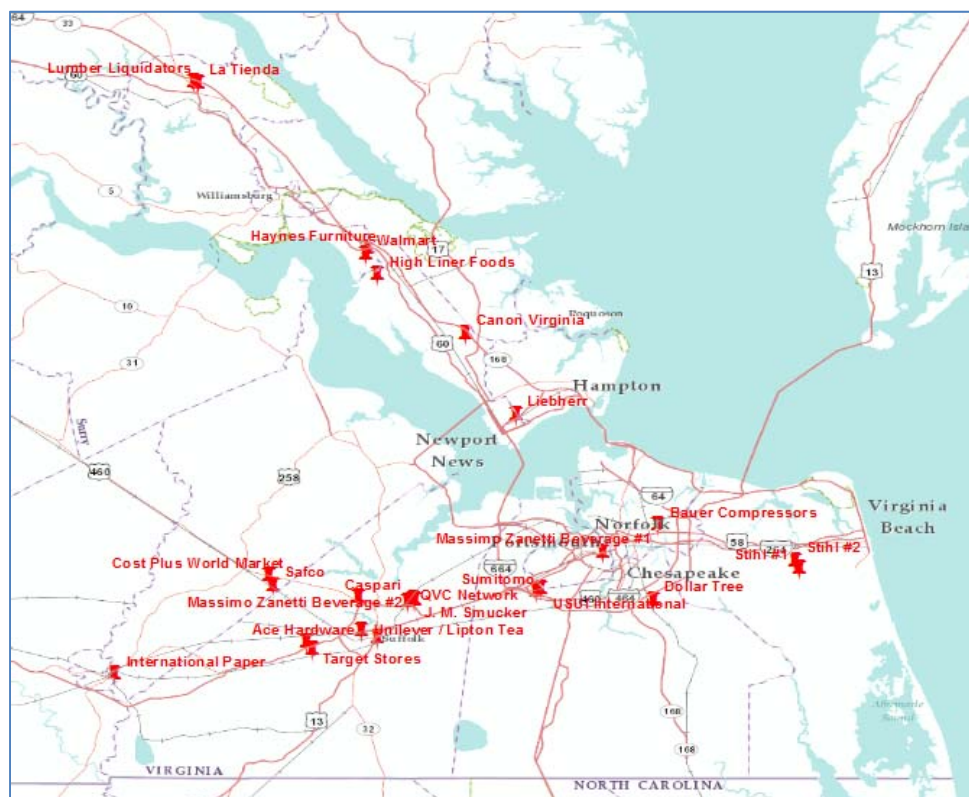
<sup>3</sup> Source: "Distribution Centers Utilizing The Port" map, Port of Virginia Update to the Transportation Technical Advisory Committee, Jeff Florin, June 3, 2015 TTAC (see following page).





**FIGURE 7 Port-Related Distribution Centers**

Source: Port of Virginia Update to the Transportation Technical Advisory Committee, Jeff Florin, June 3, 2015 TTAC



**FIGURE 8 Port-Related Distribution Centers within Hampton Roads**

Source: "Distribution Centers Utilizing the Port" slide entered by HRTPO staff into Streetlight then processed with ESRI (snipped)

