Delmarva Freight Plan

Chapter 7

Future Freight Planning Scenarios

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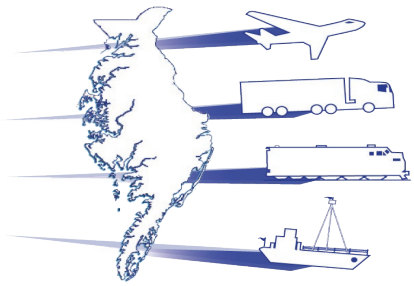
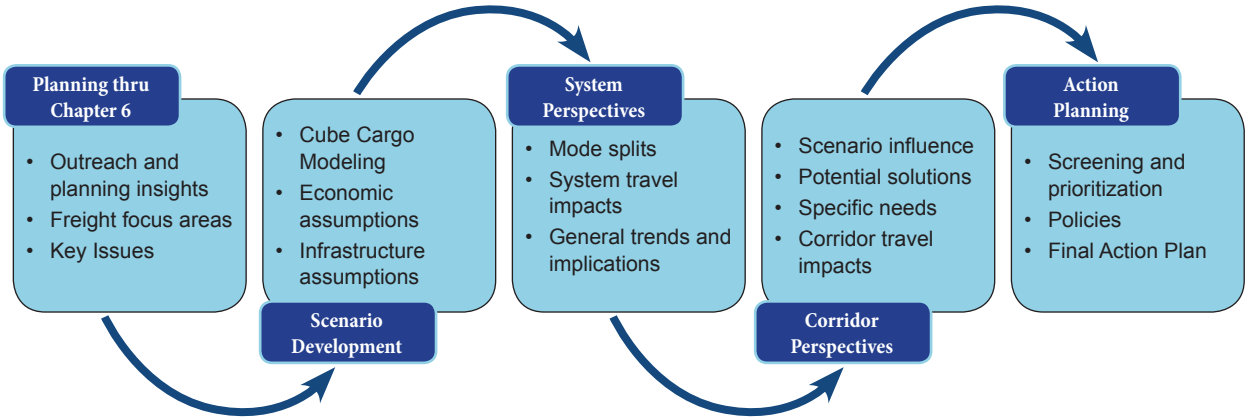
An evaluation of future freight planning scenarios was completed to explore "what-if" types of questions by way of "methodically-constructed stories about alternative futures in which today's decisions might play out."[1] Each scenario assumed a combination of changes that to varying degrees may be within an agency's control (e.g. transportation investments) or beyond an agency's control (e.g. regional economic influences). Evaluating how such changes might impact the freight transportation system helped to describe futures to which the DOTs, MPOs, and other stakeholders can better prepare to react, ultimately fostering more informed decision-making, effective infrastructure planning, and relevant policy guidance.



7.1 Scenario Planning Process

The scenario planning process (*Exhibit 7.1*) encompassed a qualitative/quantitative review of how the freight transportation system might perform under different scenarios by combining stakeholder guidance on future trends and issues with general study insights, commodity details, and the project's Cube Cargo commodity flow model. Background planning efforts and key issues from previous chapters drove the selection of interests that would be reflected in specific scenarios. These interests were then defined by a series of economic and infrastructure related assumptions that could be coded into the Cube Cargo model. The model was re-analyzed for each scenario, and revised model output was compiled to compare performance measurements at the system level for the overall peninsula, and at the corridor level for key freight corridors serving the area. These perspectives supported the identification of freight-related needs, scenario influences, and project or policy solutions that were subsequently crafted into the final action plan.

Exhibit 7.1 – Scenario Planning Process



[1] Caplice, C., and S. Phadnis. 2013. NCHRP Report 750: Strategic Issues Facing Transportation; Volume 1: Scenario Planning for Freight Transportation Infrastructure Investment. Transportation Research Board.

7.2 Scenario Development

Freight planning outreach, coordination, and study efforts identified an initial set of economic and infrastructure related factors that were incorporated into six scenarios as follows:

- 2010 Baseline
- 2040 Trendline (or Future No-Build)
- 2040 Multimodal Constraint (with Trendline Growth)
- 2040 Multimodal Constraint (with Accelerated Growth)
- 2040 Multimodal Enhancement (with Trendline Growth)
- 2040 Multimodal Enhancement (with Accelerated Growth)

Scenario Definitions

2010 Baseline corresponds to "existing" conditions on the peninsula, matched in this case to a snapshot in time of approximately calendar year 2010 based on the dates of the population, demographic, freight, or other data sets used throughout this study and as a source for the Baseline commodity flow model.

2040 Trendline, alternately referred to as the Future No-Build, assumes that population, households, and employment levels on the peninsula will increase or decrease in a manner consistent with today's trends and expectations. From an infrastructure perspective, the available highway, rail, water, or other transportation networks on the peninsula are assumed to be essentially the same as they are today, with the exception of completing/adding select committed transportation improvements (*Chapter 5*) that are or will be programmed for implementation by 2040.

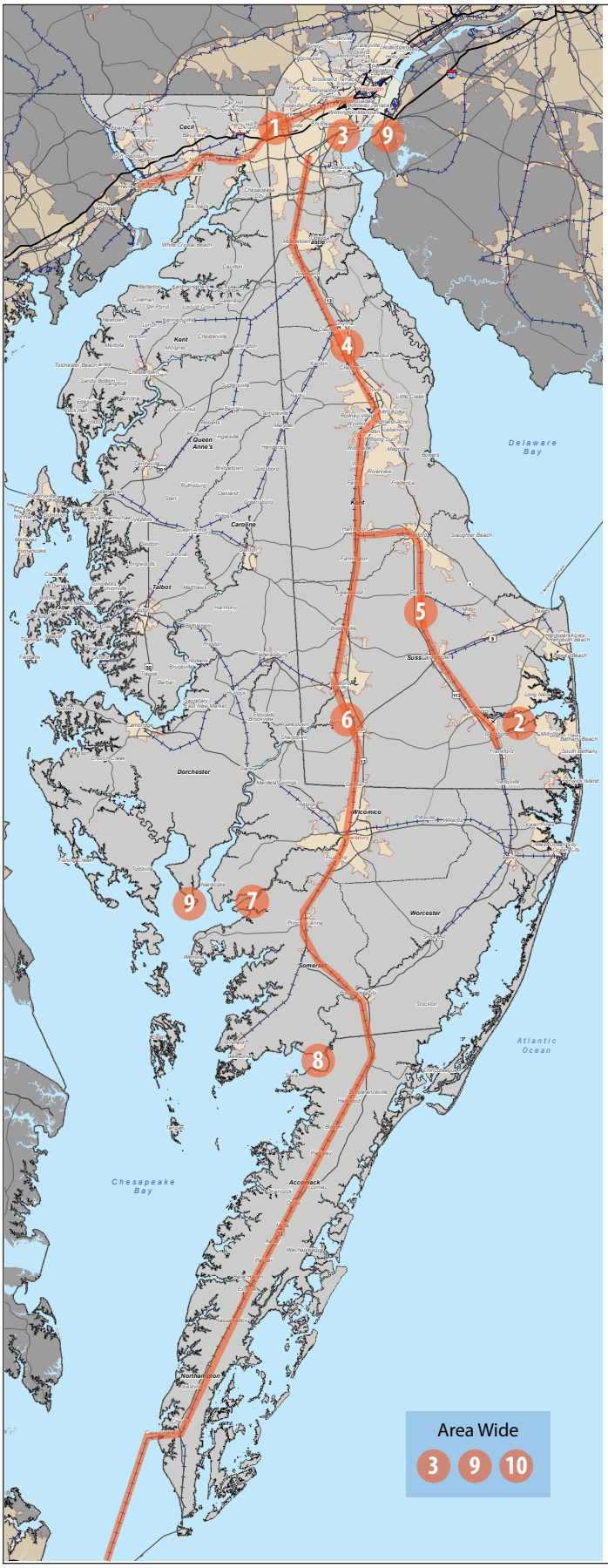
2040 Multimodal Constraint (with Trendline Growth) explores a loss or reduction of key multimodal freight transportation elements or opportunities on the peninsula (*Exhibit 7.2*). Infrastructure changes focus primarily on constraints to the rail and barge transportation networks, which invariably increases reliance on truck transportation and the highway network. Future population, household, and employment growth assumptions in this scenario match those assumed in the 2040 Trendline.

2040 Multimodal Constraint (with Accelerated Growth) explores the same infrastructure constraints as the related scenario above, but in this case assumes a more expansive future economic climate on the peninsula. Economic growth beyond that projected for the 2040 Trendline is assumed to come from a general background increase (or decreased rate of decline) in overall population, household, and employment levels, coupled with growth surges in targeted industries and due to market shifts or productivity improvements.

2040 Multimodal Enhancement (with Trendline Growth) explores an improvement or expansion of key multimodal transportation elements or opportunities on and around the peninsula (*Exhibit 7.3*). Infrastructure changes focus primarily on operational or intermodal access improvements that maintain or refine the peninsula's current highway, rail, and barge transportation networks. The influences of potentially significant regional multimodal shifts are also incorporated including, for example, substantial increases in freight activity at the Delaware City Refinery and through the Ports of Wilmington, Baltimore, and Norfolk. With the exception of these added regional shifts, future population, household, and employment growth assumptions in this scenario match those assumed in the 2040 Trendline.

2040 Multimodal Enhancement (with Accelerated Growth) explores the same infrastructure enhancements and regional multimodal shifts as the related scenario above, but in this case assumes a more expansive future economic climate on the peninsula. Economic growth beyond that projected for the 2040 Trendline is assumed to occur at the same levels and for the same reasons as those noted in the 2040 Multimodal Constraint (with Accelerated Growth) scenario.

Exhibit 7.2 – Multimodal Constraint Scenario Overview



What would the future look like if freight transportation on the peninsula was constrained by a loss or reduction of key multimodal elements or opportunities?

For example, WHAT IF…

1. … freight rail access across/along the NEC continues to be restricted to a narrow window of time?
2. … coal freight demand to the Indian River power plant ceased?
3. … at-grade rail / highway crossing conflicts increased?
4. … the NS Delmarva Secondary became a shortline railroad (from Porter to Seaford)?
5. … the NS Indian River Secondary became a shortline railroad (from Harrington to Frankford)?
6. … rail operations south of Seaford effectively ceased due to key infrastructure failures (e.g. Seaford rail bridge or BCRR car float)?
7. … Wicomico River barge travel was restricted due to funding / dredging constraints?
8. … Pocomoke River barge travel was restricted due to funding / dredging constraints?
9. … oil and gas imports/exports had fewer transport options?
10. … truck volumes and roadway maintenance needs increased substantially?

Constraint Scenario w/ Trendline Growth:

What would this future look like in 2040 with trendline economic or demographic changes?

Constraint Scenario w/ Accelerated Employment:

What would this future look like in 2040 with accelerated employment growth in certain industries?