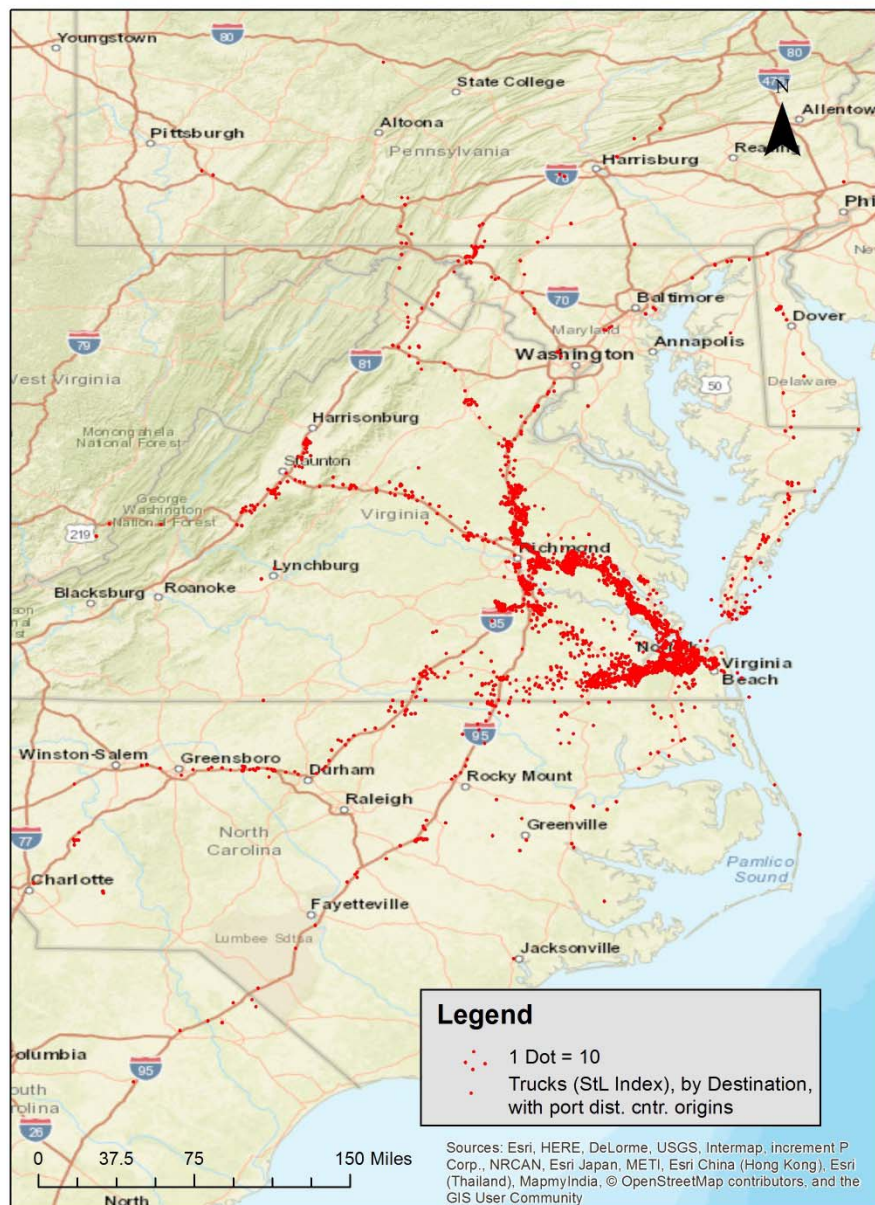
## FINDINGS

Having identified a method of analyzing the travel of port-related trucks *while accounting for the 5-minute StreetLight* rule—i.e. using port-related distribution centers, instead of port terminals, as trip origins—HRTPO staff was able to successfully determine routes used by port-related trucks.

First, HRTPO staff programmed StreetLight to determine the *destinations* of trips from Port-Related Distribution Centers using the following specifications:

- Geography: census block groups
- Data period: July 2016 thru June 2017 (one year)
- Vehicle type: commercial trucks (14k lbs. and above)
- Data type: average weekday, StreetLight traffic index

According to StreetLight, the destination of trucks with origins at Port-Related Distribution Centers in Hampton Roads is as follows:



**FIGURE 9 Destinations of Trucks from Port-Related Distribution Centers, Jul'16-Jun'17**

Source: HRTPO staff processing (via ESRI) of trips from Port Distribution Centers via Streetlight (seven states w world st map.jpg)

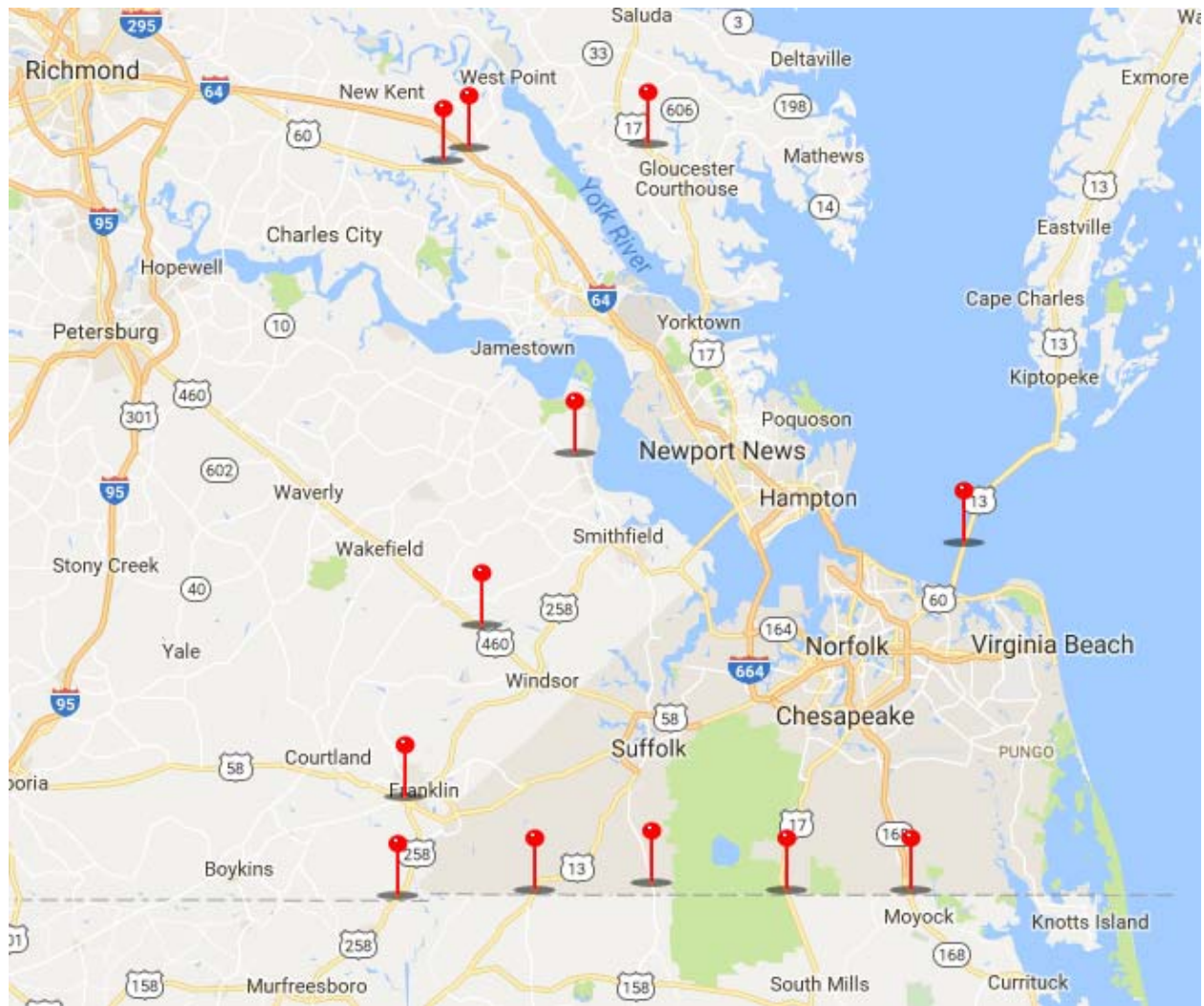
Note that, due to the 5-minute StreetLight trip rule discussed above, although the above trip ends may be intermediate stops (e.g. fueling locations) along the way to the actual final (undetermined) destination, they fall far enough from the distribution center origins to determine the highway gateway used.

As expected, port-related trucks (in this case trucks serving Port-Related Distribution Centers) appear to be using I-64, US 460, and US 58 to reach destinations served by I-95, I-81, and I-85.

Fortunately, for our purposes, StreetLight can also be used to count vehicles at gateways identified along the paths to trip destinations. Accordingly, HRTPO staff entered the following Regional Highway Gateways for Hampton Roads into StreetLight:

- VA 168 (Chesapeake)
- US 17 (Chesapeake)
- VA 32 (Suffolk)
- US 13 (Suffolk)
- US 258 (Southampton County)
- US 58 (Franklin)
- US 460 (Isle of Wight County)
- VA 10 (Isle of Wight County)
- US 60 (James City County)
- I-64 (James City County)
- US 17 (Gloucester County)
- US 13 (Virginia Beach)





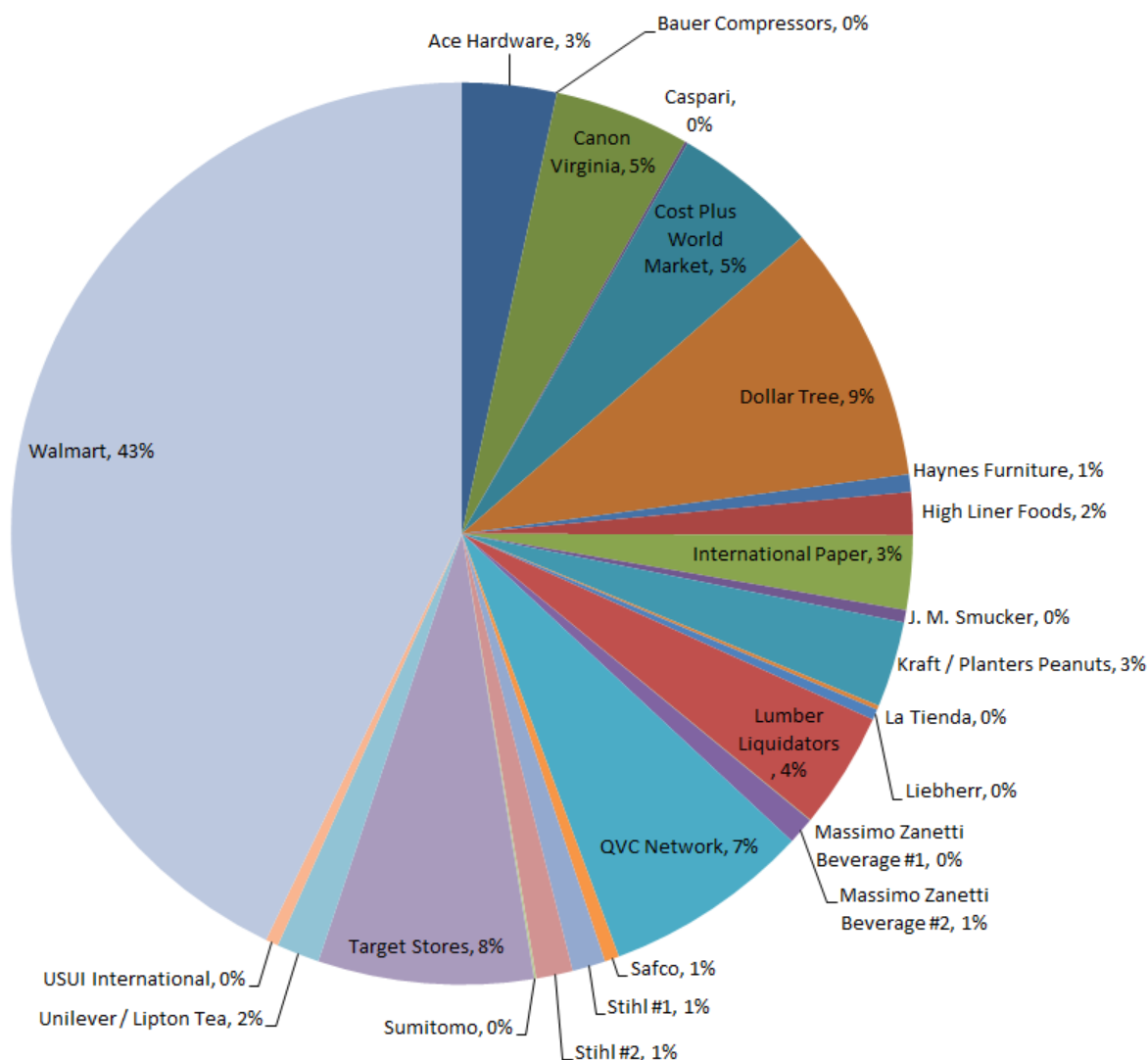
**FIGURE 10 Highway Gateways at the Edge of Hampton Roads**