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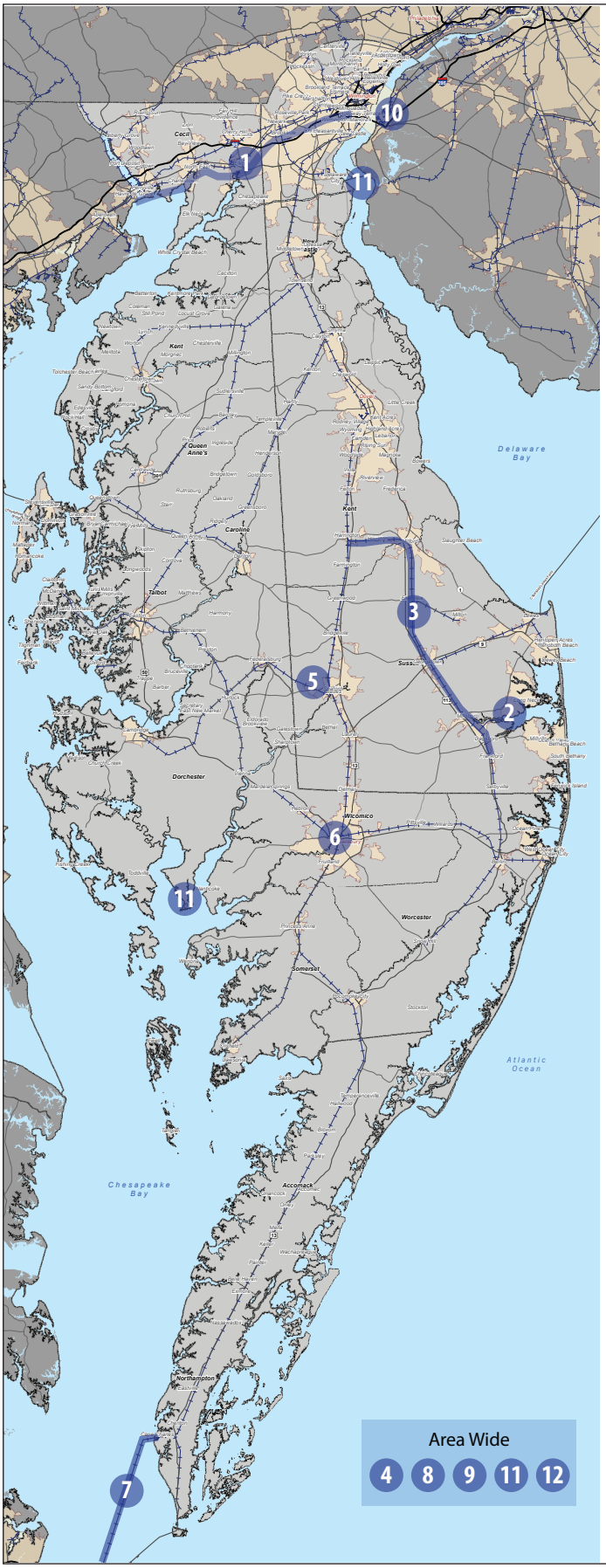
Exhibit 7.3 – Multimodal Enhancement Scenario Overview



What would the future look like if freight transportation on the peninsula was enhanced or expanded by key multimodal elements or opportunities?

For example, WHAT IF…

1. … a completed Chesapeake Connector expanded freight rail access along/across the NEC?
2. … coal freight losses to the Indian River power plant were offset by other/new rail demand?
3. … the NS Indian River Secondary became a shortline railroad (from Harrington to Frankford)?
4. … the peninsula's rail and shortline rail networks were enhanced (e.g., removal of speed/weight restrictions or bottlenecks)?
5. … the Seaford Rail Bridge was reconstructed?
6. … a new intermodal facility was strategically located (e.g. near Newark, Seaford, Delmar, or Salisbury)?
7. … BCRR car float operations were stabilized or expanded?
8. … Post-Panamax shipping trends directly impacted the region (e.g., via Baltimore or Norfolk)?
9. … short sea shipping opportunities or the marine highway concept flourished?
10. … the Port of Wilmington developed a new container facility?
11. … oil and gas imports/exports had more transport options?
12. … higher freight volumes increased conflicts with other users (e.g., barges versus recreational water or waterfront property access; or trucks versus seasonal tourism)?

Enhancement Scenario w/ Trendline Growth:

What would this future look like in 2040 with trendline economic or demographic changes?

Enhancement Scenario w/ Accelerated Employment:

What would this future look like in 2040 with accelerated employment growth in certain industries?

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Future Growth Assumptions

Variations in the level of future economic growth between scenarios were defined in terms of population, household, and employment changes that were incorporated into the project's Cube Cargo model. Considering the internal workings of the model, these changes affected future estimates of freight production and consumption on the peninsula in two primary ways:

- **Coarse Zone Analysis:** at a broader county level the county-specific population, household, and employment inputs directly influence the types and amounts of freight that are produced or consumed in each county. Details such as the specific categories of employment needed by the model to estimate its 11 different commodity groups (*Chapter 3*) were derived during the model development and calibration/validation process. Once calibrated to match the 2010 Baseline conditions, the model utilized the same freight-generating equations to estimate future freight tonnage for each county based on the revised population, household, and employment estimates in each scenario.

- **Fine Zone Analysis:** at a more detailed traffic analysis zone (TAZ) level corresponding to the model's smaller areas that make-up each county, similar inputs also influenced the distribution of freight production and consumption throughout each county. In effect, assumptions at the coarse zone level dictate "how much" freight travels to/from each county, whereas assumptions at the fine zone level dictate "where" in the county that freight begins/ends its trip.

Trendline Growth

Baseline and Trendline estimates of the population, household, and employment levels and related growth factors on the peninsula were derived from a combination of 2010 County Business Pattern (CBP) data from the U.S. Census Bureau and WILMAPCO's 2010-2040 regional projections for growth and development. Overall for the study area, the 2040 Trendline Growth scenario reflected a 28% increase in population and a 30% increase in employment versus Baseline conditions (*Exhibit 7.4*). The corresponding model-generated annual freight estimates increased by approximately 70-80% versus Baseline conditions (*Exhibit 7.5-Exhibit 7.6*).

Exhibit 7.4 – Trendline and Accelerated Growth Comparison

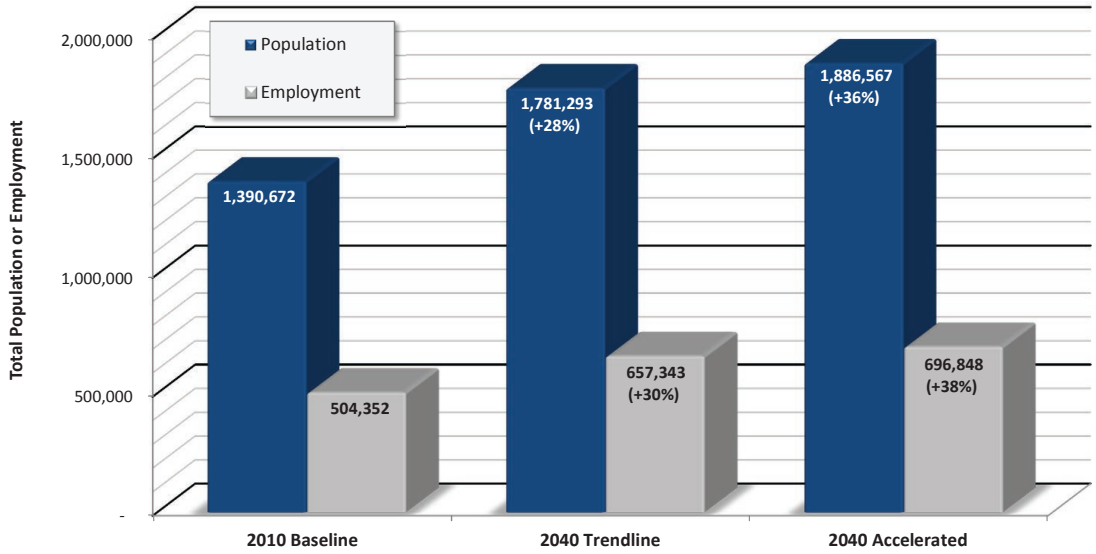


Exhibit 7.5 – 2040 Trendline Freight Production and Consumption by Cube Cargo Model Commodity Group

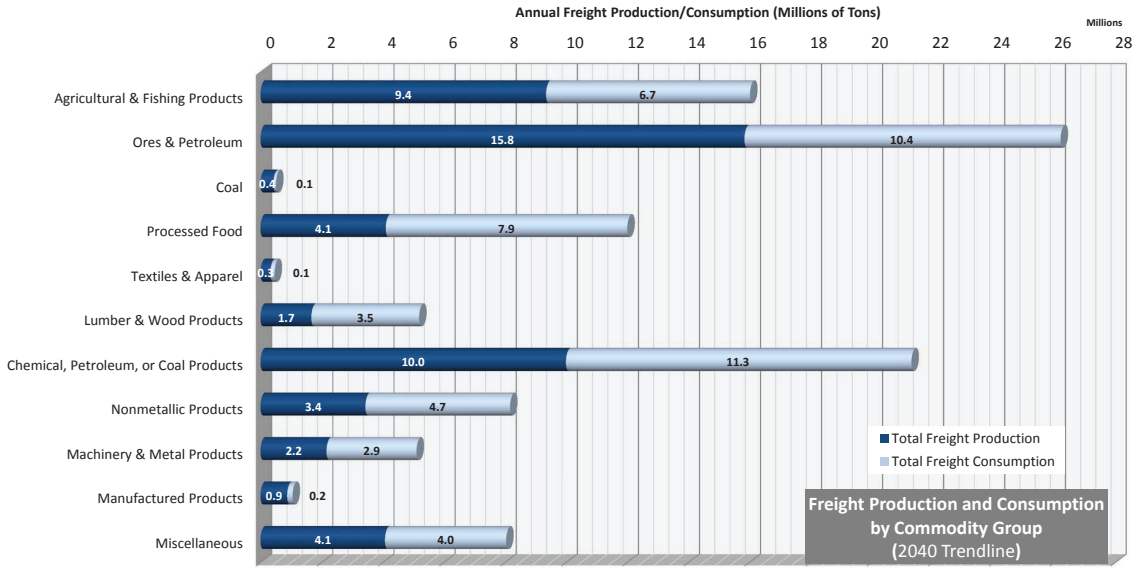
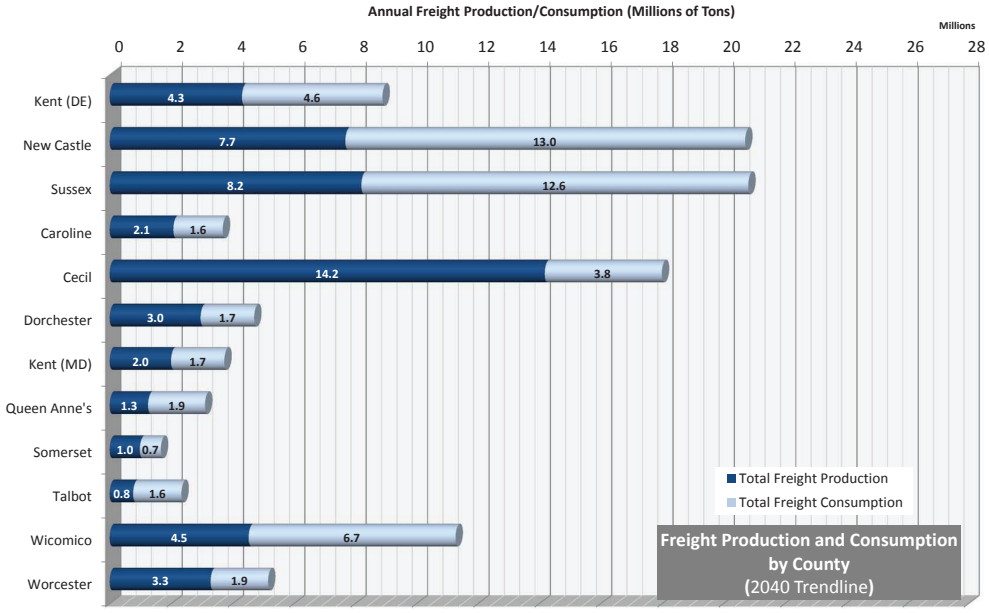


Exhibit 7.6 – 2040 Trendline Freight Production and Consumption by County



Accelerated Growth

The 2040 Accelerated Growth scenario reflected a number of changes derived from the study's economic research (*Chapter 2*), outreach discussions, and related questions or insights. These changes effectively assumed accelerated growth in four categories:

- **Background Growth:** population, household, and employment growth across all counties was assumed to occur at a 20% improved rate versus the Trendline. Population and households, specifically, were also further increased proportional to (and in support of) other employment growth that was assumed to occur due to the targeted industry or market shift assumptions noted below.

- **Targeted Industries:** employment growth in a select set of targeted industries that were deemed critical to the peninsula was assumed to occur at a 40% improved rate versus the Trendline. Specific industries included food manufacturing, petroleum and coal products, chemical manufacturing, fabricated metals, transportation & utilities, and wholesale trade.

- **Market Shifts:** a 5% additive surge in employment growth was applied to certain industries to reflect potential market shifts that could increase future poultry exports, agribusiness or grain imports, agriculture and higher-value crop or added-value food products, a chemical industry rebound, or related construction activities. Specific industries included agriculture, food manufacturing, petroleum and coal products, chemical manufacturing, and construction.