Source: HRTPO staff processing via StreetLight (snipped)



Using the same specifications as outlined above for the above destination analysis, HRTPO staff used StreetLight to determine the highway gateways used by trucks from Port-Related Distribution Centers.

According to HRTPO staff processing of StreetLight data, the subject Port-Related Distribution Centers contribute to truck traffic at the gateways as follows:

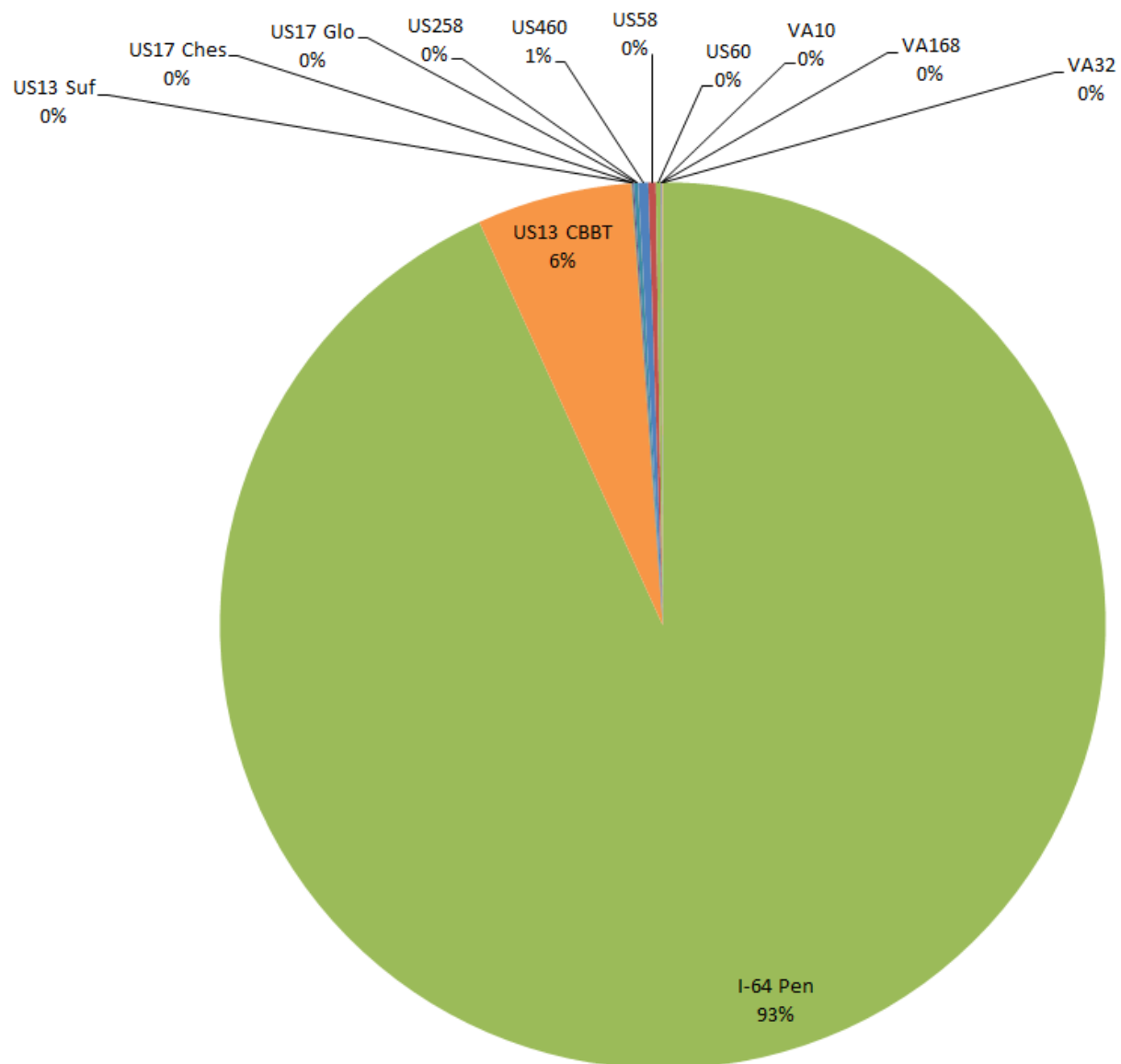


**FIGURE 11 Truck Usage of Highway Gateways, by Port-Related Distribution Center**

Source: HRTPO staff processing of StreetLight data, July'16 thru June'17 (Port\_Distr\_Cntrs\_1040\_od\_commercial.xlsx)