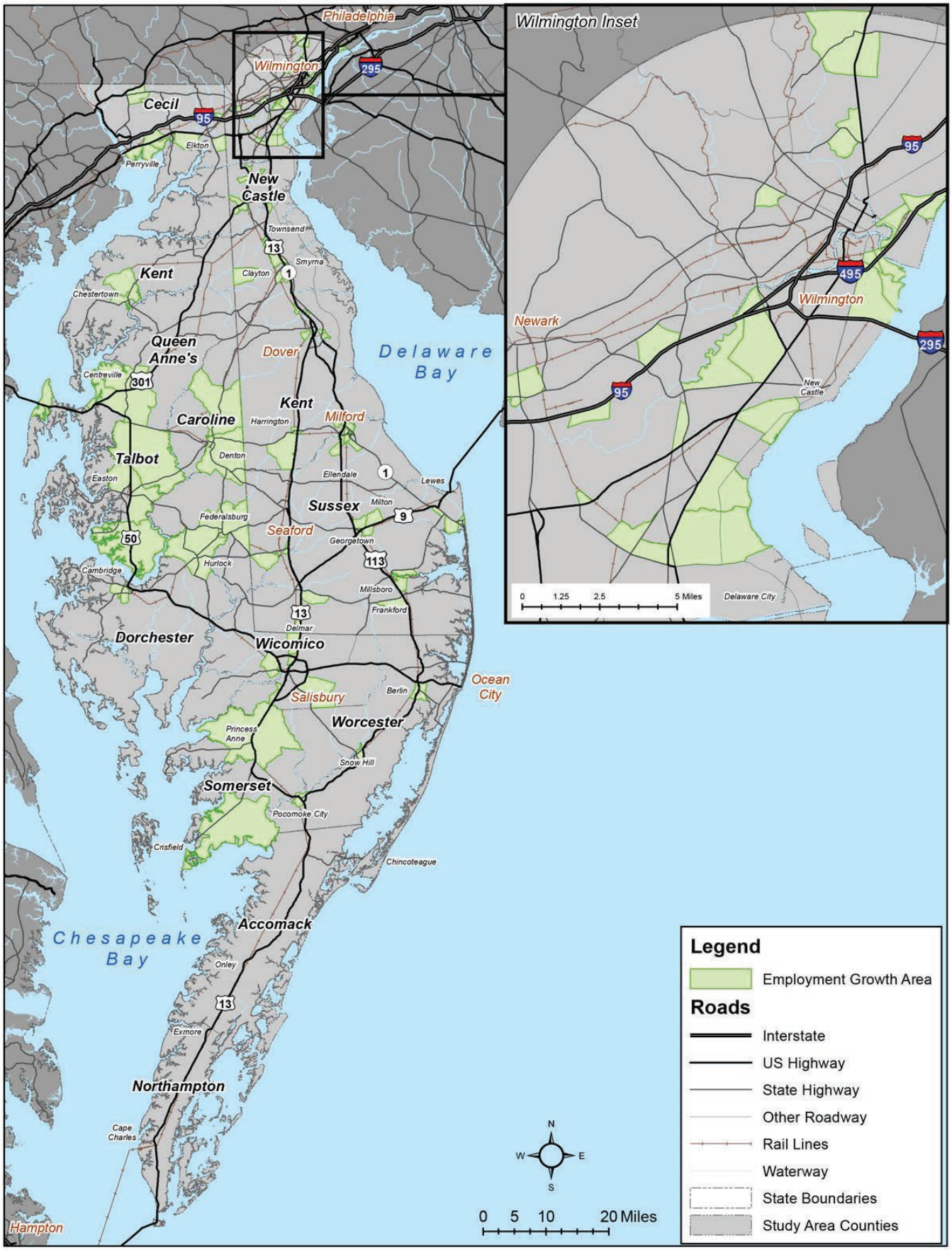
- **Productivity Factors:** a marginal increase in certain productivity factors within the commodity flow model (i.e., essentially influencing how much freight can be generated per employee) was applied to reflect future productivity increases within wholesale trade and truck, rail, or water transportation.

Overall for the study area, the 2040 Accelerated Growth scenario reflected a 36% increase in population and a 38% increase in employment versus Baseline conditions (previous *Exhibit 7.4*), or approximately 8% more growth than the Trendline scenario. The corresponding model-generated annual freight estimates were essentially double those of the Baseline, or approximately 14% additional growth versus the Trendline.

In terms of locating future growth throughout the peninsula, population and household growth was generally distributed proportionally versus the existing or projected totals at the county-level based on CBP data or at the TAZ-level based on WILMAPCO data. Employment growth in the Trendline scenario was likewise distributed; however, additional employment growth in the Accelerated scenario was manually distributed based on a series of assumptions. These assumptions helped to locate the accelerated growth in areas where it would be reasonable for additional freight activity to occur (*Exhibit 7.7*) based on:

- High volume employment areas
- High proportional growth areas
- Major employment or freight transfer hubs
- Surrounding transportation infrastructure
- Surrounding land use patterns
- Industrial parks, enterprise zones, or other incentive areas

Exhibit 7.7 – Accelerated Employment Growth Areas



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7.3 System Perspectives

System perspectives cover a broad snapshot of differences between scenarios and help to support the identification of policy or performance monitoring needs. Though system level distinctions between scenarios were often subtle, perspectives included model-based performance data that generally summarized the following:

- **Mode Splits**, focusing on freight tonnage by truck, rail, or barge[2] (*Exhibit 7.8*)
- **Travel Times**, focusing on representative travel to/from the Bay Bridge (*Exhibit 7.9*)
- **Truck VHT**, as a combined measure of truck volumes, travel times, and delays (*Exhibit 7.10*)
- **Annual Truck Costs**, focusing on vehicle and driver related costs (*Exhibit 7.11*)

Mode Splits

Key insights relative to tonnage and mode split data (*Exhibit 7.8*) include:

Truck Dominance: Freight movement by truck is clearly the dominant mode across all scenarios, typically moving around 80% of all goods, versus 12-15% by rail and only 5-8% by water in any future scenario.

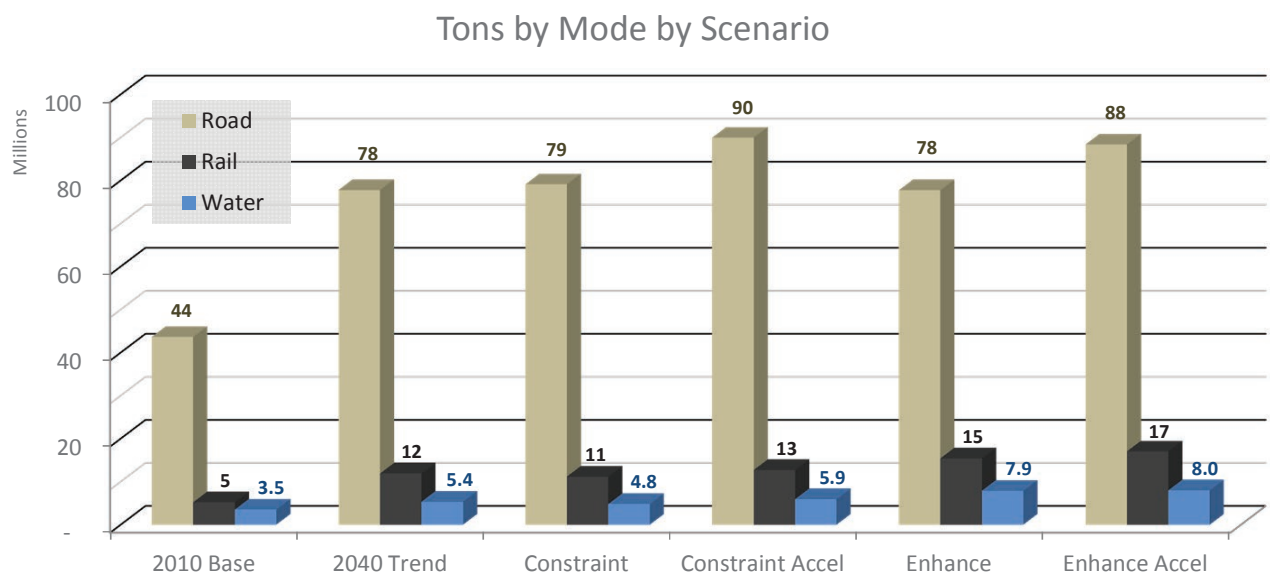
Mode Shift Potential: At the system level, multimodal infrastructure changes – whether constraints such as barge restrictions or enhancements such as improved rail access – do not have an overwhelming influence on the overall mode split. In part, this is likely attributable to the potential influence area of improvements on the peninsula versus the national/international reach of freight and goods movement. Relative to trips between very distant locations such as Chicago or Canada, for example, improvements on the peninsula may not, by themselves, provide sufficient benefits to alter the overall route or mode choice of a given freight movement. This does not, however, negate potential local/regional benefits for the peninsula or the need to support future growth and economic opportunities, nor does it reflect subtle differences that may be more relevant to corridor-specific operations that will be discussed in the pages ahead.

Multimodal Role in Growth Management: Despite a relatively low level of sensitivity in terms of shifting which modes of freight travel may be utilized today, efficient multimodal access will help to manage the overall freight system and related truck traffic increases in each future scenario. This would be especially true in light of notable growth under the two Accelerated scenarios – each showing a 14-16% annual freight increase by truck (10-12M additional tons) versus the 2040 Trendline. It would also be true in both Enhancement scenarios in which 30-49% tonnage increases via rail/water modes effectively yield a nominal decrease in the proportion of freight moving by truck (78% by truck with enhancements versus 83% without).

Economic Competitiveness: Quantitative insights aside, an overarching fact is that the ability to move Delmarva freight by rail or barge efficiently is inherently valuable to the peninsula's existing and future industry-specific needs, economic competitiveness, and its ability to help enable or accommodate future freight-related growth.

[2] Model-based performance data compares only freight movements via road, rail, or water (i.e., river barge) systems that are coded and analyzed within the Cube Cargo model. This does not include cargo movements by air or commodity flows exclusively by pipeline. The water tonnages reported here also do not include shipping volumes to/from major regional/international ports such as the Port of Wilmington, although the landside component of this port traffic would be reflected in the reported truck tonnages.

Exhibit 7.8 – System Performance Summary – Tonnage and Mode Splits



MTon by Mode	2010 Base	2040 Trend	Constraint	Constraint Accel	Enhance	Enhance Accel
Road	43.7	77.8	79.1	90.0	77.7	88.4
Rail	5.2	11.9	11.2	12.7	15.4	17.0
Water	3.5	5.4	4.8	5.9	7.9	8.0
TOTAL	**52.4**	**95.1**	**95.1**	**108.6**	**101.1**	**113.4**

% Change in Ton by Mode	2010 Base	2040 Trend	Constraint	Constraint Accel	Enhance	Enhance Accel
Road	-	78%	2%	16%	0%	14%
Rail	-	127%	-6%	7%	30%	43%
Water	-	53%	-10%	11%	47%	49%
TOTAL	**-**	**81%**	**0%**	**14%**	**6%**	**19%**

** % change in 2040 Trendline as compared to 2010 Baseline; % change in other scenarios as compared to 2040 Trendline*

Mode Split	2010 Base	2040 Trend	Constraint	Constraint Accel	Enhance	Enhance Accel
Road	83%	82%	83%	83%	77%	78%
Rail	10%	13%	12%	12%	15%	15%
Water	7%	6%	5%	5%	8%	7%
TOTAL	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

Travel Times

Key insights relative to travel time data (*Exhibit 7.9*) include:

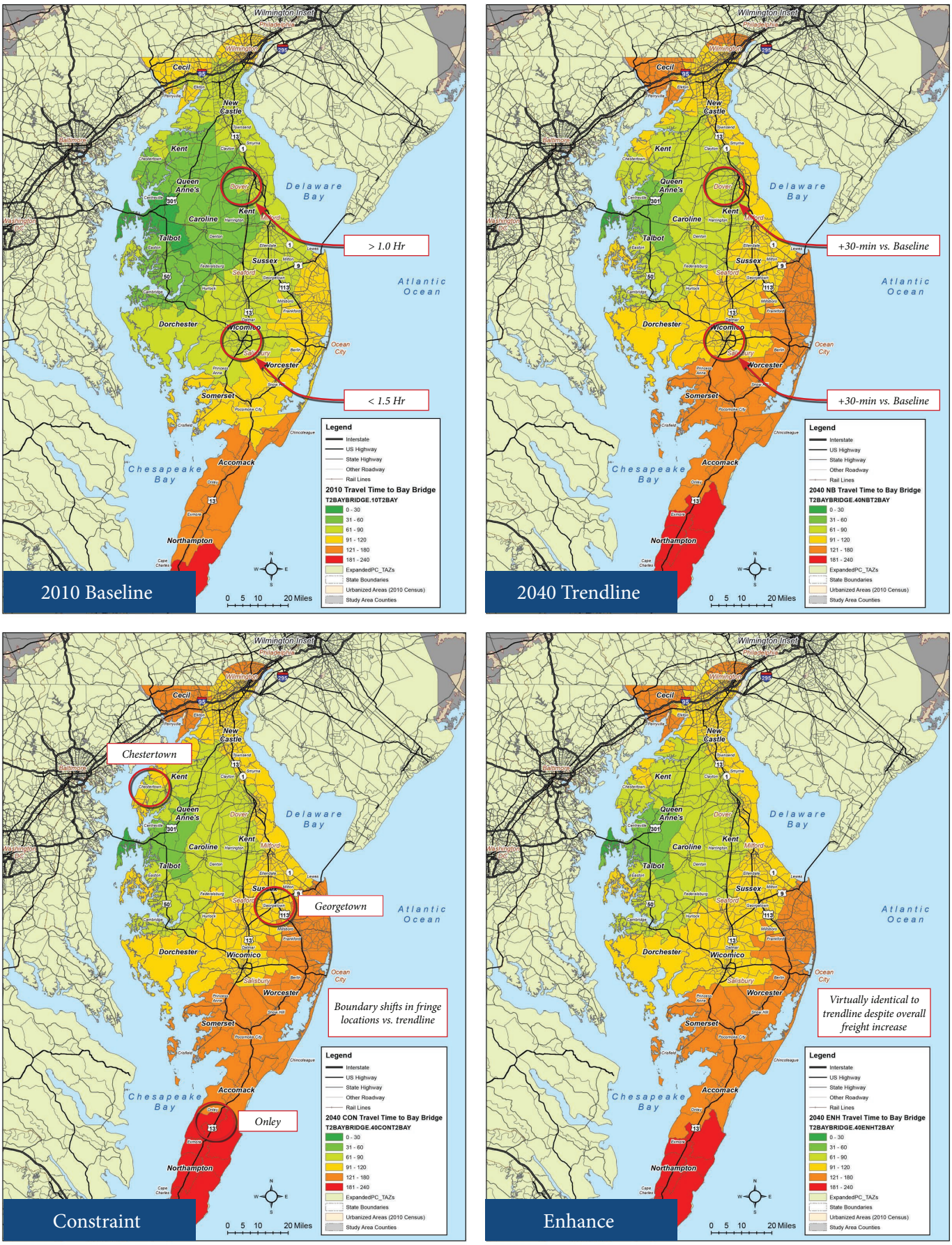
Future Congestion: Future changes in travel time vary by location and scenario, though in general an added 15-30 minutes between the Bay Bridge and key freight hubs such as Dover or Salisbury are anticipated by 2040 with Trendline growth. Barring additional improvements, most of the congestion and delay increases are expected to occur or expand in areas that are currently experiencing congestion today.

Constraints and Additional Local Freight Hub Impacts: The Multimodal Constraint scenario inevitably increases dependency on freight transportation by truck, which adds to roadway demands and congestion throughout the region. While system level travel times in the Constraint scenario only nominally degrade versus the 2040 Trendline, negative impacts and less convenient access will likely become more apparent for many smaller freights hubs at the fringes of the peninsula including, for example, areas east of Georgetown, Delaware; around Chestertown, Maryland; or south of Onley, Virginia.

Enhancements and Travel Time Management: Travel times under the Multimodal Enhancement scenario, particularly at the system level, are anticipated to be virtually identical to the 2040 Trendline. While not an immediately apparent benefit, this "holding steady" trend occurs alongside an overall increase in the amount of freight that moves through the system, illustrating an advantage of the enhanced rail or water networks.

Freight and Overall Transportation Planning: System travel times are generally influenced far more by the dominance of passenger car travel than by freight. Such influence is exacerbated through busy urban areas or during periods of peak seasonal congestion, neither of which are fully reflected in the scenarios analyzed here. Considering the conflicts between congestion and freight travel or logistics in the Delmarva region, it is vital that both freight planning and overall transportation planning be closely and thoroughly coordinated as part of the region's planning processes at the federal, state, MPO, corridor, or other local levels.

Exhibit 7.9 – System Performance Summary – Travel Times to/from Bay Bridge



Truck VHT

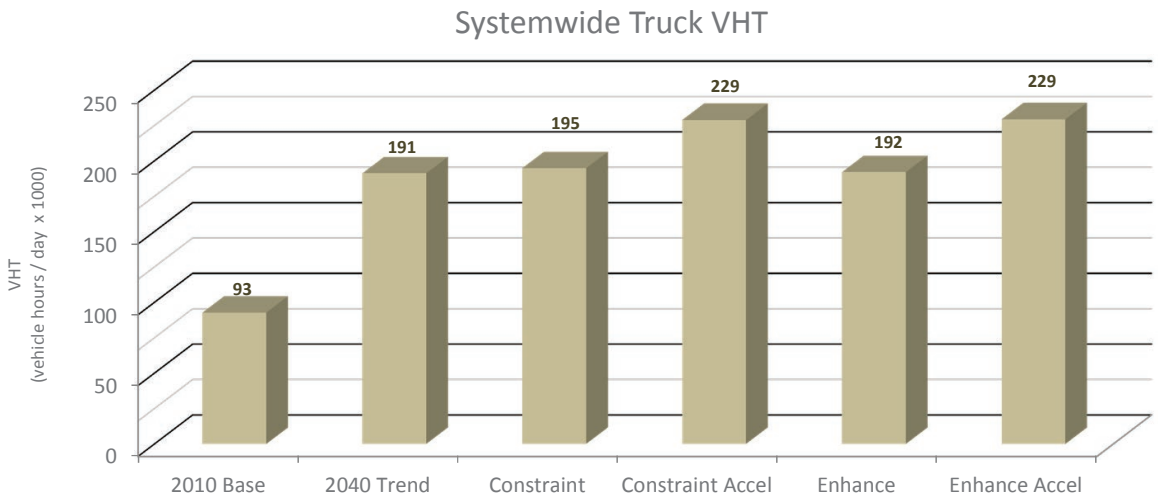
Key insights relative to truck VHT details (*Exhibit 7.10*) include:

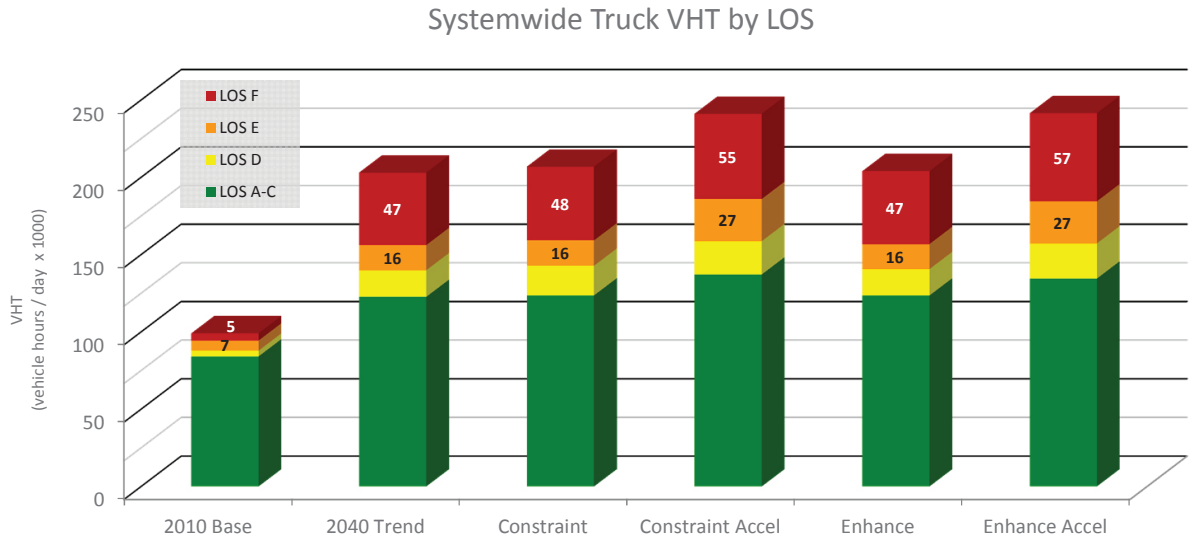
Future Truck Congestion: With future increases in truck volumes and background roadway congestion, system level truck VHT is anticipated to approximately double by year 2040. Given current and projected travel demands, VHT impacts will also disproportionately occur under borderline or less than acceptable travel conditions (i.e. congested levels-of-service D, E, or F), further exacerbating regional congestion levels.

Infrastructure Influence: Versus the 2040 Trendline, only nominal VHT impacts of 2% or less are anticipated in either the Constraint or Enhancement scenarios with matching growth assumptions. Consistent with previous findings, this nominal change reinforces a lower level of sensitivity to potential mode shifts in the immediate area on the basis of infrastructure changes alone (i.e., without a corresponding assumption of added business market or similar economic influences).

Accelerated Growth Influence: In contrast to any of the scenarios with trendline growth, substantial truck VHT increases of approximately 20% occur in either the Constraint or Enhancement scenarios with Accelerated Growth. While the accelerated growth reflects a more positive economic climate, the additional VHT – almost all of which occurs under congested LOS E/F conditions – reflects some of the potential impacts of the additional truck traffic needed to support such growth.

Exhibit 7.10 – System Performance Summary – Truck VHT Details





Measure	2010 Base	2040 Trend	Constraint	Constraint Accel	Enhance	Enhance Accel
VHT (1000 Hours/Day)	93	191	195	229	192	229
% Change in VHT	-	106%	2%	20%	0%	20%

** % change in 2040 Trendline as compared to 2010 Baseline; % change in other scenarios as compared to 2040 Trendline*

Truck Costs

Key insights relative to annual truck cost estimates[3] (*Exhibit 7.11*) include:

General Trends: In terms of the potential vehicle and driver related costs of moving freight, trends between scenarios are similar to those for VHT – including nominal differences between any scenarios with trendline growth, versus larger differences with accelerated growth.

Constraint Impacts: In comparison to the 2040 Trendline, the forced reliance on truck transportation under the Multimodal Constraint scenario increases annual truck costs by approximately $64 million.

Enhancement Savings: In comparison to the 2040 Trendline, the availability of improved infrastructure under the Multimodal Enhancement scenario reduces annual truck costs by approximately $15 million. Potential savings versus the Constraint scenarios range from $55 to $79 million annually.

Other System Insights

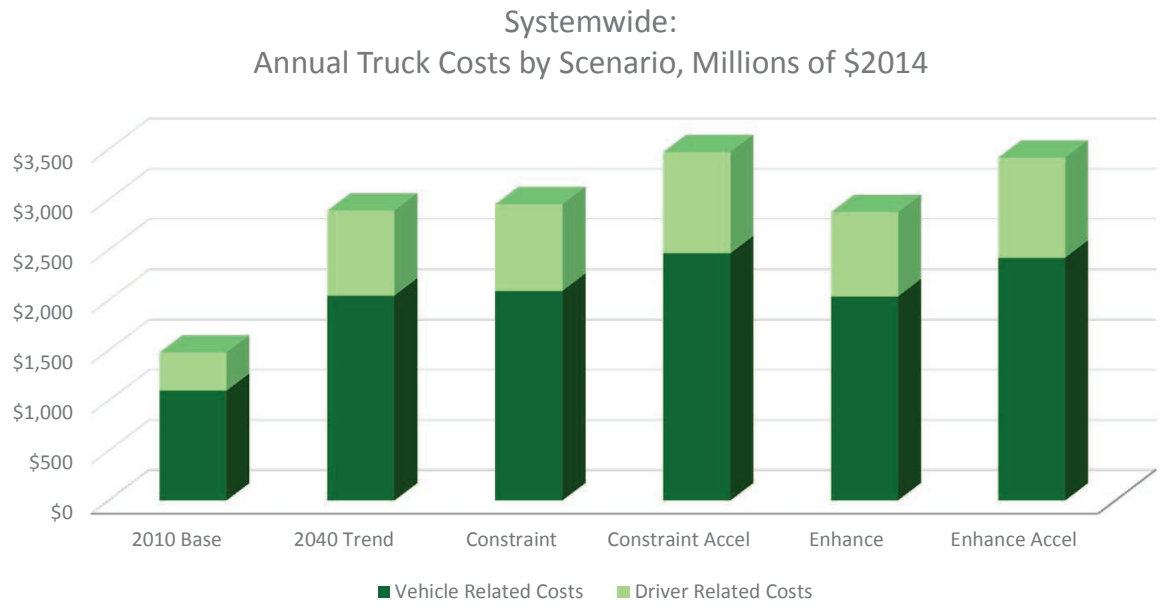
Additional key system level insights that are anticipated to be critical under all scenarios include:

Management, Operations, and Maintenance: All future scenarios will see an increase in truck traffic. This increase will, in turn, affect future roadway management, operations, and maintenance needs, as well as related issues such as freight inspection, safety monitoring, or enforcement requirements. Constraint scenarios that shift more truck traffic onto the highway system will further impact these types of activities. Accelerated growth scenarios, though they reflect a more positive economic outlook, will likewise add to such impacts with an additional increase in truck traffic needed to support the accelerated growth.