Note the dominance of the Walmart distribution center in James City County. The high truck volumes at Walmart (43%) and Haynes (1%), both located on Green Mount Parkway, indicates the importance of the proposed Skiffes Creek Connector project.

According to HRTPO staff processing of StreetLight data, trucks from Port-Related Distribution Centers on the Peninsula use highway gateways as follows:



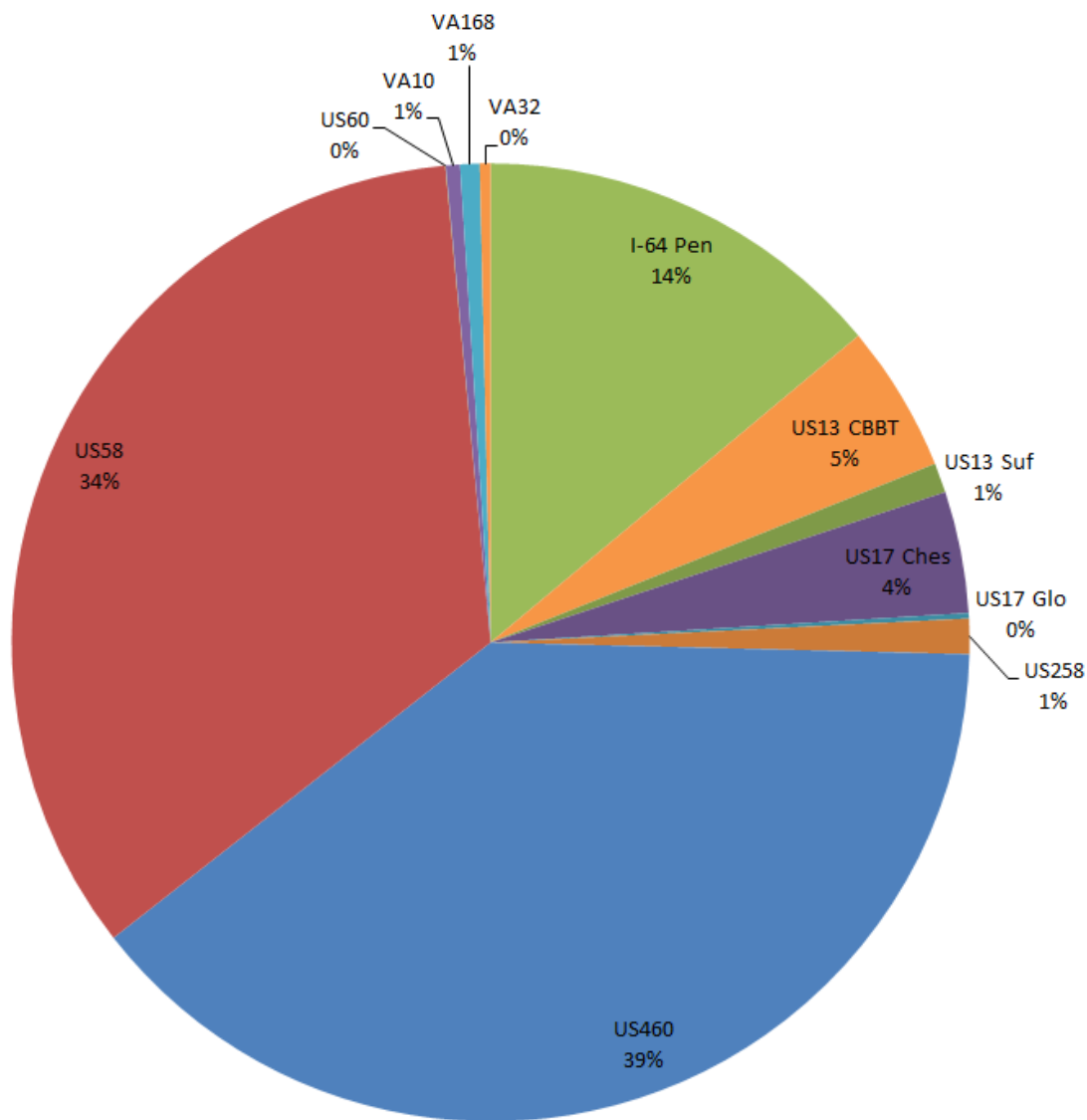
**FIGURE 12 Usage of Gateways by *Peninsula* Port-Related Distribution Centers**

Source: HRTPO staff processing of StreetLight data, July'16 thru June'17 (Port\_Distr\_Cntrs\_1040\_od\_commercial.xlsx)

Not surprisingly, most of the trucks from Port-Related Distribution Centers on the Peninsula use I-64 to leave the region. Somewhat surprisingly, a significant number of truck drivers serving distribution centers on the Peninsula use the Chesapeake Bay Bridge Tunnel (CBBT), apparently driving out of their way<sup>4</sup> to avoid traffic in the DC area when serving destinations in the northeast.