Logistics, Distribution, and Warehousing: As future congestion increases, travel time reliability will likely decrease and impacts related to truck costs, first/last mile access, just-in-time (JIT) deliveries, or similar truck transportation issues may become more volatile. As such, planning for efficient logistics, warehousing, and distribution centers relative to population and employment markets on the peninsula may require more intense or innovative efforts. Addressing such issues will be important in all future scenarios whether due to the impacts of background growth in the Trendline scenario, additional freight activity in the Accelerated scenarios, increased reliance on truck transportation in the Constraint scenarios, or a change in trends or opportunities in the Enhancement scenarios.

[3] Truck costs, in this case, include vehicle related costs (e.g. fuel, truck/trailer lease or purchase payments, repair/maintenance, truck insurance premiums, permits/licenses, tires, tolls) monetized at approximately $1.18 per mile versus model-based truck VMT data, plus driver related costs (e.g. driver wages and benefits) monetized at $24.27 per hour versus model-based truck VHT data. Underlying cost assumptions are primarily sourced from American Transportation Research Institute (ATRI) data, adjusted to year 2014 dollars for the Northeast Region, and annualized assuming 250 working days versus daily model estimates.

Exhibit 7.11 – System Performance Summary – Annual Truck Costs



Cost (Millions of $2014)	2010 Base	2040 Trend	Constraint	Constraint Accel	Enhance	Enhance Accel
Vehicle Related Costs	$1,095	$2,043	$2,089	$2,463	$2,033	$2,420
Driver Related Costs	$381	$844	$862	$1,007	$839	$995
Total Truck Costs	**$1,475**	**$2,887**	**$2,951**	**$3,470**	**$2,872**	**$3,415**

Change in Cost	2010 Base	2040 Trend	Constraint	Constraint Accel	Enhance	Enhance Accel
Vehicle Related Costs	-	$948	$46	$419	-$10	$377
Driver Related Costs	-	$463	$18	$163	-$5	$151
Total Truck Costs	**-**	**$1,412**	**$64**	**$583**	**-$15**	**$528**

** change in 2040 Trendline as compared to 2010 Baseline; change in other scenarios as compared to 2040 Trendline*

7.4 Corridor Perspectives

Moving to a more detailed level than the overall system findings described above, corridor perspectives focus on potential scenario impacts along the key freight corridors identified by this plan. These efforts identify general issues that may be especially relevant to a given corridor (*Exhibit 7.12*), while also capturing roadway or segment-specific insights to help support planning, screening, and prioritization of future transportation improvements. Model-based performance data for each corridor summarizes Truck VHT and Annual Truck Costs in a fashion similar to the system approach, but adds Truck Delay per Mile and Truck Vehicle-Miles-Traveled (VMT) for additional comparisons. Specific corridors and performance summary datasets include:

- I-95 Metro Freight Corridor (*Exhibit 7.13*)
- US 301 Bay Freight Corridor (*Exhibit 7.14*)
- US 50 Ocean City Freight Corridor (*Exhibit 7.15*)
- US 13/113 and DE 1 Coastal Freight Corridor (*Exhibit 7.16*)
- US 202 and DE 41 Piedmont Freight Corridor (*Exhibit 7.17*)
- MD/DE 404 and US 9 Lewes Freight Corridor (*Exhibit 7.18*)

Exhibit 7.12 – Relevant General Issues by Corridor

Corridor Insights, Issues, or Sensitivities	Metro	Bay	Ocean City	Coastal	Piedmont	Lewes
Truck Cost Sensitivity to Accelerated Scenario*	+3% $37M	+34% $75M	+11% $25M	+38% $395M		
Truck Cost Sensitivity to Constraint Scenario*			+16% $36M			+25% $13M
Development patterns or warehousing shifts	✓					
Regional alternate routes or system redundancy		✓		✓		
Peak season traffic, tourism and freight conflicts			✓	✓		✓
Community and freight access conflicts	✓	✓			✓	✓
Multi-jurisdictional cooperation	✓				✓	✓
Oversize or special freight movements	✓			✓		
Technology advancements (ITS, VWS, autonomous vehicles)	✓	✓		✓		

** shown as a % increase and equivalent $ value increase in truck costs based on VHT and VMT changes vs. the 2040 Trendline*

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I-95 Metro Freight Corridor

Given the regional/national significance of I-95 coupled with a predominance of through-freight, linkages to major urban areas, and the sheer volume of traffic that it carries, the relative impacts of (and differences between) the scenarios analyzed in this plan were minimal. However, performance data including truck delay, VMT, VHT, and related costs were substantially higher for I-95 than for all other freight corridors on the peninsula. Future growth in all scenarios is expected to increase congestion levels as evidenced, for example, by scenario output showing that the majority of truck VHT increases will likely occur at failing or overcapacity traffic conditions (LOS F). Notable considerations include the following:

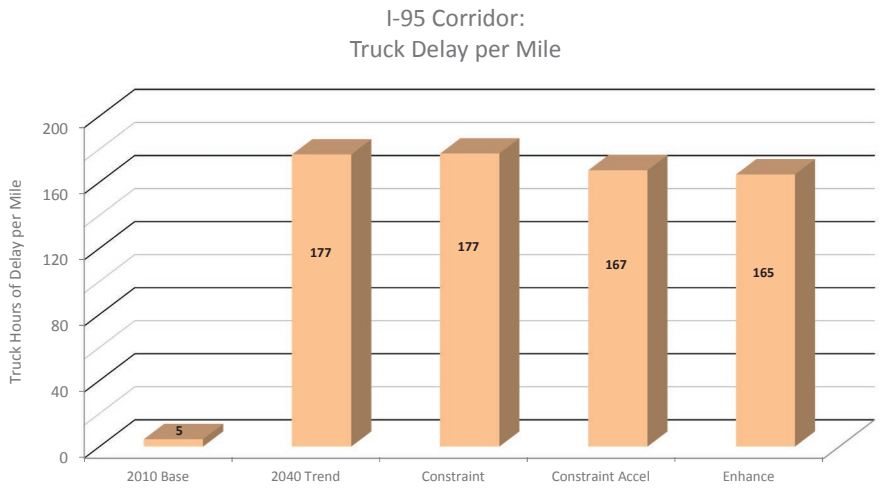
Accelerated Growth Impacts: I-95 is somewhat sensitive to the Accelerated Growth scenarios, which show a 3-4% increase in truck VMT. As a major truck route feeding the peninsula as a whole, as well as key freight hubs in Cecil and New Castle counties, the corridor can be expected to carry a substantial portion of any truck increases that may accompany future economic growth.

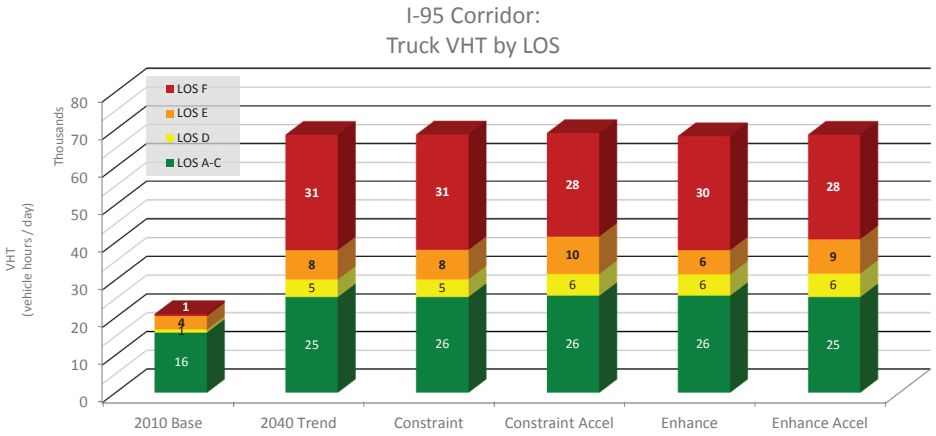
Management Strategies: With increasing congestion along the I-95 corridor and throughout the surrounding urbanized areas, effective planning and management strategies will become increasingly important over time. Examples include managing future development patterns, optimizing access to warehousing or distribution facilities, or balancing first/last mile freight needs with community interests to minimize potential conflicts.

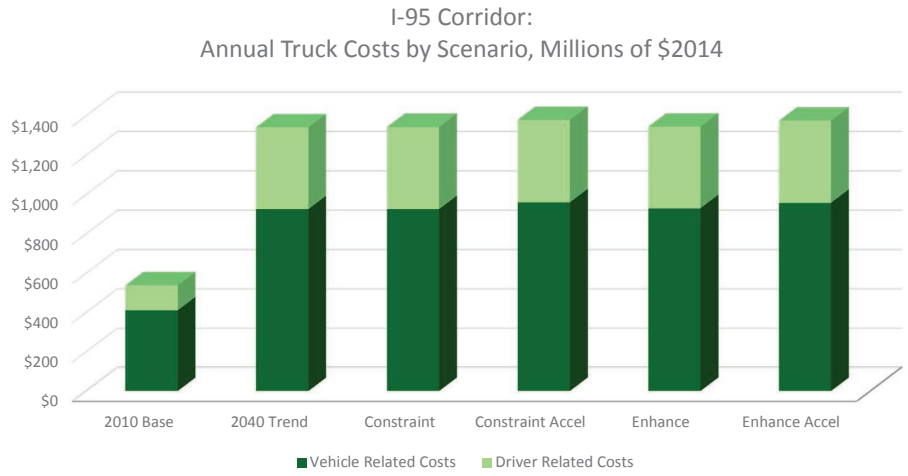
Innovative Technologies: Given the significance of the I-95 corridor and the degree of potential traffic and freight increases, special attention to innovative or technological solutions will also become increasingly important over time. Future advances in ITS, virtual weigh and inspection stations, tolling strategies, or similar technologies may find very relevant applications along this corridor. Developments related to autonomous vehicle technology – whether in terms of passenger car influences or possibly future freight applications – may also give rise to unknown implications on how the future corridor can or should operate.

Cooperative Planning: The I-95 corridor on the peninsula clearly supports a much broader transportation system, and the impacts or benefits of large-scale changes within that system can certainly have implications that extend beyond typical jurisdictional boundaries through Delaware or Cecil County, Maryland. This system influence plus the challenges and possibilities noted above collectively emphasize the need to encourage cooperative multi-jurisdictional/multi-agency planning efforts for the I-95 corridor on a very broad regional scale. Such efforts encompass the missions of organizations like the I-95 Corridor Coalition, NEC Commission, or TCI (see Chapter 5). Cooperative interests also encompass larger-scale multimodal opportunities that affect or benefit the corridor. Example possibilities identified by this plan include enhanced rail access via the Chesapeake Connector, regional port expansion concepts south of the Port of Wilmington, or larger scale port activity implications due to future Post-Panamax influences (i.e., that may affect I-95 freight flows across the Peninsula between Baltimore, Philadelphia, New York, or other major metropolitan areas).