<sup>4</sup> The CBBT lies south of the Peninsula.

According to HRTPO staff processing of StreetLight data, trucks from Port-Related Distribution Centers on the Southside use highway gateways as follows:

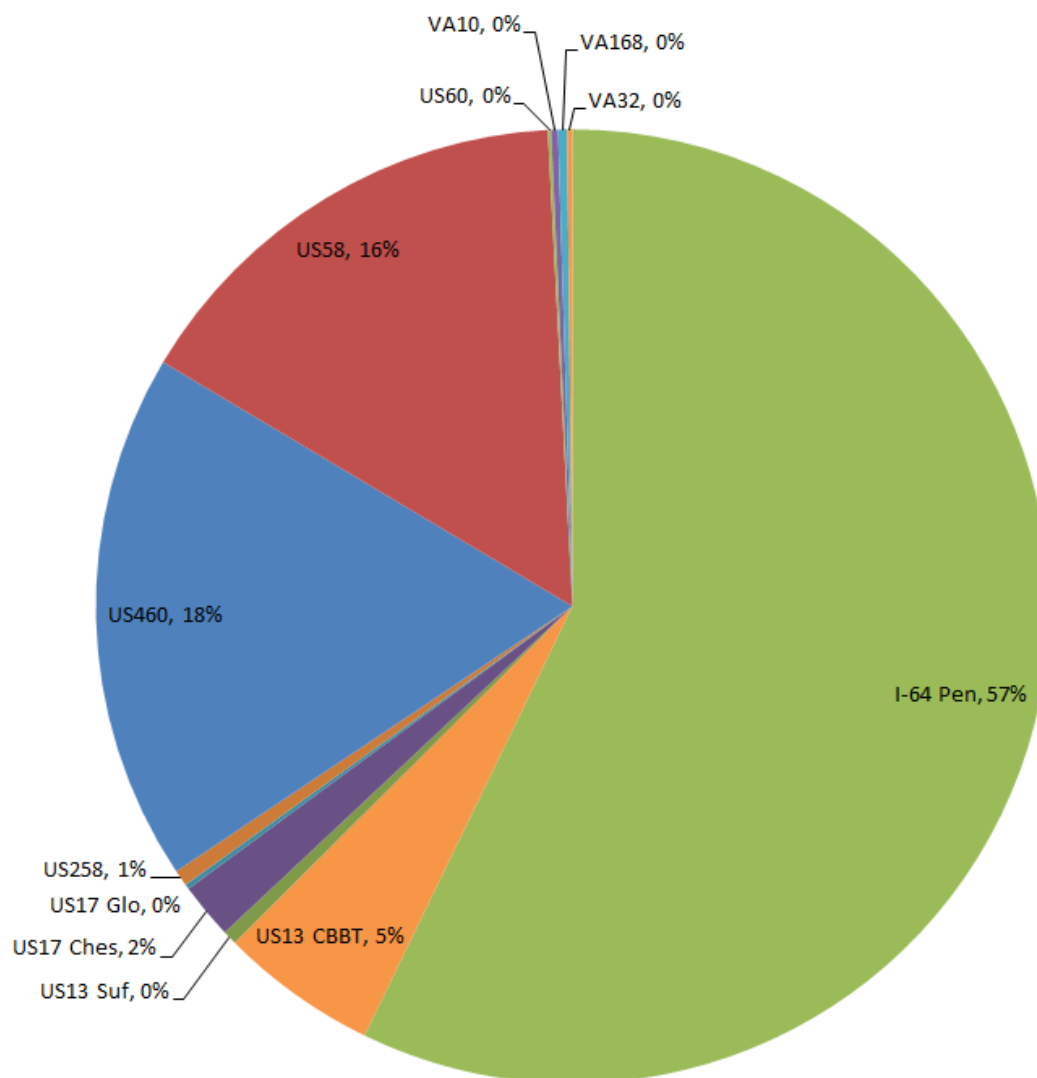


**FIGURE 13 Usage of Gateways by *Southside* Port-Related Distribution Centers**

Source: HRTPO staff processing of StreetLight data, July'16 thru June'17 (Port\_Distr\_Cntrs\_1040\_od\_commercial.xlsx)

Not surprisingly, many of the trucks from Port-Related Distribution Centers on the Southside use US 58 and US 460 to leave the region. Given that many destinations lie west and north of Richmond, the portion of port-related trucks using I-64 to leave Hampton Roads (14%, or one out of seven) is surprisingly small. Congestion at the harbor crossings (Hampton Roads Bridge Tunnel [HRBT] and Monitor Merrimac Memorial Bridge Tunnel [MMMBT]) and along I-64 west of the Newport News – Williamsburg airport may explain this result.