Exhibit 7.13 – Corridor Performance Summary – I-95 Metro Freight Corridor







I-95	2010 Base	2040 Trend	Constraint	Constraint Accel	Enhance	Enhance Accel
Truck VMT	1,392,765	3,138,996	3,140,151	3,255,217	3,155,164	3,248,450
% Change	-	*125%*	*0%*	*4%*	*1%*	*3%*
Truck VHT	20,979	68,627	68,717	69,116	68,274	68,695
% Change	-	*227%*	*0%*	*1%*	*-1%*	*0%*

** % change in 2040 Trendline as compared to 2010 Baseline; in all other scenarios as compared to 2040 Trendline.*

US 301 Bay Freight Corridor

Performance data for the US 301 freight corridor imply varying levels of sensitivity to economic influences under the Accelerated Growth scenarios, as well as infrastructure changes under the Multimodal Enhancement scenario. Findings in both cases are likely influenced by US 301's linkage to the Bay Bridge, its role as a major freight route serving the peninsula, and its system-wide potential to function as an alternate to I-95, particularly in light of future project commitment assumptions that include completion of the US 301 freeway sections connecting to DE 1. Notable insights include the following:

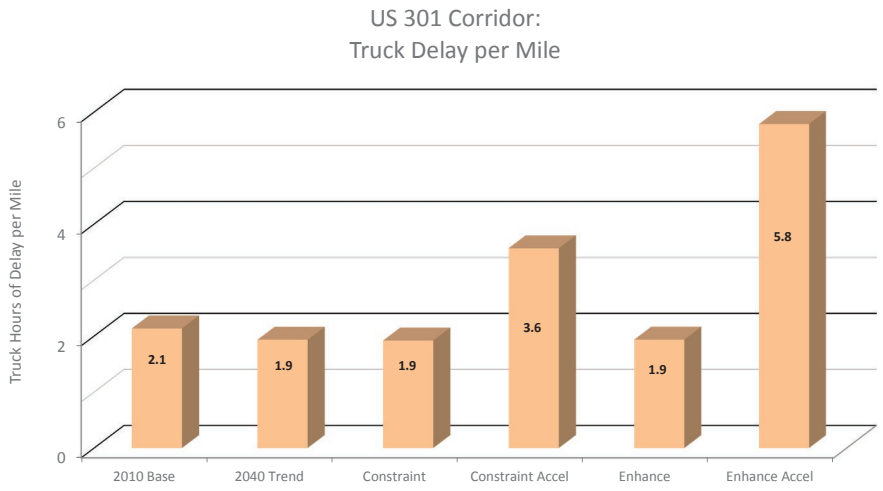
Accelerated Growth Impacts: US 301 is exceptionally sensitive to the Accelerated Growth scenarios, which show truck VMT and VHT increases of approximately 30% or more versus the 2040 Trendline. The route feeds various freight hubs and assumed growth areas, so it can be expected to carry a portion of any truck increases that may accompany future growth. Additionally, if system-wide growth exacerbates congestion along I-95, US 301 is likely to become more attractive as a regional alternate route, effectively working in parallel with the I-95 corridor to serve access to, from, or across the peninsula.

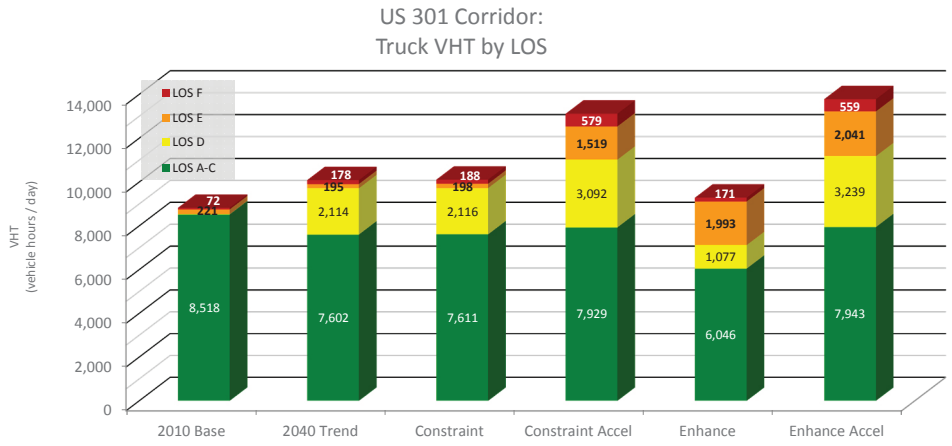
Multimodal Enhancement Benefits: US 301 would likely experience some travel benefits under the Multimodal Enhancement scenario, which shows an 8% reduction in truck VMT and VHT along the corridor, or an annual truck cost reduction of approximately $17-18 million versus the 2040 Trendline and Constraint scenarios. As with the accelerated growth impacts, changes are likely attributable to the influence of local freight hubs as well as system-wide implications – in this case, potentially a lesser amount of traffic diverted to the US 301 corridor as a result of improved multimodal access and related benefits in other locations.

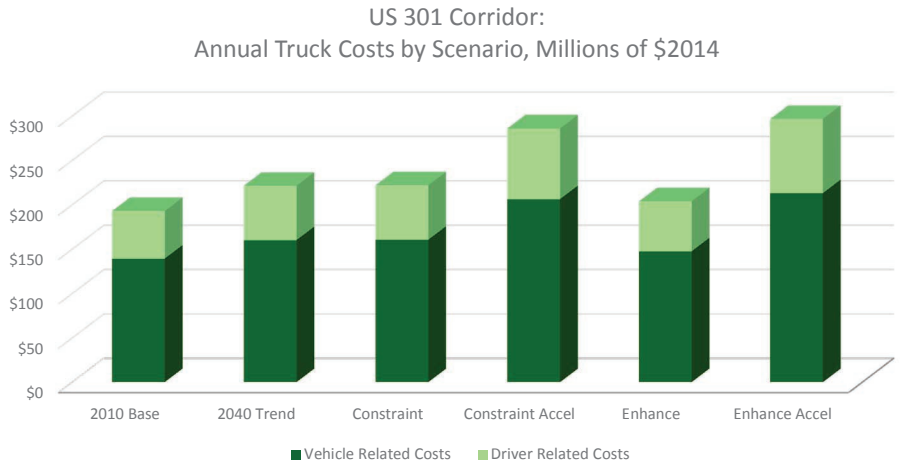
Community Freight Access: First/last mile freight access and potential community conflicts through several local freight hubs along the corridor will be important issues to monitor, particularly under any scenarios that either expand local freight-related economic developments or influence regional traffic shifts to the area. Example locations include connections to US 301 near Middletown or Odessa, as well as hubs along MD 213 in Centreville or Chestertown, or related travels along DE 896.

Truck Enforcement: Commercial vehicle safety, inspections, and enforcement have been identified by Delaware and Maryland as important issues along the US 301 corridor and nearby connecting routes including, for example, east-west access toward Smyrna or Dover. Any scenario that adds or diverts additional truck traffic to this corridor is likely to add to existing concerns. It will, therefore, become increasingly important to support effective truck route management strategies and infrastructure improvements such as VWS or other CVISN opportunities.

Exhibit 7.14 – Corridor Performance Summary – US 301 Bay Freight Corridor







US 301	2010 Base	2040 Trend	Constraint	Constraint Accel	Enhance	Enhance Accel
Truck VMT	472,198	543,000	544,395	699,619	500,082	722,462
% Change	-	*15%*	*0%*	*29%*	*-8%*	*33%*
Truck VHT	8,824	10,089	10,113	13,119	9,287	13,782
% Change	-	*14%*	*0%*	*30%*	*-8%*	*37%*

** % change in 2040 Trendline as compared to 2010 Baseline; in all other scenarios as compared to 2040 Trendline.*

US 50 Ocean City Freight Corridor

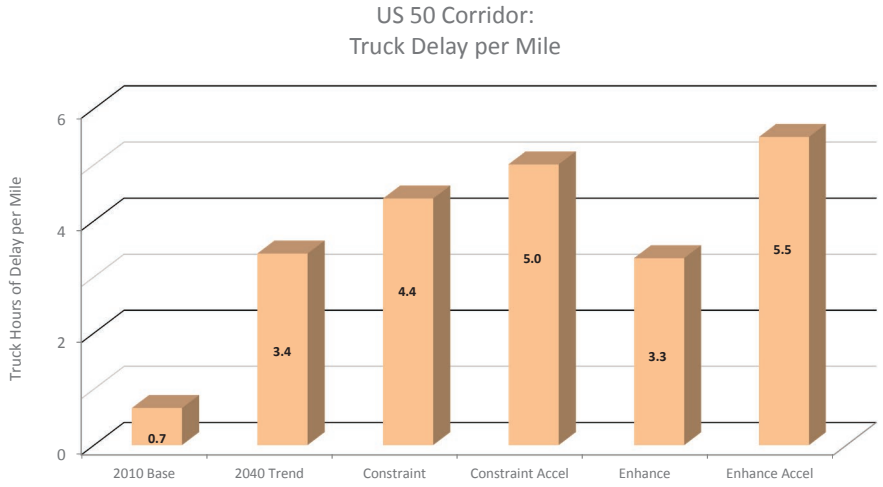
Performance data for the US 50 freight corridor imply notable levels of sensitivity to infrastructure changes under the Multimodal Constraint scenario, as well as economic influences under the Accelerated Growth scenarios. In the former case, given key assumptions in the Constraint scenario that impacted rail access south of Seaford and barge access to Salisbury and Pocomoke, US 50 could bear the brunt of any additional truck traffic diverted from other modal opportunities. In the latter, with connections to the Bay Bridge and freight access to central and southern portions of the peninsula, US 50 is shown to be a vital component of the area's economic engine. Other specific insights include the following:

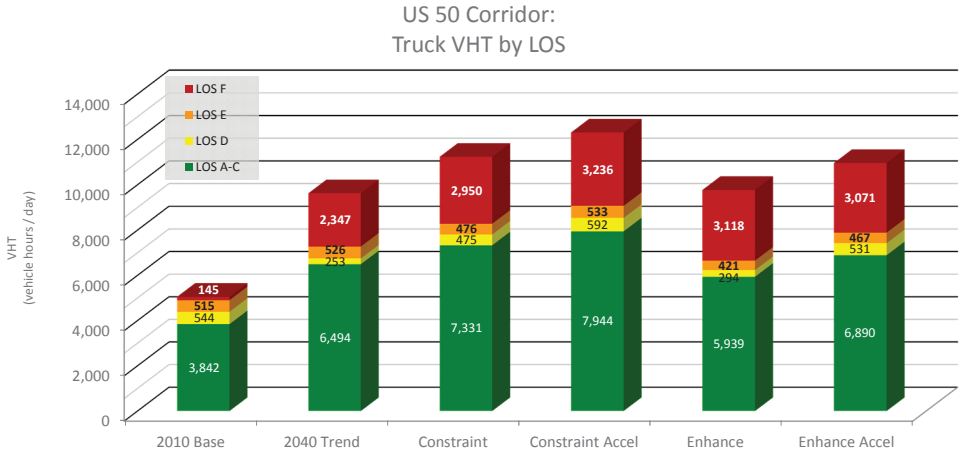
Multimodal Constraint Impacts: Sensitivities to the Constraint scenario's reduction in barge and rail opportunities were estimated to yield a 16-17% increase in truck VMT or VHT along US 50, or an equivalent increase in truck transportation costs of approximately $36 million per year versus the 2040 Trendline. Specific assumptions within the Cube Cargo model diverted more than 1.5 million tons of freight from barges alone, potentially adding thousands of trucks to the highway network. Realistically, however, such changes could also result in much farther-reaching implications in terms of negative impacts to the viability of existing or future freight related business activities in this corridor.

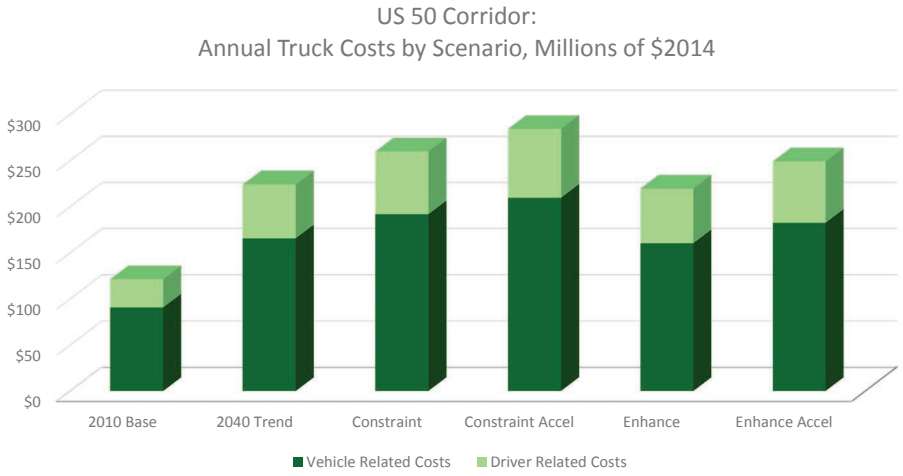
Accelerated Growth Impacts: US 50's sensitivity to the Accelerated Growth scenarios appear as an additional increase in truck VMT or VHT of at least 10%, as well as notable increases in truck delay. As such, proactively and strategically managing issues such as congestion near the Bay Bridge, interchange operations, roadway access, or overall corridor safety will become increasingly important as a means of supporting future growth potential.

Peak Season Traffic Impacts: In both of the above situations, tourism demands and related peak season traffic surges will continue to present challenges to the efficient movement of freight throughout the corridor area. Connecting the Bay Bridge with coastal resort areas around Ocean City, such impacts along US 50 are inevitable. Potential conflicts affect freight movements to/from hub areas such as Easton, Cambridge, Salisbury, or Berlin; as well as first/last mile access directly to the coastal resorts; as well as local/rural agriculture trucking activities in between.

Exhibit 7.15 – Corridor Performance Summary – US 50 Ocean City Freight Corridor







US 50	2010 Base	2040 Trend	Constraint	Constraint Accel	Enhance	Enhance Accel
Truck VMT	306,890	561,051	649,468	710,017	543,125	618,028
% Change	-	*83%*	*16%*	*27%*	*-3%*	*10%*
Truck VHT	5,046	9,621	11,232	12,304	9,771	10,960
% Change	-	*91%*	*17%*	*28%*	*2%*	*14%*

** % change in 2040 Trendline as compared to 2010 Baseline; in all other scenarios as compared to 2040 Trendline.*

US 13/113 and DE 1 Coastal Freight Corridor

Performance data for the Coastal Freight Corridor primarily implies sensitivity to economic increases under the Accelerated Growth scenarios. As the key north/south trunkline serving the peninsula, the US 13, US 113, and DE 1 corridors serve many of the areas busiest freight hubs, coastal resorts, and assumed growth areas. Specific insights include the following:

Accelerated Growth Impacts: Economic influences in the Accelerated Growth scenario yield an estimated VMT and VHT increase of around 40% versus the 2040 Trendline. Relative to other freight corridors on the peninsula, such a substantial increase can be partly attributed to the sheer mileage and geographic coverage of the Coastal Freight Corridor. Nonetheless, its connectivity to key locations through all three states as well as interconnectivity with each of the other studied freight corridors reflects a critical role in supporting future economic development opportunities in the region.

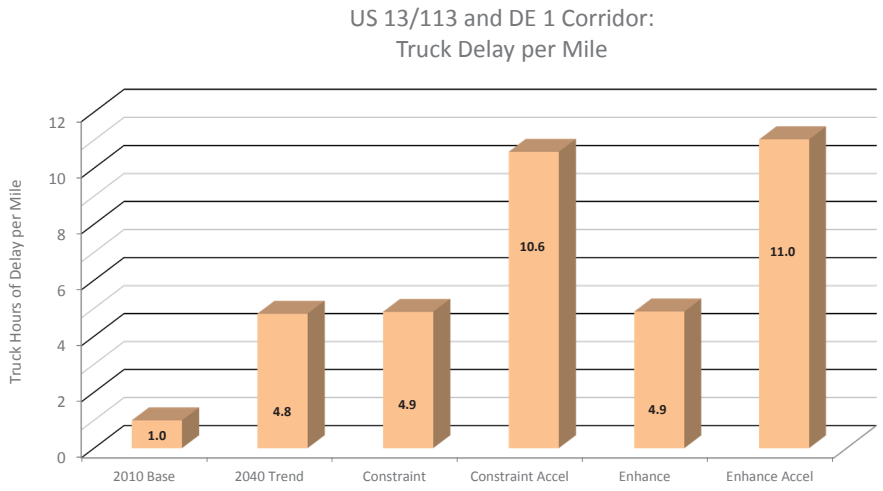
Peak Season Traffic Impacts: Similar to the US 50 corridor, the Coastal Freight corridor is notably impacted by tourism demands and related peak season traffic surges that will continue to present challenges to the efficient movement of freight throughout the area. Such impacts are inevitable given the corridors linkage of coastal resort areas to key regional access points via I-95 in the north or the US 13 Chesapeake Bay Bridge and Tunnel in the south. Potential conflicts may be especially noticeable through larger freight hubs such as Dover, along US 113 from Milford to Millsboro, and along DE 1 to and through the coastal resort locations.

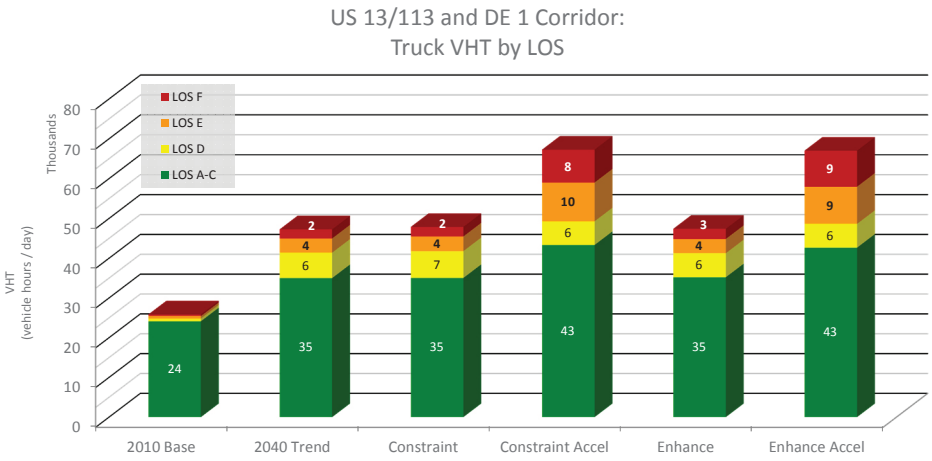
Rail Choices and System Redundancy: From a broader perspective, the Coastal Freight Corridor includes key rail infrastructure that enhances freight transportation options and system redundancies. Included, for example, are the NS Delmarva Secondary, NS Harrington South line, and BCRR shortline operations that collectively parallel US 13 throughout the peninsula. The NS Indian River Secondary and MDDE shortline operations provide additional services parallel to US 113; while various local freight hubs are also linked by additional MDDE or DCLR shortline operations. Alternate rail access onto the peninsula can also be achieved from the south via BCRR carfloat operations across the Chesapeake Bay. Limiting any of these components could affect future economic competitiveness or related opportunities on the peninsula in ways beyond the implications of the scenario results quantified here.

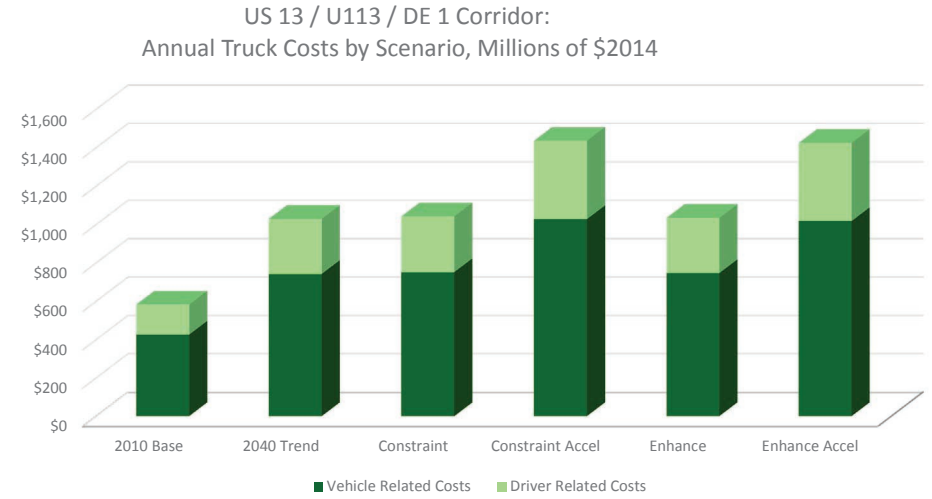
Truck Enforcement: With existing and/or planned truck weigh and inspection stations (or virtual weigh stations) in all three states, commercial vehicle safety and enforcement is a key component along the Coastal Freight Corridor. The future importance of these efforts is only anticipated to increase in light of the accelerated growth or peak season traffic impacts noted above.

Special Freight Needs: Unique activities along the Coastal Freight Corridor periodically introduce special freight needs that must be integrated within the area's overall transportation planning efforts. Three key locations include the Port of Wilmington, Dover Air Force Base, and the NASA Wallops Flight Facility. Freight movements may include oversize, overweight, or other unique cargo that potentially requires special permitting, handling, screening, routing, escorting, etc. to move materials ranging from wind turbine blades to rocket booster cores to military freight.

Exhibit 7.16 – Corridor Performance Summary – US 13/113 and DE 1 Coastal Freight Corridor







US 13/113 and DE 1	2010 Base	2040 Trend	Constraint	Constraint Accel	Enhance	Enhance Accel
Truck VMT	1,441,880	2,516,627	2,548,737	3,484,124	2,530,513	3,450,146
% Change	-	*75%*	*1%*	*38%*	*1%*	*37%*
Truck VHT	25,860	47,253	47,880	67,284	47,397	67,028
% Change	-	*83%*	*1%*	*42%*	*0%*	*42%*

** % change in 2040 Trendline as compared to 2010 Baseline; in all other scenarios as compared to 2040 Trendline.*

US 202 and DE 41 Piedmont Freight Corridor

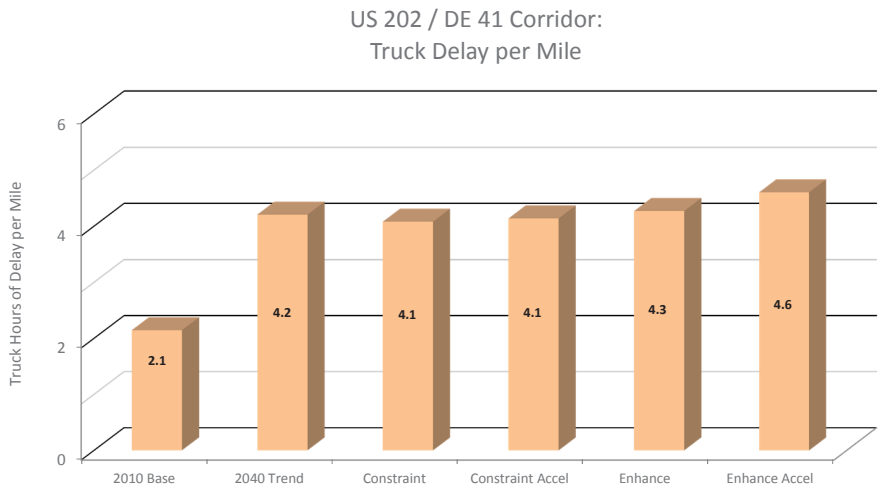
Relative to other freight corridors on the peninsula, the US 202 and DE 41 Piedmont corridor did not appear to be exceptionally sensitive to the scenarios analyzed in this plan. That trend can largely be attributed to the fact that most of the key scenario assumptions were geographically distant from the Piedmont corridor's location at the northern tip of the peninsula, or their regional influence was directed more along the I-95 corridor than it was into southeastern Pennsylvania. Notable insights include the following:

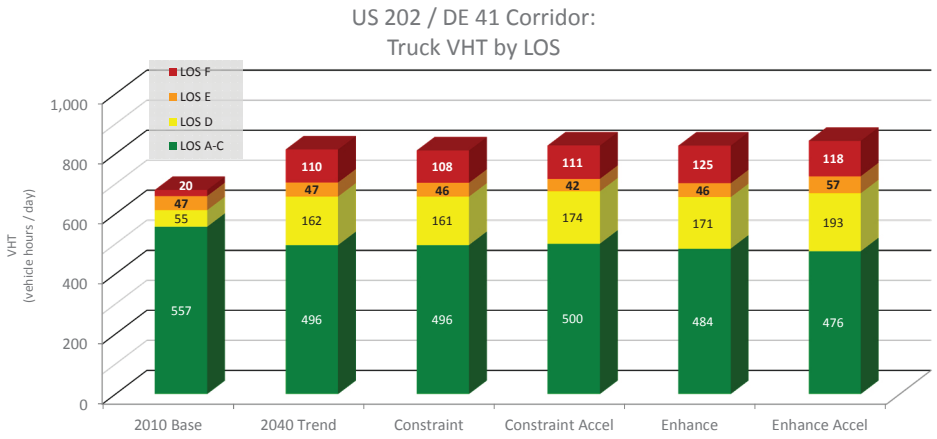
Accelerated Growth Impacts: A nominal sensitivity to the Accelerated Growth scenario appears in estimated VMT or VHT increases of 4% or less. However, the Piedmont Corridor does provide numerous connections between Pennsylvania and freight-centric urbanized areas in northern New Castle County, including Newark and Wilmington; plus nearby access to the I-95 corridor; plus access into northern Cecil County if connectivity to MD 273 is considered. As such, future freight related economic developments, increases in background congestion, or related influences on circulation between local areas (e.g., along DE state routes 2, 7, 48, or 141) will be important issues to monitor.