Combining Southside and Peninsula, trucks from Port-Related Distribution Centers in Hampton Roads use highway gateways as follows:



**FIGURE 14 Usage of Gateways by Hampton Roads Port-Related Distribution Centers**

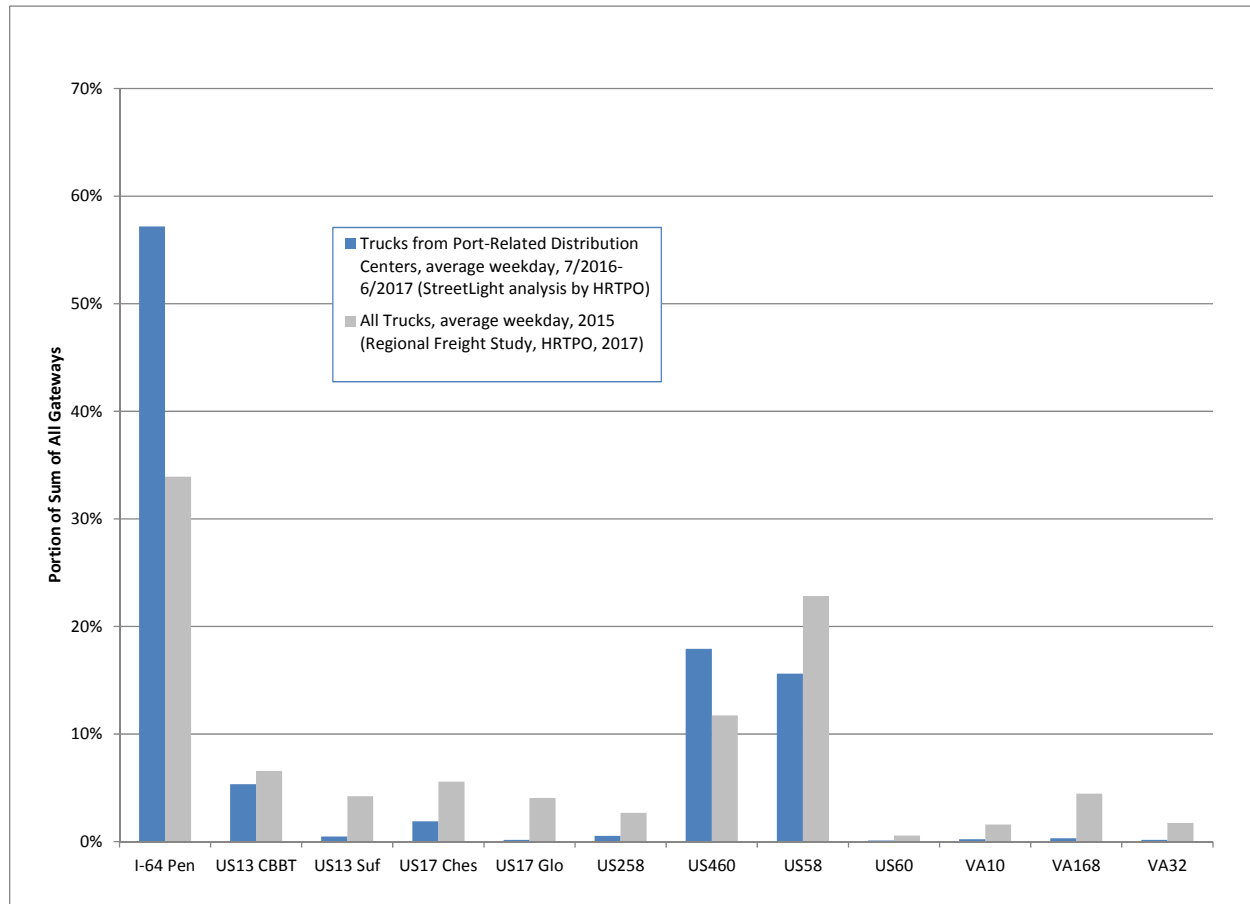
Source: HRTPO staff processing of StreetLight data, July'16 thru June'17 (Port\_Distr\_Cntrs\_1040\_od\_commercial.xlsx)

Not surprisingly, most of the trucks from Port-Related Distribution Centers in Hampton Roads use I-64, US 58, and US 460 to leave the region.

This identification/confirmation of major gateways indicates the importance of VDOT's current US 58 Arterial Management Plan work and several of the projects the HRTPO Board recommended for funding via the Hampton Roads Transportation Fund (HRTF), including:

- I-64 Peninsula (3 phases)
- US 460/58/13 Connector

In order to check the study results, HRTPO staff compared the study's measurement of highway gateway usage by trucks serving *port-related distribution centers* to known highway gateway usage by trucks serving *all purposes*, as shown below:



**FIGURE 15 Usage of Gateways by Trucks**

Source: HRTPO staff processing of VDOT count and StreetLight GPS data (Port\_Distr\_Cntrs\_1040\_od\_commercial.xlsx)

The above comparison indicates:

- The top three gateways for port-related trucks, and the top three gateways for all trucks, are the same three gateways: I-64, US 460, and US 58.
- I-64 Peninsula and US 460 appear to be even more important to port-related trucks than they are to all trucks.