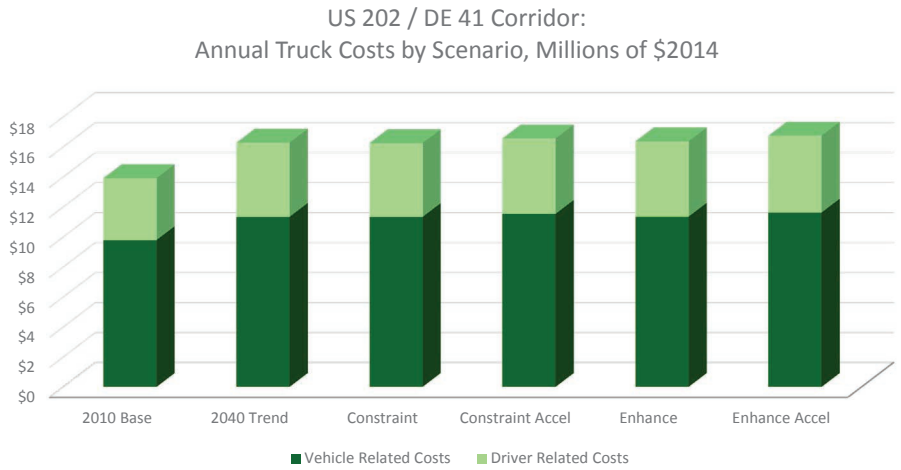
Community Freight Access: Considering the numerous residential areas and local communities throughout the northern portion of New Castle County, balancing community interests with potential freight access needs will likely be an ongoing challenge for this corridor. Such challenges may encompass through-freight connections into Pennsylvania (e.g., via DE 41) as well as first/last mile access throughout the area.

Multi-Jurisdictional Planning: Given the Piedmont Corridor's reach into Pennsylvania, including access to US 1, US 30, I-76, and various communities from Lancaster to King of Prussia, multi-jurisdictional cooperation between adjacent states (DelDOT and PennDOT) and MPOs (WILMAPCO and DVRPC) would be relevant to corridor-specific freight planning efforts in this area. Identifying a consistent vision, approach, priorities, or typical solutions for the broader multi-state corridor area will help to support future economic opportunities or freight transportation needs while managing any potential growth or community impacts such as those noted above.

Exhibit 7.17 – Corridor Performance Summary – US 202 and DE 41 Piedmont Freight Corridor







US 202 / DE 41	2010 Base	2040 Trend	Constraint	Constraint Accel	Enhance	Enhance Accel
Truck VMT	33,192	38,428	38,400	39,113	38,473	39,412
% Change	-	*16%*	*0%*	*2%*	*0%*	*3%*
Truck VHT	680	815	811	828	827	844
% Change	-	*20%*	*0%*	*2%*	*2%*	*4%*

** % change in 2040 Trendline as compared to 2010 Baseline; in all other scenarios as compared to 2040 Trendline.*

MD/DE 404 and US 9 Lewes Freight Corridor

Performance data for the MD/DE 404 Lewes Freight Corridor imply notable levels of sensitivity to infrastructure changes under the Multimodal Constraint scenario. Given key scenario assumptions that impacted rail access south of Seaford and barge access to Salisbury and Pocomoke, the location of this corridor makes it a likely candidate to pick-up additional traffic diverted as a result of fewer modal opportunities in the area. Specific insights include the following:

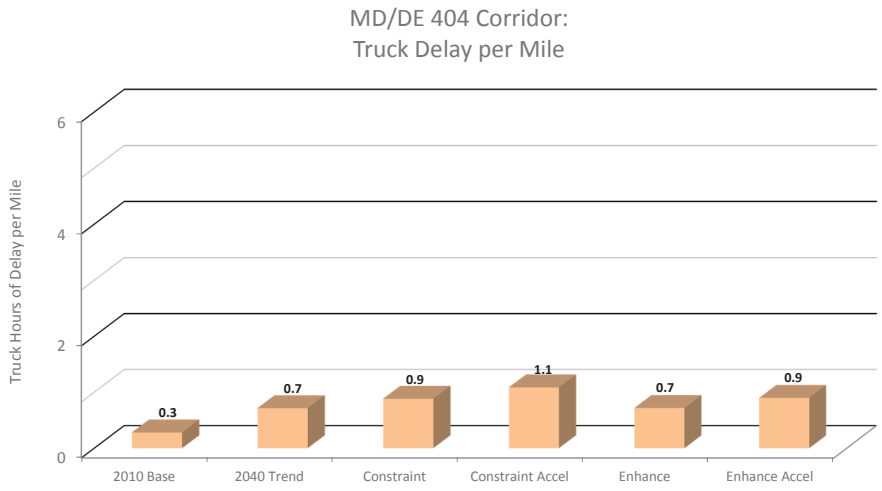
- **Multimodal Constraint Impacts**: Sensitivities to the Constraint scenario's reduction in barge and rail opportunities were estimated to yield a 25% increase in truck VMT or VHT along MD/DE 404, or an equivalent increase in truck transportation costs of approximately $13 million per year versus the 2040 Trendline. Such increases are in addition to similar impacts described previously for the US 50 Ocean City Freight Corridor located just to the south. Diverted traffic impacts, in this case, could result from a combination of adding truck movements due to a change in rail or barge opportunities, or adding passenger car movements that may divert from US 50 as a result of increased congestion along that corridor in the same scenario.

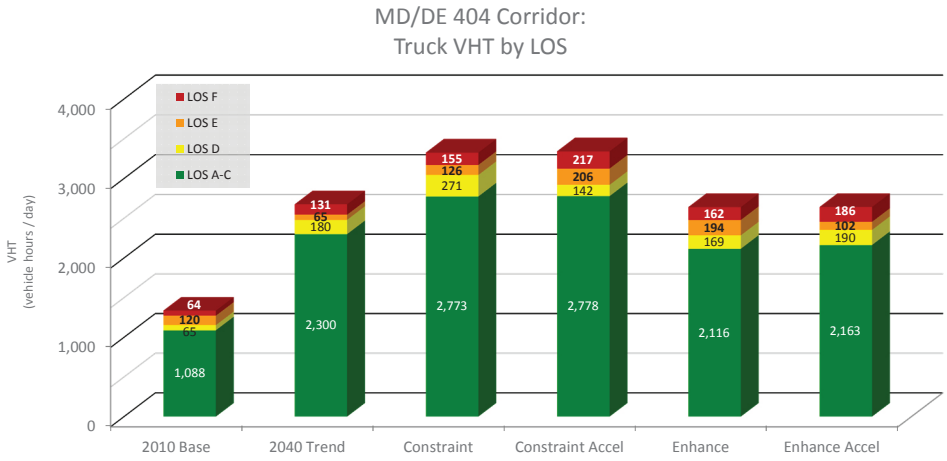
- **Peak Season Traffic Impacts**: Similar to other corridors with connections to the peninsula's coastal resort areas – in this case directly from US 50 near the Bay Bridge to DE 1 near Lewes and Rehoboth Beaches – tourism demands and related peak season traffic surges will inevitably present challenges to the efficient movement of freight throughout the corridor area. Integrating freight considerations into general transportation planning efforts will become increasingly important.

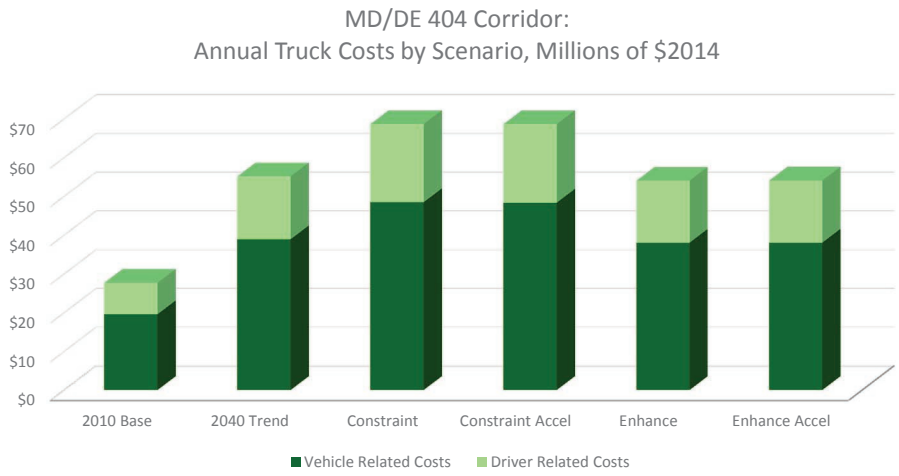
- **Community Freight Access**: First/last mile freight access and potential community conflicts through several local freight hubs along the corridor will be important issues to monitor, particularly in light of the potential impacts noted above. Potential conflicts affect freight movements to/from hub areas such as Denton, Federalsburg, Seaford, or Georgetown; as well as first/last mile access directly to the coastal resorts; as well as local/rural agriculture trucking activities in between.

- **Multi-Jurisdictional Planning**: Given the Lewes Corridor's east-west reach across Maryland and Delaware, including access to various local freight hubs along the way, multi-jurisdictional cooperation between state agencies would be relevant to corridor-specific freight planning efforts in this area. Identifying a consistent vision for the broader multi-state corridor area will help to support local economic developments or freight transportation needs while managing any potential impacts such as those noted above. Clearly defining the specific role that MD/DE 404 can or should play in terms freight movements may, in this case, impact decisions related to truck routing, truck restrictions, community access needs, or long-term upgrade planning.

Exhibit 7.18 – Corridor Performance Summary – MD/DE 404 and US 9 Freight Corridor







MD/DE 404	2010 Base	2040 Trend	Constraint	Constraint Accel	Enhance	Enhance Accel
Truck VMT	66,334	131,893	164,317	163,936	128,929	128,976
% Change	-	*99%*	*25%*	*24%*	*-2%*	*-2%*
Truck VHT	1,337	2,675	3,326	3,342	2,640	2,642
% Change	-	*100%*	*24%*	*25%*	*-1%*	*-1%*

** % change in 2040 Trendline as compared to 2010 Baseline; in all other scenarios as compared to 2040 Trendline.*

Additional Corridor Details

In addition to the system and corridor level insights summarized above, detailed model performance data at the corridor segment level was reviewed to help identify future congestion or bottleneck sites that may impact truck traffic. These reviews focused on impacts under the 2040 Trendline scenario and, in the interest of narrowing locations to those relevant to trucks versus typical passenger car congestion, included the following:

- **Truck VHT by LOS**: for the six primary freight corridors identified by this plan, detail reviews highlighted specific roadway segments experiencing higher truck VHT at poor levels-of-service.
- **Truck Volume by LOS**: for secondary roadways that connected to the primary freight corridors, detail reviews highlighted specific roadway segments carrying higher truck volumes at poor levels-of-service.

All such reviews were accomplished using 3D GIS graphics to visually represent the performance data (*Exhibit 7.19*). By this method, the height of the displayed data bars represented the order-of-magnitude of the truck VHT or truck volume on each segment, whereas the color shading represented the segment's level-of-service. Visually reviewing the combined results helped to supplement a list of potential areas of concern and the development of candidate project locations. These locations were subsequently incorporated into the project planning, screening, and prioritization process detailed in the final phase of this freight plan.

Exhibit 7.19 – Corridor Performance Summary – Sample 3D GIS Segment Data