## **NEXT STEPS**

The HRTPO can use the product of this study as input to its decisions when planning and funding highway improvements with an eye to helping port operations. Specifically, HRTPO staff intends to:

- Employ the study's measurement of highway gateway usage by port-related trucks in scoring candidate projects with the HRTPO Prioritization Tool (tool component: "increase access to port facilities", 10 points for highway projects)
- Provide the study's measurement of highway gateway usage by port-related trucks to the consultants preparing the US 58 Arterial Management Plan
- Provide the study's measurement of highway gateway usage by port-related trucks to the consultants preparing the Regional Connectors Study.

## **PUBLIC COMMENTS**

Find public comments on the following pages, with responses **in red**.



# COMMONWEALTH of VIRGINIA

DEPARTMENT OF TRANSPORTATION  
HAMPTON ROADS DISTRICT  
1700 NORTH MAIN STREET  
SUFFOLK, VIRGINIA 23434

Charles A. Kilpatrick, P.E.  
Commissioner

January 17, 2018

Camelia Ravanbakht, Ph.D.  
Hampton Roads Transportation Planning Organization  
723 Woodlake Drive  
Chesapeake, Virginia 23320

Re: District Review of HRTPO Draft Transportation Studies for January 2018

- DRAFT Hampton Roads Regional Priority Projects Round 2
- DRAFT Hampton Roads Highway Gateways Used by Port Trucks

Dear Dr. Ravanbakht,

The Hampton Roads District Transportation Planning Office has completed a formal review of the Hampton Roads Transportation Planning Organization's (HRTPO) draft reports listed above. The primary focus of this review is to ensure consistency with federal and state program requirements as identified in federal transportation code.

The *Hampton Roads Regional Priority Projects Round 2* is produced as part of HB 2313 and the Hampton Roads Transportation Accountability Committee, the HRTPO Board directed TPO staff to review and identify projects in the 2040 LRTP that could be considered as Round 2 Hampton Roads Regional Priority Projects. Round 1 projects will not be impacted in terms of priority or funding by the work done in Round 2. The *Hampton Roads Highway Gateways Used by Port Trucks* will be used to inform the scoring of candidate projects under the HRTPO project Prioritization Tool, and to provide the study results as input for major regional studies currently being conducted by HRTPO and VDOT.

The Hampton Roads District has reviewed these documents and finds that they are consistent with state and federal MPO program requirements and will continue to coordinate and provide data with the HRTPO for subsequent updates. We do however have the following comments regarding the documents:

*Hampton Roads Regional Priority Projects Round 2*

- Please consider including the Air Terminal Interchange Project for consideration on the Round 2 priority list.
- Please reconsider including the Brambleton Avenue (Norfolk) and Route 17 (York-Gloucester) improvement projects in the Round 2 priority list. Although your analysis shows limited regional congestion relief, these principal arterials meet the congestion threshold and provide direct access to state maintained regional interstates and facilities.
- Consider using a legend to explain the highlighted items in gray and the meaning of the red line separating the items (Slide 10).

*Hampton Roads Highway Gateways Used by Port Trucks:*

Although these two examples are gateways to the HR District, this HRTPO study used gateways to the HRTPO study area.

Page 4, Figure 1: Are there any gateways identified in the western and northern edges of The VDOT Hampton Road District such as US 58 in Emporia or Route 13 near the Maryland state line?

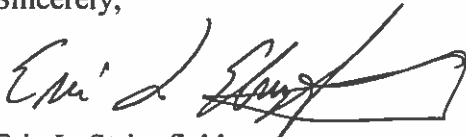
Page 5-6: We concur with your findings related to ATRI American Trucking Research Institute Data. The data dated (Sept 2014) does agree with observed existing conditions. ARTI data should be referenced as information only and not be used for analysis that determines future recommendations. For future studies continue to use ARTI as a comparison data only until it can be validated against confirmed data resources. O.K.

- Page 17, Figure 11: Please note the importance of noting the 43% "dominance" of the Walmart Distribution Center in James City County. Are you certain that truck traffic is only going to this particular Walmart facility? If so, might be better to note the importance of planned projects within the vicinity of Route 60 such as Route 60 Relocation, Skiffes Creek Connector, I-64 Capacity Improvements, etc. Project implications were added to pages 17 and 20.
- Page 18, Figure 12: Please identify the remaining corridors shown on pie chart. Done.
- Will the final report be in the standard HRTPO Format? Yes.
- Please consider adjusting the paragraph alignment, the paragraphs prior to the Table of Contents have a justified alignment and preceding sections are aligned left.

Changed paragraphs under "Report Documentation" to left-justified.

The comments identified are preliminary in nature and provided for your review or revision as deemed appropriate. Please notify Mr. Carl Jackson at 757-925-2596, should you have any questions.

Sincerely,



Eric L. Stringfield  
Hampton Roads Transportation Planning Director

ELS/cej